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A biopsychosocial framework for understanding sexual and gender minority health: A call for action

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ABSTRACT

The number of US adults identifying as lesbian, gay, bisexual, transgender, or a different sexual identity has doubled since 2008, and about 40 % of the sexual and gender minority population identify as people of color. Minority stress theory posits that sexual and gender minorities are at particular risk for stress via stigma and discrimination at the structural, interpersonal, and individual levels. This stress, in turn, elevates the risk of adverse health outcomes across several domains. However, there remains a conspicuously limited amount of research on the psychoneuroimmunology of stress among sexual and gender minorities. We developed the Biopsychosocial Minority Stress Framework which posits that sexual minority status leads to unique experiences of minority stress which results in adverse health behavioral factors, elevated psychological distress and sleep disturbance, and immune dysregulation. Moderators in the model include both individual differences and intersectional identities. There is a crucial need to understand the biological-psychological axis of stress among the increasingly visible sexual and gender minority population to increase their health, longevity, and quality of life.

1. Health disparities affecting sexual and gender minorities

The number of US adults identifying as lesbian, gay, bisexual, and transgender, among other emerging sexual and gender identities, on national population-based surveys has doubled since 2008 to 4.5 %, or more than 11 million adults (Newport, 2018). During this same time period, the number of US households headed by same-sex couples increased by 73 %, from 539,230–935,229 households (US Census Bureau, 2019), with continued increases expected in coming years. Sexual and gender minorities (SGM) have significantly greater risk for overweight/obesity, asthma, diabetes, cardiovascular disease, and some forms of cancer compared to cis-gender heterosexuals (Alzahrani et al., 2019; Bostwick et al., 2010; Bradford et al., 2013; Caceres et al., 2017; Corte et al., 2013; Dilley et al., 2010; Institute of Medicine, 2011; Mayer et al., 2008; Morgan et al., 2019a; National Academies of Sciences, 2020; Patterson et al., 2020). Exposure to stressors including stigma and discrimination are implicated in these disparities, in part through behavioral factors including sleep, depression, and health behaviors (e.g., tobacco use, alcohol use, sedentary behavior; Blosnich et al., 2013; Boehmer et al., 2012; Frost et al., 2015; Gamarel et al., 2016; Garrido-Hernansaiz et al., 2016; Jackson et al., 2016; LeBlanc et al., 2015; Lee et al., 2016; Lick et al., 2013; Liu et al., 2017; Patterson et al., 2018; Wight et al., 2012). However, data on biological functioning, and its association with stress and behavioral factors, in sexual and gender

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minority populations are remarkably limited.

An estimated 40 % of the sexual and gender minority population in the US are also racial/ethnic minorities, which is higher than the 33 % of cis-gender heterosexuals who are racial/ethnic minorities (Gates, 2017). It is critical to note that race is a social rather than biological construct and "racial groups are not genetically discrete, reliably measured, or scientifically meaningful" (Smedley and Smedley, 2005). In fact, Americans of African descent have greater genetic substructure than other groups, with 73.2–82.1 % West African, 16.7 %–24 % European, and 0.8–1.2 % Native American genetic ancestry on average (Bryc et al., 2010, 2015; Zakharia et al., 2009). Consistent with race as a social construct, Americans of African descent as well as members of other minoritized groups have unique stressor exposures as members of a mistreated racial minority group. These exposures, rather than genetic differences, impart vulnerability to health inequities (Boyd et al., 2020; Cooper, 2003).

In 2017, the percentage of US adults identifying as SGM was 4.0 % among White people, 5.0 % among Black people, 6.1 % among Hispanic people, 4.9 % among Asian people, and 6.3 % among those of other races/ethnicities (Newport, 2018), resulting in significantly higher identification as SGM among racial/ethnic minorities compared to Whites. Comparatively, the rate of US adults identifying as transgender was 0.5 % among White people, 0.8 % among Black people, 0.8 % among Hispanic people, and 0.6 % among those identifying as a different race or ethnicity (Flores et al., 2016). Despite this high frequency of co-occurring minoritized identities (Chae et al., 2010), the intersecting roles of sexual and racial/ethnic identities are rarely addressed in the biobehavioral health literature. Herein, we describe a biopsychosocial framework for empirical studies (Fig. 1), as well as potential opportunities and obstacles for research in this area.

2. Stress and SGM health

Stigma refers to the co-occurrence of labeling, stereotyping, separation, status loss, and discrimination in a context in which unequal power exists (Hatzenbuehler et al., 2013b). Increasingly rigorous research locates stigma across structural, interpersonal, and individual levels as the primary source of the disproportionately poor health experienced by sexual and gender minorities (Hatzenbuehler and Pachankis, 2016; White Hughto et al., 2015). For instance, at the structural level, several natural experiments have shown that reductions in discriminatory laws and policies prospectively predict reductions in sexual minorities' health care expenditures, health-risk behaviors, and mental health problems (e.g., Everett et al., 2016; Hatzenbuehler et al., 2012; Raifman et al., 2018). At the interpersonal level, discrimination and victimization are consistently associated with poor physical health among sexual minorities (e.g., Bränström et al., 2016; Frost et al., 2015). Among transgender people, discrimination and victimization are compounded, leading to poorer overall health through reduced access to a variety of services including mental health, and employment services (Bockting et al., 2013; White Hughto et al., 2015). Finally, cultural ideologies of anti-sexual and gender minority stigma can become internalized by the individual and directed toward the self. At the individual level, this type of self-stigma is consistently associated with poor mental health and health behaviors (e.g., Berg et al., 2013; Bockting et al., 2013; Newcomb and Mustanski, 2010).

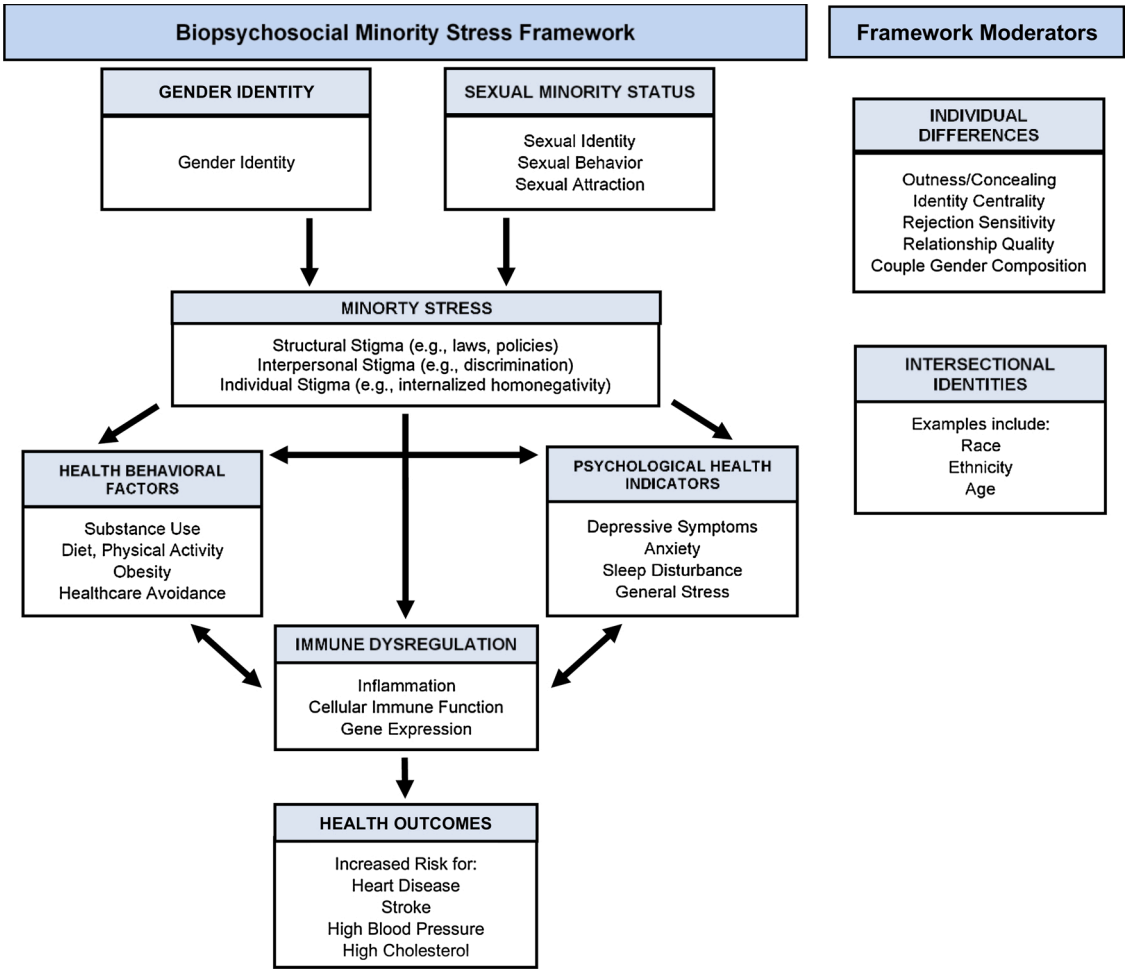

Fig. 1. Biopsychosocial Minority Stress Framework.

According to minority stress theory (Meyer, 2003), structural, interpersonal, and individual forms of stigma give rise to proximal stress experiences that in turn elevate health risk for sexual and gender minorities. These stigma-related stressors experienced by sexual and gender minorities across these levels compound general life stressors to additively confer risk for stress-related health outcomes (Bockting et al., 2019; Meyer et al., 2008; Puckett and Levitt, 2015). For instance, sexual minorities living in countries with higher degrees of structural stigma toward sexual minorities (e.g., more discriminatory laws and policies) report more internalized homonegativity, are more likely to conceal their sexual orientation, and experience greater social isolation than sexual minorities living in countries with lower degrees of structural stigma (Pachankis et al., 2020). Similarly, internalized transphobia can be described across four key domains: having pride in one's transgender identity, investment in passing as a cisgender person, alienation from other transgender people, and shame (Bockting et al., 2019). Interpersonal discrimination and victimization are closely associated with proximal minority stressors, including internalized homonegativity and sensitivity to status-based rejection, which are in turn associated with poor mental health and health-risk behaviors (Bockting et al., 2013; Feinstein et al., 2012; Frost et al., 2015; Frost and Meyer, 2009; Pachankis et al., 2015b). Anxious expectations of rejection might be particularly pronounced among gender minorities, with one study finding that two-thirds of transgender men report having experienced mistreatment in healthcare settings at some point in their lives and nearly half reported having avoided healthcare services in the past year (Hughto et al., 2018). Taken together, these data paint a picture of SGM populations at greater risk for a host of poor health outcomes.

Yet, not all sexual and gender minorities are similarly stressed by their exposure to structural and interpersonal forms of stigma, and even stigma processes at the individual level interact in complex ways to predict health outcomes. For example, the impact of structural stigma on substance use among sexual minority men is more pronounced for those who report greater tendencies to anxiously anticipate stigma-related rejection (Pachankis et al., 2014). And although rates of stigma-related substance use among transgender youth (aged 14–18) are partially mitigated by a feeling of family or school connectedness, overall levels remain much higher than among their cis-gendered peers (Watson et al., 2019). Similarly, the association between country-level structural stigma, discrimination, and mental health depends on the extent to which sexual and gender minority individuals conceal their identity (Mizock and Mueser, 2014; Pachankis and Bränström, 2018). Likewise, the association between concealment and mental health depends on social isolation – concealment is only associated with poor mental health for those with low social support (van der Star et al., 2019). Finally, minority stress theory proposes that the centrality of one's sexual minority identity moderates the impact of stigma-related stress on health, although this tenet currently has mixed empirical support (e.g., la Roi et al., 2019). Within the sexual and gender minority community, bisexual individuals are at unique risk for negative mental health outcomes (Ross et al., 2018; Salway et al., 2019; Schrimshaw et al., 2013) perhaps due to facing both heterosexism and monosexism which elevates intimate relationships and attractions between individuals who both identify as the same gender (Roberts et al., 2015). Further, individuals with non-LGB or multiple sexual identities may also experience the negative effects of both hetero and monosexism (Feinstein et al., 2020). Meta-analytic results suggest that bisexual individuals report the highest rates of suicide ideation and attempts (Salway et al., 2019), as well as depression and anxiety (Ross et al., 2018), compared to gay, lesbian, and heterosexual individuals. Bi-erasure can emerge from heterosexism and monosexism which is an internalized feeling of invisibility (Yoshino, 2017). As such, recent research identifies high levels of concealment in the bisexual and other non-monosexual community, and this concealment was associated with elevated depression and anxiety (Feinstein et al., 2020). Importantly, the bulk of this research focuses on mental or behavioral health as operationalized by self-report measures without complementary data on biomarkers.

Health disparities among sexual and gender minorities also differ across race/ethnicity (Rodriguez-Seijas et al., 2019), sexual identity (e.g., bisexual vs. gay/lesbian; Dyar et al., 2019), gender identity (Bostwick et al., 2010; Reisner et al., 2014; White Hughto et al., 2015), partner gender (Dyar et al., 2019), and intersections thereof (Trinh et al., 2017). These disparities call for future research to determine whether these demographic factors might also moderate the impact of structural, interpersonal, and individual stigma exposure on sexual minority health (Lewis and Van Dyke, 2018). For instance, existing research shows that the mental health benefits of outness accrue more heavily to sexual minority women than men (Pachankis et al., 2015a) and that outness is associated with positive physical health for sexual minority men of higher socioeconomic status, but poorer physical health for sexual minority men of lower socioeconomic status (McGarrity and Huebner, 2014). Additional research suggets that transgender youth who have chosen a name aligning with their gender identity experience large reductions in poor health outcomes but limited gains in positive mental health outcomes (Pollitt et al., 2019). Future research is needed to investigate such associations across additional axes of identity-related stress, both sexuality- and gender-related.

3. Stress and the immune system: psychoneuroimmunology

Effects of chronic stress on the immune system are well documented. While early studies hypothesized that stress "impairs" immune function, it is now apparent that the body responds to chronic stress in a complex manner that is better described as immune dysregulation, with complementary up-regulation of inflammatory processes and down-regulation of viral monitoring. Inflammation increases risk for a variety of chronic diseases including cardiovascular and neurodegenerative diseases as well as some types of cancer, while reduced cellular immune function increases risk for acute illnesses via poorer responses to vaccines and reduced ability to fight viral infections.

Chronic stress affects the immune system directly via effects on the hypothalamic-pituitary-adrenal axis and sympathetic nervous system. Stress also indirectly affects immune function by promoting poor sleep, depressed mood, and adverse health behaviors (e.g., poor diet/sedentary behavior) which act synergistically to impact health (Irwin et al., 2015; Kiecolt-Glaser et al., 2015, 2010; Lopresti et al., 2013; O'Neill et al., 2018; Shelton and Miller, 2010; Slavich and Irwin, 2014). Sexual and gender minority status increases risk for sleep disturbance, depression, and adverse health behaviors (Blosnich et al., 2013; Boehmer et al., 2012; Frost et al., 2015; Gamarel et al., 2016; Garrido-Hernansaiz et al., 2016; Harry-Hernandez et al., 2020; Jackson et al., 2016; LeBlanc et al., 2015; Lee et al., 2016; Lick et al., 2013; Liu et al., 2017; Patterson et al., 2018; White Hughto et al., 2015; Wight et al., 2012), with differential effects in SM women and men (e.g., compared to heterosexuals, lesbians have greater propensity toward sedentary behavior and obesity, while gay men show less; Conron et al., 2010). Links between sexual minority stress, behavioral factors, and biological health are poorly delineated. In addition, an extensive body of work documents effects of racial/ethnic minority status and discrimination on immune, neuroendocrine, and cardiovascular processes, with direct implication for disparities in health (Allen et al., 2019; Christian, 2020; Cunningham et al., 2012; Hall et al., 2009; Kershaw et al., 2016; Lewis et al., 2010; Moody et al., 2018; Slopen et al., 2010; Stepanikova et al., 2017; Williams, 1999). Critically, the intersectional effects of sexual, gender, and racial/ethnic minority status remain unexamined in the PNI literature.

3.1. Inflammation

As described, a central pathway by which stress exerts ill health effects is via enhancement of inflammatory processes. Inflammation is an essential immune response to infection or injury. Among multiple other functions, inflammation promotes destruction (phagocytosis) and clearance of pathogens and initiates wound healing. However, exaggerated or chronic inflammation is implicated in risk for a number of serious medical conditions including cardiovascular and neurodegenerative diseases, arthritis, diabetes, inflammatory bowel disease, periodontal disease, certain cancers, and age-related functional decline (Ben-Neriah and Karin, 2011; Cekici et al., 2014; Collaboration, 2012; Donath, 2014; Esser et al., 2014; Franceschi and Campisi, 2014; Michaud et al., 2013).

Studies have established that chronic stress enhances circulating levels of inflammatory markers – particularly interleukin-6 (IL-6) and C-reactive protein (CRP) – and increases inflammatory responses to behavioral and biological challenges (e.g., sleep deprivation, vaccination). Of particular relevance to minority health disparities, chronic stress associated with racial minority status and racial discrimination are linked with exaggerated inflammatory responses to acute laboratory stressors (Christian et al., 2013) and greater vulnerability to inflammatory dysregulation upon exposure to both poor diet and sleep disturbance (Blair et al., 2015; Christian et al., 2016, 2018). Data from Morgan and colleagues shows that CRP is broadly elevated among young sexual and gender minorities (50 % of sample $\geq$ 3 mg/L), independent of socioeconomic status, geographic location, or HIV status (Morgan et al., 2019a, b). Research is needed to examine the effects of sexual and gender minority status and the intersectional effects of racial minority status on inflammatory processes.

3.2. Cellular immune function

While inflammation is up-regulated in the context of chronic stress, cellular immune function is impaired, decreasing the body's ability to respond to vaccines and fight viral infections. Latent viruses provide an ideal opportunity for examining these effects (Christian et al., 2009). Normally viruses are eliminated from the host when infection is resolved. However, some viruses are maintained in the body in a latent (suppressed) state in asymptomatic individuals after primary infection. These include viruses from the herpesviruses family, such as varicella-zoster virus (VZV), cytomegalovirus (CMV), and Epstein-Barr virus (EBV). After primary infection, latent viruses are maintained within certain cells (e.g., B-lymphocytes for EBV). The immune system is typically quite effective in keeping these viruses suppressed (i.e., in a latent state). However, these viruses act opportunistically, reactivating when they detect that the cellular immune system is impaired. Thus, higher levels of EBV-specific antibodies indicate greater impairment of cellular immunity.

A methodological strength of studying EBV is that it is ubiquitous; >95 % of US adults are infected with EBV (Wolf and Morag, 1998). A meta-analysis of 20 immune outcomes found that EBV reactivation was among the strongest and most reliable correlates of stress (Van Rood et al., 1993). Greater EBV reactivation has been documented in the context of greater perceived stress, poorer sleep quality, caregiving for a spouse with dementia, stress of divorce/separation, and low social status and stress related to "Westernization" among Samoan youth (Kiecolt-Glaser et al., 1991, 1987, 1988; McDade, 2001, 2002). The chronic stress of racial minority status and exposure to racial discrimination has been associated with chronic elevations in EBV antibody titers across a 10 month assessment period (Christian et al., 2012). Data on stress and viral monitoring in relation to sexual minority status are lacking. These data, in conjunction with data on inflammatory status, would permit the testing of the hypothesis that complementary up-regulation of inflammation and down-regulation of viral monitoring may typify chronic stress associated with sexual minority status.

3.3. Social genomics

As the AIDS epidemic emerged in the 1980s, PNI research began to map the biological pathways through which social and psychological processes impacted the speed of HIV disease progression and mortality. Issues of sexual identity played a central role in these analyses, with disease-related stigma compounding stigmatized sexual identities to emerge as some of the strongest psychosocial predictors of accelerated disease progression (e.g., immune decline, AIDS onset, and mortality in closeted gay men) (Cole et al., 1997, 1996b). A range of laboratory virological studies (Cole et al., 1999, 1998, 2001; Collado-Hidalgo et al., 2006), experimental animal models (Cole et al., 2015; Sloan et al., 2007, 2006), and human clinical studies (Cole et al., 2003, 2001) subsequently converged in mapping biological pathways through which threat-related psychosocial processes act through the sympathetic nervous system to accelerate HIV-1 replication via stimulation of viral gene expression, up-regulation of viral coreceptors on human host immune cells, and the inhibition of antiviral immune responses (particularly transcriptional down-regulation of the Type I interferon response to viral replication) (Cole, 2008; Collado-Hidalgo et al., 2006).

As the human genome sequence emerged, the gene regulatory principles, molecular analysis strategies, and bioinformatics tools originally developed to analyze social regulation of relatively simple viral genomes were soon directed toward the more complex human genome to understand how social epidemiological risk factors impacted the development of chronic non-infectious illnesses such as cancer, cardiovascular disease, and neurodegeneration. A seminal study analyzed gene expression profiles in peripheral blood leukocytes from chronically lonely older adults and found a striking pattern of up-regulated expression of pro-inflammatory genes and down-regulated expression of antiviral genes (including the Type I interferons previously implicated in HIV-1 infection; Fig. 2; Cole et al., 2007).

A similar pattern of pro-inflammatory / anti-antiviral transcriptome skewing has since been observed in leukocytes sampled from people exposed to a diverse array of adverse life circumstances such as imminent bereavement (Bourassa et al., 2020; Miller et al., 2008), traumatic stress (Yang and Jiang, 2020), social isolation (Cole et al., 2007; Frost et al., 2015; Smith, 2020), low SES (Chen et al., 2009; Muscatell et al., 2020), and cancer diagnosis (Lutgendorf et al., 2009; Peppas et al., 2020). Similar dynamics have also been observed in experimental animal models of social instability, low social rank, and repeated social defeat. Coined the "conserved transcriptional response to adversity" (CTRA) (Cole, 2013, 2014, 2019), this pattern of immune cell transcriptional alteration provided a molecular framework for understanding the previously puzzling epidemiological observation that chronic psychosocial adversities are often associated with diseases that involve both up-regulated immune function (inflammation-related diseases such as heart and neurodegenerative diseases, and some cancers) and down-regulated immune function (reduced responses to vaccines and viral infections in particular). The CTRA appears to be stimulated by "fight-or-flight" sympathetic nervous system activity whenever environmental conditions are experienced as threatening, stressful, or uncertain for an extended period of time (Cole, 2019). Of particular significance for sexual minorities, experiences of discrimination have also been linked to increased CTRA profiles (Brown et al., 2020; Thames et al., 2019), including discrimination based on sexual identity (Li et al., 2020). As such, the application of social genomics to understanding SM health disparities holds great promise.

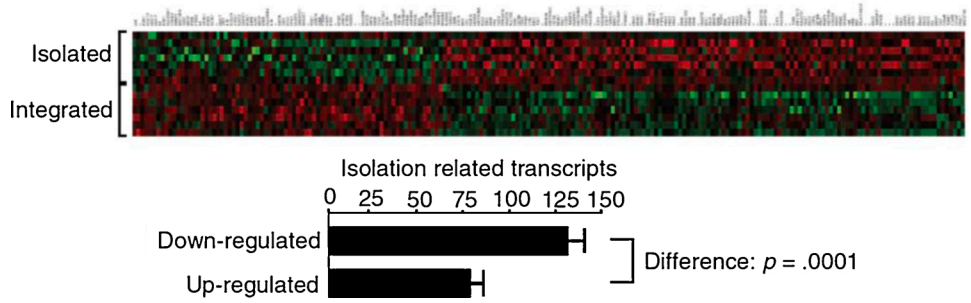

Fig. 2. Leukocyte transcriptional fingerprint of social isolation. 209 human genes differentially expressed in leukocytes from chronically lonely and socially integrated older adults. Rows = individuals, Columns = genes, Cell color: red = up-regulated >30 %, green = down-regulated >30 %. (Reprinted from Cole et al., 2007).

4. Available psychoneuroimmunology data among SGM

Within the PNI literature, robust effects of racial/ethnic discrimination are clear (Allen et al., 2019; Christian, 2012; Cunningham et al., 2012; Hall et al., 2009; Kershaw et al., 2016; Lewis et al., 2010; Moody et al., 2018; Slopen et al., 2010; Stepanikova et al., 2017; Williams, 1999). Yet, studies of stress biology among SGM are sparse, with a few on cortisol (Hatzenbuehler and McLaughlin, 2014; Juster et al., 2015, 2013; Manigault et al., 2018; Parra et al., 2016), CRP (Everett et al., 2014; Hatzenbuehler et al., 2013a; Morgan et al., 2019a, b), and/or immunity in HIV (e.g., Burack et al., 1993; Cole et al., 2003, 1996b). Even fewer exist on immunity among the broader SGM population. These studies have had somewhat contradictory findings, and interpretation has been difficult due to insufficient assessment of key moderators/mediators (e.g., minority stress, outness). Data from National Health and Nutrition Examination Survey (NHANES) showed elevated allostatic load (a composite index of 9 indicators including CRP) in bisexual vs heterosexual men (Mays et al., 2018). The National Longitudinal Study for Adolescent to Adult Health (Add Health), which included 520 lesbian, gay, or bisexual individuals, found that gay/bisexual men had elevated CRP compared to heterosexual men, an effect not observed in lesbian/bisexual women (although these effects were significant only with specific variables added to the model, as the authors themselves note) (Hatzenbuehler et al., 2013a). Data from Add Health also showed complex interactions between gender and sexual minority status in relation to both CRP and EBV, effects that were not readily explainable (Everett et al., 2014). The authors called for more nuanced methodological approaches, including assessments of SGM stress. The little work available on other biomarkers (CRP, IL-6, IL-10, etc.) has been conducted primarily among young (aged 16–29) men who have sex with men and transgender women, noting broadly elevated levels of systemic inflammation (Morgan et al., 2019a; Morgan et al., 2019b). Data on gene expression and SM health are particularly sparse. Among SM men with HIV, differential expression of genes related to inflammation/immune function as well as cancer and CVD risk was observed in those reporting high (n = 18) vs low (n = 20) SM stress (Flentje et al., 2018).

Sexual and gender minorities may choose to attempt to conceal their stigmatized status. “Outness” can differ by relational/social context (e.g., family, friends, work) (Mohr and Fassinger, 2000). Greater outness has paradoxically been associated with both better psychological resilience (positive identity) and stress-buffering effects (greater community acceptance), but also greater exposure to discrimination (Doyle and Molix, 2016; Juster et al., 2013). For example, among 78 gay men, elevations in IL-6 were seen in those reporting greater discrimination, but only among those reporting greater outness (Doyle and Molix, 2016). Similar to sexual minorities, transgender adults in the U.S. typically conceal their identity to avoid stigma and victimization (Rood et al., 2017), however, findings within this population are much more limited. Outness has also been linked to greater physical health in gay men (Cole et al., 1996a, b) although this effect is complex, and modified by individual sensitivity to social rejection (with closeting apparently providing some health-protective effects for those most vulnerable to homophobic rejection) (Cole et al., 1997). Similar to sexual minorities, a study conducted among 56 transgender and gender non-conforming youth (aged 9–20) found a significant association between inflammation (assessed via CRP and dried blood spots) and higher composite score on the Gender Minority Stress and Resilience scale, although individual components of the scale were not significantly associated with inflammation (McQuillan et al., 2021). Taken together, factors contributing to outness and mental/physical health effects are complex and multifactorial and must be examined in further detail (Mohr and Fassinger, 2000).

5. Methodological hurdle: accessing a large, representative sample of SGM individuals

A central challenge of conducting biological research focused on SGM health is the difficulty in accessing a diverse, representative sample. In fact, it is difficult to even estimate how many Americans are sexual or gender minorities. Most federal surveys including the Census and the American Community Survey do not ask respondents their sexual and gender identity (National Academies of Sciences, 2020). Both the Census and the American Community Survey do now include questions for partnered individuals as to whether they are partnered with a person of the same or different-sex. About one million same-sex couples were reported in the US in 2019 according to the American Community Survey (US Census Bureau, 2020). But, same-sex married couples accounted for just 1 % of married-couple households and 5 % of cohabiting-couple households in the US in 2019. Just over 50 % of couples were same-sex couples headed by women. Of same-sex couples, about 15 % had a child under 18 in their household, about 58 % were married, and about 42 % were cohabiting (Taylor, 2020). And while reporting is limited among sexual minorities, no data exists regarding the number households headed by transgender individuals. Even more so, these counts miss the proportion of the population that identifies as a sexual or gender minority and are single, as well as those that identify as a sexual or gender minority and are partnered with someone of a different gender (e.g., a bisexual individual partnered with someone of a different-sex). As noted above, the percentage of US adults who identify as SGM has steadily increased since 2012 (Gates, 2017). Between 2012 and 2017, the percentage of US adults personally identifying as SGM grew from 3.5 % in 2012 to 4.5 % in 2017. The growth was most concentrated among Millennials who were born between 1980 and 1999; 5.8 % identified as SGM in 2012, and 8.2 % did in 2017. The growth occurred across the gender, race/ethnicity, and education spectrums. Yet even with this growth in the SGM population, their continued low incidence in the population make them a hard to reach population.

Collecting a large, diverse sample of sexual and gender minorities to understand their stress biology is important (Conron et al., 2012) because SGM who live in communities and states with adverse climates

(i.e. that lack sexual orientation or transgender employment discrimination bans) have elevated psychiatric disorders (Blosnich et al., 2016; Hatzenbuehler et al., 2009) and increased health care use and costs (Hatzenbuehler et al., 2012). As an indicator of how policy contexts shape health, sexual and gender minorities' wellbeing declined in the months before and after the 2016 presidential election (Gates, 2016). Further, intersectionality is "a theoretical framework that posits that multiple social categories (e.g., race, ethnicity, gender, sexual orientation, socioeconomic status) intersect at the micro level of individual experience to reflect multiple interlocking systems of privilege and oppression at the macro, social-structural level (e.g., racism, sexism, heterosexism)" (pp. 1267, Bowleg, 2012). Intersectionality plays out in the lives of sexual and gender minorities; sexual and gender minorities of color face greater stigma and hostility due to their sexual minority status (Grov et al., 2006; Lewis, 2003; Meyer et al., 2008; Schulte and Battle, 2004; Swank et al., 2013; Whitfield et al., 2014). For example, the self-rated health disadvantage of women in same-gender cohabiting unions as compared to women in different-gender marriages was higher in magnitude for women who were Black and Hispanic as compared to women who were White (Liu et al., 2017). Large, racially/ethnically and geographically diverse samples of sexual and gender minorities are critical to understand the contextual effects of stress in this population.

6. Methodological opportunities: biological data collection in the home

Historically, large community- and population-based studies investigating how social contexts and identities shape health have relied on vital records or participant self-reports of mental and physical functioning (McDade et al., 2007). An advantage of this approach is that it can be used to recruit large, representative, and diverse samples, as well as foreground a wide range of environments and experiences that have important effects on health. However, self-report measures are subjective and potentially biased, and cannot reveal the underlying biological mechanisms and pre-disease pathways that connect contexts and health outcomes. By contrast, biomedical approaches bring participants into controlled laboratory or clinical settings where it is feasible to collect direct measures of biological function and health status. But these studies rely on small, and often very select, samples of participants and rarely consider measures of social context and experience beyond standard measures of socioeconomic status or self-reported health behaviors.

Over the past 20 years, calls for more multi-level, integrative approaches to understanding health and health disparities, as well as the rapid expansion of methodological options for collecting biological samples in non-clinical settings, have helped bridge this gap (Lindau and McDade, 2007; Seeman and Crimmins, 2001). Some large population-based surveys (e.g., Add Health), as well as smaller community-based studies, are now including biological measures to facilitate investigations into the origins of health disparities in general, and disparities in SGM groups in particular.

The logistics and burdens associated with collecting blood—the clinical standard for many, if not most, measures of physiological function and health—pose barriers to implementation outside of the clinical setting. Now, however, several low cost, "field-friendly" alternatives to venipuncture exist, including dried blood spot (DBS) sampling, in-home collection of small vials of saliva or urine, or collection of small hair samples (Lindau and McDade, 2007). Dried blood spot sampling—drops of capillary whole blood collected on filter paper following a simple prick of the finger—has been integrated into several studies because it affords the following advantages (McDade et al., 2007): 1) Sample collection is relatively straightforward, and can be implemented in the home by non-medical interviewers, or by participants themselves (Roberts et al., 2016); 2) most biomarkers in DBS remain stable for days, if not weeks, at room temperature; 3) samples can be shipped through the regular mail; and 4) protocols for hundreds of biomarkers have been validated, including indicators of endocrine, immune, reproductive, and metabolic function, as well as measures of gene sequence, expression, and DNA methylation (Freeman et al., 2018; McDade et al., 2016, 2007).

Saliva and hair contain a more circumscribed set of biomarkers, but may be particularly well-suited for research on stress physiology (Adam and Kumari, 2009; Russell et al., 2012). Saliva sampling is non-invasive and facilitates repeat sampling, which is particularly useful for modeling diurnal variation in cortisol production, and investigating responsiveness to acute stressors. Hair has the advantage of providing a retrospective, integrated measure of cortisol production over several weeks to generate insight into levels of chronic stress. However, in some cases this approach may be limited by participants' willingness to provide a hair sample, impacts of hair treatments on cortisol recovery, and inability to model diurnal cortisol rhythms or responses to acute stressors (Kirschbaum et al., 2009; Sauve et al., 2007).

The toolkit for the collection of biological samples in the home is rapidly expanding, and assay technologies increasingly allow the quantification of proteins, gene transcripts, epigenetic marks, and DNA sequences in smaller quantities of sample, at higher resolution, at lower per sample costs (McDade et al., 2016). In addition, wearable technologies and smart phone apps provide additional opportunities for objectively measuring sleep, physical activity, and aspects of cardiovascular function neural activity (George et al., 2017; Lindau and McDade, 2007; Marino et al., 2013). The ability to engage hard-to-reach and under-represented groups with methods that allow for biological data collection in the home has tremendous potential to advance our understanding of the determinants of health in SGM communities.

7. Call to action

As reviewed, existing studies of stress and health among SGM have marked limitations. First, there is a predominate focus on sexual minority men rather than sexual minority women, although 55 % of sexual minorities are women (Gates, 2017). Further, there is very little research distinguishing within sexual and gender identities. For example, given the elevated risk for psychological distress among bisexual individuals as compared to lesbian and gay identified individuals (Ross et al., 2018; Salway et al., 2019), it is critical that biological stress and health within-sexual and gender minority research is examined. Younger generations are less likely to identify as gay or lesbian (Gates, 2017), and thus understanding the experiences of non-monosexual identities which may be largely invisible (Yoshino, 2017) is critical. This begins with measurement that allows for individuals to identify their gender and sexual identity in multiple ways. Recent research indicated that during the COVID-19 pandemic, bisexual and individuals that identified as other non-monosexual or multiple sexual identities reported more stress than both gay and lesbian individuals, and sexual minorities reported more stress than heterosexual individuals (Manning and Kamp Dush, 2021). The long-term consequences of the unique stress of the pandemic (Goldberg et al., 2021; Moore et al., 2021), and the accompanying racial trauma stress sparked by the murder of George Floyd and others at the hands of police (Brodie et al., 2021; Liu and Modir, 2020) and elevated Asian American discrimination and violence (Hopwood, 2021; Jeung et al., 2021; OCA-Asian Pacific American Advocates, 2020; Ruiz et al., 2020), are unknown. Research and intervention efforts related to the stress of the pandemic and racial trauma must examine these intersectional issues and that begins with measurement. Studies that do not measure sexual identity and gender identity at (Moore et al., 2021) the minimum will have unmeasured, systematic, critical heterogeneity in their estimates. We call on scholars to include a question or series of questions on sexual and gender (Patterson et al., 2020), and we call on paper and grant reviewers to demand it, and if sexual and gender identity are not reported, it needs to be listed as a limitation.

It is remarkable how little research we have on the biological indicators of stress for sexual and gender minorities given how well documented their stress has been for over thirty years. As a key modifier

of effects, research examining biobehavioral health should routinely measure and report the sexual and gender identity of their samples. In addition, studies need to be designed and implemented that explicitly seek to understand the stress biology of sexual and gender minority individuals. Critically, the intersectional effects of sexual, gender, and racial minority status on biobehavioral health remain unexamined; 40 % of sexual/gender minorities are also racial/ethnic minorities (Gates, 2017). Further, these studies need to include, in addition to the robust assessment of biological indicators of stress and health, sufficient assessment of minority stress, outness, and behavioral factors (sleep, depressive symptoms, and health behaviors) needed to delineate mechanistic pathways linking minority stress with biological health.

Data on stress biology among SGMs is critical for identifying modifiable mechanisms and highlighting structural factors linking stressor exposure with biological health. Specifically, stress biology indicators hold particular promise for identifying the mechanisms underlying sexual and gender minority health disparities. Without fully-powered stress biology studies of sexual and gender minorities, the underlying causes of biological stress will remain elusive, and mechanisms that can be identified as potential targets for change will remain hidden.

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References

Adam, E.K., Kumari, M., 2009. Assessing salivary cortisol in large-scale, epidemiological research. Psychoneuroendocrinology 34, 1423–1436.
Allen, A.M., Thomas, M.D., Michaels, E.K., Reeves, A.N., Okoye, U., Price, M.M., Hasson, R.E., Syme, S.L., Chae, D.H., 2019. Racial discrimination, educational attainment, and biological dysregulation among midlife African American women. Psychoneuroendocrinology 99, 225–235.
Alzahrani, T., Nguyen, T., Ryan, A., Dwairy, A., McCaffrey, J., Yunus, R., Forgione, J., Krepp, J., Nagy, C., Mazhari, R., Reiner, J., 2019. Cardiovascular disease risk factors and myocardial infarction in the transgender population. Circ. Cardiovasc. Qual. Outcomes 12, e005597.
Ben-Neriah, Y., Karin, M., 2011. Inflammation meets cancer, with NF-κB as the matchmaker. Nat. Immunol. 12, 715.
Berg, R.C., Ross, M.W., Weatherburn, P., Schmidt, A.J., 2013. Structural and environmental factors are associated with internalised homonegativity in men who have sex with men: findings from the European MSM Internet Survey (EMIS) in 38 countries. Soc. Sci. Med. 78, 61–69.
Blair, L.M., Porter, K., Leblebicioglu, B., Christian, L.M., 2015. Poor sleep quality and associated inflammation predict preterm birth: heightened risk among african americans. Sleep 38, 1259–1267.
Blosnich, J., Lee, J.G., Horn, K., 2013. A systematic review of the aetiology of tobacco disparities for sexual minorities. Tob. Control 22, 66–73.
Blosnich, J.R., Marsiglio, M.C., Gao, S., Gordon, A.J., Shipherd, J.C., Kauth, M., Brown, G.R., Fine, M.J., 2016. Mental health of transgender veterans in US states with and without discrimination and hate crime legal protection. Am. J. Public Health 106, 534–540.
Bockting, W.O., Miner, M.H., Swinburne Romine, R.E., Hamilton, A., Coleman, E., 2013. Stigma, mental health, and resilience in an online sample of the US transgender population. Am. J. Public Health 103, 943–951.
Bockting, W.O., Miner, M.H., Swinburne Romine, R.E., Dolezal, C., Robinson, B.B.E., Rosser, B.R.S., Coleman, E., 2019. The transgender identity survey: a measure of internalized transphobia. LGBT Health 7, 15–27.
Boehmer, U., Miao, X., Linkletter, C., Clark, M.A., 2012. Adult health behaviors over the life course by sexual orientation. Am. J. Public Health 102, 292–300.
Bostwick, W.B., Boyd, C.J., Hughes, T.L., McCabe, S.E., 2010. Dimensions of sexual orientation and the prevalence of mood and anxiety disorders in the United States. Am. J. Public Health 100, 468–475.
Bourassa, K.J., Cornelius, T.M., Birk, J.L., 2020. Bereavement is associated with reduced systemic inflammation: C-Reactive protein before and after widowhood. Brain Behav. Immun.
Bowleg, L., 2012. The problem with the phrase women and minorities: intersectionality—an important theoretical framework for public health. Am. J. Public Health 102, 1267–1273.
Boyd, R.W., Lindo, E.G., Weeks, L.D., McLemore, M.R., 2020. On Racism: A New Standard For Publishing On Racial Health Inequities Health Affairs Blog.
Bradford, J., Reisner, S.L., Honnold, J.A., Xavier, J., 2013. Experiences of transgender-related discrimination and implications for health: results from the Virginia transgender Health Initiative Study. Am. J. Public Health 103, 1820–1829.
Bränström, R., Hatzenbuehler, M.L., Pachankis, J.E., 2016. Sexual orientation disparities in physical health: age and gender effects in a population-based study. Soc. Psychiatry Psychiatr. Epidemiol. 51, 289–301.
Brodie, N., Perdomo, J.E., Silberholz, E.A., 2021. The dual pandemics of COVID-19 and racism: impact on early childhood development and implications for physicians. Curr. Opin. Pediatr. 33.
Brown, K.M., Diez-Roux, A.V., Smith, J.A., Needham, B.L., Mukherjee, B., Ware, E.B., Liu, Y., Cole, S.W., Seeman, T.E., Kardia, S.L.R., 2020. Social regulation of inflammation related gene expression in the multi-ethnic study of atherosclerosis. Psychoneuroendocrinology 117.
Bryc, K., Auton, A., Nelson, M.R., Oksenberg, J.R., Hauser, S.L., Williams, S., Froment, A., Bodo, J.M., Wambebe, C., Tishkoff, S.A., Bustamante, C.D., 2010. Genome-wide patterns of population structure and admixture in West Africans and African Americans. Proc. Natl. Acad. Sci. U. S. A. 107, 786–791.
Bryc, K., Durand, E.Y., Macpherson, J.M., Reich, D., Mountain, J.L., 2015. The genetic ancestry of african americans, latinos, and european americans across the United States. Am. J. Hum. Genet. 96, 37–53.
Burack, J.H., Barrett, D.C., Stall, R.D., Chesney, M.A., Ekstrand, M.L., Coates, T.J., 1993. Depressive symptoms and Cd4 lymphocyte decline among hiv-infected men. JAMA-J. Am. Med. Assoc. 270, 2568–2573.
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. Am. J. Public Health 107, e13–e21.
Cekici, A., Kantarci, A., Hasturk, H., Van Dyke, T.E., 2014. Inflammatory and immune pathways in the pathogenesis of periodontal disease. Periodontology 2000 (64), 57–80.
Chae, D.H., Krieger, N., Bennett, G.G., Lindsey, J.C., Stoddard, A.M., Barbeau, E.M., 2010. Implications of discrimination based on sexuality, gender, and Race/Ethnicity for psychological distress among working-class sexual minorities: the united for health study, 2003-2004. Int. J. Health Serv. 40, 589–608.
Chen, E., Miller, G., Walker, H., Arevalo, J., Sung, C., Cole, S., 2009. Genome-wide transcriptional profiling linked to social class in asthma. Thorax 64, 38–43.
Christian, L.M., 2012. Psychoneuroimmunology in pregnancy: immune pathways linking stress with maternal health, adverse birth outcomes, and fetal development. Neurosci. Biobehav. Rev. 36.
Christian, L.M., 2020. At the forefront of psychoneuroimmunology in pregnancy: implications for racial disparities in birth outcomes: PART 2: biological mechanisms. Neurosci. Biobehav. Rev. 117, 327–333.
Christian, L.M., Deichert, N., Gouin, J.-P., Graham, J.E., Kiecolt-Glaser, J.K., 2009. Psychological influences on neuroendocrine and immune outcomes. In: Cacioppo, J. T., Berntson, G. (Eds.), Handbook of Neuroscience for the Behavioral Sciences. John Wiley & Sons, Inc., New Jersey, pp. 1260–1279.
Christian, L.M., Iams, J.D., Porter, K., Glaser, R., 2012. Epstein-Barr virus reactivation during pregnancy and postpartum: effects of race and racial discrimination. Brain Behav. Immun. 26, 1280–1287.
Christian, L.M., Glaser, R., Porter, K., Iams, J.D., 2013. Stress-induced inflammatory responses in women: effects of race and pregnancy. Psychosom. Med. 75, 658–669.
Christian, L.M., Blair, L.M., Porter, K., Lower, M., Cole, R.M., Belury, M.A., 2016. Polyunsaturated fatty acid (PUFA) status in pregnant women: associations with sleep quality, inflammation, and length of gestation. PLoS One 11.
Christian, L.M., Kowalsky, J.M., Mitchell, A.M., Porter, K., 2018. Associations of postpartum sleep, stress, and depressive symptoms with LPS-stimulated cytokine production among African American and White women. J. Neuroimmunol. 94–106.
Cole, S.W., 2008. Psychosocial influences on HIV-1 disease progression: neural, endocrine, and virologic mechanisms. Psychosom. Med. 70, 562–568.
Cole, S.W., 2013. Social regulation of human gene expression: mechanisms and implications for public health. Am. J. Public Health 103, S84–S92.
Cole, S.W., 2014. Human social genomics. PLoS Genet. 10, e1004601.
Cole, S.W., 2019. The conserved transcriptional response to adversity. Curr. Opin. Behav. Sci. 28, 31–37.
Cole, S.W., Kemeny, M.E., Taylor, S.E., Visscher, B.R., 1996a. Elevated physical health risk among gay men who conceal their homosexual identity. Health Psychol. 15, 243.
Cole, S.W., Kemeny, M.E., Taylor, S.E., Visscher, B.R., Fahey, J.L., 1996b. Accelerated course of human immunodeficiency virus infection in gay men who conceal their homosexual identity. Psychosom. Med. 58, 219–231.
Cole, S.W., Kemeny, M.E., Taylor, S.E., 1997. Social identity and physical health: accelerated HIV progression in rejection-sensitive gay men. J. Pers. Soc. Psychol. 72, 320.
Cole, S.W., Korin, Y.D., Fahey, J.L., Zack, J.A., 1998. Norepinephrine accelerates HIV replication via protein kinase A-dependent effects on cytokine production. J. Immunol. 161, 610–616.
Cole, S.W., Jamieson, B.D., Zack, J.A., 1999. cAMP up-regulates cell surface expression of lymphocyte CXCR4: implications for chemotaxis and HIV-1 infection. J. Immunol. 162, 1392–1400.
Cole, S.W., Naliboff, B.D., Kemeny, M.E., Griswold, M.P., Fahey, J.L., Zack, J.A., 2001. Impaired response to HAART in HIV-infected individuals with high autonomic nervous system activity. Proc. Natl. Acad. Sci. 98, 12695–12700.

Cole, S.W., Kemeny, M.E., Fahey, J.L., Zack, J.A., Naliboff, B.D., 2003. Psychological risk factors for HIV pathogenesis: mediation by the autonomic nervous system. Biol. Psychiatry 54, 1444–1456.
Cole, S.W., Hawkley, L.C., Arevalo, J.M., Sung, C.Y., Rose, R.M., Cacioppo, J.T., 2007. Social regulation of gene expression in human leukocytes. Genome Biol. 8, R189.
Cole, S.W., Capitanio, J.P., Chun, K., Arevalo, J.M., Ma, J., Cacioppo, J.T., 2015. Myeloid differentiation architecture of leukocyte transcriptome dynamics in perceived social isolation. Proc. Natl. Acad. Sci. 112, 15142–15147.
Collaboration, E.R.F., 2012. C-reactive protein, fibrinogen, and cardiovascular disease prediction. N. Engl. J. Med. 367, 1310–1320.
Collado-Hidalgo, A., Sung, C., Cole, S., 2006. Adrenergic inhibition of innate anti-viral response: PKA blockade of Type I interferon gene transcription mediates catecholamine support for HIV-1 replication. Brain Behav. Immun. 20, 552–563.
Conron, K.J., Mimiaga, M.J., Landers, S.J., 2010. A population-based study of sexual orientation identity and gender differences in adult health. Am. J. Public Health 100, 1953–1960.
Conron, K.J., Scott, G., Stowell, G.S., Landers, S.J., 2012. Transgender health in Massachusetts: results from a household probability sample of adults. Am. J. Public Health 102, 118–122.
Cooper, R.S., 2003. Race, genes, and health–new wine in old bottles? Int. J. Epidemiol. 32, 23–25.
Corte, C., Matthews, A.K., Brown, R., Hughes, T.L., 2013. Advancing health Equity in disparity populations: a focused issue on lesbian, gay, bisexual, and transgender people. J. Am. Psychiatr. Nurses Assoc. 19, 239–240.
Cunningham, T.J., Seeman, T.E., Kawachi, I., Gortmaker, S.L., Jacobs, D.R., Kiefe, C.I., Berkman, L.F., 2012. Racial/ethnic and gender differences in the association between self-reported experiences of racial/ethnic discrimination and inflammation in the CARDIA cohort of 4 US communities. Soc. Sci. Med. 75, 922–931.
Dilley, J.A., Simmons, K.W., Boysun, M.J., Pizacani, B.A., Stark, M.J., 2010. Demonstrating the importance and feasibility of including sexual orientation in public health surveys: health disparities in the Pacific Northwest. Am. J. Public Health 100, 460–467.
Donath, M.Y., 2014. Targeting inflammation in the treatment of type 2 diabetes: time to start. Nat. Rev. Drug Discov. 13, 465.
Doyle, D.M., Molix, L., 2016. Minority stress and inflammatory mediators: covering moderates associations between perceived discrimination and salivary interleukin-6 in gay men. J. Behav. Med. 39, 782–792.
Dyar, C., Taggart, T.C., Rodriguez-Seijas, C., Thompson, R.G., Elliott, J.C., Hasin, D.S., Eaton, N.R., 2019. Physical health disparities across dimensions of sexual orientation, race/ethnicity, and sex: evidence for increased risk among bisexual adults. Arch. Sex. Behav. 48, 225–242.
Esser, N., Legrand-Poels, S., Piette, J., Scheen, A.J., Paquot, N., 2014. Inflammation as a link between obesity, metabolic syndrome and type 2 diabetes. Diabetes Res. Clin. Pract. 105, 141–150.
Everett, B.G., Rosario, M., McLaughlin, K.A., Austin, S.B., 2014. Sexual orientation and gender differences in markers of inflammation and immune functioning. Ann. Behav. Med. 47, 57–70.
Everett, B.G., Hatzenbuehler, M.L., Hughes, T.L., 2016. The impact of civil union legislation on minority stress, depression, and hazardous drinking in a diverse sample of sexual-minority women: a quasi-natural experiment. Soc. Sci. Med. 169, 180–190.
Feinstein, B.A., Goldfried, M.R., Davila, J., 2012. The relationship between experiences of discrimination and mental health among lesbians and gay men: an examination of internalized homonegativity and rejection sensitivity as potential mechanisms. J. Consult. Clin. Psychol. 80, 917.
Feinstein, B.A., Xavier Hall, C.D., Dyar, C., Davila, J., 2020. Motivations for sexual identity concealment and their associations with mental health among bisexual, pansexual, queer, and fluid (Bi+) individuals. J. Bisex. 20, 324–341.
Flentje, A., Kober, K.M., Carrico, A.W., Neilands, T.B., Flowers, E., Heck, N.C., Aouizerat, B.E., 2018. Minority stress and leukocyte gene expression in sexual minority men living with treated HIV infection. Brain Behav. Immun. 70, 335–345.
Flores, A., Brown, T., Herman, J., 2016. Race and Ethnicity of Adults Who Identify As Transgender in the United States. The Williams Institute, Los Angelos, CA.
Franceschi, C., Campisi, J., 2014. Chronic inflammation (inflammaging) and its potential contribution to age-associated diseases. J. Gerontol. Series A: Biomed. Sci. Med. Sci. 69, S4–S9.
Freeman, J.D., Rosman, L.M., Ratcliff, J.D., Strickland, P.T., Graham, D.R., Silbergeld, E. K., 2018. State of the science in dried blood spots. Clin. Chem. 64, 656–679.
Frost, D.M., Meyer, I.H., 2009. Internalized homophobia and relationship quality among lesbians, gay men, and bisexuals. J. Couns. Psychol. 56, 97.
Frost, D.M., Lehavot, K., Meyer, I.H., 2015. Minority stress and physical health among sexual minority individuals. J. Behav. Med. 38, 1–8.
Gamarel, K.E., Kahler, C.W., Lee, J.H., Reisner, S.L., Mereish, E.H., Matthews, A.K., Operario, D., 2016. Sexual orientation disparities in smoking vary by sex and household smoking among US adults: findings from the 2003-2012 National Health and Nutrition Examination Surveys. Prev. Med. 82, 1–6.
Garrido-Hernansaiz, H., Heylen, E., Bharat, S., Ramakrishna, J., Ekstrand, M.L., 2016. Stigmas, symptom severity and perceived social support predict quality of life for PLHIV in urban Indian context. Health Qual. Life Outcomes 14, 152.
Gates, G.J., 2016. In: Gallup (Ed.), Life Evaluations of LGBT Americans Decline After Election. Gallup.
Gates, G.J., 2017. In: Gallup (Ed.), In US, More Adults Identifying as LGBT. Social Issues, Princeton, NJ.
George, M.J., Russell, M.A., Odgers, C.L., 2017. Using mobile technologies to advance the study of psychopathology among children and adolescents. The Wiley Handbook of Developmental Psychopathology, pp. 45–60.
Goldberg, A.E., McCormick, N., Virginia, H., 2021. Parenting in a pandemic: work–family arrangements, well-being, and intimate relationships among adoptive parents. Fam. Relat. 70, 7–25.
Grov, C., Bimbi, D.S., Nanín, J.E., Parsons, J.T., 2006. Race, ethnicity, gender, and generational factors associated with the coming-out process among gay, lesbian, and bisexual individuals. J. Sex Res. 43, 115–121.
Hall, M.H., Matthews, K.A., Kravitz, H.M., Gold, E.B., Buysse, D.J., Bromberger, J.T., Owens, J.F., Sowers, M., 2009. Race and financial strain are independent correlates of sleep in midlife women: the SWAN sleep study. Sleep 32, 73–82.
Harry-Hernandez, S., Reisner, S.L., Schrimshaw, E.W., Radix, A., Mallick, R., Callander, D., Suarez, L., Dubin, S., Khan, A., Duncan, D.T., 2020. Gender Dysphoria, mental health, and poor sleep health among transgender and gender nonbinary individuals: a qualitative study in New York City. Transgend. Health 5, 59–68.
Hatzenbuehler, M.L., McLaughlin, K.A., 2014. Structural stigma and hypothalamic-pituitary-adrenocortical axis reactivity in lesbian, gay, and bisexual young adults. Ann. Behav. Med. 47, 39–47.
Hatzenbuehler, M.L., Pachankis, J.E., 2016. Stigma and minority stress as social determinants of health among lesbian, gay, bisexual, and transgender youth: research evidence and clinical implications. Pediatric Clinics 63, 985–997.
Hatzenbuehler, M.L., Keyes, K.M., Hasin, D.S., 2009. State-level policies and psychiatric morbidity in lesbian, gay, and bisexual populations. Am. J. Public Health 99, 2275–2281.
Hatzenbuehler, M.L., O'Cleirigh, C., Grasso, C., Mayer, K., Safren, S., Bradford, J., 2012. Effect of same-sex marriage laws on health care use and expenditures in sexual minority men: a quasi-natural experiment. Am. J. Public Health 102, 285–291.
Hatzenbuehler, M.L., McLaughlin, K.A., Slopen, N., 2013a. Sexual orientation disparities in cardiovascular biomarkers among young adults. Am. J. Prev. Med. 44, 612–621.
Hatzenbuehler, M.L., Phelan, J.C., Link, B.G., 2013b. Stigma as a fundamental cause of population health inequalities. Am. J. Public Health 103, 813–821.
Hopwood, Y., 2021. In: Action, Cf.A. (Ed.), CAA Responds to the Attacks in Atlanta Area. Chinese for Affirmative Action, San Francisco, CA.
Hughto, J.M., Pachankis, J.E., Reisner, S.L., 2018. Healthcare mistreatment and avoidance in trans masculine adults: the mediating role of rejection sensitivity. Psychol. Sex. Orientat. Gend. Divers. 5, 471.
Institute of Medicine, 2011. The Health of Lesbian, Gay, Bisexual, and Transgender People: Building a Foundation for Better Understanding, Washington (DC).
Irwin, M.R., Olmstead, R., Carroll, J.E., 2015. Sleep disturbance, sleep duration, and inflammation: a systematic review and meta-analysis of cohort studies and experimental sleep deprivation. Biol. Psychiatry 80, 40–52.
Jackson, C.L., Agenor, M., Johnson, D.A., Austin, S.B., Kawachi, I., 2016. Sexual orientation identity disparities in health behaviors, outcomes, and services use among men and women in the United States: a cross-sectional study. BMC Public Health 16.
Jeung, R., Yellow Horse, A., Popovic, T., Lim, R., 2021. Stop AAPI Hate National Report.
Juster, R.P., Smith, N.G., Ouellet, E., Sindi, S., Lupien, S.J., 2013. Sexual orientation and disclosure in relation to psychiatric symptoms, diurnal cortisol, and allostatic load. Psychosom. Med. 75, 103–116.
Juster, R.P., Hatzenbuehler, M.L., Mendrek, A., Pfaus, J.G., Smith, N.G., Johnson, P.J., Lefebvre-Louis, J.P., Raymond, C., Marin, M.F., Sindi, S., Lupien, S.J., Pruessner, J. C., 2015. Sexual orientation modulates endocrine stress reactivity. Biol. Psychiatry 77, 668–676.
Kershaw, K.N., Lewis, T.T., Roux, A.V.D., Jenny, N.S., Liu, K., Penedo, F.J., Carnethon, M.R., 2016. Self-reported experiences of discrimination and inflammation among men and women: the multi-ethnic study of atherosclerosis. Health Psychol. 35, 343.
Kiecolt-Glaser, J.K., Fisher, L.D., Ogrocki, P., Stout, J.C., Speicher, C.E., Glaser, R., 1987. Marital quality, marital disruption, and immune function. Psychosom. Med. 49, 31–34.
Kiecolt-Glaser, J.K., Kennedy, S., Malkoff, S., Fisher, L., Speicher, C.E., Glaser, R., 1988. Marital discord and immunity in males. Psychosom. Med. 50, 213–229.
Kiecolt-Glaser, J.K., Dura, J.R., Speicher, C.E., Trask, O.J., Glaser, R., 1991. Spousal caregivers of dementia victims: longitudinal changes in immunity and health. Psychosom. Med. 53, 345–362.
Kiecolt-Glaser, J.K., Gouin, J.P., Hantsoo, L., 2010. Close relationships, inflammation, and health. Neurosci. Biobehav. Rev. 35, 33–38.
Kiecolt-Glaser, J.K., Derry, H.M., Fagundes, C.P., 2015. Inflammation: depression fans the flames and feasts on the heat. Am. J. Psychiatry 172, 1075–1091.
Kirschbaum, C., Tietze, A., Skoluda, N., Dettenborn, L., 2009. Hair as a retrospective calendar of cortisol production-Increased cortisol incorporation into hair in the third trimester of pregnancy. Psychoneuroendocrinology 34, 32–37.
la Roi, C., Meyer, I.H., Frost, D.M., 2019. Differences in sexual identity dimensions between bisexual and other sexual minority individuals: implications for minority stress and mental health. Am. J. Orthopsychiatry 89, 40.
LeBlanc, A.J., Frost, D.M., Wight, R.G., 2015. Minority stress and stress proliferation among same-sex and other marginalized couples. J. Marriage Fam. 77, 40–59.
Lee, J.H., Gamarel, K.E., Bryant, K.J., Zaller, N.D., Operario, D., 2016. Discrimination, mental health, and substance use disorders among sexual minority populations. LGBT Health 3, 258–265.
Lewis, G.B., 2003. Black-white differences in attitudes toward homosexuality and gay rights*. Public Opin. Q. 67, 59–78.
Lewis, T.T., Van Dyke, M.E., 2018. Discrimination and the health of African Americans: the potential importance of intersectionalities. Curr. Dir. Psychol. Sci. 27, 176–182.
Lewis, T.T., Aiello, A.E., Leurgans, S., Kelly, J., Barnes, L.L., 2010. Self-reported experiences of everyday discrimination are associated with elevated C-reactive protein levels in older African-American adults. Brain Behav. Immun. 24, 438–443.

Li, M.J., Takada, S., Okafor, C.N., Gorbach, P.M., Shoptaw, S.J., Cole, S.W., 2020. Experienced homophobia and gene expression alterations in Black and Latino men who have sex with men in Los Angeles County. Brain Behav. Immun. 83, 120–125.
Lick, D.J., Durso, L.E., Johnson, K.L., 2013. Minority stress and physical health among sexual minorities. Perspect. Psychol. Sci. 8, 521–548.
Lindau, S.T., McDade, T.W., 2007. Minimally invasive and innovative methods for biomeasure collection in population-based research. In: Weinstein, M., Vaupel, J.W., Wachter, K.W., Council, N.R. (Eds.), Biosocial Surveys. The National Academies Press, Washington D.C, pp. 251–277.
Liu, S., Modir, S., 2020. The outbreak that was always here: racial trauma in the context of COVID-19 and implications for mental health providers. Psychol. Trauma Theory Res. Pract. Policy 12, 439–442.
Liu, H., Reczek, C., Mindes, S.C.H., Shen, S., 2017. The health disparities of same-sex cohabitors at the intersection of race-ethnicity and gender. Sociol. Perspect. 60, 620–639.
Lopresti, A.L., Hood, S.D., Drummond, P.D., 2013. A review of lifestyle factors that contribute to important pathways associated with major depression: diet, sleep and exercise. J. Affect. Disord. 148, 12–27.
Lutgendorf, S.K., DeGeest, K., Sung, C.Y., Arevalo, J.M., Penedo, F., Lucci III, J., Goodheart, M., Lubaroff, D., Farley, D.M., Sood, A.K., 2009. Depression, social support, and beta-adrenergic transcription control in human ovarian cancer. Brain Behav. Immun. 23, 176–183.
Manigault, A.W., Figueroa, W.S., Hollenbeck, C.R., Mendlein, A.E., Woody, A., Hamilton, K.R., Scanlin, M.C., Johnson, R.C., Zoccola, P.M., 2018. When family matters most: a test of the association between sexual minority identity disclosure context and diurnal cortisol in sexual minority young adults. Psychosom. Med. 80, 717–723.
Manning, W.D., Kamp Dush, C.M., 2021. Stress and COVID-19 Experiences among Sexual Minority and Heterosexual Couples. Population Association of America Virtual.
Marino, M., Li, Y., Rueschman, M.N., Winkelman, J.W., Ellenbogen, J., Solet, J.M., Dulin, H., Berkman, L.F., Buxton, O.M., 2013. Measuring sleep: accuracy, sensitivity, and specificity of wrist actigraphy compared to polysomnography. Sleep 36, 1747–1755.
Mayer, K.H., Bradford, J.B., Makadon, H.J., Stall, R., Goldhammer, H., Landers, S., 2008. Sexual and gender minority health: what we know and what needs to be done. Am. J. Public Health 98, 989–995.
Mays, V.M., Juster, R.P., Williamson, T.J., Seeman, T.E., Cochran, S.D., 2018. Chronic physiologic effects of stress among lesbian, gay, and bisexual adults: results from the national health and nutrition examination survey. Psychosom. Med. 80, 551–563.
McDade, T.W., 2001. Lifestyle incongruity, social integration, and immune function in Samoan adolescents. Soc. Sci. Med. 53, 1351–1362.
McDade, T.W., 2002. Status incongruity in Samoan youth: a biocultural analysis of culture change, stress, and immune function. Med. Anthropol. Q. 16, 123–150.
McDade, T.W., Williams, S., Snodgrass, J.J., 2007. What a drop can do: dried blood spots as a minimally invasive method for integrating biomarkers into population-based research. Demography 44, 899–925.
McDade, T.W., Ross, K.M., Fried, R.L., Arevalo, J.M., Ma, J., Miller, G.E., Cole, S.W., 2016. Genome-wide profiling of RNA from dried blood spots: convergence with bioinformatic results derived from whole venous blood and peripheral blood mononuclear cells. Biodemography Soc. Biol. 62, 182–197.
McGarrity, L.A., Huebner, D.M., 2014. Is being out about sexual orientation uniformly healthy? The moderating role of socioeconomic status in a prospective study of gay and bisexual men. Ann. Behav. Med. 47, 28–38.
McQuillan, M.T., Kuhns, L.M., Miller, A.A., McDade, T., Garofalo, R., 2021. Gender minority stress, support, and inflammation in transgender and gender-nonconforming youth. Transgend. Health 6 (2), 91–100.
Meyer, I.H., 2003. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. Psychol. Bull. 129, 674.
Meyer, I.H., Schwartz, S., Frost, D.M., 2008. Social patterning of stress and coping: Does disadvantaged social statuses confer more stress and fewer coping resources? Soc. Sci. Med. 67, 368–379.
Michaud, M., Balardy, L., Moulis, G., Gaudin, C., Peyrot, C., Vellas, B., Cesari, M., Nourhashemi, F., 2013. Proinflammatory cytokines, aging, and age-related diseases. J. Am. Med. Dir. Assoc. 14, 877–882.
Miller, G.E., Chen, E., Sze, J., Marin, T., Arevalo, J.M., Doll, R., Ma, R., Cole, S.W., 2008. A functional genomic fingerprint of chronic stress in humans: blunted glucocorticoid and increased NF-κB signaling. Biol. Psychiatry 64, 266–272.
Mizock, L., Mueser, K., 2014. Employment, mental health, internalized stigma, and coping with transphobia among transgender individuals. Psychol. Sex. Orientat. Gend. Divers. 1, 146–158.
Mohr, J., Fassinger, R., 2000. Measuring dimensions of lesbian and gay male experience. Meas. Eval. Couns. Dev. 33, 66–90.
Moody, D.L.B., Chang, Y.-F., Pantesco, E.J., Darden, T.M., Lewis, T.T., Brown, C., Bromberger, J.T., Matthews, K.A., 2018. Everyday discrimination prospectively predicts blood pressure across 10 years in Racially/Ethnically diverse midlife women: study of women's health across the nation. Ann. Behav. Med. 53, 608–620.
Moore, S.E., Wierenga, K.L., Prince, D.M., Gillani, B., Mintz, L.J., 2021. Disproportionate impact of the COVID-19 pandemic on perceived social support, mental health and somatic symptoms in sexual and gender minority populations. J. Homosex. 1–15.
Morgan, E., D'Aquila, R., Carnethon, M.R., Mustanski, B., 2019a. Cardiovascular disease risk factors are elevated among a cohort of young sexual and gender minorities in Chicago. J. Behav. Med. 42, 1073–1081.
Morgan, E., Taylor, H., Ryan, D.T., D'Aquila, R., Mustanski, B., 2019b. Systemic inflammation is elevated among both HIV-uninfected and -infected young men who have sex with men. AIDS 33, 757–759.
Muscatell, K.A., Brosso, S.N., Humphreys, K.L., 2020. Socioeconomic status and inflammation: a meta-analysis. Mol. Psychiatry 25, 2189–2199.
National Academies of Sciences, E., and Medicine, 2020. Understanding the Well-being of LGBTQI+ populations. In: Press, T.N.A. (Ed.), The National Academies of Sciences, Engineering, and Medicine. The National Academies Press, Washington, DC.
Newcomb, M.E., Mustanski, B., 2010. Internalized homophobia and internalizing mental health problems: a meta-analytic review. Clin. Psychol. Rev. 30, 1019–1029.
Newport, F., 2018. In U.S., Estimate of LGBT Population Rises to 4.5%. Gallup (Ed.).
O'Neill, A., Beck, K., Chae, D., Dyer, T., He, X., Lee, S., 2018. The pathway from childhood maltreatment to adulthood obesity: the role of mediation by adolescent depressive symptoms and BMI. J. Adolesc. 67, 22–30.
OCA-Asian Pacific American Advocates, 2020. OCA Demands Apology for Trump Tweets That Stoke Anti-asian Sentiment.
Pachankis, J.E., Bränström, R., 2018. Hidden from happiness: structural stigma, sexual orientation concealment, and life satisfaction across 28 countries. J. Consult. Clin. Psychol. 86, 403.
Pachankis, J.E., Hatzenbuehler, M.L., Starks, T.J., 2014. The influence of structural stigma and rejection sensitivity on young sexual minority men's daily tobacco and alcohol use. Soc Sci Med 103, 67–75.
Pachankis, J.E., Cochran, S.D., Mays, V.M., 2015a. The mental health of sexual minority adults in and out of the closet: a population-based study. J. Consult. Clin. Psychol. 83, 890–901.
Pachankis, J.E., Rendina, H.J., Restar, A., Ventuneac, A., Grov, C., Parsons, J.T., 2015b. A minority stress—emotion regulation model of sexual compulsivity among highly sexually active gay and bisexual men. Health Psychol. 34, 829.
Pachankis, H., Bränström, Schmidt, Berg, Jonas, Weatherburn, 2020. Structural Stigma and Sexual Minority Men's Depression and Suicidality: a Multi-level Examination of Geographic Mobility Patterns and Mechanisms Across 48 Countries. Yale University, New Haven, CT.
Parra, L.A., Benibgui, M., Helm, J.L., Hastings, P.D., 2016. Minority stress predicts depression in lesbian, gay, and bisexual emerging adults via elevated diurnal cortisol. Emerg. Adulthood 4, 365–372.
Patterson, C.J., Tate, D.P., Sumontha, J., Xu, R., 2018. Sleep difficulties among sexual minority adults: associations with family relationship problems. Psychol. Sex. Orientat. Gend. Divers. 5, 109.
Patterson, C.J., Sepúlveda, M.-J., White, J., 2020. Understanding the Well-Being of LGBTQI+ Populations.
Peppas, I., George, G., Sollie, S., Josephs, D.H., Hammar, N., Walldius, G., Karagiannis, S. N., Van Hemelrijck, M., 2020. Association of serum immunoglobulin levels with solid cancer: a systematic review and meta-analysis. Cancer Epidemiol. Prevention Biomarkers 29, 527–538.
Pollitt, A.M., Ioverno, S., Russell, S.T., Li, G., Grossman, A.H., 2019. Predictors and mental health benefits of chosen name use among transgender youth. Youth Soc. 0044118X19855898.
Puckett, J.A., Levitt, H.M., 2015. Internalized stigma within sexual and gender minorities: change strategies and clinical implications. J. LGBTQ Issues Counseling 9, 329–349.
Raifman, J., Moscoe, E., Austin, S.B., Hatzenbuehler, M.L., Galea, S., 2018. Association of state laws permitting denial of services to same-sex couples with mental distress in sexual minority adults: a difference-in-difference-in-differences analysis. JAMA Psychiatry 75, 671–677.
Reisner, S.L., White, J.M., Bradford, J.B., Mimiaga, M.J., 2014. Transgender health disparities: comparing full cohort and nested matched-pair study designs in a community health center. LGBT Health 1, 177–184.
Roberts, T.S., Horne, S.G., Hoyt, W.T., 2015. Between a gay and a straight place: bisexual individuals' experiences with monosexism. J. Bisex. 15, 554–569.
Roberts, S.C., Seav, S.M., McDade, T.W., Dominick, S.A., Gorman, J.R., Whitcomb, B.W., Su, H.I., 2016. Self-collected dried blood spots as a tool for measuring ovarian reserve in young female cancer survivors. Hum. Reprod. 31, 1570–1578.
Rodriguez-Seijas, C., Eaton, N.R., Pachankis, J.E., 2019. Prevalence of psychiatric disorders at the intersection of race and sexual orientation: Results from the National Epidemiologic Survey of Alcohol and Related Conditions-III. J. Consult. Clin. Psychol. 87, 321–331.
Rood, B.A., Maroney, M.R., Puckett, J.A., Berman, A.K., Reisner, S.L., Pantalone, D.W., 2017. Identity concealment in transgender adults: a qualitative assessment of minority stress and gender affirmation. Am. J. Orthopsychiatry 87, 704–713.
Ross, L.E., Salway, T., Tarasoff, L.A., Mackay, J.M., Hawkins, B.W., Fehr, C.P., 2018. Prevalence of depression and anxiety among bisexual people compared to gay, lesbian, and heterosexual individuals:a systematic review and meta-analysis. J. Sex Res. 55, 435–456.
Ruiz, N.G., Menasce Horowitz, J., Tamir, C., 2020. Many Black and Asian Americans Say They Have Experienced Discrimination Amid the COVID-19 Outbreak. Pew Research Center.
Russell, E., Koren, G., Rieder, M., Van Uum, S., 2012. Hair cortisol as a biological marker of chronic stress: current status, future directions and unanswered questions. Psychoneuroendocrinology 37, 589–601.
Salway, T., Ross, L.E., Fehr, C.P., Burley, J., Asadi, S., Hawkins, B., Tarasoff, L.A., 2019. A systematic review and meta-analysis of disparities in the prevalence of suicide ideation and attempt among bisexual populations. Arch. Sex. Behav. 48, 89–111.
Sauve, B., Koren, G., Walsh, G., Tokmakejian, S., Van Uum, S.H., 2007. Measurement of cortisol in human hair as a biomarker of systemic exposure. Clin. Invest. Med. 30, E183–191.
Schrimshaw, E.W., Siegel, K., Downing Jr., M.J., Parsons, J.T., 2013. Disclosure and concealment of sexual orientation and the mental health of non-gay-identified, behaviorally bisexual men. J. Consult. Clin. Psychol. 81, 141.

Schulte, L.J., Battle, J., 2004. The relative importance of ethnicity and religion in predicting attitudes towards gays and lesbians. J. Homosex. 47, 127–142.
Seeman, T.E., Crimmins, E., 2001. Social environment effects on health and aging: integrating epidemiologic and demographic approaches and perspectives. Ann. N. Y. Acad. Sci. 954, 88–117.
Shelton, R.C., Miller, A.H., 2010. Eating ourselves to death (and despair): the contribution of adiposity and inflammation to depression. Prog. Neurobiol. 91, 275–299.
Slavich, G.M., Irwin, M.R., 2014. From stress to inflammation and major depressive disorder: a social signal transduction theory of depression. Psychol. Bull. 140, 774–815.
Sloan, E.K., Tarara, R.P., Capitanio, J.P., Cole, S.W., 2006. Enhanced replication of simian immunodeficiency virus adjacent to catecholaminergic varicosities in primate lymph nodes. J. Virol. 80, 4326–4335.
Sloan, E.K., Capitanio, J.P., Tarara, R.P., Mendoza, S.P., Mason, W.A., Cole, S.W., 2007. Social stress enhances sympathetic innervation of primate lymph nodes: mechanisms and implications for viral pathogenesis. J. Neurosci. 27, 8857–8865.
Slopen, N., Lewis, T.T., Gruenewald, T.L., Mujahid, M.S., Ryff, C.D., Albert, M.A., Williams, D.R., 2010. Early life adversity and inflammation in African Americans and whites in the midlife in the United States survey. Psychosom. Med. 72, 694.
Smedley, A., Smedley, B.D., 2005. Race as biology is. fiction, racism as a social problem is real - Anthropological and historical perspectives on the social construction of race. Am. Psychol. 60, 16–26.
Smith, K., 2020. The association between loneliness, social isolation and inflammation: a systematic review and meta-analysis. Neurosci. Biobehav. Rev. 112, 519–541.
Stepanikova, I., Bateman, L.B., Oates, G.R., 2017. Systemic inflammation in midlife: race, socioeconomic status, and perceived discrimination. Am. J. Prev. Med. 52, S63–S76.
Swank, E., Fahs, B., Frost, D.M., 2013. Region, social identities, and disclosure practices as predictors of heterosexist discrimination against sexual minorities in the United States. Sociol. Inq. 83, 238–258.
Taylor, D., 2020. Fifteen percent of Same-sex couples have children in their household. In: Bureau, U.S.C. (Ed.), Same-Sex Couples Are More Likely to Adopt or Foster Children. United State Census Bureau, Washington, DC.
Thames, A.D., Irwin, M.R., Breen, E.C., Cole, S.W., 2019. Experienced discrimination and racial differences in leukocyte gene expression. Psychoneuroendocrinology 106, 277–283.
Trinh, M.-H., Agénor, M., Austin, S.B., Jackson, C.L., 2017. Health and healthcare disparities among US women and men at the intersection of sexual orientation and race/ethnicity: a nationally representative cross-sectional study. BMC Public Health 17, 964.
US Census Bureau, 2019. Characteristics of Same-sex Couple Households: 2005 to Present. Washington D.C..
US Census Bureau, 2020. Coupled Households by Type: American Community Survey: 2019: ACS 1-Year Estimates Detailed Tables (TableID: B11009). data.census.gov., Washington D.C.
van der Star, A., Pachankis, J.E., Branstrom, R., 2019. Sexual orientation openness and depression symptoms: a population-based study. Eur. J. Public Health 29.
Van Rood, Y.R., Bogaards, M., Goulmy, E., Van Houwelingen, H.C., 1993. The effects of stress and relaxation on the vitro immune response in man: a meta-analytic study. J. Behav. Med. 16, 163–181.
Watson, R.J., Veale, J.F., Gordon, A.R., Clark, B.A., Saewyc, E.M., 2019. Risk and protective factors for transgender youths' substance use. Prev. Med. Rep. 15, 100905.
White Hughto, J.M., Reisner, S.L., Pachankis, J.E., 2015. Transgender stigma and health: a critical review of stigma determinants, mechanisms, and interventions. Soc Sci Med 147, 222–231.
Whitfield, D.L., Walls, N.E., Langenderfer-Magruder, L., Clark, B., 2014. Queer is the new black? Not so much: racial disparities in Anti-LGBTQ discrimination. J. Gay Lesbian Soc. Serv. 26, 426–440.
Wight, R.G., LeBlanc, A.J., de Vries, B., Detels, R., 2012. Stress and mental health among midlife and older gay-identified men. Am. J. Public Health 102, 503–510.
Williams, D.R., 1999. Race, socioeconomic status, and health the added effects of racism and discrimination. Ann. N. Y. Acad. Sci. 896, 173–188.
Wolf, H.J., Morag, A.J., 1998. Epstein-Barr virus vaccines. In: Medveczky, P.G., Bendinelli, M., Friedman, H. (Eds.), Herpesviruses and Immunity. Plenum Press, New York, pp. 231–246.
Yang, J.-J., Jiang, W., 2020. Immune biomarkers alterations in post-traumatic stress disorder: a systematic review and meta-analysis. J. Affect. Disord. 268, 39–46.
Yoshino, K., 2017. The Epistemic Contract of Bisexual Erasure 1. Sexuality and Equality Law, pp. 329–352.
Zakharia, F., Basu, A., Absher, D., Assimes, T.L., Go, A.S., Hlatky, M.A., Iribarren, C., Knowles, J.W., Li, J., Narasimhan, B., Sidney, S., Southwick, A., Myers, R.M., Quertermous, T., Risch, N., Tang, H., 2009. Characterizing the admixed african ancestry of african americans. Genome Biol. 10, R141.