A BACKGROUND SUMMARY OF CONSANGUINEOUS MARRIAGE

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Introduction

Although marriages between close biological kin are preferential in many parts of the world, there still is a great lack of knowledge of this central feature of human kinship structure. As an introduction to the subject, brief summaries are presented on topics such as the religious and legal backgrounds to consanguineous marriage in different societies, sociodemographic aspects of marriages between close biological kin, fertility in consanguineous unions, and the effects of consanguinity on rates and patterns of morbidity and mortality. Unfortunately, in many of the more populous countries representative information on consanguineous marriage and its outcomes is sparse or even unavailable. In others, legislation introduced within the present generation may be exerting a marked effect on traditional patterns of marriage preference, an example being the 1981 Marriage Law of the People's Republic of China which prohibits marriage between couples related as first cousins or closer. It is envisaged that this Website can serve both as a spur to continuing data collection on consanguinity, and as a baseline against which future changes in marriage practices and their outcomes can be assessed.

Current prevalence of consanguineous unions

As a working definition, unions contracted between persons biologically related as second cousins ($F \geq 0.0156$) are categorized as consanguineous. This arbitrary limit has been chosen because the genetic influence in marriages between couples related to a lesser degree would usually be expected to differ only slightly from that observed in the general population. Globally, the most common form of consanguineous union contracted is between first cousins, in which the spouses share 1/8 of their genes inherited from a common ancestor, and so their progeny are homozygous (or more correctly autozygous) at 1/16 of all loci. Conventionally this is expressed as the coefficient of inbreeding (F) and for first cousin offspring, $F = 0.0625$. That is, the progeny are predicted to have inherited identical gene copies from each parent at 6.25% of all gene loci, over and above the baseline level of homozygosity in the general population. In some large human populations genetically closer marriages also are favoured, in particular uncle-niece and double first cousin unions where the level of homozygosity in the progeny is equivalent to $F = 0.125$.

As shown in the accompanying map, national populations can be approximately subdivided into four main categories: those in which consanguineous unions account for less

than 1% of marriages, 1% to 10%, and 20% to over 50%, and populations where the level of consanguinity is unknown, either because it has not been reported or the data are of insufficient reliability and depth to make a prediction with any degree of confidence. Applying these definitions, the present numbers in each category are: less than 1% consanguinity, 1,061 million; 1% to 10% consanguinity, 2,811 million; 20% to 50+% consanguinity, 991 million; and unknown, 1,064 million (Bittles *et al.* 2001). As the data collection methods employed were conservative, these figures should be regarded as lower bound estimates.

With the exception of Japan, which has undergone rapid industrialization and urbanization since World War II, past predictions of a rapid decline in the overall prevalence of consanguineous unions have proved to be largely incorrect. In fact, the recorded numbers of consanguineous unions appear to have grown at least in step with increasing national and regional populations, and in some economically less developed countries the proportion of marriages contracted between close biological kin has expanded. The simplest explanation for this observation is that as greater numbers of children survive to marriageable age, the traditional social preference for consanguineous unions can be more readily accommodated.

Migrant communities now permanently resident in Western countries may represent a special case, especially where they practise a religion not followed by the majority indigenous population. In such communities, the available evidence from Western Europe, North America and Australasia suggests that the prevalence of consanguineous unions is increasing, in many cases from an already high level (for example, de Costa 1988; Modell 1991; Hoodfar and Teebi 1996; Reniers 1998). Various reasons can be advanced for this finding, including the desire to find a marital partner from within the community, which itself may be numerically small and composed of a restricted number of kindreds, and the wish to maintain community traditions in a new and unfamiliar environment. However, explanations of this type underestimate the strong belief that marriage within the family, as opposed solely to community endogamy, is the most desirable and reliable marital option (Bittles *et al.* 1991; Hussain and Bittles 1998; Hussain 1999). As previously noted, the current increase in the numbers of persons of marriageable age within these communities effectively facilitates the fulfillment of this belief.

Religious and legal regulation of consanguineous marriage

Religious proscription

There appears to be no particular rationale for the subdivision of human populations into opposing forms of marriage preference, and even within the major religions there are quite marked differences in attitude to close kin marriage. Thus in Christianity, the Orthodox churches prohibit consanguineous marriage, the Roman Catholic church currently requires Diocesan permission for marriages between first cousins, and the Protestant denominations permit marriages up to and including first cousin unions (Bittles *et al.* 2001).

A similar degree of non-uniformity exists in Hinduism. The Aryan Hindus of northern India prohibit marriage between biological kin for approximately seven generations on the male side and five generations on the female side (Kapadia 1958). By comparison, Dravidian Hindus of South India strongly favour marriage between first cousins of the type mother's brother's daughter (MBD) and, particularly in the states of Andhra Pradesh, Karnataka and Tamil Nadu, uncle-niece marriages also are widely contracted.

In general, Muslim regulations on marriage parallel the Judaic pattern detailed in *Leviticus* 18: 7-18. However, uncle-niece unions are permitted in Judaism. Yet they are forbidden by the *Koran*, even though double first cousin marriages, which have the same coefficient of inbreeding ($F = 0.125$), are recognized within Islam. In southern Asia, Buddhism sanctions marriage between first cousins, as does the Zoroastrian/Parsi tradition. The Sikh religion forbids consanguineous marriage, although some minority Sikh groups appear to exercise flexibility in the observance of this proscription.

Legislation

A similar lack of coherence exists in legislation enacted in different countries to govern permitted types of consanguineous relationships in marriage. For example, first cousin marriages are legal in countries such as the U.K. and Australia, but they are criminal offences in eight of the states of the U.S.A. and illegal in a further 31 states (Ottenheimer 1990). Yet exceptions can be incorporated into state laws, for example, to permit uncle-niece marriage within the Jewish community of Rhode Island (Bratt 1984). Legislation approved and adopted at the national level may also prove to be inoperable in practice, as exemplified by the Hindu Marriage Act of 1955 which includes a ban on uncle-niece marriage (Kapadia 1958). Yet in a study conducted between 1980 and 1989 in Bangalore and Mysore, the two

major cities of the state of Karnataka in southern India, 21.3% of Hindu marriages were uncle-niece unions (Bittles *et al.* 1992).

Sociodemographic aspects of consanguinity

The specific types of consanguineous marriage that are favoured can vary quite widely between and within different countries, with religious, ethnic, and local or tribal traditions playing a major role at local and national levels. The reasons most commonly given for the popularity of consanguineous marriage can be summarized as: a strong family tradition of consanguineous unions; the maintenance of family structure and property, and the strengthening of family ties; financial advantages relating to dowry or bridewealth payments; the ease of marital arrangements and a closer relationship between the wife and her in-laws; and greater marriage stability and durability (Bittles 1994; Hussain 1999). The degree of social compatibility, and the close involvement of the entire family in consanguineous unions, may explain both the greater stability that has been claimed for consanguineous unions, which have lower divorce rates, and enhanced female autonomy.

Among the major populations so far studied, the highest rates of consanguineous marriage have been associated with low socioeconomic status, illiteracy, and rural residence. In some populations a high prevalence of marital unions between close relatives has however been reported among land-owning families, and in traditional ruling groups and the highest socioeconomic strata (Bittles 1994, 1995a). Interactions between consanguinity and social variables can potentially complicate assessment of the genetic effects of human inbreeding, and failure to account for social variables when estimating the possible effects of inbreeding on mortality predictably would lead to biased results, with overestimation of the adverse biological effects ascribed to consanguinity. Conversely, where consanguinity has not been included as an explanatory variable, the influence of other more widely investigated demographic determinants, such as maternal age, maternal education, birth interval, and birth order, probably require significant downward revision.

Consanguinity and reproductive behaviour

It has been proposed that fertility may be lower in consanguineous couples due to a failure to initiate pregnancy when the couple share specific HLA haplotypes (Ober *et al.* 1992), or because of the expression of deleterious genes acting during early embryonic or

fetal development that result in periconceptual losses (Ober *et al.* 1999). Conversely, it could be argued that the greater genetic compatibility between the mother and developing fetus in a consanguineous pregnancy would lead to reduced rates of involuntary sterility and prenatal losses. Additionally, there is a strong possibility that greater fertility may be observed in consanguineous unions as a compensatory mechanism for infant and childhood losses (Schull and Neel 1972; Tunçbilek and Koç 1994; Bittles *et al.* 2001).

In general, higher total fertility rates are reported for consanguineous marriages (Bittles 1995b). A partial explanation for these findings is the generally lower parental age at marriage and the age at the first birth of couples who are close relatives (Bittles *et al.* 1991, 1993). Although the time elapsed to first pregnancy often is longer in consanguineous unions, possibly due to gynaecological immaturity in females who marry at a young age, subsequent birth intervals are shorter, and consanguineous couples may continue their child-bearing to comparatively later ages (Tunçbilek and Koç 1994). Consanguineous couples may also be less likely to use reliable methods of contraception (Hussain and Bittles 1999). These social variables exert a significant positive influence on the fertility of consanguineous couples, resulting in optimization of the maternal reproductive span and, to a lesser extent, concentration of child-bearing in the mothers' most fertile years.

Consanguinity, morbidity, and mortality

The detrimental health effects associated with consanguinity are caused by the expression of rare, recessive genes inherited from a common ancestor(s). In populations where inbred unions are common, increased levels of morbidity and mortality caused by the action of detrimental recessive genes can be predicted. Generally, inbreeding is associated with loss of biological fitness. It is however appropriate to note that, even in the absence of preferential consanguinity, alleles which are rare in large populations can rapidly increase to high frequency in a breeding pool of restricted size, because of factors such as founder effect and random genetic drift.

Empirical studies on the progeny of first cousins indicate morbidity levels to be some 1% to 4% higher than in the offspring of unrelated couples (reviewed in Bittles and Makov 1988). The less common a disorder, the greater the influence of consanguinity on its prevalence, a generalization that applies to recessive multigene disorders as well as to single gene conditions. For this reason, many previously unrecognized genetic diseases have first

been diagnosed in highly endogamous communities, and in a significant proportion of cases the underlying mutation may be unique to the community. At a practical level, this community-specific pattern of disease leads to major problems when attempting to estimate the burden imposed by consanguinity-associated morbidity at national or even at regional and local levels.

In a study based on combined data from 38 populations in eastern and southern Asia, the Middle East, Africa, Europe, and South America, with average coefficient of inbreeding (α) values ranging from 0.0005 to 0.0370, mean excess mortality at the first cousin level was 4.4% (Bittles and Neel 1994). This estimate appears to be valid for all of the large human populations so far examined. However, consanguinity interacts with a range of sociodemographic variables in determining rates of mortality during infancy and early childhood. When these influences were simultaneously analyzed using data collected retrospectively as part of the 1990/91 Pakistan Demographic and Health Survey, the major determinants of early death were maternal illiteracy, maternal age at birth of less than 20 years, and a birth interval of less than 18 months. But, even after controlling for these factors, first cousin progeny had statistically significant odds ratios for neonatal, postneonatal, and infant mortality of 1.36, 1.28, and 1.32, respectively (Grant and Bittles 1997).

Given the numbers potentially involved, the contribution of recessive genes as predisposing factors in common diseases of adulthood is of great interest and significance, but to date this topic has been little investigated. Nonetheless, in a preliminary study in Pakistan, higher levels of inbreeding were reported in patients with a range of major adult disorders, including some common cancers and cardiovascular disease (Shami *et al.* 1991).

Future prospects

Irrespective of prevailing legislation, a future decline in the prevalence of consanguineous unions can be predicted, accompanying the expected reduction in family sizes. It seems probable that this decline will not be uniform in effect across populations but will be mainly observed in urbanized populations and among couples who share higher educational standards and later ages at marriage. The specific type of consanguineous union contracted may also prove to be an important determining factor. As family sizes reduce, double first cousin and uncle-niece marriages in particular will become increasingly difficult to arrange within the accepted norms of spousal age difference at marriage. At the same time,

there may be lesser emphasis placed on the requirement to marry within the prescribed consanguineous marriage pattern, for example, mother's brother's daughter in southern India, in order to ensure that a marriage within the family can be contracted.

With improving socioeconomic conditions, the incidence of primarily "environmental" disease is declining in most developing countries, largely because of better basic public health measures and the introduction of vaccination programs for lethal childhood infectious diseases. As a result, genetic disorders now account for an increasing proportion of morbidity and death. This epidemiological transition has already been observed over the course of the last two generations in more developed, low mortality countries, and within the last two decades it also has become evident in the Gulf States, where favourable socioeconomic circumstances have been translated into advanced diagnostic and health care facilities.

Our limited knowledge and understanding of consanguinity is unfortunate, especially since in Western societies the information that is available tends to be overly focused on the undesirable clinical outcomes of close kin marriage, which adversely affect a minority of families and individuals. This lack of balance operates to the detriment of the much larger proportion of consanguineous couples whose children do not show identifiable deleterious biological effects, and to whom the social and economic benefits of a consanguineous union appear obvious.

For the benefit of those families and communities where one or more detrimental recessive genes are segregating, it is important that greater efforts be invested in establishing multidisciplinary surveys to estimate the extent of the problem, accompanied by the initiation of community-based counselling programmes. Given the numbers of consanguineous marriages contracted in many of the world's most populous countries, and the fact that inherited disorders which currently are lethal in less developed societies may be associated with lifetime care under improved treatment facilities, programmes of this nature would clearly be beneficial to human society as a whole.

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