Short communication

Greater social cohesion is associated with lower body mass index among African American adults

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ARTICLE INFO

ABSTRACT

Obesity remains a public health issue, especially for Blacks (or African Americans). Obesity is thought to reflect a complex interaction of socioenvironmental, biological, and cognitive factors. Yet, insufficient attention has been given to psychosocial factors like social cohesion within the African American community. Using multivariable linear regression, we examined the association between social cohesion, measured by the Social Cohesion and Trust scale, and body mass index (BMI) with cross-sectional data (n = 1467) from a cohort study (2008–2009). Greater social cohesion was associated with lower BMI (b = -0.88; 95% CI: −1.45, −0.32) in an unadjusted model. The association was strengthened after further adjusting for relevant covariates (i.e., individual-level sociodemographic factors, health behaviors, and depressive symptoms) (b = -1.26; 95% CI: −1.94, −0.58). Future research should examine potential mechanisms underlying the association between social cohesion and BMI with longitudinal data. In the meantime, obesity prevention and intervention measures should consider promoting social ties and bonds to lower BMI in African American communities.

Black individuals have a higher prevalence of obesity compared to their non-Hispanic White counterparts, placing Black individuals at an increased risk for a number of obesity-related chronic diseases, such as diabetes and cardiovascular disease (Hales et al., 2018; Krueger and Reither, 2015). Obesity is thought to reflect a complex interaction of environmental, biological, cultural, and cognitive factors (MacLean et al., 2015). Yet, little focus has been given to the role of psychosocial factors on obesity risk (Carrillo-Álvarez et al., 2018; Glonti et al., 2016). Researchers are becoming, particularly, attentive to the influence of positive psychosocial resources in reducing obesity (Carrillo-Álvarez et al., 2018).

In a systematic review of 22 studies, Carrillo-Álvarez and colleagues implicate social capital as a psychosocial determinant of obesity (Carrillo-Álvarez et al., 2018). Social capital refers to the perceived or actual availability of resources through one's membership in social networks (Kawachi and Berkman, 2000). A key feature of social capital is social cohesion, which is the individual's perceived presence of strong social bonds and absence of conflict in a community (Kawachi and

Berkman, 2000). Social cohesion can influence health through multiple mechanisms, including social support, access to health promoting information, and increased sense of belonging. These factors in turn can help address community members' obesity-related concerns and psychological health challenges (Jennings and Bamkole, 2019; Kawachi and Berkman, 2000). The review by Carrillo-Álvarez and colleagues finds that individuals with greater social cohesion tend to have better physical health (Carrillo-Álvarez et al., 2018).

The relationship between social cohesion and obesity, however, may not be straightforward. Social cohesion can have both positive and negative effects on obesity (Carrillo-Álvarez et al., 2018). Socially cohesive groups can provide social support during stressful events, decreasing the risk of depression, and in turn, decreasing the risk of obesity. However, socially cohesive groups can also promote pro-social activities, such as drinking and unhealthful eating, that can increase the risk of elevated body mass or obesity as well. Thus, while many studies in the systematic review found inverse associations between social cohesion and body mass index (BMI), other studies have found mixed

results (e.g., no associations or positive associations) (Carrillo-Álvarez et al., 2018).

A critical gap in the literature is the limited focus on African Americans. Despite that African Americans experience a disproportionate burden of obesity, little attention has been given to the role that social cohesion plays in obesity for this population. Hobson-Prater and Leech (2012) find that the majority of Black neighborhoods have low levels of social cohesion, which they suggest may partially influence existing social and health inequalities. The unfavorable perception of social connectedness in a community can have obesogenic influence for African Americans. A better understanding of the role that social cohesion plays on excess weight will provide insight into interventions seeking to reduce obesity rates in African American communities.[1]

Using a relatively large sample of African Americans, we examined the association of social cohesion and BMI, a common measure of obesity. To identify the factors that may help explain the association between social cohesion and BMI, we adjusted for sociodemographic factors, health behaviors, and depressive symptoms. A better understanding of the role that social cohesion plays on BMI will provide insight into interventions seeking to lower obesity in African American communities.

1. Methods

1.1. Participants and procedures

We used cross-sectional data (2008–2009) from a cohort study designed to investigate associations between biopsychosocial factors and health behaviors among African American adults (McNeill et al., 2018). Participants were recruited from a large mega-church in Houston with over 15,000 members at the time, Texas, through printed and televised media within the church and in-person solicitation (details of the study design is found in McNeill et al., 2018). Individuals were eligible to participate in the study if they were 18 years of age or older, lived in the Houston area, had a functional telephone number, and attended church (membership was not a requirement). Overall, 1501 African American adults consented and enrolled in the study. This convenience sample represents about 10% of the church membership, but the cohort study was capped at this enrollment number and participants were enrolled on a first-come, first-served basis over only a few recruitment days. Participants completed surveys at the church, where they viewed questionnaire items on a computer screen and responded using the computer keyboard. As compensation for time, participants each received a $30 Visa Debit Card. This study was approved by the IRB at the University of Texas, MD Anderson Cancer Center.

1.2. Measures

1.2.1. Social cohesion

Social cohesion was measured using the Social Cohesion and Trust scale (Sampson et al., 1997). This 5-item scale includes items such as "People around here are willing to help their neighbors" and "People in my neighborhood do not share the same values." The scale employs five Likert response options ranging from "strongly disagree" to "strongly agree", with possible scores ranging from 5 to 25 (higher scores indicating greater social cohesion). In the present study, the scale had good internal consistency (Cronbach's $\alpha = 0.81$).

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[1] In this paper, we use Black and African American interchangeably to refer to peoples of African descent in the United States. While these terms are not tantamount, we use both as a racial category to describe people who have self-identified as Black or African American in previous studies. In the current study, we use the term African American in describing the study participants.

1.2.2. Body Mass Index

BMI is a tool to measure whether a person is underweight, normal weight, overweight, or obese. BMI was determined based on staff-administered height and weight measurements, which is measured as weight in kilograms divided by height in meters square (BMI; kg/m^2). BMI was used as a continuous variable to understand the effects of social cohesion across the entire range of BMI. We also categorized BMI into three categories, underweight and normal weight (BMI < 25), overweight (BMI 25–29.99), and obesity (≥ 30).

1.2.3. Covariates

Analyses adjusted for sets of factors, including sociodemographic factors, health behaviors (current smoking status, fruit intake, vegetable intake, alcohol consumption, and physical activity), and depressive symptoms. Sociodemographic factors included age (continuous), sex (male as reference), family income ($0–4999 as reference), educational attainment (less than high school as reference), employment status (employed as reference), and marital status (married or cohabitating as reference). Participants were classified as current smokers (smoked ≥ 100 cigarettes in lifetime and currently smoke) or former smokers/never smokers (i.e., smoked ≥ 100 cigarettes in lifetime but quit, or smoked < 100 cigarettes in lifetime; reference). Fruit and vegetable intake were assessed by self-reported daily servings of fruit and vegetables, with options ranging from Never (reference) to 5 or more times per day. Alcohol consumption was a continuous variable and examined using self-report measure of the average number of alcohol consumed on each day of the week over the last 30 days. Physical activity was a continuous variable and assessed with the International Physical Activity Questionnaire - Short Format (IPAQ) (Craig et al., 2003). The IPAQ is a self-report questionnaire used to measure the amount time spent engaging in moderate activity, vigorous activity, and walking during the past 7 days. Metabolic equivalent (MET) minutes (i.e., ratio of energy expended during an activity to the energy expended during rest) were summed, with higher scores indicating greater physical activity (Ainsworth et al., 2000). The Center for Epidemiologic Studies Depression Scale (CES-D) 10-item scale was used to measure symptoms of depression (Andresen et al., 1994). Two items were reversed-scored and were recoded before aggregating across all items. Scores were averaged, with higher scores indicating high severity of depressive symptoms (Cronbach's $\alpha = 0.82$).

1.3. Data analysis

Only participants with complete data were included in the current study. We performed descriptive analyses to characterize the sample's sociodemographic characteristics. We also conducted independent samples t-tests to assess differences in social cohesion among dichotomized variables (e.g., sex and smoking status). Moreover, we conducted Spearman's correlation to assess association between social cohesion and an ordinal variable (e.g., education) and Pearson's correlation to assess association between social cohesion and a continuous variable (e.g., age). To test the central hypothesis, four models were tested to examine the association between social cohesion and BMI using multivariable linear regression. Model 1 tested the association between social cohesion and BMI, without adjusting for any factors; Model 2 tested the association between social cohesion and BMI, adjusting for sociodemographic factors; Model 3 added health behaviors; lastly, Model 4 included depressive symptoms.

We used multinomial logistic regression models to quantify associations between social cohesion and overweight and obesity. Sociodemographic factors and health behaviors were adjusted in the models. All analyses were conducted using Stata 14.2 software. For the multinomial logistic regression, we used Stata's *svy: mlogit* suite of commands (StataCorp, 2015).

Table 1
Descriptive statistics of study sample.

	N	% or Range	M	SD
Social Cohesion	1464	5–25	18.0	3.3
Age (in years)	1467	18–86	45.19	12.86
Gender				
Male	372	25.36		
Female	1095	74.64		
Educational Attainment				
Less than High School	45	3.05		
High School Diploma	136	9.27		
Some College	465	31.70		
Bachelor's Degree	110	7.50		
Advanced Degree	711	48.47		
Relationship Status				
Married, or Cohabitating	638	43.55		
Divorced	293	20.00		
Single	534	36.45		
Employment Status				
Employed	1083	73.82		
Unemployed	229	15.61		
Retired or Disabled	155	10.57		
Family Household Income				
$0–4999	30	2.12		
$5000–$9999	21	1.48		
$10,000–$19,999	59	4.16		
$20,000–$29,999	105	7.40		
$30,000–$39,999	144	10.16		
$40,000–$49,999	154	10.86		
$50,000–$79,999	405	28.56		
$80,000–$99,999	193	13.61		
$100,000 or more	307	21.65		
Current Smoking Status				
No	1101	75.88		
Yes	350	24.12		
Vegetable Intake				
Never	19	1.30		
1–3 times last month	117	7.98		
1–2 times per week	275	18.76		
3–4 times per week	383	26.13		
5–6 times per week	253	17.26		
Once per day	186	12.69		
2 times per day	175	11.94		
3 times per day	34	2.32		
4 times per day	11	0.75		
5 or more times per day	13	0.089		
Fruit Intake				
Never	37	2.52		
1–3 times last month	220	15.01		
1–2 times per week	338	23.06		
3–4 times per week	298	20.33		
5–6 times per week	168	11.46		
Once per day	153	10.44		
2 times per day	159	10.85		
3 times per day	57	3.89		
4 times per day	22	1.50		
5 or more times per day	14	0.95		
Physical Activity (in minutes)	1419	0–110610	5657	8985
Alcohol consumption	1172	0–36	2.85	4.45
Depression	1464	0–2.7	0.89	0.39
Body mass index	1464	0–50	31.66	7.24
Underweight/Normal weight	252	17.18		
Overweight	438	29.86		
Obese	777	52.97		

Note: For continuous variables, we provide the range; for categorical variables we provide percentage among the study sample.

2. Results

The study consisted of the 1467 participants with complete data. Participants were on average 45 years of age (SD = 12.9), and the majority identifying as female (75%). Approximately 85% of participants completed high school and 75% reported an annual family household income of $40,000 or more. Most participants were currently working (74%). About 17% of the sample are underweight or normal weight, about 30% are overweight, and about 53% are obese. See Table 1 for all participant characteristics.

There was no evidence that non-smokers (M = 2.61; SD = 0.66) differed in perceived social cohesion compared to smokers (M = 2.56; SD = 0.67; t(1443) = 1.17, p = 0.24; data not shown). Social cohesion was positively correlated with fruit (r(1461) = 0.08, p < 0.01) and vegetable intake (r(1460) = 0.11, p < 0.01), and depressive symptoms (r(1459) = 0.14, p < 0.01; data not shown). There was no evidence that social cohesion was correlated with alcohol consumption (r(1168) = 0.01, p = 0.79) or physical activity (r(1415) = 0.02, p = 0.39; data not shown).

2.1. Main analysis

Social cohesion was inversely associated with BMI, unadjusted for any factors (b = −0.89; 95% CI: −1.45, −0.32). The association was strengthened slightly after further adjusting for sociodemographic factors in the model (b = −0.93; 95% CI: −1.53, −0.34) and again remained significant after including health behaviors (b = −1.37; 95% CI: −2.05, −0.69). The relationship was attenuated, yet remained significant, when depressive symptoms was included in the final model (b = −1.26; 95% CI: −1.94, −0.58; see Table 2 and Fig. 1).

Greater social cohesion was associated with lower risk of obesity after adjusting for sociodemographic factors, health behaviors, and depressive symptoms (RR: −0.39; 95% CI: −0.69, −0.08); see supplementary material). There was no evidence of an association between social cohesion and risk of overweight (RR: −0.13; 95% CI: −0.46, 0.19).

3. Discussion

We examined the association between social cohesion and BMI among African American churchgoers. We found that greater social cohesion was associated with lower BMI. Exploratory analyses reveal that greater social cohesion was associated with lower risk of obesity, but was not associated with risk of overweight. This is consistent with other studies that have found greater social cohesion to be associated with lower BMI or lower odds of obesity among urban-dwelling Canadians, Australian youths, and African American and Hispanic women (Guilcher et al., 2017; Veitch et al., 2012). The association between social cohesion and BMI can be explained by health behaviors and mental health (Carrillo-Álvarez et al., 2018; Halbert et al., 2014; Strong et al., 2013). For instance, a previous study found that greater social cohesion is associated with fewer depressive symptoms (Echeverría et al., 2008). It may be that individuals in less cohesive communities attain fewer support systems to cope with stressful events, which can lead to loneliness and poor mental health. There is compelling evidence that depression increases the odds of obesity (Luppino et al., 2010). Nevertheless, even after adjusting for socio-demographic factors, health behaviors, and depression, greater social cohesion remained associated with BMI and obesity. This suggests that other unexamined social and psychological factors may further explain these differences. Prospective research is needed to elucidate the relationship between social cohesion and BMI.

There are limitations to consider in our study. We used cross-sectional data, which precluded the assumptions of causal associations between social cohesion and obesity. We used a single measure of social capital—social cohesion. Social capital is a multidimensional construct that includes structural, relational and cognitive components (Kawachi and Berkman, 2000). In our study, we focused on the relational component of social capital. However, other social capital components can have obesogenic influences as well. For instance, structural social capital (e.g., the number of social network ties) can affect how health promoting resources (e.g., knowledge of healthy eating) are transferred within a community. Future research is needed to comprehensively examine how structural, relational and cognitive components of social

Table 2
Association between Social Cohesion and BMI (n = 1464).

	OR (95% Confidence Interval)			
	Model 1	Model 2	Model 3	Model 4
Social Cohesion	−0.88 (−1.45, −0.32)**	−0.93 (−1.52, −0.34)**	−1.37 (−2.05, −0.69)**	−1.26 (−1.94, −0.58)**
Age (in years)		0.11 (0.07, 0.14)**	0.10 (0.06. 0.15)**	0.11 (0.07, 0.15)**
Gender				
Male				
Female		0.77 (−0.12, 1.66)	0.34 (−0.70, 1.38)	0.27 (−0.77, 1.31)
Educational Attainment				
Less than High School				
High School Diploma		0.32 (−2.29, 2.94)	0.20 (−3.42, 3.82)	−0.04 (−3.65, 3.56)
Some College		1.61 (−0.80, 4.02)	1.44 (−1.94, 4.82)	1.26 (−2.11, 4.63)
Bachelor's Degree		1.16 (−1.53, 3.85)	0.33 (−3.30, 3.96)	0.12 (−3.50, 3.75)
Advanced Degree		0.09 (−2.33, 2.52)	−0.62 (−4.02, 2.77)	−0.78 (−4.16, 2.60)
Relationship Status				
Married, or Cohabitating				
Divorced		−4.67 (−1.55, 0.62)	−1.19 (−2.41, 0.04)	−1.25 (−2.46, −0.03)*
Single		0.20 (−0.78, 1.17)	−0.20 (−1.50, 1.09)	0.45 (−0.64, 1.54)
Employment Status				
Employed				
Unemployed		−0.44 (−1.59, 0.62)	−0.20 (−1.50, 1.09)	−0.32 (−1.61, 0.97)
Retired or Disabled		−1.48 (−0.78, 1.17)	−1.13 (−2.71, 0.46)	−1.30 (−2.89, 0.28)
Family Household Income				
$0–4999				
$5000–9999		−2.99 (−7.01, 1.02)	−4.58 (−9.62, 0.46)	−4.61 (−9.63, 0.41)
$10,000–19,999		−2.46 (−5.70, 0.79)	−3.37 (−7.20, 0.46)	−3.28 (−7.10, 0.54)
$20,000–29,999		−1.12 (−4.13, 1.89)	−3.52 (−6.99, −0.04)*	−3.53 (−6.99, −0.07)*
$30,000–39,999		−2.00 (−4.94, 0.94)	−3.31 (−6.71, 0.08)	−3.24 (−6.62, −0.14)
$40,000–49,999		−1.25 (−4.20, 1.71)	−2.76 (−6.16, 0.29)	−2.53 (−5.92, 0.86)
$50,000–79,999		−2.21 (−5.05, 0.64)	−3.01 (−6.31, 0.29)	−2.81 (−6.10, 0.48)
$80,000–99,999		−1.93 (−4.87, 1.03)	−3.03 (−6.43, 0.38)	−2.78 (−6.18, 0.62)
$100,000 or more		−2.93 (−5.89, 0.02)	−4.18 (−7.60, −0.75)*	−3.97 (−7.39, −0.55)*
Current Smoking Status				
No				
Yes			−0.01 (−1.06, 1.04)	−0.08 (−1.13, 0.97)
Vegetable Intake				
Never				
1–3 times last month			2.20 (−2.12, 6.52)	1.86 (−2.44, 6.18)
1–2 times per week			2.84 (−1.40, 7.08)	2.38 (−1.86, 6.61)
3–4 times per week			3.90 (−0.34, 8.14)	3.53 (−0.70, 7.77)
5–6 times per week			2.97 (−1.35, 7.28)	2.70 (−1.60, 7.00)
Once per day			4.32 (−0.05, 8.69)	4.07 (−0.29, 8.43)
2 times per day			5.61 (1.18, 10.0)*	5.33 (0.91, 9.75)*
3 times per day			5.05 (−0.19, 10.3)	4.84 (−0.39, 10.1)
4 times per day			4.62 (−2.07, 11.3)	4.41 (−2.26, 11.1)
5 or more times per day			0.98 (−5.29, 7.26)	0.83 (−5.42, 7.09)
Fruit Intake				
Never				
1–3 times last month			−1.09 (−4.07, 1.89)	−1.19 (−4.26, 1.77)
1–2 times per week			−0.97 (−3.95, 2.02)	−1.07 (−4.05, 1.90)
3–4 times per week			−1.18 (−4.21, 1.85)	−1.25 (−4.26, 1.77)
5–6 times per week			−0.87 (−4.03, 2.28)	−0.91 (−4.05, 2.24)
Once per day			−2.37 (−5.56, 0.81)	−2.43 (−5.61, 0.74)
2 times per day			−1.50 (−4.69, 1.69)	−1.54 (−4.72, 1.63)
3 times per day			−3.58 (−7.27, 0.11)	−3.76 (−5.78, −0.09)*
4 times per day			−0.45 (−5.68, 4.78)	−0.57 (−5.78, 4.68)
5 or more times per day			−2.29 (−7.97 3.39)	−2.31 (−7.97, 3.34)
Physical Activity (in minutes)			−0.0001 (−0.0001, 6.64)	−0.0001 (−0.0001, −0.00006)*
Alcohol consumption			0.01 (−0.09, 0.11)	0.002 (−0.10, 0.10)
Depression				1.69 (0.56, 2.83)**

Multivariable regression models:
Model 1: social cohesion, unadjusted.
Model 2: model 1 + sociodemographic factors (age, sex, family income, educational attainment, employment status, and marital status).
Model 3: model 2 + health behaviors/risk factors (current smoking status, fruit intake, vegetable intake, alcohol consumption, and physical activity).
Model 4: model 3 + depressive symptoms.
[a]: *: $p < 0.05$; **: $p < 0.01$.

capital is associated with obesity among African Americans. In addition, we did not examine the moderating role of neighborhood-level variables (e.g., distance to neighbors and grocery stores) in the relationship between social cohesion and obesity. Understanding how the neighborhood social and built environment influences both social cohesion and obesity can inform obesity-related interventions. The findings of

this study were mainly among a church-going sample, who may be part of a socially cohesive community already compared to non-church-goers. However, research suggests that religiosity and church attendance is common and more prevalent among African Americans than among other racial/ethnic groups (Pew Research Center, 2009). Relatedly, approximately 75% participants identified as female and close
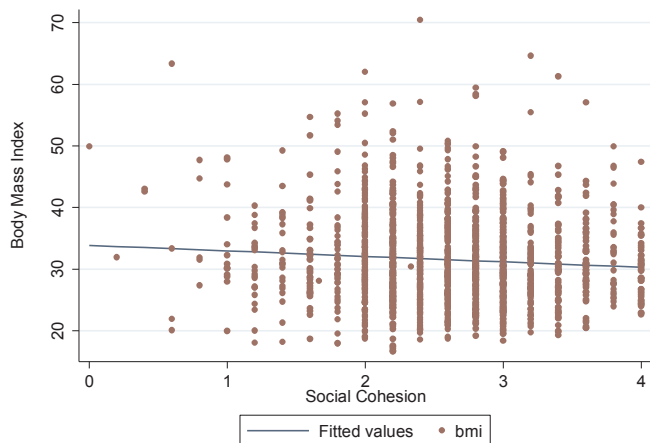
Fig. 1. Association between Social Cohesion and BMI (n = 1464).

to half of respondents reported having an advanced degree. The sociodemographic distribution of the sample does not mirror that of the general African American population (de Brey et al., 2019). Further research is still needed to determine whether the findings are generalizable to the wider African American population.

4. Conclusion

Greater social cohesion was linked to lower BMI and lower risk of obesity in this sample of African Americans. Although not measured in this study, it may be that interventions to enhance social cohesion can positively affect obesity within at-risk communities. Promoting neighborhood activities, community BBQ or community holiday parties, for example, can improve social ties among community members that in turn may reduce BMI. Understanding more about the mechanisms though which social cohesion can influence obesity is critical to find effective solutions to the disproportionate burden of obesity that African Americans experience. Moreover, understanding how perceived social cohesion interacts with physical environmental features can provide better insight as to how social cohesion can be produced within communities to lower the risk of obesity.

Funding

CRediT authorship contribution statement

Adolfo G. Cuevas: Conceptualization, Methodology. **Ichiro Kawachi:** Writing - original draft, Writing - review & editing. **Kasim Ortiz:** Formal analysis. **Mariam Pena:** Writing - original draft, Writing - review & editing. **Lorraine R. Reitzel:** Writing - original draft, Writing - review & editing, Supervision. **Lorna H. McNeill:** Supervision, Writing - review & editing, Writing - original draft.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://

doi.org/10.1016/j.pmedr.2020.101098.

References

Ainsworth, B.E., Haskell, W.L., Whitt, M.C., Irwin, M.L., Swartz, A.M., Strath, S.J., Leon, A.S., 2000. Compendium of physical activities: an update of activity codes and MET intensities. Med. Sci. Sports Exerc. 32 (9 Suppl), S498–S504.

Andresen, E.M., Malmgren, J.A., Carter, W.B., Patrick, D.L., 1994. Screening for depression in well older adults: evaluation of a short form of the CES-D (Center for Epidemiologic Studies Depression Scale). Am. J. Prev. Med. 10 (2), 77–84.

Carrillo-Álvarez, E., Kawachi, I., Riera-Romaní, J., 2018. Neighbourhood social capital and obesity: a systematic review of the literature. Obesity Rev.: Off. J. Int. Assoc. Study Obesity. https://doi.org/10.1111/obr.12760.

Craig, C., Marshall, A., Sjöström, M., Bauman, A., Booth, M.L., Ainsworth, B.E., Oja, P., 2003. International physical activity questionnaire: 12-country reliability and validity. Med. Sci. Sports Exerc. 195 (9131/03), 1381–1395.

de Brey, C., Musu, L., McFarland, J., Wilkinson-Flicker, S., Diliberti, M., Zhang, A., … Wang, X. (2019). Status and trends in the education of racial and ethnic groups 2018. NCES 2019-038. National Center for Education Statistics.

Echeverría, S., Diez-Roux, A.V., Shea, S., Borrell, L.N., Jackson, S., 2008. Associations of neighborhood problems and neighborhood social cohesion with mental health and health behaviors: the multi-ethnic study of atherosclerosis. Health Place 14 (4), 853–865. https://doi.org/10.1016/j.healthplace.2008.01.004.

Glonti, K., Mackenbach, J.D., Ng, J., Lakerveld, J., Oppert, J.-M., Bárdos, H., Rutter, H., 2016. Psychosocial environment: definitions, measures and associations with weight status–a systematic review. Obesity Rev.: Off. J. Int. Assoc. Study Obesity 17 (Suppl 1), 81–95. https://doi.org/10.1111/obr.12383.

Guilcher, S.J.T., Kaufman-Shriqui, V., Hwang, J., O'Campo, P., Matheson, F.I., Glazier, R.H., Booth, G.L., 2017. The association between social cohesion in the neighborhood and body mass index (BMI): an examination of gendered differences among urban-dwelling Canadians. Prev. Med. 99, 293–298. https://doi.org/10.1016/j.ypmed.2017.02.022.

Halbert, C.H., Bellamy, S., Briggs, V., Bowman, M., Delmoor, E., Kumanyika, S., Johnson, J.C., 2014. Collective efficacy and obesity-related health behaviors in a community sample of African Americans. J. Community Health 39 (1), 124–131. https://doi.org/10.1007/s10900-013-9748-z.

Hales, C.M., Fryar, C.D., Carroll, M.D., Freedman, D.S., Ogden, C.L., 2018. Trends in obesity and severe obesity prevalence in US youth and adults by sex and age, 2007–2008 to 2015–2016. JAMA 319 (16), 1723–1725. https://doi.org/10.1001/jama.2018.3060.

Hobson-Prater, T., Leech, T.G., 2012. The significance of race for neighborhood social cohesion: perceived difficulty of collective action in majority black neighborhoods. J. Soc. Soc. Welfare 39, 89.

Jennings, V., Bamkole, O., 2019. The relationship between social cohesion and urban green space: an avenue for health promotion. Int. J. Environ. Res. Public Health 16 (3). https://doi.org/10.3390/ijerph16030452.

Kawachi, I., Berkman, L., 2000. Social cohesion, social capital, and health. Soc. Epidemiol. 174, 190.

Krueger, P.M., Reither, E.N., 2015. Mind the gap: race\ethnic and socioeconomic disparities in obesity. Curr. Diab.Rep. 15 (11), 95. https://doi.org/10.1007/s11892-015-0666-6.

Luppino, F.S., de Wit, L.M., Bouvy, P.F., Stijnen, T., Cuijpers, P., Penninx, B.W.J.H., Zitman, F.G., 2010. Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies. Arch. Gen. Psychiatry 67 (3), 220–229. https://doi.org/10.1001/archgenpsychiatry.2010.2.

MacLean, P.S., Wing, R.R., Davidson, T., Epstein, L., Goodpaster, B., Hall, K.D., Ryan, D., 2015. NIH working group report: innovative research to improve maintenance of weight loss. Obesity 23 (1), 7–15. https://doi.org/10.1002/oby.20967.

McNeill, L.H., Reitzel, L.R., Escoto, K.H., Roberson, C.L., Nguyen, N., Vidrine, J.I., Wetter, D.W., 2018. Engaging black churches to address cancer health disparities: project CHURCH. Front. Public Health 6. https://doi.org/10.3389/fpubh.2018.00191.

Pew Research Center. (2009, January 30). A Religious Portrait of African-Americans. Retrieved April 29, 2019, from https://www.pewforum.org/2009/01/30/a-religious-portrait-of-african-americans/.

Sampson, R.J., Raudenbush, S.W., Earls, F., 1997. Neighborhoods and violent crime: a multilevel study of collective efficacy. Science 277 (5328), 918–924. https://doi.org/10.1126/science.277.5328.918.

StataCorp. (2015). Stata Statistical Software: Release 14. College Station, TX.

Strong, L.L., Reitzel, L.R., Wetter, D.W., McNeill, L.H., 2013. Associations of perceived neighborhood physical and social environments with physical activity and television viewing in African American men and women. Am. J. Health Promotion: AJHP 27 (6). https://doi.org/10.4278/ajhp.120306-QUAN-127.

Veitch, J., van Stralen, M.M., Chinapaw, M.J.M., te Velde, S.J., Crawford, D., Salmon, J., Timperio, A., 2012. The neighborhood social environment and body mass index among youth: a mediation analysis. Int. J. Behav. Nutr. Phys. Activity 9, 31. https://doi.org/10.1186/1479-5868-9-31.