

Sexual Experimentation in Heterosexual, Bisexual, Lesbian/Gay, and Questioning

Adolescents From Ages 11 to 15

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Abstract

To examine adolescent sexuality development, we analyzed data from a British cohort study ($N = 5,070$), which assessed the same 12–14 sexual activities at ages 11, 12, 13, and 15, and sexual orientation identity at age 15. The sexual activities ranged from low (e.g., cuddling), moderate (e.g., kissing), to high (e.g., sexual intercourse) intensity. We found that most adolescents having sexual activities of low-to-moderate intensity with same-sex individuals also had them with other-sex individuals, and adolescents having other-sex contacts of low intensity often reported them nonexclusively. Furthermore, other-sex and same-sex sexual activities did not reliably distinguish between sexual orientation identities. Sex differences in these phenomena were absent or small. These findings suggest that many adolescents have low-intensity nonexclusive sexual behaviors.

Keywords: sexual orientation, sexual behavior, adolescence, CARTs, ALSPAC

Sexual Experimentation in Heterosexual, Bisexual, Lesbian/Gay, and Questioning Adolescents From Ages 11 to 15

One distinctive phenomenon during adolescence is sexual experimentation: Compared to children, more adolescents engage in sexual activities to explore their own and partners' bodies, to gain pleasure and intimacy, and to achieve identity formation, integration, and commitment (reviewed in Diamond, Bonner, & Dickenson, 2015). Sexual experimentation among adolescents increases with age and involves different types of sexual activities, ranging from low intensity (e.g., cuddling) to moderate intensity (e.g., kissing on the mouth) and to high intensity (e.g., having oral sex) (Carver, Joyner, & Udry, 2003; Hansen, Paskett, & Carter, 1999).

While recent research on adolescent sexuality has begun to adopt a normative perspective to examine sexual activities other than intercourse (Tolman & McClelland, 2011), few studies have systematically investigated the sexes of partners with whom various adolescent sexual activities take place. However, with increasing societal acceptance of sexual diversity, sexual experimentation with different sexes have become more visible among adolescents, especially among adolescent girls, in the contemporary West (Mercer et al., 2013). In essence, sexual experimentation with different sexes may reflect sexual fluidity, defined as “a sensitivity to situational, interpersonal, and contextual influences which may facilitate shifts in sexual attraction, behavior, and identity” (Diamond, Dickenson, & Blair, 2017, p. 193). Studying sexual fluidity is important not only because this idea challenges the traditional view portraying sexual orientation as fixed and predetermined before birth (Diamond et al., 2017), but also because sexual fluidity is associated with mental health in adolescents (e.g., Needham, 2012). However, most research on sexual fluidity has focused on adults, despite recent evidence suggesting that sexual fluidity in adulthood differs from that in adolescence (Diamond et al., 2017). To examine

sexual fluidity in early to middle adolescence, we investigate three themes of adolescent sexual experimentation: nonexclusivity of same-sex sexuality, inconsistency between sexual behavior and sexual orientation identity, and (lack of) sex differences in the first two phenomena.

Nonexclusive Same-Sex Sexuality in Adolescence

Supporting sexual fluidity in adolescence, accumulating evidence suggests that adolescent same-sex sexuality is largely nonexclusive, meaning that increased same-sex sexual attraction and sexual behavior do not always relate to decreased other-sex sexual attraction and sexual behavior (e.g., Diamond, 2003, 2008; Li & Hines, 2016; Ott, Corliss, Wypij, Rosario, & Austin, 2011; Savin-Williams & Ream, 2007). For example, data from the U.S. National Longitudinal Study of Adolescent to Adult Health revealed that among 5–13% of girls and 5–7% of boys who had same-sex attraction across three waves of data collection, 74–95% of girls and 67–88% of boys also reported other-sex attraction (Savin-Williams & Ream, 2007). In addition, another study analyzing data from the U.S. Youth Risk Behavior Surveillance System of 26,882 adolescents reported that among 12% of girls and 7% of boys who had same-sex sexual contact, 73% of girls and 50% of boys also had other-sex sexual contact (Mustanski et al., 2014).

Notably, the prevalence of nonexclusive sexual behavior appears to be more variable across studies and on average smaller than the prevalence of nonexclusive sexual attraction or identity in the same study (Savin-Williams & Ream, 2007; Mustanski et al., 2014). However, many prior studies defined “sexual behavior” as having sexual intercourse, ignoring the fact that sexual activities of low to moderate intensity (e.g., cuddling or kissing on the mouth) are more popular among adolescents than sexual intercourse (Hansen et al., 1999). Some other studies did not define “sexual behavior,” and left the definition to participants; yet participants may disagree, with each other and with the researcher, on what constitutes sexual behavior. These inadequate

definitions, in particular the lack of focus on sexual activities of low-to-moderate intensity, may have underestimated the prevalence of nonexclusive sexual experimentation among adolescents.

Inconsistency Between Sexual Behavior and Sexual Orientation Identity

Sexual fluidity also manifests in the incongruence between different components of sexual orientation. As a multidimensional construct, sexual orientation encompasses sexual attraction, sexual behavior, and sexual identity, which do not always align (Bailey et al., 2016; Institute of Medicine, 2011; Klein, Sepekoff, & Wolf, 1985). Supporting this view, several large-scale studies in the U.S. found that 6–20% of heterosexual women and 3–7% of heterosexual men recalled having same-sex sexual experience in adolescence (Katz-Wise et al., 2017; Mustanski et al., 2014; Savin-Williams & Joyner, 2014), 40–85% of bisexual women and 47–86% of bisexual men did not report having both-sex experience in adolescence (Mustanski et al., 2014; Savin-Williams & Joyner, 2014), and 56–93% of lesbian women and 46–51% of gay men recalled having other-sex sexual experience in adolescence (Katz-Wise et al., 2017; Mustanski et al., 2014; Rosario et al., 1996).

It has been suggested that the inconsistency between sexual orientation dimensions may occur throughout adolescence and adulthood (Bailey et al., 2016; Institute of Medicine, 2011; Klein et al., 1985); therefore, people's sexual orientation identity cannot be reliably inferred by examining their past sexual experience. In other words, adolescents sharing the same sexual orientation identity may have diverging sexual experiences with the same sex or the other sex, following “differential trajectories” of sexual orientation identity development (Savin-Williams, 1998). Acknowledging diversity in these trajectories is important, because people often treat traditional sexual orientation identities such as “heterosexual,” “bisexual,” and “lesbian/gay” as

distinct immutable traits, nurturing harmful stereotypes and stigma about sexual minority groups (Diamond & Rosky, 2016).

Echoing this diversity, accumulating research has been focused on the non-traditional “questioning/unsure” identity, noting that more young adolescents label themselves as questioning/unsure than bisexual and lesbian/gay young adolescents combined (Igartua, Thombs, Burgos, & Montoro, 2009; Ott et al., 2011; Zhao, Montoro, Igartua, & Thombs, 2010). One study found that majority of questioning young people later identified as heterosexual (Ott et al., 2011), yet it is unknown whether this transition resulted from active sexual experimentation (e.g., Morgan & Thompson, 2011) or from delayed sexual experimentation (e.g., Mustanski et al., 2014).

Several methodological limitations should be considered when interpreting previous findings on sexual orientation development. First, most studies were retrospective, thereby reducing the reliability of the findings due to memory biases. Of particular interest are sexual activities of low to moderate intensity (e.g., cuddling), which may be interpreted by some young adolescents as involving sexual intent but be reinterpreted as nonsexual in later recalls, thus biasing the true discordance between sexual behavior and sexual orientation identity. Second, when multiple sexual activities are examined at the same time, conventional statistical methods such as classic regression models are inappropriate, because sexual activities are often interdependent, leading to multicollinearity, thus violating one assumption of classic regression models (Cohen, 2013). Such interdependence is apparent not only between different types of sexual activities (e.g., kissing someone and cuddling with the same person), but also in the same behavior reoccurring over time. Because classic regression models may not reliably model interactions among different sexual activities, especially when the number of interactions is large,

a new statistical technique that accounts for interdependence and complex interactions could be employed to model the relation between sexual behavior and sexual orientation identity.

Sex Differences

Noting that women's sexual behavior is more nonexclusive and shows greater disagreement with sexual orientation identity than men's sexual behavior (Mustanski et al., 2014; Savin-Williams & Ream, 2007), researchers have proposed that same-sex sexuality is more fluid in women than in men (Baumeister, 2000; Diamond, 2008). This sex difference in sexual fluidity may have evolutionary origins at the distal level, as sexual fluidity may increase women's fitness in polygamous relationships and other factors that promote women's (more than men's) reproductive success (Kanazawa, 2017; Luoto, Krams, & Rantala, 2018). At the proximal level, the greater sexual fluidity among women may be partly explained by lower sex drive mediated by lower levels of circulating gonadal steroids in women (Baumeister, 2000) and by women's greater capacity and tendency to experience sexual attraction and behavior in close relationships, including same-sex intimate friendships (Diamond, 2008; Peplau, 2001).

The sex difference in sexual fluidity during adolescence may differ from that during adulthood, because the proximal influences of sexual fluidity differ between these developmental periods. Specifically, gonadal hormone levels were lower in early adolescence than in later developmental periods (Shirtcliff, Dahl, & Pollak, 2009), resulting in low sex drive in girls and in boys during early adolescence (Hansen et al., 1999). In addition, young adolescent boys are as likely as young adolescent girls to develop intimate relationships with same-sex peers (Diamond, Savin-Williams, & Dubé, 1999; Way, 2011). Therefore, it is possible that the sex difference in sexual fluidity is less pronounced in early to middle adolescence than in adulthood. Supporting this hypothesis, some evidence suggests that similar proportions of girls and boys report having

nonexclusive same-sex sexuality in early adolescence (Calzo, Masyn, Austin, Jun, & Corliss, 2017; Li & Hines, 2016) and that girls and boys experience the same level of inconsistency between different dimensions of sexual orientation in early adolescence (Li & Hines, 2016). Another prospective study also found that the sex difference in the change in sexual orientation identity over a 2-year period appeared to be smaller among adolescents aged 12–13 than among older adolescents (Ott et al., 2011).

The Current Study

This study provides a comprehensive investigation into a range of other-sex and same-sex sexual activities from early to middle adolescence, as well as sexual orientation identity in middle adolescence. We aim to describe the prevalence of other-sex and same-sex sexual activities during adolescence, paying particular attention to the proportion of nonexclusive sexual activities. We then examine concurrent and prospective associations between other-sex and same-sex sexual activities. Finally, we investigate how other-sex and same-sex sexual activities differ by and distinguish between sexual orientation identities. Sex differences are compared where appropriate. Improving from prior studies, we assess clearly defined sexual experiences with different sexes, repeatedly in a longitudinal cohort study. In addition, when analyzing the associations between sexual behavior and sexual orientation identity, we employ a machine learning approach for data analysis, namely classification and regression trees (CARTs), to model interdependence and complex interactions between these sexual activities (Strobl, Malley, & Tutz, 2009). We hypothesize that (1) a majority of same-sex sexual activities in adolescence are nonexclusive; (2) other-sex sexual activities do not negatively relate to same-sex sexual activities; (3) other-sex and same-sex sexual activities do not reliably distinguish between sexual orientation identities; and (4) there are small to no sex differences favoring girls in the

nonexclusivity of same-sex sexuality or in the inconsistency between sexual behavior and sexual orientation identity during early to middle adolescence.

Method

Participants

Participants were from the Avon Longitudinal Study of Parents and Children (ALSPAC), a prospective cohort study launched in the early 1990s, tracking more than 14,000 families in Avon, Southwest England. ALSPAC families were slightly less representative of poor and racial/ethnic minority families in the U.K.: About 79% of the ALSPAC families lived in owner-occupied accommodation, 91% had a car, 79% were married couples, and 2% were racial/ethnic minority. For additional information, see Boyd et al. (2013). Ethics approval for the ALSPAC was obtained from the ALSPAC Ethics and Law Committee and the Local Research Ethics Committees. The ALSPAC website contains details of all the data, which are available through a fully searchable data dictionary: <http://www.bris.ac.uk/alspac/researchers/data-access/data-dictionary/>.

Data in this study were collected between 2003 and 2008, when the young participants grew from ages 11 to 15. We applied two exclusion criteria for the current study. First, we excluded participants who had missing data either in all of the questions about sexual activities or in the question about sexual orientation identity. This resulted in 9,413 (65%) young people being excluded from the 14,498 ALSPAC child participants, largely due to attrition¹. Second, we excluded participants who reported not being sexually attracted to either sex ($n = 15$; 0.1%), due to the small group size.

¹ According to Boyd et al. (2013), the attrition rates in the 2003–2008 data collections ranged from 51% to 62%.

Therefore, the present sample comprised 5,070 young people (53% girls), representing 35% of the ALSPAC child participants. Girls were more likely to be included in the current study than boys (38% vs. 32%), $\chi^2(1, n = 14498) = 64.97, p < .001$. Participants from Caucasian families were more likely to be included than those from racial/ethnic minority families (39% vs. 32%), $\chi^2(1, n = 11923) = 12.73, p < .001$.

Measures

Sexual activities. Table 1 summarizes sexual activities measured in this study. To facilitate self-disclosure of sensitive information, all questions about sexual activities were administered using computer-assisted self-interview (Turner et al., 1998). At age 11, participants were asked about sexual activities with the other sex, using a scale adapted from the Adolescent Sexual Activities Index (ASAI; Hansen et al., 1999). Twelve other-sex sexual activities were listed, of which intensity ranged from low (e.g., hugging the other sex), to moderate (e.g., kissing the other sex), and to high (e.g., undressing with the other sex). Participants reported whether they had each experience in the last year (0 = no, 1 = yes). To reduce survey length and to avoid alienating families by exposing adolescents to unnecessary questions on sexual contact, ALSPAC applied a few stopping rules so that participants who denied having sexual activities of lower intensity were not asked about sexual activities of higher intensity; these skipped sexual activities were coded as nonoccurring. The stopping rules were logical skips and have been supported by previous research, which suggests that the ASAI items are presented from high-occurring to low-occurring activities (Hansen et al., 1999; Smiler, Frankel, & Savin-Williams, 2011). At age 11, the interview stopped if the participant (1) did not spend time alone with the other sex, (2) did not kiss and was not kissed by the other sex, or (3) did not cuddle the other sex (Table 1).

At age 12, participants again recalled whether they had the same 12 sexual activities with the other sex in the last year. In addition, they reported the occurrence of two more activities, both of high intensity: having one's private parts touched by the other sex and having oral sex with the other sex (0 = no, 1 = yes). Participants who indicated not having their body touched by another person and not touching the body of another person were not asked about subsequent sexual activities of higher intensity (Table 1).

At ages 13 and 15, participants reported whether they had the above 14 sexual activities in the last year. They also reported the sex of the partners with whom they had each behavior (same-sex only, both sexes, or other-sex only). Therefore, the adapted ASAI was recoded into two subscales, the first comprising 14 same-sex sexual activities (combining "same-sex only" and "both sexes" options; 0 = no, 1 = yes), and the second comprising 14 other-sex sexual activities (combining "other-sex only" and "both sexes" options; 0 = no, 1 = yes). At age 13, participants who reported not having their body touched by another person and not touching the body of another person were not asked about subsequent sexual activities of higher intensity. At age 15, participants who reported not having their private parts touched by another person and not touching the private parts of another person were not asked about subsequent sexual activities of higher intensity (Table 1).

In addition to analyzing individual sexual activities, item response theory (IRT; Embretson & Reise, 2000) was employed to aggregate sexual activities by age and by sex of sexual partners. According to IRT, the items in a scale vary in difficulty; the more difficult an item is, the less likely an individual is going to score on that item. Likewise, for an item of certain difficulty, individuals whose ability is above this item difficulty are more likely to score on this item than individuals whose ability is below this item difficulty. Therefore, item difficulty

is used in one-parameter logistic (1PL) models of IRT to estimate respondents' ability; higher aggregated IRT levels represent larger probabilities of having scored on items of high difficulty. Apart from item difficulty, 2PL models additionally account for item discrimination when estimating respondents' ability, which refers to how an item distinguishes between individuals with different ability (Embreston & Reise, 2000).

Because sexual activities also vary in item difficulty (e.g., touching private parts of the same sex is less popular [more "difficult"] than hugging the same sex) and in item discrimination (e.g., touching the body of the other sex measures other-sex sexual activity levels more precisely than holding hands with the other sex), they can also be fitted by 1PL and 2PL models. Therefore, we applied both 1PL and 2PL models on the 82 sexual activities in Table 1, separately by age and by sex of sexual partners. Item statistics confirmed that the sexual activities listed in Table 1 varied in difficulty and discrimination; we therefore describe these sexual activities as of "low intensity," "moderate intensity," and "high intensity" in subsequent discussions. However, we do not imply that all activities involved sexual intentions for every adolescent, but that these activities vary in the degree of sexual intensity. It is also possible that some activities of low intensity (e.g., hugging) may involve few sexual intentions for most adolescents; however, we did not refer to these activities as "intimate" as in previous research (de Graaf, Vanwesenbeeck, Meijer, Woertman, & Meeus, 2009), because "intimate" could describe physical, sexual, or emotional closeness, and therefore does not contrast with "sexual." Thus, we referred to the activities listed in Table 1 as sexual activities, while recognizing that there is variation in the intensity of sexual intentions and sexual arousal in these activities (Hansen et al., 1999).

The model fit of 1PL and 2PL models on the same set of sexual activities was compared using chi-square difference tests (Embreston & Reise, 2000). A significant change in χ^2 at p

< .05, two-tailed, suggests a better fit of the 2PL model than the 1PL model. When significant, the 2PL model was used to estimate sexual activity levels for that set of sexual activities; otherwise, the 1PL model was used. In total, six aggregated levels were derived, representing other-sex sexual activity levels at ages 11, 12, 13, and 15, and same-sex sexual activity levels at ages 13 and 15. Higher levels indicate larger probabilities of engaging in sexual activities of high intensity (i.e., high item difficulty and/or high item discrimination), such as having oral sex.

Sexual orientation identity. At age 15, participants reported their sexual orientation identity, using the modified Kinsey scale (Kinsey, Pomeroy, & Martin, 1948). Among girls, 2,283 identified as completely heterosexual, 292 as mostly heterosexual, 55 as bisexual, 13 as mostly lesbian/gay, 4 as completely lesbian/gay, and 55 as questioning/unsure; among boys, the corresponding numbers were 2,130, 145, 29, 14, 15, and 35, respectively. To increase group sizes and statistical power, mostly lesbian/gay individuals were combined with completely lesbian/gay individuals to form a single group of lesbian/gay individuals, following prior studies (e.g., Katz-Wise et al., 2017; Li, Kung, & Hines, 2017). In addition, mostly heterosexual adolescents were combined with completely heterosexual adolescents to increase replicability of the findings, because past studies found that the mostly heterosexual identity was not stable until after middle adolescence (Calzo et al., 2017) and that adolescents with mostly or completely heterosexual identities often switched between these two labels (Ott et al., 2011; Savin-Williams, Joyner, & Rieger, 2012)².

A Brief Introduction of CARTs

² Per reviewers' comments, we used CARTs to predict a 5-category sexual orientation identity that further separated "completely heterosexual" from "mostly heterosexual." Results suggested that a large proportion of completely heterosexual individuals were misclassified as mostly heterosexual, and vice versa, which were consistent to the findings in prior research (e.g., Calzo et al., 2017; Ott et al., 2011; Savin-Williams et al., 2012). Therefore, to increase interpretability and replicability of our findings, we combined completely heterosexual individuals with mostly heterosexual individuals in this study.

As an innovation of this study, we conducted CARTs to account for interdependence and complex interactions between the sexual activities (Strobl et al., 2009), when investigating the relations between individual sexual activities and sexual orientation identity. As a type of nonparametric analysis, CARTs recursively partition the range of the outcome in the full sample into smaller segments, based on participants' responses to the indicators. From a set of candidate indicators, the algorithm selects the variable most indicative of outcome responses and performs a first binary split of the sample according to responses to this indicator. The first split results in two groups of participants, with increased within-group homogeneity than their parent group. The algorithm then selects other most indicative variables and performs more binary splits of the previous subsamples, leading to more homogenous subgroups. These recursive iterations stop when no indicators can significantly increase homogeneity of subgroups above a given threshold, or when a given maximum number of iterations is reached. CARTs are often illustrated using a tree graph, comprising splitting rules and hierarchical nodes (Breiman, Friedman, Olshen, & Stone, 1984; Quinlan, 1986).

We performed CARTs on sexual activities using the R package "rpart" (Version 4.1-9; Therneau, Atkinson, & Mayo Foundation, 2017). Considering sex differences found in the descriptive analyses (Table 1), data from girls and boys were separately analyzed. Sexual orientation identity was entered into CARTs as the outcome variable. All 82 other-sex and same-sex sexual activities between ages 11 and 15 were entered as the indicators. Classification splitting was conducted because the outcome of interest was categorical. We specified equal prior probabilities across the four categories of sexual orientation identity, rather than priors proportional to the observed category frequencies, because we are more interested in identifying individual sexual activities that best distinguish between the sexual orientation identities than in

making the most accurate prediction of someone's sexual orientation identity³. To avoid overfitting the data, a 5-fold cross-validation was conducted and the complexity parameter associated with the first minimal cross-validation error was used to prune the trees.

The pruned CARTs models were then used to classify participants' sexual orientation identity according to sexual activities, separately by sex. Proportion of agreement and Cohen's (1960) kappa were used to evaluate the prediction accuracy. According to Landis and Koch (1977), κ values lower than 0 indicate no agreement, values between 0 and 0.20 indicate slight agreement, values between 0.21 and 0.40 indicate fair agreement, values between 0.41 and 0.60 indicate moderate agreement, values between 0.61 and 0.80 indicate substantial agreement, and values between 0.81 and 1 indicate almost perfect agreement.

Results

How Prevalent Were Other-Sex, Same-Sex, and Nonexclusive Same-Sex Sexual Activities During Adolescence? Are There Sex Differences?

Table 1 demonstrates the prevalence of other-sex and same-sex sexual activities from early to middle adolescence and the proportion of same-sex sexual activities that were nonexclusive, separated by participant sex. Several patterns can be observed about other-sex sexual activities: First, the proportion of participants who engaged in other-sex sexual activities and the variety of sexual activities increased from ages 11 to 15; at age 15, most girls and boys experienced other-sex sexual activities of low intensity (e.g., hugging, holding hands, and kissing or being kissed on the mouth, etc.) and more than 15% of girls and boys reported having other-sex sexual activities of high intensity (e.g., having oral sex and sexual intercourse). Second, Chi-square tests (with Bonferroni corrections) suggest that there were few sex differences in the

³ When priors were proportional to the observed category frequencies, there was a bias toward classifying all adolescents as heterosexual due to the largest base rate of heterosexual adolescents in the sample.

prevalence of other-sex sexual activities until age 15, when larger proportions of girls than boys reported having different types of other-sex sexual experiences. However, these sex differences were in general small, with largest odds ratio (OR) to be 1.58.

Somewhat different patterns were found regarding same-sex sexual activities (Table 1). For example, while larger proportions of girls and boys had same-sex sexual activities age 15 than at age 13, the prevalence remained low for most same-sex sexual activities of moderate to high intensity. In addition, at both ages, girls were much more likely to engage in same-sex sexual activities of low intensity (e.g., holding hands, kissing) than were boys, ORs = 2.99–26.33; however, small or no sex differences were found for activities of moderate to high intensity.

Except in 2 out of 28 activities, when girls and boys reported having one type of same-sex sexual activity, over half of them also reported having the same sexual activity with the other sex; for example, 75% of girls who reported touching private parts of other girls at age 13 also reported touching private parts of other boys at age 13 (Table 1). At age 13, there were no sex differences in the prevalence of nonexclusive sexual activities, except that among those who hugged same-sex individuals, a smaller proportion of girls also reported hugging the other sex than did boys, OR = 0.30. At age 15, sex differences in the proportions of nonexclusive sexual activities were found in hugging others, OR = 0.38 (favoring boys), being kissed by others, OR = 2.97 (favoring girls), having one's body touched by others, OR = 5.14 (favoring girls), and touching the body of others, OR = 4.89 (favoring girls). Sex differences in nonexclusive same-sex sexual behaviors were not found in the other ten sexual activities at age 15 (Table 1). Notably, when girls and boys reported having one sexual activity of low-intensity with other-sex individuals, they also reported it nonexclusively; however, this was not always true for other-sex sexual activities of moderate-to-high intensity (Table 1).

How Did Aggregated Sexual Activity Levels Correlate?

Table 2 shows robust correlations between aggregated sexual activity levels. Because some of the variables were not normally distributed and because neither square root transformation nor logarithm transformation can eliminate this problem, biweight midcorrelations, a type of robust correlations (Wilcox, 2011), were calculated by the R package “WGCNA” (Version 1.42; Langfelder & Horvath, 2012). Pearson’s correlations without robust estimation yielded similar findings. Early other-sex sexual activity levels positively related to subsequent other-sex sexual activity levels in girls, $r_s = .30-.61$, $p_s < .001$, and in boys, $r_s = .37-.59$, $p_s < .001$, suggesting that having sexual activities of high intensity at a younger age was moderately to strongly associated with an increased likelihood of having sexual activities of high intensity at an older age. Similarly, same-sex sexual activity levels at age 13 predicted same-sex sexual activity levels at age 15 in girls, $r(2395) = .35$, and in boys, $r(2139) = .26$, $p_s < .001$.

Supporting the hypothesis on nonexclusive sexual activities, other-sex sexual activity levels positively and slightly correlated with same-sex sexual activity levels in girls (with one marginally significant correlation), $r_s = .04-.26$, $p_s < .07$, and in boys (with one marginally significant correlation), $r_s = .04-.22$, $p_s < .07$. Overall, only two correlations showed a significant sex difference (out of 15 comparisons; see Table 2). Similar correlations were found when analyzed within sexual orientation identity, with exceptions in lesbian girls: Other-sex sexual activity levels at age 12 related negatively to same-sex sexual activity levels at age 13, $r(14) = -.67$, $p = .009$, while all other correlations between other-sex and same-sex sexual activity levels were nonsignificant, probably due to the small sample size of lesbian girls (correlations by sexual orientation identity are available from the first author).

Did Aggregated Sexual Activity Levels Differ by Sex and Sexual Orientation Identity?

To examine whether adolescents differ in aggregated sexual activity levels by sex and sexual orientation identity, we conducted 2 (sex: girls vs. boys) \times 4 (sexual orientation identity: heterosexual, bisexual, lesbian/gay, or questioning) Analyses of Variance (ANOVAs) on other-sex sexual activity levels at ages 11, 12, 13, and 15, and on same-sex sexual activity levels at ages 13 and 15 (Table 3). Regarding other-sex sexual activity levels, two small sex differences were found: Girls had lower other-sex sexual activity levels than boys at age 11, $F(1, 4306) = 5.51, p = .019, \eta_p^2 = .001$, but higher other-sex sexual activity levels at age 15, $F(1, 5062) = 34.20, p < .001, \eta_p^2 = .007$. In addition, the main effects of sexual orientation identity were small but significant at age 12, $F(3, 4656) = 3.77, p = .010, \eta_p^2 = .002$, at age 13, $F(3, 4526) = 10.20, p < .001, \eta_p^2 = .007$, and at age 15, $F(1, 5062) = 13.67, p < .001, \eta_p^2 = .008$. Post hoc analyses suggested the most consistent difference being that questioning adolescents reported lower other-sex sexual activity levels than heterosexual, bisexual, or lesbian/gay individuals at ages 12, 13, and 15 (Table 3). At age 15, there was a small but significant interaction effect by sex and sexual orientation identity, $F(3, 5062) = 2.68, p = .045, \eta_p^2 = .002$, reflecting that lesbian girls reported similarly high other-sex sexual activity levels as bisexual girls, while gay boys reported lower other-sex sexual activity levels than bisexual boys (Figure 1). There were no other significant main effects or interaction effects on other-sex sexual activity levels (Table 3).

Regarding same-sex sexual activity levels, girls reported higher aggregated levels than boys at age 13, $F(1, 4526) = 2301.71, p < .001, \eta_p^2 = .337$, and at age 15, $F(1, 5062) = 2000.10, p < .001, \eta_p^2 = .283$. Notably, the sex differences in same-sex sexual activity levels were larger than those in other-sex sexual activity levels. There were also small but significant main effects of sexual orientation identity at age 13, $F(3, 4526) = 6.71, p < .001, \eta_p^2 = .004$, and at age 15, $F(3, 5062) = 64.11, p < .001, \eta_p^2 = .037$. Post hoc analyses indicated that bisexual adolescents

reported consistently higher same-sex sexual activity levels than other adolescents at age 13 and than heterosexual and questioning adolescents at age 15 (Table 3). There was also a small but significant interaction effect on same-sex sexual activity levels at age 15, $F(3, 5062) = 3.45$, $p = .016$, $\eta_p^2 = .002$, reflecting that lesbian girls reported highest same-sex sexual activity levels among adolescent girls, while gay boys did not among adolescent boys (Figure 1).

Post-hoc power analysis using G*Power statistical software (Faul, Erdfelder, Lang, & Buchner, 2007) suggested that the statistical power of these ANOVAs ranged from a maximum of 1.00 to detect the largest effect, which was the main effect of sex on same-sex sexual activity levels at age 13 (observed $\eta_p^2 = 0.337$, observed $F = 2301.71$, critical $F = 3.84$), to a minimum of 0.41 to detect the smallest non-zero effect, which was the interaction between sex and sexual orientation identity for other-sex sexual activity levels at age 13 (observed $\eta_p^2 = 0.001$, observed $F = 1.58$, critical $F = 2.61$). Therefore, it is possible that a larger study, which included more sexual minority adolescents, could have detected an interaction between sex and sexual orientation identity on other-sex sexual activity levels. However, the small effect size detected in this study suggests that this interaction is negligible in magnitude compared to the main effect of sexual orientation identity at age 13, on both other-sex sexual activity levels (observed $\eta_p^2 = 0.007$, observed $F = 10.20$, critical $F = 2.61$, power = 0.99) and same-sex sexual activity levels (observed $\eta_p^2 = 0.004$, observed $F = 6.71$, critical $F = 2.61$, power = 0.96).

How Did Individual Sexual Activities Interact to Distinguish Adolescents With Different Sexual Orientation Identities?

Finally, we conducted CARTs to examine the relations between the 82 sexual activities from ages 11 to 15 and sexual orientation identity at age 15 (Strobl et al., 2009). Figure 2 illustrates the final CARTs model for girls. The first splitting rule, kissing same-sex individuals

at age 15, was the most salient indicator of sexual orientation identity; this split classified 85% of adolescent girls into heterosexual and 15% into lesbian. Subsequent splits further classified the parent heterosexual group into heterosexual, questioning, and lesbian groups and classified the parent lesbian group into lesbian and bisexual groups. These subsequent splits relied on sexual activities of low to moderate intensity, which largely occurred at age 15, including holding hands with other-sex individuals at age 15, cuddling other-sex individuals at age 12 (used twice), cuddling same-sex individuals at age 15, being kissed by same-sex individuals at age 15, holding hands with other-sex individuals at age 15, and touching private parts of the same-sex individuals at age 15 (Figure 2).

It often took more than two continuous splits to reach an end node, suggesting that the same sexual activities were often practiced by girls with different sexual orientation identities (Figure 2). Finally, there were repeated end nodes on parallel tree branches, suggesting large variations in the types of sexual activities practiced by girls with the same sexual orientation identity (Figure 2). As the only exception, many questioning girls were distinguished from other girls by two continuous splitting rules: did not kiss same-sex individuals at age 15 *and* did not hold hands with other-sex individuals at age 15 (Figure 2). The CARTs in Figure 2 successfully classified 65% of girls' sexual orientation identity and showed slight agreement between self-reported and classified sexual orientation identity, $\kappa = 0.10$, 95% CI = (0.08, 0.13) (Table 4).

Figure 3 illustrates the final CARTs model for boys. Once again, the first splitting rule, kissing same-sex individuals at age 15, was the most salient indicator of sexual orientation identity; this split classified 97% of adolescent boys into heterosexual and 68% into bisexual. Subsequent splits further classified the parent heterosexual group into heterosexual and questioning groups, the latter of which was then classified into questioning, bisexual, and gay

groups. In addition, the parent bisexual group was further classified into bisexual, gay, and questioning groups in subsequent splits. These subsequent splits relied on sexual activities of low to moderate intensity, which largely occurred at age 15, including laying down with other-sex individuals at age 15, hugging other-sex individuals at age 15, hugging same-sex individuals at age 15, spending time alone with other-sex individuals at age 13, laying down with same-sex individuals at age 15, touching the body of other-sex individuals at age 15, and having one's private parts touched by other-sex individuals at age 13 (Figure 3).

No end nodes were reached within two splits, suggesting that the same sexual activities were often practiced by boys with different sexual orientation identities (Figure 3). Finally, there were repeated end nodes on parallel tree branches, suggesting large variations in the types of sexual activities practiced by boys with the same sexual orientation identity, including questioning boys (Figure 3). As the only exception, many heterosexual boys were distinguished from other boys by three continuous splitting rules: did not kiss same-sex individuals at age 15 *and* laid down with other-sex individuals at age 15 *and* did not lay down with same-sex individuals at age 15 (Figure 3). The CARTs in Figure 3 correctly classified 49% of boys' sexual orientation and showed slight agreement between self-reported and classified sexual orientation identity, $\kappa = 0.07$, 95% CI = (0.05, 0.09) (Table 4). The overlapping 95% CIs of κ between girls and boys indicate no significant sex difference in the inconsistency between sexual behavior and sexual orientation identity.

Discussion

Using data from a British prospective cohort study, we provide a comprehensive analysis on other-sex and same-sex sexual activities from early to middle adolescence. The findings suggest that adolescence is a period of increasing sexual experimentation, which is apparent in (1)

the increasing proportion of individuals having sex from early to middle adolescence; (2) the increasing variety of sexual activities in which adolescents engage; (3) the positive association between other-sex sexual activity level at a younger age and that at an older age; and (4) the positive association between same-sex sexual activity level at age 13 and that at age 15. Further, sexual experimentation seemed to be slightly more pronounced among adolescent girls than among adolescent boys of the same age (Table 1), perhaps due in part to the earlier pubertal onset among girls (Dorn & Biro, 2011).

As hypothesized, we found that when adolescents reported having a particular sexual activity with the same sex, in most cases over half of them also reported having the same sexual activity with the other sex, especially for low-to-moderate sexual activities. In addition, most adolescents reporting other-sex sexual behaviors of low intensity also reported it nonexclusively, although this was not always true for other-sex behaviors of moderate-to-high intensity (Table 1). We also found that with few exceptions, same-sex sexual activity levels were positively associated with other-sex sexual activity levels, both concurrently and prospectively (Table 2); these positive correlations were probably driven by the nonexclusive activities of low intensity (Table 1). Together, these findings contribute to the accumulating evidence on nonexclusive sexuality (e.g., Diamond, 2003, 2008; Li & Hines, 2016; Mustanski et al., 2014; Ott et al., 2011; Savin-Williams & Ream, 2007) and suggest that sexual experimentation in adolescence, especially that of low intensity, are largely nonexclusive.

Our next findings concern the relations between sexual behavior and sexual orientation identity. We found in ANOVAs that sexual orientation identity only explained a small proportion of variance in aggregated sexual activity levels from early to middle adolescence, suggesting that adolescents with different sexual orientation identities may not differ substantially in other-sex or

same-sex sexual activity levels between ages 11 to 15, when the intensity of sexual activities is low to moderate. In addition, it was found that despite methodological improvement from prior research, the CARTs models fitted the data poorly, misclassifying 35% of girls' and 51% of boys' sexual orientation identity after accounting for interdependence and complex interactions between the 82 sexual activities. Together, these findings suggest that adolescents may follow different trajectories of sexual activities to arrive at the same sexual orientation identity and that, conversely, adolescents who experience identical sexual activities may adopt different sexual orientation identities (Savin-Williams, 1998). In other words, sexual behaviors (especially those of low to moderate intensity) do not equate sexual orientation identity, and it is unreliable to infer someone's sexual orientation identity from the various behaviors they engage in with the same or other sex.

As an exception, adolescents who question their sexual orientation identity, comprising 2% of girls and 1% of boys, showed consistently low sexual activity levels across early to middle adolescence. In CARTs analysis, 49% of questioning girls were correctly classified by not having two low-intensity sexual activities at age 15, whereas 88% of questioning boys followed one of the two main trajectories: Many did not have three to four low-intensity sexual activities at age 15 and some had low-intensity same-sex sexual contact at ages 15 and moderate-intensity other-sex sexual contact at age 13. These findings suggest that, most adolescents who experience sexual questioning have delayed sexual experimentation compared to peers (e.g., Mustanski et al., 2014), while some others engage in active sexual experimentation with different sexes (e.g., Morgan & Thompson, 2011).

It is worth noting that most sexual activities selected by CARTs occurred at age 15. This finding possibly resulted from several factors. First, adolescents may refer more quickly to recent

sexual activities than to previous ones when adopting a sexual orientation identity, in an anchoring effect. Second, higher rates of same-sex sexual behavior at age 15 than at age 13 may have resulted in an improved performance of the statistical model at age 15, when more data were available. The third possibility is a true effect, wherein other-sex and same-sex sexual activities undertaken early in adolescence are not reliable indicators of sexual minority identities. This third explanation is also supported by prior retrospective studies (Calzo, Antonucci, Mays, & Cochran, 2011; Katz-Wise et al., 2017; Rosario, Schrimshaw, & Hunter, 2008), which suggest that on average, relatively consistent behavioral expressions of sexual orientation identities do not emerge until middle adolescence.

We found few or small sex differences in the prevalence of nonexclusive same-sex sexual behavior (Table 1) and in the agreement between sexual behavior and sexual orientation identity (e.g., the trivial interaction effects between sex and sexual orientation when predicting sexual activity levels in Table 3 and the overlapping 95% CIs of κ values in Table 4), suggesting that girls' and boys' same-sex sexual behaviors, especially those of low to moderate intensity, may be similarly plastic and fluid during early to middle adolescence. This gender similarity has been found not only in same-sex sexual behavior, as in the current study, but also in same-sex sexual attraction (Li & Hines, 2016) and sexual minority identities (Calzo et al., 2017; Ott et al., 2011). A recent study suggests that the causes of adult sexual fluidity may differ from those of adolescent sexual fluidity (Diamond et al., 2017); while the former may involve evolutionary origins that predispose women to sexual fluidity more than men (Kanazawa, 2017; Luoto et al., 2018), the latter may solely or additionally involve more immediate social and biological influences from developmental transitions during adolescence, for both girls and boys (e.g., Diamond et al., 1999; Shirtcliff et al., 2009; Way, 2011). Therefore, future studies could use a

longitudinal design to examine the ontology of sexual fluidity at different time scales (Diamond et al., 2017).

The current findings should be interpreted in light of five limitations. First, sexual orientation identity was measured in adolescence, therefore our findings may not be generalized to adult sexual orientation identity, because sexual orientation identity may change from adolescence to adulthood (Ott et al., 2011; Savin-Williams et al., 2012). Second, to increase generalizability of our findings to adulthood, we combined completely heterosexual with mostly heterosexual individuals and mostly lesbian/gay with completely lesbian/gay individuals, because these combined groups were likely stable from adolescence to adulthood, according to previous studies (Ott et al., 2011; Savin-Williams et al., 2012). However, this combination may have underestimated the discordance between sexual behaviors and sexual orientation identity in adolescence, in a more nuanced analysis. Third, the current findings may not apply to ethnic/racial minority people, to non-Western cultures, or to other generations, due to sample constraints. For example, it is possible that the high societal acceptance of sexual diversity contributes to the sexual experimentation with different sexes in ALSPAC cohort, but not in older generations; conversely, we may see greater sexual fluidity among today's young adolescents (Mercer et al., 2013). Fourth, considering non-partnered sexual activities and the context of the partnered activities (e.g., consensual or not; committed or casual; sexual or non-sexual, especially for low-intensity behaviors) may strengthen the CARTs analysis. Fifth, the current findings may have been biased by the use of stopping rules in ALSPAC when measuring sexual activities, because some participants may progress to sexual activities of high intensity without having sexual activities of low to moderate intensity (e.g., de Graaf et al., 2009). However, this bias was likely small, because the stopping points used in ALSPAC were few and

at logical skip points. Further, these stopping are supported by prior research (Hansen et al., 1999; Smiler et al., 2011).

Despite these limitations, the current findings have implications for future research. Whereas most large-scale studies measured sexual behavior without giving a clear definition or only measured sexual activities of high intensity (Saewyc et al., 2004; Gray et al., 2008; Harris, 2013; Mustanski et al., 2014), future research could also assess sexual activities of low to moderate intensity, such as kissing and touching private parts in adolescents. Researchers are also encouraged to study the health implications of same-sex sexual activities of low to moderate intensity, given stigma and prejudice associated with adolescent same-sex sexuality (Russell & Fish, 2016).

Conclusion

The present research illustrates the need to consider the sex(es) of partners in a broad range of adolescent sexual behaviors. Nonexclusive same-sex sexual behaviors, especially those of low-to-moderate intensity, are more prevalent than exclusive same-sex sexual behaviors, and are not limited to adolescents with a particular sexual orientation identity. Other-sex sexual behaviors of low intensity are also more nonexclusive than exclusive, although those of moderate-to-high intensity are often exclusive. In addition, while theories propose that women's sexuality is more fluid than men's, the current study suggests that boys' sexual experiences may be as nonexclusive as girls' during early to middle adolescence, especially for low-intensity behaviors. Finally, as adolescents increasingly participate in different types of sexual behavior with people of different sexes upon entering puberty, there is a need to accurately assess a full range of sexual activities, not just sexual intercourse, and to examine their implications on adolescent health.

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Table 1

Descriptive Statistics of Individual Other-Sex and Same-Sex Sexual Activities in the U.K. Avon Longitudinal Study of Parents and Children

	Other sex, <i>n</i> (%)			Same sex, <i>n</i> (%)			<i>n</i> (%) of adolescents having a same-sex sexual activity nonexclusively		
	Girls	Boys	OR	Girls	Boys	OR	Girls	Boys	OR
	Age 11	2,293 (100)	2,021 (100)	—	—	—	—	—	—
Hugged...	704 (31)	632 (31)	0.97	—	—	—	—	—	—
Held hands with...	465 (20)	496 (25)	0.78*	—	—	—	—	—	—
Spent time alone with...	496 (22)	493 (24)	0.86	—	—	—	—	—	—
Kissed...	292 (13)	318 (16)	0.78	—	—	—	—	—	—
Kissed by...	304 (13)	333 (16)	0.77	—	—	—	—	—	—
Cuddled...	192 (8)	222 (11)	0.74	—	—	—	—	—	—
Laid down with...	0 (0)	0 (0)	—	—	—	—	—	—	—
Body touched by...	0 (0)	0 (0)	—	—	—	—	—	—	—
Touched body of...	0 (0)	0 (0)	—	—	—	—	—	—	—
Undressed with...	0 (0)	0 (0)	—	—	—	—	—	—	—
Touched private parts of...	0 (0)	0 (0)	—	—	—	—	—	—	—
Had sexual intercourse with...	0 (0)	0 (0)	—	—	—	—	—	—	—
Age 12	2,475 (100)	2,189 (100)	—	—	—	—	—	—	—
Hugged...	1,353 (55)	1,155 (53)	1.08	—	—	—	—	—	—

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Held hands with...	927 (37)	879 (40)	0.89	—	—	—	—	—	—
Spent time alone with...	966 (39)	833 (38)	1.04	—	—	—	—	—	—
Kissed...	716 (29)	687 (31)	0.89	—	—	—	—	—	—
Kissed by...	683 (28)	677 (31)	0.85	—	—	—	—	—	—
Cuddled...	752 (30)	726 (33)	0.88	—	—	—	—	—	—
Laid down with...	236 (10)	248 (11)	0.82	—	—	—	—	—	—
Body touched by...	80 (3)	110 (5)	0.63	—	—	—	—	—	—
Touched body of...	61 (2)	119 (5)	0.44***	—	—	—	—	—	—
Undressed with...	23 (1)	42 (2)	0.48	—	—	—	—	—	—
Touched private parts of...	22 (1)	36 (2)	0.54	—	—	—	—	—	—
Private parts touched by...	18 (1)	31 (1)	0.51	—	—	—	—	—	—
Had oral sex with...	12 (0)	17 (1)	0.62	—	—	—	—	—	—
Had sexual intercourse with...	5 (0)	14 (1)	0.31	—	—	—	—	—	—
Age 13	2,395 (100)	2,139 (100)	—	2,395 (100)	2,139 (100)	—	—	—	—
Hugged...	1,867 (78)	1,804 (84)	0.66***	1,888 (79)	265 (12)	26.33***	1,521 (81)	247 (93)	0.30***
Held hands with...	1,452 (61)	1,285 (60)	1.02	643 (27)	51 (2)	15.03***	479 (74)	42 (82)	0.63
Spent time alone with...	1,388 (58)	1,225 (57)	1.03	1,417 (59)	698 (33)	2.99***	893 (63)	449 (64)	0.95
Kissed...	1,214 (51)	1,038 (49)	1.09	86 (4)	13 (1)	6.09***	70 (81)	11 (85)	0.80
Kissed by...	1,083 (45)	934 (44)	1.06	56 (2)	13 (1)	3.92***	41 (73)	9 (69)	1.21
Cuddled...	1,237 (52)	1,039 (49)	1.13	326 (14)	30 (1)	11.08***	259 (79)	25 (83)	0.77
Laid down with...	572 (24)	465 (22)	1.13	125 (5)	21 (1)	5.55***	97 (78)	20 (95)	0.17

SEXUAL EXPERIMENTATION IN ADOLESCENCE

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Body touched by...	308 (13)	263 (12)	1.05	9 (0)	3 (0)	2.69	8 (89)	3 (100)	0.00
Touched body of...	224 (9)	269 (13)	0.72*	8 (0)	2 (0)	3.58	6 (75)	2 (100)	0.00
Undressed with... Touched private parts of...	103 (4)	95 (4)	0.97	12 (1)	4 (0)	2.69	3 (25)	3 (75)	0.11
Private parts touched by...	90 (4)	86 (4)	0.93	4 (0)	1 (0)	3.58	3 (75)	1 (100)	0.00
Had oral sex with...	84 (4)	77 (4)	0.97	3 (0)	2 (0)	1.34	2 (67)	1 (50)	2.00
Had sexual intercourse with...	55 (2)	50 (2)	0.98	2 (0)	1 (0)	1.79	1 (50)	0 (0)	—
	39 (2)	38 (2)	0.92	2 (0)	0 (0)	—	0 (0)	0 (0)	—
Age 15	2,702 (100)	2,368 (100)	—	2,702 (100)	2,368 (100)	—	—	—	—
Hugged...	2,541 (94)	2,229 (94)	0.98	2,478 (92)	1,016 (43)	14.72***	2,348 (95)	995 (98)	0.38***
Held hands with...	2,188 (81)	1,812 (77)	1.31**	1,349 (50)	173 (7)	12.65***	1,242 (92)	157 (91)	1.18
Spent time alone with...	2,226 (82)	1,892 (80)	1.18	1,974 (73)	1,003 (42)	3.69***	1,698 (86)	899 (90)	0.71
Kissed...	2,011 (74)	1,622 (68)	1.34***	400 (15)	74 (3)	5.39***	364 (91)	60 (81)	2.36
Kissed by...	1,910 (71)	1,516 (64)	1.36***	296 (11)	68 (3)	4.16***	264 (89)	50 (74)	2.97*
Cuddled...	2,095 (78)	1,681 (71)	1.41***	646 (24)	114 (5)	6.21***	602 (93)	104 (91)	1.32
Laid down with...	1,647 (61)	1,195 (50)	1.53***	411 (15)	89 (4)	4.59***	369 (90)	74 (83)	1.78
Body touched by...	1,359 (50)	925 (39)	1.58***	56 (2)	39 (2)	1.26	48 (86)	21 (54)	5.14*
Touched body of...	1,170 (43)	929 (39)	1.18	54 (2)	37 (2)	1.28	46 (85)	20 (54)	4.89*
Undressed with... Touched private parts of...	860 (32)	609 (26)	1.35***	67 (2)	39 (2)	1.52	42 (63)	25 (64)	0.94
	792 (29)	564 (24)	1.33***	28 (1)	27 (1)	0.91	20 (71)	15 (56)	2.00

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Private parts touched by...	802 (30)	551 (23)	1.39***	28 (1)	27 (1)	0.91	22 (79)	17 (63)	2.16
Had oral sex with...	637 (24)	456 (19)	1.29**	13 (0)	24 (1)	0.47	9 (69)	12 (50)	2.25
Had sexual intercourse with...	539 (20)	351 (15)	1.43***	6 (0)	8 (0)	0.66	3 (50)	3 (38)	1.67

Note. At ages 11 and 12, only other-sex sexual activities were measured. Chi-square tests were conducted to compare sex differences.

OR = odds ratio; boys were used as the reference group.

* $p < .05$, ** $p < .01$, *** $p < .001$, after Bonferroni corrections for 54 comparisons of sex differences in other-sex sexual activities; for 28 comparisons of sex differences in same-sex sexual activities; and for 28 comparisons of sex differences in the proportion of adolescents having a same-sex sexual activity nonexclusively.

Table 2

Robust Correlations of Aggregated Sexual Activity Levels in Girls (Below Diagonal) and Boys (Above Diagonal) From the U.K. Avon Longitudinal Study of Parents and Children

Variable	1	2	3	4	5	6
1. Other-sex sexual activity level at age 11	—	.53***	.38***	.37***	.05*	.09***
2. Other-sex sexual activity level at age 12	.51***	—	.58***	.52***	.05*	.14***
3. Other-sex sexual activity level at age 13	.36***	.58***	—	.59***	.14***	.16***
4. Other-sex sexual activity level at age 15	.30***	.45***	.61***	—	.04†	.22***
5. Same-sex sexual activity level at age 13	.04*	.04†	.18***	.07***	—	.26***
6. Same-sex sexual activity level at age 15	.10***	.12***	.20***	.26***	.35***	—

Note. See Table 3 for means and standard deviations of aggregated sexual activity levels. Biweight midcorrelations (Wilcox, 2005) are calculated to reduce bias from bivariate outliers. Shaded areas indicate significant sex differences at $p < .05$, after Bonferroni correction for 15 comparisons of sex difference.

† $p < .10$. * $p < .05$. *** $p < .001$.

Table 3

Aggregated Other-Sex and Same-Sex Sexual Activity Levels in Adolescence by Sex and Sexual Orientation Identity in the U.K. Avon Longitudinal Study of Parents and Children

	Other-sex sexual activity level				Same-sex sexual activity level	
	Age 11	Age 12	Age 13	Age 15	Age 13	Age 15
Sex, <i>M</i> (<i>SD</i>)						
Girls (<i>n</i> = 2,702)	-0.20 (0.17)	-0.04 (0.68)	-0.29 (0.88)	0.31 (0.98)	0.55 (0.72)	0.49 (0.74)
Boys (<i>n</i> = 2,368)	-0.18 (0.19)	-0.01 (0.72)	-0.29 (0.83)	0.13 (0.98)	-0.34 (0.47)	-0.40 (0.70)
Sexual orientation identity, <i>M</i> (<i>SD</i>)						
Heterosexual (<i>n</i> = 4,850)	-0.19 (0.18) _a	-0.03 (0.70) _a	-0.29 (0.86) _a	0.24 (0.97) _a	0.12 (0.75) _a	0.04 (0.81) _a
Bisexual (<i>n</i> = 84)	-0.17 (0.19) _a	-0.04 (0.66) _{a,b}	-0.21 (0.83) _a	0.57 (1.02) _b	0.58 (0.94) _b	1.37 (1.12) _b
Lesbian/gay (<i>n</i> = 46)	-0.18 (0.17) _a	0.25 (0.59) _a	-0.07 (0.85) _a	-0.07 (1.02) _a	0.04 (0.83) _a	1.30 (1.38) _b
Questioning (<i>n</i> = 90)	-0.23 (0.16) _a	-0.29 (0.60) _b	-0.80 (0.88) _b	-0.58 (1.10) _c	0.09 (0.76) _a	-0.02 (0.96) _a
ANOVA, <i>F</i> (<i>p</i>)						
Sex	5.51 (.019)	1.77 (.183)	0.02 (.890)	34.20 (< .001)	2301.71 (< .001)	2000.10 (< .001)
Sexual orientation identity	1.12 (.339)	3.77 (.010)	10.20 (< .001)	13.67 (< .001)	6.71 (< .001)	64.11 (< .001)
Sex × sexual orientation identity	0.26 (.857)	0.42 (.741)	1.58 (.193)	2.68 (.045)	0.61 (.608)	3.45 (.016)
Residual <i>df</i>	4,306	4,656	4,526	5,062	4,526	5,062
ANOVA, η_p^2						
Sex	.001	.000	.000	.007	.337	.283
Sexual orientation identity	.001	.002	.007	.008	.004	.037
Sex × sexual orientation identity	.000	.000	.001	.002	.000	.002

Note. Values with different subscripts in the same column denote significant pairwise comparisons after Bonferroni adjustment, $p < .05$, two-tailed. Missing values were deleted from analysis. Comparisons cannot be made across columns because the outcomes were not measured on the same scale and were not standardized. See Figure 1 for illustration of significant interactions.

Table 4

Agreement Between Self-Reported and Classified Sexual Orientation Identity Using Classification and Regression Trees in the U.K. Avon Longitudinal Study of Parents and Children

Self-reported sexual orientation identity	Classified sexual orientation identity			
	Heterosexual <i>n</i> (%)	Bisexual <i>n</i> (%)	Lesbian/gay <i>n</i> (%)	Questioning <i>n</i> (%)
Girls (<i>n</i> = 2,702)				
Heterosexual	1,685 (65)	239 (9)	192 (8)	459 (18)
Bisexual	9 (16)	32 (58)	8 (15)	6 (11)
Lesbian/gay	1 (6)	1 (6)	15 (88)	0 (0)
Questioning	18 (33)	8 (14)	2 (4)	27 (49)
Overall agreement = 65%; κ (95% CI) = 0.10 (0.08, 0.13)				
Boys (<i>n</i> = 2,368)				
Heterosexual	1,093 (48)	220 (10)	205 (9)	757 (33)
Bisexual	2 (7)	20 (69)	0 (0)	7 (24)
Lesbian/gay	1 (3)	2 (7)	19 (66)	7 (24)
Questioning	3 (9)	0 (0)	1 (3)	31 (88)
Overall agreement = 49%; κ (95% CI) = 0.07 (0.05, 0.09)				

Note. See Figures 2 and 3 for illustrations of the classification and regression trees.

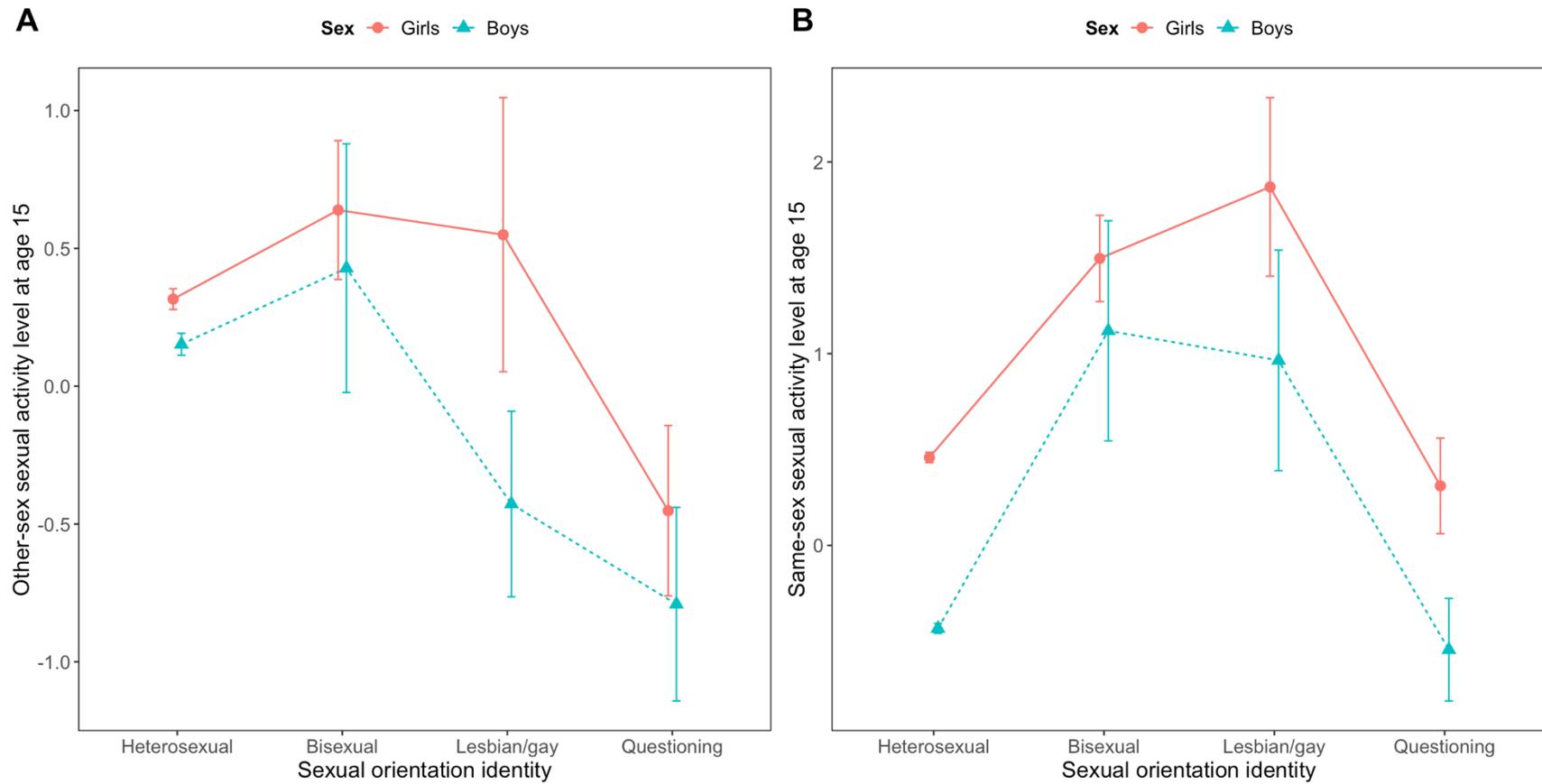


Figure 1. Interaction between sex and sexual orientation identity on (A) aggregated other-sex sexual activity level at age 15 and (B) aggregated same-sex sexual activity level at age 15 in the U.K. Avon Longitudinal Study of Parents and Children. Error bars represent 95% confidence intervals.

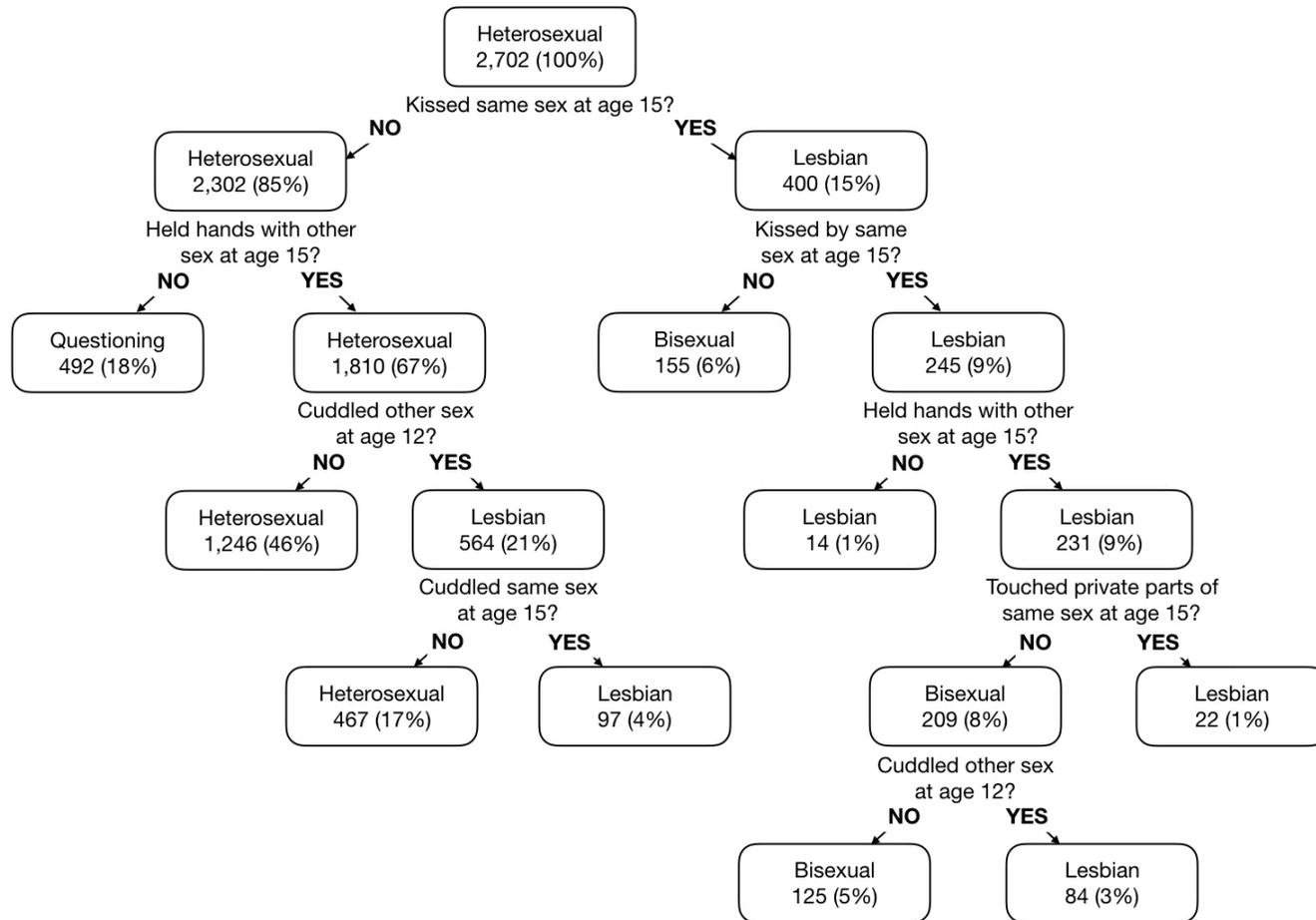


Figure 2. Classification and regression trees fitting sexual orientation identity in girls from the U.K. Avon Longitudinal Study of Parents and Children. The label in each node denotes the sexual orientation identity that shows the largest probability. Values represent n (%) of participants classified into that sexual orientation identity.

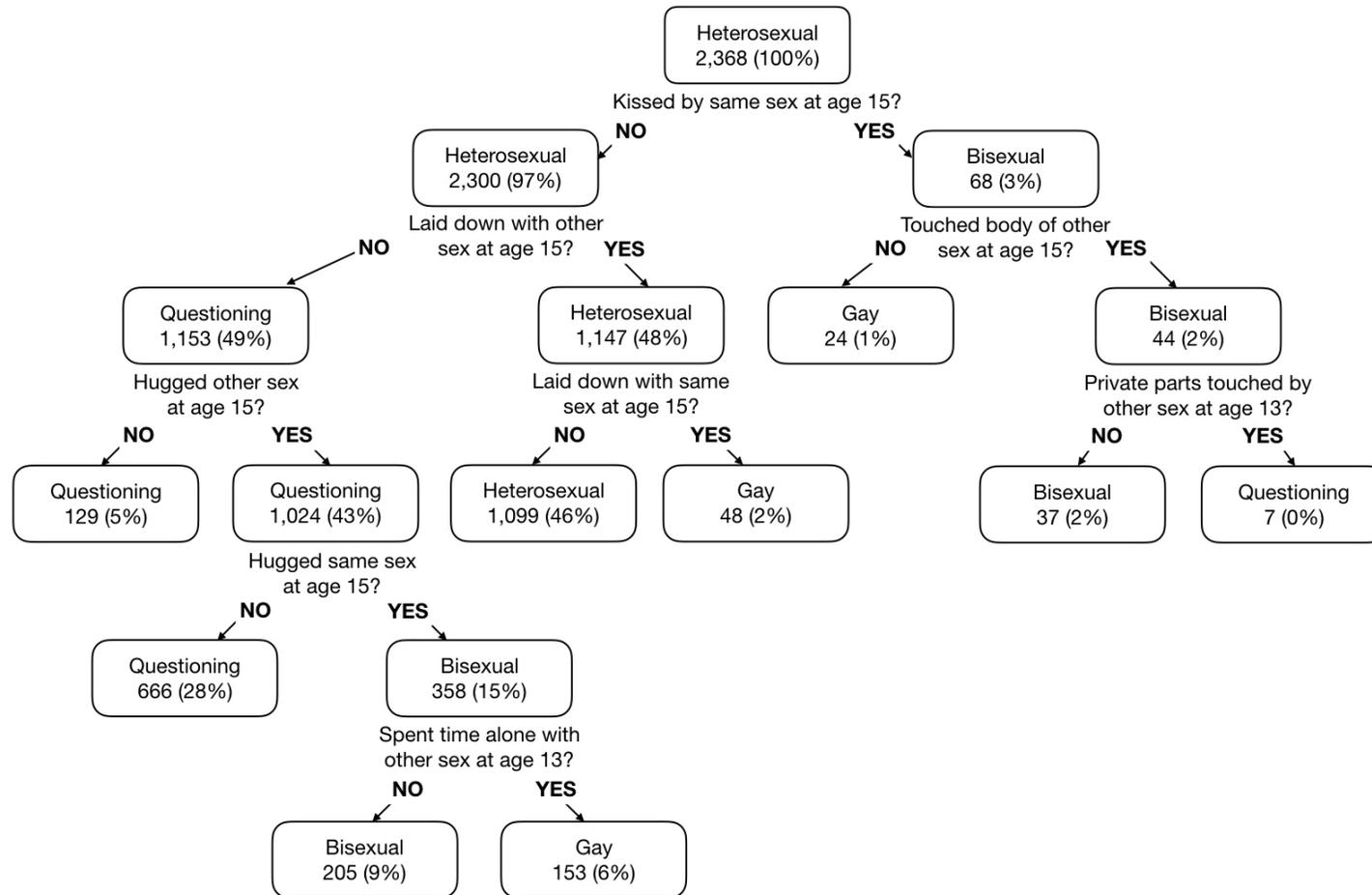


Figure 3. Classification and regression trees fitting sexual orientation identity in boys from the U.K. Avon Longitudinal Study of Parents and Children. The label in each node denotes the sexual orientation identity that shows the largest probability. Values represent n (%) of participants classified into that sexual orientation identity.