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Disparities in long-term cardiovascular disease risk by sexual identity: The National Longitudinal Study of Adolescent to Adult Health

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Abstract

Objective—To examine long-term cardiovascular disease (CVD) risk disparities by sexual identity using a nationally representative sample of young adults in the United States.

Methods—Data include participants in wave 4 (2008/09; ages 24–34 years) of the National Longitudinal Study of Adolescent to Adult Health (7087 females; 6340 males). Sexual identity was self-reported (heterosexual, mostly heterosexual, bisexual, mostly homosexual, homosexual) and a Framingham-based prediction model was used to estimate participants' risk of a CVD event

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Conflict of interest statement

The authors declare that there are no conflicts of interest.

over 30 years. Differences in CVD risk by sexual identity, relative to heterosexuals were calculated with linear regression models adjusted for age, race/ethnicity, education, and financial distress.

Results—Average 30-year CVD risk was 17.2% (95% CI: 16.7, 17.7) in males and 9.0% (95% CI: 8.6, 9.3) in females. Compared to heterosexual females, mostly heterosexual (0.8%; 95% CI: 0.2, 1.4) and mostly homosexual females (2.8%; 95% CI: 0.8, 4.9) had higher CVD risk. Bisexual and homosexual females had higher but not statistically significant CVD risk compared to heterosexuals. Among males, differences in CVD risk by sexual identity were not statistically significant.

Conclusion—Sexual identity was associated with CVD risk in sexual minority subgroups. Population- and clinic-based prevention strategies are needed to minimize disparities in subsequent disease.

Keywords

Cardiovascular diseases; Homosexuality; Health status disparities

Introduction

Given the estimated costs of cardiovascular disease (CVD) ($1 trillion by 2030) (Heidenreich et al., 2011) and growing evidence of the cost effectiveness of primary prevention (Weintraub et al., 2011), greater attention is being paid to the extent of and disparities in CVD risk in young adults (ages 18–35) in an effort to mitigate risk well in advance of disease onset. Disparities in young adult CVD risk by race/ethnicity and socioeconomic status are well described in the literature, yet critical information gaps remain regarding potentially increased risk among individuals with a sexual minority identity (i.e., those who identify as anything other than heterosexual, including gay, lesbian, bisexual, queer, or pansexual) in early adulthood (Institute of Medicine, 2011).

Most prior research examining sexual identity differences in individual CVD risk factors has found that young individuals with a sexual minority identity are at elevated risk of a number of CVD risk factors (e.g., smoking, obesity, hypertension, C-reactive protein) (Everett and Mollborn, 2013; Hatzenbuehler et al., 2013; Katz-Wise et al., 2014). However, by examining individual risk factors, studies have not accounted for the fact that risk factors cluster and differ in the strength of their relationship to CVD (Freedman et al., 1999). Studies that have accounted for these factors (Farmer et al., 2013a,b) have examined risk among older adults and utilized a short-term prediction function that has been shown to be a poorer predictor of subclinical (Berry et al., 2009) and clinical (Pencina et al., 2009) CVD than a longer-term risk prediction function, which also accounts for competing causes of death. This is of particular relevance to assessing CVD risk in young adults whose risk of having a CVD event increases steadily but minimally each year until middle age (Go et al., 2014).

This study addresses this gap by providing the first long-term CVD risk comparisons across sexual identity using data from a nationally representative sample of young adults. This

information is of particular importance to developing primary prevention strategies targeted to this diverse segment of the population.

Methods

Sample

Data were from the National Longitudinal Study of Adolescent to Adult Health (Harris et al., 2009) and include non-Hispanic White, Black, Asian/Pacific Islander (API), and Hispanic respondents who participated in wave 4 (2008–09; response rate 80.3%; ages 24–34 years), were free of cancer and heart disease, and who had valid study weights and non-missing data (7087 females; 6340 males).

Variables

Age, race/ethnicity, sexual identity, education, financial stress (a positive response to any of 6 items indicating an inability to pay for basic needs), and CVD risk factors (BMI (Entzel et al., 2009), current smoking, systolic blood pressure (Entzel et al., 2009), use of antihypertensive medication (Tabor and Whitsel, 2010), and diabetes (considered present if the participant had a fasting glucose ≥126 mg/dl, a non-fasting glucose ≥200 mg/dl, HbA1c ≥6.5%, self-reported a health provider diagnosis of diabetes except during pregnancy, or used anti-diabetic medication in the prior four weeks (Whitsel et al., 2012)), were ascertained from interview data, anthropometric measurements, and biological specimens. Sexual identity was assessed through self-report and categorized as 1) heterosexual, 2) mostly heterosexual, 3) bisexual, 4) mostly homosexual, and 5) homosexual. Pansexual and queer sexual identities were not measured in the Add Health data. Participants provided written informed consent and the parent study was approved by the institutional review board of the University of North Carolina, Chapel Hill.

Statistical analyses

The risk of developing CVD over a 30-year period was calculated using a Framingham-based prediction model (Pencina et al., 2009). The function predicts the occurrence of a “general” composite CVD endpoint including coronary death, myocardial infarction, coronary insufficiency, angina pectoris, stroke, transient ischemic attack, intermittent claudication, and congestive heart failure (Pencina et al., 2009). Descriptive statistics were calculated by sex and sexual identity. Differences in 30-year CVD risk by sexual identity, relative to heterosexuals, were calculated with linear regression models adjusted for age, race/ethnicity, education, and financial distress, separately for males and females. Descriptive statistics and regression models were computed using SUDAAN 11 survey procedures. All analyses incorporated survey design and unequal probability of selection per Add Health user guidance (Chantala and Tabor, 2010). Statistical significance is defined as a p-value < 0.05.

Results

Mean age was 28.9 (95% CI: 28.6, 29.1) years; the sample was 69.5% non-Hispanic White (n = 7617), 15.5% Black (n = 2861), 3.4% API (n = 845), and 11.7% Hispanic (n = 2104).

Table 1 indicates participant characteristics by sexual identity. Among females, 80.5% were heterosexual (n = 5713), 15.6% were mostly heterosexual (n = 1089), 2.3% were bisexual (n = 154), 0.8% were mostly homosexual (n = 60) and 0.9% (n = 71) were homosexual. Among males, the sample was 93.5% heterosexual (n = 5912), 3.5% mostly heterosexual (n = 213), 0.7% bisexual (n = 45), 0.6% mostly homosexual (n = 53), and 1.7% were homosexual (n = 117). Average 30-year CVD risk was 17.2% (95% CI: 16.7, 17.7) in males and 9.0% (95% CI: 8.6, 9.3) in females. Compared to heterosexuals, long-term CVD risk was higher among all subgroups of sexual minority females (SMF) and lower among mostly heterosexual and homosexual males.

Table 2 presents estimated average differences in 30-year CVD risk by sexual identity compared to heterosexuals, adjusted for age, race/ethnicity, education, and financial stress. Black compared to White race, older age, and financial stress were associated with increased CVD risk; higher educational levels were associated with decreased CVD risk. API and Hispanic females had lower CVD risk than White females.

Compared to heterosexual females, mostly heterosexual and mostly homosexual females had a 0.8% (95% CI: 0.2, 1.4) and 2.8% (95% CI: 0.8, 4.9) higher risk of CVD, respectively. Bisexual and homosexual females had a higher risk of CVD compared to heterosexuals, but these findings were not statistically significant. Among males, differences in CVD risk by sexual identity were not statistically significant, but demonstrate a pronounced elevated risk among mostly homosexual men compared to heterosexuals.

Discussion

This study provides further evidence for CVD risk disparities between subgroups of SMF compared to heterosexual females (Farmer et al., 2013b; Lick et al., 2013) and suggests that mostly homosexual males may additionally be at higher risk of CVD compared to heterosexual males. Study findings are bolstered by the use of a nationally representative sample of young adults, objectively measured CVD risk factors, and a longer-term risk prediction function which may more accurately predict CVD risk (Berry et al., 2009; Pencina et al., 2009), especially among young adults.

Compared to heterosexuals, mostly homosexual and mostly heterosexual females had significantly higher CVD risk. Mostly homosexual males also had higher CVD risk, than heterosexual males, although not at traditionally significant levels. While more research is needed to understand the mechanisms underlying the increased CVD risk among those who identify as mostly homosexual or mostly heterosexual, individuals in these groups might have discordant identities or are in the process of sexual orientation identity change. Both sexual orientation identity discordance (Gattis et al., 2012) and sexual orientation identity change (Everett, 2015) have been associated with psychological distress which increases risk for CVD though behavioral and physiologic pathways (Everson-Rose and Lewis, 2005).

To the best of our knowledge, the present study is the first to examine long-term CVD risk by sexual identity among young adults so comparisons across studies are limited. However, a 10-year Framingham risk prediction function used to determine the ratio of vascular to

chronological age in a sample of adults 20–69 years of age showed higher risk among SMF and bisexual males (Farmer et al., 2013a,b). The researchers, however, grouped homosexual and bisexual females together for the analysis and did not distinguish among mostly heterosexual, mostly homosexual, and bisexual males. In those prior studies, homosexually experienced heterosexual males were shown to have lower CVD risk. Our findings cannot speak to CVD risk in this population because sexual behavior was not used to examine CVD risk in the present study. As recommended by the Institute of Medicine, standardization of sexual identity measures is needed to facilitate comparison across studies (Institute of Medicine, 2011).

Limitations

The current study is limited to an assessment of sexual identity, which does not always track with sexual attraction and behavior, especially among sexual minority males (Wolitski et al., 2006). Sample sizes of some sexual minority subgroups may have been too small to detect differences between groups. The Framingham risk score was developed on a predominately White cohort and may overestimate coronary heart disease risk in some racial/ethnic minorities (D'Agostino et al., 2001). Calibration is often warranted, but cannot be accomplished on such a young cohort. Validation of the risk function's ability to accurately detect CVD risk across diverse racial and ethnic groups is needed in older cohorts where sufficient numbers of the participants have had a CVD event.

Conclusion

Our findings highlight an elevated long-term risk of CVD among young adults with a sexual minority identity, especially females. CVD prevention guidelines for women address risk disparities across a number of socio-demographic strata, and highlight the need for cultural competence, but do not acknowledge disparities by sexual identity (Mosca et al., 2011). This study and a growing body of health disparities' literature begins to fill that gap to support the development of targeted clinical and population based strategies to minimize disparities in subsequent disease.

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Table 1

Participant Characteristics in the National Longitudinal Study of Adolescent to Adult Health (2008–09) by Sexual Identity, Females and Males (N=13,427), weighted.

	FEMALES (N=7,087)					
	Total Women	**Heterosexual (N=5713)**	**Mostly Heterosexual (N=1089)**	**Bisexual (N=154)**	**Mostly Homosexual (N=60)**	**Homosexual (N=71)**
Age, mean (95% CI)	28.8 (28.5, 29.0)	28.8 (28.6, 29.1)	28.5 (28.2, 28.7)	28.3 (27.9, 28.6)	28.4 (27.8, 29.0)	28.9 (28.3, 29.5)
Education, n (%)						
< High School	416 (7.1)	316 (6.7)	69 (7.1)	22 (19.5)	2 (3.5)	7 (10.5)
High school graduate	936 (13.7)	761 (13.9)	133 (11.7)	22 (17.2)	8 (24.1)	12 (18.7)
Some college	3139 (44.6)	2481 (43.8)	511 (48.2)	77 (45.0)	32 (47.4)	38 (47.8)
College graduate +	2596 (34.6)	2155 (35.6)	376 (33.0)	33 (18.4)	18 (25.0)	14 (23.0)
Race, n (%)						
Non-Hispanic White	3959 (69.3)	3111 (67.7)	701 (77.5)	84 (69.4)	31 (73.2)	32 (64.1)
Black	1625 (16.1)	1360 (17.3)	187 (9.4)	39 (16.6)	14 (12.0)	25 (26.0)
Asian/Pacific Islander	409 (3.3)	341 (3.4)	58 (2.9)	6 (1.8)	1 (0.1)	3 (1.1)
Hispanic	1094 (11.4)	901 (11.6)	143 (10.2)	25 (12.2)	14 (14.7)	11 (8.8)
Financial stress, n (%)						
No	5195 (72.9)	4318 (75.1)	710 (65.6)	78 (45.0)	41 (66.8)	48 (72.9)
Yes	1892 (27.1)	1395 (24.9)	379 (34.4)	76 (55.0)	19 (33.2)	23 (27.1)
Body mass index, mean (95% CI)	29.0 (28.6, 29.3)	29.0 (28.6, 29.4)	28.7 (27.9, 29.4)	29.8 (28.1, 31.4)	30.3 (27.2, 33.3)	31.0 (28.5, 33.5)
Systolic blood pressure, mean (95% CI)	120.0 (119.5, 120.4)	119.9 (119.4, 120.4)	119.7 (118.5, 121.0)	121.6 (118.7, 124.6)	123.1 (119.9, 126.3)	122.4 (119.4, 125.4)
Hypertensive medication usage, n (%)						
No	6901 (97.3)	5563 (97.4)	1058 (96.8)	150 (97.0)	60 (100.0)	70 (98.3)
Yes	186 (2.7)	150 (2.6)	31 (3.2)	4 (3.0)	0 (0.0)	1 (1.7)
Current smoker, n (%)						
No	4910 (65.9)	4149 (69.3)	610 (53.8)	84 (46.0)	34 (43.5)	33 (44.7)
Yes	2177 (34.1)	1564 (30.7)	479 (46.2)	70 (54.0)	26 (56.5)	38 (55.3)
Diabetes, n (%)						
No	6593 (94.0)	5318 (94.0)	1012 (94.0)	142 (93.2)	53 (87.0)	68 (98.1)
Yes	494 (6.0)	395 (6.0)	77 (6.0)	12 (6.8)	7 (13.0)	3 (1.9)

	FEMALES (N=7,087)					
	Total Women	**Heterosexual (N=5713)**	**Mostly Heterosexual (N=1089)**	**Bisexual (N=154)**	**Mostly Homosexual (N=60)**	**Homosexual (N=71)**
30-year Cardiovascular Disease Risk	9.0 (8.6, 9.3)	8.8 (8.4, 9.1)	9.4 (8.7, 10.0)	10.4 (8.8, 12.1)	11.6 (9.1, 14.1)	10.5 (9.1, 11.9)

	MALES (N=6,340)					
	Total Men	**Heterosexual (N=5912)**	**Mostly Heterosexual (N=213)**	**Bisexual (N=45)**	**Mostly Homosexual (N=53)**	**Homosexual (N=117)**
Age, mean (95% CI)	29.0 (28.7, 29.2)	29.0 (28.7, 29.2)	28.8 (28.3, 29.4)	28.8 (28.1, 29.4)	28.5 (27.8, 29.2)	29.1 (28.6, 29.6)
Education, n (%)						
< High School	575 (10.2)	545 (10.4)	14 (6.5)	8 (22.1)	2 (3.6)	6 (3.8)
High school graduate	1163 (20.5)	1114 (21.1)	27 (12.0)	7 (18.4)	5 (7.8)	10 (10.8)
Some college	2811 (42.1)	2636 (42.3)	85 (37.7)	18 (39.4)	21 (38.2)	51 (43.5)
College graduate +	1791 (27.1)	1617 (26.1)	87 (43.9)	12 (20.2)	25 (50.5)	50 (42.0)
Race, n (%)						
Non-Hispanic White	3658 (69.7)	3403 (69.5)	146 (77.4)	25 (78.1)	27 (67.4)	57 (59.3)
Black	1236 (14.9)	1169 (15.2)	26 (8.1)	10 (12.9)	12 (13.5)	19 (12.7)
Asian/Pacific Islander	436 (3.4)	409 (3.4)	12 (3.3)	1 (1.1)	2 (3.3)	12 (5.4)
Hispanic	1010 (12.0)	931 (11.8)	29 (11.3)	9 (7.9)	12 (15.8)	29 (22.6)
Financial stress, n (%)						
No	4980 (77.5)	4668 (78.0)	151 (68.6)	27 (53.0)	41 (74.2)	93 (78.3)
Yes	1360 (22.5)	1244 (22.0)	62 (31.4)	18(47.0)	12 (25.8)	24 (21.8)
Body mass index, mean (95% CI)	28.8 (28.6, 29.1)	28.9 (28.7, 29.2)	27.3 (26.4, 28.3)	29.1 (25.6, 32.6)	29.1 (26.2, 32.0)	26.8 (25.4, 28.2)
Systolic blood pressure, mean (95% CI)	129.9 (129.4, 130.4)	129.8 (129.3, 130.4)	130.3 (127.8, 132.7)	128.1 (122.6, 133.6)	131.8 (127.5, 136.1)	131.4 (127.9, 134.8)
Hypertensive medication usage, n (%)						
No	6153 (96.7)	5736 (96.7)	210 (99.0)	45 (100.0)	49 (90.1)	113 (94.8)
Yes	187 (3.3)	176 (3.4)	3 (1.0)	0 (0.0)	4 (9.9)	4 (5.2)
Current smoker, n (%)						
No	3752 (56.8)	3506 (56.7)	126 (61.9)	21 (36.3)	30 (53.2)	69 (56.4)
Yes	2588 (43.3)	2406 (43.3)	87 (38.1)	24 (63.7)	23 (46.8)	48 (43.7)
Diabetes, n (%)						
No	5944 (94.1)	5546 (94.0)	198 (95.6)	42 (91.4)	49 (90.1)	109 (96.5)
Yes	396 (5.9)	366 (6.0)	15 (4.4)	3 (8.6)	4 (9.9)	8 (3.5)

	MALES (N=6,340)					
	Total Men	**Heterosexual (N=5912)**	**Mostly Heterosexual (N=213)**	**Bisexual (N=45)**	**Mostly Homosexual (N=53)**	**Homosexual (N=117)**
30-year Cardiovascular Disease Risk	17.2 (16.7, 17.7)	17.3 (16.8, 17.8)	15.6 (14.0, 17.2)	18.4 (15.4, 21.3)	18.7 (15.1, 22.3)	16.2 (14.3, 18.0)

Table 2

Thirty Year Cardiovascular Disease Risk for Sexual Minorities Compared to Heterosexuals in the National Longitudinal Study of Adolescent to Adult Health (2008–09), Males and Females (N=13,427), weighted.

	FEMALES (N=7,087)			MALES (N=6,340)	
	Percent Difference (95% CI) Compared to Reference	**p-value**		**Percent Difference (95% CI) Compared to Reference**	**p-value**
Sexual Identity			**Sexual Identity**		
Heterosexual	ref	Ref	Heterosexual	Ref	ref
Mostly Heterosexual	0.8 (0.2, 1.4)	<0.01	Mostly Heterosexual	−0.9 (−2.4, 0.5)	0.22
Bisexual	1.2 (−0.4, 2.8)	0.13	Bisexual	0.7 (−2.6, 4.0)	0.66
Mostly Homosexual	2.8 (0.8, 4.9)	<0.01	Mostly Homosexual	3.0 (−0.4, 6.4)	0.09
Homosexual	1.2 (−0.1, 2.4)	0.08	Homosexual	−0.6 (−2.2, 1.0)	0.46
Age	0.9 (0.8, 1.0)	<0.001	**Age**	1.5 (1.3, 1.6)	<0.001
Financial Stress	1.2 (0.7, 1.8)	<0.001	**Financial Stress**	0.9 (0.0, 1.7)	0.04
Education			**Education**		
< High School	ref	Ref	< High School	Ref	ref
High school graduate	−0.2 (−1.1, 0.7)	0.60	High school graduate	−1.6 (−3.0, −0.3)	0.02
Some college	−1.2 (−2.0, −0.5)	<0.01	Some college	−2.4 (−3.8, −1.0)	<0.01
College graduate +	−3.2 (−4.0, −2.5)	<0.001	College graduate +	−5.2 (−6.5, −3.8)	<0.001
Race			**Race**		
Non-Hispanic White	Ref	Ref	Non-Hispanic White	ref	ref
Black	0.9 (0.4, 1.5)	<0.001	Black	1.0 (0.1, 1.9)	0.03
Asian/Pacific Islander	−1.4 (−2.2, −0.5)	<0.01	Asian/Pacific Islander	−0.2 (−2.0, 1.6)	0.79
Hispanic	−0.9 (−1.5, −0.3)	<0.01	Hispanic	−0.2 (−1.2, 0.8)	0.65

Notes: Linear regression models were conducted separately by sex. Each model contains all of the variables listed.