Discrimination is Associated with C-Reactive Protein Among Young Sexual Minority Men

Stephanie H. Cook,[1,2] Natalie Slopen,[3] Laura Scarimbolo,[1] Nicholas Mirin,[1] Erica P. Wood,[1] Nicole Rosendale,[4,5] Rumi Chunara,[2,6] Colin W. Burke,[7] & Perry N. Halkitis[8-12]

[1]Department of Social and Behavioral Sciences, School of Global Public Health, New York University

[2]Department of Biostatistics, School of Global Public Health, New York University

[3]Department of Social and Behavioral Science, Harvard T. H. Chan School of Public Health, Boston, MA, USA

[4]Department of Neurology, University of California San Francisco Medical Center, San Francisco, CA, USA

[5]Weill Institute for Neurosciences, University of California San Francisco, San Francisco, CA, USA

[6]Department of Computer Science & Engineering, NYU Tandon School of Engineering, Brooklyn, New York, USA

[7]Department of Psychiatry, Harvard Medical School, Boston, MA, USA

[8]Center for Health, Identity, Behavior and Prevention Studies, Rutgers University, Piscataway, NJ, USA

[9]Department of Biostatistics and Social and Behavioral Health Sciences, Rutgers School of Public Health, Rutgers University, Piscataway, NJ, USA

[10]Rutgers Robert Wood Johnson Medical School, Rutgers University, Piscataway, NJ, USA

[11]Graduate School of Applied and Professional Psychology, Rutgers University, Piscataway, NJ, USA

[12]School of Public Affairs and Administration, Rutgers University, Piscataway, NJ, USA

Corresponding Author
Stephanie H. Cook
708 Broadway, Room 757
New York, NY 10012
sc5810@nyu.edu

Declarations

Funding: N/A

Conflicts of interest/Competing interests: The authors declare no conflicts of interest.

Ethics approval: This study was approved by the New York University Institutional Review Board.

Consent to participate: All participants consented to participate in this study.

Consent for publication: All participants consented to have their data published in this study.

Availability of data and material: The data used in this study are available upon reasonable request from the corresponding author, SHC.

Code availability: The code that supports the findings of this study are available upon reasonable request from the corresponding author, SHC.

Authors' contributions: SHC conceptualized the study, wrote and oversaw the analysis, and edited the manuscript; LS helped to conceptualize the study; LS and NM conducted the statistical analyses; NM, EPW, NR, RC, CWB, & PNH made substantial edits to the manuscript.

Abstract

Objective: This report examines associations between everyday discrimination, microaggressions, and CRP to gain insight on potential mechanisms that may underlie increased CVD risk among sexual minority male young adults.

Methods: The sample consisted of 60 participants taken from the P18 cohort between the ages of 24 and 28 years. Multinomial logistic regression models were used to examine the association between perceived everyday discrimination and LGBQ microaggressions with C-reactive protein cardiovascular risk categories of low-, average-, and high-risk, as defined by the American Heart Association and Centers for Disease Control. Adjustments were made for BMI.

Results: Individuals who experienced more everyday discrimination had a higher risk of being classified in the high-risk CRP group compared to the low-risk CRP group (RRR = 3.35, p = 0.02). Interpersonal LGBQ microaggressions were not associated with CRP risk category.

Conclusions: Everyday discrimination, but not specific microaggression based on sexual orientation, were associated with elevated levels of CRP among young sexual minority men (YSMM). Thus, to implement culturally and age-appropriate interventions, further researcher is needed to critically examine the specific types of discrimination and the resultant impact on YSMM's health.

Key words: Discrimination; C-reactive protein (CRP); Sexual minority men; Microaggressions

BMI = body mass index, **CASI** = computer-assisted survey-interview, **CRP** = C-reactive protein, **CVD** = cardiovascular disease, **hs-CRP** = high-sensitivity C-reactive protein, **LGBQ** = Lesbian, Gay, Bisexual, Queer

Introduction

Sexual minority populations are more likely to develop cardiovascular disease (CVD) than heterosexuals (Caceres et al., 2017; Caceres et al., 2020), which is attributed to, in part, the disproportionate burden of stress and discrimination they experience (Meyer, 2003). Sexual minority stress, a framework for describing the association between sexual orientation-related discrimination and health outcomes, suggests that stressful experiences (e.g., discrimination) related to one's sexual minority identity is associated with an elevated stress response (Cook & Calebs, 2016; Meyer, 2003). In addition to discrimination, microaggressions are another source of stress for sexual minorities (Nadal et al., 2011; Sue et al., 2007). Microaggressions are slights that convey hostile or negative messages to individuals within marginalized groups whether intentional or unintentional (Nadal et al., 2011; Sue et al., 2007). There are two distinct ways in which an individual may experience discriminatory microaggressions: interpersonal or environmental. Interpersonal microaggressions are experienced directly within an individual's social environment, whereas environmental microaggressions are experienced systematically within an individual's surroundings (Woodford et al., 2015).

Previous studies have linked minority stress and inflammation to an increased risk of developing CVD (Goosby et al., 2015; Hänsel et al., 2010; Hatzenbuehler et al., 2013; Slopen et al., 2013). Inflammatory biomarkers such as C-reactive protein (CRP) have been recommended by the American Heart Association (AHA) and Centers for Disease Control and Prevention (CDC) as a means of monitoring risk for CVD development (Pearson et al., 2003). Substantial literature demonstrates that chronic stress may lead to persistently elevated levels of CRP, indicating an ongoing inflammatory response (Everett et al., 2014; Goosby et al., 2015; Hänsel et al., 2010). Over time, sustained inflammation may increase the risk of cardiovascular events, leading to early-onset CVD or other chronic conditions associated with inflammation (Caceres et al., 2017).

Research suggests that sexual minorities display higher levels of CRP compared to their heterosexual counterparts (Everett et al., 2014; Hatzenbuehler et al., 2013). However, the social origins of this disparity have yet to be carefully examined. Stress-related biology is theorized to be a mechanism linking discrimination and microaggressions to health within sexual minorities (Meyer, 2003), and a more robust understanding of the links between discrimination, stress-related biology, and health outcomes among YSMM is needed. In this study, we evaluate the impact of everyday discrimination, and interpersonal and environmental microaggressions on CRP levels in sexual minority young men.

Methods

Participants and Procedures

Participants were recruited through the Center for Health, Identity, Behavior and Prevention Studies (CHIBPS) via the P18 cohort study on HIV risk behavior during their 24-month visit. The present study was not a part of the core P18 protocol, but rather the P18 cohort was used for recruitment. The P18 cohort was a longitudinal study that assessed the emergence of syndetic conditions among sexual minority young men in New York City. Full study details are described elsewhere (Halkitis et al., 2015).

Participants were between 24 to 28 years old. In addition to P18 cohort eligibility criteria, participants that reported a diagnosis of hypertension, diabetes, or a recent illness were excluded from the study in order to eliminate elevated hsCRP levels due to inflammation caused by these conditions (N=10). The final sample consisted of 60 men. Participants completed an informed consent prior to enrollment and audio computer-assisted self-interviewing (ACASI). Blood samples were collected by a trained phlebotomist following completion of the survey, and frozen samples were delivered to the Center for Studies in Demography and Ecology (CSDE) Biodemography Lab for processing at the University of Washington in Seattle, WA (Fujita et al., 2009; Fujita et al., 2011).

Measures

Demographics. Participants' age and race/ethnicity were collected via self-report. Race was collapsed into two categories, non-Hispanic White and other, given our sample size. The "other" group

was composed of 18 non-Hispanic Black men, 7 Hispanic men, and 19 Other race/ethnicity, which included Asian/Pacific Islander and multiracial.

Everyday Discrimination Scale. Participants completed the 10-item Everyday Discrimination Scale (Williams et al., 2008). In this questionnaire, participants were prompted with the following: "In your day-to-day life, how often do any of the following things happen to you". An example item is "You are called names or insulted." Responses were provided using a 5-point Likert scale ranging from never (0) to almost every day (5). Higher scores indicated higher frequency of everyday discrimination in the participant's day-to-day life.

LGBQ Microaggressions on Campus Scale. Participants completed the LGBQ Microaggressions on Campus scale, a validated 20-item measure that consists of two subscales assessing interpersonal and environmental LGBQ microaggressions (15 and 5 items, respectively; Woodford et al., 2015). Participants were prompted with the following: "Over the past six months, how often have you experienced these incidents". An example of an interpersonal microaggression is "Straight people assumed that I would come on to them because they thought or knew I was LGBQ" whereas an example of an environmental microaggression is "I heard the phrase 'no homo'." Participants responded to each item using a 5-point Likert scale ranging from never (0) to very frequently (5). A subscale score for each type of microaggression was created by averaging the values for the items that corresponded to the subscale. Higher scores indicated a higher exposure to LGBQ microaggressions in the past six months. Internal consistency for the study sample was high for both the interpersonal (alpha=0.94) and environmental (alpha=0.80) LGBQ microaggression scales.

Hs-CRP. The CSDE Biodemography Lab analyzed serum hsCRP values using an enzyme-linked immunoabsorbant assay (ELISA) described in detail elsewhere (Brindle et al., 2010). Microliter plates were coated in anti-CRP antibodies to measure CRP concentrations within serum samples and stored at -20°C. The method has been validated for population health research as a robust method able to detect low concentrations of CRP (Brindle et al., 2010; Fujita et al., 2009; Fujita et al., 2011).

HsCRP values were arranged into three categories according to clinical risk for CVD assigned by the AHA and CDC to create a nominal outcome variable for calculation: low (<1.00 mg/L), average (1.00-3.00 mg/L), and high (>3.00 mg/L) (Pearson Thomas et al., 2003; Salazar et al., 2014). The categories described the results in terms of clinical significance as CVD risk increases with greater CRP concentrations. Previous studies utilizing CRP in heart disease demonstrate this clinical significance using categorical CVD risk (Albert Michelle & Ridker Paul, 2006; Ballantyne Christie et al., 2004; Cushman et al., 2005).

Covariates. BMI was calculated using a standard formula based on the participant's height and weight (kg/m^2), measured by a research assistant. The values were sorted into two categories consisting of underweight/normal weight (<25.00) and overweight/obese (≥25.00). These categories were selected due to the small number of respondents in the underweight category (n=1) and the obese categories (n=11). Participants were categorized as never, former, and current smokers.

Statistical Analyses

Univariate and bivariate statistics were calculated for all study variables. Covariates that displayed significant associations with CRP at $p<.05$ in the bivariate analyses were included in multinomial logistic regression models to examine the association between perceived everyday discrimination and LGBQ microaggressions with CRP. The multinomial logistic regressions analyzed the probability of the predictor variables' association with average and high CRP relative to low CRP. Separate models were run for all 3 independent variables to avoid collinearity. In addition, 3 separate linear regression models were run to assess the associations using continuous CRP. Due to missing data patterns and in order to preserve sample size, our final study samples consisted of n=60, n=57, and n=58 YSMM for everyday discrimination, environmental LGBQ microaggressions, and interpersonal LGBQ microaggressions, respectively. Stata version 16 was used for all analyses.

Results

Descriptive Statistics

Table 1 displays the characteristics of the sample. The participants' age ranged from 24 to 28 years old (mean [M] (standard deviation [SD]) = 26.6(0.9)). The majority of the sample was normal/underweight (61.7%), never smoked (43.3%), and non-White (73.3%). Race, age, and smoking status were not associated with CRP in bivariate associations (Supplemental Tables 1-3) thus, these variables were not included in the multinomial logistic regression models. BMI was included in the multinomial regression models as it was associated with CRP in bivariate associations. The average values for the Everyday Discrimination Scale (Mean (Standard Deviation) (M(SD)) = 1.2(1.0)), environmental LGBQ microaggressions (M(SD) = 1.6(1.2)), and interpersonal LGBQ microaggressions (M(SD) = 1.0(1.0)) were low, indicating few experiences of daily discrimination and microaggressions. Sixty percent of the sample was classified into the low-risk CRP group.

Everyday Discrimination

Prior to running the multinomial regression models, we ran independent t-tests to examine if everyday discrimination differed by racial identity. However, the t-test did not reach statistical significance ($t(56) = -0.85$, $p = .40$).

Results of the multinomial model for everyday discrimination are shown in Table 2. We found that individuals that had experienced more discrimination had a higher risk of being classified in the high-risk CRP group compared to the low-risk CRP group (RRR = 3.35, p = 0.02; Table 2). There was not a significant association between discrimination and the average-risk CRP group compared with the low-risk CRP. In the sensitivity analysis utilizing continuous CRP, there was no association between everyday discrimination and the log transformed CRP.

LGBQ Microaggressions

We ran independent t-tests prior to the multinomial regression models in order to examine if LBGQ microaggressions (both environmental and interpersonal) differed by race/ethnicity. We found that YSMM who identified as Black had higher levels of environmental LGBQ microaggressions as compared to those who identified as White ($t(53) = -2.51$, $p = .02$). However, the t-test did not reach statistical significance for interpersonal microaggressions ($t(54) = -1.44$, $p = .16$).

Results of the multinomial regression models for LGBQ microaggressions are shown in Tables 3 and 4. There was no association between interpersonal LGBQ microaggressions and CRP in both the average-risk and high-risk groups compared to low-risk CRP groups (Tables 3 and 4). There was a trend towards an association between environmental LGBQ microaggressions and high-risk CRP designation, although this did not reach statistical significance (RRR = 1.81, p = 0.09). In the sensitivity analysis utilizing continuous CRP there was no association between either interpersonal or environmental LGBQ microaggressions and CRP (Supplemental Tables 5-6).

Discussion

In the current analysis, we sought to understand if there was an association between discrimination (everyday discrimination, environmental microaggressions, and interpersonal microaggressions) and CRP in a sample of YSMM. Our hypothesis was partially supported. First, YSMM with who experienced more frequent everyday discrimination had an increased likelihood of being in the high-risk CRP group versus the low CRP group. We did not observe significant associations between the microaggression scales and CRP in our study sample. Our findings are novel in that they support the need for research examining the links between discrimination, CRP, and cardiovascular risk among YSMM.

Our results regarding everyday discrimination and CRP align with a recent systematic review, which found that everyday discrimination is associated with inflammation, including CRP, in a wide range of populations (Cuevas et al., 2020). Further, Doyle and Molix (2016) found that, among gay men, perceived discrimination was associated with increased inflammation (e.g., IL-6 cytokine response). However, there are some important additional contributions that our findings make to the extant research literature. First, much of the research on discrimination is among older individuals; our study makes a unique and important contribution by examining discrimination in relation to CRP in younger populations of your sexual minority men. Our findings suggest that we must also consider this process for emerging adults who are in a developmental period where interventions related to discrimination may be most

useful (Schwartz & Petrova, 2019). Further research should critically examine how stress from discrimination influences inflammation and potentially later cardiovascular disease among diverse YSMM. Second, research aimed at understanding the specific types of discrimination that impact cardiovascular disease risk among YSMM is limited. Our results suggest that everyday discrimination may be associated with CRP among YSMM, yet we did not observe evidence for similar associations with interpersonal or environmental microaggressions. It is possible that more overt experiences of discrimination, such as being overlooked for a promotion, may have a greater impact on CRP than smaller slights (e.g., microaggressions) related to young men's sexual minority status. Future studies should specifically examine perceptions of different types of discrimination (e.g., race, sexuality, age, etc.) and their influence on CVD risk longitudinally. Such work could help better specify prevention intervention pathways that are tailored for YSMM.

This study is not without limitations. First, the sample size was small and thus limits our generalizability. However, our findings are largely supported by the results of studies with larger samples sizes and thus we have confidence in the reliability of our study findings. Secondly, we did not have granular racial/ethnic data and thus were not able to understand if there were key differences in CRP that were specifically driven by race/ethnicity. Thus, our analyses specifically focused on YSMM as a whole and based on minority stress theory (Meyer, 2003) we hypothesized that increased discrimination experienced by sexual minorities would be associated with CRP. However, there are a myriad of diverse considerations / diversities within YSMM populations that should be further examined due to their potentially elevated risk / due to potentially elevated CVD risk within the population. For instance, Poteat et al. (2021) suggests that Hispanic sexual and gender minorities (SGM) may experience greater CVD risk compared to non-Hispanic SGM. Third, we only used one measure of inflammation. Future studies should examine multiple indicators of CVD risk, such as carotid intima-media thickness (cIMT; Willeit et al., 2020), hypertension (Veliz et al., 2020), and diabetes status (Caceres et al., 2021). Utilizing a variety of CVD risk markers independently and in tandem could increase the validity of the relationship between

discrimination and CVD risk among YSMM. Limitations notwithstanding, our findings suggest that discrimination is linked to CRP among YSMM.

As suggested by the American Heart Association scientific report (Caceres et al., 2020), researchers must address discrimination as a social determinate of cardiovascular risk among sexual minority individuals. Moreover, such research should also include young sexual minority individuals in order to design prevention-oriented interventions to protect against long-term risks. Thus, we suggest that focusing future research on both older and a greater proportion of younger sexual minority men may lead to strategies to promote better cardiovascular health among sexual minority men across the life-course.

Table 1

Sample Characteristics (*N*=60)

Variable	M (*SD*)/ *N (%)*
Age	26.6 (0.9)
BMI Classification	
Underweight/Normal Weight	37 (61.7)
Overweight/Obese	23 (38.3)
Smoking Status[1]	
Never Smoked	26 (43.3)
Former Smoker	24 (40.0)
Current Smoker	9 (15.0)
Race[2]	
Non-Hispanic White	14 (23.3)
Other	44 (73.3)
Expanded Everyday Discrimination Scale [range=0, 4.5]	1.2 (1.0)
Environmental LGBQ Microaggressions Score[3] [range=0, 4.4]	1.6 (1.2)
Interpersonal LGBQ Microaggressions Score[4] [range=0, 3.5]	1.0 (1.0)
Hs-CRP, mg/L	1.6 (2.3)
Hs-CRP, mg/L (median (IQR))	0.6 (1.81)
Categorical HsCRP CVD Risk	
Low Risk (<1mg/L)	36 (60.0)
Average Risk (1-3mg/L)	14 (23.3)
High Risk (>3mg/L)	10 (16.7)

[1] Two participants' values missing (3.4%); [2] One participant's value missing (1.7%); [3] *N*=57 participants; [4] *N*=58 participants.
M=mean, SD=standard deviation, BMI=Body Mass Index, LGBQ=Lesbian, Gay, Bisexual, Queer, Hs-CRP=high-sensitivity C-reactive protein, IQR=Inter Quartile Range.

Table 2

Multinomial Logistic Regression Models for hsCRP and BMI Classification, and Everyday Discrimination Scale Score (*N*=60)

	Average (1.0 – 3.0 m/L) vs. Low (<1.0 mg/L)	High (>3.0 mg/L) vs. Low (<1.0 mg/L)
	RRR (95% CI)	*RRR (95% CI)*
Everyday Discrimination Score	0.61 (0.26, 1.41)	3.35 (1.17, 9.60)*
BMI Classification		
Underweight/Normal Weight	*Ref.*	*Ref.*
Overweight/Obese	3.64 (.92, 14.43)	17.09 (2.39, 122.32)**

Note: Ref.=reference category. Adjusted $R^2 = 0.24$ ($p=0.001$).
BMI=Body Mass Index, hsCRP=high-sensitivity C-reactive protein, RRR= relative risk ratio, CI=confidence interval.
*p<0.05; **p<.01.

Table 3

Multinomial Logistic Regression Models for hsCRP and BMI Classification, and Environmental LGBQ Microaggressions (*N*=57)

	Average (1.0 – 3.0 m/L) vs. Low (<1.0 mg/L)	High (>3.0 mg/L) vs. Low (<1.0 mg/L)
	RRR (95% CI)	*RRR (95% CI)*
Environmental LGBQ Microaggressions	.86 (48, 1.54)	1.82 (.91, 3.62)†
BMI Classification		
Underweight/Normal Weight	*Ref.*	*Ref.*
Overweight/Obese	3.28 (.88, 12.18)	6.55 (1.06, 40.34)*

Note: Ref.=reference category. Adjusted $R^2 = 0.19$ ($p=0.002$).
LGBQ=Lesbian, Gay, Bisexual, Queer, BMI=Body Mass Index, hsCRP high-sensitivity C-reactive protein, RRR=relative risk ratio, CI=confidence interval.
†p<.10; *p<0.050.

Table 4

Multinomial Logistic Regression Models for hsCRP and BMI Classification, and Interpersonal LGBQ Microaggressions (*N*=58)

	Average (1.0 – 3.0 m/L) vs. Low (<1.0 mg/L)	High (>3.0 mg/L) vs. Low (<1.0 mg/L)
	RRR (95% CI)	*RRR (95% CI)*
Interpersonal LGBQ Microaggressions	.51 (.22, 1.21)	1.24 (.60, 2.57)
BMI Classification		
Underweight/Normal Weight	*Ref.*	*Ref.*
Overweight/Obese	3.90 (1.01, 14.99)*	11.18 (1.97, 63.36)**

Note: Ref.=reference category. Adjusted $R^2 = 0.21$ ($p<0.001$).
LGBQ=Lesbian, Gay, Bisexual, Queer, BMI=Body Mass Index, hsCRP=high-sensitivity C-reactive protein, RRR=relative risk ratio, CI=confidence interval.
*p<0.05; **p<.01

References

Albert Michelle, A., & Ridker Paul, M. (2006, 2006/08/01). C-Reactive Protein as a Risk Predictor. *Circulation, 114*(5), e67-e74. https://doi.org/10.1161/CIRCULATIONAHA.106.613570

Ballantyne Christie, M., Hoogeveen Ron, C., Bang, H., Coresh, J., Folsom Aaron, R., Heiss, G., & Sharrett, A. R. (2004, 2004/02/24). Lipoprotein-Associated Phospholipase A2, High-Sensitivity C-Reactive Protein, and Risk for Incident Coronary Heart Disease in Middle-Aged Men and Women in the Atherosclerosis Risk in Communities (ARIC) Study. *Circulation, 109*(7), 837-842. https://doi.org/10.1161/01.CIR.0000116763.91992.F1

Brindle, E., Fujita, M., Shofer, J., & O'Connor, K. A. (2010). Serum, plasma, and dried blood spot high-sensitivity C-reactive protein enzyme immunoassay for population research. *Journal of immunological methods, 362*(1-2), 112-120. https://doi.org/10.1016/j.jim.2010.09.014

Caceres, B. A., Brody, A., Luscombe, R. E., Primiano, J. E., Marusca, P., Sitts, E. M., & Chyun, D. (2017). A Systematic Review of Cardiovascular Disease in Sexual Minorities. *American journal of public health, 107*(4), e13-e21. https://doi.org/10.2105/AJPH.2016.303630

Caceres, B. A., Streed, C. G., Corliss, H. L., Lloyd-Jones, D. M., Matthews, P. A., Mukherjee, M., Poteat, T., Rosendale, N., Ross, L. M., & null, n. (2020, 2020/11/10). Assessing and Addressing Cardiovascular Health in LGBTQ Adults: A Scientific Statement From the American Heart Association. *Circulation, 142*(19), e321-e332. https://doi.org/10.1161/CIR.0000000000000914

Caceres, B. A., Wardecker, B. M., Anderson, J., & Hughes, T. L. (2021, 2021/07/01/). Revictimization Is Associated With Higher Cardiometabolic Risk in Sexual Minority Women. *Women's Health Issues, 31*(4), 341-352. https://doi.org/https://doi.org/10.1016/j.whi.2021.02.004

Cook, S. H., & Calebs, B. J. (2016, Jul-Sep). The Integrated Attachment and Sexual Minority Stress Model: Understanding the Role of Adult Attachment in the Health and Well-Being of Sexual Minority Men. *Behavioral medicine (Washington, D.C.), 42*(3), 164-173. https://doi.org/10.1080/08964289.2016.1165173

Cuevas, A. G., Ong, A. D., Carvalho, K., Ho, T., Chan, S. W., Allen, J. D., Chen, R., Rodgers, J., Biba, U., & Williams, D. R. (2020, 2020/10/01/). Discrimination and systemic inflammation: A critical review and synthesis. *Brain, behavior, and immunity, 89*, 465-479. https://doi.org/https://doi.org/10.1016/j.bbi.2020.07.017

Cushman, M., Arnold Alice, M., Psaty Bruce, M., Manolio Teri, A., Kuller Lewis, H., Burke Gregory, L., Polak Joseph, F., & Tracy Russell, P. (2005, 2005/07/05). C-Reactive Protein and the 10-Year Incidence of Coronary Heart Disease in Older Men and Women. *Circulation, 112*(1), 25-31. https://doi.org/10.1161/CIRCULATIONAHA.104.504159

Doyle, D. M., & Molix, L. (2016, 2016/10/01). Minority stress and inflammatory mediators: covering moderates associations between perceived discrimination and salivary interleukin-6 in gay men. *Journal of Behavioral Medicine, 39*(5), 782-792. https://doi.org/10.1007/s10865-016-9784-0

Everett, B. G., Rosario, M., McLaughlin, K. A., & Austin, S. B. (2014). Sexual orientation and gender differences in markers of inflammation and immune functioning. *Annals of behavioral medicine : a publication of the Society of Behavioral Medicine, 47*(1), 57-70. https://doi.org/10.1007/s12160-013-9567-6

Fujita, M., Brindle, E., Rocha, A., Shell-Duncan, B., Ndemwa, P., & O'Connor, K. (2009, 08/01). Assessment of the relative dose-response test based on serum retinol-binding protein instead of serum retinol in determining low hepatic vitamin A stores. *The American journal of clinical nutrition, 90*, 217-224. https://doi.org/10.3945/ajcn.2009.27569

Fujita, M., Shell-Duncan, B., Ndemwa, P., Brindle, E., Lo, Y.-J., Kombe, Y., & O'Connor, K. (2011, Sep-Oct). Vitamin A dynamics in breastmilk and liver stores: a life history perspective. *American journal of human biology : the official journal of the Human Biology Council, 23*(5), 664-673. https://doi.org/10.1002/ajhb.21195

Goosby, B. J., Malone, S., Richardson, E. A., Cheadle, J. E., & Williams, D. T. (2015, Jul-Aug). Perceived discrimination and markers of cardiovascular risk among low-income African American youth. *American journal of human biology : the official journal of the Human Biology Council, 27*(4), 546-552. https://doi.org/10.1002/ajhb.22683

Halkitis, P. N., Kapadia, F., Bub, K. L., Barton, S., Moreira, A. D., & Stults, C. B. (2015). A Longitudinal Investigation of Syndemic Conditions Among Young Gay, Bisexual, and Other MSM: The P18 Cohort Study. *AIDS and behavior, 19*(6), 970-980. https://doi.org/10.1007/s10461-014-0892-y

Hänsel, A., Hong, S., Cámara, R. J., & von Känel, R. (2010, Sep). Inflammation as a psychophysiological biomarker in chronic psychosocial stress. *Neurosci Biobehav Rev, 35*(1), 115-121. https://doi.org/10.1016/j.neubiorev.2009.12.012

Hatzenbuehler, M. L., McLaughlin, K. A., & Slopen, N. (2013). Sexual orientation disparities in cardiovascular biomarkers among young adults. *American journal of preventive medicine, 44*(6), 612-621. https://doi.org/10.1016/j.amepre.2013.01.027

Meyer, I. H. (2003). Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. *Psychological bulletin, 129*(5), 674-697. https://doi.org/10.1037/0033-2909.129.5.674

Nadal, K. L., Wong, Y., Issa, M.-A., Meterko, V., Leon, J., & Wideman, M. (2011). Sexual orientation microaggressions: Processes and coping mechanisms for lesbian, gay, and bisexual individuals. *Journal of LGBT Issues in Counseling, 5*(1), 21-46. https://doi.org/10.1080/15538605.2011.554606

Pearson, T. A., Mensah, G. A., Alexander, R. W., Anderson, J. L., Cannon, R. O., Criqui, M., Fadl, Y. Y., Fortmann, S. P., Hong, Y., Myers, G. L., Rifai, N., Smith, S. C., Taubert, K., Tracy, R. P., & Vinicor, F. (2003, 2003/01/28). Markers of Inflammation and Cardiovascular Disease. *Circulation, 107*(3), 499-511. https://doi.org/10.1161/01.CIR.0000052939.59093.45

Pearson Thomas, A., Mensah George, A., Alexander, R. W., Anderson Jeffrey, L., Cannon Richard, O., Criqui, M., Fadl Yazid, Y., Fortmann Stephen, P., Hong, Y., Myers Gary, L., Rifai, N., Smith Sidney, C., Taubert, K., Tracy Russell, P., & Vinicor, F. (2003, 2003/01/28). Markers of Inflammation and Cardiovascular Disease. *Circulation, 107*(3), 499-511. https://doi.org/10.1161/01.CIR.0000052939.59093.45

Poteat, T., Gallo, L. C., Harkness, A., Isasi, C. R., Matthews, P., Schneiderman, N., Thyagarajan, B., Daviglus, M. L., Sotres-Alvarez, D., & Perreira, K. M. (2021, 2021/5/6). Influence of Stress, Gender, and Minority Status on Cardiovascular Disease Risk in the Hispanic/Latino Community:

Protocol for a Longitudinal Observational Cohort Study. *JMIR Res Protoc, 10*(5), e28997. https://doi.org/10.2196/28997

Salazar, J., Martínez, M. S., Chávez, M., Toledo, A., Añez, R., Torres, Y., Apruzzese, V., Silva, C., Rojas, J., & Bermúdez, V. (2014). C-reactive protein: clinical and epidemiological perspectives. *Cardiology research and practice, 2014*, 605810-605810. https://doi.org/10.1155/2014/605810

Schwartz, S. J., & Petrova, M. (2019, 2019/04/01). Prevention Science in Emerging Adulthood: a Field Coming of Age. *Prevention Science, 20*(3), 305-309. https://doi.org/10.1007/s11121-019-0975-0

Slopen, N., Kubzansky, L. D., McLaughlin, K. A., & Koenen, K. C. (2013). Childhood adversity and inflammatory processes in youth: a prospective study. *Psychoneuroendocrinology, 38*(2), 188-200. https://doi.org/10.1016/j.psyneuen.2012.05.013

Sue, D. W., Capodilupo, C. M., Torino, G. C., Bucceri, J. M., Holder, A. M. B., Nadal, K. L., & Esquilin, M. (2007). Racial microaggressions in everyday life: Implications for clinical practice. *American Psychologist, 62*(4), 271-286. https://doi.org/10.1037/0003-066X.62.4.271

Veliz, P. T., McCabe, S. E., Hughes, T. L., Everett, B. G., Caceres, B. A., & Arslanian-Engoren, C. (2020). Sexual Orientation and Hypertension Risk Reduction Behaviors Among Adults with High Blood Pressure. *Annals of LGBTQ public and population health, 1*(2), 115-127. https://doi.org/10.1891/lgbtq-2019-0011

Willeit, P., Tschiderer, L., Allara, E., Reuber, K., Seekircher, L., Gao, L., Liao, X., Lonn, E., Gerstein, H. C., Yusuf, S., Brouwers, F. P., Asselbergs, F. W., van Gilst, W., Anderssen, S. A., Grobbee, D. E., Kastelein, J. J. P., Visseren, F. L. J., Ntaios, G., Hatzitolios, A. I., Savopoulos, C., Nieuwkerk, P. T., Stroes, E., Walters, M., Higgins, P., Dawson, J., Gresele, P., Guglielmini, G., Migliacci, R., Ezhov, M., Safarova, M., Balakhonova, T., Sato, E., Amaha, M., Nakamura, T., Kapellas, K., Jamieson, L. M., Skilton, M., Blumenthal, J. A., Hinderliter, A., Sherwood, A., Smith, P. J., van Agtmael, M. A., Reiss, P., van Vonderen, M. G. A., Kiechl, S., Klingenschmid, G., Sitzer, M., Stehouwer, C. D. A., Uthoff, H., Zou, Z.-Y., Cunha, A. R., Neves, M. F., Witham, M. D., Park, H.-W., Lee, M.-S., Bae, J.-H., Bernal, E., Wachtell, K., Kjeldsen, S. E., Olsen, M. H., Preiss, D., Sattar, N., Beishuizen, E., Huisman, M. V., Espeland, M. A., Schmidt, C., Agewall, S., Ok, E., Aşçi, G., de Groot, E., Grooteman, M. P. C., Blankestijn, P. J., Bots, M. L., Sweeting, M. J., Thompson, S. G., Lorenz, M. W., & null, n. (2020, 2020/08/18). Carotid Intima-Media Thickness Progression as Surrogate Marker for Cardiovascular Risk. *Circulation, 142*(7), 621-642. https://doi.org/10.1161/CIRCULATIONAHA.120.046361

Williams, D. R., Gonzalez, H. M., Williams, S., Mohammed, S. A., Moomal, H., & Stein, D. J. (2008). Perceived discrimination, race and health in South Africa. *Social science & medicine (1982), 67*(3), 441-452. https://doi.org/10.1016/j.socscimed.2008.03.021

Woodford, M. R., Chonody, J. M., Kulick, A., Brennan, D. J., & Renn, K. (2015). The LGBQ microaggressions on campus scale: A scale development and validation study. *Journal of Homosexuality, 62*(12), 1660-1687. https://doi.org/10.1080/00918369.2015.1078205