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The Sex Ratio in Familial Persistent Stuttering

To the Editor:

Stuttering is a speech disorder characterized by involuntary syllable repetitions, syllable prolongations, or interruptions, known as blocks, in the smooth flow of speech (World Health Organization 1992; Bloodstein 1995). Stuttering typically arises in young children, where it affects ⩾15% of children in the age range of 4–6 years (Bloodstein 1995). Stuttering often resolves spontaneously before adolescence, leading to a population prevalence of 1%–2% among adults. Stuttering beyond childhood is characterized by a significant bias toward males, with males outnumbering females by a ratio of 3:1–5:1 (Yairi et al. 1996).

Many studies support the view that inherited factors contribute to stuttering (Howie 1981; Yairi et al. 1996; Felsenfeld and Plomin 1997). As part of a linkage study to identify predisposing loci for this disorder, we assembled >100 small-to-medium–sized unrelated families with multiple cases of persistent stuttering, chosen to represent the typical presentation of familial stuttering in the adult population. In these families, we have observed a male-to-female ratio among the affected individuals that is strikingly different from the generally accepted ratio in the overall adult stuttering population.

Family ascertainment was designed to obtain the most diverse sample possible from the North American population. The NIH families were ascertained under NIH IRB-approved protocol 97-DC-0087, through a broad variety of appeals directed at stuttering interest groups, stuttering support groups, professional speech and language organizations, alumni of stuttering therapy programs—including intensive residential programs and part-time, outpatient programs—and the general public. The enrolled families included whites, African Americans, Hispanics, and Asians, with no evidence for over- or under-representation of any group compared to the general population. Among the identifiable probands in these families, 56% were male and 44% were female. We exhaustively ascertained and evaluated family members aged >8 years according to well-established diagnostic criteria for stuttering (Webster 1978; World Health Organization 1992), using videotaped speech samples and counting the number of stuttering-like dysfluencies, in both conversation and reading. In some cases, audio tape recordings were substituted. The standardized reading passage was 500 words in length and contained balanced numbers of each of the different classes of speech sounds. This tool has been used for >10 years and has well-established performance norms (R. Webster, personal communication; copy available, on request, from corresponding author). For individuals to be classified as affected, a score of ⩾4% dysfluent words (representing the 25th percentile among individuals who present themselves for stuttering therapy) was required in the individual's speech in both conversation and reading. In some cases, videotaped speech samples were not obtainable, and audio recordings of speech were substituted. By these criteria, 224 individuals were classified as affected in our families. Affection status, as determined by professional speech evaluation, was generally in agreement with self-reported affection status. The few discrepancies showed no evidence of bias between males and females. The affected individuals had an age range of 10–86 years, with a mean age of 39.9 years. Among these affected individuals, 137 are male and 87 are female, yielding a male-to-female ratio of 1.57.

To compare this ratio to the male-to-female ratio in the general stuttering population, we examined four different populations of unrelated, persistent stutterers. We chose four different groups of persistent stutterers, because each group was subject to individual ascertainment biases. For example, therapy programs are generally believed to ascertain males preferentially, while support groups are believed to attract more females, frequently affected mothers of affected children. We sought the largest available sources of such populations of stutterers and derived data from the clinical records of two large therapy programs, the Hollins Communications Research Institute (HCRI) and the American Institute for Stuttering (AIS), plus data on two groups, ascertained

Table 1

Numbers of Males and Females in Populations of Unrelated Persistent Stutterers, and χ^2 Analysis of the Differences in Gender Ratios between Groups

	No. of Patients in Population				
Sex	HCRI Alumni	NSP Members	SFA Records	AIS Alumni	Total
Males	810	285	131	826	2052
Females	156	112	52	212	532

Note.—Overall, familial cases versus general stuttering population $\chi^2 = 43$; df 1; $P < .00001$. Familial cases versus cases ascertained via therapy programs $\chi^2 = 63$. $P < .000001$. Familial cases versus cases ascertained without respect to treatment $\chi^2 = 13$. $P < .002$.

Table 2

Comparison of Sex Ratios in Familial Cases Versus Unrelated Cases Who Report No Family History

Group	No Family History	Males	Females	Male-to-Female Ratio
Familial, NIH	0	137	87	1.57
Unrelated, HCRI	468	410	58	7.07
Unrelated, AIS	435	360	75	4.8

without respect to treatment history, obtained from the records of the National Stuttering Project (NSP), and the Stuttering Foundation of America (SFA). The clinical affection status of individuals in the latter two groups was based on self-report, and all individuals were of age >14 years. The number of males and females in these sample populations is shown in table 1. As expected, these four groups displayed male-to-female ratios that were significantly different from each other. However, the combined overall male-to-female ratio is 3.8, which is in good agreement with numerous published estimates for persistent stuttering (Kidd et al. 1981; Bloodstein 1995; Janssen et al. 1996).

To obtain an estimate of the true sex-ratio difference between familial stuttering and sporadic stuttering, we made a closer examination of the data from HCRI and AIS and excluded individuals who reported any family history of stuttering (see table 2). Although using only alumni of therapy programs as a source of cases is susceptible to ascertainment and other potential biases, these data suggest that the differences in sex ratio between familial and sporadic persistent stuttering may be even greater than the values shown in table 1.

A potential source of bias in this study would result if, within the NIH families, females were significantly more likely to volunteer and be evaluated than were males. Information gathered from multiple members of each family gave no evidence that such bias occurred. Our results could also arise if, within our families in general, females significantly outnumbered males. In fact, counting all family members, there are slightly more males than females in our families (266 males and 216 females), providing additional support for the conclusion that the sex ratio in familial cases differs from the sex ratio in cases overall.

The observation in the NIH cohort of small families is similar to that made in at least one unusual family with persistent stuttering (Mellon 1991). In this large extended family, stuttering appears to segregate under the control of a single major gene, and affected members of this family exist in a male-to-female ratio of 1.6. While the great majority of cases of familial stuttering do not show such apparently simple genetic transmission, this similarity to the results in the NIH families suggests that genetic persistent stuttering may be unified by a consistent effect, in which males and females are more equally affected than is seen in the general stuttering population.

Regarding familial versus sporadic stuttering, our data agree with previous findings (Yairi et al. 1996) and suggest that approximately half of all cases of persistent stuttering are accompanied with a report of family history (468/966 from HCRI, 598/1,033 from AIS), while the remaining half appear to be sporadic. One possibility suggested by these data is that roughly half of all cases of stuttering is due to inherited causes, while the other half are due to poorly understood but nongenetic factors. This hypothesis is consistent with the view that persistent stuttering of nongenetic origin is largely a male disorder and may be related to a greater ability of females to overcome childhood stuttering (Ambrose et al. 1997). Genetic stuttering, in contrast, affects males and females more equally, which has important implications for genetic studies of this disorder that exclude young children. In particular, genetic-linkage studies will be much less obscured by the distortion in sex ratio, since this distortion is largely a phenomenon of sporadic stuttering.

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