

FAMILIALITY OF GENDER NONCONFORMITY

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Familiarity of Gender Nonconformity Among Homosexual Men

Abstract

Gender nonconformity—both in childhood and in adulthood—is a strong correlate of male sexual orientation, with homosexual men showing greater gender nonconformity during both periods. Gender nonconformity also tends to be markedly variable, with some homosexual men being more feminine, or less masculine, than others. We replicated large differences in self-reported childhood and adult gender nonconformity between homosexual and heterosexual men. Subsequently, we examined the extent to which homosexual men’s variation in gender nonconformity runs in families by examining pairs of genetic brothers who were either both homosexual (concordant pairs) or had different sexual orientations (discordant pairs). Both concordant and discordant pairs yielded modest positive correlations consistent with moderate genetic and/or familial environmental effects on gender nonconformity. Our results support the feasibility of supplementing genetic studies of male sexual orientation with analyses of gender nonconformity variation.

KEY WORDS: sexual orientation; homosexuality; gender nonconformity; familiarity; genetics

INTRODUCTION

Gender nonconformity is one of the strongest correlates of homosexuality, especially among males (Bailey, Vasey, Diamond, Breedlove, Vilain, & Eprecht, 2016). Robust sexual orientation differences in childhood gender nonconformity have been established in both prospective and retrospective studies (Bailey & Zucker, 1995). These differences occur quite early and often persist into adulthood (Bailey et al., 2016; Li, Kung, & Hines, 2017; Lippa, 2005; Rieger, Linsenmeier, Gygax, & Bailey, 2008; Rieger, Linsenmeier, Gygax, Garcia, & Bailey, 2010).

Although homosexual men tend to be more gender nonconforming than heterosexual men, there is considerable variation within both groups, with substantial overlap. Furthermore, the variance among homosexual men's retrospectively reported childhood gender nonconformity greatly exceeds that of heterosexual men's (Bailey & Zucker, 1995). The validity of homosexual men's differing childhood memories—with some reporting that they were very feminine and others reporting that they were typically masculine—was supported by a study in which both mothers and their homosexual sons recalled the sons' childhood behavior. The correlation between mothers' and sons' memories was .69 (Bailey, Nothnagel, & Wolfe, 1995). Adult gender nonconformity also tends to vary more among homosexual than among heterosexual men (Rieger et al., 2010).

Group differences in gender nonconformity between homosexual and heterosexual men have strongly influenced theories of the origins of sexual orientation (Bailey et al., 2016). In contrast, the fact that homosexual men are substantially variable in their degree of gender nonconformity has received little scientific attention. At least three different (but not mutually exclusive) explanations of the within-orientation variation in gender nonconformity are

plausible. First, the variation may reflect etiologic heterogeneity. That is, there may be different causal pathways to male homosexuality, and these may vary in the degree to which gender nonconformity cooccurs with it. Second, it may reflect a dosage effect, with greater gender nonconformity reflecting a higher dose of relevant causal factors, such as genetic variants that contribute to homosexuality. (This would not necessarily imply that homosexual men with less gender nonconformity are more bisexual than men with more gender nonconformity.) Third, it could reflect variation in developmental timing of factors that cause homosexuality. For example, if some males have contributory hormonal events that persist long enough during neurodevelopment to influence differentiation of both sexual orientation and gender-typical behavior, but for other males the factors are more temporally circumscribed, this would result in gender nonconformity variation among homosexual males. All three of these hypotheses would be important if confirmed, but only the second has been investigated. Bailey and Pillard (1991) showed that among monozygotic (MZ) twins the probability of concordance for homosexuality was unrelated to degree of the probands' degree of childhood gender nonconformity. Thus, variation in homosexual men's childhood gender nonconformity is unlikely to reflect dosage of genetic variation contributing to homosexuality.

Three studies have explored variation in self-reported childhood gender nonconformity among homosexual men using a family-genetic approach (Table 1). Although these studies were small, two generalizations are apparent. First, genetically-related brothers concordant for homosexuality were somewhat similar in their degree of recalled childhood gender nonconformity. For these concordant pairs, correlations were higher for MZ twins than for dizygotic (DZ) twins or for non-twin genetic brothers, but they were also appreciable for the latter two kinds of relatives. Second, brothers discordant for homosexuality showed no

appreciable correlation in their degree of childhood gender nonconformity, even if they were MZ twins. These findings are consistent with—but do not prove—two hypotheses. First, the substantial familiarity of childhood gender nonconformity suggests that genetic factors may differentiate homosexual men with higher and lower degrees of gender nonconformity. Second, the fact that familial resemblance for childhood gender nonconformity appears higher among genetic brothers who are concordant for homosexuality than among those who are discordant suggests that gender nonconformity variation may be differently explained in homosexual and heterosexual men.

Although the results of studies in Table 1 are intriguing, the studies are all small, and the estimates they provide are subject to substantial sampling error. The number of concordant homosexual genetic brother pairs included in Table 1 is 84, and the number of discordant genetic brother pairs is 81 across the three studies. The current study investigates familial resemblance in gender nonconformity using a much larger sample of genetic brother pairs including more than 700 pairs concordant for homosexuality.

METHOD

Participants

Homosexual men with homosexual brothers were recruited from 2004 through 2008, for a molecular genetics study of male sexual orientation. Proband recruitment was opportunistic, mostly during Gay Pride festivals, supplemented by online and homophile media, advertisements, and organizational announcements. Almost all probands were from the United States (98%). To reduce genetic heterogeneity, Caucasian samples were especially targeted and comprised approximately 98% of the final sample (Sanders et al., 2015). Although homosexual men comprised the target population, other family members (brothers and parents) were encouraged to enroll. Although full siblings were targeted, smaller subsamples of half siblings

and of MZ twins also participated, and we also report their results herein. We included all participants returning a questionnaire, which were more than those whose DNA we were able to obtain and study for linkage (Sanders et al., 2015). We obtained institutional review board approval from NorthShore University HealthSystem, and all participants provided informed consent.

Measures

Sexual Orientation. We distinguished sexual orientations by participants' sexual identities: heterosexual or homosexual. (We excluded participants who identified as bisexual.) We checked that these identities were consistent with their self-reported sexual feelings, assessed by seven-point Kinsey ratings (from 0=sexual attraction only to women to 6=sexual attraction only to men; Kinsey et al., 1948) and by two five-point items in which participants rated their separate feelings about having sex with men or with women (1=disgusting; 2=unpleasant; 3=neutral; 4=moderately exciting; 5=very sexually exciting). Heterosexual men's Kinsey ratings were required to be 0 or 1, and homosexual men's Kinsey ratings were required to be 5 or 6. Eight men's sexual identities (all heterosexual) were inconsistent with their reported sexual feelings (based on any of the three aforementioned scales), and were excluded from the present study.

Childhood Gender Nonconformity. This measure used the 23 items from The Recalled Childhood Gender Identity/Gender Role Questionnaire (Zucker, Mitchell, Bradley, Tkachuk, Cantor, & Allin, 2006). Items were standardized (for the sake of computational simplicity) and then averaged. Higher scores represented greater degrees of childhood gender nonconformity. Reliability (coefficient alpha) was .91.

Adult Gender Nonconformity. This measure, previously called the Adulthood Continuous Gender Identity Scale (Rieger et al., 2008) included eight items regarding the degree to which the respondent reported feeling more feminine and less masculine. Each item used a seven-point rating scale, and higher scores represented increased femininity. Coefficient alpha was .76.

Demographic Information. We examined year of birth as one potential correlate of childhood gender nonconformity. This variable is obviously highly correlated with age at which data were provided, but in a multi-year study such as this one, these variables are not perfectly correlated. Year of birth allowed us to examine whether there are age or cohort effects in the expression (or reporting) of gender nonconformity. (Cross sectional data do not allow the separation of age and cohort effects; Schaie, 1965.) Because brothers tend to be highly correlated for age in samples that draw a wide age range, it is important to control for the effects of age in examining familial factors via correlations between brothers.

We assessed educational level with values ranging from 1 (no high school) to 7 (graduate degree). There is some evidence that persistence of gender nonconformity between childhood and adulthood is greater for men of lower social class (Harry, 1985). The earlier research used information from father's occupation to assess social class. Respondent's educational level is the most similar variable available in the current study.

RESULTS

The sample included 1,959 homosexual men and 100 heterosexual men from 1,154 distinct families. On average, the heterosexual participants reported Kinsey ratings of sexual feelings during the past year of 0.1 (SD=0.36) and homosexual participants 5.86 (SD=0.38). The average birth year of participants was 1962.8, SD=11.0, Range: 1930–1989). Heterosexual participants were born significantly later than homosexual participants, with respective years of

birth of 1962.5 (SD=11.1) and 1957 (11.0), respectively, $t(1,998)=3.30$, $p=.001$. This may have reflected younger homosexual participants being more willing than older homosexual participants to involve their heterosexual brothers, due to the marked increase in positive attitudes towards homosexuality during the past few decades (e.g., Loftus, 2001). On average participants had educational attainment of 5.3 (SD=1.4), or somewhat more than a college degree; heterosexual and homosexual participants did not differ significantly.

Gender Nonconformity Differences Between Heterosexual and Homosexual Men

Adult and childhood gender nonconformity were significantly correlated with each other, for both heterosexual and homosexual men. Respectively, $r(94)=.54$, $p<.0001$ and $r(1898)=.60$, $p<.0001$. (Six heterosexual men and 61 homosexual men were missing data for at least one measure.)

Table 2 presents the means and standard deviations for measures of gender nonconformity during childhood and adulthood, separately for heterosexual and homosexual men. Both differences were statistically significant and large. For childhood $t(2002)=15.16$, $p<.0001$, $d=1.99$, and for adulthood, $t(2040)=7.24$, $p<.0001$. $d=0.85$.

Figure 1 presents the distributions of heterosexual and homosexual men for both variables. The distribution of childhood gender nonconformity was typical of this literature, with heterosexual men's scores tending towards the low end (suggesting a floor effect) and with homosexual men's scores more evenly distributed with higher variance (see, e.g., Figure 2 of Bailey & Zucker, 1995). For gender nonconformity during adulthood the two orientations were less separated, and both tended to congregate in the low regions of the scale.

Familial Resemblance in Gender Nonconformity

We examined similarity between brothers' gender nonconformity separately for those concordant and discordant for homosexuality. Analyses for concordant pairs used data from families which contributed at least two brothers to the study. Only data from the first two homosexual brothers who were recruited in a family were used in analyses of similarity among brothers concordant for homosexuality. (That is, for a few families, more than two homosexual brothers provided data. In order to simplify data analysis, only two were included from each family.) The first brother's childhood and adult gender nonconformity were predicted from his brothers' respective scores, controlling for both the first brother's birth year and his educational level. Results for these analyses are presented in the left-hand columns of Table 3, separately for MZ twins, full siblings (who comprised the bulk of concordant brother pairs,), and half siblings. Among the full siblings (the only group with adequate statistical power), both childhood and adult gender nonconformity were significantly related among concordant pairs. Furthermore, full siblings' birth year was a robust predictor of brothers' gender nonconformity.

Although there were only 8 pairs of MZ twins, their correlation for childhood gender nonconformity was statistically significant. The 34 pairs of half-brothers were significantly correlated for adult gender nonconformity. In principle, the three kinds of brothers on the left-hand side of Table 3 could be used to estimate heritability of childhood and adolescent gender nonconformity. However, the sample sizes of the MZ twins and half-brothers were too small to provide useful estimation.

To analyze data for brothers discordant for homosexuality, we began by identifying families who contributed both at least one heterosexual brother and at least one homosexual brother. (Two pairs who were genetic half-siblings were eliminated. All the rest were full siblings.) We then conducted multiple regressions predicting the heterosexual men's childhood

and adult gender nonconformity scores from their homosexual brothers' gender nonconformity scores, controlling for heterosexual brothers' birth year and educational level. Results for these analyses are presented in the right-hand side of Table 3. The correspondences between discordant brothers' gender nonconformity (both from childhood and adulthood) were not significant. However, Table 3 also shows that regression coefficients for homosexual brothers' gender nonconformity were only slightly smaller than respective coefficients in the analyses for concordant pairs of full siblings. Furthermore, the respective confidence intervals overlapped.

DISCUSSION

Our results are generally consistent with those of past studies showing substantial family resemblance for homosexual brothers in their degree of gender nonconformity. Our sample is much larger than the aggregate of previous samples (Table 1). Estimates of familiarity were accordingly more precise, and they excluded zero by a very large margin. For our largest sample, the full siblings, the correlations between brothers concordant for homosexuality were .263 for childhood gender nonconformity and .168 for adult gender nonconformity. Although these correlations were small in magnitude, the effects that they imply are larger for two reasons. First, in order to estimate the proportion of variance attributable to familial factors, one does not square the correlations; the correlations estimate this proportion directly (Bouchard, Lykken, McGue, Segal, & Tellegen, 1990). Second, if the factors responsible for familial resemblance are genetic rather than environmental, the magnitude of their effect would be even larger than the correlations. This is so because, in general, effects of the shared environment are dwarfed by those of genes (Turkheimer, 2000). Hence, if all the factors causing homosexual brothers' gender nonconformity to be similar were additive and genetic and none of them environmental—then the magnitude of variance explained by genetic factors would be double the correlations. Siblings

who are not MZ twins share only half of their genes (identical by descent) and thus, their resemblance reflects only half the effect of heredity.

In total, our results are consistent with the likelihood of considerable genetic variation in the expression of male gender nonconformity, and possibly even in its causes. Further support for this hypothesis comes from Table 1, in which the average correlation for concordant MZ twins, .675, is larger than that for concordant DZ twins and nontwin brothers, .485; our correlation for concordant nontwin brothers is even smaller. It is likely that genetic factors play a role in gender nonconformity variation among homosexual men, but clearly demonstrating this will require more research. Examining genetic variants related to gender nonconformity is one obvious path, for example, by following up genetic linkage or genome-wide association studies of sexual orientation with analyses of gender nonconformity. Homosexual men appear to be especially variable in their gender nonconformity, relative to heterosexual men (Table 2 and Figure 1), and may therefore be an especially useful population in which to study contributory genetic variants.

Our sample of brothers discordant for homosexuality was much smaller than our sample of concordant brothers, but it is slightly larger than the aggregate of previous samples (Table 1; note that prior studies of genetic brothers discordant for sexual orientation all focused on twins). Unlike in previous studies (e.g., Bailey & Pillard, 1991), gender nonconformity correlations were not much lower among discordant brothers compared with brothers concordant for homosexuality. Furthermore, confidence intervals overlapped (Table 3). Thus, our results do not support the hypothesis we raised in the Introduction that causes of gender nonconformity may differ among homosexual and heterosexual men.

The two covariates we included, birth year and educational attainment, yielded consistent findings for the brothers concordant for homosexuality. Specifically, birth year was positively correlated with both childhood and adult gender nonconformity, meaning that more recently born homosexual men reported more gender nonconformity. These effects were not large (Table 3). For example, for full siblings, one standard deviation increase in birth year (approximately ten years) was associated with 0.15 standard deviation increase in childhood gender nonconformity; the effect for adult gender nonconformity was even smaller. One possible explanation for this finding is an age or cohort effect, in which younger men are more likely to recall or report gender nonconformity than older men. By this explanation, they will report less gender nonconformity—even childhood gender nonconformity—as they age.

Educational attainment was unrelated to childhood and adult gender nonconformity among homosexual men. This contrasts with findings of Harry (1985), who reported that feminine men from lower social classes were more likely to stay feminine from childhood through adulthood. Thus, we expected to observe a correlation between educational attainment (an important component of social class) and adult gender nonconformity. However, we did not.

Limitations

Like most studies of sexual orientation, ours used non-representative sampling techniques subject to various volunteer biases. This can cause distortions in certain kinds of findings, such as twin concordances for sexual orientation because twin pairs concordant for homosexuality may be more likely to volunteer for family-genetic studies compared with twin pairs discordant for homosexuality (Bailey et al., 2016). An analogous volunteer bias could extend to gender nonconformity similarity. Such bias would mean that the likelihood of volunteering for our study (a molecular genetics study of male sexual orientation) would be higher for homosexual brothers

similar in gender nonconformity than in brothers dissimilar for gender nonconformity. We cannot exclude the possibility that such bias occurred.

Self-report bias is also a concern. To be valid, retrospective childhood gender nonconformity measures such as ours require both accurate memories and honesty; similarly, contemporaneous adult gender nonconformity measures require accurate self-assessment and honesty. Although we acknowledge the potential limitations of self-report, it is unclear that these facts would result in spuriously high findings of familial gender nonconformity. Furthermore, other studies have supported the validity of measures of childhood gender nonconformity (Bailey et al., 1993; Rieger et al., 2008).

CONCLUSIONS

Both childhood and adult gender nonconformity are markedly variable among homosexual men. We have shown that both run in families to an appreciable degree. We hope that our results will encourage research to elucidate their precise nature.

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Table 1
Childhood gender nonconformity correlations for pairs of brothers either concordant or discordant for homosexuality from three previous studies.

Study	Correlations (N pairs)							
	Concordant Pairs				Discordant Pairs			
	MZ Twins	DZ Twins	Nontwin Genetic Brothers	Adoptive Brothers	MZ Twins	DZ Twins	Nontwin Genetic Brothers	Adoptive Brothers
Bailey & Pillard (1991)	.76 (25)	.43 (11)		-.26 (6)	.10 (25)	-.02 (32)		-.06 (25)
Watts et al. (2018)	.59 (19)				-.18 (24)			
Dawood et al. (2000)			.54 (29)					

Table 2
Group Ns, Means, and Standard Deviations for childhood and adult gender nonconformity.

Group	Childhood Gender Nonconformity			Adult Gender Nonconformity		
	N	Mean	SD	N	Mean	SD
Heterosexual	94	-0.90	0.30	99	1.68	0.78
Homosexual	1,910	0.04	0.60	1,943	2.48	1.08

Table 3. Standardized partial regression coefficients for predicting brothers' gender nonconformity.

		Concordant Pairs ^a				Discordant Pairs ^b			
Type of Brother		N (Pairs)	Predictor			N (Pairs)	Predictor		
			Brother's Gender Nonconformity	Birth Year	Education		Brother's Gender Nonconformity	Birth Year	Education
Full sibling	Childhood Gender Nonconformity	672	0.263** 0.188–0.337	0.151** 0.075–0.226	-0.037 -0.112–0.037	79	0.220 -0.011–0.451	0.170 -0.051–0.392	0.183 -0.039–0.405
	Adult Gender Nonconformity	697	0.168** 0.094–0.241	0.153** 0.079–0.228	-0.031 -0.105–0.043	82	0.079 -0.138–0.296	0.259* 0.046–0.471	0.085 -0.119–0.289
MZ twin	Childhood Gender Nonconformity	8	0.541* 0.123–0.958	0.277 -0.464–1.019	0.418 -0.353–1.189				
	Adult Gender Nonconformity	8	0.342 -0.991–1.674	1.481* 0.112–2.849	1.449* 0.160–2.739				
Half sibling	Childhood Gender Nonconformity	31	0.160 -0.245–0.410	0.210 -0.316–0.540	0.193 -0.189–0.603				
	Adult Gender Nonconformity	34	0.329* 0.036–0.622	0.171 -0.157–0.542	-0.053 -0.384–0.278				

Coefficients for concordant pairs are from the multiple regression predicting the first homosexual brother's childhood and adult gender nonconformity scores from the second brother's respective scores, controlling for the first brother's birth year and educational level. Coefficients for discordant pairs are from the multiple regression predicting heterosexual brothers' childhood and adult gender nonconformity scores from homosexual brother's respective scores, controlling for heterosexual brothers' birth year and educational level. Cells for predictors include the standardized estimate in the first row and their 95% confidence interval in the second row.

* $p < .05$

** $p < .0001$

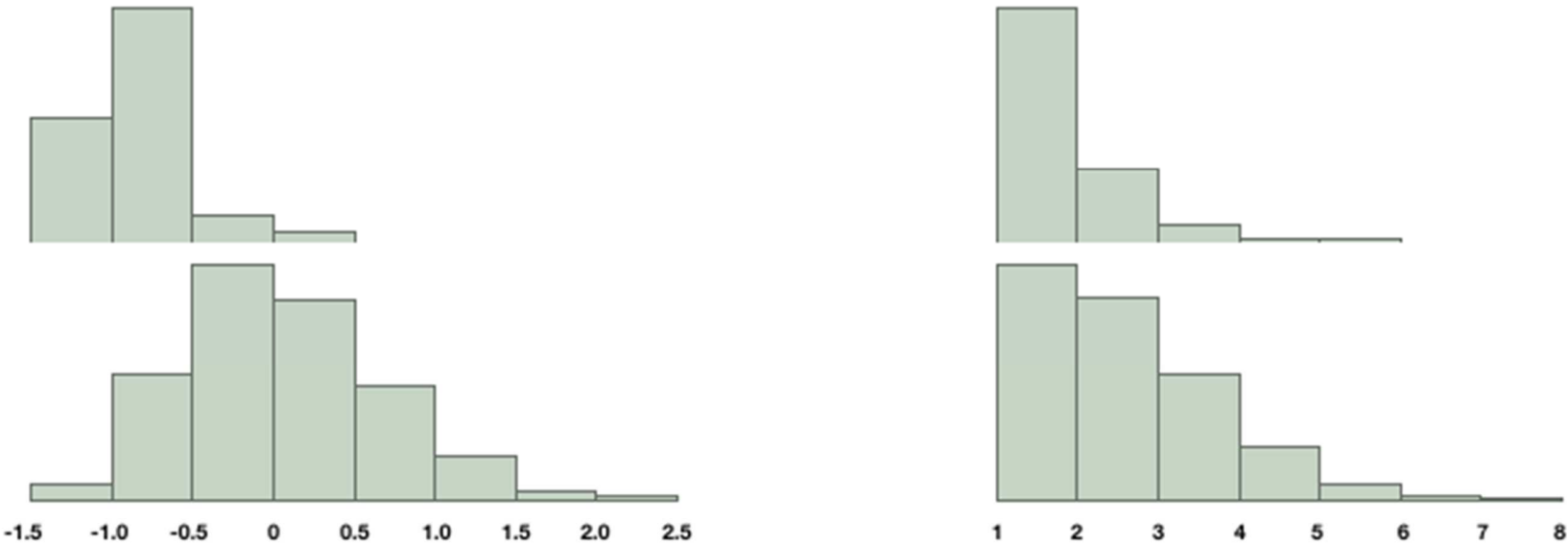


Figure 1. Self-reported childhood gender nonconformity (left) and adult gender nonconformity (right) distributions for heterosexual (top) and homosexual (bottom) participants. Higher scores (i.e., to the right) indicate increased gender nonconformity.