

**Tiffany A. Brakefield , Sara C. Mednick, Helen W. Wilson,
Jan-Emmanuel De Neve, Nicholas A. Christakis,
James H. Fowler**

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Same-Sex Sexual Attraction Does Not Spread in Adolescent Social Networks

Tiffany A. Brakefield · Sara C. Mednick · Helen W. Wilson ·
Jan-Emmanuel De Neve · Nicholas A. Christakis ·
James H. Fowler

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Abstract Peers have a powerful effect on adolescents' beliefs, attitudes, and behaviors. Here, we examine the role of social networks in the spread of attitudes towards sexuality using data from the National Longitudinal Study of Adolescent Health (Add Health). Although we found evidence that both sexual activity (OR = 1.79) and desire to have a romantic relationship (OR = 2.69) may spread from person to person, attraction to same sex partners did not spread (OR = 0.96). Analyses of comparable power to those that suggest positive and significant peer-to-peer influence in sexual behavior fail to demonstrate a significant relationship on sexual attraction between friends or siblings. These results suggest that peer influence has little or no effect on the tendency toward heterosexual or homosexual attraction in teens, and that sexual orientation is not transmitted via social networks.

Keywords Adolescents · Sexual attraction · Sexual orientation · Social networks

Introduction

Social influences play a crucial role in adolescent development and behavior (Mednick, Christakis, & Fowler, 2010; Steinberg & Monahan, 2007; Wolfe, Jaffe, & Crooks, 2006). For example, adolescents are known to take more risks when in the presence of peers compared to solitary conditions (Gardner & Steinberg, 2005). Early romantic relationships, representing a key focus of adolescent development, are highly influenced by peer relationships, at least among heterosexual peers (Furman & Wehner, 1994, 1997). Friendship networks are fundamental to shaping the structure and quality of dating relationships during adolescence (Connolly, Craig, Goldberg, & Pepler, 1999). For example, longitudinal research has found that the number of other-sex friends in the 9th and 10th grade predicted the likelihood that adolescents would be in a romantic relationship by 11th grade, and the level of support and conflict in earlier friendships predicted the quality of these romantic partnerships (Connolly, Craig, Goldberg, & Pepler, 1999).

In general, there is strong empirical evidence of associations between peer influence and sexual activity in adolescents

T. A. Brakefield (✉) · H. W. Wilson
Department of Psychology, Rosalind Franklin University of
Medicine and Science, North Chicago, IL 60064, USA
e-mail: tiffany.brakefield@gmail.com

S. C. Mednick
Department of Psychiatry, University of California, Riverside,
Riverside, CA, USA

J.-E. De Neve
School of Public Policy, University College London, London, UK

J.-E. De Neve
Centre for Economic Performance, London School of Economics,
London, UK

N. A. Christakis
Department of Medicine and Department of Health Care Policy,
Harvard Medical School, Boston, MA, USA

N. A. Christakis
Department of Sociology, Faculty of Arts and Sciences, Harvard
University, Cambridge, MA, USA

J. H. Fowler
Division of Medical Genetics, University of California, San Diego,
La Jolla, CA, USA

J. H. Fowler
Department of Political Science, University of California, La Jolla,
CA, USA

(DeBlasio & Benda, 1990; Furstenburg, Moore, & Peterson, 1986; Jessor, Costa, Jessor, & Donovan, 1983). Peer groups also influence adolescent sexual behaviors, including age of sexual debut (Hair, Park, Ling, & Moore, 2009; Sieving, Eisenberg, Pettingell, & Skay, 2006), frequency of sexual activity (DeBlasio & Benda, 1990), and safe sex acts (Catania, Kegeles, & Coates, 1990; Fisher, 1988) such as consistent condom use (Walter et al., 1992). A study using data from the National Longitudinal Study of Adolescent Health (Harris, 2009) found that sexually inexperienced adolescents were more likely to have had sexual intercourse (defined as vaginal intercourse) at follow-up if their peers were also sexually experienced (Sieving, Eisenberg, Pettingell, & Skay, 2006).

Furthermore, a number of studies have shown that various phenomena, such as smoking, obesity, alcohol use, loneliness, depression, spread in adult social networks (Cacioppo, Fowler, & Christakis, 2009; Christakis & Fowler, 2008a; Fowler & Christakis, 2008; Rosenquist, Fowler, & Christakis, 2011; Rosenquist, Murabito, Fowler, & Christakis, 2010). This kind of social network influence may be even more prominent in adolescents (Mednick, Christakis, & Fowler, 2010) given the impact of social influence on their behavior. However, no studies have directly examined the relationship between social networks and the development of same-sex attraction in adolescents. Thus, it is unclear whether social network influence generalizes to all aspects of romantic and sexual relationship development or applies only to specific behaviors and attitudes.

Most research on the development of early romantic relationships has focused on heterosexual relationships and therefore less is known about the development of same-sex romantic or sexual relationships. There is limited evidence that the development of these relationships may be different from those of heterosexuals (Rotherbam-Borus, Reid, Rosario, & Kasen, 1995). In contrast with strong peer influences on heterosexual activity, Rotherbam-Borus et al. (1995) found no peer influence on gay male adolescent sexual behavior. Few have further examined the development of romantic or sexual relationships among same-sex individuals; however, there exists a substantial body of literature which instead focuses on the origin of same-sex attraction. Same-sex orientation has been related to biological factors, including genetics and neuroendocrine differences. Sexual orientation appears to have a genetic influence (Bailey & Bell, 1993; Bailey & Benishay, 1993; Pattatucci & Hamer, 1995; Pillard, 1990; Pillard & Weinrich, 1986); likewise, twin studies have suggested genetic rather than family environment influences (Bailey & Pillard, 1991; Bailey, Pillard, Neale, & Agyei, 1993). Additionally, some evidence suggests that male sexual orientation is influenced by a gene on the X chromosome (Hamer, Hu, Magnuson, Hu, & Pattatucci, 1993; Hu et al., 1995), although other studies have found contradictory evidence (Bailey et al., 1999; Rice, Anderson, & Ebers, 1995). The neuroendocrine theory proposes that homosexual individuals have been exposed to atypical levels of hormones in development,

resulting in sex-atypical neural differentiation (MacCulloch & Waddington, 1981). In support of this perspective, LeVay (1991) found that for one hypothalamic nucleus, gay men were more similar to heterosexual women than to heterosexual men. This study aims to contribute to the limited body of knowledge examining the development of romantic or sexual relationships among same-sex individuals, beyond these more extensively studied biological factors.

In the present study, we used nationally representative data from Add Health to examine whether same-sex romantic attractions spread through social networks, and we compared this effect to the spread of desire to have a romantic relationship and self-reported sexual activity. Given the powerful effects of social influence across other domains of adolescent behavior and development, we might expect that adolescents would be more likely to report having had a romantic attraction to someone of the same sex if their friends reported same-sex attractions. On the other hand, given the strong influence of biology on sexual orientation, we would expect any social network influence on same-sex attraction to be weaker than the influence on general desire for romantic relationships or sexual activity.

Method

Participants

This study draws upon data from the National Longitudinal Study of Adolescent Health (Add Health), a nationally representative sample of students in Grades 7–12 (Harris, 2009). At the beginning of Wave I, researchers identified an “in-school” sample of 90,118 adolescents in 142 schools. A subset of this group was then chosen for in-depth “in-home” follow-up in Waves I (1994–1995), II (1996), and III (2001–2002). During these in-home interviews, adolescents completed measures about their social networks and health behavior, from which we derived our information about romantic and sexual relationships ($N = 14,738$). The average age at baseline was 15.8 years (SD 1.6), 51 % were female, 23 % Black, 17 % Hispanic, and 7 % Asian-American (see Table 1 for summary statistics).

The primary analyses reported here include only Wave I and II data, since by Wave III the participants were young adults and no longer embedded within their high school networks. However, we used Wave III data to validate the measure of same sex attraction from Waves I and II. We treated each friendship nomination as a “directed tie” from the namer to the named friend. We call individuals who were the objects of analysis “egos” and the people to whom they were connected “alters.”

Measures

Students were allowed to nominate up to five female and five male friends and were then asked more specific details about

Table 1 Summary statistics: Add Health Wave II

	<i>M</i>	<i>SD</i>
Age (in years)	16.73	1.608
Mother's income (thousands of dollars)	46.062	52.207
Mother's education (10 point scale)	5.446	2.397
Female (51.3 %)		
Black (22.7 %)		
Hispanic (16.9 %)		
Asian (7.4 %)		
Has had feelings of same-sex attraction (4.6 %)		
Has had sexual intercourse (44.7 %)		
Desires a romantic relationship (7.2 %)		

those friendships. Specifically, subjects were asked: (1) "List your closest male friends. List your best male friend first, then your next best friend, and so on. Girls may include boys who are friends and boyfriends." (2) "List your closest female friends. List your best female friend first, then your next best friend, and so on. Boys may include girls who are friends and girlfriends." Subjects were also asked to name their siblings. These names were then matched to school rosters to locate the unique identifier for each named friend and sibling who was also in the study.

Sexual activity was assessed by self-report at both waves by answers to the question "Have you ever had sexual intercourse?" Subjects were classified dichotomously as sexually active if they answered "yes." Sexual attraction was assessed by self-reported answers to two questions: "Have you ever had a romantic attraction to a male?" and "Have you ever had a romantic attraction to a female?" Subjects were classified dichotomously as being attracted to same-sex partners if they said "yes" to the question for their same sex. The validity of self-report of sexual behavior is controversial (Schroder, Carey, & Vanable, 2003), but this measure is frequently used in studies of adolescent sexual behavior (Rosenbaum, Rabenhorst, Reddy, Fleming, & Howells, 2006). Although our same-sex attraction measure was somewhat crude, it was highly correlated (Pearson's $r = 0.67$, $SE \pm 0.01$, $p < .001$) with responses to a question administered at Wave III assessing identified sexual orientation: "Please choose the description that best fits how you think about yourself: (1) 100 % heterosexual (straight); (2) mostly heterosexual (straight), but somewhat attracted to people of your own sex; (3) bisexual' that is, attracted to men and women equally; (4) mostly homosexual (gay), but somewhat attracted to people of the opposite sex; (5) 100 % homosexual (gay)." Ideally, we would use this measure instead, but subjects were no longer embedded in their high school networks at Wave III. The high correlation with the earlier measure provides evidence of predictive validity and suggests that same-sex attraction captured much of the variation in self-reported sexual orientation.

Finally, for comparison to the same-sex attraction measure, we also evaluated the desire for *any* kind of romantic relationship with answers to the question "How much would you like to have a romantic relationship in the next year? (1) Not at all; (2) Very little; (3) Somewhat; (4) Quite a bit; (5) Very much." We categorized subjects dichotomously as *not* desiring a relationship if they responded "Not at all." This cut-off resulted in a variable with an incidence of 4.7 % and therefore yielded a test with similar power to tests with the same-sex attraction measure, which had an incidence of 4.6 %.

Statistical Analyses

To establish whether friends exhibited correlated outcomes in the network at a single point in time, we used a permutation method. Here, we compared the Pearson correlation in observed values between all friendship pairs in the network to the Pearson correlation that resulted when we randomly permuted those values while keeping the network intact. Repeating this process 1,000 times gave us a distribution of the observed value minus the random value, which we used to estimate confidence intervals.

An association in the behaviors of connected individuals can be attributed to at least three processes: (1) *influence*, whereby a behavior in one person causes the behavior of others; (2) *homophily*, whereby individuals with the same behaviors preferentially choose one another as friends (Christakis & Fowler, 2013); or (3) *confounding*, whereby connected individuals jointly experience contemporaneous exposures (a sex education class may make all students feel more comfortable expressing feelings of same-sex attraction). Repeated measures of sexual feelings or behavior, longitudinal information about network ties, and information about the nature or direction of the ties (e.g., who nominated whom as a friend) help to distinguish these effects (Christakis & Fowler, 2013; Liang & Zeger, 1986).

We conducted regressions of ego sexual behavior or feelings in Wave II as a function of ego's age, gender, race, ethnicity, household income, parental education, and sexual behavior or feelings in Wave I, and of the sexual behavior or feelings of an *alter* in both Wave II and Wave I. Inclusion of ego's behavior at Wave I controls for ego's genetic endowment and any intrinsic, stable predilection to have romantic feelings or to engage in sexual behavior. Including alter's behavior at Wave I controls for homophily. In each model, the coefficient for the alter at Wave II (e.g., "alter attracted to same sex") reflected the effect of social influence controlling for other variables in the model. For a full review of the literature on the advantages and limitations of this method, see Christakis and Fowler (2013).

We estimated logit models where we considered a dichotomous version of the outcome variable using generalized estimating equation (GEE) procedures to account for multiple observations of the same ego across ego-alter pairings and we assumed an independent working correlation structure for the

clusters (Bollen & Stine, 1990). Huber-White sandwich estimates with clustering on the egos yielded very similar results. The GEE regression models in the tables provide parameter estimates in the form of beta coefficients, which can be interpreted as log odds ratios. For clarity, we transformed these to odds ratios in some parts of the text and in Fig. 2.

Finally, figures of networks were drawn using the free open-source software Pajek (Batagelj & Mrvar, 2011).

Results

Figure 1 depicts part of the network from a cluster of 123 connected adolescents and, below these, permutation analyses of the full sample. Figure 1, on the left, also shows results of the analyses examining the extent to which sexually active adolescents tended to be friends with one another. The right side of the figure shows the extent to which friends tend to have the same sexual attractions. The correlation in sexual activity between friends was significant at 0.17 (95 % CI 0.11–0.16), and there was a significant relationship between friends of friends at two degrees of separation (0.05, 95 % CI 0.02–0.07). However, we found no evidence of such clusters among adolescents who reported same-sex attraction. The correlation in these feelings between friends was non-significant at 0.02 (95 % CI –0.01 to 0.05), and

at higher degrees of separation the correlation remained non-significant and close to 0.

These initial results represented a static analysis of a single wave, but Add Health collected information at two different waves that was used to model peer influence dynamically. Results of the first model (Table 2) indicated that sexual activity was significantly associated with a friend's answer to that question, even after controlling for the previous behavior of both individuals, sex, age, race, ethnicity, household income, and mother's education. The odds of sexual intercourse increased by about 79 % (95 % CI 30–146 %) for each friend who had had intercourse. It is important to note that it is easier to detect effects when there is more variation in the dependent variable. The incidence of sexual behavior was high (44.7 %) compared to the incidence of same-sex attraction (4.6 %), so this may not be a fair comparison. Thus, we also analyzed this question in a restricted sub-sample of participants ages 15 and under, for whom the incidence of sexual intercourse was only 17.3 %. We nonetheless found a significant effect in this subsample, with the odds of sexual intercourse more than double (158 % increase, 95 % CI 28–421 %) for each friend who had had intercourse.

Since behaviors and desires may differ, we also examined whether there was evidence for interpersonal influence in the self-reported *desire* to have a romantic relationship. To ensure a fair comparison with the same-sex attraction measure, we dichot-

Fig. 1 In the upper part of the figure, two representations of a portion of the adolescent network ($N = 123$) show girls (circles) and boys (squares), their friendship nominations (arrows), and their sexual behavior (blue nodes have had intercourse, green nodes have felt same-sex attraction). Below each network, a statistical analysis shows significant correlation in sexual activity up to two degrees of separation, but no correlation in same-sex attraction. Vertical lines indicate 95 % confidence intervals (Color figure online)

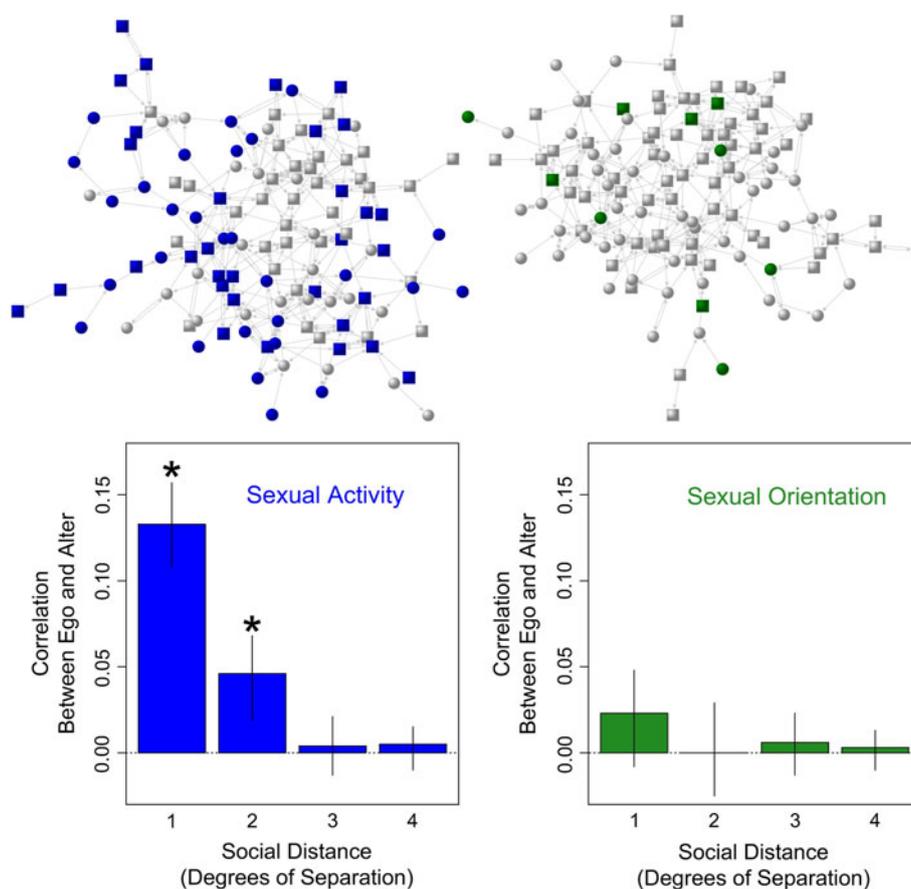


Table 2 Friend association in having sexual intercourse

	All			Age 15 and under		
	Estimate	SE	p	Estimate	SE	p
Alter has had sexual intercourse	0.58	0.16	<.01	0.95	0.35	.01
Ego previously had sexual intercourse	3.05	0.21	<.01	3.02	0.42	<.01
Alter previously had sexual intercourse	0.42	0.18	.02	0.37	0.43	ns
Ego female	0.29	0.17	ns	0.67	0.36	ns
Ego age	0.31	0.06	.001	0.76	0.27	<.01
Household income	0.00	0.00	ns	−0.01	0.01	ns
Mother's education	0.07	0.04	ns	0.18	0.09	.05
Hispanic	0.53	0.27	.05	1.27	0.51	.01
Black	0.33	0.25	ns	0.29	0.43	ns
Asian	−0.66	0.35	ns	−39.81	0.56	<.01
Constant	−7.40	1.11	<.01	−15.08	4.39	.01
Deviance	262			53.1		
Null deviance	462			84.2		
N	2,014			565		

Note Results from a GEE general linear regression with logit link function of “Ego Has Had Sexual Intercourse” on the independent variables shown above. Model 1 shows results for the basic specification and Model 2 shows results with controls

omized the variable to reflect those who said “Not at all” versus all others. This dichotomy yielded a variable with very similar incidence (4.7 %) to the same-sex attraction measure (4.6 %). As shown in Table 3, we found a significant relationship whereby each friend who desired a romantic relationship significantly increased the odds of one's own desire by 169 % (95 % CI 9–561 %).

After demonstrating adequate power to detect the spread of sexual behavior and the desire to have romantic relationships, we tested the primary models of interest—those predicting same-sex attraction. As shown in Table 4, romantic attraction to same-sex partners did not spread—the coefficients were small and close to zero, with odds ratios of 0.96 (95 % CI 0.27–3.45) in a model without demographic controls, and 0.97 (95 % CI 0.25–3.35) in a model with demographic controls. The confidence intervals on these estimates were wide, but the baseline rates were also quite low. Simulations of predicted values from the coefficient covariance matrix (King, Tomz, & Wittenberg, 2000) of Model 2 in Table 4 suggested that the predicted baseline rate of romantic attraction to same-sex partners among individuals with a friend who was gay was 0.03 (95 % CI 0.01–0.09) compared to 0.03 (95 % CI 0.02–0.04) for those with a friend who was heterosexual. We also examined the spread of same-sex attraction in models restricted to males, to females, to opposite sex friends, and to same-sex friends (available from the corresponding author upon request). In all cases, we found a similar pattern indicating non-significant peer associations. Given that prior studies have found

Table 3 Friend association in desire for a romantic relationship

	All		
	Estimate	SE	p
Alter desires romantic relationship	0.99	0.45	.03
Ego previously desired romantic relationship	2.11	0.41	<.01
Alter previously desired romantic relationship	−0.46	0.65	ns
Ego female	0.43	0.31	ns
Ego age	−0.14	0.10	ns
Household income	0.00	0.00	ns
Mother's education	−0.10	0.08	ns
Hispanic	0.30	0.44	ns
Black	−0.12	0.42	ns
Asian	−1.02	0.82	ns
Constant	−0.82	1.67	nNs
Deviance	69.1		
Null deviance	74.1		
N	2,038		

Note Results from a GEE general linear regression with logit link function of “Ego Desires Romantic Relationship” on the independent variables shown above. Model 1 shows results for the basic specification and Model 2 shows results with controls

Table 4 Friend association in same sex attraction, all friends

	Model 1			Model 2		
	Estimate	SE	p	Estimate	SE	p
Alter attracted to same sex	−0.04	0.67	ns	−0.07	0.67	ns
Ego previously attracted to same sex	2.03	0.37	<.01	1.98	0.38	<.01
Alter previously attracted to same sex	−0.45	0.71	ns	−0.36	0.69	ns
Ego female	−0.10	0.33	ns	−0.11	0.34	ns
Ego age				0.07	0.12	ns
Household income				0.00	0.01	ns
Mother's education				−0.09	0.08	ns
Hispanic				0.30	0.45	ns
Black				0.40	0.43	ns
Asian				0.10	0.91	ns
Constant	−3.49	0.26	<.01	−4.20	2.22	ns
Deviance	66.5			66.5		
Null deviance	68.5			68.5		
N	2,047			2,047		

Note Results from a GEE general linear regression with logit link function of “Ego Attracted to Same Sex” on the independent variables shown above. Model 1 shows results for the basic specification and Model 2 shows results with controls

the strongest social network effects between close friends (Christakis & Fowler, 2008a, 2008b; Rosenquist et al., 2010), we also investigated whether same-sex attraction spread between *mutual* ties, defined as pairs in which each person independently

Table 5 Sibling association in same sex attraction, all siblings

	Model 1			Model 2		
	Estimate	SE	p	Estimate	SE	p
Alter attracted to same sex	−0.06	0.38	ns	−0.08	0.39	ns
Ego previously attracted to same sex	2.00	0.22	<.01	2.03	0.23	<.01
Alter previously attracted to same sex	0.56	0.30	ns	0.59	0.30	.05
Ego female	−0.03	0.20	ns	−0.03	0.20	ns
Ego age				−0.01	0.06	ns
Household income				0.00	0.00	ns
Mother's education				0.00	0.05	ns
Hispanic				0.22	0.30	ns
Black				0.30	0.24	ns
Asian				−0.23	0.47	ns
Constant	−3.48	0.17	<.01	−3.20	1.07	<.01
Deviance	122			122		
Null deviance	127			127		
N	3,321			3,321		

Note Results from a GEE general linear regression with logit link function of “Ego Attracted to Same Sex” on the independent variables shown above. Model 1 shows results for the basic specification and Model 2 shows results with controls

named the other as a friend, but none of these models showed a significant association.

Table 5 shows the results of the model examining whether siblings influence same-sex attraction. Consistent with past work on the genetic basis of sexual orientation, some of these analyses indicated that a sibling's baseline disposition was correlated with an adolescent's sexual orientation. However, net of this baseline, we failed to find any evidence for social influence in models with or without demographic controls. We also restricted the sample to men, women, opposite-sex siblings, and same-sex siblings, but none of these models showed a significant relationship (available from the corresponding author upon request).

Figure 2 summarizes the main results of the analysis of social influence. It shows the large and significant association in friends' sexual behavior and compares it to the near-zero and non-significant association in friends' and siblings' sexual orientation.

The only significant effect of same-sex attraction that we were able to discern had to do with its impact on the *structure* of the social network rather than the *spread* of behavior. When we used a prospective model to regress Wave II in-degree (the number of times a person was nominated as a friend) on in-degree and same-sex attraction measured at Wave I, we found that girls who reported attraction to females were less likely to be named as friends in the future (Table 6). Although the result was only marginally significant ($p = .06$), it suggests that about

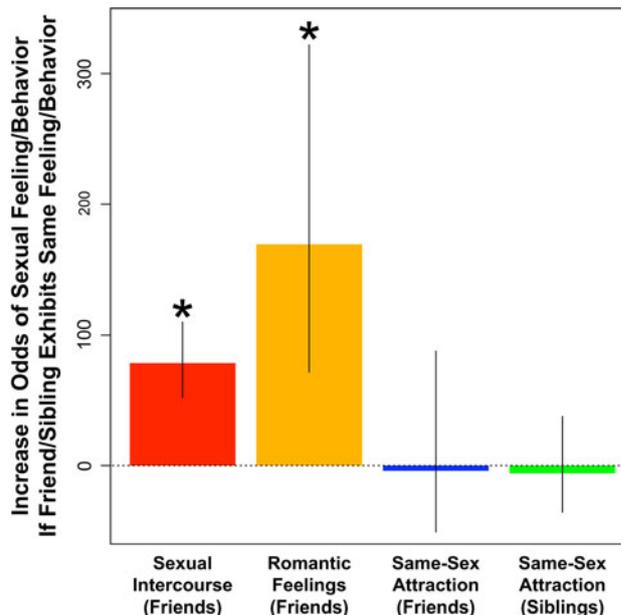


Fig. 2 Results from four models showing the increase in odds of reporting sexual intercourse, a desire for a romantic relationship, and feelings of same-sex attraction associated with each friend/sibling who does the same. Although sexual behavior shows signs of peer influence, sexual orientation does not. Vertical lines indicate 95% confidence intervals

Table 6 Prospective effect of same sex attraction on number of times named as a friend (in degree)

	Females			Males		
	Estimate	SE	p	Estimate	SE	p
Previously attracted to same sex	−0.33	0.18	.06	0.04	0.14	ns
Number of times previously named as friend (in degree)	0.02	0.02	ns	0.00	0.02	ns
Age	0.03	0.02	ns	0.04	0.02	ns
Household income	0.00	0.00	ns	0.00	0.00	ns
Mother's education	−0.01	0.02	ns	−0.03	0.02	ns
Hispanic	−0.21	0.10	.04	−0.27	0.10	.01
Black	−0.29	0.09	<.01	−0.35	0.09	<.01
Asian	0.00	0.14	ns	0.02	0.14	ns
Constant	0.46	0.37	ns	0.33	0.37	ns
Deviance	4498.6			4751.1		
Null deviance	4454.0			4691.0		
N	2,001			2,058		

Note Results from a prospective general linear regression of In Degree (number of times ego named as friend) on the independent variables shown above. Model 1 shows results for females and Model 2 shows results for males

one in three women with same-sex attraction may lose a friend over the course of a year in adolescence. We did not find a comparable effect for boys who reported attraction to males.

Discussion

In a large, nationally representative, social-network sample, we found that whereas sexual behavior may spread in adolescent social networks, there was no evidence that same-sex attraction spreads. These findings suggest that having friends who are sexually active or who are interested in having romantic relationships may influence an adolescent's own behavior and attitudes, but this influence does not extend to the sex of the object of these affections. We tested a variety of social network models and found no evidence that peers influence the likelihood that adolescents have feelings of romantic attraction to same-sex partners. Although we demonstrated adequate power to detect network effects on self-reported sexual behavior and desire for a romantic relationship, similar analyses of partner preference revealed no signs of peer influence. This study is the first to examine peer influence on sexual attraction among both male and female adolescents from a longitudinal dataset. These results suggest that changing attitudes towards same-sex behavior in one's peers are unlikely to affect the incidence of same sex relationships, and that adolescents who engage in or desire homosexual relationships have no effect on the sexual attractions of their friends.

The peer influence model suggests that peers significantly influence the behavior of other peers, including private or non-public behavior, such as sexual activity (Catania et al., 1990; Fisher, 1988). Social network effects on intimate sex-acts have been demonstrated in numerous studies of condom use, contraception use, and sexual risk behavior (Ali et al., 2011; Jackson et al., 2011). However, this body of research largely examined sexual behavior between opposite-sex individuals. Research has shown that, unlike most heterosexual adolescents, gay male adolescents may be more susceptible to peer influence with regards to risky sexual behavior (DiClemente, 1991; Walter et al., 1992). These findings suggest that gay adolescents may follow a different developmental pathway when compared to their heterosexual peers (Rotherbam-Borus et al., 1995).

This differing developmental pathway may, in part, stem from problems with peer acceptance of differing sexual attractions or orientations. Gay adolescents may feel isolated from their heterosexual peers as they are often subjected to harassment, bullying, teasing, or even violence at school (Bos et al., 2008; D'Augelli, 1989). Attitudes of adolescents towards sexual minorities, and homosexuality in general, are complicated by developing identities of religion, politics, race, and gender (Calzo & Ward, 2009).

Previous research investigating environmental influence on sexual development or orientation has focused primarily on parenting or traumatic events in childhood. One prospective study found that adult men with a documented history of childhood sexual abuse were more likely than matched controls to report having same-sex sexual partners (Wilson & Widom, 2010), but that was not true for women, and no connections were

found between physical abuse or neglect and sexual orientation. Similarly, another study of childhood sexual trauma found that the effect of abuse was greater on the sexual orientation of men than women and that causal relationships between abuse and sexual orientation may be bidirectional and differ by sex and type of abuse (Roberts, Glymour, & Koenen, 2013).

Likewise, in one of the most extensive studies comparing the childhood experiences of homosexual and heterosexual adults, Bell, Weinberg, and Hammersmith (1981) concluded that early parenting experiences, whether positive or negative, had very little direct influence on sexual orientation. Similarly, romantic relationships and sexual behavior were not related to family type in a study including adolescents parented by both same-sex and opposite-sex couples (Wainright et al., 2004). Effects of parental sexual orientation on that of children also appear to be negligible between gay fathers and sons (Bailey et al., 1995) and between lesbian mothers and their children (Golombok & Tasker, 1996). Bem (1996) suggested that childhood temperament, rather than biological factors, determines preference for sex-typical or sex-atypical activities, and these factors in turn influence sexual orientation. Although there is some evidence that the acquisition of sex-typed behavior is associated with parental socialization, this effect diminishes by the preschool years (Fagot & Leinbach, 1989). In contrast, parental transmission of norms and modeling of behavior appears to be an important influence on other aspects of sexual behavior (Bonell et al., 2006; Cavazos-Rehg et al., 2010; Mott et al., 1996; Udry, 1988).

None of these non-biological explanations have attempted to examine peer influence on sexual orientation or the effect of peer networks on non-heterosexual romantic relationships, despite knowledge that peer networks may be more powerful social influences on adolescents than their parents. Add Health studies have shown that the number of friends, the age and gender of those friends, and their academic performance all affect the onset of sexual behavior (Cavanagh, 2004). Friends' religiosity also affects whether adolescents report having sex and the effect was strongest in dense social networks, where the adolescents' friends tend to be friends with one another (Adamczyk & Felson, 2006). These studies demonstrate that sexual behavior can spread from person to person and the impact of the network depends on how tightly interconnected individuals are. Adolescents who believe that their peers would look favorably on being sexually active were more likely to have casual, non-romantic sex (Manning et al., 2005). Engaging in oral sex with a partner can even make one more popular among one's friends (Prinstein et al., 2003). Romantic and sexual practices as diverse as contraceptive use, anal sex, fertility decisions, and divorce are all strongly influenced by the existence of these behaviors within one's network (Christakis & Fowler, 2009). By contrast, we have demonstrated that sexual attraction during adolescence does not appear to be a behavior that spreads through peer networks, consistent with a biological determinant of same- or opposite-sex sexual attraction.

The current study had several limitations. The way in which sexual attraction to a same-sex romantic partner was defined may not adequately capture sexual orientation since sexual behavior and identity are complex constructs that are often incongruent (Savin-Williams, 2006). For example, having same-sex attractions or engaging in same-sex sexual experiences does not necessarily mean that an adolescent identifies with a lesbian, gay, or bisexual orientation (Blumenfield & Raymond, 1993). Likewise, adolescents who do identify as lesbian, gay, or bisexual, or who may be romantically attracted to the same sex, may not have had any sexual experience, same-sex, or otherwise (Savin-Williams, 2006; Ryan et al., 1998). Secondly, sexual orientation may be more appropriately studied along a spectrum, rather than as a static and dichotomous “gay” or “straight” construct. Given these considerations, the continuous measure used at Wave III of our data might have been more appropriate to study sexual identity. However, our evidence indicates that these measures were highly correlated, suggesting that the measure was a relatively good indicator of which youth would identify a same-sex romantic orientation by early adulthood. Moreover, our measure captured adolescents who had same-sex attractions but had not identified with a same-sex orientation. Nonetheless, our results should be interpreted with these limitations in mind. An additional limitation of the study was that, despite the nationally representative sample, only adolescents on high school rosters were selected, and the initial assessment took place at school. Therefore, the findings may not generalize to youths who are not attending school or chose not to participate.

Although we found evidence among youth that both sexual behavior and feelings of romantic attraction may spread from person to person, the desire to have a romantic relationship with someone of the same sex (or opposite sex) does not appear to spread. The absence of an effect of social networks on sexual attraction may have important societal implications. Such a finding could also function as a “negative control” and hence help address a methodological debate in the social network literature about whether statistical methods for discerning influence are falsifiable (Christakis & Fowler, 2013; Cohen-Cole & Fletcher, 2008).

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