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An Examination of the Sociodemographic and Health Determinants of Major Depressive Disorder Among Black Women

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Abstract

Objectives Black women disproportionately share the distribution of risk factors for physical and mental illnesses. The goal of this study was to examine the sociodemographic and health correlates of major depressive disorder (MDD) symptoms among black women.

Methods Pooled data from the 2005–2010 National Health and Nutrition Examination Survey (NHANES) were used to assess the sociodemographic and health correlates of MDD symptoms among black women ($n = 227$). Multivariate logistic regression techniques assessed the association between MDD symptoms and age, socioeconomic status, health status, and health behaviors.

Results Poverty income ratio and smoking status were significantly associated with the likelihood of having MDD symptoms. Black women who were smokers were also more likely to have MDD symptoms compared to non-smokers [OR = 8.05, 95% CI = (4.56, 14.23)]. After controlling for all other socioeconomic and health variables, this association remained statistically significant. In addition, after controlling for all other variables, the multivariate analyses showed that black women below 299% federal poverty level (FPL) were nearly three times more likely to have MDD symptoms compared to women above 300% FPL [OR = 2.82, 95% CI = (1.02, 7.96)].

Conclusions These analyses suggest that poverty and smoking status are associated with MDD symptoms among black women. A deeper understanding of the underlying mechanisms and key factors which influence MDD symptoms are needed in order to develop and create mental health programs targeting women of color.

Keywords Black women · Depression · Major depressive disorder · Health disparities

Introduction

Depression is one of the most common disorders in the USA [1, 2] and disproportionately affects black women [3] for reasons that have not been fully explored. Of all mental health disorders, major depressive disorder (MDD) carries the heaviest burden for people of color in the USA [4]. Previous studies examining MDD by race found that compared with non-Hispanic whites, non-Hispanic blacks had lower lifetime rates of MDD. However, the authors who examined data from the National Comorbidity Study posited that blacks are less likely to have access to mental health services and often receive poorer quality care compared to their white counterparts [5]. Additionally, the results of a study examining MDD utilizing data from the National Epidemiologic Survey on Alcoholism and Related Conditions revealed that Native Americans had the highest rates of MDD, followed by non-Hispanic whites, and blacks. The lifetime prevalence rate for MDD is reportedly highest among whites (17.9%), followed by Caribbean blacks (12.9%), and African Americans (10.4%) [5].

While depression is the leading cause of disability for both men and women, women are twice as likely to be diagnosed with depression as men. In 2009, the prevalence of depressive symptoms for women of color between the ages of 18 and 64 was 13.8%. Almost 15% of women of color reported a

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lifetime diagnosis of a depressive disorder, adding to the theory that US women of color share a disproportionate burden of the risk factors associated with depression and other mental illnesses [6]. White women experience episodes of MDD more often than black women; however, black women experience episodes of greater severity and persistence [2, 4]. Although the rates of depressive symptoms and MDD appear to be lower among black women compared to white women in the USA, MDD and depressive symptoms often go untreated in black women, resulting in a more severe and disabling illness compared to white women [5]. Additionally, extant research shows that black women face several different types of oppression that can place them at higher risks of depression and depressive symptoms [7]. While women in general are more likely to seek out help for mental illness compared to men, only 12% of black women reportedly seek out help, creating a health disparity with important implications for mental health policy [2, 4].

As a population that is significantly burdened by mental illness, it is important to assess the correlates of MDD symptoms among black women [3]. The current research landscape examines depression among women and race independently, underscoring the need for studies focused on examining factors related to MDD among black women. Our study aims to expand on current research and examines the correlates of MDD symptoms among a nationally representative sample of black women.

Correlates of MDD Symptoms

Race and Allostatic Load

In considering various pathways that may explain why black women are at an increased risk of MDD, the concept of allostatic load (AL) provides insight into the mechanisms at work. AL is a useful tool for measuring the effects of stress on the body generated by social conditions and can account for the cumulative wear and tear on the body's systems due to repeated adaptation to psychosocial stressors [8]. Prolonged activation of these systems can increase the risk of both physical and mental disorders [9, 10]. Research shows that black women have the highest predicted AL score compared to other racial and ethnic groups, regardless of age [11]. Chronic stress may lead to higher AL among black women and trigger the body's response system [12]. High AL among black women is also associated with low education and low socioeconomic status [13]. Notably, AL is linked to many of the stress-sensitive morbidities disproportionately faced by black women, such as depression [14].

The impact of racism and discrimination on health is well established in the literature and is an important element in considering the relationship between AL and depression and depressive symptoms. Experiences of racism and discrimination can act as chronic stressors. Black women experience the stress of living in a race-conscious society that may cause disproportionate

physiological and mental deterioration, leading to high AL. Black women are particularly vulnerable to stressors from discrimination due to race and sex, which adds an additional layer of complexity. Findings from Keith et al. found that black women experience discrimination across many domains, including the interpersonal and structural levels. Specifically, the authors found that black women are exposed to psychological insults that may exacerbate depressive symptoms [15]. Additionally, racism and other forms of marginalization support the "weathering" hypothesis developed by Geronimus and colleagues, which suggests that blacks experience early physical and mental health deterioration as a result of higher levels of AL [8]. Given this relationship, AL is a useful method of assessing the body's physiological response to stressors, potentially influencing the rate of MDD among the black women population.

Allostatic Load and Smoking Status

Several studies report a positive association between smoking and mental illness, and depression in particular. The association between smoking and depression is significant at all age groups; however, it appears that the relationship is due to the reciprocal causal effects between smoking and depression that manifest in early adolescent and continue into adulthood [16]. AL appears to have an adverse effect on both the risk of smoking and depression among black women. Smoking rates are higher among black women compared to white women, and black women are less likely to quit or attempt to quit smoking compared to women of other racial/ethnic groups [17]. Black women are also more likely to maintain smoking later in life, putting them at greater risk for developing depressive symptoms [17]. While black women are more likely to report depression regardless of smoking status when compared to black men, it may be that smoking increases the likelihood of depression in black women even more [18]. Since black women are more likely to smoke than white women [17], smoking has the potential to pose unique problems for black women who experience depression, despite the fact that black women are less likely to suffer from MDD than white women [5].

The existing evidence regarding the direction of the association between smoking and depression remains inconsistent and highlights two main hypotheses. The self-medication hypothesis states that individuals turn to smoking to alleviate their symptoms [19, 20]. An alternative hypothesis suggests that smoking may lead to depression or anxiety, through effects on the brain's physiology that elevate susceptibility to environmental stressors [21]. Given what is known about the race-based disparities in AL and how AL can account for the body's response to external stressors, in this study, we examine the association between smoking status and MDD in order to fully describe the potential correlates of MDD among black women.

Poverty and Education

Low-income women and black women are at a disproportionately higher risk of depression compared to high-income women and white women [22]. Further, black women are less likely to possess fundamental resources that could aid in preventing depression [23]. This disparity exists in part due to the underutilization of mental health care services in black and low-income communities [23]. Past research shows that there is a wide variety of barriers preventing black and low-income women from accessing the mental health treatment they may need [23]. The intersection of low socioeconomic status and race has the potential to create an even stronger disconnect for black women, affecting the way that they receive treatment for mental health conditions such as MDD. Women with fewer than 12 years of education and women with only a high school diploma/GED were more likely to report current depressive symptoms than women with some college or college diploma [6]. Black women are more likely to have a lower education and income and are less likely to be employed than white women [6, 23, 24]. These factors place them at an increased risk for depressive disorders suggesting a need to re-evaluate services available for black women.

Methods

Data

Pooled data were derived from the 2005–2010 NHANES publicly available dataset to examine correlates of MDD symptoms among non-Hispanic black women. Informed consent was gained from each individual prior to their participation in the NHANES survey [24]. NHANES uses a stratified, multistage probability sample to provide national estimates of the nutritional status and health for the civilian, non-institutionalized population of the USA [24]. Our sample included respondents that had laboratory tests and were medically examined. Pregnant women, men, and respondents under age 20 years were excluded from the analysis. NHANES denotes the variable for race/ethnicity by combining individuals' responses to questions on Hispanic origin and race. The full analytical sample included 227 black women. Data were analyzed using SAS 9.3 [25]. Descriptive statistics and logistic regressions were weighted using the MEC survey weight provided by NHANES to account for the complex sampling design of pooled data. We also conducted a cross tabulation of the independent variables using Rao-Scott chi-square and tested the regression models using multicollinearity diagnostic statistics (tolerance and variance inflation factors [VIF]). Although there is no formal cutoff value for determining the presence of multicollinearity using VIF, values of VIF exceeding 10 are often regarded as indicative of multicollinearity.

The regression models were checked for multicollinearity, and no problem was detected (all variance inflation factors <2). Independence was assumed because of the strict NHANES sampling methodology utilized.

Measures

Independent Variables

Age was a continuous variable defined as participants' age in years at the time of the screening interview. We measured education as a four-level categorical variable (1 = less than high school, 2 = high school diploma/GED equivalent, 3 = more than high school/some college/associate's degree, 4 = college graduate or above). NHANES defines the poverty income ratio (PIR) as a ratio of the family income to the federal poverty level based on family size in a calendar year with values ranging from 0 to 5. Values of 4 and above were coded as 5 in order to protect individuals' anonymity. If the family income value was reported as a range, then the mid-point of the range is used. If the family income data was missing, the PIR values were not computed. According to the 2006 Department of Health and Human Services (HHS) poverty guidelines, for a family of four, the FPL was \$20,000. Therefore, a PIR value of "1" is 100% of the FPL, a value of "2" is 200% of the FPL, and so forth. We defined this variable into two categories: between 0 and 2.99, and greater than 3. Marital status was recoded into a three-level categorical variable (1 = never married; 2 = married, living with partner; 3 = widowed, divorced, or separated). Physical health-related independent variables included BMI, self-rated health, allostatic load, and cigarette smoking status. BMI was assessed using measured weight (in kilograms) and height (in meters) and was divided into three categories (under and normal weight [reference group], <25.0 kg/m²; overweight, 25.0–29.9 kg/m²; and obese, >29.9 kg/m²). Self-rated health was categorized as a dichotomous variable based on a five-point scale (1 = excellent, very good, good; 0 = fair, poor). Current non-smokers were defined as those who had never smoked at least 100 cigarettes in their lifetime and did not smoke at the time of the interview. Individuals who smoked at least 100 cigarettes in their lifetime and currently smoked were designated as current smokers.

AL was constructed from eight biomarkers (systolic blood pressure, diastolic blood pressure, 60-s pulse, C-reactive protein, high-density lipoprotein (HDL), total cholesterol, creatinine clearance, and serum albumin) that represent dysregulation of physiological systems known to protect the individual from disease risk. A high threshold was determined for each biomarker based on clinical recommendations of health risk. The 75th and 25th percentiles were used to categorize respondents at greater risk of developing disease relative to the rest of the sample. A high threshold was defined as below the 25th

percentile for albumin and HDL and above the 75th percentile for the other biomarkers. Systolic and diastolic blood pressures were an average of two readings conducted by trained medical personnel. Individuals with a reading beyond the threshold for each biomarker were assigned one point for that particular biomarker. Individuals who reported taking medication for hypertension or high cholesterol were defined as high risk when designating points for blood pressure and total cholesterol. AL scores for individuals with a score for at least seven of the eight biomarkers were summed up for a maximum score of eight. A higher AL score is an indication of poorer health. High AL score was defined as a total AL score of 4 or above since previous research suggests group differences in morbidity and mortality are observed when AL scores reach above 3 or 4 [8, 26]. The variable was dichotomized where high AL score = 1 and low AL score = 0.

Dependent Variable

The Patient Health Questionnaire-9 (PHQ-9), a screening tool for assessing the frequency and severity of depression, was used to measure the dependent variable. PHQ-9 has nine items that are based on the DSM-IV diagnostic criteria. All the items share the header "Over the last 2 weeks, how often have you been bothered by any of the following problems?" Scores for each item range from 0 "not at all" to 3 "nearly every day" with a total score ranging from 0 to 27. Items include the following: "Thoughts that you would be better off dead, or of hurting yourself," "Trouble falling or staying asleep, or sleeping too much," and "Feeling bad about yourself or that you are a failure or have let yourself or your family down."

The threshold score for the PHQ-9 was categorized as 10 or greater. The variable was dichotomized and characterized patients as having MDD symptoms or not (1 = PHQ-9 \geq 10, 0 = PHQ-9 < 10). PHQ-9 has shown good internal validity and test-retest reliability among several different cultural groups [27–29]. A PHQ-9 score higher than 10 places a person into the moderate depression, moderately severe depression, or severe depression categories [29].

Data Analysis

We stratified the data by each independent variable and conducted chi-square tests to examine the distribution of each variable. As recommended by NHANES, the *P* value corresponding to the Rao-Scott chi-square statistic was reported. We used multivariate logistic regression models to assess the association between the independent variables and MDD symptoms. Model 1 included age and marital status. Model 2 added education and PIR to the model. Model 3 introduced smoking, self-rated health, and BMI, and the final model, model 4, added AL.

Results

Table 1 shows the distribution of the independent and dependent variables in the sample. Among the sample of black women, 38% were married or living with a partner and 34% were never married. Less than a quarter of the black women had a college education or more, and a large majority of the women were below 299% of the FPL (69%). Sixty-eight percent of the sample reported that their health was excellent, very good, or good, and a little over half of the sample had a BMI of 29.9 or greater. Sixteen percent of the sample had MDD symptoms, and 64% had a low AL score.

As shown in Table 2, a larger proportion of those with MDD symptoms compared to those without had less than a high school education (31.53 vs 15.88). Among the women reporting MDD symptoms, a larger percentage of them were below 299% FPL although the majority of them reported excellent, very good, or good health. Educational differences in MDD symptoms were also observed. Lower proportions of MDD symptoms were found among those with higher levels of education. Table 3 shows the bivariate relationships between the independent variables under study. There was a statistically significant relationship between self-rated health (SRH) and all of the independent variables except for marital status. Further, AL was associated with marital status, SRH, and BMI.

Multivariate logistic regression models presented in Table 4 indicated that of all the sociodemographic and health variables, PIR and smoking status were significantly associated with MDD symptoms among black women. After controlling for age, marital status, and education, black women below 299% FPL were three times more likely to report MDD symptoms compared to black women who lived above 300% FPL (OR = 3.56, 95% CI = 1.19, 10.68) (model 2). PIR remained a strong correlate of MDD symptoms even after including the health variables in the model. When controlling for all other variables, black women below 299% FPL were close to three times more likely to report MDD symptoms compared to women above 300% FPL (OR = 2.82, 95% CI = 1.02, 7.96) (model 4). Black women who were current smokers were eight times more likely to have MDD symptoms compared to non-smokers (OR = 8.11, 95% CI = 4.53, 14.45) (model 3), and this effect remained after controlling for all other variables in the model (OR = 8.05, 95% CI = 4.56, 14.23) (model 4). Collinearity diagnostics did not indicate issues with the independent variables in any of the regression models.

Discussion

In a nationally representative sample of non-Hispanic black women, the present investigation sought to examine the factors associated with MDD symptoms. We found that PIR and

Table 1 Weighted descriptive statistics for sample: National Health and Nutrition Examination Survey, USA, 2005–2010

Characteristic	n (%)
Age (mean)	42
Marital status	
Unmarried	72 (34.48)
Married/living with partner	84 (37.86)
Divorced/separated/widowed	71 (27.66)
Education	
Less than high school/no diploma	47 (18.33)
High school diploma	64 (28.15)
More than high school/some college/AA	77 (35.32)
College graduate or above	39 (18.20)
Poverty income ratio	
Below 299% federal poverty level	158 (68.54)
Above 300% federal poverty level	69 (31.46)
SRH	
Excellent, very good, good	156 (67.98)
Fair, poor	71 (32.02)
BMI	
<25	51 (23.94)
25–29.9	61 (24.71)
>29.9	115 (51.35)
Cigarette smoking status	
Current non-smoker	179 (78.77)
Current smoker	48 (21.23)
Allostatic Load	
With high AL score AL \geq 4	94 (35.86)
With low AL score AL < 4	133 (64.14)
MDD	
0	194 (84.34)
1	33 (15.66)

smoking status were strong correlates of MDD symptoms in this population. Even after adjusting for all other demographic and health status variables, women below 299% of the poverty level and women who were smokers were more likely to report MDD symptoms than their higher income and non-smoking counterparts. These findings are consistent with research showing higher rates of depressive symptoms and depression among individuals living in poverty.

As stated earlier, although several studies have found a correlation between smoking status and mental health, evidence on the direction of this relationship is mixed [17, 30–32]. Our results are consistent with the finding that MDD symptoms are more common among women who smoke [30, 32], providing support for the notion that smoking may lead to depression and pointing toward a need for more smoking cessation programs for high-risk groups such as black women who may be experiencing moderate to severe

depressive symptoms. While black women are less likely to smoke than their male and white counterparts, they experience a higher rate of depression diagnoses potentially contributed to by smoking habits [18].

As mentioned earlier, PIR was found to be significantly correlated with MDD symptoms. This finding is consistent with the well-established association between income and health. The link between poverty, health, and mental health has been persistently assessed at both the individual and neighborhood levels. In terms of mental health disorders, studies highlight higher incidence of depressive symptoms among low-income individuals [33, 34]. Adults with psychological distress are also more likely to have family income below \$20,000 (44%) than those without (20%) [35]. Other studies examining depression overall find that living in poverty increases an individual's risk of developing depression or depressive symptoms [36]. Interactions between income, race, and gender highlight that being a black woman further exacerbates the link between income and depression [22, 36]. Our study suggests that the association between smoking status, PIR, and MDD symptoms is significant beyond the demographic and health status factors that are related to MDD symptoms.

Interestingly, the health status variables examined, particularly AL, were not significantly associated with MDD symptoms in this study. Research shows that chronic stress is a major mechanism through which poverty or low socioeconomic status can impact mental health. With this in mind, we posit that there may be more complex mediating, moderating, or bi-directional mechanisms at work that our study does not fully capture. For example, AL may mediate the relationship between self-rated health and other health-related variables and MDD symptoms or may act as a predictor of self-rated health as has been documented [37]. These potentially multifaceted relationships may be at play here, which may explain why a significant association between AL, the other health-related variables, and MDD symptoms was not observed. Studies show that poverty influences mental health and health in general through a wide range of physiological and behavioral mechanisms which were not assessed in this study. Future research must aim to disentangle these pathways among black women in order to fully understand the mechanisms influencing MDD symptoms.

Limitations

This study is not without limitations. First, due to the small number of women reporting MDD symptoms, we were not able to examine the PHQ-9 measure on the item level. Second, the data were cross-sectional, which limited our ability to make meaningful statements about causality. Additionally, this study was unable to examine nativity-based differences in MDD symptoms due to the small number of foreign-born

Table 2 Weighted sociodemographic and behavioral characteristics among non-Hispanic black women by MDD status: National Health and Nutrition Examination Survey, USA, 2005–2010

Characteristic	% MDD (n = 33)	% non-MDD (n = 194)	P
Marital status			
Never married	32.98	34.76	0.73
Married/living with partner	33.84	38.60	
Widowed/divorced/separated	33.18	26.63	
Education			
Less than high school/no diploma	31.53	15.88	0.01
High school diploma	20.38	29.59	
More than high school/some college/AA	41.79	34.12	
College graduate or above	6.29	20.42	
Poverty income ratio			
Below 299% federal poverty level	54.62	64.76	0.002
Above 300% federal poverty level	29.72	35.24	
SRH			
Excellent, very good, good	92.12	63.50	0.001
Fair, poor	7.88	36.50	
BMI			
<25	15.87	25.44	0.19
25–29.9	20.82	25.44	
>29.9	63.32	49.13	
Cigarette smoking status			
Current non-smoker	58.78	85.74	<0.0001
Current smoker	41.22	14.26	
AL			
Low <4	52.87	66.24	0.08
High >4	47.13	33.76	

women in the sample. Previous research shows that immigrant women experience depression less often when compared to US-born women [38]. There are also studies citing differences by region of origin. For example, US-born black women are almost three times more likely to experience depression compared to African-born and Caribbean-born women [6, 38].

However, the longer foreign-born women reside in the USA, their risk of experiencing negative health outcomes increases [39]. As the black population continues to grow more and more heterogeneous, it will be important to fully understand the impact of nativity on MDD symptoms among black women. It will also be important for further research to examine

Table 3 Weighted cross tabulation of sociodemographic and behavioral characteristics among non-Hispanic black women: National Health and Nutrition Examination Survey, USA, 2005–2010

Characteristic	P value						
	Marital status	Education	Poverty income ratio	SRH	BMI	Cigarette smoking status	AL
Marital status		0.05	0.13	0.54	0.22	0.36	<0.001
Education	0.05		<0.001	<0.001	0.64	<0.001	0.70
Poverty income ratio	0.13	<0.001		<0.001	0.19	<0.001	0.34
SRH	0.54	<0.001	<0.001		<0.001	0.0012	<0.001
BMI	0.22	0.64	0.19	<0.001		0.24	<0.001
Cigarette smoking status	0.36	<0.001	<0.001	0.001	0.24		0.86
AL	<0.001	0.70	0.34	<0.001	<0.001	0.86	

Table 4 Multivariate logistic regression models presented in Table 4 predicting MDD on non-Hispanic black women: National Health and Nutrition Examination Survey, 2005–2010

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Age (years)	0.98 (0.96, 1.003)	0.98 (0.96, 1.01)	0.98 (0.96, 1.01)	0.98 (0.95, 1.02)
Marital status				
Married/living with partner (ref)	1.00	1.00	1.00	1.00
Never married	0.92 (0.33, 2.56)	0.75 (0.27, 2.08)	0.75 (0.24, 2.33)	0.75 (0.24, 2.34)
Widowed/divorced/separated	1.73 (0.69, 4.34)	1.27 (0.49, 3.30)	1.45 (0.45, 4.63)	1.42 (0.41, 4.91)
Education				
College graduate or above (ref)		1.00	1.00	1.00
More than high school/some college/AA		2.51 (0.78, 8.13)	1.50 (0.27, 8.40)	1.51 (0.27, 8.31)
High school diploma		1.23 (0.34, 4.50)	0.55 (0.01, 3.08)	0.57 (0.11, 3.01)
Less than high school/no diploma		3.78 (0.90, 16.06)	1.12 (0.15, 9.44)	1.21 (0.15, 9.45)
Poverty income ratio				
Above 300% federal poverty level (ref)		1.00	1.00	1.00
Below 299% federal poverty level		3.36 (1.15, 9.85)	2.83 (1.01, 7.93)	2.82 (1.01, 7.96)
Self-rated health				
Fair, poor (ref)			1.00	1.00
Excellent, very good, good			3.68 (0.94, 14.37)	3.50 (0.95, 12.92)
BMI				
25–29.9 ref			1.00	1.00
<25			0.69 (0.24, 1.95)	0.69 (0.23, 2.07)
Cigarette smoking				
Current non-smoker (ref)			1.00	1.00
Current smoker			8.11 (4.53, 14.45)	8.05 (4.56, 14.23)
AL				
High>4 (ref)				1.00
Low <4				0.86 (0.27, 2.78)

OR odds ratio, CI confidence interval

* $P < .05$

these relationships in a larger sample of black women in order to confirm the findings highlighted in this study. Lastly, the NHANES data are derived from self-reported information, which is subject to information bias.

There is limited literature examining MDD among black women in the USA. As a result of this limitation, much of the previous research focused on depression or depressive symptoms rather than MDD specifically [40]. There is a continued need for research in this area, specifically examining the influence of socioeconomic status and smoking status, as these were found to be significantly correlated with MDD symptoms in our analysis.

Conclusions

Our analyses suggest that certain sociodemographic and health variables are associated with MDD symptoms

among black women than others. Researchers should consider the larger contextual implications and factors that contribute to MDD symptoms for black women as compared to other ethnic and racial groups in the USA. Future analyses should consider examining how the correlates of MDD symptoms may or may not differ based on the individual items on the PHQ-9 measure in a larger sample of black women. This study was unable to test the mediating, moderating, or bi-directional pathways that may exist between the variables examined. This may explain why associations between the health-related variables and MDD symptoms were not observed. Future research examining the between and within differences as well as the multidirectional associations would aid in a deeper understanding of the contributing factors of MDD symptoms among black women. This study is consistent with existing findings regarding poverty and smoking behavior but provides an opportunity for more investigation in this

area to fully recognize and address the racial and ethnic disparities in MDD symptoms and the burden of MDD on black women.

Compliance with Ethical Standards

Ethical Approval This article does not contain any studies with human participants performed by any of the authors.

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