

much of the reduced fertility in those societies was caused by impaired fecundity and how much by covert individual or societal restraints on childbearing. Henry (1961) believes that these societies do not practice any voluntary fertility restriction, with the possible exception of delayed marriage and sexual taboos, for example, during lactation. He presents convincing evidence for this belief by showing that the age-specific fertilities in all these societies follow a common pattern—fertility is reduced from the Hutterite fertility by approximately the same factor at all ages. It might be expected that families deliberately controlling family size would do so selectively at the end of the reproductive lifetime, when the desired number of children had been achieved. Thus the ratio of observed age-specific fertility to Hutterite age-specific fertility (a rough measure of fecundity) would be expected to be constant through age 30 or 35, and then to decrease as voluntary controls begin to be utilized. Numerous other populations with a markedly decreasing fertility as a function of age have been observed. Espenshade (1971) has used the decrease in the ratio of age-specific fertility relative to Hutterite fertility to estimate both the natural fecundity (from fertilities in ages 20 to 30) and the degree of control practiced by these "birth-controlling" societies (from fertilities in ages 35 to 45).

Davis and Blake (1956) have greatly clarified the discussions of variations in human fertility by classifying all the possible variable aspects of human fertility under three basic biological categories: intercourse, conception, and gestation-parturition. The Davis-Blake classification of the "intermediate variables" of human fertility is:

- I. Factors affecting exposure to intercourse:
 - A. Formation and dissolution of sexual unions.
 1. Age of entry into sexual unions.
 2. Extent of permanent celibacy.
 3. Amount of reproductive period spent after or between unions.
 - a. Unions broken by divorce, separation, desertion.
 - b. Unions broken by death of spouse.
 - B. Exposure to intercourse within unions.
 4. Voluntary abstinence.
 5. Involuntary abstinence (impotence, illness, separations).
 6. Coital frequency, excluding periods of abstinence.
- II. Factors affecting conception:
 7. Fecundity affected by involuntary causes.
 8. Use of contraception.
 9. Fecundity affected by voluntary causes (voluntary sterilization).
- III. Factors affecting gestation and parturition:
 10. Fetal mortality from involuntary causes (miscarriage, stillbirth).
 11. Fetal mortality from voluntary causes (induced abortion).

Four of these factors—3b, 5, 7, and 10—are variables that reflect the influence of external, involuntary, environmental factors on maximum human fertility. All the other factors are subject to some degree of conscious human control, on either an individual or a societal level. They will be discussed later. Here we shall examine the four involuntary factors as potential influences on human fecundity.

To repeat and somewhat expand the Davis-Blake analysis, the factors that influence maximum total fertility must operate through:

- 3b. Interruption of sexual unions by death.
5. Involuntary sexual abstinence within sexual unions: impotence, illness, or involuntary separation.
7. Infecundity occasioned by the primary or secondary sterility of either member of a sexual union or by the partial infecundity of either member. The latter may be caused by infrequency of ovulation or an abnormally short duration of the female fertile period, an insufficient number or viability of sperm, postpartum infecundity, or a reduced length of reproductive lifetime.
10. Involuntary fetal mortality, leading to spontaneous abortion, miscarriage, or stillbirth.

With the possible exceptions of impotence and involuntary separation, all these factors are influenced in some way by the general health of the population. All are summarized in World3 by one variable, the fecundity multiplier FM, which expresses the general influence of health on maximum total fertility MTF through all possible mechanisms. We shall first discuss separately what little is known about each mechanism and then describe how they were combined into the fecundity multiplier FM.

The influence of health on fecundity is perhaps most obvious in the interruption of sexual unions by death. In a typical society with a thirty-year life expectancy, only 60 percent of fifteen-year-old brides will survive to the end of their reproductive period. If we assume that they all marry men five years older than themselves, almost half of the women who survive will lose their husbands before they themselves reach the age of forty-five. The deaths of reproductive-age females can be accounted for in a demographic model by proper representation of the population age structure. The effect of the deaths of reproductive males on total fertility depends partly on the social customs regarding the remarriage of widows, for these customs vary widely in different societies (Davis and Blake 1956).

Little is known about the importance of involuntary sexual abstinence during illness, but we would certainly expect such abstinence to decrease as the general health of a population improves.

Sterility appears to be an important variable in the differential fecundity of populations, especially of populations with inadequate medical care. Moni Nag (1968), in a survey of 65 nonindustrial societies, finds sterility a major factor in 7 of the 10 societies that exhibited very low fertility (for 2 of these 10 societies no information on sterility was available). In most cases the sterility was medically avoidable, since it resulted from venereal disease or from infections associated with childbirth. The potential importance of primary fertility (secondary fertility appearing after the birth of one child is not included) on the reproductive rate can be seen in data from several African populations, shown in Figure 2-59 (U. N. 1965, p. 24). In contrast, Wyon and Gordon (1971, p. 163) found an extraordinarily low incidence of primary sterility (1-3 percent) in North Indian villages.