



Factors associated with sexual orientation and gender disparities in chronic pain among U.S. adolescents and young adults

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ABSTRACT

This research investigated factors associated with sexual orientation disparities in chronic pain frequency among youth. Data were analyzed from 4534 female and 3785 male youth from Waves I–IV (1995–2009) of the U.S. National Longitudinal Study of Adolescent to Adult Health. Gender-stratified weighted logistic regression models controlled for sociodemographic characteristics and included sexual orientation (primary predictor) and frequency of three types of chronic pain (outcomes). Models with sexual orientation only were compared to models with factors hypothesized to increase or decrease risk of pain. Significant odds ratios (OR) for chronic pain frequency (daily/weekly vs. rarely) with confidence intervals (CI) and associated factors are reported. Compared to same-gender heterosexual females, mostly heterosexuals were more likely to report headaches (OR = 1.40, CI = 1.09, 1.79) and mostly heterosexuals and bisexuals were more likely to report muscle/joint pain (mostly heterosexual OR = 1.69, CI = 1.29, 2.20; bisexual OR = 1.87, CI = 1.03, 3.38). Compared to same-gender heterosexual males, gay males were more likely to report headaches (OR = 2.00, CI = 1.06, 3.82), but less likely to report muscle/joint pain (OR = 0.28, CI = 0.11, 0.74). Significant disparities were attenuated by up to 16% when associated factors were added to the model. Sexual orientation disparities in chronic pain were partially explained by associated factors, but more research is needed to develop intervention and prevention strategies.

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Introduction

Pain, defined as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” is subjective and constitutes both a physical and emotional experience (International Association for the Study of Pain, 2012). Chronic pain, defined as ongoing or recurrent pain lasting more than several months (American Chronic Pain Association, 2015), constitutes a major public health problem in the United States (Institute of Medicine, 2011), with females reporting greater pain than males (Keogh and Eccleston, 2006). Compared to heterosexuals, sexual minority adults are at greater risk for functional limitations due

to pain (Case et al., 2004) and multiple sites of pain, including headaches, migraines, abdominal pain, digestive complaints, back pain, shoulder/neck pain, and arthritis (Cochran and Mays, 2007; Roberts et al., 2013; Sandfort et al., 2006). Sexual minority refers to non-heterosexual orientation, including mostly heterosexual, bisexual, and lesbian/gay. Only one study of sexual orientation disparities in chronic pain among youth exists, which found greater risk of headache, abdominal pain, and pelvic pain among females and sexual minorities than among males and heterosexuals, respectively (Roberts et al., 2013). Sexual orientation disparities in chronic pain are likely related to minority stress (Meyer, 2003), which refers to prejudice and discrimination related to being a sexual minority. However, research is needed to identify specific factors related to greater pain in sexual minority youth.

A number of factors may be associated with an increased risk of chronic pain among sexual minorities compared to heterosexuals. In the study described above, sexual orientation disparities in pain were partially (14–33%) accounted for by child abuse history (Roberts et al., 2013). Other research has demonstrated associations between

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depression and abdominal pain (Youssef et al., 2008) and suicidality and pain (Fishbain et al., 2014). Sexual minorities are at greater risk for depression and suicidality than heterosexuals (King et al., 2008; Meyer, 2003), which may be related to disparities in pain. Associations between pain and depression may also differ by gender. Females are at greater risk than males for depression, beginning in adolescence (Hyde et al., 2008). One study found that although female and male youth reported similar levels of headache and abdominal pain, females reported more depressive symptoms (Kaczynski et al., 2009). While it is unclear whether depression and suicidality are an antecedent or consequence of pain, results suggest potential gender and sexual orientation group differences in risk factors for pain.

Other factors may be associated with a decreased risk of chronic pain among sexual minorities compared to heterosexuals. Family acceptance is protective for sexual minority adolescents' mental and physical health (Ryan et al., 2010), and a study of adults with chronic pain found that greater family support was associated with less pain intensity (Jamison and Virts, 1990). Although previous research has indicated peer relationship deficiencies among adolescents with chronic pain across multiple types (Forgeron et al., 2010), social support from friends may be protective for pain. Self-esteem is also likely to be protective and is associated with lower headache frequency among adolescents (Stanford et al., 2008). Sexual minority adolescents report lower self-esteem than heterosexuals (Jager and Davis-Kean, 2011), which may put them at greater risk for chronic pain.

The current study used data from the National Longitudinal Study of Adolescent to Adult Health (Add Health), a nationally representative study of U.S. youth, to prospectively examine potential factors to increase or decrease risk of chronic pain in sexual minority compared to heterosexual adolescents and young adults. We hypothesized that all sexual minority groups (mostly heterosexual, bisexual, lesbian/gay) would report greater pain frequency than heterosexuals and that factors hypothesized to increase and decrease risk of chronic pain would partially explain sexual orientation differences in pain. We further

hypothesized that sexual minority females will be at greatest risk for pain, compared to other gender and sexual orientation groups, and that this risk may emerge through a depression pathway.

Material and methods

Study sample

The study population was 14,738 adolescents who completed in-home questionnaires during Waves I–IV of Add Health (Harris et al., 2009). Data were collected as follows: Wave I (1995), Wave II (1996), Wave III (2001–2002), and Wave IV (2008–2009). Participants who were in the 12th grade at Wave I were not followed up in Wave II. After exclusion criteria (described below) were applied, the final analytic sample included a total of 8319 participants (4534 females, 3785 males). Participants were ages 11–21 years at Wave I and ages 24–34 years at Wave IV. Other sociodemographic characteristics are reported for females in Table 1 and for males in Table 2.

Participants were excluded if they were missing sampling weights at Wave II ($n = 1168$, 8%) or any missing data on the outcomes, predictors, or covariates, with the exception of parental education and income. Participants were excluded if they were missing any of the chronic pain outcome variables ($n = 2190$, 16%). Participants were excluded if they were missing data on sexual orientation at both Waves III and IV ($n = 2507$, 18%) or responded “not sexually attracted to either males or females” to the sexual orientation question at either Wave III ($n = 42$, 0.34%) or Wave IV ($n = 39$, 0.3%). Participants were also excluded if they were missing any other covariates ($n = 5139$, 38%) or reported ever having a diagnosis of cancer at Wave IV due to concern for disease-related chronic pain ($n = 140$, 13%); other diagnoses were not clearly linked to chronic pain and did not serve as exclusion criteria. This study was approved by the Boston Children's Hospital Institutional Review Board.

Table 1
Female sociodemographics by sexual orientation from weighted analysis of 4534 youth in the U.S. National Longitudinal Study of Adolescent to Adult Health (1995–2009).

Measure	Completely heterosexual ($n = 3952$)		Mostly heterosexual ($n = 431$)		Bisexual ($n = 105$)		Lesbian ^a ($n = 46$)		p-value ^b
	Weighted mean (SE)		Weighted mean (SE)		Weighted mean (SE)		Weighted mean (SE)		
Age in years	15.9 (0.12)		15.7 (0.15)		15.8 (0.26)		16.3 (0.29)		0.12
Parental income (% FPL)	2.72 (0.05)		2.94 (0.39)		2.69 (0.24)		2.56 (0.31)		0.90
	<i>n</i>	Weighted % (SE)	<i>n</i>	Weighted % (SE)	<i>n</i>	Weighted % (SE)	<i>n</i>	Weighted % (SE)	
Race/ethnicity									0.01
White	2119	68% (3.1)	261	72% (3.3)	72	87% (2.9)	24	74% (7.2)	
Black/African-American	838	15% (2.2)	51	8% (1.6)	12	5% (1.9)	8	9% (3.8)	
Latino/Hispanic	551	10% (1.6)	63	10% (2.1)	14	6% (2.3)	11	10% (5.1)	
American Indian/ Native American	17	0.3% (0.2)	4	1% (0.5)	0	0% (0.0)	1	2% (1.8)	
Asian/Pacific islander	226	3% (0.8)	21	2% (0.8)	3	0.1% (0.09)	0	0% (0.0)	
Multiracial	201	4% (0.4)	29	7% (1.4)	6	2% (0.9)	4	5% (3.0)	
Parental education									0.66
Less than high school	419	10% (0.6)	59	13% (1.9)	12	11% (4.1)	9	9% (3.8)	
Graduated high school	1058	27% (1.0)	104	26% (2.7)	31	31% (5.6)	6	25% (10.0)	
Some college	1341	35% (0.9)	155	36% (3.3)	39	38% (6.4)	19	44% (9.7)	
College graduate	1134	28% (1.0)	113	24% (2.6)	23	21% (5.0)	12	21% (7.1)	
Weight status ^c									0.33
Underweight	108	3% (0.3)	11	2% (1.0)	1	1% (1.3)	1	2% (2.3)	
Healthy weight	2915	74% (1.2)	325	75% (2.8)	69	66% (5.8)	33	72% (9.2)	
Overweight	555	14% (0.8)	54	12% (1.8)	18	18% (4.9)	8	24% (9.0)	
Obese	374	9% (0.7)	41	10% (2.0)	17	15% (3.9)	4	2% (1.7)	

^a Lesbian combines “mostly gay” and “100% gay.”

^b Results from t-tests and chi-square analyses to test the differences among sexual orientation groups within each gender group for each sociodemographic variable.

^c Weight status was created from continuous body mass index (kg/m^2), which was calculated from self-reported height and weight, as follows: *underweight* (<5th percentile), *healthy weight* (5th \leq BMI < 85th percentile), *overweight* (85th \leq BMI < 95th percentile), *obese* (\geq 95th percentile) (Centers for Disease Control and Prevention, 2011).

Table 2

Male sociodemographics by sexual orientation from weighted analysis of 3785 youth in the U.S. National Longitudinal Study of Adolescent to Adult Health (1995–2009).

Measure	Completely heterosexual (n = 3552)		Mostly heterosexual (n = 131)		Bisexual (n = 23)		Gay ^a (n = 79)		p-value ^b
	Weighted mean (SE)		Weighted mean (SE)		Weighted mean (SE)		Weighted mean (SE)		
Age in years	16.0 (0.12)		16.2 (0.26)		15.5 (0.43)		16.5 (0.29)		0.18
Parental Income (% FPL)	2.74 (0.06)		3.24 (0.55)		2.53 (0.46)		2.90 (0.54)		0.69
	n	Weighted % (SE)	n	Weighted % (SE)	n	Weighted % (SE)	n	Weighted % (SE)	
Race/ethnicity									0.05
White	1974	69% (2.9)	82	80% (4.5)	12	72% (11.9)	33	56% (7.6)	
Black/African-American	627	12% (1.8)	14	6% (2.2)	2	10% (9.0)	10	7% (3.0)	
Latino/Hispanic	523	11% (1.7)	19	8% (2.9)	7	13% (8.6)	19	16% (5.5)	
American Indian/ Native American	18	0.7% (0.3)	1	0.5% (0.5)	1	4% (3.8)	0	0% (0)	
Asian/Pacific islander	230	3% (0.8)	10	5% (2.0)	1	0.2% (0.3)	10	8% (3.5)	
Multiracial	180	5% (0.5)	5	1% (0.7)	0	0% (0)	7	12% (4.7)	
Parental education									0.80
Less than high school	395	11% (0.8)	12	9% (3.4)	2	17% (11.2)	9	13% (5.8)	
Graduated high school	952	26% (1.0)	33	22% (4.2)	11	40% (13.2)	18	19% (5.9)	
Some college	1239	34% (1.1)	45	38% (7.0)	3	13% (9.1)	28	36% (7.8)	
College graduate	966	28% (1.0)	41	31% (5.5)	7	30% (12.5)	24	31% (5.5)	
Weight status ^c									<0.001
Underweight	100	3% (0.4)	4	2% (1.6)	4	24% (12.1)	2	1% (1.4)	
Healthy weight	2445	68% (1.2)	78	53% (6.0)	15	66% (13.3)	48	70% (7.1)	
Overweight	551	16% (0.8)	21	16% (4.2)	3	10% (8.9)	16	15% (4.7)	
Obese	456	13% (0.9)	28	28% (6.1)	1	0.2% (0.2)	13	14% (5.5)	

^a Gay combines “mostly gay” and “100% gay.”^b Results from t-tests and chi-square analyses to test the differences among sexual orientation groups within each gender group for each sociodemographic variable.^c Weight status was created from continuous body mass index (kg/m²), which was calculated from self-reported height and weight, as follows: *underweight* (<5th percentile), *healthy weight* (5th ≤ BMI < 85th percentile), *overweight* (85th ≤ BMI < 95th percentile), *obese* (≥95th percentile) (Centers for Disease Control and Prevention, 2011).

Measures

Exposure

Sexual orientation identity was assessed in Waves III and IV with the item “Please choose the description that best fits how you think about yourself” and the following response options: *100% heterosexual (straight)*; *mostly heterosexual (straight), but somewhat attracted to people of your own sex*; *bisexual, that is attracted to men and women equally*; *mostly homosexual (gay), but somewhat attracted to people of the opposite sex*; *100% homosexual (gay), not sexually attracted to either males or females*. Sexual orientation reported in Wave III was used because sexual orientation identity was not measured in Waves I and II; if the Wave III report was missing, Wave IV was used. *Mostly homosexual (gay)* and *100% homosexual (gay)* were combined into a *lesbian/gay* group due to small sample sizes, yielding the following groups: *completely heterosexual* (100% heterosexual), *mostly heterosexual*, *bisexual*, *lesbian/gay*.

Outcomes

Chronic pain frequency in the past 12 months was assessed in Wave II for three types of pain: headache, stomachache/upset stomach, and aches/pains/soreness in muscles/joints. The items were worded as follows: “In the past 12 months, how often have you had a headache [stomachache or upset stomach; aches, pains, or soreness in your muscles or joints]?” Items were measured on a 5-point scale with the following response options: *never, just a few times, about once a week, almost every day, every day*. Items were recoded as: *rare (never, just a few times)*, *daily/weekly (about once a week, almost every day, every day)* (Youssef et al., 2008).

Possible mediators

Factors hypothesized to increase the risk of chronic pain frequency included: child maltreatment, depressive symptoms, and suicidality. With the exception of child maltreatment, all mediators were measured prior to the assessment of chronic pain. Frequency of child

maltreatment from parents or other adult caregivers experienced prior to 6th grade (prior to Wave II) was assessed retrospectively in Wave III with four items: physical abuse (1 item), sexual abuse (1 item), and neglect (2 items). Items were measured on a 6-point scale with the following response options: *this has never happened, 1 time, 2 times, 3–5 times, 6–10 times, more than 10 times*. Items were recoded as: *none (this has never happened), 1 or more times* (Shin and Miller, 2012). Depressive symptoms in the past week were assessed in Wave I with 19 items included on the survey from the original 20-item Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977). Items were measured on a 4-point scale with the following response options: *never or rarely, sometimes, a lot of the time, most of the time or all of the time*. Positive items were reverse-scored and a sum scale score was created, such that higher scores indicated greater depressive symptomatology (range: 0–57). Scale scores were standardized for clinical relevance to make them proportional to the original CES-D (range: 0–60) (Radloff, 1977). Suicidal ideation (*no, yes*) and frequency of suicide attempts in the past 12 months were assessed in Wave I with two items. The suicide attempts item was measured on a 5-point scale with the following response options: *0 times, 1 time, 2 or 3 times, 4 or 5 times, 6 or more times*. The item was recoded as: *never, 1 or more times*.

Factors hypothesized to decrease the risk of chronic pain frequency included: social support and self-esteem. All mediators were measured prior to the measure of chronic pain. Perceptions of social support received from adults, teachers, parents, and friends were assessed in Wave I. Items were measured on a 5-point Likert scale from 1 (*not at all*) to 5 (*very much*). A sum scale score was created, with higher scores indicating greater social support (range: 4–20). Self-esteem was assessed in Wave I with six items (Regnerus and Elder, 2003), measured on a 5-point Likert scale from 1 (*strongly agree*) to 5 (*strongly disagree*). A mean scale score was created (Kort-Butler, 2010), with higher scores indicating greater self-esteem (range: 1–5).

Possible effect modifier

Gender was assessed in Wave I as *female, male*.

Covariates

Covariates included age, race/ethnicity, weight status, parental education, parental income, and chronic pain (Wave I). Age in years was assessed at Wave II. Race/ethnicity was assessed in Wave I: *white (non-Hispanic)*, *black/African American (non-Hispanic)*, *Latino/Hispanic*, *American Indian/Native American (non-Hispanic)*, *Asian/Pacific Islander (non-Hispanic)*, *multiracial (non-Hispanic)*. Based on previous evidence for associations between obesity and chronic pain among adolescents (Hoftun et al., 2012), weight status was included as a covariate. Continuous body mass index (BMI) (kg/m^2) was calculated from self-reported height and weight, assessed in Wave I. A categorical weight status variable was created as follows: *underweight* (<5th percentile), *healthy weight* (5th \leq BMI < 85th percentile), *overweight* (85th \leq BMI < 95th percentile), *obese* (\geq 95th percentile) (Centers for Disease Control and Prevention, 2011).

Parental education and income were assessed at Wave I. Due to a high degree of missing data (~10% and 15%, respectively), these variables were imputed from race/ethnicity, parents' marital status, employment status (work full-time, work outside of home), receipt of public assistance, and neighborhood demographic and socioeconomic status factors using Gaussian normal regression. Highest level of education achieved by either parent was constructed from continuous reported education level (imputed where missing) and collapsed into 4

categories: *less than high school*, *high school graduate*, *some college*, *college graduate or beyond*. Parental income as percent of the federal poverty level was constructed from imputed household income and federal poverty cutoffs in 1996 according to the number of people living in the household. Chronic pain at Wave I was assessed the same as for Wave II (see Outcomes).

Statistical analysis

All analyses were performed in STATA (version 13.1; College Station, TX). Cross-sectional grand sampling weights were applied using svy commands to adjust for the complex survey design, including the region (strata) and primary sampling unit (school), and to account for unequal probability of sampling individuals (Chen and Chantala, 2014; Harris et al., 2009). Sexual orientation subgroup differences were tested using t-tests for continuous variables and chi-square tests for categorical variables. Weighted mean and standard error are reported for continuous variables and sampled frequency, weighted percent, and standard error are reported for categorical variables. To test the hypotheses, logistic regression models were constructed. Odds ratios (ORs) are presented for daily/weekly pain relative to rare pain. Models were gender-stratified due to established gender differences in pain (Keogh and Eccleston, 2006) and risk factors associated with chronic pain

Table 3
Female outcomes and mediators by sexual orientation from weighted analysis of 4534 youth in the U.S. National Longitudinal Study of Adolescent to Adult Health (1995–2009).

Measure	Compl hetero (n = 3952)		Mostly hetero (n = 431)		Bisexual (n = 105)		Lesbian ^a (n = 46)		p-value ^b
	n	Weighted % (SE)	n	Weighted % (SE)	n	Weighted % (SE)	n	Weighted % (SE)	
Chronic pain outcomes									
Headache									
Rare	2547	63% (1.2)	256	55% (3.0)	61	55% (5.8)	20	38% (10.3)	0.003
Weekly or daily	1405	37% (1.2)	175	45% (3.0)	44	45% (5.8)	26	62% (10.3)	
Stomachache									
Rare	3176	80% (0.8)	323	75% (3.0)	77	75% (5.3)	35	71% (8.0)	0.20
Weekly or Daily	776	20% (0.8)	108	25% (3.0)	28	25% (5.3)	11	29% (8.0)	
Muscle/joint pain									
Rare	3164	80% (1.0)	311	67% (2.5)	72	63% (6.6)	31	65% (8.9)	<0.001
Weekly or daily	788	20% (1.0)	120	33% (2.5)	33	37% (6.6)	15	35% (8.9)	
Mediators									
Child maltreatment									
Neglect									
None	3652	92% (0.5)	390	92% (1.6)	82	80% (5.5)	39	89% (5.8)	0.007
1+ times	300	8% (0.5)	41	8% (1.6)	23	20% (5.5)	7	11% (5.8)	
Physical									
None	2964	75% (1.1)	267	66% (3.1)	61	60% (6.7)	30	70% (7.9)	0.003
1+ times	988	25% (1.1)	164	34% (3.1)	44	40% (6.7)	16	30% (7.9)	
Sexual									
None	3794	96% (0.4)	393	93% (1.5)	92	91% (3.4)	39	86% (6.1)	<0.001
1+ times	158	4% (0.4)	38	7% (1.5)	13	9% (3.4)	7	14% (6.1)	
Suicidal ideation (SI)									
No	3357	85% (0.8)	323	74% (3.0)	77	78% (4.9)	34	76% (8.5)	<0.001
Yes	595	15% (0.8)	108	26% (3.0)	28	22% (4.9)	12	24% (8.5)	
Suicide attempt ^d among those with SI									
Never	408	66% (2.8)	69	61% (5.5)	17	62% (12.1)	8	85% (9.8)	0.51
1+ times	187	34% (2.8)	39	39% (5.5)	11	38% (12.1)	4	15% (9.8)	
		Weighted mean (SE)		Weighted mean (SE)		Weighted mean (SE)		Weighted mean (SE)	
Depressive symptoms ^c		16.2 (0.16)		17.6 (0.31)		18.1 (0.83)		17.2 (0.94)	<0.001
Social support ^e									
From adults		4.51 (0.02)		4.26 (0.06)		4.34 (0.10)		4.13 (0.14)	<0.001
From teachers		3.62 (0.03)		3.35 (0.05)		3.44 (0.12)		3.25 (0.15)	<0.001
From parents		4.83 (0.01)		4.73 (0.03)		4.66 (0.09)		4.70 (0.09)	0.003
From friends		4.41 (0.02)		4.38 (0.04)		4.37 (0.09)		4.63 (0.12)	0.30
Total support		17.4 (0.06)		16.7 (0.12)		16.8 (0.30)		16.7 (0.34)	<0.001
Self-esteem ^f		11.7 (0.10)		12.7 (0.29)		12.6 (0.48)		13.7 (0.63)	<0.001

^a Lesbian combines "mostly gay" and "100% gay."

^b Results from t-tests and chi-square analyses to test the differences among sexual orientation groups within each gender group for each mediator and outcome.

^c Depressive symptoms: 0–60; higher scores indicate greater depression.

^d Suicide attempts reported only for participants who responded "yes" to suicidal ideation.

^e Social support from adults, teachers, parents, friends: 1–5, total: 4–20; higher scores indicate greater social support.

^f Self-esteem: 1–5; higher scores indicate greater self-esteem.

(Kaczynski et al., 2009). Headache, stomachache, and joint/muscle pain were treated as separate outcomes, with rare frequency of pain as the reference group, because many adolescents with chronic pain may only report one type of pain (Winger et al., 2014), and it is possible that some stressors are associated with certain locations of chronic pain. Models with sexual orientation as the predictor (Model 1) were compared to models with sexual orientation, mediators hypothesized to increase the risk of pain frequency (child maltreatment, depressive symptoms, suicidality), and mediators hypothesized to decrease the risk of pain frequency (social support, self-esteem) as predictors (Model 2). All models adjusted for age, race/ethnicity, weight status, parental education, parental income, and chronic pain (headache, stomachache, and joint/muscle pain) at Wave I.

Theory

Minority Stress Theory proposes that sexual minorities experience stressors related to the stigmatization of non-heterosexuality that produce negative health outcomes (Meyer, 2003), which may include chronic pain. The Elaborated Cognitive Vulnerability-Transactional Stress Model proposes that adolescent females have greater cognitive vulnerability to depression and are more likely to encounter negative life events compared to adolescent males, leading to greater depression (Hankin and Abramson, 2001).

Results

Results from descriptive analyses are displayed for females in Table 3 and for males in Table 4. Among females, lesbians were the most likely to report headaches (62%) and bisexuals were the most likely to report muscle/joint pain (37%) (Table 3). Compared to completely heterosexual females, sexual minority females were more likely to report child maltreatment, suicidal ideation, and depressive symptoms, but less likely to report social support. Sexual minority females reported higher self-esteem than completely heterosexual females. Among males, gay males were the least likely to report muscle/joint pain (9%) (Table 4). Compared to completely heterosexual males, sexual minority males generally reported higher self-esteem, but less support from adults, with the exception of gay males who reported the most support from adults. Results comparing Model 1 to Model 2 are displayed in Table 5.

Model 1: Sexual orientation differences in chronic pain

Among females and compared to completely heterosexuals, mostly heterosexuals were more likely to report headaches, and mostly heterosexuals and bisexuals were more likely to report muscle/joint pain (Table 5). Among males and compared to completely heterosexuals, gay males were more likely to report headaches, but less likely to report

Table 4

Male outcomes and mediators by sexual orientation from weighted analysis of 3785 youth in the U.S. National Longitudinal Study of Adolescent to Adult Health (1995–2009).

Measure	Compl hetero (n = 3552)		Mostly hetero (n = 131)		Bisexual (n = 23)		Gay ^a (n = 79)		p-value ^b
	n	Weighted % (SE)	n	Weighted % (SE)	n	Weighted % (SE)	n	Weighted % (SE)	
Chronic pain outcomes									
Headache									
Rare	2952	82% (1.0)	97	75% (5.6)	16	76% (11.9)	61	70% (7.3)	0.19
Weekly or daily	600	18% (1.0)	34	25% (5.6)	7	24% (11.9)	18	30% (7.3)	
Stomachache									
Rare	3126	87% (0.9)	110	89% (3.1)	20	85% (9.7)	67	89% (4.9)	0.96
Weekly or daily	426	13% (0.9)	21	11% (3.1)	3	15% (9.7)	12	11% (4.9)	
Muscle/joint pain									
Rare	2457	69% (1.1)	95	75% (4.5)	17	77% (11.7)	69	91% (3.6)	0.007
Weekly or daily	1095	31% (1.1)	36	25% (4.5)	6	23% (11.7)	10	9% (3.6)	
Mediators									
Child maltreatment									
Neglect									
None	3075	87% (0.9)	117	91% (3.2)	19	92% (4.8)	67	90% (4.5)	0.50
1 + times	477	13% (0.9)	14	9% (3.2)	4	8% (4.8)	12	10% (4.5)	
Physical									
None	2458	71% (1.2)	84	70% (6.2)	11	58% (13.1)	42	60% (6.7)	0.32
1 + times	1094	29% (1.2)	47	30% (6.2)	12	42% (13.1)	37	40% (6.7)	
Sexual									
None	3409	96% (0.5)	125	98% (1.4)	21	84% (10.2)	73	98% (2.0)	0.10
1 + times	143	4% (0.5)	6	2% (1.4)	2	16% (10.2)	6	2% (2.0)	
Suicidal ideation (SI)									
No	3219	90% (0.7)	110	81% (4.9)	20	89% (7.9)	69	88% (5.3)	0.07
Yes	333	10% (0.7)	21	19% (4.9)	3	11% (7.9)	10	12% (5.3)	
Suicide attempt^d among those with SI									
Never	261	79% (3.2)	15	77% (11.1)	2	72% (28.3)	9	86% (13.8)	0.95
1 + times	72	21% (3.2)	6	23% (11.1)	1	28% (28.3)	1	14% (13.8)	
		Weighted mean (SE)		Weighted mean (SE)		Weighted mean (SE)		Weighted mean (SE)	
Depressive symptoms ^c		15.1 (0.12)		16.4 (0.65)		15.0 (0.82)		16.6 (0.77)	0.05
Social support^e									
From adults		4.35 (0.02)		4.14 (0.11)		3.69 (0.34)		4.48 (0.12)	0.03
From teachers		3.46 (0.03)		3.44 (0.12)		3.53 (0.29)		3.61 (0.14)	0.72
From parents		4.82 (0.01)		4.79 (0.05)		4.91 (0.08)		4.91 (0.04)	0.07
From friends		4.13 (0.02)		4.07 (0.09)		3.95 (0.15)		4.25 (0.11)	0.44
Total support		16.8 (0.07)		16.4 (0.24)		16.1 (0.70)		17.3 (0.31)	0.16
Self-esteem ^f		10.6 (0.08)		11.7 (0.43)		12.0 (0.66)		11.5 (0.57)	0.01

^a Gay combines "mostly gay" and "100% gay."

^b Results from t-tests and chi-square analyses to test the differences among sexual orientation groups within each gender group for each mediator and outcome.

^c Depressive symptoms: 0–60; higher scores indicate greater depression.

^d Suicide attempts reported only for participants who responded "yes" to suicidal ideation.

^e Social support from adults, teachers, parents, friends: 1–5, total: 4–20; higher scores indicate greater social support.

^f Self-esteem: 1–5; higher scores indicate greater self-esteem.

Table 5
Results from weighted logistic regression models^a with associated factors predicting sexual orientation differences in chronic pain among female (N = 4534) and male (N = 3785) youth in the U.S. National Longitudinal Study of adolescent to adult health (1995–2009).

Sexual orientation	Headache Daily/weekly vs. rare OR (95% CI)		Stomachache Daily/weekly vs. rare OR (95% CI)		Muscle/joint pain Daily/weekly vs. rare OR (95% CI)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Females						
Completely heterosexual	1.00 (Ref.)	1.00 (Ref.)	1.00 (Ref.)	1.00 (Ref.)	1.00 (Ref.)	1.00 (Ref.)
Mostly heterosexual	1.40 (1.09, 1.79)	1.25 (0.97, 1.61)	1.18 (0.84, 1.66)	1.02 (0.72, 1.44)	1.69 (1.29, 2.20)	1.58 (1.20, 2.07)
Bisexual	1.22 (0.70, 2.12)	1.09 (0.63, 1.89)	1.22 (0.65, 2.29)	1.03 (0.53, 2.00)	1.87 (1.03, 3.38)	1.68 (0.94, 3.01)
Lesbian ^b	1.96 (0.95, 4.06)	1.68 (0.79, 3.57)	1.50 (0.54, 4.17)	1.31 (0.48, 3.59)	1.97 (0.78, 4.99)	1.85 (0.74, 4.58)
Males						
Completely heterosexual	1.00 (Ref.)	1.00 (Ref.)	1.00 (Ref.)	1.00 (Ref.)	1.00 (Ref.)	1.00 (Ref.)
Mostly heterosexual	1.70 (0.85, 3.24)	1.60 (0.83, 3.09)	0.95 (0.52, 1.73)	0.87 (0.46, 1.62)	0.73 (0.45, 1.17)	0.68 (0.43, 1.07)
Bisexual	1.24 (0.30, 5.18)	1.07 (0.26, 4.45)	1.31 (0.23, 7.50)	1.19 (0.21, 6.57)	0.96 (0.30, 3.08)	0.93 (0.28, 3.11)
Gay ^b	2.00 (1.06, 3.82)	2.05 (1.04, 4.02)	0.82 (0.30, 2.21)	0.79 (0.29, 2.18)	0.28 (0.11, 0.74)	0.26 (0.09, 0.69)

^a Model 1 = sexual orientation only; Model 2 = sexual orientation and the following associated factors: child maltreatment (physical abuse, sexual abuse), depressive symptoms, suicidal ideation, social support (from adults, parents, friends, teachers), and self-esteem. Models adjusted for age (Wave II), race/ethnicity (Wave I), weight status (Wave I), parental education (Wave I), parental income (Wave I), and chronic pain (Wave I). Significant effects are bolded, $p < .05$.

^b Lesbian and gay combine "mostly gay" and "100% gay."

^c Percent attenuation in OR between Models 1 and 2. $[(OR_{Model 1} - OR_{Model 2}) / OR_{Model 1}] * 100$; "+" indicates that the effect becomes stronger (OR further from 1.0), whereas "-" indicates that the effect becomes weaker (OR closer to 1.0).

muscle/joint pain (Table 5). No sexual orientation differences in stomachache frequency were found for females or males.

Model 2: Sexual orientation and associated factors

Among females, the sexual orientation disparity in headache frequency was attenuated by 11% (OR = 1.40 to 1.25) when mediators were added to the model (Table 5). Sexual orientation disparities in muscle/joint pain were attenuated by 7% (OR = 1.69 to 1.58) for mostly heterosexuals and 10% (OR = 1.87 to 1.68) for bisexuals when mediators were added to the model. Among males, the sexual orientation disparity in headache frequency did not indicate attenuation when mediators were added to the model (Table 5), but the sexual orientation disparity in muscle/joint pain was attenuated by 7% (OR = 0.28 to 0.26).

Discussion

This study examined sexual orientation disparities in chronic pain among youth and associated factors hypothesized to increase or decrease risk of chronic pain among sexual minorities compared to heterosexuals. Results indicated sexual orientation disparities in chronic pain, with mostly heterosexual females and gay males more likely than same-gender completely heterosexuals to report headaches, and mostly heterosexual and bisexual females more likely to report muscle/joint pain. These disparities may be related to greater internalizing symptoms (depression and anxiety) among sexual minorities compared to heterosexuals (Hatzenbuehler et al., 2008; Meyer, 2003; Rosario et al., 2002), likely related to exposure to sexual minority stressors (Meyer, 2003). In a study of adults, the majority of sexual orientation disparities in physical health disappeared after controlling for psychological distress more so among females than males (Cochran and Mays, 2007). In the current study, among females, sexual minorities reported more suicidal ideation and depressive symptoms than completely heterosexuals, and sexual orientation disparities in pain among females were partially explained by mediators that included suicidal ideation, suicide attempt, and depressive symptoms. Internalizing symptoms may be an important potential risk factor for sexual orientation disparities in chronic pain, particularly among females.

Among females, sexual minority groups that were oriented toward more than one gender (mostly heterosexuals and bisexuals) were at the greatest risk of reporting pain, compared to completely heterosexuals. These results are consistent with previous research indicating worse mental and physical health among bisexual females compared to other sexual minority groups (Balsam et al., 2005; Case et al., 2004; Lehavot, 2012). In the current study, bisexual females were most likely to report all three types of child maltreatment and had the most depressive symptoms, compared to other female sexual orientation groups; mostly heterosexual females were the most likely to report suicidal ideation. These sexual orientation group differences may help to explain disparities in pain. Greater pain risk among bisexual females may also be related to biphobia (bisexuality-specific prejudice) experienced from both heterosexual and sexual minority communities (Mulick and Wright, 2002), which may produce greater minority stress among bisexual females, leading to more frequent chronic pain.

Although the majority of sexual orientation disparities indicated greater pain among sexual minorities, gay males were less likely than completely heterosexual males to report muscle/joint pain. Gay males had the highest support from adults, compared to other male sexual orientation groups, which may be protective for muscle/joint pain. This disparity may also be attributed to lower BMI in gay males compared to completely heterosexual males (Austin et al., 2009) or to sexual orientation differences in physical activity. Heterosexual males are more likely than sexual minority males to engage in physical activity and team sports (Calzo et al., 2014), which may lead to greater proneness to muscle injury and soreness.

Some potential limitations should be mentioned. Chronic pain data were collected in Wave II (1996). Some research has suggested that prevalence of chronic low back pain is rising over time among adults (Freburger et al., 2009). More research is needed to confirm this trend in adolescents across multiple sites of pain and to examine sexual orientation differences. The items used to measure pain in Add Health assessed frequency and location of pain; future research could assess pain more comprehensively. Sexual orientation identity was used from Wave III, because it was not measured at earlier waves. Participants who identified as a sexual minority at Wave III may not have identified as such when they were reporting chronic pain at Wave II; however, these individuals may have experienced other aspects of sexual minority orientation (e.g., same-gender attractions) prior to identifying as a sexual minority (Floyd and Bakeman, 2006). In addition, although previous research has indicated that sexual orientation changes for some individuals, the majority do not experience changes (Ott et al., 2011). Child maltreatment was not measured until Wave III, which may have led to less accurate recollections of abuse prior to sixth grade. Finally, although we included many factors hypothesized to increase or decrease the risk of chronic pain, future research could examine other factors that may be related to sexual orientation disparities in chronic pain, such as anxiety or victimization.

Conclusions

Results from this study indicated sexual orientation disparities in chronic pain frequency among both female and male youth, with sexual minorities generally reporting greater frequency of chronic pain compared to completely heterosexuals. Prospectively examined factors accounted for a sizable portion of these disparities, but more research is needed to understand why these disparities are occurring. Sexual orientation disparities in chronic pain have important implications for clinical practice. Chronic pain is longitudinally associated with increased risk for suicidality among youth, particularly when comorbid depressive symptoms are present (van Tilburg et al., 2011). Health care providers should take underlying psychological factors into account when presented with somatic complaints from adolescent and young adult patients, rather than simply addressing the pain itself. Awareness of sexual orientation disparities in chronic pain and associated factors is crucial to efforts to reduce these disparities.

Conflict of interest

The authors declare no financial conflict of interests.

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