Sex and the Birth Rate: Human Biology, Demographic Change, and Access to Fertility-Regulation Methods

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BIOLOGICAL EVOLUTION is driven by differential levels of reproductive success among competing individuals of the same species. Animals whose combinations of genes fit them more successfully to their environment than others will, on average, leave more progeny to reproduce in the next generation. Since Darwin's *Origin of Species* (1859), and more particularly *The Descent of Man and Selection in Relation to Sex* (1871), scientists have accepted that human beings evolved from other primates. Indeed, much of modern scientific medicine is based on observations of other mammals made within an evolutionary framework. Among mammals that live in social groups, males with high rank and power often impregnate more sexual partners and have an above-average number of offspring. Females with the highest social status gain access to more resources and also achieve greater reproductive success. In preliterate and preindustrial societies, successful men and women, as measured by wealth or social status, also on average had more children. But in the contemporary world, economic status is commonly inversely related to family size. Existing theories of the demographic transition confront but do not satisfactorily explain this important yet exceedingly puzzling fact.

Human beings have been able to exercise conscious control over their fertility since the second half of the twentieth century, but wherever access to birth control technologies is not constrained by law, policies, custom, or economic factors, there has been a marked fall in family size, in most cases to a total fertility rate of 2 or less (the TFR is the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children at each age in accordance with prevailing age-specific fertility rates). Social success in the modern world

tends to be associated with the acquisition of material goods but not with larger families. It follows that making fertility-regulation choices available (including voluntary sterilization and safe abortion) through multiple, convenient channels of distribution is likely to prove the most straightforward strategy for lowering birth rates. This article explores the implications of this perspective for international family planning policies.

Evolution and the drive for sex

Charles Darwin acknowledged his debt to Robert Malthus, but the converse of integrating Darwin's evolutionary principles into demographic theory has taken place slowly. The problem is two-way. Not only have evolutionary insights been overlooked by social scientists and demographers, but social biologists have given insufficient attention to the changing patterns of human fertility. Vining (1986) called the fact that "the actual possession of status and power seems, on average, to deter rather than to stimulate reproductive effort among modern humans . . . the central theoretical problem of human sociobiology."

Individuals are merely vehicles carrying, in Dawkins's (1976) powerful phrase, "selfish genes." If, as evolutionary biology asserts, reproductive achievement is the measure by which evolution "judges" the individual, then it is reasonable to look for evolved reproductive behaviors common to all societies (Symons 1979; Ridley 1993; Dunbar 1995). Contemporary biological analysis of human behavior avoids the dichotomy between nature and nurture that has plagued thinking in this field since Francis Galton.[1] Primates in particular have evolved a nervous system that allows them to change their behavior to suit their environment. It is unfortunate, therefore, that biological and cultural forms of determinism have been sometimes portrayed as alternatives, the acceptance of one being automatically assumed to exclude the other. We are, par excellence, an animal that evolved to learn, and learning means changing our behavior to fit the world around us. Nature and nurture interact continuously in wonderfully complex ways. "Inherited temperaments in different environments," write Wrangham and Peterson (1996), "can express all sorts of different behaviors."[2] The study of family size certainly shows this to be true. At the same time, certain aspects of our behavior, as well as our anatomy, are shaped by genetic factors; and human behavior is not infinitely plastic, but it is limited by certain universal, inherited traits. Sexual jealousy, for example, appears to be found across all cultures.

Evolution depends on the slow spread of inherited mutations that enable individuals, and therefore also their offspring, to survive and compete more effectively in their environment.[3] Some animals, such as polar bears, appear to have evolved rapidly, but a mere 8,000–10,000 years of settled

agriculture or 6,000 years of urban living do not seem to have been long enough for any large-scale evolutionary adaptations to have occurred in our species. Over 90 percent of the one to two hundred thousand years of human existence was spent in hunter-gatherer societies, and evolution must have tailored human behavior to produce a range of family sizes that approached the optimum to fit that environment (Blurton-Jones 1986). The details of that largely lost world of the hunter-gather way of life probably differed quite widely over time and geography, but some individuals will have always reproduced more successfully than others. Those whose genetic fitness in the environment in which they found themselves was greatest did not necessarily have the largest number of children, but they manifested a combination of family size and parental care which ensured that the maximum number of their offspring survived to the next generation.

In the evolution of our species the enlargement of the brain has produced an exceedingly vulnerable infant that takes many years to mature, stretching to the limit the ability of a mother to care for her child. When a couple is bonded by frequent sexual intercourse, the man is more likely to make a personal investment in any children conceived in the partnership, in turn helping to create a domestic environment where any infant has a better chance of survival. The fact that human females are sexually receptive throughout the ovarian cycle contributes to this parenting bond based on sex. Most human sexual intercourse takes place when a woman cannot conceive, either because it occurs before or after the time of ovulation in a particular menstrual cycle, or because ovulation is suppressed during pregnancy and for much of lactation (Diggory, Potts, and Tepper 1988). In the absence of contraception and abortion, conception is a probabilistic event—the inevitable result of relatively frequent intercourse occurring against a background of neurophysiological changes that determine the time of ovulation—and that are totally beyond the woman's control.

The great apes, including *Homo sapiens*, have evolved to be slow-breeding animals with a late puberty, and with pregnancies spaced several years apart. In the few preliterate societies that have been studied the total fertility rate is usually between 4 and 6, and about half of all children born probably died before they could themselves reproduce (Campbell and Wood 1988; Wood 1994). Contemporary developing countries with a TFR of 7 or 8 are those where, in the past century or less, a declining age of puberty and changed patterns of breastfeeding have *increased* fertility above the natural average.

Insights into human behavior based on evolutionary biology have exploded in the past quarter-century,[4] yet biological insights have been slow to influence demographic thinking. Over the past decade, a handful of articles published in this journal (Davis 1986; Turke 1989; Kaplan 1994; Carey and Lopreato 1995) have interpreted human fertility behavior in an evo-

lutionary context. These writers conclude, as I will also, that our species is not programmed to have a large number of children. Davis (1986) noted that human beings do not have "a high, biologically determined 'natural' fertility," and Turke (1989) suggested that a conscious desire to conceive "is relatively weak." Carey and Lopreato (1995) hypothesize certain "embedded" patterns of human behavior and suggest human beings evolved to have a "two-child psychology."[5] Kaplan suggested that if parents elected to have few children, "their assessment must be that the care and resources diverted to a third or fourth child would worsen outcomes for the first two children sufficiently to motivate cessation of reproduction" (1994: 781). Davis also assumed some sort of intrinsic drive toward replacement-level fertility. "The genius of the [human] species," he writes, "is rather to have few offspring and to invest heavily in their care and training, so that the advantages of a cultural adaptation can be realized. Throughout 99 percent of hominid history, then, fertility was kept as low as it could be, given the current mortality" (1986: 52). Such arguments imply some sort of internal "kinderstat." There are, however, both biological and empirical reasons for questioning the notion that we are in some way predisposed to want a *specific* number of children.

While it is possible that other big-brained animals such as elephants, chimpanzees, and whales associate sex with pregnancy, it seems unlikely. Human beings evolved from less intelligent animals with a stand-alone sex drive not consciously related to pregnancy, and it would seem redundant for evolution to have added any additional behavioral mechanisms. It seems reasonable to assume that human beings, like other animals, are genetically programmed to engage in sexual intercourse. Even Augustine, who taught that sex was the original sin and that the only moral justification for so ignoble an act was to conceive a child, admitted he had never met a married couple who had sex purely for procreation (Ranke-Heinemann 1990).

The role of culture

As noted, nature and nurture are partners in determining human behavior, and we have evolved a flexible set of behaviors highly influenced by the culture in which we live. In preliterate societies, with little or no conscious regulation of fertility, the total fertility rate varies due to cultural differences in breastfeeding practices and the age of initiating sexual intercourse. As the conscious regulation of fertility began in Europe, fertility fell in some language and social groups before others, again reflecting cultural differences (Anderson 1986). Culture influences how we interpret family size, so that when desired family size is surveyed in a high-fertility society, although a great many report they want fewer children than un-

der prevailing fertility patterns, it is rare for people to say they want only two children. It is also true that infertility can cause great anguish, both in traditional societies and in the modern world where some couples spend much money on advanced technologies to treat infertility. Obviously people want children, and how we express that want is influenced by our culture. At the same time, we know that hundreds of millions of people, in Europe, North America, Australia, Korea, and Japan, once given the means to control their fertility, have chosen to have fewer than two children. It would not be plausible to argue that such people are genetically different with respect to wanting children from, say, Nigerians who have six children.

The role of biological predispositions

I suggest that the most parsimonious explanation of human family size from a biological perspective is to assume the following:

—We are genetically predisposed to seek sexual relations. It is possible to find many people who want sex but who do not want to have children, but there is no significant group of heterosexuals who want children but do not wish to have sex. (Sex in this context is used as a shorthand to encompass all the complex behaviors that bond men and women as parents and potential parents.)

—We are genetically predisposed to cherish and support our own children when they arrive. All female mammals protect and nurse their offspring, and the great apes invest in their offspring over many years (Jolly 1985). Relatively few parents in any society will say they did not want a child they have.[6]

—We are genetically predisposed to be socially and sexually competitive. Men attempt to better their status by honing personal skills, and by politics, guile, and brute force. Women garner resources, establish sexual partnerships with men they perceive to be powerful, or sometimes cuckold less powerful men by mating secretly with men they perceive to be more successful than their regular partners. Chimpanzees compete in many similar ways, including establishing male coalitions to out-maneuver rivals, murder members of their own troop (de Waal 1982), and engage in warfare against rival troops of animals (Goodall 1986; Wrangham and Peterson 1996).

These three straightforward generalizations adequately account for the differential patterns of fertility found in preliterate and historical societies. If we are competitive, motivated by the desire for sex, and love our children when they arrive, but conception is controlled by hidden physiological rhythms, then in the absence of contraception and abortion those men who control most resources, and those women who have access to most resources, are likely to end up seeing a more than average number of chil-

dren survive to maturity and reproduce in the next generation. For as long as people did not have access to the means to control their fertility, they behaved as other animals, with the biologically most successful leaving most descendants. It was Turke's (1989: 79) view that "social and economic success is desired as a means to reproductive success, not that reproductive success is desired as a means to social and economic rewards." But if, as I suggest, there is no empirical support for some sort of internal "kinderstat" of the type posited by Carey and Lopreato, Davis, and others, then it is possible that the link between social success and reproductive success can be broken rather easily. In this new situation we cease to behave like other animals and begin to do something that from the perspective of evolutionary biology is counter-productive, where the more successful individuals put self-interest before reproductive achievement.

From the perspective of the sociologist and economist, the fact that wealth and social success are associated with families of less than average size is a central feature of the demographic transition. Many analyses of the demographic transition emphasize socioeconomic development as the engine of change, and some decisionmakers in international agencies build policies around the supposition that development is a prerequisite for fertility decline. The alternative explanation starts with the recognition that raising the next generation to maturity is a long, arduous process. If human beings have a predisposition for sex and for nurturing children as they arrive, but they have no predisposition for large families, then as they obtain unconstrained access to fertility regulation they will tend to have fewer and fewer children.

As society modernizes, it is assumed that the predisposition for sex and for individual competition continues unchanged. Men with more power may continue to express their predisposition for sex by increasing the number and youthfulness of their partners, but in the modern world not only wives, but mistresses and other sexual partners no longer get pregnant with a frequency commensurate with their level of sexual activity. Socially successful women may seek to be the partners of rich and powerful men, as well as to accumulate wealth for their own security and satisfaction, but they still avoid having more offspring.

From a biological perspective, the accumulation of material wealth by men and women is merely the ultimate expression of the selfish gene. Charlton (1996) points out that in a society adapted by evolution to its environment, such as a hunter-gatherer community, social stratification leads to stratification in reproductive success, while in contemporary Western societies, stratification in status leads to stratification in health outcomes. Richer couples apply their resources to their health, among other things. The more affluent consistently enjoy lower mortality and morbidity, while the status-based differentials related to reproductive success found

in societies without the means to control their fertility tend to disappear. Once the means to control births become readily available, the empirical evidence suggests that fertility usually falls rapidly: people put their personal interests before that of raising children. Accumulating wealth and spending resources on extending the expectation of life, rather than maximizing reproductive potential, is in a biological sense "unnatural." It is brought about by an accidental mixture of inherited behavioral predispositions and a complex but unconscious physiological mechanism, common to other apes, that originally evolved to secure the optimum spacing of pregnancies. Given this combination of circumstances, access to contraception and abortion and a lack of any predisposition for a specific number of children can explain Vining's paradox that wealth and family size are inversely related.

Causes and correlations of fertility decline

Without doubt, human behavior is highly plastic and manifestly influenced by the surrounding culture, and many socioeconomic variables do indeed correlate with family size. But does the common correlation between income and education and small families occur because the wealthy and socially successful decide to have fewer children, or rather because they are often better placed to secure access to the means to limit family size? Until recently, abortion and contraception received no public support and were often illegal. This led to differential access to contraception and abortion, with the wealthy better able to find compliant physicians to help with family planning and more able to gain access to safe abortions. It also had the effect of making contraception and abortion difficult to study. Data on abortion are often incomplete, and people may underreport something earthy like condom use, even when it is socially sanctioned (Ahmed, Schellstede, and Williamson 1987). As a consequence the role of fertility-regulating technologies in fertility decline has often been underestimated. Early in this century, when the trend toward smaller families first began to be discussed, the role of what was then termed "voluntary restraint" was not immediately obvious and it only came to the fore slowly (Soloway 1982). Britain's National Birth Rate Commission in 1916 spoke of the "endless explanations" put forward to account for fertility decline. They included suggestions of spontaneous fluctuations in the birth rate, nutritional changes, and biological speculation about alterations in "germinal activity." Eighty years later, despite rapid fertility decline in many of the countries with family planning programs, the role of access to fertility-regulation technologies continues to be questioned. Pritchett (1994: 2) wrote recently that "high fertility primarily reflects desired births and . . . couples are roughly able to achieve their fertility targets." Pritchett was not suggesting that contraception and abortion are irrelevant to achieved fertility, but merely that if

people really want to use them they will somehow find what they want and use it to achieve their goals.

In reality, however, access to contraception and safe abortion often remains much more restricted than may appear on the surface. Fertility regulation is difficult, and some contraceptives are unacceptable to many people, or fail when used. In addition, contraception and abortion are intensely private issues that commonly arouse strong emotions. In the discussion that follows, and as outlined in Table 1, I define "unconstrained access" as access to at least three reversible methods of contraception (e.g., pills, condoms, and IUDs) through a minimum of two channels of distribution, including elective sterilization and the choice of safe abortion or menstrual regulation,[7] all within a framework that permits the unhampered sharing of unbiased information about individual methods.

Table 2 divides countries into those with unconstrained access and those with constrained (or partially constrained) access to fertility regulation. Unconstrained access has become available in only a limited number of developed countries since the 1960s. It is a single, relatively homogeneous category, and I will argue below that all societies with unconstrained access to fertility regulation experience a rapid decline to replacement levels of fertility, and often lower.

Constrained access encompasses a spectrum of situations. At one extreme (e.g., Francophone Africa today) most people have no realistic access to contraception or safe abortion, while at the other extreme (e.g., Western Europe between 1920 and 1960, or Sri Lanka today) several methods of contraception may be available and de facto safe abortion networks

TABLE 1 Definitions of access to family planning

Unconstrained access	Constrained access
At least three reversible methods of contraception available through a minimum of two channels of distribution.	Contraceptive choices limited by policies (e.g., injections forbidden); or restrictive medical practices (e.g., pills forbidden to women over 35); or outlets limited exclusively to health facilities.
Voluntary sterilization available without arbitrary criteria of age and parity applied by providers.	Tubal ligation and vasectomy not available, or offered only to older couples with several children.
Family planning choices readily advertised, with objective information available for potential consumers.	Restrictions on advertising, or gross misinformation (e.g., pills believed to lead to abnormal babies).
Safe abortion economically accessible.	Abortion services unsafe, expensive, or exploitive.

TABLE 2 Ease of access to fertility-regulation methods around 1990 and estimated total fertility rate around 1995 for countries with over 10 million population

TFR	Constrained access	Partially constrained access	Unconstrained access
7+	Yemen (7.7), Uganda (7.3)		
6	Afghanistan, Burkino Faso, Syria (6.9), Ethiopia (6.8), Iraq (6.7), Zaire (6.6), Angola, Mozambique (6.5), Tanzania (6.3), Madagascar, Sudan (6.1), Nigeria (6.0)		
5	Cameroon (5.9), Ivory Coast (5.7), Pakistan (5.6), Ghana, Saudi Arabia (5.5), Kenya (5.4), Nepal (5.2), Iran (5.1)		
4	Zimbabwe (4.4), Algeria (4.3), Philippines, South Africa (4.1), Morocco, Myanmar (4.0)		
3	Vietnam (3.7), Egypt, Ecuador (3.6), Peru, Uzbekistan (3.5), India (3.4), Malaysia (3.3), Mexico, Venezuela (3.1), Colombia (3.0)	Bangladesh (3.7)	
2	Indonesia (2.9), Brazil (2.8), Argentina (2.7), Chile (2.5), North Korea (2.4), Kazakhstan (2.3)	Turkey (2.7) Sri Lanka (2.3) Thailand (2.2)	United States (2.0)
<2	Poland (1.7), Japan, Ukraine (1.5), Belarus, Russia (1.4) Romania (1.3)		Yugoslavia (1.9), Australia, China, Taiwan (1.8), France, South Korea, United Kingdom (1.7), Belgium, Canada, Hungary, Netherlands (1.6), Cuba (1.5), Germany, Greece (1.3), Italy, Spain (1.2)

SOURCE: TFR estimates from Population Reference Bureau (1996). Ease of access classification: author's estimate.

may exist, although de jure the operation is still forbidden. In situations of partially constrained access to fertility-regulation methods, family size can fall to a TFR of 3 or below (Table 2), but many couples still have unplanned births.

Assuming all couples engage in sexual activity more frequently than is necessary to conceive, it follows that the link between sexual activity and birth can be fully broken only where unconstrained access to fertility

regulation truly exists. In the following section, historical examples are given illustrating situations where the conscious control of births was impossible or exceedingly limited. In Table 2 all countries with more than 10 million people are categorized according to their level of access to contraception and abortion as defined in Table 1. Some now have unconstrained access to fertility regulation but did not have it previously (e.g., Italy), while others still do not have it today (e.g., Argentina). This categorization overlaps with earlier analyses of the quality of family planning services, the first item of which is the availability of several family planning choices (Jain 1989). While acknowledging the role of socioeconomic factors in accelerating the switch to smaller families, I argue here that unconstrained access to fertility-regulation technologies is the primary factor responsible for fertility decline and that the empirical evidence supports the generalizations put forward.

Situations where sex and births are linked

Preliterate societies

Infanticide and crude abortion techniques have been practiced in many preliterate societies, but their use is largely restricted to extreme hardships or to pregnancies that break societal rules on marriage and family building. Such societies may be broadly egalitarian in the distribution of goods, but demonstrate marked fertility differentials. Good hunters and socially powerful men have more sexual partners and father more children. This is true both where women enjoy some degree of sexual autonomy and seek what they perceive as successful men as partners, as among the Ache of Paraguay, and where sex involves male coercion, as among the Yanomamo of Venezuela. Hill and Hurtado (1996) found in Ache clans that some men father as many as 15 children and others none at all. Chagnon (1988) observed that successful Yanomamo warriors who had killed other men had three times as many children as men not honored as warriors, and he traced the lineage of one man who had 14 children, 143 grandchildren, and 335 great grandchildren (Chagnon 1979).

Preindustrial societies

In settled, agricultural societies, from Mesopotamia, the Mediterranean, and ancient China, through the pre-Columbian Americas to nonindustrialized countries in this century, land ownership and agricultural technology provided sufficient surplus to support a relatively wealthy elite. Such rulers often adopt despotic powers within hierarchically structured societies and use wealth and status to control a disproportionate number of women, and to father a disproportionate number of children. In the Chou Dynasty (1500–771 BC) in China, the royal harem was regulated by court ladies who tracked

TABLE 3 Social status and family size: The impact of access to fertility-regulation methods

	Elites	General population
1812: Little access to fertility regulation (Ostfriesland)[a]		
Children born	6.58	4.59
Children who married	3.05	1.90
1911: Limited access to fertility regulation (England and Wales)[b]		
Children born	2.94	4.57
1955: Access to contraception and abortion (Japan)[c]		
Children born	1.47	1.75

[a]Wealth based on the Napoleonic Tax List of 1812 (Voland 1995).
[b]Family size of professional and white-collar workers compared with agricultural laborers in the Census of England and Wales.
[c]Average number of children in Japanese *Who's Who* compared with average number of children born to all ever-married Japanese women (Vining 1986). Cohorts are those born after 1920; therefore some of the childbearing will have taken place after the 1949 liberal abortion law.

the menstrual cycles of concubines and presented the concubines to the royal bedchamber when they were believed to be most fertile (Gulik 1974). In the Bible, Solomon is said to have had 700 wives and 300 concubines, and the Roman Emperor Commodius is reported to have had 300 concubines. Wealthy Romans kept huge numbers of slaves and often chose to have sex with their female slaves. The Inca kings had 700 concubines and lesser aristocrats 5 to 30 women, depending on rank. In nineteenth- and early-twentieth-century Africa and Asia, rulers kept harems. In Dahomey, for example, "all women were at the pleasure of the King" (Betzig 1992). Power was often used to seclude women in harems and to torture and kill any man who had intercourse with any of the despot's wives: it was in these societies that female genital mutilation and foot binding arose, as mechanisms reinforcing the control of women by men. In short, male power and success was ruthlessly employed and almost invariably accompanied by many offspring.

Voland's (1995) study of Ostfriesland, Germany provides an example of an early-modern monogamous European community with few means to control births, where a positive relationship existed between wealth and family size. The primary social restraint on fertility was the strict limitation of sex to marriage, where marriage for some was delayed and for others never possible. Voland categorized families according to wealth based on the 1812 Napoleonic tax records. By tracking both family size and the percentage of children who later married, an excellent marker of overall reproductive success, he demonstrated that wealthier couples had larger families (see top panel of Table 3). By the beginning of this century many

societies, for example in Europe, had begun to control family size, although access to fertility regulation remained limited, leaving the elites more likely to succeed in the control of their fertility than those with less education and income (middle panel of Table 3). But once a society obtained broad access to fertility regulation, as for example occurred when safe abortion was made available in Japan, the differential between social classes disappeared, or was reversed (bottom panel of Table 3).

Breaking the link between sex and birth

European urban societies appear to have begun to control family size centuries ago. Late age at marriage, strictures on premarital sex, *coitus interruptus* (Potts 1995), *coitus reservatus*, and traditional abortion practices, and possibly a reduction in the frequency of marital sex, have all been used in an attempt to lower fertility.[8] Such means had an impact on family size (Wrigley and Schofield 1981), but they were rarely sufficient to bring the TFR below 3. The European family structure, late marriage, and a tradition of primogeniture all exerted pressures to lower fertility. Had the means to control births been available in early-nineteenth-century Ostfriesland, for example, the primary drive for status might have been expressed in the accumulation of material goods rather than in a larger family. It is even possible, had the history of medical technology been reversed, with the development of effective birth control technologies preceding the availability of effective death control technologies, that societies with high mortality, such as preindustrial Europe, might still have chosen to have small families. In that circumstance, the combination of biological predispositions, learned behaviors, and stage of technological development might have led to a population implosion. By contrast, in this century, the fact that birth control technologies have been retarded relative to death control technologies has led to a population explosion. The scale of this explosion in developing countries was probably also increased by the fact that the tradition of the extended family and of early marriage created a social structure that proved more accommodating to large families than was the case in Europe immediately before the demographic transition. It is unlikely that developing countries, in the absence of modern contraception, would ever have gotten as far as nineteenth- and early-twentieth-century Europe did in the quest to lower fertility.

For some preliterate societies and through classical times until the eighteenth century in Europe, the choice for many people, burdened with more children than they could support, was either infanticide or to place the unwanted child in a foundling hospital (Boswell 1988). These two choices were often virtually the same thing, with mortality varying from 48.6 percent in the London foundling hospital in 1741 to 99.6 percent in Dublin in

1775–76 (Fildes 1986). But our predisposition to care for our children is strong, and abandoning an infant is a much bigger step than preventing a birth. In the nineteenth century abortion became more common. A doctor working in Manchester Lying-in Hospital in 1845 observed that 247 out of 2,000 women had had one or more abortions (Whitehead 1847).

For the greater part of the Western decline in fertility, contraceptives were "under-the-counter" items of uneven quality, and abortion was illegal, often unsafe, and frequently offered in exploitive circumstances. The manufacture and sale of condoms and spermicides became significant in the later part of the nineteenth century (Peel 1962), but contraceptives were never freely available in the manner of other domestic, low-cost, high-volume commodities. In many states of the United States, the nineteenth-century anti-contraceptive laws, introduced by Anthony Comstock, were not finally struck down until a 1965 ruling of the US Supreme Court.[9] Safe abortion did not become widely available outside Eastern Europe and parts of Asia until even later. The abortion law in Britain was not reformed until 1967, and it was another six years before the US Supreme Court declared state laws restricting abortion unconstitutional.

By the time abortion was legalized in the West, family size had fallen a great deal, although many people probably still had more children than they planned. The available methods of contraception were few and of uneven effectiveness. As noted, there is evidence that abortion played an important part in this demographic transition for a century or more before it was legalized. The cost, however, in emotional, physical, and financial terms was great, and it is reasonable to assert that many women who might have wanted an abortion were not prepared, or did not know how, to obtain an illegal operation. Data from Japan, South Korea, and Taiwan, where abortion was legalized relatively earlier in the transition from large to small families than it was in the West, demonstrate the important role played by induced abortion in the decline of fertility. In Korea today, with a 79 percent prevalence of contraceptive use, there is still more than one abortion for every birth (Noble and Potts 1996). The historical and contemporary record indicates that no society has achieved replacement-level fertility without a large number of abortions (Kulczycki, Potts, and Rosenfield 1996). Before the link between sex and birth was finally broken, many couples—perhaps most—suffered considerable pain striving to achieve a small family.

The link between sex and birth is broken

Changes in family size since 1960

Attempts have been made to quantify access to family planning and the strength of public policies supporting family planning, notably by Mauldin

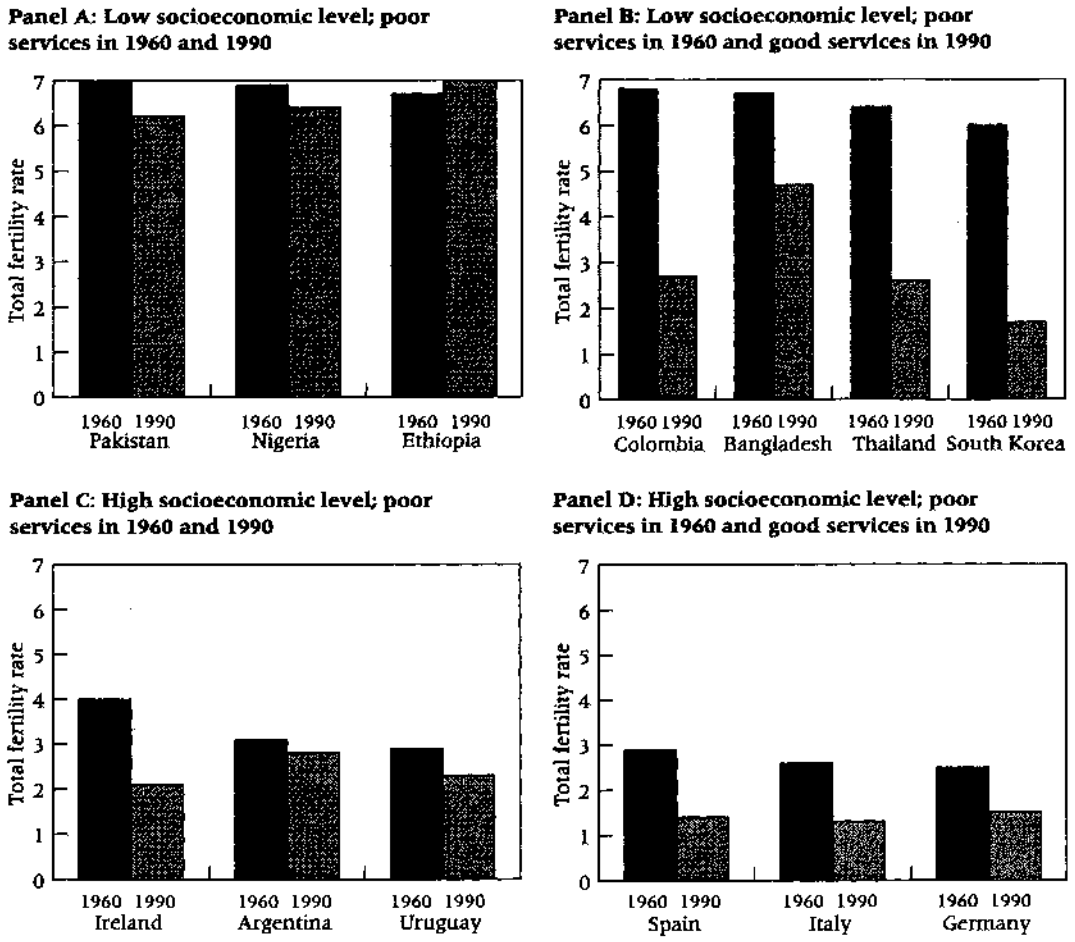
and Ross (1991), but, ultimately, all scoring systems evaluating program effort contain subjective elements that are difficult to combine with the quantitative data available on fertility change. Within the broad framework set out in Table 1, the four panels in Figure 1 demonstrate a strong and consistent relationship between fertility decline and access to family planning and abortion.

Developing countries with constrained access to fertility-regulation technologies (Panel A). Where people are poor, uneducated, and have no realistic access to fertility-regulation technology, there has been little change in family size in the past 30 years. In Nigeria, family size has undergone only a 7 percent decline in 30 years, while in Ethiopia fertility has risen by 4 percent, perhaps because of a reduction in the mean duration of breastfeeding. Some countries, such as Pakistan, have a long history of national family planning programs, but the programs are so badly organized that they have had little or no impact. They employ many people, but they have not presented realistic choices to couples attempting to plan their families.

Developing countries with moderate to good access to fertility-regulation technologies (Panel B). In situations where people are poor and are sometimes uneducated but access to family planning is emerging, family size often falls rapidly (low socioeconomic level in this context refers to the year 1960). Between 1960 and 1990, the TFR fell by around 60 percent in both Colombia and Thailand. In both countries, community-based distribution programs helped carry contraceptive choices into rural areas. In Thailand there was effective action by the government and by nongovernmental organizations, in particular the Population and Community Development Association, which provided services in some rural areas and, probably more importantly, promoted the use of family planning nationwide. In Colombia the main effort to take family planning choices to poor communities was organized and subsidized by PROFAMILIA, the national family planning association, supported by the United States and other donors. Thailand has made a practical effort to deal with the public health issue of unsafe abortion, quietly allowing de facto access to early pregnancy interruption, and in Colombia a few safe abortion services have become available in big cities. Access to fertility regulation is still constrained, but it is sufficiently advanced to permit rapid fertility decline.

Contemporary developing countries with successful family planning programs, such as Thailand and Colombia, make an interesting contrast with Europe in the nineteenth century, where many people were poor and universal education was beginning, but family planning was difficult to obtain and abortion was illegal. In nineteenth-century Europe, families had far fewer than the biological maximum number of children, but there is plenty of evidence that the number was often more than they intended. It took the United States 58 years (1842–1900) to make the transition from

FIGURE 1 Total fertility rate in 1960 and 1990 for selected countries with high and low socioeconomic levels in 1960 and constrained or unconstrained access to family planning services in 1960 and 1990



a TFR of 6 to 3.5. Colombia completed the same transition in 15 years (1968–83) and Thailand in 8 years (1969–77). The fact family size fell four times as rapidly in some countries with relatively good access to fertility-regulation technologies as it did in nineteenth-century America can be interpreted as strong evidence of the influence of effective choices in accelerating fertility decline.

In 1960, Korea was largely a rice farming country with a per capita income of well under US$100 a year.[10] The annual rate of population growth exceeded the rate of economic growth. In the early 1960s, the government and nongovernmental organizations began offering voluntary sterilization

and IUD insertions by subsidizing private medical practitioners, among whom women could make their own selection. Later, the community-based distribution of subsidized pills became important. The country enjoyed de facto access to safe abortion. In 30 years the TFR plummeted from 6.0 to 1.7, and per capita income rocketed to over $5000 a year. It would be easy to suggest that such spectacular economic progress was the engine driving fertility decline, but Cuba has an economy renowned for its economic failure, where people have become poorer over the past decades; yet the mixture of contraception and safe abortion is similar to that in Korea and fertility fell in Cuba at the same rate as in Korea and to the same low level (Noble and Potts 1996), casting serious doubt on the hypothesis that Korea's fertility decline was caused by its economic development.

Algeria, too, aligned itself with the Soviet bloc in the 1960s, although not as closely as Cuba. It created a few clinically restricted contraceptive services with conservative medical controls, integrated with maternal and child health care and not explicitly directed at making fertility-regulation choices available. Unlike Cuba, Algeria never had the density of service delivery points to carry these clinic-based services to the bulk of the population. As a result, in 1996 the TFR in Algeria (4.3) is 26 percent higher than in neighboring Tunisia (TFR: 3.4), which has always had a more straightforward delivery of services, including legalized abortion.

Bangladesh is the most striking example of a country where access to fertility-regulation methods has greatly reduced family size, even though there has been very little socioeconomic improvement. It provides a dramatic contrast with Pakistan. Bangladesh is poorer and less urbanized than Pakistan, and as recently as 1975 it had an identical family size. Access to family planning in Bangladesh is still constrained in many areas of the country, but a strong effort has been made to improve government services, and committed, active nongovernmental organizations are involved. Unlike the case of Pakistan, menstrual regulation is available and as many as 10,000 practitioners and fieldworkers have been trained to do this procedure. The well-established social marketing program run by Population Services International uses 100,000 commercial outlets to sell contraceptives at a subsidized price, with active advertising of their named brands. One measure of access to family planning choices is to calculate the number of women of reproductive age for each outlet where contraceptives can be obtained. In Nigeria it is over 12,000, in Pakistan it is almost 3,500; while in Bangladesh it is only 500 and in Thailand just under 300. By 1995, the TFR in Bangladesh was 3.7 and, even more importantly, the desired family size has fallen to close to replacement levels. Both of these measures remain high in Pakistan and have hardly changed since the 1970s.[11]

Thailand and the Philippines represent another informative pair of countries.[12] By standard economic indicators, in 1960 the Philippines was

ahead of Thailand (1960: Philippines per capita income $230, infant mortality 76 per thousand, literacy 72 percent; Thailand $171, 95 per thousand, and 68 percent respectively). Yet Thailand had an efficient family planning program, while the Catholic Church in the Philippines diluted every effort that was made to offer people reasonable contraceptive choices and, by passionate opposition to abortion, successfully ensured that the operation remained unsafe and expensive. By 1996, the Philippines had a TFR almost twice that of Thailand (4.1 and 2.2 respectively) and a per capita income less than half that of Thailand (1996: $965 vs $2210 per annum). The number of people living below the poverty level in the Philippines rose from 21 percent in 1971 to 38 percent in 1988 (Lee et al., n.d.).

Developed countries with constrained access to fertility-regulation technologies (Panel C). Where incomes are higher and education is widespread, but where access to contraception is limited and abortion is illegal, some will find ways of reducing their fertility, although they probably still exceed fertility goals. In the 1960s, Ireland was a high-income country with almost no access to modern fertility-regulating technologies. Through late marriage, a high proportion of people who never married, and withdrawal, condom use, and some illegal abortions, the TFR was held at 4.0. In 1973 the Irish Supreme Court upheld the right to use contraception, although Irish customs authorities continued to impound contraceptives after the ruling. Even today the sale of condoms (which are treated rather like an addictive drug) is legally restricted to pharmacies. Since the late 1960s, however, more and more Irish women have traveled to England to obtain a safe abortion, and by 1990 the TFR had fallen to 2.1. Other Catholic countries (e.g., Argentina) have similar restrictions, but have not had Ireland's safety valve whereby women needing safe abortions can travel to a more liberal neighboring country.

Quebec and Italy provide additional compelling examples of the role of access to needed technologies in fertility decline in a developed country. For the first half of this century fertility was markedly higher in Quebec than in other Canadian provinces. Politicians and commentators spoke of the *revanche des berceaux* ("revenge of the cradle"), expressing the common assumption that the Québecois were attempting to outbreed their English rivals. But the fact that the TFR in Quebec was 30 percent to 50 percent higher in the 1920s and 1930s than in the rest of Canada can be explained by the even greater difficulty of obtaining family planning in Catholic Quebec than elsewhere in Canada. By the 1950s, despite these restrictions, the Québecois and the whole of the country had similar TFRs (4.09 and 3.87 respectively). Additional decline occurred in Quebec in the 1980s, once the final restraints on access to fertility-regulation technologies were overcome. In the 1960s, Italy also fell into the category of an industrialized country where access to contraception was limited and abortion was ille-

gal. In more prosperous northern Italy, people contrived to lower their fertility, as they did in Canada, but in the less prosperous South, fertility remained fairly high.[13] The wealthy are always more likely to secure contraceptives or to obtain a safe abortion than the poor; consequently, there is a negative relationship between income and fertility.

Developed countries with unconstrained access to fertility-regulation technologies (Panel D). Family size in Canada was halved between the 1950s and 1970s as unconstrained access to fertility regulation became available. The pill and other methods of contraception became more widely used in the mid-1960s, and abortion was legalized in 1969. Quebec's provincial public health clinics offered abortions even before the operation was legally available in other parts of the country. The number of safe abortions rose rapidly from 1.4 per one hundred live births in 1971 to 14.9 by 1981. The number of sterilized women climbed to 245 per thousand women of reproductive age by 1981, with 51 percent of women over age 40 having had the operation (Lux 1984). In Quebec the TFR plunged from 4.09 in 1957 to 1.81 in 1976, and continued to fall to 1.46 in 1983, one of the lowest rates in the world at that time and considerably below its English-speaking neighbors. "The revenge of the cradle," it seems, had not been driven by social or political forces, but by a situation in which the natural restraints on conception (such as anovulation associated with long intervals of breastfeeding) had largely broken down and had not been effectively replaced by artificial contraception and safe abortion. The Quebec experience was repeated in Italy, where, once contraception became legal and a referendum made safe abortion available, fertility fell by 50 percent. In addition, as the whole country came to enjoy unconstrained access to fertility regulation, the earlier differences in family size between north and south were greatly reduced. Similar changes occurred slightly later in Spain and, today, Italy and Spain have the lowest TFRs in the world. Murphy (1993), who analyzed the decline in the TFR in Britain between 1963 and 1980, found the best correlation was not with socioeconomic variables, but with the number of oral contraceptive packs distributed. This suggests not that British couples happened to want smaller families at the moment the pill was introduced, but that the desire for smaller families existed before the pill's invention, although it could not be fully expressed until the new technology came along.

The continuing fall in desired family size

Even the rich and educated in the West did not have unconstrained access to a range of contraceptives, voluntary sterilization, and safe abortion before the 1960s, though wherever people since then have come to enjoy unconstrained access to the means of controlling fertility, fertility has fallen

to replacement levels or below.[14] People do not stop having sex, but they stop having many children. Once unconstrained access to fertility regulation exists, including safe abortion or menstrual regulation, fertility declines regardless of socioeconomic status.

Some countries have a TFR of 2 or less and do not have access to at least four methods of contraception, including voluntary sterilization, but all such countries have access to safe abortion. Under such circumstances it is possible to control fertility, but the ratio of abortions to births may reach as high as one to one. All countries with nationwide unconstrained access to fertility regulation have a TFR of 2.0 or less, and all countries that have not achieved replacement-level fertility have constrained access to fertility-regulation methods. There are no exceptions.

Some countries with partial access to fertility regulation appear to be moving rapidly to join those with a TFR of 2 or less. Sri Lanka is placed in the partially constrained access category because, although abortion is not legal, menstrual regulation is becoming widely available. Indonesia has a long history of promoting contraception, particularly oral contraceptives and IUDs, and the TFR has fallen to 2.9. Access to family planning, however, is constrained by restrictions on voluntary sterilization and laws against abortion. On the island of Bali, however, as a result of the commitment of local health professionals, these two constraints have been effectively overcome. Bali is a Hindu minority in the world's largest Muslim nation, and most people live in rural areas and are employed in agriculture. Arguing from the development model of fertility decline, one might expect Bali to have high fertility. In fact, as a consequence of unconstrained access to family planning and menstrual regulation, the TFR has plunged from 6.0 in 1970 to 2.1 in 1994. By contrast, Turkey has a liberal abortion law, but services in many rural areas are still uneven and safe abortion is less accessible to many Turks than it is to the Balinese. In addition, Turkey is plagued with a great deal of misinformation (for example, many women believe the pill causes cancer). As a result, although the TFR is falling it is still some way from replacement level.

It seems reasonable to argue that much of the well-documented correlation between fertility differentials and socioeconomic status reflects differing abilities to gain access to fertility-regulation technologies, as much as or more closely than it reflects an inherent link between socioeconomic status and preferred family size. The role played by technology may be relatively less among adolescents, who have less experience and who are more prone to risk-taking than adults. The age of puberty has fallen in many parts of the world (Wood 1994), but as far as is known, intellectual and emotional maturation is chronologically driven, while behavior is strongly influenced by the level of circulating sex hormones.[15] Pregnancies among adolescents in the United States would probably fall if access to contracep-

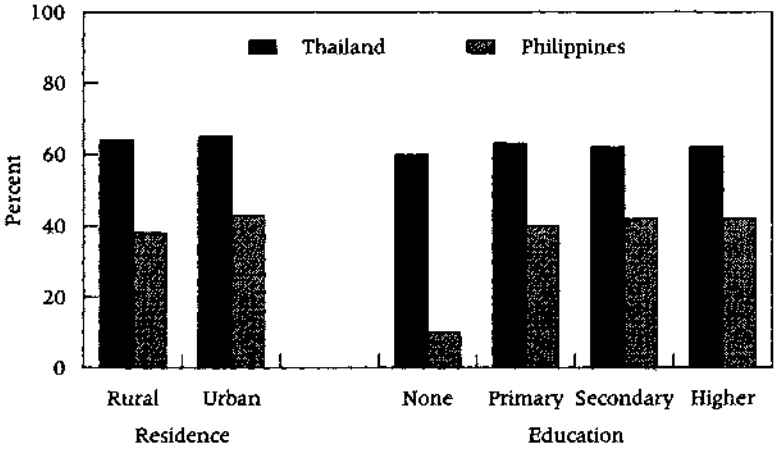
tion and abortion were made easier, but unintended pregnancies would not disappear. However, as US teenagers contribute 13 percent of all births, even a modest reduction in unintended pregnancies would lower the country's TFR, bringing it closer to that of other developed countries.

The above analysis suggests that, especially among stable, mature couples who make up the majority of parents, unconstrained access to a range of fertility-regulation technologies tends to override socioeconomic variables in family size. Evidence is emerging that among stable couples in both developed and developing countries, unconstrained access to contraception and safe abortion will be sufficient to lower family size to replacement levels. In nearly all circumstances people's desire for family planning services exceeds the adequacy of the public provision of those services (Sinding 1993).

Where fertility-regulation choices are only partially available, richer couples often have fewer children because educated, mobile individuals are better able to surmount the hurdles that society places between them and the technologies they need to control their fertility. In countries such as Thailand, with good availability of family planning choices, there is little variation in family size by socioeconomic status (see Figure 2). A high degree of uniformity in any social indicator regardless of income or education and across the rural/urban divide is rare. In countries with limited family planning choices, such as the Philippines, barriers restricting access to fertility regulation leave poor people more likely to exceed their fertility goals than the rich, and there is considerable variation in family size by socioeconomic category. The uniformity of contraceptive use in the presence of realistic access to fertility-regulation options is compelling evidence of the equity and justice inherent in well-run family planning programs.[16]

Our biological predispositions and our learned behaviors—nature and nurture—interact at many levels and in many ways. While access to contraception and safe abortion is a necessary, and seemingly in most cases also a sufficient reason for family size to fall to low levels, culture and socioeconomic circumstances obviously also play important roles. Most of the barriers to unconstrained access to fertility regulation are themselves the result of cultural and religious pressures. Some religions forbid contraception or abortion and some providers follow these injunctions. Culture and socioeconomic circumstances will determine how hard people struggle to control family size when fertility-regulation choices are restricted, and how rapidly they exploit access to contraception and safe abortion when choices become available. Many social practices, such as variations in the age of marriage or the timing of the resumption of intercourse postpartum, are strongly influenced by culture and ethnicity. It also seems likely that some degree of modernization is needed to trigger the switch to investing in personal wealth rather than in large families. If this is true, then

FIGURE 2 Percent of women of reproductive age using contraception, Thailand 1988 and Philippines 1993, by residence and educational level



SOURCE: Based on Lee et al. (n.d.)

it may be that quite general changes of the type that have overtaken nearly the whole world are all that is necessary to bring about the switch. Education, while still not universal, is spreading rapidly, access to the media is bringing new visions into the homes of thousands of millions of people, and improvements in transportation are opening up new opportunities for increasing numbers of people. The preference for small families may well be self-propagating, in the sense that as some individuals take advantage of access to contraception and safe abortion, others see what is happening and adopt the same practices. Once desired family size begins to fall, it usually continues to fall and it never rises spontaneously. In short, a multitude of factors come together in Ansley Coale's oft-quoted observation that fertility decisions must lie within the "calculus of human choice" (Coale 1973)—but without access to fertility-regulation options there can be few choices.

Mental models of fertility behavior

Policymakers do not think in a vacuum, and the particular mental model adopted to understand human behavior shapes all interpretations of fertility change. In an area as important as fertility, from which so many individual and social consequences flow but where feelings of discomfort may not be far below the surface, the mental models adopted by analysts and by decisionmakers are particularly significant.

The development model of the demographic transition assumes that family size will be high unless significant changes in social conditions oc-

cur. Development paradigms (e.g., Thompson 1929; Nag 1980; Coale 1973; Caldwell 1982) remain a powerful mental model, particularly among politicians and senior administrators who are not specialists in family planning and population, but who hold the purse strings for development budgets. The development model tends to encourage broad, top-down policies.[17] The perception that education must be improved or infant mortality reduced before family size will fall remains widespread. It is assumed that a "cultural resistance" to family planning exists in developing countries, and often there is reluctance among those who control resources in international institutions to recognize that access to technology, of itself, can bring about social change. In contrast, biologists tend to see fertility set at a moderate to low level, naturally limited in the human animal by late puberty and long intervals of lactation-induced suppression of ovulation. In such a context, modern contraception replaces what breastfeeding once did to limit fertility, and the transition to small families does not seem difficult or surprising. The perspective developed here makes unconstrained access to fertility-regulation technologies and appropriate information the primary step in lowering fertility. It promotes community-level responses to encourage access to family planning choices. Unfortunately, barriers of habit and self-reinforcement separating disciplines often prevent creative exchange between biologists and social scientists. Different disciplines seldom talk to one another: evolution is central to the thinking of biologists, but there are still sociologists for whom it is of no interest or relevance.

Theories are tested by their power to predict. But as pointed out by Marchetti, Meyer, and Ausubel (1996), "up to now fertility has escaped all model [statistical] descriptions." Over the past 20 to 30 years the development model of the demographic transition failed to predict or explain any one of the three impressive demographic changes that have taken place during this interval: (1) the rapid fall in fertility observed once the citizens of less developed countries enjoyed unconstrained access to the means to control fertility; (2) the decline to fewer than two children now overtaking hundreds of millions of Western parents; and (3) the reduction in socioeconomic differences in family size within developed countries following the removal of most of the last restraints on fertility regulation.

In the history of academic analyses about fertility decline, one of the first writers to highlight the role of access to contraception was the economist Gary Becker. In 1960, Becker speculated that "differential knowledge of contraceptive techniques might explain the negative relationship between fertility and income." He then reanalyzed data from the 1950s Indianapolis study according to self-reported contraceptive use, and identified the role of access to fertility-regulating technologies in lowering family size. Becker's insight was unusual, as most academic commentators of the time interpreted fertility decline primarily in terms of socioeconomic change. In

1967, Kingsley Davis wrote a policy-setting paper in *Science* in which he called the first large-scale family planning programs "either quackery or wishful thinking." Davis had written in forceful terms about excessive population growth in India and elsewhere (Harkavy 1995), but when it came to looking for solutions he condemned family planning programs for their "self-confident naiveté" and "an ostrich-like approach." He concluded,

> There is no reason to expect that the millions of decisions about family size made by couples in their interest will automatically control population for the benefit of society. On the contrary there are good reasons to think it will not. (Davis 1967: 732)

An evolutionary biologist could agree with the argument that individuals are unlikely to make decisions "for the benefit of society," but it was Ravenholt (1969: 124), replying to Davis in *Science*, who shifted the paradigm. He wrote:

> Bearing and rearing children is hard work, and few women have unlimited enthusiasm for the task. . . . It is clear that the main element initially in any population planning . . . should be the extension of family planning information and the means to all elements of the population. . . . It seems reasonable to believe that when women throughout the world need only reproduce when they choose, then the many intense family and social problems generated by unplanned, unwanted, and poorly cared for children will be greatly ameliorated and the now acute problems of too rapid population growth will be reduced to manageable proportions.

The belief that women in particular, given full and accurate information, make rational choices about family size has been confirmed again and again since Ravenholt wrote over a quarter-century ago.

In the late 1960s, some demographers began to challenge the early explanations of the fertility transition based on socioeconomic change. Detailed analyses found that fertility declines occurred at the same time in countries with different levels of industrialization and urbanization (Demeny 1968). To a considerable extent, there has been a shift from an exclusive emphasis on socioeconomic factors toward taking into account what has been called the "culture of contraception" (Gillis, Tilly, and Levine 1992). Cleland (1994) has remarked how the fertility transition in many developing countries "has dazzled demographers and confounded many experts." The role of access to cheap contraception and safe abortion in fertility decline is increasingly accepted, but acknowledgment is by no means universal, and some aspects of the policy debate over international family planning remain mired in yesterday's mental models (Thomas 1993).

Classic economic theory is built on the premise that human beings make rational choices, choosing the best value for the goods and services offered by the market place. Similarly, the development model of fertility decline assumes human beings make rational choices about family size, choosing to have smaller families as the benefits of having many children decline and the costs of educating and rearing children increase. By contrast, the biological interpretation is that couples will have frequent sex, which initiates reproduction when female physiological processes beyond human control are in the fertile phase, unless some deliberate action is taken to prevent conception or to interrupt a pregnancy. This holds true whether the couples are poor or rich, illiterate or educated. In such circumstances, whether people can make rational choices about family size is moot, unless they have realistic access to the means to control fertility. In the absence of needed technologies, people may struggle to lower fertility, but they will not be able to exercise the type of rational choices people make in the purchase of other kinds of goods or services.

Many commentators make the mistake of analyzing fertility change as if the means to separate sex from conception were readily available, when they were not. Two recent examples of the way the paradigms adopted by different disciplines influence academic analyses can be found in articles by O'Grada and Walsh (1995) and by Kaplan et al. (1995). O'Grada and Walsh look at such correlates as religion, car ownership, and unemployment to explore family size decline in Ireland, but do not mention such causal factors as the legal changes since the 1960s that have made contraception more available, or the thousands of Irish women who travel to England to obtain a safe abortion. Kaplan and coauthors develop several models to explain changes in family size among a cohort of men born between 1900 and 1960 who are now residents of Albuquerque, New Mexico. The authors attribute declining family size to human capital investment in competitive labor markets, but omit to mention that US-born couples who were fertile before abortion was legalized in the early 1970s had no totally secure way to achieve their fertility goals, or that the 39 percent of the sample of Hispanic origin who lived south of the US border for much of their reproductive lives would have been unable to fully implement their fertility desires.

At their most extreme, some sociologists, economists, and demographers claim that the means for birth control have always been potentially available to all societies, and when they are not much used it is because there is little demand. Pritchett (1994) asserts both that couples act rationally and that they can control their fertility without publicly funded family planning programs.[18] He states that

> The decision to have another child is simply too important and too costly for contraceptive costs to play a major role. In economic terms, fertility is in-

> elastic with respect to contraceptive costs because contraceptive costs are so small in comparison to the costs of children. (p. 3)

Unfortunately, many family planning services are so contrived and skewed as the result of medically restrictive practices and religious biases that the costs of fertility regulation are much higher than the drive to have sex. In the real world, the demand by the poor for contraceptives is highly sensitive to price (Harvey 1994). Furthermore, prevention is not a priority for many people who are struggling to survive from day to day. Economists often overlook the effect of medical policies and protocols, or the lack of access to safe abortion.[19] Using the mistaken framework of a demand model, many demographers have confused correlations with causality, neglecting one of the first rules of scientific investigation.

Thus the population movement, as it prepares to enter the twenty-first century, is confused. There have been some spectacular declines in family size, often defying the development model of fertility decline many policymakers still hold. Nevertheless, in terms of absolute annual increase in human numbers, the "population explosion" is more of a reality today than it was when the Ehrlichs wrote *The Population Bomb* in 1968, but concern is less fashionable than 30 years ago. Indeed, the recent decline in the rate of population growth is being used by some policy analysts (e.g., Wattenberg 1996) to undermine the very family planning programs that have made a central contribution to this decline and that need larger budgets to meet the increased demand for fertility regulation by a burgeoning population of fertile couples. Meanwhile, the 1994 International Conference on Population and Development (ICPD) added concerns for gender equality and reproductive health to traditional family planning programs. While these broader areas of human suffering and justice represent valid and urgent humanitarian concerns, there is no empirical evidence that their solution is a prerequisite to further fertility decline. The international community is following up on the ICPD by cutting rather than increasing budgets (Potts 1996). McNicoll (1989) calls the population movement "tired," and Harkavy (1995) has written of the "malaise and self-doubt" that have entered the movement since the mid-1970s.

Policy implications

Government-run and -financed family planning programs are an effort to accelerate changes that would otherwise occur extremely slowly, and that might never lead to replacement levels of fertility. Given that adult heterosexuals of fertile age have sex more often than is needed to procreate, they can achieve their fertility goals only if they have access to the necessary technologies. Family planning users also require access to objective infor-

mation about the disadvantages as well as the advantages of each method. This review has suggested that offering people unconstrained access to contraception and safe abortion might be a sufficient as well as a necessary element for fertility decline. When realistic family planning choices are made available, fertility will fall even in a poor society, with its high illiteracy and low status for women. This is not to deny that socioeconomic factors correlate with patterns of family building, or that many people strongly and specifically want children, but it is to assert that access to reproductive technologies is key to bringing about fertility decline.

If we are indeed predisposed to separate sex from procreation, and if socioeconomic progress is not a prerequisite for fertility decline, then for an overcrowded world this is an optimistic message. It implies that in devising policies to deal with the impact of population on the environment or to move toward biologically sustainable economies, the population element in the equation is open to change, and if more resources are invested in improving access to fertility-regulation methods the trend toward lower fertility will be accelerated. If we had been predisposed to want more children as we grew richer, it would be exceedingly difficult to survive in a finite world without coercive controls on family size. But, by an accident of nature, individuals put their material needs and their sexual pleasure before deliberately increasing the burden of an excessive number of offspring.

In the medium term, the human population will inevitably increase because of the momentum built into the youthful population structure of the contemporary developing world. Past constraints on access to contraception and abortion have created serious demographic imbalances, with declines in the birth rate lagging half a century or more behind falls in mortality in countries such as Egypt or the Philippines.[20] In the longer term, the tendency to have fewer than two children once full access to contraception and abortion is achieved means not only that global population will level off, but that it is likely to decline.

For a world in which industrial effluents are threatening the biosphere, the message that people will tend to accumulate material wealth rather than large families is more worrying. The combination of the continuing momentum of population growth and rising material wealth must lead to somber conclusions, not only for biologists, but also for physicists, climatologists, agronomists, and others. Evolution emphasizes the individual competitive side of human nature, and although we are often socialized to be broadly altruistic, our underlying behavior will always be directed toward the benefit of our closest genetic relatives. This means that when it comes to the prudent use of finite external resources, we are likely to act selfishly, whether it be in the form of excessive deep sea fishing or rain forest exploitation. Economists, too, assume that human behavior is motivated by selfish interests, but they focus on exceedingly short-term cost/benefit

projections that often undervalue the real price of nonrenewable natural resources, and economists have only limited ways of assessing the costs of the global effects of pollution. Hence, they extrapolate current trends in economic prosperity in a much more optimistic way than biologists, who are aware that prosperous countries with dense populations have an ecological footprint (the area of land needed to provide food and raw materials to that population and required to absorb the pollution put out by industry) that is very much larger than their national boundaries (Rees and Wackernagel 1994).[21] If we fail to exploit the opportunity our biology has given us to lower fertility rapidly, then, in the words of a statement prepared by the World's Scientific Academies for the 1994 International Conference on Population and Development, "science and technology may not be able to prevent the irreversible degradation of the natural environment and continued poverty for much of the world" (Graham-Smith 1994: 377).

Some modern technologies and the information and promotion needed to support them (e.g., condoms, IUD insertion, injectables, oral contraceptives, and voluntary sterilization) are too expensive for many people in developing countries to purchase at their full cost. Some degree of subsidy is essential if fertility is to fall rapidly.[22] This is especially important if abortion rates are not to rise. Some of the poorest nations with the most rapid population growth are heavily dependent upon external subsidies from rich nations for their family planning services. It follows that the level of resources made available by the international community to help those who are too poor to afford the full cost of modern methods of birth control will have an impact on the rate at which they complete the transition to small families. Within certain limits, the greater the investment made by the international community, the more rapidly average global family size will fall. If the amount of foreign aid from OECD donor countries that is devoted to family planning were to rise from the current level of somewhat over one percent (Conly and Speidel 1993) to 2 or 3 percent, then current experience suggests that fertility decline in many parts of the world could be accelerated significantly.

Tsui (1995) has written of the danger of "a chasm arising between traditional and Cairo-driven views" on population programs. It would be a misfortune if this occurred, because both sets of views support the common pathway of making reproductive choices available. There is an urgent need to improve many aspects of women's health, over and above access to family planning and safe abortion, and beyond concerns about fertility levels. Efforts to promote the autonomy of women are self-justifying and need not be tied to a supposed impact on fertility decline. Women are more susceptible to sexually transmitted diseases than men, and HIV/AIDS continues to spread exponentially in many parts of the world. Improvements in education, particularly for women, may well be among the investments

with greatest leverage national governments or OECD donors can make to help improve the quality of life in many countries. Confusion arises, however, because while efforts to improve reproductive health can be readily justified in their own right, there are no observational data to link better reproductive health with smaller families.[23] With limited budgets, as Harvey (1996: 284) has pointed out, "we must often choose between providing contraceptive services for large numbers of people and providing more comprehensive health services for smaller numbers."

Family planning is a small but vital part of the total development equation, and it will never consume more than a few percent of the total development budget,[24] while programs to improve the status of women are broader and more expensive. Attempts to squeeze other aspects of women's development into the family planning sector could end up shortchanging the much larger needs of women. Broadening education or improving women's access to credit will each take a larger slice of the development budget than family planning could ever justify.

Given the real-world constraints enforced by the limited funds donors currently make available to international family planning, the policy implications of the above generalizations are straightforward. All countries should focus on making available, as rapidly as feasible, the fullest possible range of fertility-regulation choices that respect individual choice.[25] Choice in this context includes information about the method, where to get it, and objective data on its advantages and disadvantages. Since the development budget as a whole is never sufficient for the calls made on it by numerous sectors, and since the administrative span of many governments and nongovernmental organizations is limited, it is important that resources be allotted according to verifiable criteria. The design of new family planning services and the maintenance and expansion of existing ones must be managed in the most cost-effective ways possible. Those professionally involved in family planning must also understand what the empirical data are saying about the relationship between induced abortion and contraception: (1) a society could achieve any desired family size merely by the use of abortion, but in order to achieve a small family the average woman would need a large number of abortions; (2) even a moderate use of contraception will greatly reduce the abortion rate; (3) no contemporary society has achieved replacement-level fertility purely through the use of contraceptives, but all contemporary societies use a combination of contraception and abortion or menstrual regulation to achieve their fertility goals; and (4) no country has achieved low maternal mortality without access to safe abortion.[26] If countries and the international community wish to see the maximum use of contraception and the minimum recourse to induced abortion, then this implies, as noted above, the need to subsidize contraceptive services for the poor.

If the relatively modest resources needed are focused on improving access to family planning, then hundreds of millions of women and their families will benefit, and other aspects of development will be facilitated. Improving access to the technologies necessary to control fertility will help meet intensely personal goals at the level of individual welfare and happiness while also contributing to an essential demographic balance at the country and global level. The emphasis given to these two mutually supportive goals has varied over time (Donaldson 1990; Finkle and Crane 1975, 1985; McIntosh and Finkle 1995), but those who deny one or the other element in this "win-win" situation end up harming both causes. Women cannot be free unless they can choose when to have a child, instead of being forced to exceed their fertility goals owing to lack of access to fertility-regulation services. The implications for macro-aspects of development of the rate and timing of fertility decline in Africa and large areas of the Indian subcontinent cannot be overemphasized. Indeed, the world of the twenty-first century may be divided not into North and South, but into those countries that achieve a net replacement rate of one early in the century and those that do so later.

We are a large, intensely social animal facing the challenge of surviving in an increasingly complex and ever-changing world.[27] We need clear thinking about human sexual and reproductive decisionmaking. Universal access to fertility-regulating technologies must be achieved as soon as possible. This, together with appropriate investments focused on helping the poorest groups, will increase individual happiness, enhance health, and strengthen family bonds, and at the same time increase the odds that this earth can support the generations to come.

Notes

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1 Both biological and cultural determinism are mistaken concepts. Since Emile Durkheim (1895) revived John Locke's concept of the *tabula rasa*, part of modern sociology has regarded the newborn baby as an "empty vessel" whose behavior will be entirely shaped by the culture in which the individual is born. Franz Boaz in his preface to Margaret Mead's *Coming of Age in Samoa* (1928: xv) considered that her study confirmed "the suspicion long held by anthropologists that much of what we ascribe to human nature is no more than a reaction to the restraints put upon us by our civilization." Fifty years later, Goode (1978) wrote, "In a nutshell: sexual behavior, sexual custom, and sexual deviance are all dictated not by the body's animal or hormonal makeup, but the society and culture in which we live."

Evolutionary biology does not argue for the corresponding extreme degree of biological determinism, but for a balance. Certain

behaviors common to all societies can be best understood as being genetically determined, but also subject to modification by the environment. Voland (1995: 156) considers that "most of the evolved behavior-regulating mechanisms are conditional. This means that in situation A they may motivate towards a specific behavior, while in situation B, they may motivate towards another (possibly completely different) behavior. For example, parental love and care on the one hand and physical and psychological neglect, abortion and infanticide on the other, are different outcomes of the same parental brood-care system, the biological adaptiveness of which is demonstrated by its strategic flexibility and not its phenotypic rigidity."

2 The words and phrases used to describe evolved behavior can bias discussion. Dasgupta (1994), for example, writes, "We are genetically programmed to want and value [children]," and Eschenbach (1992) speaks of "the compelling desire to become a mother." Clark and Boinski (1995) and Wrangham and Peterson (1996) use the more neutral term "temperament." In this article I have adopted E. O. Wilson's phrase "genetic predisposition" to encompass what are assumed to be genetically programmed neuronal circuits controlling certain aspects of human behavior that interact in complex ways with an environment of learning (Wilson 1978). For example, a window of opportunity exists during the development of a child's brain when it is possible to learn language rapidly with a perfect accent, but the language and accent are determined by the environment.

3 E. O. Wilson (1978) has written that "with rare exceptions, the aggressive superior animal displaces the sub-ordinate from food, from mates, and from nest sites." Betzig (1982) emphasized the same message, describing how individuals "exploit positions of strength, ultimately to the end of maximizing genetic representation in descendent generations."

4 Observation in the field, especially among primates (Goodall 1986), historical analysis (Betzig 1986), and biological perspectives on anthropology (Hill and Hurtado 1996) have all made important strides. Useful insights are available, for example, into mating patterns (van den Berghe 1983; Harcourt et al. 1981), homosexuality (Symons 1979), and domestic violence (Daly and Wilson 1988).

5 Carey and Lopreato (1995: 623) write: "Individual experience—and, before that, the known experience of the individual's mother, aunts, and so forth—embedded in our female ancestors' machinery of neural processes the knowledge that high fertility equaled high child and maternal mortality, a great deal of pain and grief, and in the typical case approximately two reproductive offspring. . . . This is what is meant here by a 'two child psychology,' and everything we know about animal economy and the conservation of energy suggests that it is a plausible hypothesis." However, the idea of neural "embedding," derived apparently from conscious assessment of the costs of reproduction, seems both biologically unlikely and unnecessary. Other non-seasonally breeding animals, from red kangaroos to elephants, optimize birth intervals as a result of evolved, but *unconscious*, physiological processes built around breastfeeding and the suppression of ovulation. Such a mechanism also operates in human beings, and the neurophysiological machinery involved is identical in apes and human beings.

6 This generalization overlaps with Turke's (1989: 66) statement that "Once children have been born, rearing them to be healthy and otherwise well equipped to compete among their peers is, very often, one of the strongest of all consciously held goals." Both Kaplan (1994) and Turke, however, challenge the widespread assertion, central to many interpretations of fertility decline, that parents in poor societies have many children because they will provide "social insurance" in old age. In an interview parents may claim children are an economic asset, but direct observation of how people allocate their time suggests, at least in the preliterate societies that have been studied, that the flow of resources is predominantly from parents to children, and from grandparents to grandchildren, just as evolutionary biology would predict. Evolutionary biology also highlights the contrast between the behavior of biologi-

cal parents and stepparents in certain primates (Hrdy 1979). Among lions and some primates, such as gorillas and langur monkeys, where one male controls a harem of several females, if a new male fights and displaces a previous male, then the new male will systematically kill the infants conceived by his predecessor. The killing of unweaned infants terminates the interval of lactational amenorrhea and anovulation that would otherwise prevent the new male from impregnating his sexual partners. Human stepparents have up to a 60-fold relative risk of killing an infant compared to biological parents (Daly and Wilson 1988).

7 In menstrual regulation a hand-held syringe and a flexible plastic cannula, slightly larger than a drinking straw, are used to evacuate the uterus. The procedure is appropriate until approximately ten weeks after the missed period. The method, also known as manual vacuum aspiration, is suitable for treating the complications of unsafe abortion and certain pathologies of pregnancy. It takes a few minutes, can be done in any clean room, and can be completed either without anesthesia or with a local anesthetic. The procedure was first described by Karman and Potts (1972); its simplicity, and the fact it is sometimes done for reasons other than inducing abortion, have made it acceptable in some situations where routine abortion is not permitted.

8 Medieval society sequestered many unmarried women in convents (Hager 1992), limiting the flow of resources out of wealthy families with many children. By the eighteenth and nineteenth centuries, the definition of status according to material goods rather than according to maximizing reproductive potential appears to have been implicitly established. For example, in Jane Austen's novel *Mansfield Park* (published 1814), one sister marries a rich and powerful aristocrat and has four children, while another marries a marine and has nine children and is portrayed as a failure. Condoms were manufactured and marketed at this time, and the promotional material associated with them suggests an emphasis on sexual pleasure rather than procreation. The eighteenth century *Panegirick upon Cundums* contains the verse, "Joys untasted but for them/Unknown Big Belly and the squalling Brat" (Dingwall 1953).

9 Even as late as the 1950s, when Pincus, Rock, and Chang developed the oral contraceptive, they were breaking the law in Massachusetts. This is one reason why the first large-scale oral contraceptive trials were conducted in Puerto Rico, where the environment was less hostile to family planning (Asbell 1995).

10 As valued in 1960 US dollars.

11 Although Bangladesh is categorized as a country that has achieved partially constrained access to family planning, and the family planning program is much superior to that of Pakistan, there are still many shortcomings to the Bangladesh program. One survey, for example, found that in Bangladesh 17 out of 18 male family planning supervisors had additional jobs, from farming to private tutoring (Koenig and Simmons 1992). Besides deficiencies in service delivery, many women remain in *purdah* and must depend on their husbands to bring contraceptives home. Clearly, Bangladesh still has some way to go to reach unconstrained access to family planning, although it is reasonable to anticipate that the country may reach the two-child level by the time unconstrained access to fertility regulation is truly available.

12 A team from the London School of Hygiene and Tropical Medicine led by John Cleland studied four pairs of countries (Bangladesh and Pakistan; Thailand and the Philippines, Zimbabwe and Zambia; Tunisia and Algeria) selected to compare relatively good and very poor access to family planning choices (Lee et al., n.d.: 86). "The overall conclusion of this study is that, in at least three of the four pairs of countries, there is a strong case that public sector FP [family planning] policies and programmes have been largely responsible for their divergent fertility patterns." The authors are interested in why some countries "create appropriate and effective population policies while other, rather similar, countries do not." They argue that Thailand and the Philippines may be exceptions to their overall conclusion, because fertility decline had begun before government policies on family planning were

fully evolved. Instead, I interpret all four pairs as supporting the argument that access to contraception and abortion is the key to fertility decline. I accept that policymaking by social elites is important, but mainly to the extent it influences access to fertility-regulation technology. In other words, the hypothesis I have set out assumes any society will move to low fertility once the barriers limiting access to fertility regulation are removed.

13 In 1965, the birth rate in Piedmont, the area centered on Turin, was 13.4 per thousand, while in Calabria in the toe of Italy and in Sicily it was 24 per thousand (Potts 1968).

14 The observation that, if the world is divided into countries with unconstrained access to several methods of contraception and safe abortion and into countries with constrained access, then the former group all have families of two children or fewer has been explored by Martha Campbell in an unpublished paper titled "Redefining access." Campbell argues that access must include the elimination of harmful misinformation and also allow women the social power to make decisions about their lives, including their fertility. She suggests that by bringing knowledge and women's decisionmaking power into the definition of access to choices, this model then fits all countries more consistently than any other known model of fertility decline.

15 Udry and coworkers measured testosterone levels in adolescent boys in the United States and then determined the effect of religiosity on sexual behavior for a given hormone level. Boys with the highest hormone levels who never or rarely went to church were the most sexually active; those with the lowest levels who attended church weekly or more frequently were the least active; and those with high hormone levels and frequent church attendance were between these two extremes (Halpern et al. 1994).

16 Despite this evidence it is fashionable in some quarters to criticize the organized family planning programs established in the past 30 years. Sen (1995), for example, asserts that "coercive measures are often advocated for reducing fertility rates in the poorer countries. They have received attention in international debates and have been favored by some political pressure groups." The canard of coercion is often repeated, but revealingly Sen gives no references. In fact, no substantial Western group has ever advocated coercion in family planning, and no OECD donor would countenance such a stance. The Chinese one-child family policy is an unwelcome response to the denial of access to family planning choices characterizing that country's earlier history, which left the present generation with few choices. It is true that totally unacceptable examples of individual coercion have occurred in family planning programs, but sadly abuses of power exist wherever people are poor and bureaucracies corrupt, and they are not specific to the field of family planning. During the 1976 "Emergency" in India, coercion undoubtedly occurred in mass sterilization programs, but Soonawala (1993) reports that only 120 people sought compensation out of 8 million sterilized when the next government reversed the policies that had obtained during the Emergency.

17 Many international agencies supporting family planning use the development model of fertility decline in making projections, constructing policies, and designing services. In each of these areas, however, use of the model has proved misleading. In a 1972 Sector Working Paper on Population Planning, the World Bank projected the TFR for developed countries in 1995 as between 2.26 and 2.47. In fact, the 1995 TFR for developed countries was 1.67. The Bank in 1972 interpreted the fertility transition in the West as exclusively the results of "the spread of education, the progress of urbanization, and a realization that reduced death rates would lead to larger families unless fertility were checked." Had they appreciated the role of access to fertility regulation, they could have made a more accurate estimate.

The development model of fertility decline continues to color UNFPA and World Bank policies. UNFPA, for example, bases country programs on massive reviews of all sectors and encourages the creation of population councils to coordinate sectoral interests. These rarely prove a success.

At the service level, the development model led agencies up blind allies that an emphasis on access to family planning

choices would have avoided. Throughout the 1970s and 1980s Kenya was held up as an example of a high-fertility country where social, economic, and cultural factors militated against fertility decline. The primacy of accessible services was pushed to the back of the stage. An assessment of the 1977–78 Kenya Fertility Survey concluded, "In general, it appears that the attitudes of the Kenyan women toward fertility control are negative, which means that just creating an availability of family planning facilities may not greatly affect contraceptive practice" (quoted in Mott and Mott 1980: 34). Family planning services were "kept within the framework of maternal and child health services, reflecting the government's view that fertility reductions interact with reductions in child mortality and illness." Family planning centers "also provide assistance to women with infertility problems. The centers do not offer abortion" (Mott and Mott 1980: 31). This policy denied most people access to contraceptives (there were only 505 maternal and child health clinics in the country in 1978). So ingrained was the development paradigm that rather than question the quality and breadth of the services, commentators concluded: "The reasons for high dropout rates and low prevalence rates of contraceptive practice may actually be found in the almost universal desire of Kenyan parents for a large family" (quoted in Mott and Mott 1980: 34). In fact, the 1977–78 Kenya Fertility Survey (Central Bureau of Statistics 1980) showed that 16.8 percent of women of all ages wanted no more children. Between 1980 and 1993, contraceptive prevalence rose from 17 percent to 33 percent, and fertility fell by 36 percent. As a consequence, a major World Bank project had to be redesigned halfway through in order to switch resources to the support of services. Kenya has begun the transition to smaller families, but as a recent World Bank report concluded, the changes taking place cannot be ascribed to recent inputs into the population program. In Nepal, as in Kenya, experts from outside believed family planning would only be acceptable when "integrated" with other services. As a result, the first family planning services were limited to health centers serving 10,000 to 26,000 people—a policy that proved a sure recipe for ensuring incomplete access to contraceptive choices.

18 Pritchett (1994) used Demographic and Health Survey data to analyze the relationship between actual and desired fertility and contraceptive prevalence. He concluded that "because fertility is principally determined by the desires for children, contraceptive access (or cost) or family planning effort more generally is not a dominant, or typically even a major, factor in determining fertility differences" (p. 39). My review of the evidence arrives at a diametrically opposite conclusion. In fact, the self-reported average ideal number of children (AINC) is less than the TFR in 29 out of 37 countries cited by Pritchett, and sometimes the difference is large (e.g., Egypt 1988: TFR 4.4; AINC 2.9). Wherever a temporal sequence of AINC is available (15 cases), the trend is always downward; and even where examples exist of communities whose AINC exceeds the TFR (e.g., Sri Lanka 1975: AINC 3.8; TFR 3.4), actual fertility has always continued to fall (Sri Lanka 1987: AINC 3.1; TFR 2.7). In Ghana, the TFR in 1988 was 6.5 and the desired family size 5.5, while in a repeat survey in 1992, the TFR was 5.5 and desired family size had fallen to 4.7. Most people know from introspection that there is nothing contradictory about self-reporting an ideal family size greater than the actual outcome of decisionmaking in the real world with its many constraints—after all, the same "contradiction" probably applies to many people's vision of the home they live in, the automobile they drive, or the income they would like: it is not unusual to express a desire for more than we know we can have.

19 The family planning market place is skewed in many ways (Shelton, Jacobstein, and Angle 1992). Among the more egregious examples of medical restrictions on access to family planning were de jure and de facto requirements to measure the serum cholesterol level of women starting the pill in parts of Francophone Africa. Such tests had no predictive value but could cost the equivalent of five months' per capita income, or 100 times the per capita health expenditure of the country (Stanback et al. 1994). Surgeons explicitly, or implicitly, often apply arbitrary

criteria of age and parity when responding to requests for voluntary sterilization. In the United States in the 1960s, a "120 rule" (age x parity must equal 120 or over) was applied to voluntary sterilization, and this criterion persists in many developing countries. Rajan, Mishra, and Ramanathan (1993) demonstrate that Indian women usually have their second child around ages 23 to 24, whereas the average age of voluntary sterilization is about 30. Even if desired family size falls, it will be exceedingly difficult for many couples to achieve their goals unless (1) access to reversible methods of contraception is improved to meet the needs of those who want to space a small family more adequately and (2) voluntary sterilization is offered to younger couples after informed consent, or (3) safe, early abortion is made more accessible.

20 Lee et al. (n.d.) calculate that if, at a national level, Filipinos had enjoyed as direct access to family planning choices as the citizens of Thailand, then by 2050 the population of the Philippines would have risen to 74 million and would be stable. If the present growth rate continues, population will climb to 127 million by 2050, and it will still be increasing. Similar calculations for Pakistan demonstrate that if it had been as successful in Bangladesh in offering choices, then the population of Pakistan in 2050 would have reached 279 million, instead of the 467 million now projected for that date. Even with the lower rate of growth, Bangladesh has entered what King (1990) has called the "demographic trap," where the population exceeds the capacity of the country to support its numbers and must face death from starvation, death from war or civil conflict, mass emigration of ecological refugees, or the perpetual replenishment of the shortfall in food and other necessities through foreign aid. To date, the last solution seems most likely, but the fate of countries such as Pakistan in the coming 50 years must raise serious concerns.

21 There is a paradox in the complex relationship between fertility change and economic growth that is not always recognized. On the one hand, many countries with rapid population growth are getting poorer. Much of sub-Saharan Africa (taking into account human and physical capital) has become poorer every year since the 1970s. In Rwanda, many families are forced to survive on a half hectare of land (Guillebaud 1996). On the other hand, those countries that are close to replacement levels of fertility are getting richer. In the late 1980s, for example, Thailand became the most rapidly growing economy of any country in the world. From the point of view of sustainable development, a poor country with rapid population growth may well have a smaller ecological footprint than would the same country with replacement-level fertility but with rapid economic growth. Korea in 1990 with a TFR of 1.7 used much more of the world's resources than it did in 1960 with a TFR of 6.0. There seems no escape from this paradox, other than to recognize that it presents rich countries with an important challenge.

22 There is an urgent need for a centralized system to buy high-quality contraceptives on the competitive world market at the lowest rate, and then to supply commodities to governments, International Planned Parenthood Federation affiliates, and other large nongovernmental organizations (including social marketing programs) that meet criteria of service quality and that work in societies with a per capita income below a specified level (Demeny 1994).

23 "No exacting set of research findings exists to underwrite the expectations that improved reproductive and sexual health will prompt couples to exercise their reproductive choices in a manner that maintains fertility decline, and thereby slows population growth" (Tsui 1995: 245).

24 In 1991, only 1.34 percent of OECD funding for overseas development assistance was allotted to family planning. Some increase in donor funds may have occurred following the 1994 International Conference on Population and Development (ICPD) in Cairo, but today's total is far below the ICPD's suggested donor contribution of US$5.5 billion per year by the year 2000. The future is not encouraging. Funding from the US Agency for International Development, long the largest donor in dollar terms to international family planning, has partially collapsed, and some other rich countries, such as France and Italy, have never given more

than 3 to 4 US cents per capita, per annum to international family planning (Conly and Speidel 1993). There may be several reasons why politicians and bureaucrats are not committed to reaching the ICPD goal: the welfare of the world's poor (especially of women) is not high on the agenda of rich nations; "experts" from various disciplines give conflicting and sometimes contradictory advice; and the field is perceived to be intrinsically controversial.

25 Condoms, oral contraceptives, emergency contraception, and injectables should be distributed, with good information, through multiple channels. Providing family planning methods through the use of existing infrastructure—including subsidized distribution of contraceptives in private shops and stalls, the use of doctors in private practice, and the appropriate use of government health facilities—is often more cost-effective than providing services through specialized family planning clinics, or exclusively through government health centers and hospitals. For example, Korea and Taiwan used coupons made available by government workers to provide subsidized services from private medical practitioners to women and men. Probably no large developing country has achieved significant fertility decline merely by using specialized family planning clinics. Contraceptive use is enhanced by advertising and by strong brand images for contraceptive products. Many family planning programs also promote the ideal of small families. On the other hand, the promotion of family planning without access to services is likely to frustrate potential users and might even be counter-productive.

26 On this fourth point, see Kulczyki, Potts, and Rosenfield (1996). The answer to the question, When does life begin? represents an assertion of belief, not a scientifically demonstrable fact (Potts 1985; Ford 1988). Decisionmakers should take into account the fact that in any civil society that separates church and state, there is an obligation to tolerate the beliefs of others. A strong consensus exists that contraception is preferable to abortion. Technically, abortion in the first three months of pregnancy could be made available at the primary care level, and such a strategy most likely would prove financially self-sufficient within a few years of beginning the service.

27 One speculation as to why fertility regulation presents so many analytical and policy challenges is that humans have a predisposition to be shy about sex. In all cultures adults conceal their genitalia and have sex in private. Such behaviors could assist in strengthening the sexual bond between parents, but they might also explain why much of the academic literature studying family size overlooks the importance of access—or, more commonly, the lack of access—to fertility-regulation methods. This inherent desire to cover up sex may make it difficult to set rational policies or to allocate adequate resources to fertility regulation.

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