EMPIRICAL ESTIMATES OF THE GLOBAL PREVALENCE OF CONSANGUINEOUS MARRIAGE IN CONTEMPORARY SOCIETIES

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Background to the report

Although marriages between close biological kin are preferential in many parts of the world, there still is a remarkable lack of knowledge of this central feature of human kinship structure, in particular how consanguinity might influence reproductive behavior, and consanguinity-associated morbidity and mortality. The principal aim of this report is to provide a detailed and comprehensive review of the current global prevalence of consanguineous marriages. The review is based almost exclusively on data collated from refereed journal articles, supplemented where appropriate by information from edited book chapters, papers submitted for publication and personal communications. All of the results cited refer either to the current parental generation or to the two immediate past parental generations.

The original data were collected in a number of ways. In the majority of cases either structured or random household interviews were used. Additional information sources included school and workplace surveys, child health surveys, women recruited as obstetric and gynecology inpatients, obstetric outpatients, medical students, hospital visitors, blood donors, civil marriage registration records, parish records, diocesan records pertaining to Roman Catholic couples seeking dispensation to marry a biological relative, and pedigree analysis. The 381 surveys that were accessed contained information on the prevalence of consanguinity in some 6.55 million marriages. A majority (n = 235) of the surveys had been conducted in various regions of Asia. However, almost 70% of the total data entries were derived from records collected in Europe and northern America where the prevalence of consanguinity is generally low.

The data on consanguineous marriage have been partitioned into two main categories. Information on major populations is presented in Tables 1-5, ordered first by continent and then sequentially by region and country, and at state, province or district levels. In all cases the data refer either to indigenous populations or to long-term settled migrants who now represent the national majority. By comparison, the data in Table 6

are based on the rates of consanguineous marriage recorded in geographical, religious or social minorities, and in some cases the sample sizes are equivalently small.

Brief introductory summaries on associated subjects have been included to complement the statistical information presented. The topics include 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 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 seeks to prohibit marriage between couples related as first cousins or closer. Thus it is envisaged that the present report can serve both as a spur to continuing data collection on consanguinity, and as a baseline against which future changes in marriage practices 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 favored, in particular uncle-niece and double first cousin unions where the level of homozygosity in the progeny is equivalent to $F = 0.125$.

An estimate of the current global prevalence of consanguineous unions can be derived from national population projections (PRB 1998), and the reports listed in Tables 1 to 5 on the prevalence of consanguineous marriage in major populations at national, regional and local levels. Human populations can be approximately subdivided into four main categories: populations where consanguineous unions account for less than 1% of marriages, 1% to 10%, and 20% to over 50%, and those in which 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.* 1999).

It should be noted that a deliberately conservative approach was adopted when compiling the data in Tables 1-5, and so the numbers recorded can reasonably be regarded as lower-bound estimates. With the exception of a country such as 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 1998a). 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 (Bittles *et al*. 1999). 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 sanction marriages up to and including first cousin unions.

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 favor 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, whereas 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 offenses 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 favored can vary quite widely between and within different countries, with religious, ethnic, and 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). 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, may require significant downward revision.

Consanguinity and reproductive behavior

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 spontaneous abortion or miscarriage. 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).

In general, higher total fertility rates are reported for consanguineous marriages (Bittles 1995b). The most credible 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 gynecological 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 are also less likely to use reliable methods of contraception (Hussain and Bittles 1998b). 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. Thus, in general terms, 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 (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 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 owing to 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 favorable 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.

However, 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 counseling programs. 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, programs of this nature would clearly be beneficial to human society as a whole.

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Table 1 to 6

Abbreviations used

UN,	uncle-niece marriage (F = 0.125)
AN,	aunt-nephew marriage (F= 0.125)
DIC,	double first cousin marriage (F = 0.125)
1C,	first cousin marriage (F = 0.0625)
11/2C,	first cousin once removed marriage (F = 0.0313)
D2C,	double second cousin, (F = 0.0313
2C,	second cousin marriage (F = 0.156)

Mean population coefficient of inbreeding ($\bar{F}$)

Calculated according to the formula: $\bar{F} = \sum p_i F_i$

where p_i is the proportion of couples in each consanguinity class F_i

TABLE 1

CONSANGUINEOUS MARRIAGE IN AFRICA

Region/country	Location	Collection period	Study population	Sample size	Consanguinity (%)	Consanguinity types	Coefficient of inbreeding (□)	Reference
Eastern Africa								
Tanzania	Pangani (Muslims)	-	Household survey	503	37.8%	1C	0.0236	Tanner (1958)
Northern Africa								
Algeria	Algeria (urban)	1970	Civil registration	-	27.5	1C,2C	0.0136	Benallègue and Kedji (1984)
	Algeria (rural)	1970	Civil registration	-	34.0	1C,2C	0.0169	Benallègue and Kedji (1984)
	All-Algeria	1979	Civil registration	120,491	22.6	1C,2C	-	Benallègue and Kedji (1984)
Egypt	Alexandria	1961/64	Obstetric inpatients	9,475	32.8	>1C,1C,<1C	-	Stevenson *et al*. (1966)
	Nubia	1965/67	Household survey	281	60.5	1C,<1C	0.0245	Hussien (1971)
	Nubia (*Fadetchi*)	1967/68	Household survey	611	61.4	D1C,1C,11/2C,2C	0.0329	Badr (1972)

	Nubia (*Kenuzi*)	1967/68	Household survey	757	62.0%	D1C,1C,11/2C,2C	0.0335	Badr (1972)
	Nubia (Arabs)	1967/68	Household survey	414	69.8	D1C,1C,11/2C,2C	0.0338	Badr (1972)
	All-Nubia	1967/68	Household survey	1,782	63.6	D1C,1C,11/2C,2C	0.0334	Badr (1972)
	All-Egypt	1970s	Household survey	505	23.2	1C	0.0145	Habib and Böök (1983)
	All-Egypt (urban)	-	School/ workplace survey	7,646	22.1	D1C,1C,11/2C,2C	0.0092	Hafez *et al.* (1983)
	All-Egypt (suburban)	-	School survey/ hospital outpatients	11,280	26.8	D1C,1C,11/2C,2C	0.0105	Hafez *et al.* (1983)
	All-Egypt (rural)	-	Household survey	7,628	39.1	D1C,1C,11/2C,2C	0.0147	Hafez *et al.* (1983)
	All-Egypt	-	Household/ school/ workplace survey/hospital outpatients	26,554	29.0	D1C,1C,11/2C,2C	0.0101	Hafez *et al.* (1983)
Sudan	Gezira	1969/74	Household survey	2,999	44.2	1C	0.0028	Ahmed (1979)
	Khartoum (Nilotes)	-	Blood donors	345	18.3	1C,2C	0.0101	Saha and El Sheikh (1988)

	Khartoum (Negroids)	-	Blood donors	302	45.7%	1C,2C	0.0255	Saha and El Sheikh (1988)
	Khartoum (Arabs)	-	Blood donors	4,186	55.2	1C,2C	0.0322	Saha and El Sheikh (1988)
	All-Khartoum	-	Blood donors	4,833	52.0	1C,2C	0.0302	Saha and El Sheikh (1988)
Tunisia	North	-	Obstetric inpatients	5,767	26.9	>1C,1C,11/2C,2C	0.0213	Riou *et al.* (1989)
Southern Africa								
South Africa	Capetown (Cape Coloured)	1961/64	Obstetric inpatients	3,014	0.7	>1C,1C,<1C	-	Stevenson *et al.* (1966)
	Johannesburg	1961/64	Obstetric inpatients	10,909	0.4	>1C,1C,<1C	-	Stevenson *et al.* (1966)
	Pretoria (Bantu)	1961/64	Obstetric inpatients	9,831	6.1	>1C,1C,<1C	-	Stevenson *et al.* (1966)

Western Africa

Guinea	Fouta-Djallon (Tarambali-Dionfo)	-	Household survey	739	25.9%	1C,11/2C,2C	0.0131	Chantrelle and Dupire (1964)
Nigeria	West (*Yoruba*)	-	Household survey	489	51.2	UN,1C,11/2C,2C	0.0242	Scott-Emuakpor (1974)

TABLE 2

CONSANGUINEOUS MARRIAGE IN THE AMERICAS

Region/country	Location	Collection period	Study population	Sample size	Consanguinity (%)	Consanguinity types	Coefficient of inbreeding (□)	Reference
Caribbean								
Puerto Rico	San Juan (north)	1954	R C dispensation	6,013	3.3%	UN,1C,11/2C,2C	0.0013	Freire-Maia (1957)
Cuba	All-Cuba	1956/57	R C dispensation	2,277	0.8	1C,11/2C,2C	0.0005	Freire-Maia (1968)
Central America								
Costa Rica	All-Costa Rica	1954	R C dispensation	3,833	3.4	UN,1C,11/2C,2C	0.0011	Freire-Maia (1968)
El Salvador	All- El Salvador	1956/57	R C dispensation	2,494	4.9	1C,11/2C,2C	0.0014	Freire-Maia (1968)
Honduras	All-Honduras	1956/57	R C dispensation	3,759	3.4	1C,11/2C,2C	0.0011	Freire-Maia (1968)
Mexico	Mexico City	1961/64	Obstetric inpatients	24,333	0.3	>1C,1C,<1C	-	Stevenson *et al.* (1966)

	All-Mexico	1956/57	R C dispensation	28,192	1.3%	1C,11/2C,2C	0.0003	Freire-Maia (1968)
Panama	Panama City	1961/64	Obstetric inpatients	15,523	1.7	>1C,1C,<1C	-	Stevenson *et al.* (1996)
	All-Panama	1956/57	R C dispensation	350	0	-	0	Freire-Maia (1968)
Northern America								
Canada	All-Canada	1959	R C dispensation	51,729	1.5	1C,11/2C,2C	0.0005	Freire-Maia (1968)
	Quebec	1962/71	R C dispensation	21,874	1.3	UN,1C,11/2C,2C	0.0003	De Braekeleer and Ross (1991)
U.S.A.	All-U.S.A.	1959/60	R C dispensation	133,228	0.2	1C,11/2C,2C	0.0001	Freire-Maia (1968)
	Wisconsin	1941/55	R C dispensation	170,914	0.2	1C,11/2C,2C	0.0001	Dewey *et al.* (1965)
	Wisconsin	1972/81	R C dispensation	140,289	0.1	1C,11/2C,2C	<0.0001	Lebel (1983)

South America

Argentina	Buenos Aires	1954	R C dispensation	23,000	0.9%	UN,1C,11/2C,2C	0.0005	Freire-Maia (1957)
	All-Argentina	1956/57	R C dispensation	51,391	1.1	UN,1C,11/2C,2C	0.0006	Freire-Maia (1968)
	All-Argentina	1980/81	Civil registration	212,320	0.4	1C	0.0002	Castilla *et al.* (1992)
	Buenos Aires State	1984	Civil registration	32,690	0.7	1C	0.0004	Castilla *et al.* (1992)
Bolivia	Bogota	1961/64	Obstetric inpatients	18,497	2.0	>1C,1C,<1C	-	Stevenson *et al.* (1966)
	All-Bolivia	1956/57	R C dispensation	4,130	0.6	UN,1C,11/2C,2C	0.0003	Freire-Maia (1968)
Brazil	Sao Paolo	1961/64	Obstetric inpatients	14,179	3.1	>1C,1C,<1C	-	Stevenson *et al.* (1966)
	Santa Catarina (south)	1948/51	R C dispensation	4,361	3.6	UN,1C,11/2C,2C	0.0012	Freire-Maia (1957)
	Rio de Janeiro (east)	1954	R C dispensation	1,272	1.6	1C,11/2C,2C	0.0009	Freire-Maia (1957)
	Sergige (east)	1954	R C dispensation	3,815	6.4	UN,1C,11/2C,2C	0.0032	Freire-Maia (1957)
	Alagoas (north-east)	1954	R C dispensation	3,566	11.7	UN,1C,11/2C,2C	0.0055	Freire-Maia (1957)

	All-Brazil	1956/57	R C dispensation	212,090	4.8%	UN,1C,11/2C,2C	0.0023	Freire-Maia (1957)
	Bahia	1970s	Hospital visitors	925	7.0	UN,1C,11/2C,2C	0.0019	Azevedo *et al.* (1980)
	Minas Gerais	1989	Household survey	252	15.1	1C,11/2C,2C	0.0027	Kaku and Freire-Maia (1992)
Chile	Santiago	1961/64	Obstetric inpatients	23,491	0.8	>1C,1C,<1C	-	Stevenson *et al.* (1966)
	All-Chile	1956/57	R C dispensation	28,596	1.3	UN,1C,11/2C,2C	0.0007	Freire-Maia (1968)
	Valparaiso	1957/66	R C dispensation	51,828	0.7	UN,1C,11/2C,2C	0.0006	Lazo *et al.* (1970)
Colombia	Medellin	1961/64	Obstetric inpatients	20,146	4.4	>1C,1C,<1C	-	Stevenson *et al.* (1966)
	All-Colombia	1956/57	R C dispensation	34,470	3.0	UN,1C,11/2C,2C	0.0012	Freire-Maia (1968)
Ecuador	All-Ecuador	1956/57	R C dispensation	3,954	6.3	UN,1C,11/2C,2C	0.0023	Freire-Maia (1968)
Peru	All-Peru	1956/57	R C dispensation	565	4.1	UN,1C,11/2C,2C	0.0027	Freire-Maia (1968)

Uruguay	Montevideo	1952	R C dispensation	3,955	1.1%	1C,11/2C,2C	0.0006	Freire-Maia (1957)
	All-Uruguay	1956/57	R C dispensation	2,931	4.5	UN,1C,11/2C,2C	0.0019	Freire-Maia (1968)

TABLE 3

CONSANGUINEOUS MARRIAGE IN ASIA

Region/country	Location	Collection period	Study population	Sample size	Consanguinity (%)	Consanguinity types	Coefficient of inbreeding (□)	Reference
Eastern Asia								
China: *Han*	Beijing (urban)	1949/67	Household survey	2,370	0.7%	1C,11/2C,D2C, 2C	0.0003	Du *et al.* (1981)
	Beijing (suburban)	1949/67	Household survey	1,409	1.1	1C,11/2C,D2C, 2C	0.0005	Du *et al.* (1981)
	Beijing (rural)	1949/67	Household survey	1,572	1.1	1C,11/2C,D2C,	0.0003	Du *et al.* (1981)
	Shanghai (urban)	-	-	3,127	0.8	1C,1/2C,2C	0.0006	Wu (1987)
	Hubei (urban)	1949/67	Household survey	500	1.2	1C,11/2C,D2C, 2C	0.0007	Du *et al.* (1981)
	Hubei (rural)	1949/67	Household survey	1,874	2.8	1C,11/2C,D2C 2C	0.0015	Du *et al.* (1981)
	Hubei (rural)	-	-	14,427	4.3	1C,11/2C,2C	0.0026	Wu (1987)
	Sichuan (Shifang)	1987	Household survey	526	6.8	1C	0.0043	Wang (pers. comm.)

	Sichuan (rural)	-	-	168	4.8%	1C,1/2C,2C	0.0023	Wu (1987)
	Heilongiang	-	-	5,313	1.2	1C,1/2C,2C	0.0006	Wu (1987)
	Yunnan (rural)	-	-	553	4.7	1C,1/2C,2C	-	Wu (1987)
	Xinjiang	-	-	1,535	1.7	1C,1/2C,2C	0.0008	Wu (1987)
	Guizhou (rural)	-	-	518	5.7	1C,1/2C,2C	0.0034	Wu (1987)
	Zejiang (mountain)	1981/91	Household survey	11,199	3.0	1C,1/2C,2C	0.0017	Zhan *et al.* (1992)
	Zejiang (plateau)	1981/91	Household survey	15,762	1.1	UN,1C,1/2C,2C	0.0006	Zhan *et al.* (1992)
	Zejiang	1981/91	Household survey	17,381	2.5	1C,1/2C,2C	0.0014	Zhan *et al.* (1992)
	All-Hong Kong	1961/64	Obstetric inpatients	9,749	1.8	>1C,1C,<1C	-	Stevenson *et al.* (1966)
Kazakh	Xinjiang	1951/76	Household survey	1,079	2.9	D1C,1C,2C	0.0011	Ai *et al.* (1985)
Uygur	Xinjiang	1951/76	Household survey	2,553	8.2	D1C,1C,2C	0.0047	Ai *et al*. (1985)
Kirgiz	Xinjiang	-	-	2,863	45.2	D1C,1C,1/2C,2C	0.0274	Wu (1987)
Tajik	Xinjiang	-	-	1,325	42.8	D1C,1C,1/2C,2C	0.0246	Wu (1987)
Uzbek	Xinjiang	-	-	159	23.3	1C,11/2C,2C	0.0011	Wu (1987)

Huizu	Xinjiang	1951/76	Household survey	1,079	2.9%	UN,1C,2C	0.0011	Ai *et al.* (1985)
	Gansu	-	-	1,376	9.7	1C,1/2C,2C	0.0049	Wu (1987)
	Guangdong	-	-	614	3.9	1C,1/2C,2C	0.0012	Wu (1987)
	Guizhou	-	-	555	11.2	1C,1/2C,2C	0.0065	Wu (1987)
Tibetan	Xi Zhang	1949/67	Household survey	697	0	-	0	Du *et al.* (1981)
Korean	Ji Lin	1949/67	Household survey	2,080	0	-	0	Du *et al.* (1981)
Lizu	Guangdong/ Hainan	1949/67	Household survey	1,310	1.5	1C,11/2C,D2C,	0.0005	Du *et al.* (1981)
	Sichuan (urban)	-	-	354	58.2	1C,1/2C,2C	0.0431	Wu (1987)
	Sichuan (rural)	-	-	326	32.2	1C,1/2C,2C	0.0112	Wu (1987)
Yizu	Sichuan	1949/67	Household survey	2,054	14.6	1C,11/2C,D2C,	0.0091	Du *et al.* (1981)
	Guizhou	-	-	512	12.7	1C,1/2C,2C	0.0067	Wu (1987)
Dongxiang	Gansu	1949/67	Household survey	2,092	4.3	1C,11/2C,D2C,	0.0023	Du *et al.* (1981)
Bonan	Gansu	1949/67	Household survey	772	10.9	1C,11/2C,D2C, 2C	0.0058	Du *et al.* (1981)

Ewenki	Nei Meng Gu	1949/67	Household survey	626	3.4%	1C,11/2C,2C,	0.0012	Du *et al.* (1981)
Orogen	Nei Meng Gu/ Hei Lung Jiang	1949/67	Household survey	183	1.6	11/2C	0.0003	Du *et al.* (1981)
Miaozu	Guangdong/ Hainan	1949/67	Household survey	330	0.9	1C,11/2C	0.0004	Du *et al.* (1981)
Xibe	Xinjiang	1951/76	Household survey	1,222	4.7	1C,2C	0.0025	Ai *et al.* (1985)
Mongolian	Xinjiang	1951/76	Household survey	446	0.5	1C	0.0003	Ai *et al.* (1985)
Daizu	Yunnan	-	-	94	21.3	1C,1/2C,2C	-	Wu (1987)
Hizhen	Heilongiang	-	-	60	18.3	1C,1/2C,2C	0.0098	Wu (1987)
Hani	Yunnan	-	-	449	12.5	1C,1/2C,2C	-	Wu (1987)
Mong	-	1992	Household survey	525	27.4	UN,1C,11/2C,	0.0150	Yang *et al*. (1994)
Japan	Fukushima	-	Household survey	3,659	15.5	1C,11/2C,2C	0.0067	Watanabe (1956)
	Hiroshima	1948/53	Obstetric outpatients	27,934	5.9	1C,11/2C,2C	0.0027	Schull (1958)
	Nagasaki	1948/53	Obstetric outpatients	33,319	8.0	1C,11/2C,2C	0.0037	Schull (1958)
	Kure	1948/53	Obstetric outpatients	8,211	7.0	1C,11/2C,2C	0.0032	Schull (1958)
	Hirado	1964/65	Civil registration	10,457	14.7	1C,11/2C,2C	0.0061	Schull *et al*. (1970)

Fukuoka	1962/65	Household survey/civil registration	45,230	7.6%	D1C,1C,11/2C, 2C	0.0029	Yamaguchi *et al.* (1970)
Shizuoka	1958/60	Household survey	6,161	8.1	1C,11/2C,2C	0.0036	Komai and Tanaka (1972)
All-Japan	1972	Household Survey	9,385	5.7	1C,11/2C,2C	0.0018	Imaizumi *et al.* (1975)
Tokyo	1975/76	Pediatric outpatients	2,383	1.2	1C,11/2C,2C	0.0006	Tanaka *et al.* (1978)
Tokyo	1961	School survey	4,153	4.6	1C,11/2C,2C	0.0021	Furusho (1979)
Yokohama	1961	School survey	2,713	5.3	1C,11/2C,2C	0.0026	Furusho (1979)
Tokyo and Osaka	1981	Workplace survey/ optician outpatients	983	0.4	1C,11/2C,2C	0.0001	Hosoda *et al.* (1983)
All-Japan	1983	Household survey	9,225	3.9	1C,11/2C,2C	0.0013	Imaizumi (1986)

Southeastern Asia								
Indonesia	West Timor and West Flores (Roman Catholic)	1990	Household survey	970	17.8%	1C,11/2C,2C	0.0095	Glinka (1994)
Malaysia	Kuala Lumpur	1961/64	Obstetric inpatients	15,658	7.6	>1C,1C,<1C	-	Stevenson *et al.* (1966)
Philippines	Manila	1961/64	Obstetric inpatients	29,143	0.4	>1C,1C,<1C	-	Stevenson *et al.* (1966)
Singapore	All-Singapore	1961/64	Obstetric inpatients	39,333	5.0	>1C,1C,<1C	-	Stevenson *et al.* (1966)
	Chinese	1980	Marriage registration	16,698	0.3	1C	0.0002	Tay (1982)
	Indian	1980	Marriage registration	989	4.0	UN,1C	0.0028	Tay (1982)

South Asia

Bangladesh	Matlab	1966/-	Household survey	8,000	6.7%	1C,2C	0.0015	Khan *et al.* (unpublished)
	Teknaf	1976/-	Household survey	4,266	17.6	1C,2C	0.0101	Khan *et al.* (unpublished)
India (East)	Calcutta	1961/64	Obstetric inpatients	19,111	0.5	>1C,1C,<1C	-	Stevenson *et al.* (1966)
	West Bengal (Muslim)	1969/71	Household survey	835	22.2	1C,2C	0.0135	Huq (1976)
	Bihar (Muslim: surburban)	-	Household survey	7,209	24.0	1C	0.0150	Afzal (1988)
	Bihar (Muslim: rural)	-	Household survey	4,524	39.9	1C	0.0249	Afzal (1988)
	Bihar (All-Muslim)	-	Household survey	476	13.9	1C,2C	0.0076	Ansari and Sinha (1978)
	All-region (Muslim)	1992/93	Household survey	2,622	15.8	UN,1C,2C	0.0097	Bittles and Hussain (1998)
India (Central)	Madhya Pradesh (Hindu)	-	-	1,145	8.6	UN,1C,2C	0.0033	Goswami (1970)
	Madhya Pradesh (scheduled tribes and castes)	-	-	147	28.6	UN,1C,2C	0.0145	Goswami (1970)

	Madhya Pradesh (Muslim)	-	-	451	46.1%	UN,1C,2C	0.0215	Goswami (1970)
	Madhya Pradesh (Christians)	-	-	72	25.0	UN,1C,2C	0.0098	Goswami (1970)
	All-region (Muslim)	1992/93	Household survey	1,819	27.3	UN,1C,2C	0.0168	Bittles and Hussain (1998)
India (North)	Delhi (Sunni Muslim)	-	Household survey	1,483	24.4	1C,11/2C,2C	0.0100	Basu (1975)
	Lucknow (Shia Muslim)	-	Household survey	1,000	43.4	1C,11/2C,2C	0.0202	Basu (1975)
	Udaipur (Shia Muslim)	-	Household survey	957	41.1	1C,11/2C,2C	0.0218	Basu (1978)
	Delhi (Sunni Muslim)	-	Household survey	502	36.5	1C,11/2C,2C	0.0180	Krishan (1986)
	Lucknow (Hindu)	1981/84	Obstetric inpatients	7,955	0.1	UN,1C	0.0001	Agarwal *et al.* (1991)
	Lucknow (Muslim)	1981/84	Obstetric inpatients	1,276	17.2	UN,1C,2C	0.0095	Agarwal *et al.* (1991)
	All-region (Muslim)	1992/93	Household survey	1,166	23.0	UN,1C,2C	0.0130	Bittles and Hussain (1998)
India (South)	Andhra Pradesh	1959/-	Hospital inpatients	2,177	30.6	UN,AN,1C,11/2C, 2C	0.0195	Dronamraju and Meera Khan (1963)
	Andhra Pradesh	1957/58	Household survey	6,945	42.5	UN,1C	0.0324	Sanghvi (1966)

Andhra Pradesh (*Vedde*)	1982	Household survey	2,078	32.4%	UN,1C,11/2C,2C	0.0185	Reddy (1992)
Karnataka (Hindu)	1980/89	Obstetric inpatients	86,448	33.5	UN,1C,2C	0.0333	Bittles *et al.* (1991)
Karnataka (Muslim)	1980/89	Obstetric inpatients	17,019	23.7	UN,1C,2C	0.0160	Bittles *et al.* (1991)
Karnataka (Christian)	1980/89	Obstetric inpatients	4,038	18.6	UN,1C,2C	0.0173	Bittles *et al.* (1991)
All-Karnataka	1980/89	Obstetric inpatients	107,518	31.4	UN,1C,2C	0.0299	Bittles *et al.* (1991)
Kerala	1966	Hospital inpatients	889	20.7	1C,2C	0.0118	Kumar *et al.* (1967)
Kerala	-	-	1,631	13.0	1C,11/2C,2C	0.0075	Ali (1968)
Tamil Nadu	1968/69	Household survey	31,390	30.0	UN,1C,11/2C,2C	0.0231	Rao *et al.* (1971)
Tamil Nadu (rural)	1969/74	Household survey	11,628	46.3	UN,AN,1C,11/2C	0.0367	Rao and Inbaraj (1977)
Tamil Nadu (urban)	1969/74	Household survey	8,998	28.6	UN,1C,11/2C,2C	0.0203	Rao and Inbaraj (1977)
Tamil Nadu (*Brahmin*)	1971/72	Household survey	486	17.3	UN,1C,11/2C,2C	0.0124	Srinavasan and Mukherjee (1976)
Pondicherry	1971/72	Household survey	1,494	55.1	UN,1C,<1C	0.0449	Puri *et al.* (1978)

	All-region (Muslim)	1992/93	Household survey	1,912	19.4%	UN,1C,2C	0.0111	Bittles and Hussain (1998)
India (West)	Bombay (Hindu)	-	-	3,520	7.7	1C,11/2C,2C	0.0039	Sanghvi *et al.* (1956)
	Bombay (Muslim)	-	-	1,436	21.8	1C,11/2C,2C	0.0095	Sanghvi *et al.* (1956)
	Bombay (Christian)	-	-	1,063	3.4	1C,11/2C,2C	0.0012	Sanghvi *et al.* (1956)
	Bombay (Parsi)	-	-	578	18.0	1C,11/2C,2C	0.0096	Sanghvi *et al.* (1956)
	Bombay (Parsi)	1961/72	Obstetric inpatients	2,348	7.4	1C,11/2C,2C	0.0036	Undevia and Balakrishnan (1978)
	Bombay	1961/64	Obstetric inpatients	39,155	9.8	>1C,1C,<1C	-	Stevenson *et al.* (1966)
	Maharashtra	1971/73	Household survey	5,282	26.4	UN,1C	0.0175	Malhotra (1979)
	All-region (Muslim)	1992/93	Household survey	917	33.0	UN,1C,2C	0.0201	Bittles and Hussain (1998)
Iran	Shiraz	1972/75	Obstetric inpatients	9,526	24.5	1C,2C	0.0128	Naderi (1979)
	Rural (Azeri)	-	-	440	31.8	1C,2C	0.0071	Farhud *et al.* (1991)
	Rural (Kurdish)	-	-	550	38.0	1C,2C	0.0157	Farhud *et al.* (1991)
	Rural (Others)	-	-	3,688	50.0	1C,2C	0.0234	Farhud *et al.* (1991)

	Tribal (*Turkmen*)	-	-	647	18.4%	1C,2C	0.0077	Farhud *et al.* (1991)
	Tribal (*Qashqai*)	-	-	189	73.5	1C,2C	0.0392	Farhud *et al.* (1991)
	Muslim	-	-	756	24.3	1C,2C	0.0117	Farhud *et al.* (1991)
	Zoroastrian	-	-	600	17.0	1C,2C	0.0109	Farhud *et al.* (1991)
	Armenian	-	-	107	2.8	1C,2C	0.0018	Farhud *et al.* (1991)
	Assyrian	-	-	162	9.3	1C,2C	0.0020	Farhud *et al.* (1991)
	Jewish	-	-	449	25.4	UN,1C,2C	0.0134	Farhud *et al.* (1991)
Pakistan	Lahore	1979/80	Obstetric inpatients	966	38.8	D1C,1C,11/2C, D2C,2C	0.0269	Shami and Zahida (1982)
	Mianchannu	1980	Household survey	135	37.8	1C	0.0236	Shami (1983)
	Muridke	1980	Household survey	251	41.2	1C,11/2C,D2C	0.0240	Shami (1983)
	Sheikhupura	1982/83	Household survey	1,007	48.9	1C,11/2C,D2C	0.0271	Shami and Iqbal (1983)
	Gujrat	1982/83	Household survey/ obstetric inpatients	1,002	48.5	D1C,1C,11/2C, D2C,2C	0.0277	Shami and Hussain (1984)
	Jhelum	1983/84	Household survey	1,027	44.2	D1C,1C,11/2C, D2C,2C	0.0262	Shami and Minhas (1984)
	Rawalpindi	1983/84	Household survey	1,000	48.1	D1C,1C,11/2C, D2C,2C	0.0286	Shami and Siddiqui (1984)

	Faisalabad	1985/86	Household survey	1,033	52.1%	D1C,1C,11/2C, D2C,2C	0.0293	Bittles *et al.* (1993)
	Gujrunwala	1985/86	Household survey	1,059	58.9	D1C,1C,11/2C, D2C,2C	0.0323	Bittles *et al.* (1993)
	Sahiwal	1985/86	Household survey	1,003	56.1	D1C,1C,11/2C, D2C,2C	0.0295	Bittles *et al.* (1993)
	Sialkot	1985/86	Household survey	1,037	51.8	D1C,1C,11/2C, D2C,2C	0.0261	Bittles *et al.* (1993)
	All-Punjab	1979/86	Household survey/obstetric inpatients	9,520	50.3	D1C,1C,11/2C, D2C,2C	0.0280	Bittles *et al.* (1993)
	Lahore	1987/90	Household survey	940	46.2	D1C,1C,11/2C, D2C,2C	0.0242	Yaqoob *et al.* (1993)
	All-Pakistan	1990/91	Household survey	6,611	61.2	1C,2C	0.0332	Ahmed *et al.* (1992)
	Quetta	-	Gynaecology inpatients	171	31.6	1C,2C	0.0217	Mina and Mushtaq (1994)
	Swat (urban)	1986	Household survey	1,019	31.1	1C,11/2C,2C	0.0163	Wahab and Ahmad (1996)
	Swat (rural)	1986	Household survey	1,018	37.1	1C,11/2C,2C	0.0166	Wahab and Ahmad (1996)
Sri Lanka	Kandy (Buddhist)	1973	Household survey	455	21.5	1C,2C	0.0092	Reid (1976)

Western Asia

Bahrain	Bahrain	1983	Obstetric inpatients	141	10.6%	-	-	El-Shafei *et al.* (1986)
	Bahrain	1989	Child health survey	10,070	45.5	1C,<1C	0.0166	Al-Naser (1994)
	Bahrain	1989	Married women	500	31.8	1C,11/2C, 2C	0.0152	Al Arrayed (1994)
Iraq	Baghdad	-	Hospital in- and out-patients/ medical students	4,491	46.4	1C,11/2C,2C	0.0225	Al-Hamamy *et al.* (1986)
	Baghdad	-	Workplace survey	382	53.4	1C,2C	0.0228	Hamamy and Al-Hakkak (1989)
Israel	Ashkenazi migrants	1955/57	Obstetric inpatients	4,734	1.4	UN,1C	0.0009	Goldschmidt *et al.* 1960)
	Sephardi migrants	1955/57	Obstetric inpatients	6,690	8.8	UN,1C	0.0060	Goldschmidt *et al.* (1960)
	Petah Tiqwa (Jewish, Askenazi)	1969/70	Obstetric inpatients	1,242	1.3	>1C,1C,<1C	-	Tsafrir and Halbrecht (1972)
	Petah Tiqwa (Jewish, Non-Askenazi)	1969/70	Obstetric inpatients	1,916	14.3	>1C,1C,<1C	-	Tsafrir and Halbrecht (1972)
	All-Israel (Arabs)	-	School survey	3,203	34.2	D1C,1C	0.0238	Bashi (1977)
	Galilee (Druze)	-	Paediatric clinic	191	48.7	1C,11/2C,2C	0.0252	Freundlich and Hino (1984)

	Galilee (Muslim)	-	Paediatric clinic	189	39.7%	1C,2C,11/2C	0.0199	Freundlich and Hino (1984)
	Galilee (Christian)	-	Paediatric clinic	170	28.8	1C,11/2C,2C	0.0137	Freundlich and Hino (1984)
	Galilee (Arab and Druze)	1976/83	Paediatric clinic	1,546	32.2	1C,2C	0.0163	Gev *et al.* (1986)
	All-Israel (Arab) (urban)	1992	School survey	1,156	24.2	D1C,1C,11/2C	0.0153	Jaber *et al.* (1994)
	All-Israel (Arab) (suburban)	1992	School survey	2,267	28.2	D1C,1C,11/2C	0.0178	Jaber *et al.* (1994)
	All-Israel (Arab) (rural)	1992	School survey	5,098	30.6	D1C,1C,11/2C	0.0194	Jaber *et al.* (1994)
Jordan	Irbid (north-east)	1963/64	Paediatric outpatients	1,097	52.1	1C,11/2C,2C	0.0230	Cook and Hanslip (1966)
	All-Jordan	1969/79	Household survey	1,989	39.7	D1C,1C,11/2C, 2C	0.0225	Khoury and Massad (1992)
	Irbid	-	Hospital outpatients	900	50.6	D1C,1C,11/2C, 2C	0.0284	Al-Salem and Rawashdeh (1993)
	Balqa	1986/89	Household survey	340	40.3	1C,11/2C	0.0180	Nabulsi (199?)
Kuwait	All-Kuwait	1967/68	Obstetric inpatients	2,220	53.9	-	-	El-Alfi *et al.* (1968)

	All-Kuwait	-	Obstetric inpatients	2,133	38.4%	1C,11/2C,2C	0.0174	El-Alfi *et al.* (1969)
	All-Kuwait	1983	Obstetric/ gynecology outpatients	5,007	34.3	D1C,1C,11/2C, 2C	0.0219	Al-Awadi *et al.* (1985)
Lebanon	Beirut	1981/82	Obstetric Inpatients	750	26.0	1C,11/2C,2C	0.0116	Klat and Khudr (1986)
	Beirut (Christians)	1983/84	Household survey	1,001	16.5	1C,<1C	0.0049	Khlat (1988)
	Beirut (Muslims)	1983/84	Household survey	1,853	29.6	1C,<1C	0.0109	Khlat (1988)
	Beirut (All religions)	1983/84	Household survey	2,854	25.0	1C,<1C	0.0088	Khlat (1988)
Saudi Arabia	All-Saudi	1980s	Hospital visitors	143	18.9	1C,2C	0.0085	Chaleby and Tuma (1987)
	Riyadh	1979/80	Obstetric inpatients	1,149	55.0	1C,2C	0.0330	Serenius *et al.* (1988)
	Riyadh	1983/86	Obstetric inpatients	4,498	31.4	1C	0.0196	Saedi-Wong *et al.* (1989)
	Riyadh	1989/90	Household survey	6,421	45.1	1C,2C	0.0174	Zakzouk *et al.* (1993)
	Northern	-	Household survey	693	35.3	IC,2C	0.0206	El-Hazmi *et al*. (1995)
	North western	-	Household survey	391	48.1	IC,2C	0.0283	El-Hazmi *et al*. (1995)

	Central	-	Household survey	1,108	43.2%	IC,2C	0.0258	El-Hazmi *et al*. (1995)
	South western	-	Household survey	998	38.4	IC,2C	0.0229	El-Hazmi *et al*. (1995)
	Eastern	-	Household survey	22	50.0	IC,2C	0.0302	El-Hazmi *et al*. (1995)
	All-Saudi	-	Household survey	3,212	40.6	IC,2C	0.0241	El-Hazmi *et al*. (1995)
	Riyadh	1993	Health clinics	2,001	41.2	D1C,1C,11/2C, 2C	0.0219	Al-Husain and Al-Bunyan (1997)
Turkey	Ankara	1971/73	Obstetric Inpatients	23,687	17.0	D1C,1C,11/2C	0.0095	Stevenson *et al.* (1976)
	Ankara (central)	1970/87	Hospital outpatients	1,054	25.7	D1C,1C,11/2C,2C	0.0064	Ba□aran *et al.* (1988)
	Eskisehir (west)	1970/87	Hospital outpatients	38,259	16.8	D1C,1C,11/2C,2C	0.0046	Ba□aran *et al.* (1988)
	Diyarbakir (south-east)	1970/87	Hospital outpatients	15,862	31.5	D1C,1C,11/2C,2C	0.0110	Ba□aran *et al.* (1988)
	All-Turkey	1970/87	Hospital outpatients	55,175	21.2	D1C,1C,11/2C,2C	0.0065	Ba□aran *et al.* (1988)
	Antalya (south-west: rural)	1987	Household survey	1,020	13.7	1C	0.0086	G□z *et al.* (1989)

	Antalya (south-west: urban)	1987	Household survey	1,584	16.3%	1C	0.0102	G□z *et al.* (1989)
	All-Antalya (south-west)	1987	Household survey	2,604	15.3	1C	0.0096	G□z *et al.* (1989)
	West	1988	Household survey	1,910	12.8	1C,2C	0.0056	Tunçbilek and Ulusoy (1989)
	South	1988	Household survey	731	29.6	1C,2C	0.0131	Tunçbilek and Ulusoy (1989)
	Centre	1988	Household survey	1,305	20.8	1C,2C	0.0091	Tunçbilek and Ulusoy (1989)
	North	1988	Household survey	587	23.3	1C,2C	0.0115	Tunçbilek and Ulusoy (1989)
	East	1988	Household survey	881	30.8	1C,2C	0.0149	Tunçbilek and Ulusoy (1989)
	All-Turkey	1988	Household survey	5,257	21.1	1C,2C	0.0096	Tunçbilek and Ulusoy (1989)
	Trabzon	1990	Health centre	999	20.0	1C,2C	0.0108	Baki *et al.* (1992)
United Arab Emirates	Al Ain	1994/95	Health centre	1,502	37.4	D1C,1C,11/2C, 2C	0.0245	Al-Gazali *et al.* (19970
	Dubai	1994/95	Health centre	531	32.0	D1C,1C,11/2C 2C	0.0159	Al-Gazali *et al.* (1997)

TABLE 4

CONSANGUINEOUS MARRIAGE IN EUROPE

Region/country	Location	Collection period	Study population	Sample size	Consanguinity (%)	Consanguinity types	Coefficient of inbreeding (□)	Reference
Eastern Europe								
Czecho-slovakia	All Czecho-slovakia	1961/64	Obstetric inpatients	19,726	0.2%	>1C,1C,<1C	-	Stevenson *et al.* (1966)
Hungary	All- Hungary	1946	Civil registration	98,662	0.1	UN,AN,1C	0.0001	Czeilel *et al.* (1976)
	Budapest	1971	Obstetric inpatients	2,130	0.5	1C,2C	0.0002	Czeizel *et al.* (1976)
	Pecs and Szombathely	1971	Obstetric inpatients	1,061	0.8	1C,2C	0.0003	Czeizel *et al.* (1976)
	Nyiregy-haza	1971	Obstetric inpatients	2,038	0.5	1C,2C	0.0002	Czeizel *et al.* (1976)
	All-Hungary	1971	Obstetric inpatients	5,229	0.5	1C,2C	0.0002	Czeilel *et al.* (1976)

Northern Europe

Great Britain	London	1950/51	Pediatric outpatients	5,217	0.4%	1C	0.0003	Pugh and Carter (unpublished, cited in Coleman 1980)
	Reading	1972/73	Household survey	946	0.4	1C,11/2C,2C	0.0002	Coleman (1980)
	Birmingham	1986/87	Obstetric inpatients	2,431	0.2	1C,2C	0.0001	Bundey *et al.* (1990)
Ireland (Northern)	Londonderry	1954	Household survey	1,612	0.9	1C,11/2C,2C	0.0008	Kilpatrick *et al.* (1955)
	Belfast	1957	Obstetric outpatients	8,380	0.4	1C,11/2C,2C	0.0001	Stevenson and Warnock (1959)
	All-N. Ireland	1959/68	R C dispensation	41,528	0.4	UN,D1C,1C, 11/2C,2C	0.0001	Masterson (1970)
Ireland (Republic)	All-Irish Republic	1959/68	R C dispensation	149,029	0.5	UN,D1C,1C, 11/2C,D2C,2C	0.0002	Masterson (1970)
Norway	All-Norway	1967/72	Civil registration	401,671	0.6	UN,1C,11/2C,2C	0.0002	Saugstad (1977)
	All-Norway	1967/81	Civil registration	893,941	0.7	1C,2C	0.0002	Magnus *et al.* (1985)

Sweden	North (Pajala)	1947	Parish records	843	1.0%	1C	0.0006	Böök (1948)
	All-Sweden	1946/50	Pregnancy termination	15,802	0.6	1C,2C	0.0003	Romanus (1953)
Southern Europe								
Croatia	Zagreb	1961/4	Obstetric Inpatients	8,309	0.1	>1C,1C,<1C	-	Stevenson *et al.* (1966)
Italy	Florence	1939/58	R C dispensation	50,028	1.1	D1C,1C,11/2C,2C	0.0005	Bigozzi *et al.* (1970)
	All-Italy	-	R C dispensation	-	1.1	1C,2C	0.0005	Romeo *et al.* (1981)
	All-Italy	1953	Civil registration	340,693	0.5	UN,AN,1C,	0.0004	Fraccaro (1957)
	Upper Bologna Appennine	1950/80	R C dispensation	5,340	1.6	1C,11/2C,2C	0.0004	Pettener (1985)
Portugal	All-Portugal	1952/5	Civil registration	276,800	1.5	UN,1C	0.0009	Freire-Maia (1957)
	Azores Islands	1979/85	R C dispensation	12,456	2.9	>1C,1C,11/2C,2C	0.0011	Da Cunha (1986-87)
Slovenia	Ljubljana	1961/4	Obstetric inpatients	8,712	0.6	>1C,1C,<1C	-	Stevenson *et al.* (1966)

Spain	All-Spain	1940/3	R C dispensation	-	4.1%	UN,1C,11/2C,2C	0.0014	Pinto-Cisternas *et al.* (1979)
	Madrid	1961/4	Obstetric inpatients	19,365	1.1	>1C, 1C,<1C	-	Stevenson *et al.* (1966)
	Mondonedo	1922/64	R C dispensation	-	2.6	1C,2C	0.0022	Valls (1967)
	Leon	1958/68	R C Dispensation	16,656	2.8	1C,11/2C,2C	0.0007	Gomez Gomez (1989)
	Majorca	1930/62	R C dispensation	39,184	2.5	1C,11/2C,2C	0.0010	Valls (1969)
	Menorca	1943/64	R C dispensation	2,084	2.9	1C,11/2C,2C	0.0010	Valls (1969)
	Ibiza	1941/63	R C dispensation	4,042	5.4	1C,11/2C,2C	0.0019	Valls (1969)
	Formentera	1941/63	R C dispensation	498	7.8	1C,11/2C,2C	0.0026	Valls (1969)
	Alava Province (Basque country)	1951/80	R C dispensation	38,965	1.2	UN,1C,11/2C,2C	0.0003	Calderón *et al.* (1993)
	Vitoria (Basque country)	1951/80	R C dispensation	27,265	0.6	UN,1C,11/2C,2C	0.0002	Calderón *et al.* (1993)
	Alava (Basque country)	1951/80	R C dispensation	11,700	2.5	UN,1C,11/2C 2C	0.0006	Calderón *et al.* (1998)
	Sigüenza-Guadalajara	1951/80	R C dispensation	5,315	12.6	1C,11/2C,2C	0.0029	Calderón *et al.* (1998)

	Santiago de Compostela	1970/79	R C dispensation	48,984	1.5%	UN,1C,11/2C	0.0005	Varela *et al*. (1997)
Western Europe								
Belgium	All-Belgium	1950/59	R C dispensation	605,849	1.0	UN,1C,11/2C,2C	0.0003	Twiesselmann *et al.* (1962)
France	Loire Valley	1944/53	R C dispensation	19,861	0.7	1C,11/2C,2C	0.0010	Sutter and Tabah (1954)
	Brittany	1951/3	R C dispensation	13,000	1.2	1C,11/2C,2C	0.0005	Sutter and Tabah (1954)
	All-France	1946/58	R C Dispensation	510,000	0.8	UN,1C,11/2C,2C	0.0002	Sutter and Goux (1964)
Netherlands	All-Holland	1948/53	Civil registration	351,085	0.2	UN,1C	0.0001	Freire-Maia (1957)

TABLE 5

CONSANGUINEOUS MARRIAGE IN OCEANIA

Region/country	Location	Collection period	Study population	Sample size	Consanguinity (%)	Consanguinity types	Coefficient of inbreeding (□)	Reference
Oceania								
Australia	Melbourne 1	1961/64	Obstetric inpatients	7,693	0.5%	>1C,1C,<1C	-	Stevenson *et al.* (1966)
	Melbourne 2	1961/64	Obstetric inpatients	3843	1.2	>1C,1C,<1C	-	Stevenson *et al.* (1966)

TABLE 6

CONSANGUINEOUS MARRIAGE IN POPULATION MINORITIES AND ISOLATES

Region/country	Location	Collection period	Study population	Sample size	Consanguinity (%)	Consanguinity types	Coefficient of inbreeding (□)	Reference
Northern Africa								
Sudan	Tir (*Dinka*)	1954	Household survey	375	-	-	0.0015	Roberts (1956)
	Nyertiti (*Fur*)	-	Household survey	99	70.7%	1C,11/2C,2C	0.0415	Bayoumi *et al.* (1985)
	Nyertiti (*Baggara*)	-	Household survey	46	71.7	1C,11/2C	0.0442	Bayoumi *et al.* (1985)
Southern Africa								
Tristan da Cunha	All-island	1961	Pedigree analysis	267	-	-	0.0400	Roberts (1980)
Northern America								
Canada	New Brunswick (Bathhurst)	1959	R C dispensation	686	4.8	1C,11/2C,2C	0.0010	Freire-Maia (1968)

	Quebec (Gaspe)	1959	R C dispensation	600	6.0%	11/2C,2C	0.0012	Freire-Maia (1968)
	Newfoundland (Trepassey)	1960/79	Pedigree analysis	545	-	-	0.0032	Bear *et al.* (1988)
	Newfoundland (West Coast)	1960/79	Pedigree analysis	613	-	-	0.0171	Bear *et al.* (1988)
	Newfoundland (Southeast Labrador)	1960/79	Pedigree analysis	376	-	-	0.0007	Bear *et al.* (1988)
U.S.A.	Kentucky (Beech Creek)	1942	Household survey	107	18.7	1C,11/2C,2C	0.0061	Brown (1951)
	Ramah Navaho	1950/64	Pedigree analysis	1,074	-	-	0.0026	Spuhler (1989)
	New Mexico (Gallup)	1959	R C dispensation	370	1.4	1C,11/2C,2C	0.0004	Freire-Maia (1968)
	Texas (Austin)	1959	R C dispensation	675	1.3	1C,2C	0.0006	Freire-Maia (1968)
	Kansas (Mennonites)	1980	Pedigree analysis	194	33.0	-	0.0030	Moore (1987)
	Pennsylvania (Amish farmers)	1950/-	Pedigree analysis	909	-	-	0.0012	Khoury *et al.* (1987)
	Pennsylvania (Amish non-farmers)	1950/-	Pedigree analysis	1,014	-	-	0.0008	Khoury *et al.* (1987)

	Boston (Gypsies)	1980s	Pedigree analysis	21	61.9%	1C,2C,3C	0.0170	Thomas *et al.* (1987)
South America								
Brazil	South (Amerindians)	1959/60	Field study	465	13.1	UN,1C,11/2C,2C	0.0052	Salzano (1961)
	South (Jewish)	1959/60	Household survey	150	2.7	1C,11/2C	0.0013	Freire-Maia and Krieger (1963)
East Asia								
Japan	Mishima 1	-	Household survey	517	15.5	1C,11/2C,2C	0.0076	Fujiki *et al.*(1982)
	Mishima 2	-	Household survey	192	18.8	1C,11/2C,2C	0.0093	Fujiki *et al.*(1982)
	Nuwajima 1	-	Household survey	340	12.4	1C,11/2C,2C	0.0054	Fujiki *et al.*(1982)
	Nuwajima 2	-	Household survey	175	6.3	1C,11/2C,2C	0.0031	Fujiki *et al.*(1982)
	Okishima	-	Household survey	286	24.5	1C,11/2C,2C	0.0109	Fujiki *et al.*(1982)
	Midono	-	Household survey	54	16.6	1C,2C	0.0087	Fujiki *et al.*(1982)
	Kurodani 1	-	Household survey	85	9.4	1C,11/2C	0.0048	Fujiki *et al.*(1982)

	Kurodani 2	-	Household survey	48	29.2%	1C,11/2C,2C	0.0124	Fujiki *et al.*(1982)
	Arihara	-	Household survey	69	47.8	1C,11/2C,2C	0.0184	Fujiki *et al.*(1982)
	Mukugawa	-	Household survey	83	22.9	1C,11/2C,2C	0.0075	Fujiki *et al.*(1982)
	Azo	-	Household survey	95	17.9	1C,11/2C,2C	0.0098	Fujiki *et al.*(1982)
	Tomiyama	-	Household survey	156	27.6	1C,11/2C,2C	0.0115	Fujiki *et al.*(1982)
Central Asia								
Tajikistan	Urgut (Samarkand)	-	Household survey	-	-	-	0.0280	Paradeeva and Revasov (1987)
	Taimyr (Nganasans)	1974/6	Household survey	223	20.0	2C	0.0022	Goltzova (1981)
Turkmenistan	Ashkhabad	-	Household survey	1,596	-	-	0.0023	Revasov *et al.* (1983)
	Nochur	-	Household survey	600	-	-	0.0330	Revasov *et al.* (1984)
Uzbekhistan	Tersak IV	-	Household survey	-	-	-	0.0190	Ginter *et al.* (1980)
	Tersak III	-	Household survey	-	-	-	0.0078	Ginter *et al.* (1980)

	Kizil-Ketman	-	Household survey	-	-	-	0.0109	Ginter *et al.* (1980)
	Zum	-	Household survey	-	-	-	0.0158	Ginter *et al.* (1980)
	Arab-Chona	-	Household survey	-	-	-	0.0271	Ginter *et al.* (1980)
	Abron	-	Household survey	-	-	-	0.0131	Ginter *et al.* (1980)
South Asia								
India (South)	Andhra Pradesh							
East Godavari	Konda Reddis I	-	-	137	51.8%	UN,1C	0.0392	Veerraju (1978)
	Koya Doras I	-	-	154	51.3	UN,1C	0.0467	Veerraju (1978)
	Konda Reddis II	-	-	152	61.8	UN,1C,2C	0.0398	Veerraju (1978)
	Konda Kammaras	-	-	150	65.6	UN,1C	0.0571	Veerraju (1978)
	Koya Doras II	-	-	140	70.6	UN,1C,2C	0.0490	Veerraju (1978)
Vishakapatnam	Valmikis I	-	-	119	69.2	UN,1C	-	Veerraju (1978)
	Valmikis II	-	-	119	52.1	UN,1C	0.0363	Veerraju (1978)
	Bagathas	-	-	123	62.7	UN,1C	0.0427	Veerraju (1978)
	Gadabas	-	-	128	60.2	UN,1C	0.0395	Veerraju (1978)
Srikakulam	Savaras	-	-	100	72.0	-	-	Veerraju (1978)

Adilabad	Kolams I	-	-	680	20.0%	UN,1C	0.0157	Veerraju (1978)
	Kolams II	-	-	283	45.6	UN,1C	0.0287	Veerraju (1978)
	Raj Gonds	-	-	397	34.5	1C	0.0216	Veerraju (1978)
	Pardhans	-	-	114	53.5	1C	0.0334	Veerraju (1978)
	Andhs	-	-	99	22.2	UN,1C	0.0146	Veerraju (1978)
	Mathuras	-	-	93	6.5	UN,1C	0.0047	Veerraju (1978)
Karnataka	Siddis (Hindu)	1980/81	Household survey	47	38.3	UN,AN,1C,2C	0.0263	Vijayakumar and Malhotra (1983)
	Siddis (Muslim)	1980/81	Household survey	65	46.2	UN,1C,2C	0.0269	Vijayakumar and Malhotra (1983)
	Siddis (Christian)	1980/81	Household survey	156	24.4	UN,AN,1C,2C	0.0169	Vijayakumar and Malhotra (1983)
India (West)	Bombay (Irani)	1961/72	Obstetric inpatients	195	22.1	1C,11/2C,2C	0.0091	Undevia and Balakrishnan (1978)
West Asia								
Iraq	Kurds (Hamawand)	1951	Household survey	21	57.1	UN,1C	0.0417	Barth (1954)
	Kurds (South Kurdistan)	1951	Household survey	46	17.4	UN,1C	0.0122	Barth (1954)
Israel	Samaritans	1960	Household survey	28	46.4	1C,11/2C,2C	0.0190	Bonné (1963)

	Jews (Cochin)	1958	Household survey	59	15.3%	UN,1C	0.0117	Goldschmidt (1963)
Northern Europe								
Great Britain	Orkney	1910/49	Parish records	63	9.5	1C,2C	0.0017	Roberts *et al.* (1979)
	Colonsay	1977	Pedigree analysis	65	-	-	0.0023	Sheets (1980)
	Jura	1977	Pedigree analysis	65	-	-	0.0044	Sheets (1980)
	Eriskay (Hebrides)	1960/79	R C dispensation	22	18.2	2C	0.0028	Robinson (1983)
	Welsh Romany	1970s	Pedigree analysis	99	36.3	1C,2C	0.0123	Williams and Harper (1977)
	Birmingham (Pakistani)	1982/83	Obstetric inpatients	260	46.9	1C	0.0293	Honeyman *et al.* (1987)
	Bradford (Pakistani)	-	Obstetric inpatients	100	67.0	1C,11/2C,2C	0.0377	Darr and Modell (1988)
	Birmingham (Afro-Caribbean)	1986/87	Obstetric inpatients	509	0.4	1C,2C	0.0002	Bundey *et al.* (1990)
Ireland (Northern)	All counties (Travellers)	1989	Household/ itinerant survey	203	65.5	1C,<1C	-	Gordon *et al.* (1991)

Ireland (Republic)	Westmeath (Travellers)	1970/86	Household/ itinerant survey	141	71.6%	1C,11/2C,2C	0.0312	Flynn (1986)
Russian Republic	Archangel (Pinega)	-	-	-	-	-	0.0015	Revasov *et al.* (1979)
Sweden	North (Junosuando)	1947	Parish records	281	2.8	1C	0.0018	Böök (1948)
	North (Muonion-alusta)	1947	Parish records	191	6.8	1C	0.0042	Böök (1948)
	South	1901/52	Marriage/ parish/birth records	576	1.7	1C	0.0011	Larson (1956)
	West (Ostmarkt)	1901/41	Household survey	535	1.3	1C	0.0008	Böök and Mawe (1955)
	Norrbotten	1946/48	Household survey	8,667	0.4	1C	0.0003	Böök (1957)
Western Europe								
Belgium	All-Belgium (Moroccan)	1994/96	Household survey	591	28.0	1C	0.0175	Reniers (1998)
	All-Belgium (Turkish)	1994/96	Household survey	995	22.0	1C	0.0138	Reniers (1998)
Oceania								
Australia	New South Wales (Lebanese)	1984/6	Obstetric inpatients	400	35.8	D1C,1C,2C	0.0128	de Costa (1988)

References

Afzal, M. (1988) Consequences of consanguinity on cognitive behavior. *Behavior Genetics* **18**, 583-594.

Agarwal, S.S., Singh, U., Singh, P.S., Singh, S.S., Das, V., Sharma, A., *et al.* (1991) Prevalence and spectrum of congenital malformations in a prospective study at a teaching hospital. *Indian Journal of Medical Research* **94**, 413-419.

Ahmed, A.H. (1979) Consanguinity and schizophrenia in Sudan. *British Journal of Psychiatry* **134**, 635-636.

Ahmed, T., Ali, S.M., Aliaga, A., Arnold, F., Ayub, M., Bhatti, M.H., *et al.* (1992) *Pakistan Demographic and Health Survey 1990/91*. Islamabad and Columbia, MD: Pakistan National Institute of Population Studies and Macro International.

Ai, Q., Haligamu, Ke, Q., Tong, J., Zhang, B., Wang, Z., and Jiang, Y. (1985) A survey of five minority nationalities' consanguineous marriage in Yili, Xinjiang. *Acta Anthropologica Sinica* **4**, 242-249. [In Chinese].

Al Arrayed, S. (1994) Consanguinity in the state of Bahrain. In *Medical Genetics in the Setting of Middle Eastern Populations*, ed. M.A.F. El-Hazmi, pp. 97-101. Riyadh: King Abdul Aziz City for Science and Technology.

Al-Awadi, S.A., Naguib, K.K., Moussa, M.A., Farag, T.I., Teebi, A.S., and El-Khalifa, M.Y. (1986) The effect of consanguineous marriages on reproductive wastage. *Clinical Genetics* **29**, 384-388.

Al-Gazali, L.I., Bener, A., Abdulrazzaq, Y.M., Micallef, R., Al-Khayat, A.I., and Gaber, T. (1997) Consanguineous marriages in the United Arab Emirates. *Journal of Biosocial Science* **29**, 491-497.

Al-Hamamy, H., Al-Bayati, N., and Al-Kubaisy, W. (1986) Consanguineous matings in the Iraqi urban population and the effect on pregnancy outcome and infant mortality. *Iraqi Medical Journal* **34**, 75-80.

Al-Husain, M., and Al-Bunyan, M. (1997) Consanguineous marriages in a Saudi population and the effect of inbreeding on prenatal and postnatal mortality. *Annals of Tropical Paediatrics* **17**, 155-160.

Al-Naser, Y.E. (1994) The role of consanguineous marriage on infant and child mortality in Bahrain. In *Medical Genetics in the Setting of Middle Eastern Populations*, ed. M.A.F. El-Hazmi, pp. 102-118. Riyadh: King Abdul Aziz City for Science and Technology.

Ali, S.G.M. (1968) Inbreeding and endogamy in Kerala (India). *Acta Genetica et Statistica Medica* **18**, 369-379.

Al-Salem, M., and Rawashdeh, N. (1993) Consanguinity in North Jordan: prevalence and pattern. *Journal of Biosocial Science* **25**, 553-556.

Ansari, S.A., and Sinha, S.P. (1978) Survey on the effects of inbreeding in two populations of Bihar. *Indian Journal of Medical Research* **68**, 295-299.

Azevedo, E.S., Freire-Maia, N., Azevedo, M.C.C., Weimer, T.A., and Souza, M.M.M. (1980) Inbreeding in a Brazilian general hospital. *Annals of Human Genetics* **43**, 255-265.

Badr, F.M. (1972) Genetic studies of Egyptian Nubian population. Frequency and types of consanguineous marriages. *Human Heredity* **22**, 387-398.

Baki, A., Karagüzel, A., Beser, E., Çakmakçi, T., Uçar, F., and Úmeroglu, A. (1992) Consanguineous marriages in the Province of Trabzon, Turkey. *East African Medical Journal* **69**, 94-96.

Barth, F. (1954) Father's brother's daughter marriage in Kurdistan. *South Western Journal of Anthropology* **10**, 164-171.

Bayoumi, R.A., Taha, T.S.M., and Saha, N. (1985) A study of some genetic characteristics of the Fur and Baggara tribes of the Sudan. *American Journal of Physical Anthropology* **67**, 363-370.

Ba aran, N., Sayli, B.S., Ba aran, A., Solak, M., Artan, S., and Stevenson, J.D. (1988) Consanguineous marriages in the Turkish population. *Clinical Genetics* **34**, 339-341.

Bashi, J. (1977) Effects of inbreeding on cognitive performance. *Nature* **266**, 440-442.

Basu, S.K. (1975) Effect of consanguinity among North Indian Muslims. *Journal of Population Research* **2**, 57-68.

Basu, S.K. (1978) Effects of consanguinity among Muslim groups of India. In *Medical Genetics in India*, vol. **2**, ed. I.C. Verma, pp. 173-187. Pondicherry: Auroma Enterprises.

Bear, J.C., Nemec, T.F., Kennedy, J.C., Marshall, W.H., Power, A.A., Kolonel, V.M., *et al*. (1988) Inbreeding in Outport, Newfoundland. *American Journal of Medical Genetics* **29**, 649-660.

Benallègue, A., and Kedji, F. (1984) Consanguinité et santé publique: Etude algérienne. *Archives Francaises de Pediatrie* **41**, 435-440. [In French].

Bigozzi, U., Conti, C., Guazzelli, R., Montali., E., and Salti, F. (1970) Morbilita e mortalita nella prole di 300 coppie di coniugi consanguinei nel Commune di Firenze. *Acta Genetica Medica Gemellologiae* **19**, 515-528. [In Italian].

Bittles, A.H. (1994) The role and significance of consanguinity as a demographic variable. *Population and Development Review* **20**, 561-584.

Bittles, A.H. (1995a) When cousins marry: a review of consanguinity in the Middle East. *Perspectives in Human Biology* **1**, 71-83.

Bittles, A.H. (1995b) The influence of consanguineous marriage on reproductive behaviour in India and Pakistan. In *Diversity and Adaptability in Human Populations*, eds. A.J. Boyce and V. Reynolds, pp. 72-85. Oxford: Oxford University Press.

Bittles, A.H., and Hussain, R. (1998) An analysis of consanguineous marriage in the Muslim population of India at regional and state levels. Submitted for publication.

Bittles, A.H., and Makov, U. (1988) Inbreeding in human populations: assessment of the costs. In *Mating Patterns*, eds. C.G.N. Mascie-Taylor and A.J. Boyce, pp. 153-167. Cambridge: Cambridge University Press.

Bittles, A.H., and Neel, J.V. (1994) The costs of human inbreeding and their implications for variation at the DNA level. *Nature Genetics* **8**, 117-121.

Bittles, A.H., Mason, W.M., Greene, J., and Appaji Rao, N. (1991) Reproductive behavior and health in consanguineous marriages. *Science* **252**, 789-794.

Bittles, A.H., Shami, S.A., and Appaji Rao, N. (1992) Consanguineous marriage in Southern Asia: incidence, causes and effects. In *Minority Populations: Genetics, Demography and Health*, eds. A.H. Bittles and D.F. Roberts, pp. 102-118. London: Macmillan.

Bittles, A.H., Grant, J.C., and Shami, S.A. (1993) An evaluation of consanguinity as a determinant of reproductive behaviour and mortality in Pakistan. *International Journal of Epidemiology* **22**, 463-467.

Bittles, A.H., Savithri, H.S., Venkatesha Murthy, H.S., Baskaran , G., Wang, W., Cahill, J., *et al.* (1999) Human inbreeding: a familiar story full of surprises. In *Ethnicity and Health*, eds. H. Macbeth and P. Shetty, London: Taylor and Francis, in press.

Bonné, B. (1963) The Samaritans: a demographic study. *Human Biology* **35**, 61-89.

Böök, J.A. (1948) The frequency of cousin marriages in three North Swedish parishes. *Hereditas* **34**, 252-255.

Böök, J.A. (1957) Genetical investigations in a north Swedish population. The offspring of first-cousin marriages. *Annals of Human Genetics* **21**, 191-223.

Böök, J.A. and Mawe, C.E. (1955) The incidence of cousin marriage in a west-Swedish rural community. *American Journal of Human Genetics* **7**, 426-429.

Bratt, C.S. (1984) Incest statutes and the fundamental right of marriage: is Oedipus free to marry? *Family Law Quarterly* **18**, 257-309.

Brown, J.S. (1951) Social class, intermarriage, and church membership in a Kentucky community. *American Journal of Sociology* **57**, 232-242.

Bundey, S., Alam, H., Kaur, A., Mir, S., and Lancashire, R.J. (1990) Race, consanguinity and social features in Birmingham babies: a basis for a prospective study. *Journal of Epidemiology and Community Health* **44**, 130-135.

Calderón, R., Peña, J.A., Morales, B., and Guevara, J.I. (1993) Inbreeding patterns in the Basque Country (Alava Province, 1831-1980). *Human Biology* **65**, 743-770.

Calderón, R., Peña, J.A., Delgado, J., and Morales, B. (1998) Multiple kinship in two Spanish regions: new model relating multiple and simple consanguinity. *Human Biology* **70**, 535-561.

Castilla, E.E., Gomez, M.A., Lopez-Camelo, J.S., and Paz, J.E. (1991) Frequency of first-cousin marriages from civil marriage certificates in Argentina. *Human Biology* **63**, 203-210.

Chaleby, K., and Tuma, T.A. (1987) Cousin marriages and schizophrenia in Saudi Arabia. *British Journal of Psychiatry* **150**, 547-549.

Chantrelle, P., and Dupire, M. (1964) L'endogamie des peul du Fouta-Djallon. *Population* **19**, 529-558.

Coleman, D.A. (1980) A note on the frequency of consanguineous marriages in Reading, England in 1972/1973. *Human Heredity* **30**, 278-285.

Cook, R., and Hanslip, A. (1966) Mortality among offspring of consanguineous marriage in a rural area of East Jordan. *Journal of Tropical Pediatrics* **March**, 95-99.

Czeilel, A., Bodnar, L., Illei, G., and Molnar, A. (1976) The occurrence of consanguineous marriages in Hungary. *Human Heredity* **26**, 110-112.

Da Cunha, E.M.A. (1986-7) Consanguinity in the Azores Islands 1979-85. *Antropologia Portuguesa* **4-5**, 67-79.

Darr, A., and Modell, B. (1988) The frequency of consanguineous marriage among British Pakistanis. *Journal of Medical Genetics* **25**, 186-190.

De Braekeleer, M., and Ross, M. (1991) Inbreeding in Saguenay-Lac-St-Jean (Qu bec, Canada): a study of Catholic Church dispensations. *Human Heredity* **41**, 379-384.

de Costa, C. (1988) Pregnancy outcomes in Lebanese-born women in Western Sydney. *Medical Journal of Australia* **149**, 457-460.

Dewey, W.J., Barrai, I., Morton, N.E., and Mi, M.P. (1965) Recessive genes in severe mental defect. *American Journal of Human Genetics* **17**, 237-256.

Dronamraju, K.R., and Meera Khan, P. (1963) The frequency and effects of consanguineous marriages in Andhra Pradesh. *Journal of Genetics* **58**, 387-401.

Du, R.-B., Zhao, Z.-L., Xu, L.-J., Wang, Y.-F., Cui, W.-Y., Mao, Z.-R., *et al.* (1981) Percentage and types of consanguineous marriages of different nationalities and regions in China. *National Medical Journal of China* **61**, 723-728. [In Chinese].

El-Alfi, O.S., Shaker, Y., Shaath, R., and Abdul Salam, T. (1968) Congenital malformations in Kuwait. *Journal of the Kuwait Medical Medical Association* **2**, 99-108.

El-Alfi, O.S., Bahig, A.h., Abdul Salam, T., and Shaath, R. (1969) Birth weights in Kuwait, and their relation to consanguinity and to birth order. *Journal of the Kuwait Medical Association* **3**, 227-231.

El-Hazmi, M.A.F., Al-Swailem, A.R., Warsy, A.S., Al-Swailem, A.M., Sulaimani, R. and Al-Meshari, A.A. (1995) Consanguinity among the Saudi Arabian population. *Journal of Medical Genetics* **52**, 623-626.

El-Shafei, A., Rao, P.S.S., and Sandhu, A.K. (1986) Congenital malformations and consanguinity. *Australian and New Zealand Journal of Obstetrics and Gynaecology* **26**, 168-172.

Farhud, D.D., Mahmoudi, M., Kamali, M.S., Marzban, M., Andonian, L., and Saffart, R. (1991) Consanguinity in Iran. *Iranian Journal of Public Health* **20**, 1-13.

Flynn, M. (1986) Mortality, morbidity and marital features in the Irish Midlands. *Irish Medical Journal* **79**, 308-310.

Fraccaro, M. (1957) A note on consanguineous marriages in Italy. *Eugenics Quarterly* **4**, 36-39.

Freire-Maia, N. (1957) Inbreeding levels in different countries. *Eugenics Quarterly* **4**, 127-138.

Freire-Maia, N. (1968) Inbreeding levels in American and Canadian populations: a comparison with Latin America. *Eugenics Quarterly* **15**, 22-33.

Freire-Maia, N., and Krieger, H. (1963) A Jewish isolate in Southern Brazil. *Annals of Human Genetics* **27**, 31-39.

Freundlich, E., and Hino, N. (1984) Consanguineous marriage among rural Arabs in Israel. *Israel Journal of Medical Sciences* **20**, 1035-1038.

Fujiki, N., Nishigaki, I., and Mano, K. (1982) Genetic polymorphisms in isolated communities. *Japanese Journal of Human Genetics* **27**, 121-130.

Furusho, T. (1979) Incidence of consanguineous marriages in Tokyo and Yokohama. *Japanese Journal of Human Genetics* **24**, 293-294.

Gev, D., Roguin, N., and Freundlich, E. (1986) Consanguinity and congenital heart disease in the rural Arab population in Northern Israel. *Human Heredity* **36**, 213-217.

Ginter, E. K., Garkavtzeva, R.F., and Revasov, A.A. (1980) Population structure and hereditary diseases in Uzbekistan. In *Population Structure and Genetic Disorders*, eds. A.W. Eriksson, H.R. Forsius, H.R. Nevanlinna, P.L. Workman and R.K. Norio, pp. 327-337. New York: Academic Press.

Glinka, J. (1994) Consanguineous marriage. In *Culture, Gospel and Church*, ed. P.F. Gesch, pp. 92-99. Madang: Divine Word Mission.

Goldschmidt, E. (1963) Immigrant Jews from Cochin. In *Genetics of Migrant and Isolate Populations*, ed. E. Goldschmidt, pp. 352-353. New York: Williams and Wilkins.

Goldschmidt, E., Ronen, A., and Ronen, I. (1960) Changing marriage pattern systems in the Jewish communities of Israel. *Annals of Human Genetics* **24**, 191-204.

Goltzova, T.V. (1981) Consanguineous marriages, inbreeding and its effects in Taimyr Nganasans. *Genetika* **17**, 896-905. [In Russian].

Gomez Gomez, P. (1989) Consanguinity: geographical variation and temporal evolution in the North of the Iberian peninsula, 1918-1968 (Leon, Spain). *International Journal of Anthropology* **4**, 119-124.

Gordon, M., Gorman, D.R., Hashem, S., and Stewart, D.G.T. (1991) The health of Travellers' children in Northern Ireland. *Public Health* **105**, 387-391.

Goswami, H.K. (1970) Frequency of consanguineous marriages in Madhya Pradesh. *Acta Geneticae Medicae et Gemellologiae* **19**, 486-490.

Grant, J.C., and Bittles, A.H. (1997) The comparative role of consanguinity in infant and child mortality in Pakistan. *Annals of Human Genetics* **61**, 143-149.

Güz, K., Dedeoglu, N., and Lüleci, G. (1989) The frequency and medical effects of consanguineous marriages in Antalya, Turkey. *Hereditas* **111**, 79-83.

Habib, Z., and Böök, J.A. (1983) Consanguinity and the incidence of thalassaemia in Egypt. *Hereditas* **99**, 215-217.

Hafez, M., El-Tahan, H., Awadalla, M., El-Khayat, H., Abdel-Gafar, A., and Ghoneim, M. (1983) Consanguineous matings in the Egyptian population. *Journal of Medical Genetics* **20**, 58-60.

Hamamy, H.A., and Al-Hakkak, Z.S. (1989) Consanguinity and reproductive health in Iraq. *Human Heredity* **39**, 271-275.

Honeyman, M.M., Bahl, L., Marshall, T., and Wharton, B.A. (1987) Consanguinity and fetal growth in Pakistani Moslems. *Archives of Disease in Childhood* **62**, 231-235.

Hoodfar, E., and Teebi, A. (1996) Genetic referrals of Middle Eastern origin in a western city: inbreeding and disease profile. *Journal of Medical Genetics* **33**, 212-215.

Hosoda, Y., Fujiki, K., and Nakajima, A. (1983) A research of consanguinity in Japanese young couples. *Japanese Journal of Human Genetics* **28**, 205-207.

Huq, F. (1976) Consanguinity and inbreeding among the Muslims of Murshidabad and Birbhum Districts of West Bengal. *Journal of the Indian Anthropological Society* **11**, 21-25.

Hussain, R., and Bittles, A.H. (1998a) The prevalence and demographic characteristics of consanguineous marriages in Pakistan. *Journal of Biosocial Science* **30**, 261-275.

Hussain, R., and Bittles, A.H. (1998b) Differentials in age at marriage, contraceptive use and fertility in consanguineous marriages in Pakistan. *Journal of Biosocial Science*, in press.

Hussien, F.H. (1971) Endogamy in Egyptian Nubia. *Journal of Biosocial Science* **3**, 251-257.

Imaizumi, Y., Shinozaki, N., and Aoki, H. (1975) Inbreeding in Japan: results of a nation-wide study. *Japanese Journal of Human Genetics* **20**, 91-107.

Imaizumi, Y. (1986) A recent survey of consanguineous marriages in Japan. *Clinical Genetics* **30**, 230-233.

Jaber, L., Bailey-Wilson, J.E., Haj-Yehia, M., Hernandez, J., and Shohat, M. (1994) Consanguineous matings in an Israeli-Arab community. *Archives of Pediatric and Adolescent Medicine* **148**, 412-415.

Kaku, M., and Freire-Maia, N. (1990) Inbreeding effect on morbidity: IV. Further data in Brazilian populations. *American Journal of Medical Genetics* **42**, 420-423.

Kapadia, K.M. (1958) *Marriage and the Family in India*. Calcutta: Oxford University Press.

Khlat, M. (1988) Consanguineous marriage and reproduction in Beirut, Lebanon. *American Journal of Human Genetics* **43**, 188-196.

Khoury, M.J., Cohen, B.H., Diamond, E.L., Chase, G.A., and McKusick, V.A. (1987) Inbreeding and prereproductive mortality in the Old Order Amish. I. Genealogic epidemiology of inbreeding. *American Journal of Epidemiology* **125**, 453-461.

Khoury, S.A., and Massad, D. (1992) Consanguineous marriage in Jordan. *American Journal of Medical Genetics* **43**, 769-775.

Kilpatrick, S.J., Mathers, J.D., and Stevenson, A.C. (1955) The importance of population fertility and consanguinity data being available in medico-social studies. Some data on consanguineous marriages in Northern Ireland. *Ulster Medical Journal* **24**, 113-122.

Klat, M., and Khudr, A. (1984) Religious endogamy and consanguinity in marriage patterns in Beirut, Lebanon. *Social Biology* **33**,138-145.

Komai, T., and Tanaka, K. (1972) Genetic studies on inbreeding in some Japanese populations. II. The study of school children in Shizuoka: history, frequencies of consanguineous marriages and their subtypes, and comparability in socioeconomic status among consanguinity classes. *Japanese Journal of Human Genetics* **17**, 114-148.

Krishan, G. (1986) Effect of parental consanguinity on anthropometric measurements among the Sheikh Sunni Muslim boys of Delhi. *American Journal of Physical Anthropology* **70**, 60-73.

Kumar, S., Pai, R.A., and Swaminathan, M.S. (1967) Consanguineous marriages and the genetic load due to lethal genes in Kerala. *Annals of Human Genetics* **31**, 141-145.

Larson, C.A. (1956) The frequency of first cousin marriages in a south Swedish rural community. *American Journal of Human Genetics* **8**, 151-153.

Lazo, B. Figueroa, H., Salinas, C., Campusano, C., Pinto-Cisternas, J. (1970) Consanguinity in the province of Valparaiso, Chile, 1917-1966. *Social Biology* **17**, 167-179.

Lebel, R.R. (1983) Consanguinity studies in Wisconsin. I. Secular trends in consanguineous marriages, 1843-1981. *American Journal of Medical Genetics* **15**, 543-560.

Magnus, P., Berg, K., and Bjerkedal, T. (1985) Association of parental consanguinity with decreased birth weight and increased rate of early death and congenital malformations. *Clinical Genetics* **28**, 335-342.

Malhotra, K.C. (1979) Inbreeding among the Dhangar castes of Maharashtra, India. *Journal of Biosocial Science* **11**, 397-409.

Masterson, J.G. (1970) Consanguinity in Ireland. *Human Heredity* **20**, 371-382.

Mian, A., and Mushtaq, R. (1994) Consanguinity in population of Quetta (Pakistan): a preliminary study. *Journal of Human Ecology* **5**, 49-53.

Modell, B. (1991) Social and genetic implications of customary consanguineous marriage among British Pakistanis. *Journal of Medical Genetics* **28**, 720-723.

Moore, M.J. (1987) Inbreeding and reproductive parameters among Mennonites in Kansas. *Social Biology* **34**, 180-186.

Nabulsi, A. (1993) Mating patterns of the Abbad tribe in Jordan. *Social Biology* **42**, 162-174.

Naderi, S. (1979) Congenital abnormalities in newborns of consanguineous and non-consanguineous parents. *Obstetrics and Gynecology* **53**, 195-199.

Ober, C., Elias, S., Kostyu, D.D., and Hauck, W.W. (1992) Decreased fecundability in Hutterite couples sharing HLA-DR. *American Journal of Human Genetics* **50**, 6-14.

Ottenheimer, M. (1990) Lewis Henry Morgan and the prohibition of cousin marriage in the United States. *Journal of Family History* **15**, 325-334.

Paradeeva, G.M. and Revazov, A.A. (1987) The structure of the coefficient of inbreeding in a rural Tadjik population. *Genetika* **23**, 521-527. [In Russian].

Pettener, D. (1985) Consanguineous marriages in the Upper Bologna Appennine (1565-1986): microgeographic variations, pedigree structure and correlation of inbreeding secular trends with changes in population size. *Human Biology* **57**, 267-288.

Pinto-Cisternas, J., Zei, G., and Moroni, A. (1979) Consanguinity in Spain 1911-43: general methodology, behavior of demographic variables, and regional differences. *Social Biology* **26**, 55-71.

PRB (1998) *World Population Data Sheet.* Washington, D.C.: Population Reference Bureau.

Puri, R.K., Verma, I.C. and Bhargava, I. (1978) Effects of consanguinity in a community in Pondicherry. In *Medical Genetics in India*, vol. **2**, ed. I.C. Verma, pp. 129-139. Pondicherry: Auroma Enterprises.

Rao, P.S.S., and Inbaraj, S.G. (1977) Inbreeding effects on human reproduction in Tamil Nadu of South India. *Annals of Human Genetics* **41**, 87-98.

Rao, P.S.S., Inbaraj, S.G., and Kaliaperumal, V.G. (1971) An epidemiological study of consanguinity in a large South Indian town. *Indian Journal of Medical Research* **59**, 294-301.

Reddy, B.M. (1992) Inbreeding effects on reproductive performance: a study based on a large sample from the endogamous Vadde of Kolleru Lake, Andhra Pradesh, India. *Human Biology* **64**, 659-682.

Reid, R.M. (1976) Effects of consanguineous marriage and inbreeding on couple fertility and offspring mortality in rural Sri Lanka. *Human Biology* **48**, 139-146.

Reniers, G. (1998) *Post-migration survival of traditional marriage patterns : consanguineous marriage among Turkish and Moroccan immigrants in Belgium.* Interuniversity Papers in Demography, PPD-1-Working Paper 1998-1. Department of Population Studies, University of Gent.

Revasov, A.A., Tarlicheva, L.V., Lavrovsky, V.A., Kazachenko, B.N., and Babkin, B.N. (1979) Population genetics of the population of the European north of the RSFSR. IV. The level of blood relationship in 5 villages of the Pinega District, Archangel Province. *Genetika* **15**, 1494-1501. [In Russian].

Revasov, A.A., Koshechkin, V.A., Ginter, E.K., and Turaeva, S.M. (1983) Medico-genetic examination of the population of Turkmenia. II. Population structure of the Aul Izgaut of the Ashkhabad district. *Genetika* **5**, 839-846. [In Russian].

Revasov, A.A., Ginter, E.K., Asanov, A.Y., Garkavtzeva, R.F., Turaeva, S.M., Nurmuradov, K.N., *et al.* (1984) Medico-genetic examination of the population of Turkmenia. V.

Population-demographic description of the Nochur isolate. *Genetika* **9**, 1541-1548. [In Russian].

Riou, S.E, Younsi, C., and Chaabouni, H. (1989) Consanguinité dans la population du Nord de la Tunisie. *La Tunisie Médicale* **67**, 167-172. [In French].

Roberts, D.F. (1956) A demographic study of a Dinka village. *Human Biology* **28**, 323-349.

Roberts, D.F. (1980) Genetic structure and the pathology of an isolated population. In *Population Structure and Genetic Disorders*, eds. A.W. Eriksson, H.R. Forsius, H.R. Nevanlinna, P.L. Workman and K.K. Norio, pp. 7-26. New York: Academic Press.

Roberts, D.F., Roberts, M.J., and Cowie, J.A. (1979) Inbreeding levels in Orkney islanders. *Journal of Biosocial Science* **11**, 391-395.

Robinson, A.P. (1983) Inbreeding as measured by dispensations and isonymy on a small Hebridean island, Eriskay. *Human Biology* **55**, 289-295.

Romanus, T. (1953) Frequency of consanguineous relations among applications for legal abortion and among their parents. *Acta Genetica et Statistica Medica* **4**, 266-273.

Romeo, G., Menozzi, P. Mastella, G., Giunta, A., Lodi, G.. Constantini, D., *et al.* (1981) Studio genetico ed epidemiologico della fibrosi cistica in Italia. *Rivista Italiano Pediatrica* **7**, 201-209. [In Italian].

Saedi-Wong, S., Al-Frayh, A.R., and Wong, H.Y.H. (1989) Socio-economic epidemiology of consanguineous matings in the Saudi Arabian population. *Journal of Asian and African Studies* **24**, 247-251.

Saha, N., and El Sheikh, F.S. (1988) Inbreeding levels in Khartoum. *Journal of Biosocial Science* **20**, 333-336.

Salzano, F.M. (1961) Studies on Caingang Indians. *Human Biology* **33**, 110-130.

Sanghvi, L.D. (1966) Inbreeding in India. *Eugenics Quarterly* **13**, 291-301.

Sanghvi, L.D., Varde, D.S., and Master, H.R. (1956) Frequency of consanguineous marriages in twelve endogamous groups in Bombay. *Acta Genetica et Statistica Medica* **6**, 41-49.

Saugstad, L.F. (1977) Inbreeding in Norway. *Annals of Human Genetics* **40**, 481-491.

Schull, W.J. (1958) Empirical risks in consanguineous marriages: sex ratio, malformation, and viability. *American Journal of Human Genetics* **10**, 294-343.

Schull, W. J., and Neel, J.V. (1972) The effects of parental consanguinity and inbreeding in Hirado, Japan. V. Summary and interpretation. *American Journal of Human Genetics* **24**, 425-453.

Schull, W.J., Nagano, H., Yamamoto, M., and Komatsu, I. (1970) The effects of parental consanguinity and inbreeding in Hirado, Japan. I. Stillbirths and prereproductive mortality. *American Journal of Human Genetics* **22**, 239-262.

Scott-Emuakpor, A.B. (1974) The mutation load in an African population. I. An analysis of consanguineous marriages in Nigeria. *American Journal of Human Genetics* **26**, 674-682.

Serenius, F., Edressee, A.W., and Swailem, A.R. (1988) Characteristics of the obstetric population in a Saudi maternity hospital. *Acta Paediatrica Scandinavica* **346** Supplement, 29-43.

Shami, S.A. (1983) Consanguineous marriages in Mianchannu and Muridke (Punjab) Pakistan. *Biologia* **29**, 19-30.

Shami, S.A., and Hussain, S.B. (1984) Consanguinity in the population of Gujrat (Punjab), Pakistan. *Biologia* **30**, 93-109.

Shami, S.A., and Iqbal, I. (1983) Consanguineous marriages in the population of Sheikhupura (Punjab), Pakistan. *Biologia* **29**, 231-244.

Shami, S.A., and Minhas, I.B. (1984) Effects of consanguineous marriages on offspring mortality in the City of Jhelum (Punjab), Pakistan. *Biologia* **30**, 153-165.

Shami, S.A., and Siddiqui, H. (1984) The effects of parental consanguinity in Rawalpindi City (Punjab), Pakistan. *Biologia* **30**, 189-200.

Shami, S.A., and Zahida (1982) Study of consanguineous marriages in the population of Lahore (Punjab), Pakistan. *Biologia* **28**, 1-15.

Shami, S.A., Qaisar, R., and Bittles, A.H. (1991) Consanguinity and adult morbidity in Pakistan. *The Lancet* **338**, 954-955.

Sheets, J. (1980) Population structure of depreciated communities: I. The 1977 genetic demographies of Colonsay and Jura Islands, the Scottish Inner Hebrides. *Social Biology* **27**, 114-129.

Spuhler, J.N., and Kluckhohn, C. (1989) Inbreeding coefficients of the Ramah Navaho population. *Human Biology* **61**, 703-25 and 726-730.

Srinivasan, S., and Mukherjee, D.P (1976) Inbreeding among some Brahman populations of Tamil Nadu. *Human Heredity* **26**, 131-136.

Stevenson, A.C., and Warnock, H.A. (1959) Observations on the results of pregnancies in women resident in Belfast. I. Data relating to all pregnancies ending in 1957. *Annals of Human Genetics* **23**, 382-391.

Stevenson, A.C., Johnston, H.A., Stewart, M.I.P., and Golding, D.R. (1966) Congenital malformations: a report of a study of series of consecutive births in 24 centres. *Bulletin of the World Health Organization* **34** supplement, 1-125.

Stevenson, A.C., Say, B., Ustaoglu, S., and Durmus, Z. (1976) Aspects of pre-eclamptic toxaemia of pregnancy, consanguinity, and twinning in Ankara. *Journal of Medical Genetics* **13**, 1-8.

Sutter, J., and Goux, M. (1964) L'evolution de la consanguinité en France de 1926 à 1958 avec des donnes recéntes detailles. *Population* **17**, 683-702. [In French]

Sutter, J., and Tabah, L. (1954) Fréquence et nature des anomalies dans les familles consanguines. *Population* **9**, 425-450. [In French].

Tanaka, K., Haraoka, K., and Hayase, R. (1978) Incidence of consanguineous marriage in recent Metropolis Tokyo. *Japanese Journal of Human Genetics* **23**, 395-400.

Tanner, R.E.S. (1958) Fertility and child mortality in cousin marriages: a study in a Moslem community in east Africa. *Eugenics Review* **49**, 197-199.

Tay, J.T.S.H. (1982) *Consanguineous marriages in Singapore*. The Ninth Haridas Memorial Lecture, Singapore Paediatric Society and Association of Private Medical Practitioners of Singapore, Singapore, pp. 32.

Thomas, J.D., Doucette, M.A., Thomas, D.C., and Stoeckle, J.D. (1987) Disease, lifestyle and consanguinity in 58 American Gypsies. *The Lancet* **ii**, 377-379.

Tsafrir, J., and Halbrecht, I. (1972) Consanguinity and marriage systems in the Jewish community in Israel. *Annals of Human Genetics* **35**, 343-347.

Tunçbilek, E., and Koç, I. (1994) Consanguineous marriage in Turkey and its impact on fertility and mortality. *Annals of Human Genetics* **58**, 321-329.

Tunçbilek, E., and Ulusoy, M. (1989) Consanguinity in Turkey in 1988. *Turkish Journal of Population Studies* **11**, 35-46.

Twiesselmann, F., Moureau, P., and Francois, J. (1962) Evolution du taux de consanguinité en Belgique de 1918 à 1959. *Population* **17**, 241-266. [In French].

Undevia, J.V., and Balakrishnan, V. (1978) Temporal changes in consanguinity among the Parsi and Irani communities of Bombay. In *Medical Genetics in India*, vol. **2**, ed. I.C. Verma, pp. 145-150. Pondicherry, Auroma Enterprises.

Valls, A. (1967) Consanguineous marriages in a Spanish population. *Acta Genetica et Statistica Medica* **17**, 112-119.

Valls, A. (1969) Inbreeding frequencies in the Balearic Islands (Spain). *Zeitscrift für Morphologie und Anthropologie* **61**, 343-351.

Varela, T.A., Lodiero, R., and Fariña, J. (1997) Evolution of consanguinity in the Archbishopric of Santiago de Compostela (Spain) during 1900-1979. *Human Biology* **69**, 517-531.

Veerraju, P. (1978) Consanguinity in tribal communities of Andhra Pradesh. In *Medical Genetics in India*, vol. **2**, ed. I.C. Verma, pp. 157-163. Pondicherry: Auroma Enterprises.

Vijayakumar, M., and Malhotra, K.C. (1983) Inbreeding and matrimonial distances among the Siddis of Karnataka. *Current Anthropology* **24**, 228-229.

Wahab, A., and Ahmad, M. (1996) Biosocial perspectives of consanguineous marriages in rural and urban Swat, Pakistan. *Journal of Biosocial Science* **28**, 305-313.

Watanabe, M. (1956) Race hygienical studies on the dwellers in a mountainous region. I. On the frequency of consanguineous marriage in the villagers of mountainous district, Aizu, Fukushima Prefecture. *Fukushima Medical Journal* **6**, 111-117.

Williams, E.M., and Harper, P.S. (1977) Genetic study of Welsh Gypsies. *Journal of Medical Genetics* **14**, 172-176.

Wu, L. (1987) Investigation of consanguineous marriages among 30 Chinese ethnic groups. *Heredity and Disease* **4**, 163-166. [In Chinese].

Yamaguchi, M., Yanase, T., Nagano, H., and Nakamoto, N. (1970) Effects of inbreeding on mortality in Fukuoka population. *American Journal of Human Genetics* **22**, 145-159.

Yang, X., Zhou, L., Zhou, L., Jiang, Z. and Li, F. (1994) A study of consanguineous marriage and hereditary effects in the Mong people in China. *National Medical Journal of China* **11**, 246-247. [In Chinese].

Yaqoob, M., Gustavson, K.-H., Jalili, F., Karlberg, J., and Iselius, L. (1993). Early child death in Lahore, Pakistan: II. Inbreeding. *Acta Paediatrica Scandinavica* **390** Supplement, 17-26.

Zakzouk, S., El-Sayed, Y., and Bafaqeeh, S.A. (1993) Consanguinity and hereditary hearing impairment among Saudi population. *Annals of Saudi Medicine* **13**, 447-450.

Zhan, J., Qin, W., Zhou, Y., Chen, K., Yan, W., and Yu, W. (1992) Effects of consanguineous marriages on hereditary diseases: a study of the Han ethnic group in different geographic districts of Zejiang province. *National Medical Journal of China* **172**, 674-676. [In Chinese].