



Published in final edited form as:

*J Affect Disord.* 2021 September 01; 292: 471–474. doi:10.1016/j.jad.2021.05.070.

## The Effect of Physical Activity on the Association between Perceived Racial Discrimination and Depression in African Americans

Markus H. Flynn<sup>1</sup>, Angelique G. Brellenthin<sup>1</sup>, Jacob D. Meyer<sup>1</sup>, Carolyn E. Cutrona<sup>2</sup>, Duck-chul Lee<sup>1</sup>

<sup>1</sup>Department of Kinesiology, Iowa State University, Ames, IA, USA

<sup>2</sup>Department of Psychology, Iowa State University, Ames, IA, USA

### Abstract

**Background:** The purpose of this cross-sectional study was to examine the effect of physical activity (PA) on the relationship between perceived racial discrimination and major depressive disorder (MDD) in African Americans.

**Methods:** 645 African Americans (mean age 45 years) were interviewed on their perceived racial discrimination, PA, and past 12-month MDD. Participants were categorized into tertiles (lower, middle, upper) of racial discrimination as well as “active” or “inactive” groups based on the US PA guidelines. Odds ratios and 95% confidence intervals (CIs) were calculated for MDD prevalence across discrimination tertiles stratified by PA group after adjusting for potential confounders.

**Results:** The upper (higher) discrimination group had 2.99 (95% CIs 1.03-8.67) increased odds of MDD compared with the lower group after adjusting for potential confounders. The stratified analysis indicated that the increased odds of MDD in the upper discrimination group were observed only among the inactive group (5.19 [1.08-24.87]) after adjusting for age and sex. The association between discrimination and MDD was not significant among active participants.

**Limitations:** Limitations include generalizability since participants were predominantly women and recruited solely from Iowa or Georgia; the low number of MDD cases in some groups; and that causation cannot be inferred from this cross-sectional study.

**Conclusion:** Not meeting the PA guidelines may be associated with higher depression among African Americans experiencing higher levels of perceived racial discrimination.

---

Corresponding Author: Angelique Brellenthin, 0103N Forker Building, 534 Wallace Road, Ames, Iowa, abrellen@iastate.edu, (515) 294-6351, Fax: (515) 294-8740.

**Contributors:** All authors contributed significantly to this manuscript and have approved the final article.

**Publisher's Disclaimer:** This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

**Declaration of interests:** None.

**Ethics approval:** The study was approved by the institutional review boards of University of Georgia and Iowa State University.

## Keywords

physical activity; depression; racial discrimination; African Americans; exercise

---

## INTRODUCTION

Three-hundred million people worldwide suffer from depression, and major depressive disorder (MDD) is the leading cause of disability (WHO, 2018). MDD results from a complex interaction of biological and psychosocial factors, and its consequences tend to affect racial and ethnic minority groups disproportionately. Racial and ethnic minority groups in the United States (US) are less likely to have access to private or community-based mental health services and are more likely to use inpatient hospitalization or emergency rooms and receive lower-quality care (Mihail Samnaliev et al., 2008).

Racial discrimination is a pervasive and critical social problem in the US. Racial discrimination stems from larger systems of racism, which includes open threats and insults to phenomena deeply embedded in social systems and structures (Berman and Paradies, 2010). It is also a unique risk factor for MDD among African Americans. Exposure to racial discrimination is considered a significant stressor, and several studies and meta-analytic reviews have established the link between racial discrimination and depression (Matthews et al., 2013; Paradies et al., 2015).

Regular physical activity (PA) has been shown to have strong antidepressant effects comparable to medication and other common forms of treatment (Blumenthal et al., 2007; Schuch et al., 2016). However, there is still limited data on the potential modifying effect of PA on the relationship between racial discrimination and depression. The purpose of this study was to examine the effect of PA on the association between perceived racial discrimination and MDD in African Americans.

## METHODS

### Participants and Data Collection

This study used data from wave 4 (2005-2006) of The Family and Community Health Study (FACHS), an ongoing, multi-site cohort of African American families and primary caregivers of children in Iowa and Georgia. Data were collected during in-home interviews by thoroughly trained African American researchers. Full study procedures have been published previously (Cutrona et al., 2005). Research protocols adhered to the Declaration of Helsinki, and all participants provided informed consent. Participants were included if they had complete data on racial discrimination, PA, past 12-month MDD, and covariates.

### Primary Exposure: Perceived Racial Discrimination

Perceived racial discrimination was assessed using the 13-item revised version of the Schedule of Racist Events (SRE) questionnaire (Burt et al., 2017; Landrine and Klonoff, 1996). The SRE self-report inventory measures the frequency of racial discriminatory events

that someone has encountered throughout their life. Responses to each item range from 1= “never” to 4= “frequently” and are averaged together for an overall score.

### **Primary Outcome: Past 12-month Major Depressive Disorder (MDD)**

MDD was determined using the University of Michigan Composite International Diagnostic Interview (UM-CIDI) and was administered by a trained African American lay interviewer (i.e., not a clinician) (Cutrona et al., 2005). The UM-CIDI was designed to be administered by a lay interviewer in large-scale community studies and was subsequently modified to render DSM-IV diagnoses in the FACHS cohort (Kessler, 1991; Kessler et al., 1998). Interviewers were trained in a 1-week intensive training program that included videotaped demonstration interviews, role-playing, practice sessions, group discussions, and specific training on how to ask probing and clarifying questions. The UM-CIDI was administered along with a computer-assisted personal interview (CAPI), which programs in skip criteria based on the respondent’s answers. Therefore, there is minimal opportunity for interviewer bias when making decisions on which sections or questions of the diagnostic interview to skip or not. The UM-CIDI demonstrates moderate concordance validity with the Structured Clinical Interview (Kappa approximately 0.60) and moderately strong inter-rater reliability between interviewers (Kappa approximately 0.78) for various disorders (Kessler et al., 1998; Wittchen et al., 1996, 1995).

### **Moderator: Physical Activity (PA)**

Moderate- and vigorous-intensity PA were measured using two questions. Question 1 asked, “On how many of the past 7 days, did you exercise or participate in PA for at least 30 minutes that did not make you breathe hard (such as fast walking, slow bicycling, skating, pushing a lawn mower, or doing active household chores)?” These activities are generally categorized as moderate-intensity (3.0 to 5.9 metabolic equivalents [METs]) (Ainsworth et al., 2011). Question 2 asked, “On how many of the past 7 days, did you exercise or participate in PA for at least 30 minutes that made you breathe hard (such as basketball, soccer, running, or riding a bicycle hard)?” These activities are vigorous ( ≥ 6 METs) (Ainsworth et al., 2011). Response options for both questions were “0 days,” “1 or 2 days,” “3 or 4 days,” “5 or 6 days,” or “all 7 days.”

Responses were converted into PA minutes by taking the mean days of their selected response (e.g., 1.5 days if “1 or 2 days” was selected) and multiplying by 30 minutes for moderate intensity or by 60 minutes for vigorous intensity, according to the PA guidelines where 1 minute of vigorous-intensity PA = 2 minutes of moderate-intensity PA (DHHS, 2018). Thirty minutes was selected to provide a conservative estimate of time since that was the minimum bout of exercise the question considered. Once converted into minutes, both moderate- and vigorous-intensity questions were summed for total weekly moderate-to-vigorous PA (MVPA). Participants were categorized as “active” or “inactive” based on whether they met the 2018 US aerobic PA guidelines of ≥ 150 minutes/week of total MVPA (DHHS, 2018).

## Analyses

Participants were categorized into tertiles (thirds) of perceived racial discrimination based on overall SRE scores. The lower, middle, and upper discrimination groups were coded as dichotomous categorical [i.e., dummy] variables, and multivariable logistic regression was used to determine odds ratios (ORs) and 95% confidence intervals (95% CIs) for the past 12-month MDD for the middle and upper (higher) discrimination groups using the lower discrimination group as the reference. In addition, the tertile grouping of perceived racial discrimination as a continuous variable was entered as the primary independent variable into multivariable logistic regression models for a linear trend analysis of MDD prevalence across increasing levels of discrimination. Participants were also stratified into “active” or “inactive” groups in a logistic regression analysis to test the interaction of discrimination tertiles with meeting the PA guidelines on MDD. Regression models were adjusted for age (years) and sex in Model 1, and then additionally for body mass index (BMI in kg/m<sup>2</sup>), education (years), and MVPA (minutes) in Model 2. Analyses were performed in SAS Version 9.4 (SAS Institute Inc., Cary, NC, USA) with  $\alpha=0.05$ .

## RESULTS

### Sample Characteristics

The final sample included 645 African Americans, 94% of whom were women. On average, participants were 45 years old, obese, with at least a high school education and an average discrimination score of 1.8. Baseline characteristics by tertiles of discrimination are listed in Table 1.

Compared with the lower discrimination group, the upper discrimination group had 3.08 (95% CI 1.09-8.74) increased odds of MDD after adjusting for age and sex using logistic regression with racial discrimination tertiles as the primary predictor and MDD as the dependent measure. This association remained significant after further adjusting for all covariates, including MVPA (2.99 [1.03-8.67]). The middle discrimination group also had increased odds of MDD, although not significant in either model 1 (1.99 [0.67-5.94]) or model 2 (1.91 [0.63-5.75]).

The stratified analysis indicated that among inactive participants, there were increased odds of MDD in the upper discrimination group compared with the lower discrimination group in Model 1 as well as significant linear trends (both  $p<0.05$ ) across discrimination groups in both models (Table 2). Among active participants, there were no significant associations or linear trends between discrimination groups and MDD in either model among active participants. Furthermore, a linear regression analysis showed a significant interaction between SRE scores and MVPA minutes on depression ( $\beta=-0.27$ ;  $p=0.03$ ) in the fully adjusted model, such that for each 1-standard deviation (SD) increase in discrimination, a corresponding 1-SD increase in MVPA reduced depression symptoms by 0.27 SDs.

## DISCUSSION

Experiences of racial discrimination are common for African Americans, and they can have serious health implications (Paradies et al., 2015). Our results align with previous studies

showing that high levels of racial discrimination are associated with increased depression, regardless of other demographic or lifestyle variables (Karlsen et al., 2005). A novel finding of this study is that there appears to be a potential effect of PA on the association between racial discrimination and MDD in this cohort. There was a significant linear trend suggesting greater odds of MDD in the higher discrimination groups among inactive participants only, but there were no associations or trends among active participants who met the US PA guidelines. This suggests that PA may attenuate the relationship between perceived discrimination and MDD, although prospective research is needed to confirm these preliminary findings.

Previous research on discrimination has demonstrated that being entrenched in a prejudicial culture is a sufficient cause of depression (Russell et al., 2018). Fortunately, several studies have also shown that the depression-inducing effects of racial discrimination can be buffered in African Americans. Church-based social support, high-quality personal relationships, optimism, close family ties, and racial pride are all proposed buffers that can moderate the relationship between discrimination and depression in African Americans (Russell et al., 2018; Utsey et al., 2008). One caveat, though, is that each of these buffers requires dependence on others, is dispositional, or may be inherently difficult to change. PA may be a more pragmatic buffer, since it is independent of others, highly modifiable, and not based on one's disposition. Furthermore, PA is inexpensive, accessible, and comes without any added stigma.

This study has limitations. This sample is not representative of all African Americans. It is predominantly women, and participants were included if they lived in either Iowa or Georgia and were a parent or primary caregiver to a child. Therefore, these results cannot be generalized to men or individuals who are not caregivers to children. Although the sample had 5% past 12-month MDD cases, which is comparable to other studies in African Americans (Gibbs et al., 2013; Weaver et al., 2015), our results should be interpreted with caution due to the low cases of MDD. In addition, MDD cases were based on DSM-IV diagnostic criteria that were available during the data collection period rather than the current DSM-5 criteria. Furthermore, information on antidepressant treatments or medications were not available, which could affect the observed associations. This study is cross-sectional, so causal relationships cannot be inferred between discrimination, PA, and depression. Finally, we were unable to determine the exact amount of PA that participants performed due to the wording of the PA questions. However, the general associations observed between PA, discrimination, and depression are still reasonable since the PA estimations were determined using the same method for all participants.

Race-based discrimination exists in many domains of life, and it can be difficult to escape its consequences. However, meeting the PA guidelines is a relatively simple behavior that may protect against depression, which is a serious consequence of racial discrimination. Future prospective studies in larger cohorts of African Americans with more robust PA measurements are clearly warranted for this critical topic.

## Role of Funding Source:

This work was supported by the National Institute of Mental Health through funding for the Center for Family Research in Rural Mental Health (MH48165) at Iowa State University. Additional funding from the National Institute of Mental Health (MH62666, MH62668, MH62669), and the National Institute on Drug Abuse (DA021898). Additional funding for the research center and this project was provided by the National Institute on Alcohol Abuse and Alcoholism and the Iowa Agriculture and Home Economics Experiment Station (Project #3320).

## REFERENCES

- Ainsworth BE, Haskell WL, Herrmann SD, Meckes N, Bassett DR, Tudor-Locke C, Greer JL, Vezina J, Whitt-Glover MC, Leon AS, 2011. 2011 Compendium of Physical Activities: a second update of codes and MET values. *Med. Sci. Sports Exerc* 43, 1575–81. 10.1249/MSS.0b013e31821ece12 [PubMed: 21681120]
- Berman G, Paradies Y, 2010. Racism, disadvantage and multiculturalism: towards effective anti-racist praxis. *Ethn. Racial Stud* 33, 214–232. 10.1080/01419870802302272
- Blumenthal JA, Babyak MA, Doraiswamy PM, Watkins L, Hoffman BM, Barbour KA, Herman S, Craighead WE, Brosse AL, Waugh R, Hinderliter A, Sherwood A, 2007. Exercise and pharmacotherapy in the treatment of major depressive disorder. *Psychosom. Med* 69, 587–596. 10.1097/PSY.0b013e318148c19a [PubMed: 17846259]
- Burt CH, Lei MK, Simons RL, 2017. Racial discrimination, racial socialization, and crime: understanding mechanisms of resilience. *Soc. Probl* 64, 414–438. 10.1093/socpro/spw036
- Cutrona CE, Russell DW, Brown PA, Clark LA, Hessling RM, Gardner KA, 2005. Neighborhood context, personality, and stressful life events as predictors of depression among African American women. *J. Abnorm. Psychol* 114, 3–15. 10.1037/0021-843X.114.1.3 [PubMed: 15709807]
- Gibbs TA, Okuda M, Oquendo MA, Lawson WB, Wang S, Thomas YF, Blanco C, 2013. Mental health of African Americans and Caribbean blacks in the United States: results from the National Epidemiological Survey on Alcohol and Related Conditions. *Am. J. Public Health* 103, 330–8. 10.2105/AJPH.2012.300891 [PubMed: 23237171]
- Karlsen S, Nazroo JY, Mckenzie K, Bhui K, Weich S, 2005. Racism, psychosis and common mental disorder among ethnic minority groups in England. *Psychol. Med* 35, 1795–1803. 10.1017/S0033291705005830 [PubMed: 16194282]
- Kessler RC, 1991. *UM-CIDI Training Guide for the National Survey of Health and Stress, 1991–1992*. Ann Arbor, MI.
- Kessler RC, Wittchen HU, Abelson JM, McGonagle K, Schwarz N, Kendler KS, Knäuper B, Zhao S, 1998. Methodological studies of the composite international diagnostic interview (CIDI) in the US national comorbidity survey (NCS). *Int. J. Methods Psychiatr. Res* 7, 33–55. 10.1002/mpr.33
- Landrine H, Klonoff EA, 1996. The Schedule of Racist Events: A Measure of Racial Discrimination and a Study of Its Negative Physical and Mental Health Consequences. *J. Black Psychol* 22, 144–168. 10.1177/00957984960222002
- Matthews DD, Hammond WP, Nuru-Jeter A, Cole-Lewis Y, Melvin T, 2013. Racial discrimination and depressive symptoms among African-American men: The mediating and moderating roles of masculine self-reliance and John Henryism. *Psychol. Men Masc* 14, 35–46. 10.1037/a0028436 [PubMed: 30364828]
- Mihail Samnaliev M, Mark P McGovern MP, Clark Robin E., R.E., 2008. Racial/ethnic disparities in mental health treatment in six medicaid programs. *J. Health Care Poor Underserved* 20, 165–176. 10.1353/hpu.0.0125
- Paradies Y, Ben J, Denson N, Elias A, Priest N, Pieterse A, Gupta A, Kelaheer M, Gee G, 2015. Racism as a determinant of health: a systematic review and meta-analysis. *PLoS One* 10, e0138511. 10.1371/journal.pone.0138511 [PubMed: 26398658]
- Physical Activity Guidelines for Americans, 2nd edition. Washington, DC: U.S. Department of Health and Human Services; 2018.

- Russell DW, Clavé FD, Cutrona CE, Abraham WT, Burzette RG, 2018. Neighborhood racial discrimination and the development of major depression. *J. Abnorm. Psychol.* 127, 150–159. 10.1037/abn0000336 [PubMed: 29528669]
- Schuch FB, Vancampfort D, Richards J, Rosenbaum S, Ward PB, Stubbs B, 2016. Exercise as a treatment for depression: A meta-analysis adjusting for publication bias. *J. Psychiatr. Res* 77, 42–51. 10.1016/j.jpsychires.2016.02.023 [PubMed: 26978184]
- Utsey SO, Giesbrecht N, Hook J, Stanard PM, 2008. Cultural, sociofamilial, and psychological resources that inhibit psychological distress in African Americans exposed to stressful life events and race-related stress. *J. Couns. Psychol* 55, 49–62. 10.1037/0022-0167.55.1.49
- Weaver A, Himle JA, Taylor RJ, Matusko NN, Abelson JM, 2015. Urban vs rural residence and the prevalence of depression and mood disorder among African American Women and Non-Hispanic White Women. *JAMA psychiatry* 72, 576–83. 10.1001/jamapsychiatry.2015.10 [PubMed: 25853939]
- Wittchen HU, Kessler RC, Zhao S, Abelson J, 1995. Reliability and clinical validity of UM-CIDI DSM-III-R generalized anxiety disorder. *J. Psychiatr. Res* 29, 95–110. 10.1016/0022-3956(94)00044-R [PubMed: 7666382]
- Wittchen HU, Zhao S, Abelson JM, Abelson JL, Kessler RC, 1996. Reliability and procedural validity of UM-CIDI DSM-III-R phobic disorders. *Psychol. Med* 26, 1169–1177. 10.1017/s0033291700035893 [PubMed: 8931163]
- World Health Organization (WHO), 2018. Depression [WWW Document], URL <https://www.who.int/en/news-room/fact-sheets/detail/depression> (accessed 9.26.19).

**HIGHLIGHTS**

- Racial discrimination was associated with greater odds of depression in African Americans.
- Being physically inactive may worsen the association between discrimination and depression.
- Being physically active may protect against depression when experiencing high discrimination.



**Table 1.**

## Characteristics of Study Participants by Tertiles of Racial Discrimination

Characteristic	Overall	Tertiles of Racial Discrimination			P-value
		Lower	Middle	Upper	
N	645	214	222	209	
Female, n (%)	604 (94)	201 (94)	207 (94)	196 (94)	0.95
Age, years	45.2 (8.2)	44.9 (8.4)	45.2 (7.9)	45.7 (8.2)	0.58
Education, years	12.7 (2.3)	12.0 (2.2)	12.8 (2.1)	13.2 (2.4)	<0.0001
Body Mass Index, kg/m <sup>2</sup>	33.6 (10.9)	33.9 (12.4)	32.8 (7.9)	34.2 (12.0)	0.39
Discrimination (score) <sup>1</sup>	1.8 (0.7)	1.1 (0.1)	1.8 (0.2)	2.7 (0.4)	<0.0001
MVPA, minutes/week <sup>2</sup>	178.4 (168.2)	172.9 (162.6)	174.0 (164.9)	188.8 (177.3)	0.55
Meeting Physical Activity Guidelines, n (%) <sup>3</sup>	289 (45)	99 (46)	96 (43)	94 (45)	0.82
Past 12-month MDD <sup>4</sup> , n (%)	29 (5)	5 (2)	10 (5)	14 (7)	0.10

Values are means (SD) unless indicated otherwise. Differences in baseline characteristics were assessed using  $\chi^2$  test for categorical or F-tests for continuous variables.

<sup>1</sup> Average score from Schedule of Racist Events Questionnaire.

<sup>2</sup> MVPA=Moderate-to-Vigorous Physical Activity. MVPA ranged from 0-630 minutes in each group, and the medians (interquartile ranges) of MVPA in the groups were: lower=135.0 (45-210) minutes; middle=135.0 (45-210) minutes; and upper=135.0 (45-300) minutes.

<sup>3</sup> Meeting the aerobic physical activity guidelines by accumulating 150 minutes/week of MVPA.

<sup>4</sup> MDD=major depressive disorder in the past 12 months determined by the University of Michigan Composite International Diagnostic Instrument.

**Table 2.**

Odds of Past 12-month Major Depressive Disorder by Racial Discrimination Tertiles Stratified by Physical Activity

Tertiles of Racial Discrimination	n	Cases	Odds Ratios (95% confidence intervals)	
			Model 1	Model 2
Inactive				
Lower	115	2	1.00 (reference)	1.00 (reference)
Middle	126	6	3.00 (0.59-15.26)	2.84 (0.55-14.65)
Upper	115	9	<b>5.19 (1.08-24.87)</b>	4.88 (0.99-24.11)
<i>P</i> for linear trend			<b>0.03</b>	<b>0.04</b>
Active				
Lower	99	3	1.00 (reference)	1.00 (reference)
Middle	96	4	1.28 (0.28-5.93)	1.25 (0.27-5.88)
Upper	94	5	1.67 (0.38-7.25)	1.66 (0.37-7.38)
<i>P</i> for linear trend			0.49	0.50

“Active” or “Inactive” was defined as meeting the US aerobic physical activity guidelines or not.

Model 1: Adjusted for age (years) and sex.

Model 2: Adjusted for factors in model 1 plus education (years) and body mass index ( $\text{kg}/\text{m}^2$ ).