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Recommendations for cardiovascular disease research with lesbian, gay, and bisexual adults

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Abstract

Aims and objectives—The purpose of this paper is to provide recommendations to strengthen cardiovascular disease research with lesbian, gay, and bisexual adults and highlight implications for practice.

Background—Lesbian, gay, and bisexual individuals face significant discrimination that negatively impacts their health. Health disparities in lesbian, gay, and bisexual adults has focused on mental health, sexually transmitted infections, and substance use. Although cardiovascular disease is the leading cause of death and many lesbian, gay, and bisexual adults report increased risk factors for cardiovascular disease, there has been limited research in this area.

Design—This paper is a critical review.

Methods—A literature search was conducted that compared cardiovascular disease risk and/or prevalence between LGB and heterosexual adults.

Results—Measures to assess cardiovascular disease risk factors and diagnoses varied widely across the 31 included studies. There was a lack of standardization in definitions used for alcohol consumption, illicit drug use, mental health, and self-rated physical health. Most studies that reported body mass index relied on participant self-report. Few studies included measures of physical activity and diet and those that did lacked standardization. Only seven studies used laboratory data to establish presence of disease to establish diagnosis of cardiovascular disease.

Conclusions—This study is the first comprehensive review on this topic. In cardiovascular disease research with lesbian, gay, and bisexual adults there is a need for: 1) inclusion of stress as a risk factor for CVD, 2) standardized measures, 3) objective measures for determining presence of cardiovascular disease, 4) data from electronic health records to strengthen the study of cardiovascular disease in this population.

Keywords

lesbian; gay and bisexual; cardiovascular; research methods; health disparities; health promotion

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AIMS

The purpose of this paper is to provide recommendations to strengthen future cardiovascular disease (CVD) research with lesbian, gay, and bisexual (LGB) adults and highlight implications for clinical practice.

BACKGROUND

LGB individuals face significant discrimination and victimization throughout their lives that contribute to poor health outcomes in this population (Institute of Medicine [IOM] 2011). Social factors that marginalize the LGB community worldwide include discrimination, hate crimes, criminalization, and violations of their human rights (Human Rights Campaign 2015, International Lesbian, Gay, Bisexual, Trans and Intersex Association [ILGBTIA] 2015). Institutionalized discrimination related to *heterosexism* is a source of stress for many LGB individuals (Herek & Garnets 2007). Indeed, homosexuality remains a criminal offense in 76 countries and punishable by death in five (ILGBTIA, 2015). These experiences with discrimination throughout the life course may contribute to health disparities in LGB individuals (IOM 2011).

As a disenfranchised minority group LGB individuals are exposed to chronic stressors that contribute to poor mental health (Meyer, 2003). LGB individuals report negative health outcomes including depression (King et al. 2008), mood disorders (Bostwick et al. 2010, Cochran & Mays 2000), eating disorders (Feldman & Meyer 2007), and suicidality (Cochran et al. 2007, Meyer et al. 2008a). In addition, a report by the American Psychological Association (2016) found that LGB adults had elevated stress and their stress had increased substantially over the past year compared to heterosexual peers.

The extent of health disparities and discrimination experienced by the LGB community has led some to suggest that sexual orientation should be considered as a social determinant of health (SDOH) (Logie, 2012). Leading organizations have recognized the significant health disparities within the LGB community. In 2011 the IOM released a report on the health of LGB individuals (IOM 2011). Additionally, *Healthy People 2020* added improving the health of LGB individuals as a new objective (U.S. Department of Health and Human Services [HHS] 2014).

Much of the available data on health disparities in LGB individuals are related to mental health, sexually transmitted infections (including HIV/AIDS), and substance use (Coulter et al. 2014). Much less is known about other conditions including CVD. Despite decreasing mortality rates, CVD remains the leading cause of death worldwide (World Health Organization [WHO] 2012). A growing body of literature indicates there is increased risk for CVD in LGB individuals related to elevated tobacco, alcohol, and illicit drug use (Bloomfield et al. 2011, Blosnich & Horn 2011, Blosnich et al. 2013, Hughes et al. 2008, Marshal et al. 2012, McCabe et al. 2010). Increased exposure to stressors may contribute to maladaptive coping strategies including substance use (Meyer et al. 2008b). In addition, lesbian and bisexual women have been found to have higher rates of obesity than

heterosexual women that can also increase their risk for CVD (Boehmer & Bowen 2009, Boehmer et al. 2007, Bowen et al. 2008, Struble et al. 2010).

Although LGB individuals may exhibit higher levels of risk factors for CVD few researchers have focused on this area of LGB health (Lick et al. 2013). Between 1988-2011 only three NIH-funded studies on CVD in LGB adults, excluding HIV/AIDS, were conducted (Coulter et al. 2014). The IOM (2011) highlights several limitations of LGB health research including the lack of standardized sexual orientation measures, use of nonprobability samples, small sample sizes, lack of demographic data on LGB population, and lack of representative population-based studies that assess sexual orientation. Limitations related to CVD research in LGB adults have not been explored but are important to address in order to advance LGB health in research and clinical practice.

DESIGN

This paper is a critical review.

METHODS

A literature search was conducted in May 2015 and updated in January 2016 using seven electronic databases (CINAHL, Embase, LGBT Life, PsycInfo, PubMed, Scopus, and Web of Science). English-language peer-reviewed studies that compared CVD risk and/or CVD prevalence between LGB and heterosexual individuals over the age of 18 were included. Search terms included: lesbian, gay, bisexual, LGB, sexual minority, queer, cardiovascular disease, cardiac disease, heart disease, coronary heart disease, coronary artery disease, stroke, myocardial infarction, heart attack, atherosclerosis, hypertension, high blood pressure, diabetes, high cholesterol, dyslipidemia, and hyperlipidemia. Studies that focused exclusively on HIV/AIDS and/or transgender individuals were excluded. Main outcomes included CVD risk factors (tobacco use, alcohol use, illicit drug use, anthropometric measures, physical activity, diet, and mental health) and CVD diagnoses (including hypertension [HTN], diabetes mellitus [DM], and high cholesterol). During critical appraisal it became apparent that results were heavily influenced by measurement limitations. This paper discusses these limitations to underscore the need for further work in LGB health.

RESULTS

A total of 31 studies met inclusion criteria. All studies were secondary data analyses of population surveys, except for one study by Roberts et al. (2003) that was cross-sectional. As displayed in Table 1 the measures used to assess CVD risk varied widely across studies. There was a lack of standardized measures and definitions for CVD risk factors that greatly limited the ability to make comparisons across studies. Alcohol use was measured in a number of different ways throughout 21 studies. Different terms were used for alcohol use (including binge drinking, risky drinking, heavy drinking, excessive drinking, current drinking, and alcohol consumption) and nine different definitions were identified. Only 11 studies had standardized definitions for alcohol use. Use of illicit drugs (including cocaine, heroin, marijuana, and methamphetamines) may be related to increased risk for CVD (Hall

2015, Hawley et al. 2013, Qureshi et al. 2014, Rodondi et al. 2006, Stankowski et al. 2014). However, drug use was assessed in only seven studies with no standardization. The frequency of drug use measured in these studies varied from drug use in the past month to lifetime drug use. This made it difficult to make comparisons of drug use across studies. Of the 24 studies that assessed tobacco use only seven reported standardized definitions for tobacco use and only three studies included measures for smokeless tobacco use (Blosnich et al. 2014, Blosnich et al. 2015, Mays et al. 2002). Likewise, measures for overweight and obesity were similar throughout studies and approximately half used standardized measures for these variables. A total of 15 out of 19 that reported BMI levels used self-reported data to calculate BMI (Blosnich et al. 2014, Blosnich & Silenzio 2013, Boehmer et al. 2014, Case et al. 2004, Conron et al. 2010, Diamant & Wold 2003, Dilley et al. 2010, Farmer et al. 2015, Fredriksen-Goldsen 2013, Garland-Forshee et al. 2014, Matthews & Lee 2011, Mays et al. 2002, Roberts et al. 2003, Steele et al. 2009, Wang et al. 2007). The use of self-report of BMI may contribute to significant measurement error (Gorber et al. 2007, Griebeler et al. 2011, Magnusson et al. 2014).

Physical activity and diet are well-established risk factors for CVD (American Heart Association 2015), yet these variables were assessed in few studies. Physical activity was measured in only 11 studies. Seven different definitions of adequate physical activity were used of which only three were standardized. Similarly, diet was measured in four studies and defined differently in each with no standardized measures used.

In addition, poor mental health (including stress, depression and anxiety) is recognized to increase risk for CVD (Yusuf et al. 2004). A total of 19 studies included at least one measure of mental health. Terms and definitions used also varied widely. Despite recognition of increased stress in LGB adults only five studies included measures of stress (Blosnich et al. 2014, Cochran & Mays 2007, Farmer et al. 2015, Swartz 2014, Wallace et al. 2011). As shown in Table 1 several terms were used for depression including major depression and depressive disorders. Of the eight studies that measured depression only half used valid screening tools. Furthermore, self-rated health is a significant predictor of CVD morbidity and incidence (Van der Linde et al. 2013). A total of 16 studies had measures for self-rated health. Different definitions for self-rated health were used but only four were based on standardized measures.

Results for CVD risk differed considerably throughout studies depending on the method of data collection used. Researchers that used a combination of subjective and objective data found higher levels of CVD risk among LGB adults compared to self-report alone (Everett & Mollborn 2013, Hatzenbuehler et al. 2013). This highlights the importance of using objective or a combination of objective and subjective data to determine CVD. As shown in Table 2, self-report was the primary method of data collection for CVD diagnoses throughout included studies. Most of these studies were telephone surveys. As described by Bowlin et al. (1993) use of self-report in telephone surveys may contribute to significant underreporting of CVD. Therefore, the 15 studies that included CVD data collected via telephone may have significant recall bias and measurement error (Blosnich et al. 2014, Blosnich & Silenzio 2013, Boehmer et al. 2014, Cochran & Mays 2007, Conron et al. 2010, Diamant et al. 2000, Diamant & Wold 2003, Dilley et al. 2010, Farmer et al. 2015,

Fredriksen-Goldsen et al. 2013, Garland-Forshee et al. 2014, Matthews & Lee 2014, Mays et al. 2002, Wallace et al. 2011, Wang et al. 2007). An additional eight also used self-report only (Andersen et al. 2014, Blosnich et al. 2015, Case et al. 2004; Roberts et al. 2003, Swartz 2014, Steele et al. 2009, Valanis et al. 2000, Ward et al. 2015). Of the 31 studies only seven used laboratory data to establish the presence of CVD (Clark et al. 2015; Everett & Mollborn 2013, Farmer et al. 2013a, Farmer et al. 2013b, Hatzenbuehler et al. 2013, Hatzenbuehler et al. 2014, Strutz et al. 2014). Similarly HTN, DM, and high cholesterol were determined primarily by self-report in 23 studies (Andersen et al. 2014, Blosnich et al. 2014, Blosnich & Silenzio 2013 Boehmer et al. 2014, Cochran & Mays 2007, Conron et al. 2010, Diamant et al. 2000; Diamant & Wold 2003, Dilley et al. 2010, Farmer et al. 2013a, Farmer et al. 2013b, Fredriksen-Goldsen et al. 2013, Garland-Forshee et al. 2014, Matthews & Lee 2014, Mays et al. 2002, Steele et al. 2009, Strutz et al. 2014, Swartz 2014, Valanis et al. 2000, Veenstra 2013, Wallace et al. 2011, Wang et al. 2007, Ward et al. 2015).

Researchers have found significant disagreement between patient self-report and medical records for CVD may exist (Klungel, et al. 1999, Muggah et al. 2013, Okura et al. 2004, St. Sauver et al. 2005, Teh et al. 2013, Woodfield & Sudlow 2015). However, none of the included studies used data from medical records.

Another measurement concern is that CVD diagnoses (including coronary artery disease, myocardial infarction, and stroke) were frequently collapsed into one category and reported as only CVD in various studies. This obscures differences that may exist for different CVD diagnoses and may contribute to misclassification and measurement error. The operationalization of CVD diagnoses was not explicated in 12 out of 14 studies with this measure (Andersen et al. 2014, Blosnich & Silenzio 2013, Boehmer et al. 2014, Cochran & Mays 2007, Diamant & Wold 2003, Diamant et al. 2000, Dilley et al. 2010, Matthews & Lee 2014, Mays et al. 2002, Swartz 2014, Wallace et al. 2011, Ward et al. 2015). This made it difficult to determine what measures were used to establish presence of CVD. Boehmer et al. (2014) used a definition of CVD in which heart disease was considered a CVD risk factor and not CVD diagnosis. Other studies determined CVD diagnoses based on criteria that contradict established guidelines for diagnosis. Clark et al. (2015) determined if participants had DM based on a single fasting or non-fasting blood glucose reading. This method contradicts guidelines established by the American Diabetes Association (2015) for diagnosis of DM using two readings or a single reading with classic symptoms of hyperglycemia. The use of guidelines to measure CVD was also not specified in four studies that used laboratory data (Clark et al. 2015, Farmer et al. 2013a, Farmer et al. 2013b, Hatzenbuehler et al. 2013).

DISCUSSION

The findings discussed above informed the development of recommendations for future work in the nascent area of LGB health.

Inclusion of measures of stress

Measures of stress should be included as a risk factor for CVD in LGB research—Although stress is believed to contribute to physical and mental health

disparities among LGB individuals (Lick et al. 2013), only five studies included measures of stress. Two recent meta-analyses assert that stress is a significant CVD risk factor (Pikhart & Pikhartova 2015, Xue et al. 2015). Given the relationship between stress and CVD and the elevated levels of stress in LGB adults (American Psychological Association 2016), CVD studies that assess sexual orientation should also include measures of perceived stress and its relationship to CVD. The omission of stress as a contributor of CVD risk may have biased the findings of these studies.

In terms of clinical practice, nurses should recognize the impact of stress in LGB individuals and its potential to increase CVD and other conditions in this population. However, nurses and other healthcare professionals currently receive little education on factors that contribute to health disparities in LGB individuals and how to provide culturally relevant care for this population (Carabez et al. 2015, Obedin-Maliver 2011). Nursing as a profession has remained silent about LGB health compared to other health professions (Eliason et al. 2010). Yet, it is the ethical responsibility of nurses and other healthcare professionals to provide comprehensive care to their patients. Therefore, there is a need to evaluate and address health disparities that impact LGB individuals in both research and clinical practice.

Standardized measures

CVD research on LGB individuals should use standardized measures for CVD risk factors and CVD prevalence—This paper reveals that there is inconsistency in how CVD risk factors and CVD diagnoses are measured. Despite availability of evidenced-based guidelines for CVD, these were infrequently used throughout the included studies. It is imperative to use standardized measures for CVD risk factors and CVD diagnoses. This will increase the ability to compare CVD risk and prevalence in LGB adults across studies.

Objective measures

Future studies on CVD in LGB individuals should collect a combination of subjective and objective measures for determining CVD prevalence—Self-report was the predominant method of data collection, which may contribute to measurement error and recall bias. Several studies indicate that self-report can significantly underestimate BMI (Gorber et al. 2007, Griebeler et al. 2011, Magnusson et al. 2014) and CVD prevalence (Klungel, et al. 1999, Muggah et al. 2013, Okura et al. 2004, St. Sauver et al. 2005, Teh et al. 2013, Woodfield & Sudlow 2015). Therefore, when possible, anthropometrics, CVD, HTN, DM, and high cholesterol should be measured with appropriate laboratory and physical examination data rather than self-report. However, this may not be possible for many researchers given funding and time restrictions. In addition, research has shown that LGB individuals, particularly women and younger adults, are less likely to use preventive services (Buchmueller & Carpenter 2010, Diamant et al. 2000, Koh 2000, Kerker et al. 2006). Thus, relying on self-report may lead to significant measurement bias in the LGB population due to decreased use of preventive services. These sources of bias should be considered when designing studies related to CVD in LGB adults.

Electronic health records

Data on sexual orientation should be routinely collected in electronic health records (EHRs)—No studies used EHRs to assess CVD risk or prevalence. Recently the U.S. government issued a rule as part of meaningful use of EHRs requiring vendors to create electronic healthcare systems that document sexual orientation (Office of the National Coordinator for Health Information Technology, 2015). The inclusion of sexual orientation in EHRs is important for understanding health and healthcare utilization of LGB individuals (Cahill & Makadon, 2014). Similar policies should be encouraged in countries with access to EHRs. Inclusion of sexual orientation measures in EHRs will increase access to LGB patients' medical history and other valuable data including results of diagnostic tests (including electrocardiograms, echocardiograms, cardiac catheterizations, and cardiac stress tests) that are more accurate measures of CVD than self-report.

Makadon (2011) asserts that the inclusion of sexual orientation in EHRs is a first step in ensuring equitable care for LGB individuals. Inclusion of sexual orientation in EHRs may increase appropriate preventive screening for LGB patients, which may improve quality of care and outcomes (Makadon, 2011). This will not only provide more robust data to evaluate the health of LGB individuals but also help nurses and other healthcare professionals provide culturally relevant care.

CONCLUSIONS

Current research methodologies impair the ability to accurately capture CVD risk and CVD prevalence in LGB adults. It is evident that measurement issues pose a challenge in understanding CVD in LGB adults. These findings have significant implications for future research and practice in the area of LGB health.

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RELEVANCE TO CLINICAL PRACTICE

Strengthening cardiovascular disease research in lesbian, gay, and bisexual adults is an important step in addressing health disparities in this population. Nurses and other healthcare professionals should assess sexual orientation in routine health assessments.

Nurses and other healthcare professionals have an obligation to provide culturally relevant care. This paper provides insight on measurement issues related to the prevalence of CVD risk factors and diagnoses for LGB adults. Sexual orientation should be documented during healthcare visits to help providers assess patient needs. A more comprehensive understanding of CVD in LGB adults can be achieved through improving research methodologies and clinical practice with LGB adults.

SUMMARY BOX**What does this paper contribute to the wider global clinical community?**

- This paper provides recommendations for strengthening cardiovascular disease research in lesbian, gay, and bisexual individuals, which is an area that is understudied and poorly understood.
- These recommendations can provide insight into cardiovascular disease risk that can inform research and clinical practice with lesbian, gay, and bisexual individuals.

Table 1

Measures for Risk Factors of Cardiovascular Disease

Variable	Term Used	Definition	Standardized (Yes or No)	Study
<i>Alcohol use</i>	<i>Heavy drinking</i>	• 2 drinks per day over 30 days	No	• Andersen et al., 2014.
		• Consuming 60 alcohol containing drinks per month	No	• Case et al., 2004.
		• 3 drinks per day	No	• Diamant et al., 2000
		• 2 drinks per day for men and 1 drinks per day for women	No	• Dilley et al., 2010.
		• Drinking daily or almost daily	No	• Garland-Forshee et al., 2014
		• 5 drinks on one occasion for men and 4 drinks on one occasion for women	Yes:	• Centers for Disease Control and Prevention (CDC) (2010) criteria
<i>Binge drinking</i>		• 5 drinks on one occasion for men and 4 drinks on one occasion for women	Yes:	• National Institute of Alcohol Abuse and Alcoholism (NIAAA) criteria (n.d.) (corresponds with definition of binge drinking)
			No	• Hatzenbuehler et al., 2013.
			Yes:	• NIAAA (n.d.) criteria

Variable	Term Used	Definition	Standardized (Yes or No)	Study
		<ul style="list-style-type: none"> 5 drinks in one sitting in the past two weeks 	No	<ul style="list-style-type: none"> Blosnich et al., 2015.
		<ul style="list-style-type: none"> Binge drinking at least once in the past 30 days 	No	<ul style="list-style-type: none"> Blosnich & Silenzio, 2013
		<ul style="list-style-type: none"> No definition provided 	No	<ul style="list-style-type: none"> Conron et al., 2010. Wang et al. 2007.
	<i>Risky drinking</i>	<ul style="list-style-type: none"> No definition provided 	Yes: <ul style="list-style-type: none"> NIAAA (n.d.) criteria 	<ul style="list-style-type: none"> Farmer et al., 2013a. Farmer et al., 2013b.
	<i>Excessive drinking</i>	<ul style="list-style-type: none"> > 8 drinks per week 	No	<ul style="list-style-type: none"> Steele et al., 2009.
		<ul style="list-style-type: none"> 5 drinks on one occasion for men and 4 drinks on one occasion for women 	Yes: <ul style="list-style-type: none"> NIAAA (n.d.) criteria (corresponds with definition of binge drinking) 	<ul style="list-style-type: none"> Fredriksen-Goldsen et al., 2013.
<i>Current drinking</i>	<ul style="list-style-type: none"> 3 drinks on days when drinking occurs 	No	<ul style="list-style-type: none"> Mays et al., 2002. 	
	<ul style="list-style-type: none"> None or less than weekly, weekly, or daily in the past year 	No	<ul style="list-style-type: none"> Swartz, 2014. 	
	<ul style="list-style-type: none"> Frequency of beer, wine, and liquor consumption 	Yes: <ul style="list-style-type: none"> Food Frequency Questionnaire (FFQ) 	<ul style="list-style-type: none"> Valanis et al., 2000. 	
<i>Alcohol consumption</i>	<ul style="list-style-type: none"> High daily quantities in past 4 weeks 	No	<ul style="list-style-type: none"> Wang et al., 2007. 	
	<ul style="list-style-type: none"> Current smoking and 100 cigarettes in lifetime 	Yes: <ul style="list-style-type: none"> CDC (2014) criteria 	<ul style="list-style-type: none"> Blosnich et al., 2014. Dilley et al., 2010. Farmer et al., 2015. Fredriksen-Goldsen et al., 2013. 	
<i>Tobacco use</i>	Current smoking			

Variable	Term Used	Definition	Standardized (Yes or No)	Study
		<ul style="list-style-type: none"> Current smoking 	No	<ul style="list-style-type: none"> Garland-Forshee et al., 2014. Matthews & Lee, 2014. Valanis et al., 2000. Andersen et al., 2014. Blosnich & Silenzio, 2013. Case et al., 2004. Clark et al., 2015. Conron et al., 2010. Diamant et al., 2000. Diamant & Wold, 2003. Farmer et al., 2013a. Farmer et al., 2013b. Farmer et al., 2015. Roberts et al., 2003.
		<ul style="list-style-type: none"> Smoking in the last 30 days 	No	<ul style="list-style-type: none"> Blosnich et al., 2015. Everett & Mollborn, 2013. Hatzenbuehler et al., 2013. Hatzenbuehler et al., 2014.
		<ul style="list-style-type: none"> Current use of cigars, cigarettes, pipes or smokeless tobacco 	No	<ul style="list-style-type: none"> Mays et al., 2002.
	Tobacco use	<ul style="list-style-type: none"> Daily or not daily Never smoker, ex-smoker, light smoker, or heavy smoker 	No	<ul style="list-style-type: none"> Steele et al., 2009. Wang et al., 2007.
Physical Activity	Physical activity	<ul style="list-style-type: none"> Moderate activity 30 minutes 5 or more days/week; 20 minutes on 3 or more day/week 	Yes: <ul style="list-style-type: none"> U.S. Department of Health and Human Services 	<ul style="list-style-type: none"> Dilley et al., 2010. Fredriksen-Goldsen et al., 2013.

Variable	Term Used	Definition	Standardized (Yes or No) (HHS) (2008) criteria	Study		
		<ul style="list-style-type: none"> Strenuous exercise 1 time per week 	No	<ul style="list-style-type: none"> Garland-Forshee et al., 2014. Case et al., 2004. Roberts et al., 2003. 		
		<ul style="list-style-type: none"> Exercise in past 30 days 	No	<ul style="list-style-type: none"> Blosnich et al., 2014. 		
		<ul style="list-style-type: none"> Frequency and duration of walking at different speeds and strenuous/moderate exercise assessed. 	No	<ul style="list-style-type: none"> Valanis et al., 2000. 		
		<ul style="list-style-type: none"> Low, medium, or high activity in last 7 days 	No	<ul style="list-style-type: none"> Everett & Mollborn, 2013. 		
		<ul style="list-style-type: none"> No physical activity in the last 30 days 	No	<ul style="list-style-type: none"> Matthews & Lee, 2014. 		
		<ul style="list-style-type: none"> 5 bouts of moderate/strenuous exercise in the past week. 	Yes: <ul style="list-style-type: none"> Prior cited research 	<ul style="list-style-type: none"> Hatzenbuehler et al., 2013. Hatzenbuehler et al., 2014. 		
		<ul style="list-style-type: none"> Based on standardized tool 	Yes: <ul style="list-style-type: none"> Center for Epidemiologic Studies Depression (CES-D) scale 	<ul style="list-style-type: none"> Strutz et al., 2014. Valanis et al., 2000. 		
		Mental Health	Depression		Yes: <ul style="list-style-type: none"> National Institute of Mental Health Diagnostic Interview Schedule 	<ul style="list-style-type: none"> Andersen et al., 2014.
					Yes: <ul style="list-style-type: none"> Medical Outcomes Study Short Form 36 (SF-36) 	<ul style="list-style-type: none"> Case et al., 2004.

Variable	Term Used	Definition	Standardized (Yes or No)	Study
		• Any depressive disorder	No	• Matthews & Lee, 2014.
		• Depressed in the past 30 days	No	• Boehmer et al., 2014.
		• Diagnosis or treatment in the past 12 months	No	• Blossnich et al., 2015. • Wang et al., 2007.
		• 12 month diagnosis or treatment of other psychiatric conditions	No	• Blossnich et al., 2015.
	Mental/psychological distress	• 6 days when mental health was not good	Yes: •	• Blossnich et al., 2014. • Farmer et al., 2015.
		• Non-specific psychological distress	Yes: •	• Cochran & Mays, 2007. • Swartz, 2014. • Wallace et al., 2011.
	Mental health needs	• Need help with mental health or emotional problems	No	• Boehmer et al., 2014. • Diamant et al., 2000. • Wallace et al., 2011.
	Mood/anxiety disorders	• Including depression, bipolar disorder, mania, or dysthymia	No	• Steele et al., 2009.
	Bad mental health	• 5 days of poor mental health in the past 30 days	No	• Matthews & Lee, 2014.
	Poor mental health	• Days in past month that mental health was not good	No	• Diamant & Wold, 2003.
		• 7 days of poor mental health in the past 30 days	No	• Garland-Forshee et al., 2014.
		• 10 day of poor mental health in the past 30 days	No	• Dilley et al., 2010.
		• 14 days of poor mental health in the past 30 days	Yes:	• Fredriksen-Goldsen et al., 2013.

Variable	Term Used	Definition	Standardized (Yes or No)	Study
			<ul style="list-style-type: none"> • CDC (2000) criteria 	
	Self-perceived mental health status	<ul style="list-style-type: none"> • 5-point global assessment scale (excellent, very good, good, fair, or poor) 	No	<ul style="list-style-type: none"> • Steele et al., 2009.
	Tense/worried	<ul style="list-style-type: none"> • Feeling tense or worried 15 days in the past 30 days 	No	<ul style="list-style-type: none"> • Conron et al., 2010.
Self-rated Physical Health	Bad physical health	<ul style="list-style-type: none"> • 5 days of poor physical health in the past 30 days 	No	<ul style="list-style-type: none"> • Matthews & Lee, 2014.
	Self-rated general health	<ul style="list-style-type: none"> • Poor or fair general health 	No	<ul style="list-style-type: none"> • Boehmer et al., 2014.
		<ul style="list-style-type: none"> • Days in past month that physical health was not good 	No	<ul style="list-style-type: none"> • Diamant & Wold, 2003.
		<ul style="list-style-type: none"> • Poor or fair physical health 	No	<ul style="list-style-type: none"> • Conron et al., 2010. • Dilley et al., 2010.
		<ul style="list-style-type: none"> • Self-rated health 	No	<ul style="list-style-type: none"> • Diamant et al., 2000. • Strutz et al., 2014. • Wallace et al., 2011. • Wang et al., 2007.
	Poor physical health	<ul style="list-style-type: none"> • 7 days of poor mental health in the past 30 days 	No	<ul style="list-style-type: none"> • Garland-Forshee et al., 2014.
		<ul style="list-style-type: none"> • 14 days of poor physical health in the past 30 days 	Yes: <ul style="list-style-type: none"> • CDC (2000) guidelines 	<ul style="list-style-type: none"> • Blossnich et al., 2014. • Blossnich & Silenzio, 2013. • Fredriksen-Goldsen et al., 2013
	Rating of physical health	<ul style="list-style-type: none"> • Screening tool 	Yes: <ul style="list-style-type: none"> • Short Form-12 Health Survey (SF-12) Physical Component Scale 	<ul style="list-style-type: none"> • Cochran & Mays, 2007.

Variable	Term Used	Definition	Standardized (Yes or No)	Study
	Self-perceived physical health status	<ul style="list-style-type: none"> 5-point global assessment scale (excellent, very good, good, fair, or poor) 	No	<ul style="list-style-type: none"> Steele et al., 2009.
	Self-rated health status	<ul style="list-style-type: none"> Excellent, very good, good versus fair/poor 	No	<ul style="list-style-type: none"> Farmer et al., 2015.
	Illegal drug use	<ul style="list-style-type: none"> Use in last 30 days 	No	<ul style="list-style-type: none"> Blosnich et al., 2015. Conron et al., 2010.
<i>Drug Use</i>	Drug use	<ul style="list-style-type: none"> Use in the last year 	No	<ul style="list-style-type: none"> Everett & Mollborn, 2013. Swartz, 2014. Wang et al., 2007.
		<ul style="list-style-type: none"> Lifetime use 	No	<ul style="list-style-type: none"> Farmer et al., 2013a. Farmer et al., 2013b. Wang et al., 2007.
			Yes:	<ul style="list-style-type: none"> Hatzenbuehler et al., 2013.
<i>Obesity</i>	BMI	<ul style="list-style-type: none"> Not reported 	<ul style="list-style-type: none"> Standard formula (not reported) 	<ul style="list-style-type: none"> Clark et al., 2015.
	Obesity	<ul style="list-style-type: none"> BMI ≥ 30 kg/m² 	Yes:	<ul style="list-style-type: none"> Everett & Mollborn, 2013. Strutz et al., 2014.
			Yes:	<ul style="list-style-type: none"> Farmer et al., 2013a. Farmer et al., 2013b.
			Yes:	<ul style="list-style-type: none"> Fredriksen-Goldsen et al., 2013.

Variable	Term Used	Definition	Standardized (Yes or No)	Study
			Yes: <ul style="list-style-type: none"> • CDC (2013) criteria 	<ul style="list-style-type: none"> • Matthews & Lee, 2014.
			No	<ul style="list-style-type: none"> • Blosnich et al., 2014. • Case et al., 2004. • Diamant & Wold, 2003. • Garland-Forshee et al., 2014. • Mays et al., 2002. • Steele et al., 2009. • Wang et al., 2007.
		<ul style="list-style-type: none"> • Not reported 	Yes: <ul style="list-style-type: none"> • CDC (2009) criteria 	<ul style="list-style-type: none"> • Conron et al., 2010. • Valanis et al., 2000.
		<ul style="list-style-type: none"> • Self-reported weight and height 	No	<ul style="list-style-type: none"> • Blosnich & Silenzio, 2013. • Boehmer et al., 2014.
Overweight	BMI	<ul style="list-style-type: none"> • BMI 25 kg/m² 	Yes: <ul style="list-style-type: none"> • CDC (2013) criteria 	<ul style="list-style-type: none"> • Matthews & Lee, 2014.
			Yes: <ul style="list-style-type: none"> • National Heart, Lung, and Blood Institute (NHLBI) (1998) criteria 	<ul style="list-style-type: none"> • Roberts et al., 2003.
			Yes: <ul style="list-style-type: none"> • NIH (1998) criteria 	<ul style="list-style-type: none"> • Farmer et al., 2013a. • Farmer et al., 2013b.
			Yes:	<ul style="list-style-type: none"> • Everett & Mollborn, 2013.

Variable	Term Used	Definition	Standardized (Yes or No)	Study
			<ul style="list-style-type: none"> • WHO (2000) criteria 	<ul style="list-style-type: none"> • Strutz et al., 2014.
			No	<ul style="list-style-type: none"> • Blossnich et al., 2014. • Case et al., 2004. • Diamant & Wold, 2003. • Dilley et al., 2010. • Farmer et al., 2015. • Mays et al., 2002. • Steele et al., 2009.
		<ul style="list-style-type: none"> • Not reported 	Yes: <ul style="list-style-type: none"> • CDC (2009) criteria 	<ul style="list-style-type: none"> • Comron et al., 2010. • Valanis et al., 2000.
		<ul style="list-style-type: none"> • Self-reported weight and height 	No	<ul style="list-style-type: none"> • Blossnich & Silenzio, 2013. • Boehmer et al., 2014.
Diet	Daily fruit and vegetable servings	<ul style="list-style-type: none"> • Divided into 4 categories: < 2 servings, 2-3 servings, 4 to 5 servings, and more than 6 servings 	No	<ul style="list-style-type: none"> • Valanis et al., 2000.
	Insufficient fruits and vegetables	<ul style="list-style-type: none"> • Not eating fruits and vegetables 5 or more times per day 	No	<ul style="list-style-type: none"> • Dilley et al., 2010.
		<ul style="list-style-type: none"> • < 5 fruits and vegetables per day for the past 30 days 	No	<ul style="list-style-type: none"> • Matthews & Lee, 2014.
	<i>Low fat diet</i>	<ul style="list-style-type: none"> • Self-reported 	No	<ul style="list-style-type: none"> • Roberts et al., 2003.

Table 2

Measures for Cardiovascular Disease Diagnoses

Variable	Term Used	Operationalization	Standardized Definition (Yes or No)	Study		
<i>Cardiovascular Disease</i>	CVD	<ul style="list-style-type: none"> Self-report 	Yes: <ul style="list-style-type: none"> Heart disease 	<ul style="list-style-type: none"> Boehmer et al., 2014. Cochran & Mays, 2007. Conron et al., 2010 Diamant & Wold, 2003. Diamant et al., 2000. 		
			Yes: <ul style="list-style-type: none"> Heart attack, angina, or stroke 	<ul style="list-style-type: none"> Fredriksen-Goldsen et al., 2013. 		
			Yes: <ul style="list-style-type: none"> Heart attack, angina, coronary heart disease, or stroke 	<ul style="list-style-type: none"> Blosnich et al., 2014 Garland-Forshee et al., 2014. Farmer et al., 2015. 		
			Yes: <ul style="list-style-type: none"> Angina or heart disease 	<ul style="list-style-type: none"> Matthews & Lee, 2014. 		
			Yes: <ul style="list-style-type: none"> Angina, myocardial infarction, or stroke 	<ul style="list-style-type: none"> Valanis et al., 2000. 		
			Yes: <ul style="list-style-type: none"> Heart attack, stroke, or coronary heart disease 	<ul style="list-style-type: none"> Blosnich & Silenzio, 2013. 		
			No	<ul style="list-style-type: none"> Mays et al., 2002. 		
			No	<ul style="list-style-type: none"> Andersen et al., 2014. Wallace et al., 2011. Ward et al., 2015. 		
			CVD problems			
			Heart disease			

Variable	Term Used	Operationalization	Standardized Definition (Yes or No)	Study
Cardiovascular Disease Risk			Yes: • Heart disease and stroke	• Swartz et al., 2014.
	Cardiometabolic risk score	• Laboratory data	Yes: • SBP, DBP, pulse, CRP, HbA1c, and waist circumference.	• Hatzenbuehler et al., 2013.
	CVD risk	• Combination of self-report and laboratory data	Yes: • Framingham CVD risk score	• Clark et al., 2015. • Farmer et al., 2013a. • Farmer et al., 2013b.
			Yes: • Victimization, discrimination, tobacco use, drug use, BMI, and physical activity.	• Hatzenbuehler et al., 2014.
	CVD risk factors	• High blood pressure, high cholesterol, etc.	No	• Blossnich et al., 2015.
	High CVD risk	• Self-report	No	• Conron et al., 2010.
High Cholesterol	High density lipid-cholesterol	• Laboratory data	Yes: • HDL cholesterol 45 mg/dL	• Farmer et al., 2013a. • Farmer et al., 2013b.
	High cholesterol	• Self-report	No	• Diamant & Wold, 2003. • Diamant et al., 2000. • Dilley et al., 2010 • Fredriksen-Goldsen et al., 2013. • Garland-Forshee et al., 2014. • Matthews & Lee, 2014. • Strutz et al., 2014. • Wang et al., 2007.

Variable	Term Used	Operationalization	Standardized Definition (Yes or No)	Study
	Total cholesterol	<ul style="list-style-type: none"> Laboratory data 	Yes: <ul style="list-style-type: none"> Total cholesterol 160 mg/dL 	<ul style="list-style-type: none"> Farmer et al., 2013a. Farmer et al., 2013b.
Diabetes	Diabetes	<ul style="list-style-type: none"> Self-report 	No	<ul style="list-style-type: none"> Andersen et al., 2014. Blosnich et al., 2014. Blosnich & Silenzio, 2013. Boehmer et al., 2014. Cochran & Mays, 2007. Conron et al., 2010. Diamant & Wold, 2003. Diamant et al., 2000. Dilley et al., 2010. Farmer et al., 2013a. Farmer et al., 2013b. Fredriksen-Goldsen et al., 2013. Garland-Forshee et al., 2014. Matthews & Lee, 2014. Mays et al., 2002. Swartz, 2014. Wallace et al., 2011. Wang et al., 2007. Ward et al., 2015.
		<ul style="list-style-type: none"> Blood laboratory data 	Yes: <ul style="list-style-type: none"> HbA1c (parameters not reported) 	<ul style="list-style-type: none"> Hatzenbuehler et al., 2013.
		<ul style="list-style-type: none"> Combination of self-report and laboratory data 	Yes: <ul style="list-style-type: none"> Fasting glucose 126mg/dL † Non-fasting glucose 200mg/dL 	<ul style="list-style-type: none"> Clark et al., 2015.

Variable	Term Used	Operationalization	Standardized Definition (Yes or No)	Study
<i>Hypertension</i>	High blood pressure	<ul style="list-style-type: none"> Self-report 	No	<ul style="list-style-type: none"> Andersen et al., 2014. Cochran & Mays, 2007. Fredriksen-Goldsen et al., 2013. Garland-Forshee et al., 2014. Veenstra, 2013.
	Hypertension	<ul style="list-style-type: none"> Blood pressure (BP) measurement 	Yes: <ul style="list-style-type: none"> SBP 140 mm Hg DBP 90 mm Hg 	<ul style="list-style-type: none"> Everett & Mollborn, 2013. Hatzembuehler et al., 2013
			No	<ul style="list-style-type: none"> Clark et al., 2015.
		<ul style="list-style-type: none"> Self-report 	No	<ul style="list-style-type: none"> Boehmer et al., 2014. Diamant & Wold, 2003. Diamant et al., 2000. Dilley et al., 2010 Matthews & Lee, 2014. Mays et al., 2002. Steele et al., 2009. Strutz et al., 2014. Swartz, 2014. Valanis et al., 2000. Wallace et al., 2011. Wang et al., 2007. Ward et al., 2015.
	<ul style="list-style-type: none"> Combination of self-report and BP measurement 	Yes: <ul style="list-style-type: none"> SBP 130 mm Hg 	<ul style="list-style-type: none"> Färmer et al., 2013a. Färmer et al., 2013b. 	
	Taking BP medication	<ul style="list-style-type: none"> Self-report 	No	<ul style="list-style-type: none"> Boehmer et al., 2014. Clark et al., 2015. Färmer et al., 2013a.

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Variable	Term Used	Operationalization	Standardized Definition (Yes or No)	Study
				Farmer et al., 2013b.