Stability and Change in Self-Reported Sexual Orientation Identity in Young People: Application of Mobility Metrics

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Abstract

This study investigated stability and change in self-reported sexual orientation identity over time in youth. We describe gender- and age-related changes in sexual orientation identity from early adolescence through emerging adulthood in 13,840 youth ages 12–25 employing mobility measure *M*, a measure we modified from its original application for econometrics. Using prospective data from a large, ongoing cohort of U.S. adolescents, we examined mobility in sexual orientation identity in youth with up to four waves of data. Ten percent of males and 20% of females at some point described themselves as a sexual minority, while 2% of both males and females reported ever being "unsure" of their orientation. Two novel findings emerged regarding gender and mobility: (1) Although mobility scores were quite low for the full cohort, females reported significantly higher mobility than did males. (2) As expected, for sexual minorities, mobility scores were appreciably higher than for the full cohort; however, the gender difference appeared to be eliminated, indicating that changing reported sexual orientation identity throughout adolescence occurred at a similar rate in female and male sexual minorities. In addition, we found that, of those who described themselves as "unsure" of their orientation identity at any point, 66% identified as completely heterosexual at other reports and never went on to describe themselves as a sexual minority. Age was positively associated with endorsing a sexual-minority orientation identity. We discuss substantive and methodological implications of our findings for understanding development of sexual orientation identity in young people.

Keywords

Sexual orientation; Gay; Lesbian; Bisexual; Adolescence mobility metrics

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Introduction

Since the landmark publication of *Sexual Behavior in the Human Male* (Kinsey, Pomeroy, & Martin, 1948)and *Sexual Behavior in the Human Female* (Kinsey, Pomeroy, Martin, & Gebhard, 1953), research on sexual orientation has grown immensely. Consistent with a definition of sexual orientation typically used in the field of public health, we conceptualize sexual orientation to be a multidimensional construct encompassing three primary dimensions: (1) attractions; (2) sex of sexual partners; and (3) identity labeling as heterosexual, bisexual, or lesbian/gay (Institute of Medicine, 1999; Laumann, Gagnon, Michael, & Michaels, 1994). Efforts to understand how sexual orientation develops across the lifespan are gaining in research attention, with recent studies beginning to illuminate adolescent experiences.

Adolescence is a pivotal periodfor sexual orientation development (Perrin, 2002). Studies conducted over the past two decades have estimated the average age of awareness of same-sex attractions to be approximately 10 years old, following the psychophysiological changes associated with adrenal puberty (Herdt & McClintock, 2000) and the average age of first self-labeling as having a minority sexual orientation to be between 14 and 21 years old, with the younger age estimates in the range resulting from the more recent studies (Perrin, 2002). Evidence also indicates that sexual orientation-related developmental experiences of today's youth differ in important ways from prior historical cohorts. Two large U.S.-based samples of adults using retrospective data provide evidence that people with a minority sexual orientation are "coming out" (i.e., the process of sexual identity development as lesbian, gay, or bisexual) at younger ages than in previous generations (Floyd & Bakeman, 2006; Grov, Bimbi, Nanin, & Parsons, 2006). These two studies also found that males retrospectively reported becoming aware of same-sex attractions at younger ages than did females, suggesting a gender difference in the timing of onset of an important milestone of minority sexual orientation development.

The developmental process of coming out has often been approached in research as a progressive, linear, and one-time phenomenon, albeit potentially spanning a period of years (Cass, 1979, 1996; Troiden, 1988, 1989). At the same time, however, it has been acknowledged that a person's sexual orientation may change not only during adolescence but also across the adult lifespan (Diamond, 2008a; Kinnish, Strassberg, & Turner, 2005; Laumann et al., 1994). Savin-Williams and Ream (2007) and Diamond (2007) have argued that research has often been limited by reliance on study designs that treat sexual orientation as a stable trait. Those designs have often been cross-sectional and retrospective.

When study designs or measures are not able to capture change related to sexual orientation development, misclassification may be a concern, as argued by Savin-Williams and Ream (2007), and the dynamic phenomenon of sexual orientation mobility—that is, changes in self-reported orientation—is ignored (Diamond, 2007). However, such mobility is of scientific interest, potentially informative, and capable of opening up a new field of inquiry that is both substantive and methodological. Chief substantive concerns include questions as to how changes in how one perceives and reports one's sexual orientation may relate to sexual orientation identity integration and subsequent health and adjustment and also questions as to what factors may precipitate or predict changes in how individuals perceive their sexual orientation. Chief methodological challenges include the need to develop analytic approaches that have the capacity to characterize and analyze sexual orientation while accounting for both time-variance in important dimensions of sexual orientation, such as identity, attractions, and sex of sexual partners (Laumann et al., 1994), and possible time-varying effects on health, adjustment, and other outcomes.

Several leading theorists in the field of sexuality studies have argued that sexual orientation in females, compared to that in males, is more likely to change over time (Baumeister, 2000; Diamond, 2007; Peplau, 2001). Theoretical models proposed for the hypothesized greater sexual orientation fluidity in females than males ranges from biologically based sex differences in fetal hormone exposure to sociopolitical forces that constrain sexual self-concept, expression, and opportunities differently in women and men (Baumeister, 2000; Diamond, 2007; Peplau, Spalding, Conley, & Veniegas, 1999; Savin-Williams & Cohen, 2004). The theorized mechanisms driving fluidity may be expected to differentially affect each dimension of sexual orientation. For instance, sociopolitical forces that exist in many contexts and historical periods limiting women's ability to achieve economic independence from men and heterosexual marriage may be expected to affect the stability versus fluidity of highly socially mediated dimensions of identity and sex of sexual partners, while hypothesized biological effects of fetal hormone exposure may be expected to affect the stability versus fluidity of sexual attraction to the same or other sex (Peplau et al., 1999; Savin-Williams & Cohen, 2004). Empirical studies with longitudinal data across the life course and across the different dimensions of sexual orientation are scarce (Kinnish et al., 2005).

Turning to the empirical literature, a small number of prospective studies with adolescents have begun using a variety of methods to characterize mobility in different dimensions of sexual orientation and quantitatively examine gender differences. Savin-Williams and Ream (2007) used Cohen's kappa inter-rater statistics, percent agreement, and logistic regression to estimate the odds of consistency in self-reported attractions to the same or other gender comparing from wave to wave across three waves of survey data from the National Longitudinal Study of Adolescent Health (Add Health). Savin-Williams and Ream found that females were less likely to report changes in their attractions to the same or other gender than were males between the first two waves, though no gender difference was detected between Wave 1 and Wave 3 or between Wave 2 and Wave 3.

In a birth cohort of approximately 1000 New Zealand youth of all sexual orientations who responded to survey items about attractions at age 21 and again at age 26, Dickson, Paul, and Herbison (2003) estimated the proportion of each baseline attraction group who reported similar or different attractions at follow-up. They observed that females appeared to report greater increases in same-sex attractions over the 5-year follow-up period than did males. At age 21, 9% of females in the cohort reported any same-sex attractions, which increased to 16% at age 26, whereas comparable estimates for males at age 21 and age 26 were 4 and 6%; however, no statistical tests comparing mobility patterns in females versus males were presented. In a longitudinal community sample of 156 lesbian, gay, and bisexual adolescents ages 14–21 years at baseline, Rosario, Schrimshaw, Hunter, and Braun (2006) classified study participants according to orientation identity reported at baseline, and then carried out analyses to estimate the odds of maintaining the same identity at follow-up over a 12-month period. Rosario et al. found that among those who were gay/lesbian at baseline, females were 3.6 times more likely than males to maintain their gay/lesbian identity; and among those who were bisexual at baseline, females were 5.0 times more likely than males to maintain their bisexual identity.

Among the prospective studies to date that have examined sexual orientation mobility in youth, some methodological limitations underscore the need for redoubled research efforts. These limitations include samples with a small number of youth with minority sexual orientation (Dickson et al., 2003), samples that excluded heterosexuals (Rosario et al., 2006) or males (Diamond, 2008a), short follow-up period of 1 year (Rosario et al., 2006), or two or fewer waves of follow-up data collection (Dickson et al., 2003; Rosario et al., 2006; Savin-Williams & Ream, 2007).

While prior longitudinal research with adolescents has begun to examine gender differences in orientation mobility patterns, we are aware of only one that has investigated age differences in mobility. Rosario et al. (2006) found that youth who consistently identified as lesbian or gay were significantly older than peers who transitioned to a lesbian or gay identity during the year-long follow up. These data suggest that early or middle adolescence may represent times of greater mobility than subsequent developmental periods for some young people. This intriguing question needs to be examined over more than just 1 year. As mentioned above, adolescence is considered a peak period for emergence of same-sex orientation (Perrin, 2002; Rosario, Hunter, Maguen, Gwadz, & Smith, 2001; Troiden, 1989) and average age of coming out may be undergoing a historical shift downward (Floyd & Bakeman, 2006; Grov et al., 2006), but whether there are periods within adolescence characterized by more orientation mobility remains underexamined.

Research interest has been increasing in youth who describe themselves as "unsure" of their orientation, with recent studies documenting prevalence and health correlates of this group (Austin, Ziyadeh, Fisher et al., 2004; Austin, Ziyadeh, Kahn et al., 2004; Igartua, Thombs, Burgos, & Montoro, 2009; Narring, Stronski Huwiler, & Michaud, 2003; Zhao, Montoro, Igartua, & Thombs, 2010). It is unknown, however, what the eventual orientation identity outcome is likely to be among youth who are currently uncertain or "unsure" of their orientation. It is plausible, given society's stigmatization of homosexuality, that these youth might be lesbian, gay, or bisexual despite reporting that they are "unsure" (Igartua et al., 2009; Zhao et al., 2010). Prospective studies following "unsure" youth from adolescence into emerging adulthood are lacking in the literature, and so there are little empirical data available to give insight into how these youth come to describe their sexual orientation identity over time.

We undertook the current study to increase our understanding of the distribution and longitudinal mobility of self-reported sexual orientation identity, one of the three primary dimensions of sexual orientation, using data from the Growing Up Today Study (GUTS), a prospective cohort of more than 16,000 female and male adolescents of all sexual orientations living throughout the United States. Our study aims were: (1) to illustrate the age-specific distribution of self-reported sexual orientation identity from early adolescence through emerging adulthood; (2) to describe the probability of changing from one sexual orientation identity to another; and (3) to examine gender and age differences in sexual orientation identity mobility in young people.

We hypothesized that: (1) mobility in sexual orientation identity would be greater in females than in males; (2) mobility in sexual orientation identity would be greater in younger than in older adolescents; and (3) the majority of youth reporting that they were "unsure" of their orientation identity would go on to describe themselves as sexual minority.

Method

Participants

The Growing Up Today Study (GUTS) is a longitudinal cohort study of male and female adolescents living throughout the United States. GUTS participants were the children of women in the Nurses' Health Study II (NHSII), a prospective cohort study of over 116,000 female registered nurses (Brigham and Women's Hospital/Harvard Medical School). Invitations to enroll their children ages 9–14 years into the GUTS cohort were sent to mothers in NHSII, and names of over 26,765 boys and girls in the eligible age range were provided by these mothers. These children were mailed a questionnaire in 1996 covering a wide range of health topics, which they were asked to return if they wished to participate. At baseline, 7,843 boys and 9,039 girls were enrolled into the cohort. While we did not have

sociodemographic or behavioral data from youth who were invited but did not enroll in GUTS, we did have survey data from their mothers, which allowed us to assess possible enrollment bias. Comparing mothers who agreed to enroll their children in GUTS (*n* = 18,526 mothers) with those who did not agree (*n* = 15,648 mothers), we found that mothers who agreed had modestly lower rates of smoking (8% vs. 10%; *p*<.05) and alcohol use (53.4% vs. 57.5%; *p*<.05) but similar age (37.7 vs. 37.8 years) and antidepressant use (e.g., Prozac 3.8% vs. 3.9% and Zoloft 3.1% vs. 2.7%). A complete description of GUTS is reported elsewhere (Field et al., 1999). The cohort's participants were 93.3% white, 1.5% Asian, 0.9% African American, 1.5% Hispanic, 0.8% American Indian, and 2.2% of other ethnicity.

GUTS began collecting information on sexual orientation identity biannually in 1999, when participants were ages 12–17 years. For the present analysis, adolescent and young adult males and females were included if they reported sexual orientation identity in one or more of four waves of data collection (1999, 2001, 2003, and 2005). Participants included in analyses ranged in age from 12 to 25 years at the time of questionnaire return. This study was approved by the institutional review board at Brigham and Women's Hospital.

Sexual Orientation Identity Measure

GUTS questionnaires assessed sexual orientation identity with an item adapted from the Minnesota Adolescent Health Survey (Remafedi, Resnick, Blum, & Harris, 1992): "Which of the following best describes your feelings? (1) completely heterosexual (attracted to persons of the opposite sex), (2) mostly heterosexual, (3) bisexual (equally attracted to men and women), (4) mostly homosexual, (5) completely homosexual (gay/lesbian, attracted to persons of the same sex), (6) not sure."

Statistical Analysis

We explored mobility in sexual orientation identity in several ways. First, cross-sectional distributions of sexual orientation identity based on repeated measures reported over the four waves of data collection were estimated for each year of age ranging from 12 to 23 years, stratified by gender. Binary indicator terms were created for each sexual orientation identity subgroup. Generalized estimating equations (SAS proc genmod) were used with dichotomized sexual orientation identity variables to examine gender and age differences in sexual orientation identity subgroup prevalence estimates, accounting for multiple comparisons by using a significance threshold of *p*<.01.

Next, making use of the repeated measures, sexual orientation identity transition matrices were constructed to characterize mobility in self-reported sexual orientation identity, using the six-level orientation identity measure described above. A transition matrix is a $K \times K$ matrix with entries p_{ij} that denote the probability of changing to category *j* given that the initial category was *i*. Each row of the transition matrix sums to one, and p_{ii} denotes the probability of staying in category *i*, given that *i* was the initial category.

Mobility measures have been used to quantify the mobility of a particular characteristic observed in a population's transition matrix. Transition matrices have found applications in many fields, including ecological sciences (Huenneke & Marks,1987; Lertzman, 1995), risk management (Loffler & Posch, 2007), and economics (Formby, Smith, & Zheng, 2004; Shorrocks, 1978; Trede, 1999). Mobility measures have been applied primarily to the studies of income mobility (Formby et al., 2004; Shorrocks, 1978; Trede, 1999) and social mobility (Parker & Rougier, 2001) in economics. We employed a mobility measure (Boudon, 1973; Matras, 1961) *M*, which equals the proportion of the population that is mobile. We applied

this measure to assess the proportion of changes in reported sexual orientation identity that occur out of all of the opportunities to change orientation identity, as follows:

$$M = 1 - \sum_{i=1}^{K} \pi_i p_{ii}$$

where the π vector denotes the initial distribution of each of the K sexual orientation identity categories. This score does not differentiate the direction of the change of reported sexual orientation (e.g., completely heterosexual to bisexual versus bisexual to completely heterosexual) nor the magnitude (e.g., completely heterosexual to completely homosexual versus mostly homosexual to completely homosexual); rather, the score denotes that changes occurred from one time point at which sexual orientation was assessed to the next time point at which it was assessed. *M* ranges from zero (no changes in reported sexual orientation identity across waves) to one (reported sexual orientation identity changed at every wave). A score of zero denotes no changes in reported sexual orientation identity across waves—in other words, zero mobility. A score of one denotes that reported sexual orientation changed at every wave (maximum mobility).

With GUTS data, we used a 6×6 matrix to represent changes to and from the completely heterosexual, mostly heterosexual, bisexual, mostly homosexual, completely homosexual, and "unsure" categories. Transition matrices were stratified by gender and age group (12–17 years and 18–21 years). A transition was included in the younger age group if the age at the beginning of the transition was between 12 and 17 years; a transition was included in the older age group if the age at the beginning of the transition was between 18 and 21 years. Note that to be consistent with the technical use of the term *transition* as used with transition matrices, we use the term to refer to the occurrence of two consecutive waves, whereas the term *change* is used to refer to change in reported sexual orientation that occurs at a transition—that is, from one wave to the next.

We applied the mobility score M when examining the sample in age groups, as described above, and when considering the whole sample accounting for age in integer years. In addition, we calculated *M* with four subsets of the data: (1) full sample; (2) excluding the reports of "unsure" (which reduces the transition matrix to 5×5); (3) excluding the consistently completely heterosexuals (defined as those who described themselves only as completely heterosexual each time they reported their sexual orientation); and (4) excluding both the reports of "unsure" and the consistently completely heterosexuals (which again reduces the transition matrix to 5×5).

Standard errors for *M* were calculated with the method described by Trede (1999). *T*-tests were carried out to test for age (older vs. younger adolescents) and sex differences in sexual orientation mobility. All analyses were conducted using SAS statistical software v9.1 (SAS Institute Inc., 2002–2004).

Over the four waves of data collection (1999, 2001, 2003, and 2005), 13,913 participants responded to the sexual orientation identity question on one or more of these questionnaires (82.4% of the original cohort), providing 41,475 sexual orientation identity observations. For analyses of cross-sectional distributions of sexual orientation using repeated measures, the analytic sample was further restricted to reports at ages 12–23 years inclusive (observations were omitted due to the small sample size at ages 11 years [*n* observations = 1], 24 years [*n* observations = 401], and 25 years [*n* observations = 89]), leaving us with an analytic sample of 40,984 observations from 13,840 participants (82.0% of the original cohort). For longitudinal analyses using transition matrices and mobility measure *M*, 27,561

transitions occurred across the four waves of data collection. Due to small sample sizes, the longitudinal analytic sample excluded transitions beginning at age 22 years or older (*n* transitions = 452) as well as transitions that began before age 12 (*n* transitions = 1). Transitions that had an elapsed time of shorter than 0.5 years (*n* transitions = 355)or longer than 4.5 years (*n* transitions = 743) between two consecutive reports of sexual orientation identity were excluded from the analyses, leaving us with a sample of 26,010 transitions for longitudinal analyses provided by 11,109 participants (4346 males and 6763 females; 65.8% of the original cohort).

Individual-Level Analyses—In subanalyses designed to characterize the most common trajectories of sexual orientation identity that were reported by individuals, only participants with at least three sexual orientation reports were included (*n* = 9536). For these analyses, because of small cell sizes, the categories of bisexual, mostly homosexual, and completely homosexual were collapsed into one lesbian, gay, bisexual (LGB) category. In order to account for age and gender differences, the participants were divided according to age at first report. We created groups of males and females ages 12–15 years or older than 15 years at first report of sexual orientation identity. Those who ever reported they were "unsure" of their orientation identity were grouped separately from other participants. Among those who never reported "unsure," we subgrouped them into four main categories of trajectories: immobile, mobile toward completely heterosexual, mobile toward LGB, and multidirectional. For example, a youth who reported "completely heterosexual" at the first wave, then "mostly heterosexual," at the second wave and each subsequent wave would be categorized as mobile to ward LGB, whereas, a youth who reported "completely heterosexual" on the first wave, then "mostly heterosexual," "mostly heterosexual," and finally "completely heterosexual" again on the last wave would be categorized as multidirectional. The unidirectional mobile groupings were further refined to specify the first and last sexual orientation identity reports. For example, within the category defined as mobile toward completely heterosexual, there were three subgroups: (1) LGB to mostly heterosexual, (2) LGB to completely heterosexual, and (3) mostly heterosexual to completely heterosexual.

In order to detect gender and age differences in trajectories of sexual orientation identity, we considered the categories immobile, mobile toward completely heterosexual, mobile toward LGB, multidirectional, and ever "unsure." Chi-square tests were performed to examine whether there were associations between these categories and gender and age. In order to understand what might underlie potential differences, we also performed chi-square tests with the groupings of immobile versus other and ever "unsure" versus never "unsure."

Finally, to ascertain whether there was bias in follow-up related to sexual orientation identity, we examined the number of waves of follow-up provided by participants, comparing those who self-reported their sexual orientation identity as mostly heterosexual, bisexual, mostly homosexual, or completely homosexual (i.e., minority sexual orientation) or "unsure" in the 1999 wave to those who self-reported completely heterosexual in 1999. We found that the mean number of waves of follow-up did not differ in sexual orientation minorities versus completely heterosexuals in both males and females. Likewise, we found that the mean number of waves of follow-up did not differ in males versus females.

Results

The number of surveys and transitions that each of the participants contributed to the analyses are shown in Table 1.Combining reports across the four waves, 10% of males and 20% of females at some point described themselves as mostly heterosexual, bisexual, mostly homosexual, or completely homosexual, while 2% of both males and females reported ever

being "unsure" of their orientation. Cross-sectional distributions (including reports from four waves of data collection) of sexual orientation identity by age are shown in Fig. 1. It can be seen that the proportion of participants describing themselves in each of the sexual orientation identity subgroups varied widely by age and gender. For instance, over the 10-year period from age 13 to 23 years, among males, the proportion describing themselves as mostly heterosexual rose from 2.4 to 5.9%, as bisexual from 0.4 to 0.6%, and as mostly or completely homosexual from 0.3 to 3.5%. Over the same 10-year age period among females, the proportion describing themselves as mostly heterosexual rose from 4.0 to 12.3%, as bisexual from 0.6 to 2.1%, and as mostly or completely homosexual from 0 to 1.0%. In comparison, the proportion describing themselves as completely heterosexual or "unsure" of their orientation decreased with age in both males and females.

Results of generalized estimating equation models using repeated measures to examine observed gender and age patterns in each sexual orientation identity category indicated that, after adjusting for age, gender predicted all sexual orientation identity subgroups, as shown in Table 2 ($p<05$). Male gender was positively associated with identifying as completely heterosexual, mostly homosexual, and completely homosexual, while female gender was positively associated with identifying as mostly heterosexual, bisexual, and "unsure." After adjusting for gender, older age was positively associated with all sexual minority groups ($p<05$ for all models). Identifying as completely heterosexual or "unsure" decreased significantly with age, while identifying with any of the sexual orientation identity minority categories increased significantly with age. No age by gender interactions were detected.

Transition matrices (with their corresponding mobility scores with standard errors below their respective transition matrix) are shown in Table 3 for males and Table 4 for females. For example, in Table 3, by examining the first column and second row of the transition matrix of younger males, it can be seen that 55.1% of the transitions that occurred among 12–17 year old males who reported a sexual orientation identity of mostly heterosexual changed their report to completely heterosexual at the next report. The mobility score ($M = 0.081$) for this transition matrix indicated that, of all of the transitions (that is, all the occurrences of two consecutive waves of data) that occurred among males who were 12–17 years old, 8.1% of transitions resulted in a change in reported sexual orientation identity. In analyses stratified by gender, mobility scores did not differ by age group (males $p = .27$; females $p = .22$), indicating that the amount of mobility in sexual orientation identity (that is, the likelihood of changes in reported sexual orientation identity) did not differ significantly for youth ages 12–17 years compared to those ages 18–21 years. However, there was a significant difference in mobility scores by gender, with females having a higher mobility than males in the younger group ($p<0001$) and older group ($p = .0002$) (see Tables 3, 4).

Mobility scores with their standard errors at each integer age in years for males and females are shown in Figs. 2, 3, 4, and 5. Inspection of these figures supports five key observations: (1) Mobility scores were relatively low (approximately 0.1) when the consistently completely heterosexual group was included in the sample (Figs. 2, 3), because this group, by definition, had zero mobility and they made up the vast majority (78.5%) of the sample of transitions. (2) When the consistently completely heterosexual group was included in the sample, with or without the "unsure" group, females reported higher mobility than males (Figs. 2, 3). Consistently completely heterosexuals made up a larger proportion of transitions among males than among females (84.0% vs. 75.2% of transitions). (3) While mobility scores appeared to peak at the youngest ages (see especially Fig. 4), when the "unsure" group was excluded (see Fig. 5), this peak appeared attenuated and scores were stable throughout most of the observed age period. As mentioned previously, however, tests of age differences in mobility were not statistically significant. (4) When consistently completely heterosexuals were excluded from the sample (Figs. 4, 5), as expected, mobility scores

increased substantially (ranging from approximately 0.5 to 0.8). (5) Again, when consistently completely heterosexuals were excluded, the previously observed gender difference in mobility scores was eliminated, with gender-specific score lines even crossing at several points, indicating that sexual orientation identity mobility did not vary by gender among those who self-reported a minority sexual orientation identity at some point in the observation period.

In subanalyses to characterize trajectories in sexual orientation identity reported by individuals over three or more waves, we observed 80 distinct patterns among older boys, 89 among younger boys, 140 among older girls, and 119 among younger girls. As there were six possible sexual orientation reports, there are $6^4=1296$ possible distinct patterns among those who reported their sexual orientation identity for all four waves. The patterns of sexual orientation identity trajectories are detailed in Table 5. The vast majority of the participants consistently categorized themselves as completely heterosexual.

Four chi-square tests were used to assess associations among the five main categories (immobile, mobile toward completely heterosexual, mobile toward LGB, multidirectional, and ever "unsure") in younger males and older males, younger females and older females, older males and older females, and younger males and younger females. All four tests resulted in 4 degree of freedom chi-square test statistics of 36.7, 47.2, 70.2, and 72.9, respectively, all with $p<.001$, indicating that there were significant age and gender differences in the distribution of sexual orientation identity trajectories. Tests were also conducted to compare the proportion of immobile participants in each subpopulation. Again, four chi-square tests were conducted between younger males and older males, younger females and older females, older males and older females, and younger males and younger females. We found in these analyses that male gender and older age were associated with greater immobility (1 degree of freedom chi-square test statistics of 10.6, 39.9, 68.4, and 4.0 all ps<.05). Similarly, we conducted four chi-square tests to compare the proportions of ever "unsure" and found that there were no gender differences (1 degree of freedom chi-square test statistic of 0.3, when comparing younger males to younger females, and 1 degree of freedom chi-square test statistic of 1.0, when comparing older males to older females); however, there were significant age differences for ever reporting "unsure," where those in the younger groups were more likely to ever report "unsure" than those in the older groups (1 degree of freedom chi-square test statistic of 39.7, for younger males vs. older males, $p<.01$ and 1 degree of freedom chi-square test statistic of 65.8 for younger females vs. older females, $p<.01$).

Of those who reported their sexual orientation identity at least three times, 238 participants reported "unsure" at least once, including 16 who reported "unsure" more than once, with 80% of those reporting "unsure" at their first sexual orientation identity report. Four percent of the younger boys, 1% of older boys, 4% of younger girls, and 1% of older girls who had reported sexual orientation identity at least three times ever reported "unsure." Among those who ever described themselves as "unsure" of their orientation identity, 34% at some point described themselves as sexual minority (that is, mostly heterosexual or LGB), whereas, among those who never reported "unsure," only 18% described themselves as sexual minority; this difference was statistically significant ($p<.001$).

Discussion

We examined stability and change in the identity dimension of sexual orientation over time among young people by applying methods from econometrics, including transition matrices and mobility scores. Working with data from the large, prospective GUTS cohort of adolescents, we found gender differences in some analyses but not others. In cross-sectional

distribution analyses using repeated measures, we found male gender was positively associated with identifying as completely heterosexual, mostly homosexual, and completely homosexual, while female gender was positively associated with identifying as mostly heterosexual, bisexual, and unsure. In subanalyses to examine the wide range of individual trajectories in sexual orientation identity throughout adolescence in those with three or more waves of orientation data, we found females to be more likely than males to report multidirectional trajectories. When applying transition matrices and mobility score methods, we found that mobility scores were relatively low (approximately 0.1) when the full GUTS cohort was examined, and, again, there was a gender difference in which females reported a higher level of sexual orientation identity mobility than did same-age males. When the sample was restricted to participants who reported a minority sexual orientation identity at some point during the period of study, mobility scores increased appreciably (to roughly 0.5), as expected, but importantly, the results indicated that the gender difference was eliminated and was no longer statistically significant.

In additional findings, age was not a significant predictor of mobility score, suggesting that mobility in orientation identity occurred at a similar rate throughout adolescence and into emerging adulthood in people who report a minority orientation identity. Thus, while it has been proposed that attractions to the same or other sex may usually emerge subsequent to the onset of adrenal puberty (Herdt & McClintock, 2000), our findings suggest that sexual orientation identity development in sexual minority populations is a dynamic process that may occur over a period of years at least through adolescence and emerging adulthood, which are the life stages we examined in our study. Our findings also suggest that the degree of sexual orientation identity mobility was similar for female and male youth who reported a minority sexual orientation identity. Finally, we were also able to shed light on the subsequent sexual orientation identity of youth who were "unsure" of their orientation at an earlier time, finding that these youth were more likely to eventually describe themselves as completely heterosexual than as a sexual minority.

Patterns by Gender

A number of theorists have argued that sexual orientation in women is more mobile or fluid than in men (Baumeister, 2000; Diamond, 2008b; Peplau, 2001). The small body of empirical literature addressing this question, however, has been equivocal, and three prior prospective studies in adolescents have been suggestive though not definitive regarding gender differences in sexual orientation mobility (Dickson et al., 2003; Rosario et al., 2006; Savin-Williams & Ream, 2007). Our findings suggest that in relation to the identity dimension of sexual orientation, gender differences in mobility may vary by subgroup. On the one hand, in support of gender differences in mobility, we found in the cohort as a whole that females scored higher than males on our mobility measure. This finding can be attributed to our observation that a larger proportion of females (22%) than males (12%) endorsed an orientation identity other than "completely heterosexual" at some point during the study period. Our finding of a higher prevalence of minority sexual orientation identity in females than males is consistent with several other recent cohort studies (Dickson et al., 2003; Fergusson, Horwood, Ridder, & Beautrais, 2005; Savin-Williams & Ream, 2007; Wichstrøm, 2006), all of which assessed sexual orientation identity with a measure similar to our own in that they included a response option comparable to our "mostly heterosexual" option, an orientation identity category endorsed by females more often than by males and that has become an area of special interest in the study of female sexuality (Austin, Roberts, Corliss, & Molnar, 2008; Corliss, Austin, Roberts, & Molnar, 2009; Thompson & Morgan, 2008).

On the other hand, in our cohort, we did not find evidence of gender differences when the sample was restricted to those who endorsed a minority sexual orientation identity,

suggesting that perhaps characterizations in the literature (Baumeister, 2000; Diamond, 2007;Peplau, 2001) of sexual orientation in females as more mobile or fluid than that in males may not apply to orientation identity among sexual minorities during adolescence and emerging adulthood and therefore need further refinement. We did not, however, examine mobility in the sexual orientation dimensions of sexual attractions or sex of partners, so our findings cannot address whether there are gender differences in mobility in these dimensions. Similarly, our findings do not address whether there may be gender differences in orientation mobility later in adulthood.

Patterns by Age and "Unsure" Status

While adolescence is understood as a prime period for sexual orientation development (Perrin, 2002; Rosario et al., 2006; Troiden, 1989), we found age did not predict mobility scores, indicating that changes in reported orientation identity were occurring at a similar rate in the cohort throughout adolescence and into emerging adulthood and were not preponderant in any one period. This finding may be consistent with Peplau et al.'s (1999) conceptualization of the Intimate Careers Model of female sexuality, which posits that attractions to the same or other sex may shift throughout the life course and are not fixed at birth or in early adolescence. While Peplau et al.'s Intimate Careers Model was developed to apply only to females, we found that males in our cohort were similar to females in reporting changes in their sexual orientation identity throughout adolescence and emerging adulthood. It is important to note that though changes occurred fairly evenly throughout adolescence in the cohort as a whole, there may be subgroups of youth who are more likely to experience orientation identity changes earlier or later.

In our examination of youth who described themselves as "unsure" of their orientation identity, we found that an "unsure" response was most prevalent at the youngest ages in our cohort and precipitously declined with age, consistent with prior literature (Remafedi et al., 1992; Saewyc et al., 2004). We found that females were more likely to report "unsure" when taking into account repeated measures and adjusting for age, however we found no gender differences when we created a trajectory category for "ever unsure." This suggests that while males and females are equally likely to be unsure of their sexual orientation at some point, females may remain in this state for a longer period of time. Other studies of adolescents have found higher prevalence of reported "unsure" orientation identity in females (Narring et al., 2003) or in males (Remafedi et al., 1992).

Subanalyses to examine individual trajectories in sexual orientation identity over three or more waves identified over 100 unique permutations, which we subtyped into four general trajectory patterns: immobile, toward completely heterosexual, toward LGB, and multidirectional. Participants who ever described themselves as having an orientation identity other than completely heterosexual were fairly evenly distributed across the four trajectory patterns. In addition, examination of the subset of participants who said they were "unsure" of their orientation identity at one or more waves revealed that the majority (66%) selected completely heterosexual rather than the sexual minority categories at other waves, indicating that it should not be assumed that "unsure" youth will eventually go on to describe themselves as other than completely heterosexual. Both the individual-level, trajectory data and the group-level data were consistent regarding the largely heterosexual orientation identity of youth who originally had been "unsure." We had hypothesized that the majority of youth who reported that they were "unsure" of their orientation identity would eventually go on to describe themselves as sexual minority, but this hypothesis was not borne out. It is possible that problems with question comprehension more so than reticence to report a stigmatized identity may be an important factor when youth choose the "unsure" response option. Working with cross--sectional data from eight school-based studies of adolescent health, Saewyc et al. (2004) found that younger age, immigrant status,

and learning disabilities were positively associated with reporting an "unsure" sexual orientation identity. It will be important to determine whether an "unsure" response reflects uncertainty about their heterosexuality, confusion about the question wording, or something else and to gauge the consistency of their heterosexual orientation through adulthood.

Limitations

Potential limitations of this study are acknowledged. The mobility measure we used to categorize the transition matrices did not take into account directionality of transitions or magnitude of changes. We chose not to use a measure of magnitude, however, because we were hesitant to make the assumption that all one-unit transitions were of equal magnitude. For instance, one may question whether the magnitude of difference between completely heterosexual and mostly heterosexual is equal to that of the difference between mostly heterosexual and bisexual. Furthermore, the inclusion of the "unsure" category precluded the use of a mobility measure that incorporated either magnitude of change or direction of change. Future research should investigate ways to characterize and quantify the magnitude of differences between sexual orientation identity categories. Assessing sexual orientation identity at roughly 2-year intervals may not capture all of the orientation identity mobility occurring in the cohort. It is not known whether multiple changes occurring in a short interval (e.g., over a few months) carry different meaning and implications than changes occurring over a protracted period (e.g., over a decade). In addition, sexual orientation is considered a multidimensional construct (Institute of Medicine, 1999; Laumann et al., 1994), and mobility in one dimension, such as sexual orientation identity, may differ from mobility in other dimensions, such as attractions or sex of sexual partners (Diamond, 2003; Rosario, Schrimshaw, & Hunter, 2008; Savin-Williams & Ream, 2007). Short-term test-retest reliability data were not available for the sexual orientation identity measure used in our study; therefore, it is not possible to compare changes in reported orientation identity over a very short interval to those we observed over a 2-year interval. In addition, the inclusion of the parenthetical clause "equally attracted to men and women" for the bisexual response option may have been confusing for participants at the youngest ages (e.g., 12 years old) because of the use of adult-implied terms (i.e., men and women) rather than child-implied terms (i.e., boys and girls). Similarly, the terms *heterosexual* and *homosexual* may have been confusing to the youngest participants or those whose reading ability was below grade level (Saewyc et al., 2004). Furthermore, our cohort was not a representative sample of U.S. youth and lacked racial diversity, which limits generalizability of results. Our study's strengths include the comparatively large size of our cohort and the longitudinal design, with repeated measurement of sexual orientation identity at four survey waves during the critical years of adolescent development. In addition, participants were not enrolled on the basis of sexual orientation identity, which eliminates selection bias associated with sexual orientation.

Conclusions

The overarching goals of our study were twofold: To offer substantive insights into sexual orientation identity mobility in adolescence and emerging adulthood while also expanding the available methodological repertoire for scientific study of the development of sexual orientation. Substantively, our study advanced understanding of sexual orientation identity mobility in several ways: (1) Greater mobility was observed in females compared to males in the cohort as a whole but not within sexual minorities. (2) Mobility occurred at a relatively constant rate throughout adolescence and emerging adulthood and was not confined to the early adolescent period. (3) The majority of youth reporting that they were "unsure" of their orientation identity eventually went on to describe themselves as completely heterosexual, not sexual minority.

Methodologically, with the novel application of transition matrices and mobility scores, we were able to quantify the degree of mobility in population subgroups, such as females versus males and younger versus older adolescents, and to conduct statistical testingofdifferences in mobility across sub-populations. In addition, these methods have the potential to advance quantitative study of dynamism not only in sexual minority populations but also in other groups characterized by status dynamism, such as multiracial populations (Doyle & Kao, 2007; Harris & Sim, 2002; Hitlin, Brown, & Elder, 2006). These incremental advances provide a methodological basis for further investigation of potentially important dimensions of mobility, such as frequency (e.g., reports of consistent orientation vs. multiple changes over a set time period) and duration (e.g., short vs. protracted period of changing orientation during adolescence). These methods may also facilitate future study of other dimensions of mobility, such as direction of transition (e.g., from heterosexual to bisexual vs. bisexual to heterosexual, etc.) and locus of transition (e.g., mobility at the heterosexual range of the measure vs. at the lesbian/gay range of the measure, etc.). With rigorous methods to empirically characterize sexual orientation mobility, future research may lead to new understanding of both the development of sexual orientation and potential links between the timing and nature of sexual orientation mobility and important dimensions of life experience, such as health and adjustment.

Acknowledgments

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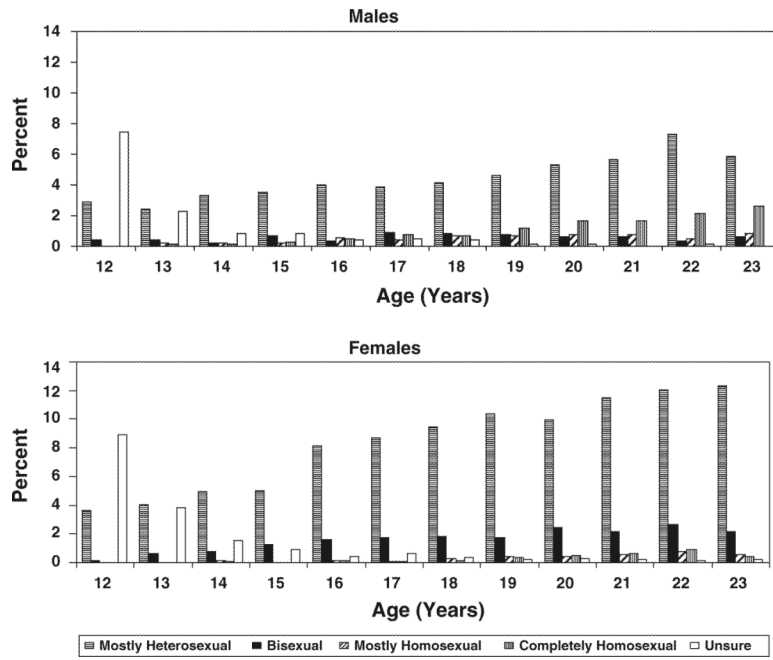
Fig. 1.
Population proportions for each sexual orientation identity minority group, by age

Fig. 2.
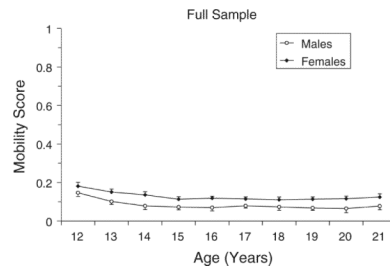Sexual orientation identity mobility scores and standard error bars in the full sample of adolescents

Fig. 3.
Sexual orientation identity mobility scores and standard error bars in a subsample of adolescents, excluding the "unsure" group

Fig. 4.
Sexual orientation identity mobility scores and standard error bars in a subsample of adolescents, excluding the consistently completely heterosexual group

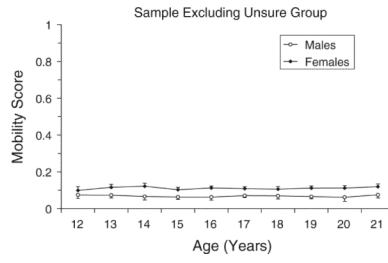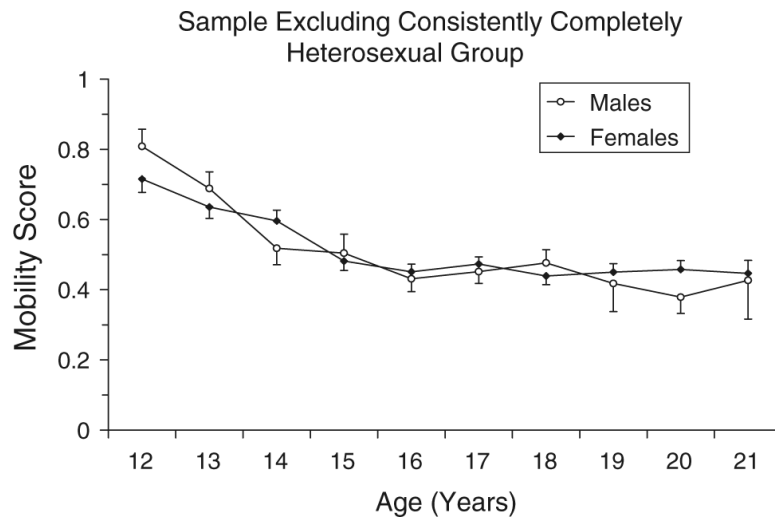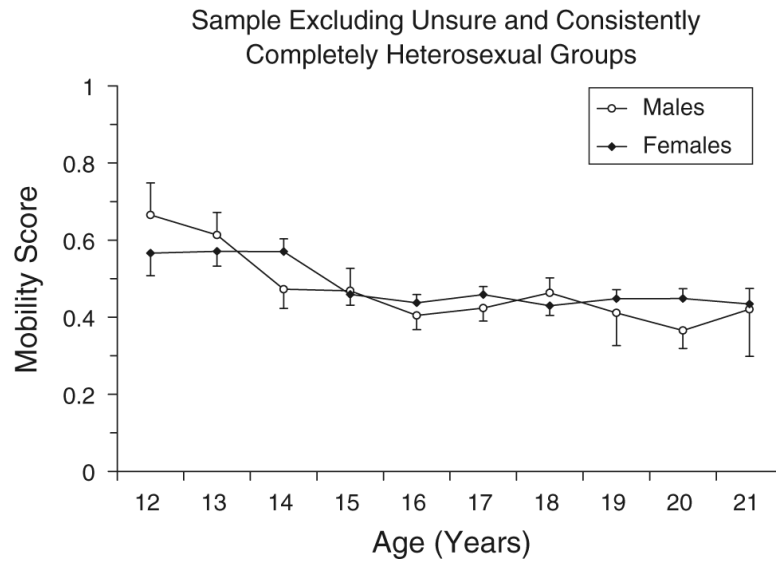**Fig. 5.**
Sexual orientation identity mobility scores and standard error bars in a subsample of
adolescents, excluding both the "unsure" and consistently completely heterosexual groups

Table 1

Participants in the Growing Up Today Study reporting sexual orientation identity across multiple waves of data collection (1999–2005) from ages 12 to 23 years

	Males (N = 5,887)	Females (N = 7,953)
Mean age at first report of sexual orientation identity, in years (*SD*)	16.1 (2.6)	16.0 (2.4)
Number of waves in which participant reported sexual orientation identity	*n* (%)	*n* (%)
One survey[a]	1,269 (21.6)	927 (11.7)
Two surveys	1,131 (19.2)	1,036 (13.0)
Three surveys	1,454 (24.7)	1,826 (23.0)
Four surveys	2,033 (34.5)	4,164 (52.4)
Number of transitions included in analysis for each participant	*n* (%)	*n* (%)
None[a]	1,541 (26.2)	1,190 (15.0)
One	1,060 (18.0)	1,012 (12.7)
Two	1,364 (23.2)	1,809 (22.7)
Three	1,922 (32.6)	3,942 (49.6)

[a] Participants with only one survey were included in the cross-sectional analysis, though not in the mobility analyses

Table 2

Multivariable odds of self-reported sexual orientation identity category associated with gender and age[a]

Predictors	Sexual orientation identity				
	Completely heterosexual	Mostly heterosexual	Bisexual	Mostly homosexual	Completely homosexual	"Unsure"
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Female gender[b]	0.57 (0.51, 0.63)	2.12 (1.89, 2.38)	2.68 (2.10, 3.42)	0.52 (0.36, 0.76)	0.32 (0.21, 0.47)	1.36 (1.07, 1.74)
Age[c]	0.93 (0.92, 0.94)	1.11 (1.09, 1.12)	1.11 (1.08, 1.15)	1.24 (1.17, 1.32)	1.32 (1.26, 1.39)	0.61 (0.57, 0.65)

[a] Separate multivariable generalized estimating equation models were used to examine gender and age as predictors of each sexual orientation identity category, using all available waves of data (1999, 2001, 2003, and 2005); all models control for both gender and age

[b] Gender odds ratios (OR) and 95% confidence intervals (CI) use males as the referent group

[c] Age ORs associated with one-year increase in age

Table 3

Sexual orientation identity transition matrices and mobility scores for male adolescents, by age group

	Sexual orientation identity at end of transition						
	Completely heterosexual	Mostly heterosexual	Bisexual	Mostly homosexual	Completely homosexual	"Unsure"	N observations
Males 12–17 years old at start of transition							
Sexual orientation identity at start of transition							
Completely heterosexual	0.961	0.030	0.004	0.002	0.001	0.003	5,658
Mostly heterosexual	0.551	0.369	0.044	0.018	0.009	0.009	225
Bisexual	0.394	0.182	0.182	0.121	0.091	0.030	33
Mostly homosexual	0.125	0.042	0.042	0.333	0.458	0	24
Completely homosexual	0.107	0	0	0.143	0.750	0	28
"Unsure"	0.763	0.088	0.038	0.038	0.063	0.013	80
		$M^a=0.081$, $SE(M)^b=0.006$					
Males 18–21 years old at start of transition							
Sexual orientation identity at start of transition							
Completely heterosexual	0.962	0.034	0.002	0.002	0.001	<0.001	3,244
Mostly heterosexual	0.376	0.533	0.049	0.024	0.018	0	165
Bisexual	0	0.238	0.333	0.286	0.143	0	21
Mostly homosexual	0	0	0.042	0.458	0.500	0	24
Completely homosexual	0.022	0	0	0.087	0.891	0	46
"Unsure"	0.500	0	0	0.167	0.333	0	6
		$M^a=0.068$, $SE(M)^b=0.010$					

[a] M = mobility measure score for full sample within gender and age group

[b] $SE(M)$ = standard error of mobility measure score

Table 4

Sexual orientation identity transition matrices and mobility scores for female adolescents, by age group

	Sexual orientation identity at end of transition						
	Completely heterosexual	Mostly heterosexual	Bisexual	Mostly homosexual	Completely homosexual	"Unsure"	N observations
Females 12–17 years old at start of transition							
Sexual orientation identity at start of transition							
Completely heterosexual	0.929	0.059	0.009	0.001	<0.001	0.001	8,862
Mostly heterosexual	0.460	0.442	0.073	0.010	0.003	0.012	674
Bisexual	0.172	0.343	0.422	0.031	0.031	0	128
Mostly homosexual	0	0.125	0.125	0.250	0.375	0.125	8
Completely homosexual	0.286	0	0.143	0.143	0.429	0.000	7
"Unsure"	0.734	0.130	0.039	0.006	0.013	0.078	154
		M^a=0.125, $SE(M)^b$=0.005					
Females 18–21 years old at start of transition							
Sexual orientation identity at start of transition							
Completely heterosexual	0.938	0.056	0.004	0.001	0.001	0.001	5,785
Mostly heterosexual	0.347	0.553	0.074	0.012	0.003	0.009	645
Bisexual	0.067	0.311	0.481	0.059	0.081	0	135
Mostly homosexual	0.050	0.150	0.200	0.350	0.250	0	20
Completely Homosexual	0.050	0	0.050	0.250	0.650	0	20
"Unsure"	0.278	0.222	0.111	0.111	0.056	0.222	18
		M^a=0.114, $SE(M)^b$=0.007					

[a] M = mobility measure score for full sample within gender and age group

[b] $SE(M)$ = standard error of mobility measure score

Table 5

Sexual orientation identity trajectories of adolescents, by age group[a] and gender (*N*=9536)[a]

	Younger males (*n*=1775) *n* (%)	Older males (*n*=1735) *n* (%)	Younger females (*n*=2758) *n* (%)	Older females (*n*=3268) *n* (%)
Immobile				
Completely heterosexual	1497 (84.3%)	1486 (85.7%)	2108 (76.4%)	2505 (76.7%)
Mostly heterosexual	4 (0.2%)	22 (1.3%)	17 (0.6%)	67 (2.1%)
LGB[c]	3 (0.2%)	29 (1.7%)	2 (0.1%)	18 (0.6%)
Towards completely heterosexual				
Mostly heterosexual to completely heterosexual	36 (2.0%)	32 (1.8%)	69 (2.5%)	122 (3.7%)
LGB to completely heterosexual	6 (0.3%)	2 (0.1%)	9 (0.3%)	6 (0.2%)
LGB to mostly heterosexual	0	0	5 (0.2%)	16 (0.5%)
Toward LGB				
Completely heterosexual to mostly heterosexual	60 (3.4%)	67 (3.9%)	187 (6.8%)	209 (6.4%)
Completely heterosexual to LGB	27 (1.5%)	14 (0.8%)	49 (1.8%)	49 (1.5%)
Mostly heterosexual to LGB	3 (0.2%)	9 (0.5%)	7 (0.3%)	31 (1.0%)
Multidirectional				
First and last report is completely heterosexual	44 (2.5%)	30 (1.7%)	105 (3.8%)	106 (3.2%)
First and last report is mostly heterosexual	7 (0.4%)	14 (0.8%)	20 (0.7%)	51 (1.6%)
First and last report is LGB	1 (<0.1%)	1 (0.1%)	0	6 (0.2%)
Other multidirectional	16 (0.9%)	16 (0.9%)	60 (2.2%)	48 (1.5%)
Ever "unsure"	71 (4.0%)	13 (0.8%)	120 (4.4%)	34 (1.0%)

[a]The younger group included participants who were 12–15 years old at the time of first sexual orientation identity report; the older group included participants who were older than 15 at the time of first sexual orientation identity report, with the oldest age at first sexual orientation identity report being 22.7 years

[b]This table includes only participants with at least three sexual orientation identity reports

[c]LGB category in this table combined bisexual, mostly homosexual, and completely homosexual