Homosexuality in Men and Number of Older Brothers

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Objective: This study investigated whether homosexual men have a higher mean birth order than heterosexual men primarily because they have more older brothers or because they have more older siblings of both sexes. Method: For the main analyses, 302 homosexual men were individually matched on year of birth with an equal number of heterosexual men. Each completed a self-administered, anonymous questionnaire concerning family background and other biodemographic information. Results: Logistic regression analysis showed that homosexuality was positively correlated with the proband's number of older brothers but not with older sisters, younger brothers, younger sisters, or parental age at the time of the proband's birth. Each additional older brother increased the odds of homosexuality by 33%. Conclusions: These results restrict the range of possible theories of the birth order phenomenon to those that can explain not only why older brothers increase the probability of homosexuality in later-born males but also why older sisters neither enhance this effect nor counteract it.
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Several studies have shown that the average birth order of homosexual men is higher than the average birth order of comparable heterosexual men (1–6). This difference has now been demonstrated in subjects examined in recent years and subjects examined decades ago, in groups collected in England, Canada, and the United States, in psychiatric patients and in nonpatient volunteers, in subjects examined during adulthood and subjects examined during childhood, and in men who wish they were women as well as men contented with their male role and anatomy. The collective evidence, therefore, suggests that a high birth order is associated with homosexuality in men, regardless of their other cultural, demographic, or psychological characteristics.

Because of other research suggesting that the sibships of homosexual men contain a higher than average proportion of males (1, 3, 7–9), Blanchard et al. (3) investigated whether the higher birth order of homosexual men primarily reflects an excess of older brothers or equal excesses of older brothers and sisters. Their findings indicated that older brothers and older sisters contribute equally to a boy's likelihood of developing a homosexual orientation. The statistical methods used in that study, however, were not optimal for addressing this particular question. That is because Blanchard et al. (3) overlooked the expected positive correlation between a proband's number of older brothers and his number of older sisters. Because of this correlation, any group whose defining characteristic is related to an excess of older brothers will also tend to show a secondary excess of older sisters. Thus, the critical question, which Blanchard et al. (3) did not address, is whether one observes an excess of older brothers only or older siblings of both sexes after the correlation between them has been taken into account.

Whether the birth order effect relates only to older brothers or also to older sisters obviously is important to theoretical interpretations of that effect. Therefore, the roles of older brothers and older sisters were reexamined in the present study, which involved a more appropriate statistical approach and a larger group of subjects. To our knowledge, this is the first study since 1970 (10) to collect the requisite biodemographic data on a large number of homosexual and heterosexual volunteers and the only large-scale study ever to focus exclusively on such information.

METHOD

Probands

The probands were selected from 877 homosexual and heterosexual men, aged 18–82 years, who were examined in Toronto and surrounding cities in southern Ontario from May 1994 to February

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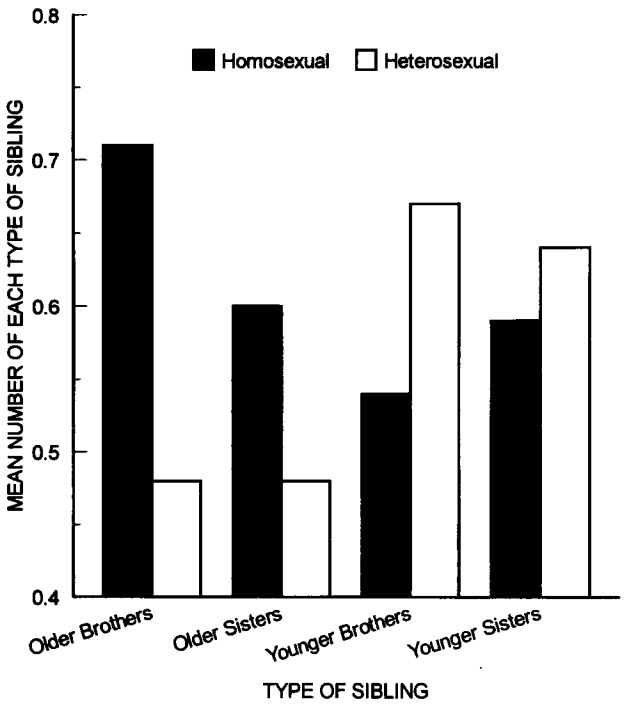
FIGURE 1. Mean Numbers of Older and Younger Brothers and Sisters for 302 Homosexual Men and 302 Matched Heterosexual Men



1995. These subjects were paid $10 (Canadian) for completing a self-administered, anonymous questionnaire concerning their family backgrounds and other personal information. Homosexuals were recruited at a meeting of a homosexual community organization and at the 1994 Toronto Lesbian and Gay Pride Day parade. Heterosexuals demographically similar to the homosexuals were subsequently recruited through service clubs and other organizations and through advertisements, posted on two university campuses, for heterosexual research subjects. Subjects recruited at service club meetings or organized community events were solicited with the understanding that payment would be made to designated charities on their behalf; those recruited as individuals were paid for their participation directly.

Probands were selected from the recruited men according to the following criteria: the proband was white, he was not a twin, he knew or could estimate the ages of his biological mother and father at the time of his birth, he was sure that he knew of all children born to his mother, and his mother had no children by any man other than his own father (i.e., he had no maternal half-siblings). The reason for selecting racially homogeneous probands was to help eliminate all sources of variance in sibship composition except for sexual orientation. Race represented such a potential source of extraneous variance: blacks have a reliably lower ratio of males to females at birth than whites (11, 12), and Orientals may have a higher sex ratio than whites (12). A total of 736 subjects met the foregoing criteria for inclusion in the study.

The probands were classified by sexual orientation according to a questionnaire item that asked whether they were heterosexual, bisexual, or homosexual. With two exceptions—a man at Lesbian and Gay Pride Day who described himself as heterosexual and one from a service club for businesspeople and professionals who described himself as homosexual—the questionnaire responses correlated perfectly with recruitment site. Only 14 of the present probands, all recruited at Lesbian and Gay Pride Day or the homosexual community organization meeting, described themselves as bisexual. These were placed, along with those who described themselves as homosexual, in the homosexual group. The remaining probands constituted the full heterosexual group, so-called to distinguish it from a selected subgroup described later. The homosexual group included 302 probands, and the full heterosexual group included 434.

The mean year of birth of the homosexual group was 1955.16 (SD=10.09), the median and the modal years of birth were both 1957, and the range was 1916–1974. The mean age of the homosexual group was 38.33 years (SD=10.07); their mean number of siblings was 2.43 (SD=1.95); and their mean educational level was 6.71 (SD=1.42), on a scale on which 6 corresponds to community college and 7 corresponds to university.

For the full heterosexual group, the mean year of birth was 1953.79 (SD=12.69), the median and the modal years of birth were 1955, and the range was 1912–1975. The mean age of this group was 40.00 years (SD=12.58), the mean number of siblings was 2.25 (SD=1.74), and the mean educational level was 6.80 (SD=1.24). These means were compared with the corresponding means for the homosexual group by means of t tests. These tests, like all other statistical tests reported later in this article, were two-tailed. No difference between means was significant.

Although the mean year of birth of the full heterosexual group did not differ significantly from that of the homosexual group, the variance of this variable was greater for the heterosexuals. The full heterosexual group included a larger proportion of probands born in recent years and a larger proportion born early in the century. Levene's test for homogeneity of variances showed that this difference in distributions was highly significant ($F=13.50$, $df=1, 734$, $p<0.001$). Because a proband's expected birth order depends on demographic trends operative around the time of his birth (13–15), any between-groups difference in year of birth represents a potential artifact in birth order comparisons.

For the foregoing reason, we selected a subgroup of 302 heterosexual probands, who closely resembled the homosexual group in year of birth, to be used in all crucial birth order comparisons. Each homosexual was matched with a heterosexual who was born the same year or, at most, one year earlier or later. By balancing the 23 heterosexuals who were born 1 year earlier than their homosexual counterparts with an equal number who were born 1 year later, we produced a matched heterosexual subgroup with an identical mean year of birth (1955.16) and a virtually identical standard deviation (10.10). The matched heterosexual subgroup did not differ significantly from the homosexual group in age (mean=38.67 years, SD=10.00), number of siblings (mean=2.27, SD=1.77), or educational level (mean=6.82, SD=1.21).

Materials and Procedure

Because homosexuals are still a stigmatized group, we felt that many homosexual men would not participate in the study if required to disclose their identity by signing a consent form. We therefore did not require signatures of any subjects. Prospective subjects were instead given an information sheet, which stated that the purpose of the study was to examine the relation between people's family backgrounds and their later sexual orientation as adults. This alternative procedure was approved by the University of Toronto Human Subjects Review Committee, which also examined and approved the information sheet. The questionnaire itself, which included other information besides that analyzed in this study, took approximately 10 minutes to complete. Copies of it may be obtained from the first author on request.

The questionnaire asked the proband to record all siblings born to his biological mother, together with related information, including the paternity of each sibling and the age at death of each deceased sibling. The few siblings described as stillborn were not counted in this study; siblings who died at any point after birth—even the same day—were counted. Paternal half-siblings (i.e., children of the proband's father by a different mother) were not recorded at all. As already stated, probands with maternal half-siblings were excluded from the study; therefore, in this article "siblings" always refers to full siblings.

RESULTS

The expected finding of a higher birth order for the homosexual men was confirmed; the number of older siblings for the homosexual group (mean=1.31, SD=1.53) was greater than that for the matched heterosexual

subgroup (mean=0.96, SD=1.43). The difference was statistically significant (t=2.86, df=602, p=0.004). The homosexual group had somewhat fewer younger siblings (mean=1.13, SD=1.40) than the matched heterosexual subgroup (mean=1.31, SD=1.38), but this difference was not significant (t=–1.61, df=602, p>0.10).

The hypothesis that the higher birth order of homosexual men derives primarily from a greater number of older brothers is consistent with the simple representation of the data in figure 1. This figure shows that the groups differed more widely in their mean numbers of older brothers than in any other class of sibling. The hypothesis was tested formally with a logistic regression analysis. The criterion variable was the proband's sexual orientation. The six predictor variables were his numbers of older brothers, older sisters, younger brothers, and younger sisters and his father's and mother's ages at the time of his birth. The equation was built with backward stepwise elimination, and the likelihood ratio test was used for removing nonsignificant variables. Table 1 shows the results for the initial equation, with all six predictors in the model, and the final equation, after all nonsignificant variables had been eliminated.

TABLE 1. Logistic Regression of Sexual Orientation on Family Variables for 302 Homosexual Men and 302 Matched Heterosexual Men

Predictor	B	SE	Wald Statistic	p	e^B
Initial equation					
Number of older brothers	0.29	0.11	7.26	0.007	1.33
Number of older sisters	0.08	0.10	0.63	0.43	1.08
Number of younger brothers	–0.14	0.10	2.14	0.14	0.87
Number of younger sisters	–0.02	0.10	0.05	0.82	0.98
Father's age at time of proband's birth	0.02	0.02	1.06	0.30	1.02
Mother's age at time of proband's birth	–0.03	0.02	1.83	0.18	0.97
Final equation—number of older brothers	0.28	0.10	8.77	0.003	1.33

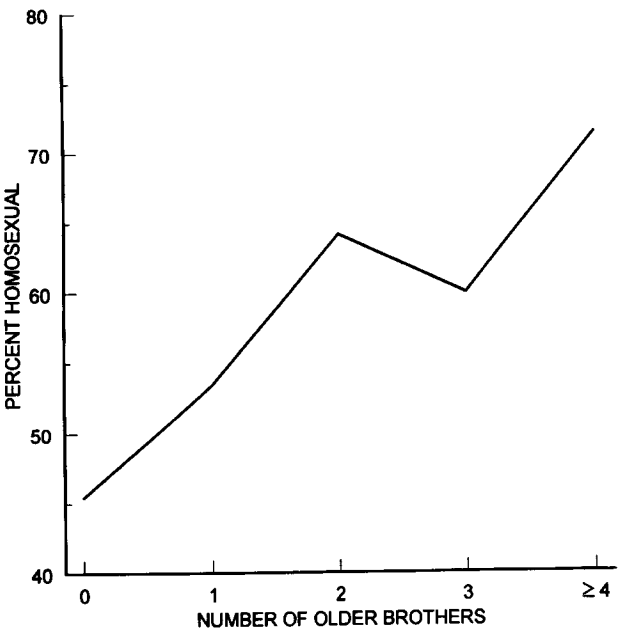
In table 1 each coefficient, B, represents the change in the logarithmic odds of homosexuality for a one-unit increase in the corresponding predictor, with all other predictors in the model controlled for. The next column presents the standard error (SE) for each B. The Wald statistic was the quantity used to determine the significance level (p) of each predictor variable. The quantity e^B is the multiplicative change in the odds of homosexuality for a one-unit increase in the corresponding predictor, and thus, $100\times(e^B-1)$ represents the percentage change in the odds for a one-unit increase in that predictor (16).

The only variable that predicted the proband's sexual orientation was his number of older brothers. The results for the final equation indicated that each additional older brother increased the odds of homosexuality by 33%.

Figure 2 shows the percentage of probands who were homosexual plotted against the number of older brothers. Of the 604 probands, 363 had no older brothers, 161 had one, 53 had two, 20 had three, and seven had four or more older brothers. Only 45% (165 of 363) of the probands with no older brothers were homosexual, whereas 71% (five of seven) of the probands with four or more older brothers were homosexual. Note that in the absence of any correlation between number of older brothers and sexual orientation, the curve should be flat, with an expected proportion of 50% homosexual probands at every point.

The logistic regression analysis was repeated with the full heterosexual group, producing very similar results and the same conclusions. The p value for older brothers (p=0.0008) was even more significant, perhaps just because of the additional degrees of freedom. The estimated percentage change in the odds of homosexuality was virtually identical, suggesting that each additional older brother increased the odds of homosexuality by 34%.

FIGURE 2. Relation Between Number of Older Brothers and Percentage of Probands Who Were Homosexual for 302 Homosexual Men and 302 Matched Heterosexual Men



The full heterosexual group was also used to investigate whether the proportion of males in the sibships of either the heterosexual or the homosexual probands differed from the expected value. The heterosexual subjects had 496 brothers and 481 sisters. The observed proportion of males, 0.5077, was compared with the known proportion of male live births in the general population, 0.5146 (11, 12) by using the z approximation to the binomial test. The proportion of males in the heterosexual group's siblings did not differ significantly from the expected value (p>0.50).

The homosexual subjects had 376 brothers and 359 sisters. Their proportion of male siblings, 0.5116, was also close to the expected value in absolute terms and also did not differ statistically from it (p>0.50).

DISCUSSION

The results confirmed that homosexual men have a higher birth order than heterosexual men primarily because they have more older brothers. They do not differ with regard to older sisters once their number of older brothers has been taken into account. These results restrict the range of possible theories of the birth order phenomenon to those that can explain not only why older brothers increase the probability of homosexuality in later-born males but also why older sisters neither enhance this effect nor counteract it.

In this study sexual orientation was unrelated to parental age, and the difference in birth order between homosexual and heterosexual men was not diminished when parental age was controlled for. This implies that the birth order phenomenon cannot be explained by increased mutation rates in the germ cells of aging mothers or fathers.

As mentioned earlier, some studies have shown that the sibships of homosexual men contain a higher than expected proportion of brothers—in other words, that homosexual men have a higher than average sibling sex ratio (1, 3, 7–9). It was therefore hypothesized that the sibling sex ratio effect and the birth order effect are merely two statistical consequences of a single characteristic of homosexual men, namely, their excess of older brothers (3). According to that view, homosexual men have a higher birth order because they have more older siblings and they have a higher sibling sex ratio because they have more male siblings. The present results argue against the notion that the sibling sex ratio and birth order effects are simply two correlated implications of excess older brothers, because the homosexual probands had more older brothers than the heterosexual probands, but the sibling sex ratios of both groups were almost exactly equal to the expected population value. Our results are, rather, consistent with the alternative hypothesis that the birth order and sibling sex ratio phenomena are independent and that high sibling sex ratios are reliably found only in extremely feminine homosexual groups (3).

Various psychosocial explanations of the birth order effect have been proposed; these have been reviewed elsewhere (1, 3). Less thought has been given to what kinds of biological processes could explain the observed data. It seems to us that if the birth order effect is biological, then it probably involves a maternal immune reaction that is provoked only by male fetuses and becomes stronger after each pregnancy with a male fetus. This hypothesis is based partly on the argument that a woman's immune system would appear the most capable of "remembering" the number of male (but not female) fetuses that she has previously carried and of progressively altering its response to the next fetus according to the current tally of preceding males. It is also based on evidence that male fetuses are more antigenic to the mother than female fetuses and more likely to provoke maternal immune reactions (17–20).

If the immune hypothesis is correct, then the connection between the mother's immune reaction and the child's future sexual orientation would likely be some effect of the maternal antibodies on the sexual differentiation of the fetal brain. It may therefore be relevant that male-specific Y-linked H-Y antigen (21), which has been hypothesized as the reason for the greater antigenicity of male fetuses (17–20), appears to be relatively well represented on the surfaces of brain cells (22), although this may depend on the type of H-Y antigen assayed (23).

Birth order, whether biological or psychosocial in its mechanism of action, is almost certainly just one of several influences on sexual orientation. Genetic inheritance is now well established as another such influence (24–27). It would be useful to know whether these two factors have simple, additive effects on sexual orientation or whether they interact in some synergistic fashion, but that question will require studies in which both factors are simultaneously assessed.

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