

The handedness of Kerrs and Carrs

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The surnames Kerr and Carr have been claimed, on the basis of folkloric and etymological evidence, to be associated with an increased incidence of left-handedness. In 1974 a survey by the Royal College of General Practitioners suggested that the incidence of left-handedness was nearly three times as high in Kerr/Carr families as in controls. That survey was however potentially flawed by response biases. In the present study, which used better controls, no evidence was found for an increased incidence of left-handedness in Kerrs and Carrs.

Left-handedness is present in approximately 8 per cent of the population (Seddon & McManus, 1991), and studies of handedness in families (Annett, 1985; McManus, 1991; McManus & Bryden, 1992) suggest that it is likely to be under genetic control. If handedness is indeed genetic then the search for a molecular basis for the polymorphism would be much aided by finding markers which indicated a high prevalence of left-handedness, particularly if these markers were themselves known to be under genetic control or ran in families in association with known genetic markers. In 1974 the research unit of the Royal College of General Practitioners (Research Unit, 1974) published a study in which they claimed that individuals with the surname Kerr or Carr were significantly more likely to be left-handed than were controls. If this claim were correct then it could be of some importance in identifying the biological basis of left-handedness.

The Royal College's research project found its origins in an editorial (Anonymous, 1971) which had used as its epigraph a traditional, anonymous poem from Scotland:

But the Kerrs were aye the deadliest foes
That e'er to Englishmen were known
For they were all bred lefthanded men
And 'fence against them there was none.

The editorial mentioned a letter to *The Times* published in September 1970 which suggested that the surname Kerr, as well as its anglicized version of Carr, was associated with left-handedness, citing its etymology as being from the Gaelic *caerr* meaning 'awkward'; additionally it was noted that 'Ker-handed' and 'Carr-handed' are sometimes used to mean left-handed. Kerr is one of the 40 most common surnames in Scotland, it dates back to at least the 14th century, and its Irish equivalents include O'Cair and Kerrane. Finally the editorial noted that some castles in Scotland which were built by the Kerrs, had spiral staircases which were left-

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handed, presumably to the advantage of the defenders. Tangentially it should also be noted that it has been reported that Kerrs, along with MacDonalds, McLeans, Campbells and MacGregors are particularly likely to be referred to clinics for speech defects, dyslexia or dysgraphia (Ingram, 1964).

The editorial in the Royal College's journal ended with a plea for interested General Practitioners (GPs) to select from their list of patients a family in which the male head was named Kerr or Carr, to identify the handedness of the family members, and to compare their handedness with a randomly selected control family. The resulting research study (Research Unit, 1974) compared the handedness of 200 members of Kerr/Carr families with 200 members of control families, the incidence being significantly higher in the Kerr/Carr families (29.5 per cent) than in the controls (11 per cent). Unfortunately despite the study's intriguing result, its methodology was almost certainly fundamentally flawed. As the report itself put it,

An unexpected consequence of the appearance of this editorial was the attention it received from the lay press first in the United Kingdom and soon afterwards in newspapers in North America. The interest that press and radio coverage of the study aroused led to a response not only from doctors with members of the Kerr clan as their patients but also from members of the family itself (Research Unit, 1974).

Essentially the problem was that those persons reporting data, be they GPs or members of the public, were more likely to report families who were consistent with the previously stated and publicized hypothesis; such a response bias could readily explain the increased incidence of left-handedness in the relatively few families of Kerrs and Carrs that were reported. Despite its methodological defects the original study has continued to be cited in the literature on left-handedness (e.g. Corballis, 1991; Coren, 1992).

The present study repeated the 1974 study using better controls and with a larger sample size than the original study.

Method

Twenty-five probands with a surname of Carr and 25 probands with a surname of Kerr were randomly chosen from the Greater London telephone directory (the directory contains approximately 450 Carrs and 300 Kerrs). 50 control probands were also chosen at random from the directory, with the constraint that their surnames had to be surnames typical of those found in the United Kingdom [i.e. they were not those which a native British observer (D.S. in this case) would regard as likely to come from continental Europe, or from Asia, Africa or South America]. Although not 100 per cent accurate, studies have suggested that surnames can be both reliably and validly used for assessing ethnic origin (McManus, Maitlis & Richards, 1990), so that almost all the subjects in this study are probably of Caucasian origin.

Each of the chosen probands was telephoned by one of us (D.S.) during the early evening or at weekends, and asked to participate in a study of handedness. If no reply was received from a particular number, or if the subject refused to help with the study, then the immediately next person in the directory was phoned, and so on, until a reply was received. Subjects were informed that D.S. was a medical student carrying out a medical research study, and that we needed control or 'normal' families to compare with various groups of patients, so that we could assess patterns of handedness in families. At no point was the hypothesis concerning Carrs and Kerrs mentioned to any subjects. Carr/Kerr and control subjects were telephoned in alternation in order to prevent any systematic bias confounded with order of telephoning.

Subjects were asked about their own handedness, and about the handedness of their siblings, parents,

grandparents, children and grandchildren. If they were married then similar questions were asked about their spouse's family, either indirectly or directly from the spouse if they were available to talk on the telephone.

A written proforma was used to ensure that telephone interviews were as uniform as possible. Handedness was assessed by asking 'Do you regard yourself as naturally right- or left-handed?'; in the event of any query respondents were asked about the hand they used for writing, with account being taken if they had been forced to change their writing hand. A similar question was then asked for other family members.

Results

Usable data were obtained from 98 subject families, 25 Kerrs, 25 Carrs and 48 controls; data from two control subjects could not be used since they were inadvertently mislaid. Approximately 66 per cent of subjects who answered the telephone were willing to take part in the study. 36 (36.7 per cent) of respondents (proband) were male, and 62 (63.3 per cent) female. Proband) were asked to indicate their age to the nearest 10 years (10-19; 20-29; 30-39; etc.). Taking the age of subjects as being at the mean of their group, then the mean age of the proband) was 46 years, with a standard deviation of 19 years; the spread of ages varied from four subjects in the 10-19 range to six subjects in the 80-89 range. Two proband) did not give their age. Fifteen (15.3 per cent) of the proband) said that they were themselves left-handed.

Information was obtained on the handedness of 1401 family members, of whom 153 (10.9 per cent) were left-handed. Left-handedness was significantly more common in male family members (109 of 716; 15.2 per cent) than in female members (44 of 685; 6.4 per cent; $\chi^2 = 27.9, p < .001$), a result consistent with other studies (McManus, 1991; Seddon & McManus, 1991).

Handedness information was available on 100 per cent of proband) ($N = 98$) and their spouses ($N = 81$), and on 100 per cent of the parents of proband), as compared with only 82.7 per cent of fathers and 87.7 per cent of mothers of spouses. The handedness of grandparents was known for only 46.4 per cent of proband)' grandfathers and 48.0 per cent of proband)' grandmothers, and for only 11.7 per cent of spouses' grandfathers and 12.3 per cent of spouses' grandmothers. The low response rate for these more distant relatives, taken in conjunction with a comparison of the incidence of handedness in the parents of proband) and of spouses and of the grandparents of proband) and of spouses which showed no significant difference overall ($\chi^2 (5) = 6.758, n.s.$), suggests that proband) probably only reported the handedness of more distant relatives if they were fairly confident about their accuracy.

The handedness of different generations being reported showed minor differences between generations: For males the overall incidence of left-handedness was 14.5 per cent in grandparents ($N = 110$), 10.3 per cent in parents ($N = 165$), 19.8 per cent in the proband)' generation ($N = 308$), 11.0 per cent in children ($N = 82$), and 24.0 per cent in grandchildren ($N = 50$); the differences are statistically significant ($\chi^2 (34) = 11.34, p < .05$), but show no obvious evidence of linear or quadratic trends. For females the overall incidence of left-handedness was 3.5 per cent in

grandparents ($N = 114$), 3.0 per cent in parents ($N = 169$), 7.9 per cent in the probands' generation ($N = 290$), 7.1 per cent in children ($N = 85$), and 0.0 per cent in grandchildren ($N = 28$); the differences are not statistically significant ($\chi^2(34) = 8.24$, n.s.).

The relationship of handedness to the cohort of birth of family members was assessed by assuming that the proband, their spouse, and their siblings were in the same age range as the proband himself, that parents were on average 25 years older, and that grandparents were 50 years older, that children were 25 years younger and that grandchildren were 50 years younger; this analysis could be carried out for 1386 subjects. Taking birth cohorts of twenty-year intervals, the percentage of left-handers was: 1970–present, 7.3 per cent ($N = 109$); 1950–1969, 17.3 per cent ($N = 271$); 1930–1949, 9.3 per cent ($N = 376$); 1910–1929, 11.8 per cent ($N = 314$); 1890–1909, 9.2 per cent ($N = 250$); before 1890, 6.1 per cent ($N = 66$). Although the differences between groups are statistically significant using a chi-squared test ($\chi^2(5) = 16.24$, $p < .005$), there is no evidence of a significant linear trend using a multiple logistic regression ($\chi^2(1) = 2.86$, n.s.), so that the results cannot be interpreted as showing evidence of a recent increase in the incidence of left-handedness.

Of 706 members of Kerr/Carr families, 65 (9.2 per cent) were left-handed, compared with 88 (12.7 per cent) of 695 members of control families ($\chi^2 = 4.3$, $p < .05$). The incidence of left-handedness was therefore significantly *lower* in the Kerr/Carr families than in the control group.

Not all individuals in the families of Kerrs and Carrs are descendants of individuals who are from the Kerr or Carr family. Figure 1 shows a schematic family tree in which the proband (male or female) is indicated by an open arrow. If the proband or their husband is called Kerr then the individuals marked with a K will also have the surname Kerr (a maiden name if female). The individuals marked in solid black are males who are direct descendants of individuals with the surname Kerr, and the females with diagonal lines are also direct descendants of individuals called Kerr. The individuals with light stippling are not descendants of Kerrs but have married into the Kerr family. If the Kerr/Carr hypothesis is correct then it should only be individuals who are direct descendants of Kerrs or Carrs who should show an increased incidence of left-handedness. Table 1 summarizes the incidence of left-

Table 1. The handedness of male and female subjects who are direct descendants of Kerrs or Carrs (see text for details), compared with equivalent relationships in control families

	Carrs/Kerrs		Controls	
	N	%L	N	%L
Male descendants	210	10.5	218	20.2
Female descendants	110	4.5	104	7.7
Male non-descendants	147	17.7	140	16.4
Female non-descendants	239	5.0	233	5.6

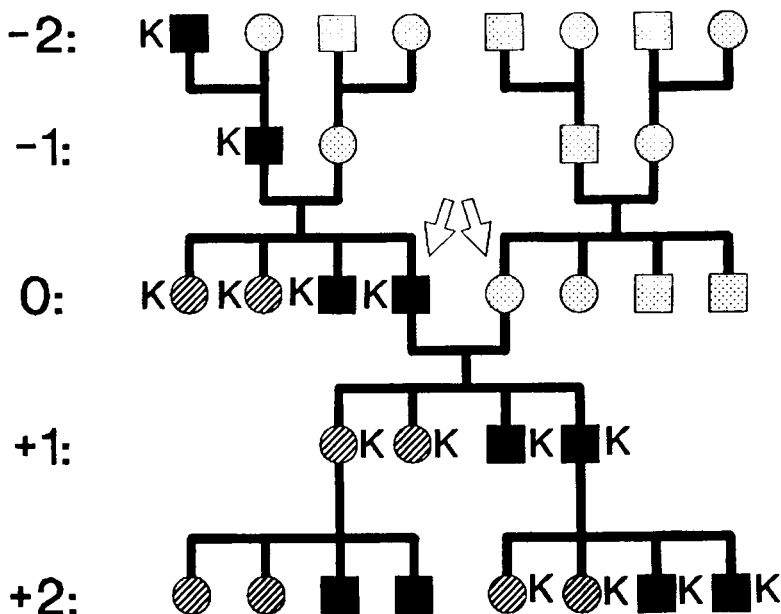


Figure 1. Shows a family tree for a family of Kerrs or Carrs. Males are indicated by squares and females by circles. The two possible probands are indicated by open arrows, according to whether they are male or female. Generation 0 consists of the proband, their siblings, their spouse and the spouse's siblings. Generation -1 is the parents of the proband and their spouse and generation -2 the grandparents of the proband and their spouse. Generation +1 is the children of the proband and generation +2 their grandchildren. A letter K next to an individual's name indicates that their surname (or maiden name) is Kerr or Carr. Solid square symbols indicate direct male descendants of Kerrs or Carrs, and hatched symbols indicate direct female descendants of Kerrs or Carrs, while lightly hatched symbols have married into a Kerr/Carr family.

handedness in males and females who are descendants of Kerrs and Carrs, and their analogous family members in control families. For the four groups taken together there is no evidence for Kerrs/Carrs to show a higher incidence of left-handedness than in controls ($\chi^2(4) = 8.81$, n.s.). The difference between Kerrs/Carrs and controls is not significant for male or female non-descendants, or female descendants ($\chi^2(1) = .080$, $.073$ and $.928$ respectively), but is significant for male descendants ($\chi^2(1) = 7.728$, $p < .01$). However, the incidence of left-handedness is *lower* in the Kerr/Carr families (10.5 per cent) than in controls (20.2 per cent), a result in the opposite direction to that expected by the hypothesis that left-handedness runs in Kerr/Carr families.

Discussion

The study reported by the Research Unit of the Royal College of General Practitioners was potentially flawed because of the hypothesis being known to the individuals who were collecting the data and reporting on families and, in some cases,

to the subjects themselves, so that a response bias was likely from left-handed Kerrs or Carrs. Our study, with a sample size some $3\frac{1}{2}$ times larger than the original study has not only failed to replicate the finding, but has found a result that is significant in the opposite direction. We must therefore conclude that there is no convincing evidence, despite a wealth of intriguing folkloric and etymological evidence, that modern-day Kerrs and Carrs have an increased likelihood of sinistrality.

The validity of the data obtained by our study are suggested by the overall estimate of the incidence of left-handedness, which is well within the limits reported in other studies (Bishop, 1990; McManus, 1991; Seddon & McManus, 1991), and the evidence of a significant difference in incidence of left-handedness in males and females, which is also compatible with other studies (Beaton, 1985; McManus, 1991; Seddon & McManus, 1991). The incidence of left-handedness in the probands ($N = 98$; 15.3 per cent, 95 per cent CI = 8.17–22.42 per cent) is highly compatible with the overall incidence of 7.78 per cent found in the meta-analysis of handedness (McManus, 1991; Seddon & McManus, 1991), particularly given the tendency for more recent cohorts to have a higher incidence of left-handedness (Halpern & Coren, 1990; McManus, 1991; Porac, Coren & Duncan, 1980). Similarly the overall incidence of handedness in the study (10.9 per cent of 1402 individuals) is clearly well within the range of incidences found in the 100 populations described in the meta-analysis (see Fig. 1 of McManus, 1991), and is typical of very many studies. That the incidence of handedness does not differ between the proband's own family and that of their spouse, despite a much lower incidence of reporting of relatives in the spouse's family, suggests that data are only reported if respondents are fairly certain of their validity.

A possibility that must be considered in a study such as this is the extent to which double-counting of family members in the Kerr/Carr families might have occurred. There are approximately 450 Carrs and 350 Kerrs in the London telephone directory. Since statistics suggest there are typically about four individuals on any telephone line, then there are about 1800 Carrs and 1400 Kerrs in London. In our study the 50 Kerr/Carr families gave information on 706 family members. Many of these will be dead, or will be living outside London, or will be specific to one family. Even in a worst case analysis that these Carrs and Kerrs are all sampling from the same pool of individuals, then at most no more than about 22 per cent of individuals are double-counted. In practice given the geographical spread present in many modern families, the proportion is likely to be between a half and a quarter of this value, at about 5–10 per cent. This should not have produced serious problems with the statistical analysis, and would be more serious if significant differences had been found in the expected direction.

The implications of a raised incidence of left-handedness would have been intriguing genetically, since surnames in British society are inherited along with the Y-chromosome. However the sex-linked portion of the Y chromosome (i.e. excluding the telomeric pseudo-autosomal region) is almost devoid of functioning genes, with the exception of those specifically involved in the determination of sex, and in particular the sex-determining gene *Sry* which has been putatively identified (Koopman, Gubbay, Vivian, Goodfellow & Lovell-Badge, 1991). If the gene for handedness were indeed on the Y chromosome, and if Kerrs and Carrs carried a

different gene pool from the population in general, then the pattern of inheritance of handedness in families would be very different from that which is actually found (McManus, 1991; McManus & Bryden, 1992). Within the Kerr/Carr families there should also have been a very specific pattern of increased sinistrality, in which the raised sinistrality would have been present only in male family members who were ancestors or descendants of male Kerrs or Carrs. Should the left-handedness gene have been on any other part of the genome than the Y-chromosome then its effects would so rapidly have been diluted that within a few generations the effect would have been undetectable.

There seems little doubt that the surnames Kerr and Carr are associated with a tradition of left-handedness. However this need not indicate that there is generally a raised incidence of sinistrality in family members. More likely is that one particular individual who founded the clan had this not unusual characteristic. The surname apparently first appears in Scottish history in 1296, when four individuals with the surname 'Ker' are reported from the Border counties, derived from one 'Kerlie', a henchman of Sir William Wallace who is reputed to have founded the clan. It seems more than possible that he was left-handed. But that his modern descendants are left-handed seems no more possible than that individuals with the surname Smith or Butcher are more likely seven centuries later themselves to be smiths or butchers.

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