

Family and Sexual Orientation: The Family-Demographic Correlates of Homosexuality in Men and Women

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Using a nationally representative sample of young adults, I identify the family-demographic correlates of sexual orientation in men and women. Hence, I test the maternal immune hypothesis, which posits that the only biodemographic correlate of male homosexuality is the number of older brothers, and there are no biodemographic correlates of female homosexuality. For men, I find that having one older brother does not raise the likelihood of homosexuality. Although having multiple older brothers has a positive coefficient, it is not significant. Moreover, having any older sisters lowers the likelihood of homosexual or bisexual identity. For women, I find that having an older brother or having any sisters decreases the likelihood of homosexuality. Family structure, ethnicity, and education are also significantly correlated with male and female sexual orientation. Therefore, the maternal immune hypothesis cannot explain the entire pattern of family-demographic correlates. The findings are consistent with either biological or social theories of sexual orientation.

Introduction

Recent research on family and sexuality concludes that the only biodemographic correlate of male sexual orientation is the number of older brothers (Blanchard & Bogaert, 1996; Bogaert, 2006). Nearly all studies find that older sisters have no effect on male homosexuality (Blanchard, 2001; Blanchard & Bogaert, 1996; Blanchard, Zucker, Siegelman, Dickey, & Klassen, 1998; Ellis & Blanchard, 2001). There is little to no evidence that any biodemographic variables correlate with female sexual orientation (Blanchard, 1997; Bogaert, 1997). These studies complement earlier studies that relate male homosexuality to birth order and intrafamily sex ratios (Blanchard & Sheridan, 1992; Blanchard & Zucker, 1994; Hare & Moran, 1979; Slater, 1962; Zucker & Blanchard, 1994).

It is hypothesized that the causal mechanism is purely biological (Blanchard, 2001; Blanchard & Bogaert, 1996; Bogaert, 2006). The maternal immune hypothesis states that a woman's immune system "remembers" the number of male, but not female, fetuses. A mother's immune system responds differently to each successive male child in that each child receives different levels of maternal antibodies, which determine the sexual differentiation of the brain. The maternal immune hypothesis is generally consistent with biological evidence on the

influence of prenatal hormones on sexual orientation (Gladue, Green, & Hellman, 1984; LeVay, 1991; Swaab & Hofman, 1990).

In this article, I empirically identify the family-demographic correlates of sexual orientation in men and women and, thereby, reevaluate the maternal immune hypothesis. Using a nationally representative sample of men and women mostly ages 20 to 24, I regress several measures of sexual orientation on a set of sibling variables with and without additional controls. For a number of reasons, the empirical strategy in this article improves upon the literature. Previous studies do not use representative datasets. Moreover, the sample size in this article is about five times larger than the sample size associated with the best-known studies of family and sexual orientation.¹ I allow for nonlinear effects in the number of siblings, while other studies assume linearity. Also, I control for potential omitted variables, that is, family structure, ethnicity, and education, which other studies ignore.

For men, I find that having one older brother does not raise the likelihood of homosexual behavior, desire,

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¹Blanchard and Bogaert (1996) analyzed 302 homosexual men matched with 302 heterosexual men. Homosexual subjects were recruited at a meeting of a homosexual community organization and at a Gay Pride parade. Bogaert (2006) examined about 900 homosexual and heterosexual men. Some of the subjects were (undergraduates) recruited at a university. The remaining subjects were recruited using advertisements in gay or other publications. All of the subjects in the two studies were Canadian.

or identity. While having multiple older brothers has a positive effect, it is not significant at the 5% level. In contrast, having any older sisters lowers the likelihood of homosexual or bisexual identity. Growing up without a biological parent is positively associated with homosexuality. Being Black and having less than a high school education are each positively related to homosexual behavior and desire, whereas having a college education is positively related to homosexual identity. For women, I find that having an older brother, as well as having any sisters, is negatively associated with homosexuality. Growing up without a biological parent is also positively correlated with homosexuality. Being Black or other race is negatively related to female homosexual desire and identity, while not graduating from high school is positively related.

Therefore, the maternal immune hypothesis is unable to explain the entire pattern of family-demographic correlates reported in this article. Contrary to the theory, having an older brother does not have a significant effect on male homosexuality, whereas having an older sister does. The theory does not account for the results on homosexuality in women. Plus, several background characteristics, that is, family structure, race, and education, also may relate to sexual orientation. Either biological or social theories of sexual orientation may help to explain and interpret the findings. Given the complexity of the empirical relationship between sexual orientation and the biodemographic and other correlates, it is likely that both biological and social mechanisms may play a role.

The remainder of the article is organized as follows. The next section describes the data, variables, and empirical strategy. Empirical results are presented in the Results Section. The final section discusses the results and concludes this article.

Data and Methods

In the empirical analysis, I linearly regress measures of sexual orientation on a set of sibling variables both with and without controls, which include respondent age and dummy variables for family structure, ethnicity, and education. The tables display the regression coefficients, robust standard errors associated with the coefficients, and asterisks indicating whether each coefficient is significantly different from zero at the 5% level. I now introduce the micro dataset, describe the dependent and independent variables, and display summary statistics.

I use the National Longitudinal Study of Adolescent Health (Add Health), a nationally representative study of adolescent health in the United States (Udry, 2003). Adolescents in grades 7 through 12 were initially

interviewed in 1995 and 1996 (Waves I and II) and were reinterviewed in 2001 (Wave III). The sample size of male respondents is about 5,000, and the sample size of female respondents is about 5,600. Table 1 displays summary statistics. At Wave III, all respondents in the sample were 18 years old or older. About 88% were between the ages of 20 and 24. It is possible that some young adults may not yet have recognized or acknowledged same-gender attraction. Nevertheless,

Table 1. *Summary Statistics*

	M/F	N	Mean	Min	Max
Same-gender sexual partner	male	5,003	0.044	0	1
Romantic attraction to a man	male	5,003	0.058	0	1
Not 100% heterosexual	male	4,981	0.059	0	1
Neither 100% nor mostly heterosexual	male	4,981	0.027	0	1
Same-gender sexual partner	female	5,656	0.060	0	1
Romantic attraction to a woman	female	5,656	0.131	0	1
Not 100% heterosexual	female	5,617	0.144	0	1
Neither 100% nor mostly heterosexual	female	5,617	0.037	0	1
One older brother	both	10,735	0.179	0	1
Multiple older brothers	both	10,735	0.026	0	1
One younger brother	both	10,735	0.245	0	1
Multiple younger brothers	both	10,735	0.060	0	1
Any same-age brothers	both	10,735	0.040	0	1
One older sister	both	10,735	0.157	0	1
Multiple older sisters	both	10,735	0.025	0	1
One younger sister	both	10,735	0.234	0	1
Multiple younger sisters	both	10,735	0.053	0	1
Any same-age sisters	both	10,735	0.040	0	1
Any half brothers	both	10,735	0.094	0	1
Any half sisters	both	10,735	0.089	0	1
Any adopted brothers	both	10,735	0.026	0	1
Any adopted sisters	both	10,735	0.025	0	1
Respondent's age (Wave III)	both	10,735	21.773	18	28
Childhood family structure (Wave I)					
Both Mom & Dad	both	10,735	0.575	0	1
Only Mom	both	10,735	0.329	0	1
Only Dad	both	10,735	0.044	0	1
Neither	both	10,735	0.052	0	1
Parents separated (between Wave I and III)	both	10,735	0.059	0	1
Ethnicity (Wave I)					
White	both	10,720	0.564	0	1
Black	both	10,720	0.207	0	1
Hispanic	both	10,720	0.153	0	1
Other	both	10,720	0.076	0	1
Education (Wave III)					
<12th grade	both	10,725	0.114	0	1
High school graduate	both	10,725	0.312	0	1
1 or 2 yrs of college	both	10,725	0.313	0	1
3 or more yrs of college	both	10,725	0.261	0	1

Note. M/F indicates whether the summary statistics are calculated for male respondents, female respondents, or both. Sibling and sexuality variables come from Waves I and III, respectively. Data source: Add Health (Waves I and III).

the evidence suggests that underreporting of homosexuality is not a problematic issue in Add Health.²

I construct four measures of homosexuality, including behavior, desire, and identity.³ The first measure (behavior) is whether the respondent had ever had a same gender sexual partner. This variable is derived from Waves I, II, and III. The second measure (desire) is whether the respondent had ever had a romantic attraction to someone of the same gender. This variable is derived from Wave III. The remaining two variables (identity/desire) are based on a survey item that only appears in Wave III.⁴ The third measure, not 100% heterosexual, equals zero if the respondent considered him or herself 100% heterosexual and equals one otherwise. The fourth, neither 100% nor mostly heterosexual, equals zero if the respondent considered him or herself 100% or mostly heterosexual and equals one otherwise. As Table 1 shows, 4.4% of male respondents reported that they had ever had a male sexual partner, and 5.8% reported that they had ever had a romantic attraction to a male. Nearly 6% (5.9%) of male respondents said that they were not 100% heterosexual, and 2.7% said that they were neither 100% nor mostly heterosexual. Six percent of female respondents reported that they had ever had a female sexual partner, and 13.1% reported that they had ever had a romantic attraction to a female. Of female respondents, 14.4% said that they were not 100% heterosexual, and 3.7% said that they were neither 100% nor mostly heterosexual.

The sibling variables are derived from Wave I. Information on the age and gender of siblings comes from the "household roster," an enumeration of the people who lived with the respondent. Since the survey also asked how many children the respondent's biological parents

had together, I am able to construct a sample of respondents with a complete and accurate record of biological siblings as of Wave I. Because most respondents no longer resided with their parents, it is not possible to count siblings in Wave III. Nevertheless, the number of siblings may have changed from Wave I to III. Some respondents may have had younger siblings who were born between waves. However, this problem is minor. Nearly all respondents were age 13 and above in Wave I. The percentage of people who had a sibling age gap of 14 years or greater was extremely low. I estimate that less than 1% of respondents in the sample had an uncounted younger sibling.⁵

The distribution of the number of siblings is skewed. About 79% of respondents did not have an older (biological) brother. About 18% had precisely one older brother, and about 3% had multiple.⁶ This distribution is typical of all of the sibling variables. Thus, in the regressions, I use two dummy variables: (for example) whether the respondent had precisely one older brother, and whether the respondent had multiple older brothers. This takes into account the skewed distribution of the number of siblings and allows for nonlinear effects. Since the percentage of respondents who had a half or adopted sibling is relatively small, I construct just one dummy variable: (for example) whether the respondent had any half brothers. Note that "adopted" siblings include step, adoptive, and foster siblings. Nearly all "same age" siblings are identical or fraternal twins.

In addition, I construct a set of background variables, including age, family structure, ethnicity, and education. It may be important to include these other background characteristics in the regressions, because they may relate to both sexual orientation and family-demographic variables. Age and education are derived from Wave III. Ethnicity is derived from Wave I, but it does not change across waves. The family structure variables are based on both Waves I and III. Four binary variables measure whether the respondent lived with both biological parents, only his or her biological mother, only his or her biological father, or neither parent as of Wave I. Since some parents separate or divorce, family structure may have changed between Wave I and III. To account for this, another binary variable measures whether a respondent's biological parents were still living together in the same household at Wave III given that they were living together at Wave I.

²In the National Health and Social Life Survey (NHSLs), which is nationally representative of people ages 18–59, 4.5% of men rated having sex with someone of the same gender as appealing, whereas 5.8% of men in Add Health reported having had a romantic attraction to another man (Laumann, Gagnon, Michael, & Michaels, 1994, 1995). About 5.6% of women in the NHSLs rated having sex with someone of the same gender as appealing, whereas 13.1% of women in Add Health reported having had a romantic attraction to another woman. Moreover, in the NHSLs, younger men tended to express more same-gender attraction than older men. About 7.7% of male respondents ages 20–24 and 5.2% of respondents ages 30–39 rated same-gender sex as appealing. This pattern reverses for women. About 4.3% of female respondents ages 20–24 and 7.0% of respondents ages 30–39 rated same-gender sex as appealing. Since same-gender attraction for women in Add Health was considerably bigger than that in the NHSLs, it is doubtful that female homosexuality is significantly underreported in Add Health.

³To measure homosexuality, Blanchard and Bogaert (1996) used self-reported sexual identity, pooling homosexual and bisexual subjects. Bogaert (2006) used a combination of self-reported measures of sexual attraction and behavior.

⁴The survey item is, "Choose the description that best fits how you think about yourself: 100% heterosexual; mostly heterosexual, but somewhat attracted to people of your own sex; bisexual, that is, attracted to men and women equally; mostly homosexual, but somewhat attracted to people of the opposite sex; or 100% homosexual."

⁵To estimate what fraction of respondents age 13, 14, etc., had a younger sibling born between Waves I and III, I examine respondents age 18 in Wave I. 1.78%, 1.28%, 1.00%, 0.50%, and 0.39% of respondents age 18 had a younger sibling at least 14, 15, 16, 17, and 18 years younger, respectively. This suggests that less than 1% of respondents in the sample had a younger sibling who is not counted.

⁶Specifically, 8,536 (79.5%) respondents had no older brothers, 1,923 (17.9%) had one, 250 (2.3%) had two, 25 (0.2%) had three, 0 had four, and 1 (0.0%) had five.

Table 2. Family-Demographic Correlates of Male Sexual Orientation Without Control Variables

Independent Variables	Dependent Variable			
	Same-Gender Sexual Partner	Romantic Attraction to a Man	Not 100% Heterosexual	Neither 100% Nor Mostly Heterosexual
One older brother	-0.008 (0.007)	-0.002 (0.008)	-0.007 (0.008)	-0.002 (0.006)
Multiple older brothers	0.040 (0.024)	0.049 (0.027)	0.039 (0.026)	0.035 (0.021)
One younger brother	0.001 (0.007)	-0.006 (0.008)	-0.006 (0.008)	0.004 (0.006)
Multiple younger brothers	-0.004 (0.011)	-0.002 (0.013)	-0.022 (0.012)	0.001 (0.009)
Any same-age brothers	0.011 (0.013)	-0.014 (0.012)	0.002 (0.014)	-0.001 (0.009)
One older sister	-0.008 (0.008)	0.002 (0.010)	-0.019 (0.009)*	-0.003 (0.006)
Multiple older sisters	0.021 (0.022)	-0.014 (0.018)	-0.053 (0.012)*	-0.014 (0.011)
One younger sister	-0.008 (0.007)	0.001 (0.008)	-0.010 (0.008)	-0.009 (0.005)
Multiple younger sisters	-0.019 (0.011)	0.010 (0.016)	-0.025 (0.013)	-0.011 (0.009)
Any same-age sisters	-0.025 (0.014)	0.011 (0.026)	-0.023 (0.020)	0.002 (0.018)
Any half brothers	0.005 (0.012)	0.008 (0.013)	-0.004 (0.012)	-0.004 (0.008)
Any half sisters	0.010 (0.012)	0.006 (0.013)	-0.007 (0.013)	-0.002 (0.009)
Any adopted brothers	0.031 (0.027)	0.034 (0.027)	0.030 (0.029)	0.027 (0.023)
Any adopted sisters	0.009 (0.023)	-0.013 (0.021)	-0.016 (0.024)	-0.015 (0.017)
Constant	0.045 (0.006)*	0.057 (0.006)*	0.071 (0.006)*	0.029 (0.004)*

Note. Numbers in parentheses are robust standard errors. An asterisk indicates significance at the 5% level. The sample size associated with the first two columns is 5,003. The sample size associated with the last two columns is 4,981. Data source: Add Health (Waves I and III).

Table 3. Family-Demographic Correlates of Female Sexual Orientation Without Control Variables

Independent Variables	Dependent Variable			
	Same-Gender Sexual Partner	Romantic Attraction to a Woman	Not 100% Heterosexual	Neither 100% Nor Mostly Heterosexual
One older brother	-0.026 (0.008)*	-0.026 (0.012)*	-0.039 (0.012)*	-0.017 (0.006)*
Multiple older brothers	-0.010 (0.020)	-0.043 (0.025)	-0.025 (0.028)	0.012 (0.019)
One younger brother	-0.012 (0.007)	-0.009 (0.011)	0.006 (0.011)	-0.001 (0.006)
Multiple younger brothers	-0.001 (0.015)	-0.059 (0.016)*	-0.033 (0.019)	-0.003 (0.011)
Any same-age brothers	0.008 (0.024)	0.000 (0.033)	0.024 (0.036)	0.015 (0.022)
One older sister	-0.019 (0.008)*	-0.039 (0.011)*	-0.034 (0.012)*	-0.012 (0.006)
Multiple older sisters	-0.036 (0.016)*	-0.056 (0.026)*	-0.042 (0.029)	-0.017 (0.014)
One younger sister	-0.014 (0.008)	-0.035 (0.011)*	-0.025 (0.011)*	-0.015 (0.006)*
Multiple younger sisters	-0.021 (0.013)	-0.033 (0.019)	-0.014 (0.021)	-0.010 (0.011)
Any same-age sisters	-0.012 (0.013)	-0.046 (0.017)*	-0.047 (0.018)*	-0.015 (0.009)
Any half brothers	-0.014 (0.012)	-0.016 (0.017)	-0.006 (0.018)	-0.005 (0.010)
Any half sisters	0.003 (0.012)	0.027 (0.018)	0.023 (0.018)	0.017 (0.011)
Any adopted brothers	-0.028 (0.016)	0.010 (0.033)	0.010 (0.034)	0.004 (0.019)
Any adopted sisters	-0.018 (0.018)	0.018 (0.036)	0.016 (0.037)	0.005 (0.020)
Constant	0.079 (0.006)*	0.161 (0.009)*	0.165 (0.009)*	0.045 (0.005)*

Note. Numbers in parentheses are robust standard errors. An asterisk indicates significance at the 5% level. The sample size associated with the first two columns is 5,656. The sample size associated with the last two columns is 5,617. Data source: Add Health (Waves I and III).

Results

At this time, I report the empirical results. Table 2 displays linear regressions of male sexual orientation on family-demographic variables without additional controls. None of the coefficients on having one older brother are significantly different from zero.⁷ While the coefficient on multiple older brothers is positive, it is not significant at the 5% level. It is, however, significant at the 10% level when the dependent variable is

“same-gender sexual partner,” “romantic attraction to a man,” or “neither 100% nor mostly heterosexual.” When the dependent variable is “not 100% heterosexual,” the coefficients on having one older sister and multiple older sisters are negative and significant.

Table 3 displays linear regressions of female sexual orientation on family-demographic variables without additional controls. The coefficient on having one older brother is negative and significantly different from zero in every regression. The coefficients on having one older sister and one younger sister are negative and significant in three of four regressions. Plus, when the dependent variable is “same-gender sexual partner” or “romantic

⁷By far, most respondents who have an older brother had just one (87%).

attraction to a woman,” the coefficient on having multiple older sisters is negative and significant. When the dependent variable is “romantic attraction to a woman” or “not 100% heterosexual,” the coefficient on having any same-age sisters is negative and significant.

Table 4 displays linear regressions of male sexual orientation on family-demographic variables as well as controls for age, family structure, ethnicity, and education. As before, none of the coefficients on having one older brother are significant. In every regression, the coefficient on having multiple older brothers is positive but insignificant at the 5% level. As before, the coefficient on having multiple older sisters is negative and significant when the dependent variable is “not 100% heterosexual.” Interpreting this regression, having multiple older sisters decreases the likelihood that a male respondent reports that he is not 100% heterosexual by about 5.0 percentage points.

Moreover, some background characteristics are correlated with male sexual orientation. Growing up without a biological parent is positively associated with homosexuality. The coefficient on living without either biological parent is positive and significant in three regressions. In addition, when the dependent variable is “not 100% heterosexual” or “neither 100% nor

mostly heterosexual,” the coefficient on living with only a biological father is positive and significant. For instance, living with only a biological father raises the likelihood that a respondent reports that he is not 100% heterosexual by about 4.5 percentage points. Being Black is positively associated with having had a male sexual partner (behavior) and romantic attraction to a man (desire) but negatively associated with self-identifying as not 100% heterosexual (identity). The other ethnicity variables do not have a significant effect. Male homosexuality is related to education. The coefficient on having less than a high school education is positive and significant when the dependent variable is “same-gender sexual partner” (behavior) or “romantic attraction to a man” (desire). The coefficients on college education, however, are positive and significant when the dependent variable is “not 100% heterosexual” or “neither 100% nor mostly heterosexual” (identity). Specifically, male respondents with 3 or more years of college are 2.5 percentage points more likely than high school graduates to report that they are not 100% heterosexual.

Table 5 displays linear regressions of female sexual orientation on family-demographic variables as well as controls for age, family structure, ethnicity, and

Table 4. Family-Demographic Correlates of Male Sexual Orientation With Control Variables

Independent Variables	Dependent Variable			
	Same-Gender Sexual Partner	Romantic Attraction to a Man	Not 100% Heterosexual	Neither 100% Nor Mostly Heterosexual
One older brother	-0.005 (0.007)	0.002 (0.009)	-0.005 (0.009)	0.000 (0.006)
Multiple older brothers	0.044 (0.024)	0.052 (0.027)	0.045 (0.027)	0.039 (0.021)
One younger brother	0.005 (0.007)	-0.001 (0.008)	-0.004 (0.008)	0.007 (0.006)
Multiple younger brothers	-0.000 (0.011)	0.003 (0.014)	-0.017 (0.012)	0.006 (0.010)
Any same-age brothers	0.014 (0.013)	-0.010 (0.012)	0.003 (0.014)	0.002 (0.009)
One older sister	-0.004 (0.008)	0.007 (0.010)	-0.016 (0.009)	0.001 (0.007)
Multiple older sisters	0.024 (0.021)	-0.011 (0.018)	-0.050 (0.012)*	-0.011 (0.011)
One younger sister	-0.004 (0.007)	0.007 (0.008)	-0.007 (0.008)	-0.005 (0.005)
Multiple younger sisters	-0.016 (0.011)	0.015 (0.016)	-0.019 (0.013)	-0.007 (0.009)
Any same-age sisters	-0.026 (0.014)	0.010 (0.026)	-0.021 (0.020)	0.004 (0.018)
Any half brothers	0.003 (0.012)	0.005 (0.013)	-0.001 (0.013)	-0.007 (0.008)
Any half sisters	0.007 (0.013)	0.003 (0.014)	-0.002 (0.013)	-0.004 (0.009)
Any adopted brothers	0.029 (0.027)	0.032 (0.027)	0.024 (0.028)	0.022 (0.023)
Any adopted sisters	0.001 (0.024)	-0.020 (0.021)	-0.024 (0.023)	-0.021 (0.017)
Age	0.001 (0.002)	-0.002 (0.002)	-0.003 (0.002)	-0.002 (0.001)
Family—only Mom	0.008 (0.008)	0.010 (0.009)	0.006 (0.009)	0.014 (0.006)*
Family—only Dad	0.031 (0.016)	0.020 (0.017)	0.045 (0.020)*	0.027 (0.014)*
Family—neither	0.038 (0.019)*	0.047 (0.020)*	0.039 (0.020)	0.039 (0.016)*
Parents separated	0.011 (0.012)	0.004 (0.014)	0.006 (0.014)	-0.004 (0.008)
Race—Black	0.017 (0.009)*	0.020 (0.010)*	-0.021 (0.008)*	-0.005 (0.006)
Race—Hispanic	0.015 (0.009)	0.008 (0.009)	0.006 (0.010)	0.012 (0.007)
Race—Other	-0.000 (0.010)	0.001 (0.012)	-0.013 (0.012)	0.005 (0.009)
Educ— <12th grade	0.026 (0.011)*	0.024 (0.012)*	-0.010 (0.010)	0.001 (0.007)
Educ—1 or 2 yrs college	0.013 (0.007)	0.016 (0.008)	0.023 (0.009)*	0.014 (0.006)*
Educ—3 or more yrs college	0.012 (0.008)	0.015 (0.009)	0.025 (0.010)*	0.013 (0.006)*
Constant	0.002 (0.041)	0.068 (0.045)	0.110 (0.045)*	0.043 (0.030)

Note. Numbers in parentheses are robust standard errors. An asterisk indicates significance at the 5% level. The sample size associated with the first two columns is 4,990. The sample size associated with the last two columns is 4,968. Data source: Add Health (Waves I and III).

Table 5. *Family-Demographic Correlates of Female Sexual Orientation With Control Variables*

Independent Variables	Dependent Variable			
	Same-Gender Sexual Partner	Romantic Attraction to a Woman	Not 100% Heterosexual	Neither 100% Nor Mostly Heterosexual
One older brother	-0.018 (0.008)*	-0.022 (0.012)	-0.036 (0.012)*	-0.016 (0.006)*
Multiple older brothers	0.001 (0.020)	-0.036 (0.025)	-0.020 (0.029)	0.014 (0.019)
One younger brother	-0.005 (0.008)	-0.003 (0.011)	-0.010 (0.011)	0.001 (0.006)
Multiple younger brothers	0.007 (0.015)	-0.049 (0.017)*	-0.023 (0.019)	0.000 (0.011)
Any same-age brothers	0.010 (0.024)	-0.002 (0.032)	0.032 (0.036)	0.017 (0.022)
One older sister	-0.014 (0.008)	-0.033 (0.011)*	-0.029 (0.012)*	-0.011 (0.006)
Multiple older sisters	-0.025 (0.016)	-0.047 (0.025)	-0.035 (0.029)	-0.013 (0.014)
One younger sister	-0.009 (0.008)	-0.032 (0.011)*	-0.022 (0.011)	-0.013 (0.006)*
Multiple younger sisters	-0.017 (0.013)	-0.032 (0.019)	-0.012 (0.021)	-0.011 (0.011)
Any same-age sisters	-0.010 (0.013)	-0.046 (0.017)*	-0.045 (0.018)*	-0.014 (0.009)
Any half brothers	-0.020 (0.012)	-0.020 (0.017)	-0.006 (0.018)	-0.010 (0.010)
Any half sisters	-0.005 (0.013)	0.018 (0.018)	0.019 (0.019)	0.011 (0.012)
Any adopted brothers	-0.035 (0.016)*	-0.003 (0.033)	-0.007 (0.035)	0.000 (0.019)
Any adopted sisters	-0.018 (0.018)	-0.011 (0.035)	-0.005 (0.037)	0.002 (0.020)
Age	0.004 (0.002)*	0.001 (0.003)	-0.001 (0.003)	-0.000 (0.002)
Family—only Mom	0.023 (0.008)*	0.019 (0.012)	0.018 (0.012)	0.009 (0.007)
Family—only Dad	-0.009 (0.014)	0.099 (0.029)*	0.095 (0.030)*	0.014 (0.015)
Family—neither	0.039 (0.018)*	0.036 (0.023)	0.034 (0.023)	0.010 (0.013)
Parents separated	0.009 (0.014)	0.031 (0.021)	0.026 (0.021)	0.013 (0.012)
Race—Black	-0.014 (0.008)	-0.052 (0.011)*	-0.069 (0.011)*	-0.011 (0.007)
Race—Hispanic	-0.007 (0.010)	-0.017 (0.014)	-0.028 (0.014)*	0.006 (0.008)
Race—Other	-0.037 (0.009)*	-0.048 (0.016)*	-0.032 (0.018)	-0.026 (0.006)*
Educ— < 12th grade	0.005 (0.013)	0.050 (0.019)*	0.062 (0.019)*	0.030 (0.012)*
Educ—1 or 2 yrs college	-0.006 (0.008)	-0.003 (0.012)	0.020 (0.012)	0.001 (0.007)
Educ—3 or more yrs college	-0.013 (0.009)	-0.017 (0.012)	0.006 (0.012)	-0.010 (0.006)
Constant	-0.009 (0.042)	0.145 (0.061)*	0.173 (0.063)*	0.051 (0.035)

Note. Numbers in parentheses are robust standard errors. An asterisk indicates significance at the 5% level. The sample size associated with the first two columns is 5,646. The sample size associated with the last two columns is 5,606. Data source: Add Health (Waves I and III).

education. The coefficient on having one older brother is negative and significant in three regressions, while the coefficients on having one older sister, one younger sister, and any same-age sisters are negative and significant in two. For example, having an older brother and an older sister each decreases the likelihood that a female respondent thinks about herself as not 100% heterosexual by 3.6 and 2.9 percentage points, respectively.

Several background characteristics are associated with female sexual orientation as well. The coefficients on growing up with only a biological mother and living without either biological parent are positive and significant when the dependent variable is “same-gender sexual partner.” When the dependent variable is “romantic attraction to a woman” or “not 100% heterosexual,” the coefficient on growing up with only a biological father is positive and significant. In particular, growing up with only a biological father increases the likelihood that a female respondent thinks about herself as not 100% heterosexual by about 9.5 percentage points. Also, being Black or other race (that is, Asian or American Indian) is negatively associated with homosexuality in several regressions. Being Black lowers the likelihood that a respondent thinks about herself as not 100% heterosexual by 6.9 percentage points. The coefficient on having less than a high school education

is positive and significant when the dependent variable is “romantic attraction to a woman,” “not 100% heterosexual,” or “neither 100% nor mostly heterosexual.” That is, relative to high school graduates, a high school drop-out is 6.2 percentage points more likely to report that she is not 100% heterosexual.

Discussion and Conclusion

The evidence in Tables 2 and 4 sheds light on the claim that the only biodemographic correlate of male sexual orientation is the number of older brothers (Blanchard, 2001; Blanchard & Bogaert, 1996; Bogaert, 2006). Most men who have an older brother have only one. The regressions suggest that, both with and without controls, having one older brother does not raise the likelihood of homosexuality in men. Moreover, although having multiple older brothers has a positive effect, it is not significant at the 5% level. Not only does the empirical evidence appear to reject the assumption of linearity, but it also casts doubt on whether there is a significant effect of older brothers on male sexual orientation in the first place. In addition, the maternal immune hypothesis rests on the prediction that the number of sisters does not affect male homosexuality

(Blanchard, 2001; Blanchard & Bogaert, 1996; Blanchard et al., 1998; Ellis & Blanchard, 2001). Nevertheless, having any older sisters is negatively associated with homosexual or bisexual identity. Plus, social and demographic background variables, including family structure, race, and education, are significantly related to homosexuality. In contrast, Bogaert (2006) found that education and male sexual orientation were unrelated.

The evidence in Tables 3 and 5 addresses the assertion that no biodemographic variables relate to female sexual orientation (Blanchard, 1997; Bogaert, 1997). Both with and without controls, a number of sibling variables are significantly associated with measures of homosexuality. In particular, having an older brother, as well as having any sisters, is negatively associated with homosexuality in women. The maternal immune hypothesis cannot explain this finding, because the biological mechanism concerns only male, not female, fetuses. Similar to the male results, several social and demographic background variables are significantly associated with measures of homosexuality in women. Growing up in a broken home is positively correlated with homosexuality. Being Black or other race is negatively related to female homosexual desire and identity, while not graduating from high school is positively related.

Therefore, while the maternal immune hypothesis is consistent with the finding that having multiple older brothers may have a positive (albeit insignificant) effect on male sexual orientation, the theory is unable to explain the entire pattern of family-demographic correlates reported in this article using a nationally representative sample of young adult Americans. Either biological or social theories of sexual orientation may help to explain and interpret the findings. Biological theories that emphasize the role of genes (Bailey & Pillard, 1991; Hamer et al., 1993; Pillard & Weinrich, 1986) or prenatal hormones (Gladue et al., 1984; LeVay, 1991; Swaab & Hofman, 1990) certainly have promise. Modern social, psychological, and economic theories may have valuable contributions too (e.g., Bearman & Brückner, 2002; Francis, 2008; Posner, 1992; Philipson & Posner, 1993). More empirical and theoretical research is necessary to distinguish among the various potential causal factors and to further illuminate the rich contours of human sexual orientation.

References

- Bailey, J. M. & Pillard, R. C. (1991). A genetic study of male sexual orientation. *Archives of General Psychiatry*, 48(12), 1089–1096.
- Bearman, P. S. & Brückner, H. (2002). Opposite-sex twins and adolescent same-sex attraction. *American Journal of Sociology*, 107(5), 1179–1205.
- Blanchard, R. (1997). Birth order and sibling sex ratio in homosexual versus heterosexual males and females. *Annual Review of Sex Research*, 8, 27–67.
- Blanchard, R. (2001). Fraternal birth order and the maternal immune hypothesis of male homosexuality. *Hormones and Behavior*, 40, 105–114.
- Blanchard, R. & Bogaert, A. F. (1996). Homosexuality in men and number of older brothers. *American Journal of Psychiatry*, 153(1), 27–31.
- Blanchard, R. & Sheridan, P. M. (1992). Sibship size, sibling sex ratio, birth order, and parental age in homosexual and nonhomosexual gender dysphorics. *Journal of Nervous and Mental Disease*, 180, 40–47.
- Blanchard, R. & Zucker, K. J. (1994). Reanalysis of Bell, Weinberg, and Hammersmith's data on birth order, sibling sex ratio, and parental age in homosexual men. *American Journal of Psychiatry*, 151, 1375–1376.
- Blanchard, R., Zucker, K. J., Siegelman, M., Dickey, R., & Klassen, P. (1998). The relation of birth order to sexual orientation in men and women. *Journal of Biosocial Science*, 30, 511–519.
- Bogaert, A. F. (1997). Birth order and sexual orientation in women. *Behavioral Neuroscience*, 111, 1395–1397.
- Bogaert, A. F. (2006). Biological versus nonbiological older brothers and men's sexual orientation. *Proceedings of the National Academy of Sciences*, 103(28), 10771–10774.
- Ellis, L. & Blanchard, R. (2001). Birth order, sibling sex ratio, and maternal miscarriages in homosexual and heterosexual men and women. *Personality and Individual Differences*, 30, 543–552.
- Francis, A. M. (2008). The economics of sexuality: The effect of HIV/AIDS on homosexual behavior in the United States. *Journal of Health Economics*, 27(3), 675–689.
- Gladue, B. A., Green, R., & Hellman, R. E. (1984). Neuroendocrine response to estrogen and sexual orientation. *Science*, 225(4669), 1496–1499.
- Hamer, D. H., Hu, S., Magnuson, V. L., Hu, N., & Pattatucci, A. M. L. (1993). A linkage between DNA markers on the X-chromosome and male sexual orientation. *Science*, 261(5119), 321–327.
- Hare, E. H. & Moran, P. A. P. (1979). Parental age and birth order in homosexual patients: A replication of Slater's study. *British Journal of Psychiatry*, 134, 178–182.
- Laumann, E. O., Gagnon, J. H., Michael, R. T., & Michaels, S. (1994). *The social organization of sexuality: Sexual practices in the United States*. Chicago: University of Chicago Press.
- Laumann, E. O., Gagnon, J. H., Michael, R. T., & Michaels, S. (1995). *National Health and Social Life Survey (ICPSR version)*. Chicago, IL: University of Chicago and National Opinion Research Center [producer]. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor].
- LeVay, S. (1991). A difference in hypothalamic structure between heterosexual and homosexual Men. *Science*, 253(5023), 1034–1037.
- Philipson, T. & Posner, R. A. (1993). *Private choices and public health: The AIDS epidemic in an economic perspective*. Cambridge, MA: Harvard University Press.
- Pillard, R. C. & Weinrich, J. D. (1986). Evidence of familial nature of male homosexuality. *Archives of General Psychiatry*, 43(8), 808–812.
- Posner, R. A. (1992). *Sex and reason*. Cambridge, MA: Harvard University Press.
- Slater, E. (1962). Birth order and maternal age of homosexuals. *Lancet*, 1, 69–71.
- Swaab, D. F. & Hofman, M. A. (1990). An enlarged suprachiasmatic nucleus in homosexual men. *Brain Research*, 537(1–2), 141–148.
- Udry, J. R. (2003). *The National Longitudinal Study of Adolescent Health (Add Health), Waves I & II, 1994–1996; Wave III, 2001–2002* [machine-readable data file and documentation]. Chapel Hill, NC: Carolina Population Center, University of North Carolina at Chapel Hill.
- Zucker, K. J. & Blanchard, R. (1994). Reanalysis of Bieber et al.'s 1962 data on sibling sex ratio and birth order in male homosexuals. *Journal of Nervous and Mental Disease*, 182, 528–530.

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