HHS Public Access

Author manuscript

J Cardiovasc Nurs. Author manuscript; available in PMC 2020 September 01.

Published in final edited form as:

J Cardiovasc Nurs. 2019 ; 34(5): 380–389. doi:10.1097/JCN.0000000000000588.

Sexual Identity, Adverse Life Experiences, and Cardiovascular Health in Women

Billy A. Caceres, PhD, RN, AGPCNP-BC,
Post-Doctoral Research Fellow, Columbia University School of Nursing, 560 West 168th Street, New York, NY 10032, bac2134@cumc.columbia.edu, 516-996-5040

Nina Markovic, PhD,
Associate Professor, University of Pittsburgh School of Dental Medicine

Donald Edmondson, PhD,
Associate Professor of Behavioral Medicine (in Medicine and Psychiatry), Columbia University Irving Medical Center

Tonda L. Hughes, PhD, RN, FAAN
Henrik H. Bendixen Professor of International Nursing (in Psychiatry), Columbia University School of Nursing

Abstract

Background: Adverse life experiences (ALE; e.g., discrimination and sexual abuse) may contribute to cardiovascular disease (CVD) risk in sexual minority women (SMW), but few studies have tested whether ALE explain the association of sexual identity with cardiovascular health (CVH) markers in women.

Objective: To examine sexual identity differences in CVH among women and the role of ALE.

Methods: In the Epidemiologic Study of Risk in Women (ESTHER), we used multinomial logistic regression to assess sexual identity differences [SMW vs. heterosexual women (reference group)] in CVH markers (ideal vs. poor; intermediate vs. poor) using the American Heart Association's Life's Simple 7 and the total score. Next, we tested whether the association of sexual identity with the total CVH score was attenuated by traditional CVD risk factors or ALE.

Results: The sample consisted of 867 women (395 heterosexual, 472 SMW). SMW were more likely to have experienced discrimination ($p<0.001$) and lifetime sexual abuse ($p<0.001$) than heterosexual women. SMW were also less likely to meet ideal CVH criteria for current tobacco use (AOR 0.43, 95% CI = 0.24–0.73) or intermediate CVH criteria for body mass index (AOR 0.60, 95% CI = 0.40–0.92). SMW had a lower cumulative CVH score (*B(SE)*= −0.35(0.14), $p<0.01$) than heterosexual women. This difference was not explained by traditional CVD risk factors or ALE.

Correspondence to: Billy A. Caceres.

Conflicts of interest: None.

Conclusions: Smoking, body mass index, and fasting glucose accounted for much of the CVH disparity due to sexual identity, but those differences were not explained by ALE. Health behavior interventions tailored to SMW should be considered.

Introduction

Cardiovascular disease (CVD) is the leading cause of death and disability among women globally.[1] Modifiable risk factors (e.g., tobacco use, physical inactivity, obesity, hypertension, hyperlipidemia, diabetes) contribute to risk for CVD, including myocardial infarction and stroke.[2] Therefore, efforts to mitigate the global burden of CVD have emphasized modification of behavioral and biological risk factors. In 2010, the American Heart Association (AHA) established Life's Simple 7, which set national goals for the promotion of ideal cardiovascular health (CVH) across the lifespan.[3] Life's Simple 7 focuses on achieving ideal criteria across three health behaviors (non-smoking, meeting physical activity recommendations, and diet intake consistent with evidence-based guidelines) and four biological factors (body mass index [BMI] <25 kg/m^2, untreated total cholesterol <200 mg/dL, untreated blood pressure <120/<80 mm Hg, and fasting blood glucose <100 mg/dL). A growing body of research indicates that meeting Life's Simple 7 criteria is associated with lower incident CVD[4,5] and mortality.[6] Despite the recognized benefits of maintaining optimal CVH, less than two percent of Americans meet criteria for ideal CVH for all seven metrics.[6]

Although significant racial/ethnic disparities in CVH are well-documented,[7,8] fewer studies have examined differences due to sexual identity.[9] In 2011, the National Academy of Medicine released a landmark report on the health of lesbian, gay, bisexual, and transgender (LGBT) populations that identified priority research areas for sexual minority health, including CVD.[10] Several studies indicate that sexual minority women (SMW; e.g., lesbian, bisexual women) in particular display higher rates of risk factors for poor CVH including tobacco use,[11] obesity,[12,13] and hyperglycemia.[12,14]

Adverse life experiences (e.g. discrimination, abuse) are posited to contribute to CVD risk in SMW.[15,16] However, with a few exceptions,[17–19] research in this area is lacking. In the general population there is mounting evidence linking discrimination to higher rates of hypertension, coronary artery calcification,[20,21] and incident CVD.[22] Similarly, trauma exposure (e.g., sexual and physical abuse) is independently associated with a higher prevalence of obesity, diabetes, and hypertension.[23–25] Relative to heterosexual women, SMW report higher rates of discrimination[26] and interpersonal trauma[27–29] across the lifecourse. Trauma among SMW is associated with modifiable risk factors for CVD including tobacco use, heavy drinking, and self-reported obesity.[15,30–32] Although some studies have found higher rates of tobacco use[11,33] and alcohol use[34,35] in SMW who have experienced some form of discrimination, there is limited research examining the impact of discrimination on CVD risk in this population.

Cardiovascular nurses are uniquely suited to promote the CVH of SMW. They possess expertise in providing care that incorporates biobehavioral approaches for prevention and management of CVD. A recent survey by the AHA's Council on Cardiovascular and Stroke

Nursing identified addressing health disparities and self-management for the prevention and treatment of CVD as priority research areas for cardiovascular nursing science.[36] Although sexual orientation disparities were not highlighted in that survey, the need to address social determinants of CVH and develop precision medicine guided self-management approaches for CVH were highlighted.[36] Informed by these research priorities for cardiovascular nursing science and given that few studies have examined whether adverse life experiences explain the excess CVD risk observed in SMW,[9] the purpose of the present study was to examine sexual identity differences in CVH among women (ages 35–64), and estimate the contribution of adverse life experiences to any observed differences.

Methods

Sample

We used data from the Epidemiologic STudy of HEalth Risk in Women (ESTHER) study, a cross-sectional study that examined CVD risk factors among women living in Pittsburgh, Pennsylvania and surrounding areas. A convenience sample of cisgender (non-transgender) women was recruited from 2003 to 2006. Women were eligible to participate in the ESTHER study if they were aged 35 years or older and had no history of CVD (i.e., angina, heart attack, stroke).

Trained research staff conducted recruitment calls and participants were asked to complete two in-person visits at the University of Pittsburgh. All data for the present study were collected at the first visit. During the first visit a physical examination was performed which included measurement of weight, height, and blood pressure. A blood draw was performed for biomarkers (e.g., fasting plasma glucose, total cholesterol). Participants also completed the written study questionnaire, which assessed demographic and psychosocial variables as well as health-related factors (e.g., physical activity, two-week medication history). A $50 incentive was provided in appreciation of participants' time.

A total of 1084 women were initially recruited. Due to difficulty recruiting Black women in a city that is less racially diverse than others, the study team selected a random sample of Black heterosexual women (n=38) proportional to the number of Black SMW (n=31) recruited. Because of sample size constraints limiting power to detect differences due to biracial/multiracial status, they also removed women who did not identify as White or Black (n=29). Similarly, because of a highly skewed distribution of older heterosexual women compared to older SMW, the original study team removed all women over the age of 65 from the dataset (n=76). The final sample consisted of 867 women. The University of Pittsburgh Institutional Review Board approved the ESTHER study.

Measures

Sexual identity.—Participants were classified as SMW if they 1) identified as anything other than heterosexual, and 2) reported either being only or primarily emotionally, physically, and romantically attracted to women in the past five years or having only or primarily female sexual partners in the past five years. Heterosexual women were those who identified as "straight/heterosexual" and reported only male sexual partners since the age of

18. Therefore, the present study examined two sexual identity groups: SMW (n=472) and heterosexual women (n=395).

Demographic characteristics.—*Age* (35–64 years old), *race*, *education*, *household income*, *employment*, *relationship status*, *geographic area*, *menopause*, *self-rated health*, and current *health insurance coverage* were assessed.

Health behaviors.—We assessed *alcohol use* in the past month (none; 1–3 times per month; 1–2 times a week; 3–4 times a week; 5–6 times a week; every day/more than once a day) and the number of times that participants ate *fast food* per week (range= 0–11 times), as alcohol use[37–39] and fast food intake[40] have been associated with increased risk for CVD in previous work.

Psychosocial factors.—*Depressive symptoms* were assessed using the Center for Epidemiologic Studies of Depression Scale (CES-D-10; Cronbach's alpha in present sample = 0.81; range 0–30). *Perceived stress* was assessed with the 4-item version of the Perceived Stress Scale (PSS; Cronbach's alpha in present sample = 0.82; range 0–13). Higher scores for the CES-D-10 and PSS indicate worse depressive symptoms and perceived stress, respectively. In addition, we assessed *perceived social support* using the Interpersonal Support Evaluation List (ISEL-12; Cronbach's alpha in present sample = 0.81). The ISEL-12 contains 12 items that assess perceived availability of social support on a 4-point Likert scale ranging from "definitely false" to "definitely true." ISEL-12 items were summed to derive a total score (range 0–36).

Adverse life experiences.—*Discrimination* was measured with 20 items adapted from a widely used validated measure.[41] Discrimination in the past year based on race/ethnicity (6 items), gender (7 items), and sexual orientation (7 items) from various sources (e.g., family, police, medical staff, work colleagues) were assessed. Participants were assigned a score of "1" for each experience of discrimination they reported (range 0–20). The Cronbach's alpha for the discrimination measure in the present sample was 0.83.

Sexual abuse was assessed using three items: 1) "Do you feel that you were sexually abused by a family member when you were growing up (before age 18)?" (intrafamilial childhood sexual abuse); 2) "Do you feel that you were sexually abused by someone other than a family member when you were growing up (before age 18)?" (extrafamilial childhood sexual abuse); and 3) "Since the age of 18, was there a time when someone forced you to have sexual activity that you really did not want?" (adulthood sexual abuse). Consistent with previous research in SMW we created a count measure of *lifetime sexual abuse* (0–3).[15,17,42] Participants were assigned a score of "1" for each type of sexual abuse they reported in their lifetime.

Cardiovascular health (CVH) markers.—We used the AHA's Life's Simple 7 to assess CVH (Table 1). Although the Life's Simple 7 incorporates a dietary component, diet data were not available in ESTHER. Therefore, we used the remaining CVH components (tobacco use, physical activity, BMI, blood pressure, fasting glucose, and total cholesterol) to calculate a cumulative CVH score. A cumulative CVH score, ranging from 0–12, was

calculated with each metric assigned a score of 0 (poor), 1 (intermediate), or 2 (ideal) following previous research.[43]

Statistical Analyses

All analyses were performed in Stata, version 15. We used Student's *t*-test and chi-square tests to examine sexual identity (heterosexual vs. SMW) differences for continuous and categorical variables, respectively. To reduce bias from missing data, multiple imputation with chained equations was used to impute missing values for covariates.[44] We then used multinomial logistic regression models to examine sexual identity differences in individual CVH components (intermediate vs. poor; ideal vs. poor). Model 1 was unadjusted; Model 2 added adjustment for demographic characteristics, and Model 3 added psychosocial factors and adverse life experiences. Lastly, we used multiple linear regression models to assess sexual identity differences in cumulative CVH. CVH was normally distributed. Model 1 was unadjusted; Model 2 added adjustment for demographic characteristics, and Model 3 added health behaviors, psychosocial factors, and adverse life experiences. Heterosexual women were the reference group for all analyses.

Results

The final sample consisted of 867 women (46% heterosexual; 54% SMW). Overall, participants had a mean age of 47.6 years, were 92% White, 33% had an income greater than $75,000, 66% had a Bachelors degree or greater, 80% were employed, 70% were in a committed relationship, and 92% had healthcare coverage.

Sample characteristics are presented in Table 2. SMW were more likely than heterosexual women to have completed graduate or professional education ($p = 0.04$). Compared to heterosexual women, SMW reported more forms of discrimination ($p < 0.001$) and lifetime sexual abuse ($p < 0.001$). SMW were less likely than heterosexual women to meet ideal criteria for tobacco use ($p < 0.001$), BMI ($p < 0.01$) and fasting glucose ($p = 0.04$) and had a lower cumulative CVH score ($p < 0.01$) relative to heterosexual women.

Findings for multinomial logistic regression analyses examining poor vs. intermediate and poor vs. ideal criteria for CVH metrics are shown in Table 3. Although SMW were less likely to meet ideal criteria for fasting glucose than heterosexual women in unadjusted models (OR 0.40, 95% CI= 0.17–0.97), this difference was attenuated after adjustment for psychosocial factors and adverse life experiences (AOR 0.44, 95% CI= 0.17–1.14) In fully adjusted models, SMW were significantly less likely than heterosexual women to meet ideal criteria for tobacco use (AOR 0.44, 95% CI=0.27–0.71) and were less likely to meet intermediate (AOR 0.66, 95% CI= 0.45–0.98) criteria for BMI. No differences in other CVH components were noted between SMW and heterosexual women.

Next, we used linear regression models to examine sexual identity differences in cumulative CVH scores (Table 4). Compared to heterosexual women, SMW were more likely to have a lower CVH score ($B(SE) = -0.32$ (0.13), $p<0.05$).

Discussion

This study is one of the first to examine cumulative CVH in SMW. A notable strength of this work is that in addition to accounting for known CVD risk factors (e.g., health behaviors, psychosocial factors), we examined the impact of adverse life experiences (i.e., discrimination and sexual abuse) on the association between sexual identity and CVH among women. Consistent with previous evidence, SMW in the present study were more likely to report experiences of discrimination[26,33] and lifetime sexual abuse than heterosexual women.[30,45,46] Furthermore, we found that established risk factors for CVD and adverse life experiences only partially explained sexual identity differences in CVH among women. The lower cumulative CVH score observed in SMW was primarily attributed to higher rates of tobacco use and elevated BMI compared to heterosexual women. This is consistent with previous studies that have found higher rates of tobacco use[11,12] and elevated BMI[12,13,47] in SMW. Although SMW had lower rates of meeting ideal criteria for fasting glucose, which is consistent with previous evidence,[12,14] this difference was attenuated after adjustment for psychosocial factors and adverse life experiences.

Although a notable strength of this study was the inclusion of discrimination and sexual abuse as potential contributors to poor CVH, it is likely that additional stressors that are unique to SMW, called *minority stressors* (e.g., harassment, expectations of rejection, internalized homophobia),[48] may contribute to poor CVH in this population. Overall, few studies have investigated the association of minority stressors and CVD in sexual minorities.[9] Findings from a small number of studies suggest that exposure to sexual minority-specific stressors are associated with higher rates of tobacco use and hazardous drinking (e.g., heavy drinking and binge drinking)[49–51] in SMW. On the contrary, a recent study of young lesbian women found that internalized homophobia was not associated with elevated BMI.[52] Therefore, additional research that examines the link between sexual minority-specific and general life stressors with poor CVH in this population is needed. Further, in the United States there are currently 28 states that provide no legal protection for SMW against discrimination in healthcare, employment, education, housing, and other settings.[53] These forms of structural stigma are conceptualized as fundamental causes for health disparities among sexual minorities,[10,12] but their relationships with health outcomes have not been tested. More work is needed to examine the potential link between structural stigma and CVH in SMW. Moreover, although we included a measure of perceived social support, future work should investigate how resilience and coping self-efficacy may mitigate the effect of stress on CVH in SMW.

These findings have important implications for cardiovascular care of SMW. Although interventions that address fundamental causes of health disparities (e.g., lack of laws that protect against discrimination) are needed, at this time targeting behavioral factors is the most appropriate approach to improve CVH in SMW. Cardiovascular nurses possess skills in health promotion and behavior change that are essential to promote the CVH of SMW.[54] Our findings indicate that prevention efforts for SMW should target behavior change, including smoking cessation and weight management, to promote their CVH. There is a paucity of culturally tailored interventions aimed at reducing modifiable risk factors for CVD in SMW.[55] Given this and mounting evidence of SMW's elevated risk for CVD, nurses

and other healthcare professionals should consider developing tailored interventions to promote CVH in this population. A recent multi-site intervention conducted in 10 cities across the United States found that tailored health promotion interventions (i.e., mindfulness, pedometer use, and gym membership) were effective at increasing physical activity and reducing waist-to-height ratio in SMW over the age of 40.[56] That work can serve as a model for future cardiovascular prevention interventions in this population. Research that examines how behavioral interventions can be used to promote the CVH of SMW is needed.

Limitations

This study has several limitations. First, because the ESTHER study used a cross-sectional design, we cannot infer causality from these findings. Second, participants were recruited via convenience sampling from one large city and its surrounding areas in the United States, which limits generalizability of findings to SMW in other cities and in rural areas. In addition, ESTHER study participants were predominately White (92%) and highly educated. We were unable to examine whether CVH differed by race/ethnicity or education. Future research should explore whether the lower CVH scores observed in SMW in this sample are consistent across geographic region, race/ethnicity, and educational status. Additionally, our measure of CVH did not include the dietary component of the Life's Simple 7, which limits confidence in our findings. However, we adjusted all models for fast food intake, which has been associated with higher rates of diabetes, hyperlipidemia, and CVD.[40,57] Posttraumatic stress disorder (PTSD), which is associated with adverse life experiences,[58,59] has been linked with incident CVD and hypertension in women[60–63] and SMW report higher rates of PTSD than heterosexual women.[64,65] Since PTSD was not measured in the ESTHER study, we were unable to examine the association of PTSD with CVH in the present study. This is an important area to examine in future work. Further, given that the present study only included cisgender women, the experience of transgender women who might also identify as a SM are not represented. Future work should be done to explore CVH in transgender women as the use of exogenous hormones may place them at increase risk for CVD.[66] Finally, data were collected from 2003–2006. Cultural, legal, and technological changes since the study was conducted may have changed how SMW's CVH is influenced by their sexual minority status, and/or how adverse life experiences influence the association of sexual minority status with CVH.

Conclusion

This study contributes to growing evidence of poor CVH in SMW and represents a first step in understanding the role that adverse life experiences play in SMW's CVH. These findings have implications for health promotion efforts aimed at improving the CVH of SMW. Additional research is needed to investigate the association of stressors and CVH in this population. Cardiovascular nurses have the opportunity to lead the field toward implementing evidence-based approaches to the prevention of CVD in this underserved and understudied population of women.

Funding:

ESTHER was funded by the National Heart, Lung and Blood Institute (NHLBI; R01HL067052). BAC was supported by a training grant from the National Institute of Nursing Research (T32NR014205).

References

1. World Health Organization. Global Status Report on Noncommunicable Diseases 2014.; 2014. doi:ISBN 9789241564854.
2. Yusuf S, Hawken S, Ôunpuu S, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): Case-control study. Lancet. 2004;364:937–952. [PubMed: 15364185]
3. Lloyd-Jones DM, Hong Y, Labarthe D, et al. Defining and Setting National Goals for Cardiovascular Health Promotion and Disease Reduction: The American Heart Association's Strategic Impact Goal Through 2020 and Beyond.; 2010. doi:10.1161/CIRCULATIONAHA.109.192703.
4. Gaye B, Tafflet M, Arveiler D, et al. Ideal cardiovascular health and incident cardiovascular disease: Heterogeneity across event subtypes and mediating effect of blood biomarkers: The PRIME Study. J Am Heart Assoc. 2017;6(10):e006389. doi:10.1161/JAHA.117.006389. [PubMed: 29042430]
5. Ommerborn MJ, Blackshear CT, Hickson DA, et al. Ideal cardiovascular health and incident cardiovascular events: The Jackson Heart Study. Am J Prev Med. 2016;51(4):502–506. doi:10.1016/j.amepre.2016.07.003. [PubMed: 27539974]
6. Ford ES, Greenlund KJ, Hong Y. Ideal cardiovascular health and mortality from all causes and diseases of the circulatory system among adults in the United States. Circulation. 2012;125(8):987–995. doi:10.1161/CIRCULATIONAHA.111.049122. [PubMed: 22291126]
7. Brown AF, Liang L-J, Vassar SD, et al. Trends in racial/ethnic and nativity disparities in cardiovascular health among adults without prevalent cardiovascular disease in the United states, 1988 to 2014. Ann Intern Med. 2018;168(8):541–549. doi:10.7326/M17-0996. [PubMed: 29554692]
8. Mujahid MS, Moore LV, Petito LC, Kershaw KN, Watson K, Diez Roux AV. Neighborhoods and racial/ethnic differences in ideal cardiovascular health (the Multi-Ethnic Study of Atherosclerosis). Health Place. 2017;44:61–69. doi:10.1016/j.healthplace.2017.01.005. [PubMed: 28167269]
9. Caceres BA, Brody A, Luscombe RE, et al. A systematic review of cardiovascular disease in sexual minorities. Am J Public Health. 2017;107(4):e13–e21. doi:10.2105/AJPH.2016.303630.
10. Institute of Medicine. The Health of Lesbian, Gay, Bisexual, and Transgender People: Building a Foundation for Better Understanding. Washington D.C.: National Academies Press; 2011.
11. McCabe SE, Hughes TL, Matthews AK, et al. Sexual orientation discrimination and tobacco use disparities in the United States. Nicotine Tob Res. 2017;00(00):1–9. doi:10.1093/ntr/ntx283.
12. Caceres BA, Brody AA, Halkitis PN, Dorsen C, Yu G, Chyun DA. Cardiovascular disease risk in sexual minority women (18–59 years old): Findings from the National Health and Nutrition Examination Survey (2001–2012). Womens Health Issues. 2018;28(4):333–341. doi:10.1016/j.whi.2018.03.004. [PubMed: 29661697]
13. Caceres BA, Makarem N, Hickey KT, Hughes TL. Cardiovascular disease disparities in sexual minority adults: An examination of the Behavioral Risk Factor Surveillance System (2014–2016). Am J Health Promot. 2018. doi:10.1177/0890117118810246.
14. Kinsky S, Stall R, Hawk M, Markovic N. Risk of the metabolic syndrome in sexual minority women: Results from the ESTHER Study. J Women's Heal. 2016;25(8):784–790. doi:10.1089/jwh.2015.5496.
15. Matthews AK, Cho YI, Hughes TL, Wilsnack SC, Aranda F, Johnson T. The effects of sexual orientation on the relationship between victimization experiences and smoking status among US women. Nicotine Tob Res. 2018;20(3):332–339. doi:10.1093/ntr/ntx052. [PubMed: 28339840]
16. Talley AE, Grimaldo G, Wilsnack SC, Hughes TL, Kristjanson AF. Childhood victimization, internalizing symptoms, and substance use among women who identify as mostly heterosexual. LGBT Heal. 2016;3(4):266–274. doi:10.1089/lgbt.2015.0073.

17. Smith HA, Markovic N, Danielson ME, et al. Sexual abuse, sexual orientation, and obesity in women. J Women's Heal. 2010;19(8):1525–1532. doi:10.1089/jwh.2009.1763.

18. Aaron DJ, Hughes TL. Association of childhood sexual abuse with obesity in a community sample of lesbians. Obesity. 2007;15(4):1023–1028. doi:10.1038/oby.2007.634. [PubMed: 17426338]

19. Hatzenbuehler ML, Slopen N, McLaughlin KA. Stressful life events, sexual orientation, and cardiometabolic risk among young adults in the United States. Heal Psychol. 2014;33(10):1185–1194. doi:doi: 10.1037/hea0000126.

20. Wagner J, Tennen H, Finan P, et al. Exposure to racial discrimination and ambulatory blood pressure in women with type 2 diabetes. Stress Heal. 2016;32(4):337–345. doi:10.1002/smi.2622.

21. Dolezsar CM, McGrath JJ, Herzig AJM, Miller SB. Perceived racial discrimination and hypertension: A comprehensive systematic review. Heal Psychol. 2014;33(1):20–34. doi:10.1037/a0033718.

22. Everson-Rose SA, Lutsey PL, Roetker NS, et al. Perceived discrimination and incident cardiovascular events: The Multi-Ethnic Study of Atherosclerosis. Am J Epidemiol. 2015;182(3):225–234. doi:10.1093/aje/kwv035. [PubMed: 26085044]

23. Suglia SF, Clark CJ, Boynton-Jarrett R, Kressin NR, Koenen KC. Child maltreatment and hypertension in young adulthood. BMC Public Health. 2014;14(1):1149. doi:10.1186/1471-2458-14-1149. [PubMed: 25374338]

24. Friedman EM, Montez JK, Sheehan CM, Guenewald TL, Seeman TE. Childhood adversities and adult cardiometabolic health. J Aging Health. 2015;27(8):1311–1338. doi:10.1177/0898264315580122. [PubMed: 25903978]

25. Huang H, Yan P, Shan Z, et al. Adverse childhood experiences and risk of type 2 diabetes: A systematic review and meta-analysis. Metabolism. 2015;64(11):1408–1418. doi:10.1016/j.metabol.2015.08.019. [PubMed: 26404480]

26. Katz-Wise SL, Hyde JS. Victimization experiences of lesbian, gay, and bisexual individuals: A meta-analysis. J Sex Res. 2012;49(January 2014):142–167. doi:10.1080/00224499.2011.637247. [PubMed: 22380586]

27. Andersen JP, Blosnich J. Disparities in adverse childhood experiences among sexual minority and heterosexual adults: Results from a multi-state probability-based sample. PLoS One. 2013;8(1). doi:10.1371/journal.pone.0054691.

28. Brown MJ, Masho SW, Perera RA, Mezuk B, Cohen SA. Sex and sexual orientation disparities in adverse childhood experiences and early age at sexual debut in the United States: Results from a nationally representative sample. Child Abuse Negl. 2015;46(7):89–102. doi:10.1016/j.chiabu.2015.02.019. [PubMed: 25804435]

29. Austin A, Herrick H, Proescholdbell S. Adverse childhood experiences related to poor adult health among lesbian, gay, and bisexual individuals. Am J Public Health. 2016;106(2):314–320. doi:10.2105/AJPH.2015.302904. [PubMed: 26691127]

30. Hughes TL, Johnson TP, Steffen AD, Wilsnack SC, Everett B. Lifetime victimization, hazardous drinking, and depression among heterosexual and sexual minority women. LGBT Heal. 2014;1(3):192–203. doi:10.1089/lgbt.2014.0014.

31. Hughes T, McCabe SE, Wilsnack SC, West BT, Boyd CJ. Victimization and substance use disorders in a national sample of heterosexual and sexual minority women and men. Addiction. 2010;105(12):2130–2140. doi:10.1111/j.1360-0443.2010.03088.x. [PubMed: 20840174]

32. Caceres BA, Veldhuis CB, Hickey KT, Hughes TL. Cardiovascular Stroke Nursing Best Abstract Award: Lifetime trauma and cardiovascular disease risk in sexual minority women. Circulation. 2018;138(Supp 1).

33. Blosnich JR, Horn K. Associations of discrimination and violence with smoking among emerging adults: Differences by gender and sexual orientation. Nicotine Tob Res. 2011;13(12):1284–1295. doi:10.1093/ntr/ntr183. [PubMed: 21994344]

34. Bränström R, Pachankis JE. Sexual orientation disparities in the co-occurrence of substance use and psychological distress: A national population-based study (2008–2015). Soc Psychiatry Psychiatr Epidemiol. 2018;0(0):1–10. doi:10.1007/s00127-018-1491-4.

35. McCabe SE, Bostwick WB, Hughes TL, West BT, Boyd CJ. The relationship between discrimination and substance use disorders among lesbian, gay, and bisexual adults in the United

States. Am J Public Health. 2010;100(10):1946–1952. doi:10.2105/AJPH.2009.163147. [PubMed: 20075317]

36. Piano MR, Artinian NT, DeVon HA, Pressler ST, Hickey KT, Chyun DA. Cardiovascular nursing science priorities: A statement From the American Heart Association Council on Cardiovascular and Stroke Nursing. J Cardiovasc Nurs. 2018;33(4):E11–E20. doi:10.1097/JCN.0000000000000489. [PubMed: 29727377]
37. Bagnardi V, Zatonski W, Scotti L, La Vecchia C, Corrao G. Does drinking pattern modify the effect of alcohol on the risk of coronary heart disease? Evidence from a meta-analysis. J Epidemiol Community Health. 2008;62:615–619. doi:10.1136/jech.2007.065607. [PubMed: 18559444]
38. O'Donnell MJ, Denis X, Liu L, et al. Risk factors for ischaemic and intracerebral haemorrhagic stroke in 22 countries (the INTERSTROKE study): A case-control study. Lancet. 2010;376(9735):112–123. doi:10.1016/S0140-6736(10)60834-3. [PubMed: 20561675]
39. Hartz SM, Oehlert M, Horton AC, et al. Daily drinking is associated with increased mortality. Alcohol Clin Exp Res. 2018;42(11):2246–2255. doi:10.1111/acer.13886. [PubMed: 30281161]
40. Bahadoran Z, Mirmiran P, Azizi F. Fast food pattern and cardiometabolic disorders: A review of current studies. Heal Promot Perspect. 2015;5(4):231–240. doi:10.15171/hpp.2015.028.
41. Krieger N, Smith K, Naishadham D, Hartman C, Barbeau EM. Experiences of discrimination: Validity and reliability of a self-report measure for population health research on racism and health. Soc Sci Med. 2005;61(7):1576–1596. doi:10.1016/j.socscimed.2005.03.006. [PubMed: 16005789]
42. Andersen JP, Hughes TL, Zou C, Wilsnack SC. Lifetime victimization and physical health outcomes among lesbian and heterosexual women. PLoS One. 2014;9(7):e101939. doi:10.1371/journal.pone.0101939. [PubMed: 25068978]
43. Slopen N, Chen Y, Guida JL, Albert MA, Williams DR. Positive childhood experiences and ideal cardiovascular health in midlife: Associations and mediators. Prev Med (Baltim). 2017;97:72–79. doi:10.1016/j.ypmed.2017.01.002.
44. Sullivan TR, Salter AB, Ryan P, Lee KJ. Bias and precision of the "multiple imputation, then deletion" method for dealing with missing outcome data. Am J Epidemiol. 2015;182(6):528–534. doi:10.1093/aje/kwv100. [PubMed: 26337075]
45. Austin SB, Jun H-J, Jackson B, et al. Disparities in child abuse victimization in lesbian, bisexual, and heterosexual women in the Nurses' Health Study II. J Womens Health (Larchmt). 2008;17(4):597–606. doi:10.1089/jwh.2007.0450. [PubMed: 18447763]
46. Wilsnack SC, Kristjanson AF, Hughes TL, Benson PW. Characteristics of childhood sexual abuse in lesbians and heterosexual women. Child Abus Negl. 2012;36(3):260–265. doi:10.1016/j.chiabu.2011.10.008.
47. Katz-Wise SL, Blood EA, Milliren CE, et al. Sexual orientation disparities in BMI among U.S. adolescents and young adults in three race/ethnicity groups. J Obes. 2014:537242. doi:10.1155/2014/537242. [PubMed: 24872890]
48. Meyer IH. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: Conceptual issues and research evidence. Psychol Bull. 2003;129(5):674–697. doi:10.1037/0033-2909.129.5.674. [PubMed: 12956539]
49. Mereish EH, Goldbach JT, Burgess C, DiBello AM. Sexual orientation, minority stress, social norms, and substance use among racially diverse adolescents. Drug Alcohol Depend. 2017;178(33):49–56. doi:10.1016/j.drugalcdep.2017.04.013. [PubMed: 28641130]
50. Coulter RWS, Bersamin ME, Russell ST, Mair C. The effects of gender- and sexuality-based harassment on lesbian, gay, bisexual, and transgender substance use disparities. J Adolesc Heal. 2017;62:688–700. doi:10.1016/j.jadohealth.2017.10.004.
51. Ylioja T, Cochran G, Woodford MR, Renn KA. Frequent experience of LGBQ microaggression on campus associated with smoking among sexual minority college students. Nicotine Tob Res. 2018:340–346. doi:10.1093/ntr/ntw305. [PubMed: 27988489]
52. Mason TB, Lewis RJ. Minority stress, depression, relationship quality, and alcohol use: Associations with overweight and obesity among partnered young adult lesbians. LGBT Heal. 2015;2(4):333–340. doi:10.1089/lgbt.2014.0053.

53. Williams Institute. LGBT People in the U.S. Not Protected by State Nondiscrimination Statutes. Los Angeles, CA; 2019 https://williamsinstitute.law.ucla.edu/wp-content/uploads/Equality-Act-April-2019.pdf.
54. Lanuza DM, Davidson PM, Dunbar SB, Hughes S, De Geest S. Preparing nurses for leadership roles in cardiovascular disease prevention. J Cardiovasc Nurs. 2011;26(4S):S56–S63. doi:10.1016/S1474-5151(11)00116-2. [PubMed: 21659815]
55. Rizer AM, Mauery DR, Haynes SG, Couser B, Gruman C. Challenges in intervention research for lesbian and bisexual women. LGBT Heal. 2015;2(2):105–112. doi:10.1089/lgbt.2014.0122.
56. McElroy JA, Haynes SG, Eliason MJ, et al. Healthy weight in lesbian and bisexual women aged 40 and older: An effective intervention in 10 cities using tailored approaches. Women's Heal issues. 2016;26 Suppl 1(S1):S18–35. doi:10.1016/j.whi.2016.05.002.
57. Gadiraju TV, Patel Y, Gaziano JM, Djoussé L. Fried food consumption and cardiovascular health: A review of current evidence. Nutrients. 2015;7(10):8424–8430. doi:10.3390/nu7105404. [PubMed: 26457715]
58. Kessler RC, Aguilar-Gaxiola S, Alonso J, et al. Trauma and PTSD in the WHO World Mental Health Surveys. Eur J Psychotraumatology I. 2017;8(Sup 5). doi:10.1080/20008198.2017.1353383.
59. Brooks Holliday S, Dubowitz T, Haas A, Ghosh-Dastidar B, DeSantis A, Troxel WM. The association between discrimination and PTSD in African Americans: Exploring the role of gender. Ethn Health. 2018:1–15. doi:10.1080/13557858.2018.1444150.
60. Sumner JA, Kubzansky LD, Elkind MSV, et al. Trauma exposure and posttraumatic stress disorder symptoms predict onset of cardiovascular events in women. Circulation. 2015;132(4):251–259. doi:10.1161/CIRCULATIONAHA.114.014492. [PubMed: 26124186]
61. Sumner JA, Kubzansky LD, Roberts AL, et al. Post-traumatic stress disorder symptoms and risk of hypertension over 22 years in a large cohort of younger and middle-aged women. Psychol Med. 2016;46(15):3105–3116. doi:10.1017/S0033291716001914. [PubMed: 27534802]
62. Kubzansky LD, Koenen KC, Jones C, Eaton WW. A prospective study of posttraumatic stress disorder symptoms and coronary heart disease in women. Health Psychol. 2009;28(1):125–130. doi:10.1037/0278-6133.28.1.125. [PubMed: 19210026]
63. Roy SS, Foraker RE, Girton RA, Mansfield AJ. Posttraumatic stress disorder and incident heart failure among a community-based sample of US veterans. Am J Public Health. 2015;105(4):757–763. doi:10.2105/AJPH.2014.302342. [PubMed: 25713943]
64. Roberts AL, Austin SB, Corliss HL, Vandermorris AK, Koenen KC. Pervasive trauma exposure among US sexual orientation minority adults and risk of posttraumatic stress disorder. Am J Public Health. 2010;100(12):2433–2441. doi:10.2105/AJPH.2009.168971. [PubMed: 20395586]
65. Roberts AL, Rosario M, Corliss HL, Koenen KC, Austin SB. Elevated risk of posttraumatic stress in sexual minority youths: Mediation by childhood abuse and gender nonconformity. Am J Public Health. 2012;102(8):1587–1593. doi:10.2105/AJPH.2011.300530. [PubMed: 22698034]
66. Getahun D, Nash R, Flanders WD, et al. Cross-sex hormones and acute cardiovascular events in transgender persons: A cohort study. Ann Intern Med. 2018:1–10. doi:10.7326/M17-2785.

Table 1.

Measures of cardiovascular health

Cardiovascular health metric	Poor (Score = 0)	Intermediate (Score = 1)	Ideal (Score = 2)
Tobacco use	Current tobacco use	Former smoker (quit less than 12 months ago)	Never smoked or quit smoking more than 12 months ago
Physical activity	No physical activity (0 minutes) per week	1–149 minutes of moderate activity or 1–74 minutes of vigorous activity or 1–149 minutes of combined moderate and vigorous activity	≥ 150 minutes of moderate activity or ≥ 75 minutes of vigorous activity or ≥ 150 minutes of combined moderate and vigorous activity
Body mass index	≥ 30 kg/m^2	25–29.99 kg/m^2	< 25 kg/m^2
Blood pressure	Systolic blood pressure ≥ 140 or diastolic blood pressure ≥ 90 mmHg	Systolic blood pressure 120–139 or diastolic blood pressure 80–89 mmHg or treated to goal	Systolic blood pressure < 120 or diastolic blood pressure < 80 mmHg
Fasting plasma glucose	≥ 126 mg/dL	100–125 mg/dL or treated to goal	< 100 mg/dL
Total cholesterol	≥ 240 mg/dL	200–239 mg/dL or treated to goal	< 200 mg/dL

Note. Adapted from Lloyd-Jones et al.[4]

Table 2.

Sample characteristics.

	Total (N=867)	Heterosexual (n=395)	SMW (n=472)	*p*-value
Demographic characteristics	Mean (SD)/n(%)			
Age (mean)	47.6 (0.2)	47.8 (0.4)	47.4 (0.3)	0.41
Race White Black	797 (91.9) 70 (8.1)	363 (91.9) 32 (8.1)	434 (92.0) 38 (8.0)	0.99
Education Less than high school High school Some college/2 Year Bachelors degree Graduate/professional	4 (0.5) 89 (10.2) 205 (23.6) 214 (24.7) 355 (41.0)	2 (0.5) 54 (13.7) 92 (23.3) 98 (24.8) 149 (37.7)	2 (0.4) 35 (7.4) 113 (24.0) 116 (24.6) 206 (43.6)	0.04*
Household income < $15,000 $15,000-$24,999 $25,000–39,999 $40,000–59,000 $60,000–74,999 ≥ $75,000 Missing	66 (7.6) 58 (6.7) 142 (16.4) 190 (22.0) 107 (12.3) 289 (33.3) 15 (1.7)	33 (8.3) 27 (6.8) 65 (16.5) 85 (21.5) 39 (9.9) 135 (34.2) 11 (2.8)	33 (7.0) 31 (6.5) 77 (16.3) 105 (22.3) 68 (14.4) 154 (32.6) 4 (0.9)	0.17
Employment Employed full-time or part-time Unemployed, looking Unemployed, not looking	622 (79.6) 39 (5.0) 120 (15.4)	282 (68.6 16 (26.5) 49 (4.9)	340 (78.3) 23 (5.3) 71 (16.4)	0.60
Relationship status Committed relationship Not in committed relationship Missing	610 (70.4) 256 (29.5) 1 (0.1)	238 (66.6) 109 (33.1) 1 (0.3)	347 (73.5) 125 (26.5) 0 (0.0)	0.06
Geographic area Open country/farm Small town (< 50,000) Medium city (50,000–250,000) Suburb near large city Large city (>250,000)	46 (5.3) 106 (12.3) 48 (5.5) 326 (37.6) 341 (39.3)	21 (5.3) 49 (12.4) 23 (5.8) 165 (41.8) 137 (34.7)	25 (5.3) 57 (12.1) 25 (5.3) 161 (34.1) 204 (43.2)	0.11
Menopause	541 (62.4)	248 (62.8)	293 (62.1)	0.83
Self-rated health Excellent Very good Good Fair Poor/very poor	115 (13.3) 366 (42.2) 299 (34.5) 68 (7.8) 19 (2.2)	63 (15.9) 159 (40.3) 148 (37.5) 22 (5.5) 3 (0.8)	52 (11.0) 207 (43.9) 151 (32.0) 46 (9.8) 16 (3.3)	<0.001***

J Cardiovasc Nurs. Author manuscript; available in PMC 2020 September 01.

	Total (N=867)	Heterosexual (n=395)	SMW (n=472)	*p*-value
Healthcare coverage	797 (91.9)	365 (92.4)	432 (91.5)	0.88
Health behaviors				
Alcohol use in past month	260 (30.0)	116 (29.4)	144 (30.5)	0.11
None	345 (39.8)	174 (44.0)	171 (36.2)	
1–3 times per month	158 (18.2)	68 (17.2)	90 (19.1)	
1–2 times per week	70 (8.1)	26 (6.6)	44 (9.3)	
3–4 times per week	25 (2.9)	7 (1.8)	18 (3.8)	
5–6 times per week	9 (1.0)	4 (1.0)	5 (1.1)	
Every day				
Fast food intake per week (mean)	1.5 (0.1)	1.5 (0.1)	1.5 (0.1)	0.96
Psychosocial factors				
Depressive symptoms (CES-D-10 score; mean)	6.3 (0.2)	5.9 (0.2)	6.5 (0.2)	0.06
Perceived stress (PSS score; mean)	7.8 (0.1)	7.9 (0.1)	7.8 (0.1)	0.47
Social support (ISEL-12; mean)	35.4 (0.2)	35.2 (0.3)	35.6 (0.3)	0.30
Adverse life experiences				
Experiences of discrimination in past year (mean)	3.1 (0.1)	1.8 (0.1)	4.2 (0.2)	<0.001***
Number of forms of lifetime sexual abuse	401 (46.2)	222 (56.2)	179 (37.9)	<0.001***
0	214 (24.7)	95 (24.0)	119 (25.2)	
1	134 (15.5)	39 (9.9)	95 (20.2)	
2	59 (6.8)	15 (3.8)	44 (9.3)	
3	59 (6.8)	24 (6.1)	35 (7.4)	
Missing				
Cardiovascular health				
Tobacco use	113 (13.0)	36 (9.1)	77 (16.3)	<0.001***
Poor	30 (3.5)	9 (2.3)	21 (4.5)	
Intermediate	724 (83.5)	350 (88.6)	374 (79.2)	
Ideal				
Physical activity	52 (6.0)	23 (5.8)	29 (6.1)	0.97
Poor	173 (20.0)	80 (20.3)	93 (19.7)	
Intermediate	643 (74.0)	292 (73.9)	350 (74.2)	
Ideal				
Body mass index	316 (36.4)	120 (30.4)	196 (41.5)	<0.01**
Poor	245 (28.3)	125 (31.6)	120 (25.4)	
Intermediate	306 (35.3)	150 (38.0)	156 (33.1)	
Ideal				
Blood pressure	21 (2.4)	8 (2.0)	13 (2.8)	0.16
Poor	325 (37.5)	136 (34.5)	189 (40.0)	
Intermediate	521 (60.1)	251 (63.5)	270 (57.2)	
Ideal				

	Total (N=867)	Heterosexual (n=395)	SMW (n=472)	*p*-value
Fasting plasma glucose	26 (3.0)	7 (1.8)	19 (4.0)	0.04*
Poor	194 (22.4)	79 (20.0)	115 (24.4)	
Intermediate	647 (74.6)	309 (78.2)	338 (71.6)	
Ideal				
Total cholesterol	167 (19.8)	78 (19.8)	89 (18.9)	0.94
Poor	340 (38.7)	153 (38.7)	187 (39.6)	
Intermediate	260 (41.5)	164 (41.5)	196 (41.5)	
Ideal				
Cumulative CVH score (mean)	8.9 (0.1)	9.1 (0.1)	8.6 (0.1)	<0.001***

Note. SMW = sexual minority women.

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Table 3.

Sexual identity differences in individual cardiovascular health components in the ESTHER study (N=867).

	Intermediate Criteria (Reference = Poor)			Ideal Criteria (Reference = Poor)		
	Model 1 OR (95% CI)	**Model 2 AOR (95% CI)**	**Model 3 AOR (95% CI)**	**Model 1 OR (95% CI)**	**Model 2 AOR (95% CI)**	**Model 3 AOR (95% CI)**
Current tobacco use						
Heterosexual	Ref	Ref	Ref	Ref	Ref	Ref
SMW	1.09 (0.45–2.62)	1.03 (0.42–2.55)	1.06 (0.41–2.76)	**0.50 (0.33–0.76)*****	**0.45 (0.29–0.71)****	**0.44 (0.27–0.71)****
Physical activity						
Heterosexual	Ref	Ref	Ref	Ref	Ref	Ref
SMW	0.92 (0.49–1.72)	0.85 (0.45–1.63)	0.80 (0.40–1.59)	0.95 (0.53–1.68)	0.95 (0.52–1.72)	0.82 (0.43–1.55)
Body mass index						
Heterosexual	Ref	Ref	Ref	Ref	Ref	Ref
SMW	**0.59 (0.42–0.82)****	**0.57 (0.40–0.81)***	**0.66 (0.45–0.98)***	**0.64 (0.46–0.88)****	**0.63 (0.44–0.89)****	0.74 (0.51–1.09)
Blood pressure						
Heterosexual	Ref	Ref	Ref	Ref	Ref	Ref
SMW	0.85 (0.34–2.12)	0.82 (0.33–2.13)	0.98 (0.35–2.74)	0.66 (0.27–1.62)	0.61 (0.24–1.58)	0.77 (0.28–2.18)
Fasting glucose						
Heterosexual	Ref	Ref	Ref	Ref	Ref	Ref
SMW	0.53 (0.22–1.34)	0.50 (0.19–1.27)	0.53 (0.20–1.43)	**0.40 (0.17–0.97)***	**0.38 (0.15–0.94)***	0.44 (0.17–1.14)
Total cholesterol						
Heterosexual	Ref	Ref	Ref	Ref	Ref	Ref
SMW	1.07 (0.74–1.55)	1.10 (0.75–1.61)	1.08 (0.71–1.63)	1.05 (0.72–1.51)	1.04 (0.70–1.56)	1.14 (0.74–1.78)

Note. Model 1 unadjusted; Model 2 added demographic characteristics; Model 3 added psychosocial factors and adverse life experiences.

* p <0.05

** p <0.01

*** p <0.001

Table 4.

Sexual identity differences in ideal cardiovascular health scores in ESTHER study (N=867).

	Model 1	Model 2	Model 3
Cumulative ideal CVH score	***B* (*SE*)**	***B* (*SE*)**	***B* (*SE*)**
Sexual identity Heterosexual SMW	Ref −0.48 (0.14)***	Ref −0.44 (0.12)***	Ref −0.32 (0.13)*
Age	-	−0.05 (0.01)***	−0.06 (0.01)***
White race	-	0.21 (0.08)**	0.12 (0.08)
Education	-	0.21 (0.06)***	0.19 (0.07)**
Household income	-	0.07 (0.05)	0.06 (0.05)
Employed	-	−0.01 (0.09)	−0.02 (0.09)
Relationship status	-	0.09 (0.15)	0.08 (0.15)
Geographic area	-	0.13 (0.05)**	0.13 (0.05)*
Self-rated health		−0.65 (0.07)***	−0.59 (0.08)***
Menopause	-	0.07 (0.18)	0.01 (0.18)
Healthcare coverage	-	0.41 (0.23)	0.40 (0.24)
Alcohol use in past month	-	-	−0.28 (0.03)
Fast food intake per week	-	-	−0.12 (0.03)***
Depressive symptoms	-	-	0.00 (0.01)
Perceived stress	-	-	−0.03 (0.02)
Social support	-	-	−0.01 (0.01)
Experiences of discrimination	-	-	−0.02 (0.02)
Lifetime sexual abuse	-	-	−0.10 (0.07)

Note. Model 1 unadjusted. Model 2 added demographic characteristics; Model 3 added health behaviors, psychosocial factors, and adverse life experiences.

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$