ESTIMATES OF COUSIN MARRIAGE AND MEAN INBREEDING IN THE UNITED KINGDOM FROM 'BIRTH BRIEFS'

MALCOLM T. SMITH

Department of Anthropology, University of Durham, 43 Old Elvet, Durham

Summary. From 626 ascendant genealogies, known as 'birth briefs', deposited by members of the Society of Genealogists in their London library, rates of consanguineous marriage and coefficients of mean inbreeding (a) of offspring were estimated for cohorts of marriages contracted in the late nineteenth and early twentieth centuries. The rate of first cousin marriage in the generation estimated to have married during the 1920s was 0·32%, with no marriages between second cousins. The mean inbreeding coefficient for the offspring of these marriages was estimated as 0·0002. In the previous generation 1·12% of the marriages were between first cousins, and the estimate of mean inbreeding was 0·0007. Comparison with data taken from the published literature suggests that the levels of cousin marriage observed are consistent with a secular decline during the late nineteenth and twentieth centuries.

Introduction

Estimation of the rate of consanguineous marriage and of mean inbreeding coefficients in most of the United Kingdom has been hampered by the scarcity of Roman Catholic marriage records, which record dispensations granted to couples to marry within the degrees of relationship prohibited by the Roman Catholic Church. The availability of such archives elsewhere in Europe has furnished long time-series of data, for example in Belgium (Deraemaeker, 1958), Italy (Moroni, 1967; Pettener, 1985), France (Sutter & Goux, 1962), Spain (Calderon, 1989) and Portugal (Abade, 1983; Smith, Abade & Cunha, 1992). Where such records are absent, it is only exceptionally that some other source is an equivalent substitute, as in Finland, where civil registration of cousin marriage has proved valuable (Jorde & Pitkanen, 1991).

Whilst in the Republic of Ireland and Northern Ireland Roman Catholic dispensations are widely available (Masterson, 1970; Kilpatrick, Mathers & Stevenson, 1955), the bench-mark estimates of inbreeding in Britain, by contrast, have been based on individual surveys of the blood relationships of hospital patients' parents (Pearson, 1908c; Bell, 1940; Pugh & Carter, reported in Coleman, 1980) or of marriage partners (Darwin, 1875; Pearson, 1908a, b, c; and Coleman, 1980).

Genealogies constructed from vital records or oral recall are another source of data on inbreeding, but their application has been limited to reports on small isolated populations, including especially a number of Scottish islands (Brennan, 1981; Morton *et al.*, 1976; Sheets, 1981; Roberts, Roberts & Cowie, 1979). Exceptionally, evidence from dispensations has been obtained for Britain: Roman Catholic dispensations have been used to estimate mean inbreeding in the Hebridean island of Eriskay (Robinson, 1983), and the registers of the Faculty Office record dispensations for consanguineous and other prohibited marriages in England during the period 1534–1540 (Smith *et al.*, 1993).

The purpose of this paper is to report estimates of the frequency of cousin marriage and mean inbreeding in the United Kingdom from an alternative source: the bilateral ascendant genealogies compiled as 'birth briefs' by members of the Society of Genealogists. Their consistency with estimates derived from the sources outlined above is assessed, and variations over time and according to sample-base noted.

Data and methods

The library of the Society of Genealogists in London houses an extensive collection of birth briefs submitted by members who have investigated their own family histories. A complete birth brief traces all branches of the family back five generations, from the compiler to the great-great-grandparents. The depth of such a pedigree is identical to that referred to as a 'Seize Quartiers' by traditional genealogists (Watson, n.d.). On the basis that each individual possesses a father and a mother, sixteen great-great-grandparents should be expected, as shown in Fig. 1a. There are, however, several ways in which such a genealogy can result in a reduced number of ancestors in generation I, and some but not all of these are associated with an inbred descendant (Fig. 1b–f). In recording the birth brief in such cases, the slots for the sixteen potential ancestors in generation I are occupied by fewer than sixteen different names.

Many of the birth briefs submitted to the Society of Genealogists are incomplete, and for this paper only those in which named individuals had been identified in at least fifteen of the sixteen ancestor-slots were considered eligible for inclusion. It is argued that if fifteen ancestors have been identified it can be assumed that the sixteenth was an unknown individual, and not one of the fifteen already identified cropping up again as a parent to another of the great-grandparents. Data were collected from eligible birth briefs submitted by 626 members of the Society of Genealogists born in the UK. The proportion of eligible records submitted by persons of UK birth comprises roughly 40% of all birth briefs, estimated on the basis of a count of the numbers bound in Volumes 17 and 18 in the Society of Genealogists' Library. It is assumed that these records are accurate.

From these ascendant genealogies the frequencies of consanguineous unions up to and including marriage between second cousins were calculated for the couples marrying in generation IV. By using the individuals in generation IV as the starting point for their own antecedents, the frequency of first cousin marriage in generation III was also estimated, and with caution the comparison of rates of cousin marriage between generations III and IV can be interpreted as a chronological succession. The
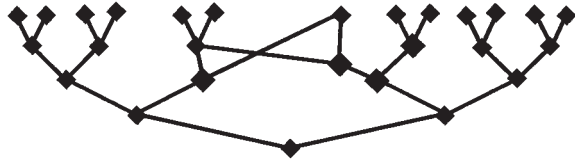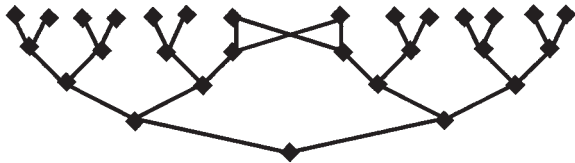
**1a. 16 ancestors
    parents unrelated
    f=0**

I
II
III
IV
V
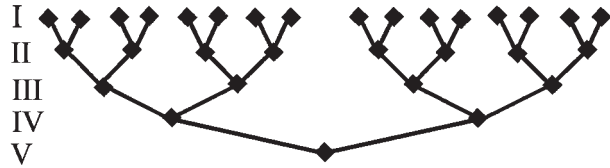
**1b. 12 ancestors
    parents first cousins
    f=1/16**
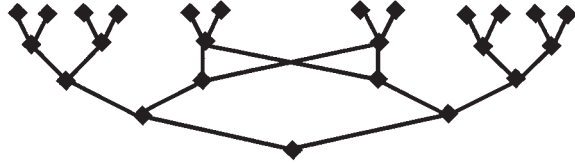
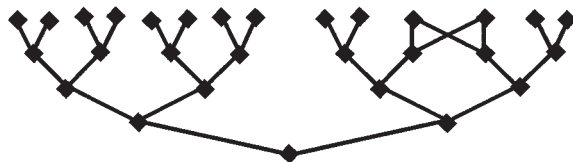**1c. 13 ancestors
    parents first cousins
    once removed
    f=1/32**

**1d. 14 ancestors
    parents second cousins
    f=1/64**

**1e. 14 ancestors
    parents unrelated
    f=0**

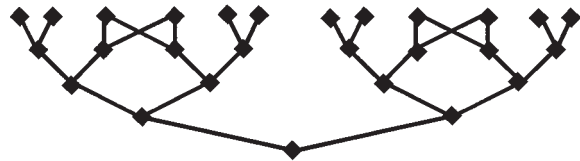**1f. 12 ancestors
    parents unrelated
    f=0**

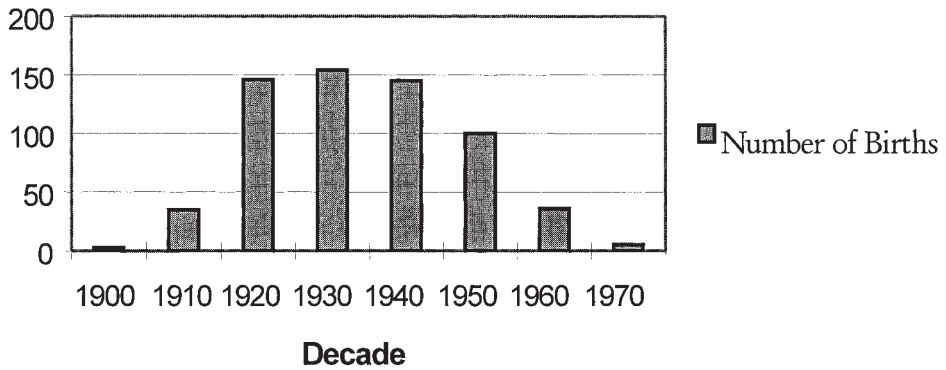**Fig. 1.** Birth briefs: some variant forms of ascendant genealogy.

Fig. 2. Decade of birth of compilers of birth briefs.

mean inbreeding coefficient of the population (a) was calculated as the average of the inbreeding coefficients of individuals derived from pedigrees.

Attributing dates to the marriages in the birth briefs can be no more than tentative, as the sampled genealogies derive from individuals with a wide range of dates of birth, as shown in Fig. 2. The modal decade of birth of generation V (the compilers of the genealogies) was the 1930s, and if a generation time of 30 years is assumed, the 1900s can roughly be designated as the modal birth decade of their parents, though necessarily with a wider spread of dates. It is reasonable to assume that these births represent marriages that took place up to 10 years beforehand, and so the estimated modal decades of marriage would be the 1920s for marriages in generation IV and the 1890s for marriages in generation III.

Comparative figures for rates of consanguineous marriage and inbreeding in England and Scotland have been taken from the published literature and are summarized in Table 1. With the exception of recent medical interest in minority populations (Bundey *et al.,* 1991; Darr & Modell, 1988), there is little more systematic knowledge of variation in inbreeding in Britain than this handful of publications affords. The following paragraphs briefly describe these data and, in order to look for evidence of secular trend in inbreeding among all these studies, an attempt has been made to assign a time period for the marriages represented by each of the reported studies using reasoning as above in relation to the birth briefs, but this can generally be no more than an approximation, especially in cases where the data come from adult patients with no other indication of their age.

Accordingly, this study attributes to the parents of adult hospital in-patients surveyed by Bell (1940) marriages dated within the range of years 1850–1920, and to the marriages of parents of Bell's sample in-patients aged less than 15 years the somewhat more restricted range of 1915–1925.

In order to look for secular trend in the proportion of first cousin marriages, Bell divided her sample into four categories according to the patients' age. The age groups of those patients – of under 15 years, 15–39, 40–64 and over 64 – have been interpreted to represent parents' marriages contracted in the periods 1915–1925, 1890–1920, 1865–1895 and 1850–1870 respectively. These cohorts are deliberately not exclusive, reflecting the coarseness of this estimate. All that is known about Bell's two

Table 1. Rates of cousin marriage and mean inbreeding (α) in Britain

Researcher	Estimated period of marriage	Location	Data type	% first cousin marriage	α
Present study	c. 1890–1900	UK	Birth briefs	1·12	0·0007
Present study	c. 1920–1930	UK	Birth briefs	0·32	0·0002
G. Darwin (1875)	c. 1800–1870	England	Questionnaire	3·41	
Pearson (1908c)	c. 1880–1905	London	Parents of sick children	0·857	0·0002
Bell (1940)	c. 1850–1920	London and provinces	Parents of adult in-patients	0·606	0·0004
Bell (1940)	c. 1915–1935	London and provinces	Parents of in-patients under 15	0·401	0·0003
Bell (1940)	c. 1890–1920	England and Wales	Parents of patients 15–39	0·595	
Bell (1940)	c. 1865–1895	England and Wales	Parents of patients 40–64	0·744	
Bell (1940)	c. 1850–1870	England and Wales	Parents of patients over 64	0·471	
Bell (1940)	Before 1940	Rural A	GP report	1·36	
Bell (1940)	Before 1940	Rural B	GP report	1·03	
Coleman (1972)	1972	Reading, England	Civil marriages	0·11	0·0001
Pugh & Carter	c. 1925–1945	England	Out-patients	0·44	0·0003
Brennan (1981)	c. 1825–1870	Sanday, Orkney	Pedigree	1·61	0·0015
Brennan (1981)	c. 1870–1910	Sanday, Orkney	Pedigree	1·14	0·0020
Brennan (1981)	c. 1910–1950	Sanday, Orkney	Pedigree	0·31	0·0009
Brennan (1981)	c. 1950–1980	Sanday, Orkney	Pedigree	0·0	0·0000
Robinson (1983)	1855–1894	Eriskay	Dispensations	0·0	0·0004
Robinson (1983)	1895–1911	Eriskay	Dispensations	0·0	0·0036
Robinson (1983)	1912–1959	Eriskay	Dispensations	0·0	0·0000
Robinson (1983)	1960–1979	Eriskay	Dispensations	0·0	0·0028

samples of consanguinity rates reported by rural general practitioners is that they were collected some time before 1940; they have therefore been taken to represent marriages occurring between 1900 and 1940.

Using the same procedure as when dealing with Bell's category of patients under the age of 15 years, Pugh and Carter's communication to Coleman (1980) of parental consanguinity among out-patients at the Hospital for Sick Children in 1950/51 has been taken to represent marriages contracted in the period 1925–1945. In 1908 Pearson reported data collected 'for a period of some years' at the Great Ormond Street Hospital for Sick Children on the consanguinity of 700 couples whose children were brought for treatment (Pearson, 1908c). Relationships up to third cousin were reported, and it is assumed that these marriages occurred between 1880 and 1905. G. H. Darwin (1875) circulated a questionnaire, probably in 1873, to about 800 'members of the upper middle and upper classes' enquiring about cousin marriage in the present and previous generation. These marriages have been tentatively assigned to the period 1800–1870.

The data from Orkney (Brennan, 1981) are organized into cohorts of married couples based on the birth date of the groom. In assigning marriage dates below, it was assumed that marriage took place when the groom was 25 years old. This is likely to be an underestimate, but will not bring any serious bias in the scale of time examined here. Thus Brennan's cohort 1800–1854 becomes this study's marriage cohort 1825–1870. Coleman (1980) and Robinson (1983) both analysed marriages directly, so the dates given in their papers are unchanged here.

Results

Table 1 shows the proportion of cousin marriages and the mean inbreeding coefficients calculated from them, in comparison with selected data taken from the published literature on the British Isles. Among 626 marriages in generation IV there were two between first cousins, and none between second cousins. Among 1252 marriages in generation III, there were fourteen between first cousins, yielding a rate of first cousin marriage of 0·32% in generation IV and of 1·12% in generation III. Mean inbreeding coefficients based on these data are 0·0002 for the children of generation IV, and 0·0007 for the children of generation III.

The inbreeding coefficients estimated from the present survey data show a greater range than the results obtained by Bell (1940). The value estimated from birth briefs for the 1890s is higher ($a=0.0007$) than Bell's value for the parents of adult patients ($a=0.0004$, marriage cohort estimated as 1850–1920), and for the 1920s is lower ($a=0.0002$) than for the parents of Bell's patients under 15 years of age ($a=0.0003$, marriage cohort estimated as 1915–1935); the results are, however, consistent with the secular trend shown by her data. The data reported by Pearson (1908c) from the casebooks of the Great Ormond Street Hospital for Sick Children in London show a rate of cousin marriage in the estimated period 1880–1905 of 0·857%, a little lower than the birth briefs for the same period (1·12%) and a little higher than Bell's (0·606%). Mean inbreeding among these children ($a=0.0002$) is half the rate of Bell for the equivalent period ($a=0.0004$, marriage cohort estimated as 1850–1920) and less than a third the rate from birth briefs ($a=0.0007$, marriage cohort 1890s).

Pugh and Carter (reported by Coleman, 1980) found inbreeding levels among the parents of children attending the Hospital for Sick Children as out-patients in 1950/51 (marriage period estimated as 1925–1945) to be the same as those recorded by Bell for the parents of in-patients up to the age of 15 years, whilst Coleman (1980) reported a lower value (0·0001) in his survey of marriages taking place in Reading in 1972/3. Both the studies on Scottish Islands indicate levels of inbreeding generally an order higher than the English data.

Bell's data hint at a secular decrease in first cousin marriage through time, but the trend is subverted by her oldest age-category having the second lowest rate of first cousin marriage. The estimates from the two generations sampled by the birth briefs suggest a decline in first cousin marriage in Britain during the twentieth century, which is consistent with the general trend of the other English data, the Scottish data from Orkney (Brennan, 1981) and the pattern evident from Europe. The English and Scottish data on rates of first cousin marriage described above are plotted in Fig. 3 against the periods of time, in 5-year periods, to which the marriages have been allocated. The high levels of inbreeding calculated from dispensations in the island of Eriskay (Robinson, 1983) were achieved without any marriages between first cousins at all and these zero values from Eriskay have been omitted from the graph.

Discussion

The values of inbreeding calculated from birth briefs seem broadly consistent with the pattern of results reported for England by Bell (1940) and Coleman (1980) from survey results. The results from England contrast with those from Scotland, which are derived from remote rural or island populations and which show higher levels of inbreeding than the English data. This difference may reflect actual variations in mean inbreeding levels, or may be attributable to the various data sources employed and their ability to detect remote kinship. Pedigrees reconstructed from vital records tend to capture more remote kinship, which can evade oral recall of relationship and dispensation testimony (Robinson, 1983).

For first cousin marriage the situation appears rather different, with the results from Orkney being similar to those in England, whilst first cousin marriages are completely absent from the records from Eriskay. It is possible that in this Roman Catholic community (where more remote blood relationship in marriage was very common, as evidenced by the high mean inbreeding coefficients) dispensations to marry first cousins were not granted. Robinson (1983) noted that the parish priest would not sanction endogamous marriages among the present-day population of Eriskay, and similar strictures might well have applied in the past.

The high rate of first cousin marriage (3·41%) discovered by G. H. Darwin (1875) is likely, by his own analysis of estimates based on the frequency of isonymous marriage, to indicate a greater preference for cousin marriage among the Victorian upper classes to whom he sent his circular, than among the middle and working classes. Certainly, in the milieu of the Darwin family cousin marriage was common, with both Charles Darwin (G. H. Darwin's father) and his sister Caroline marrying Wedgewood cousins (Desmond & Moore, 1991), and extensive cousin marriage
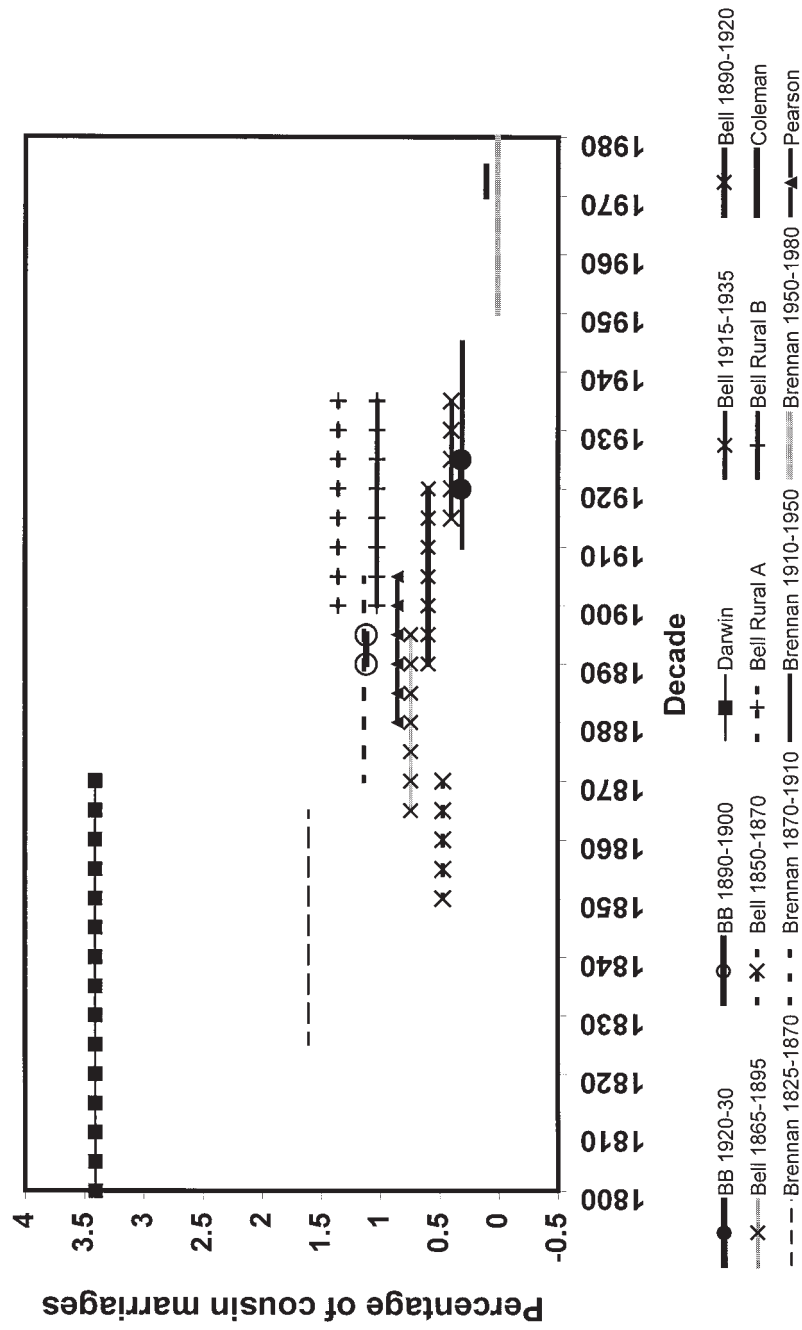
Fig. 3. Rates of first cousin marriage in the United Kingdom.

having been documented (Anderson, 1986), though not quantified, elsewhere among the Victorian intellectual and artistic elite.

There are other indications of local variation in consanguinity rates according to cultural practice and population structure. Bell (1940) noted the relatively high levels of cousin marriage reported by 'country [general] practitioners from districts where, it was rumoured, a good deal of intermarriage among relatives had occurred'. The low value of mean inbreeding among the parents of children treated at the Great Ormond Street Hospital may be consistent with a reduction in kin marriage through migration to the metropolis, a view to which Pearson (1908c) was inclined in commenting on the same data. Unfortunately the birth briefs data used in this study do not allow systematic investigation of socioeconomic variation in consanguinity, though geographical variation could be pursued in further research.

In the birth briefs data, the complete absence of marriages in generation IV between second cousins is noteworthy, since it is not consistent with the expectations of a random mating model, which predicts consanguineous marriages of different degree to occur as a function of the relative frequencies of such relationships in the population. Expected rates of consanguineous marriage under varying circumstances were modelled by Hajnal (1963), who showed that under random mating, for whatever values of the population size and migration, the number of second cousin marriages is predicted to exceed the number of marriages between first cousins. That it does not do so here is consistent with the survey of marriages in Reading 1972/3 conducted by Coleman (1980) and suggests, following Wachter (1976), that the frequencies of marriages between first cousins and between second cousins should not be regarded as occurring merely as a function of the frequencies of those relatives in the population, but should rather be conceptualized as separate categories of activity. In contrast to the absence of second cousin marriages reported in the birth briefs, Watson (n.d.), recording the Seize Quartiers of twelve kings and queens of England, presented pedigrees showing that in all three cases where there were fewer than sixteen ancestors, the monarch's or consort's parents were second cousins. This presumably reflects the closed nature of the gene pool of European royalty compared with that of commoners and the arrangement of marriages to consolidate wealth and cement alliances.

It can be observed in Fig. 1 that the degree of inbreeding does not reliably accord with the reduction of ancestors, and the question is therefore raised here of whether the number of ancestors has any independent significance in terms of population structure. Although it does not predict the probability of autozygosity, it does convey a sense, indeed a measure, of the diversity of the gene pool from which the descendant's genes are derived. The practical limitation most likely to be encountered is in the scarcity and bias of available data, the number of pedigrees extending back to more than 32 ancestors being small, and limited almost exclusively to royalty and the nobility. Forst de Battaglia (1949) refers to a number of such published accounts, a very few of which (for example, that of Kaiser Wilhelm II) extend back even to the 4096 ancestor level. Typically, the number of ancestors is much reduced, as for example in the case of King George VI of the United Kingdom, whose antecedents at the generation for whom there are 1024 theoretical ancestors numbered 400 actual individuals (Forst da Battaglia, 1949).

As to the accuracy of the birth briefs themselves, care must be taken that their nature does not introduce bias for one reason or another. One possible cause of inflation of values is ascertainment bias. Inbred pedigrees should be easier to complete, as they contain fewer ancestors than the full sixteen, with a fourteen-ancestor generation I being 7/8 as difficult to complete as a sixteen, and a twelve ancestor one 3/4 as difficult. Accordingly, they may be over-represented among the category of eligible pedigrees. A 'correction' applied on this basis would reduce the estimate of the frequency of cousin marriages in generation IV to 0·84%, and in generation III to 0·28%. Another possible source of bias is the self-selection of people with sufficient an interest in their family trees to become members of the Society of Genealogists, though in the present day, it has to be admitted, family history is an interest with a very broad appeal. What is not clear is whether a currently prevailing societal attitude that is mildly inimical to cousin marriage, might deter someone discovering consanguinity among their ancestors from persevering with the project, though the experience of meeting many family historians and discussing cousin marriage in their family trees suggests that this would not be a deterrent.

The possibility of selection biases has long dogged the collection of data on consanguinity in the UK. The surveys of hospital patients might over-represent inbreeding through the representation of diseases with some recessive genetic basis, though this can to some extent be guarded against by the selection of categories of patient (Bell, 1940). Karl Pearson himself solicited data (Pearson, 1908a, b) that have not been used in this comparative analysis since they are likely to be strongly subject to self-selection bias, a view first expressed by Pearson when he reported them (Pearson, 1908c). In two letters to the editor of the British Medical Journal in May 1908 Pearson requested readers to send a postcard stating (among other things) whether they and their spouses were cousins, and whether their maternal or paternal grandparents were cousins. Many respondents sent unsolicited information about their parents' consanguinity as well, and the data, published the following month (Pearson, 1908c), showed 4·69% first cousin marriages among the respondents. Total consanguinity (marriage between cousins of any degree) among the respondents was 8·37%, among their parents 16·15%, and among their grandparents 3·62%. These are strikingly high values in comparison with any encountered from the UK apart from Darwin's (Darwin, 1875), and high compared with the rates among parents of children treated at the Great Ormond Street Children's Hospital, which Pearson reported in the same paper, and which have been used in the analysis above. It was the variation between generations (rather than the high rates themselves), together with the marked reduction in consanguinity rates between respondents to Pearson's first and second letters in the British Medical Journal, that led Pearson to infer that his first appeal may have been misinterpreted and that 'a good many replies were received because my correspondents were the children of cousins or had married cousins' (Pearson, 1908c).

This paper has reported rates of marriage between first and second cousins using birth briefs as the data source, and the results have been shown to be consistent with the twentieth century pattern of consanguinity in the UK indicated by other published data. Possible sources of bias in the collection of consanguinity data have been considered, and it seems likely on the evidence of this paper that sufficient numbers

of birth briefs, compiled by people interested in their own family trees, are available to provide reliable estimates of mean inbreeding and cousin marriage among the general population.

Acknowledgments

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