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Screen time, physical activity and depression risk in minority women

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Abstract

Emerging research suggests that sedentary behavior, sometimes measured as screen time, may be an important correlate of depression. Physical activity, while not the direct opposite of sedentary behavior, has also been associated with depression (albeit inversely). Although low-income and minority populations may experience greater levels of depression, little research has focused on the relationships between screen time or physical activity and depression in low-income, minority populations in the United States. This study used logistic regression to assess relationships among depression, daily screen time, and weekly physical activity and the interaction between screen time and physical activity in a cross-sectional sample of 535 overweight or obese minority women in East Harlem, New York. Sixteen percent of participants were at risk for depression, which was significantly higher than national averages. Results suggested that engaging in high levels of daily screen time was associated with increased depression risk, even after controlling for physical activity and demographic variables. Neither physical activity nor the interaction between screen time and physical activity were associated with depression risk. Obesity was significantly associated with depression risk in all models, even when accounting for sedentary behavior and physical activity. Daily screen time may be an important risk factor for depression in minority women in the United States. The lack of association between physical activity and depression did not support past research and may have been due to the physical activity measure or the fact that physical activity may not be an important risk factor for depression in minority women.

Keywords

Sedentary behavior; Mood; Obesity

1. Introduction

Depression affects roughly 9% of adults in the United States at any given time (Centers for Disease Control and Prevention, 2008) and is among the leading causes of disability worldwide (World Health Organization, 2012). A significant amount of research suggests that physical activity is an effective way to prevent and treat depression (Conn, 2010; Mead et al., 2009; Rethorst, Wipfli, & Landers, 2009), but this research is not often conducted in minority populations (Conn, 2010). Furthermore, until recently, relatively little research addressed the relationship between depression and sedentary behavior. Sedentary behavior is not the opposite of physical activity, rather it refers to behaviors that do not increase energy expenditure above resting levels (Pate, O'Neill, & Lobelo, 2008) and includes activities such as television viewing, computer use and reading. Recent findings suggest that sedentary behavior and physical activity exert independent effects on risk of depression (e.g., Hamer, Stamatakis, & Mishra, 2010). Therefore, sedentary behavior may represent an important potential depression treatment target.

Indeed, a 2010 review of the relationship between depression and sedentary behavior in adults found that the majority of the 11 reviewed studies supported a positive association between sedentary behavior and depression risk (Teychenne, Ball, & Salmon, 2010a). Further, the four studies that did not support this positive association assessed a specific kind of sedentary behavior – internet or computer use – suggesting that type of sedentary behavior may affect its relationship with depression (e.g., passive web surfing was linked to depression whereas a chat room-based treatment reduced depression). The positive association between depression and TV and screen-based entertainment in adults is also supported by at least two more recent studies (Hamer et al., 2010; de Wit, van Straten, Lamers, Cuijpers, & Penninx, 2011).

Hamer et al. (2010) and de Wit et al. (2011) found that sedentary behaviors were associated with depression even after controlling for physical activity, which provides additional proof that physical activity and sedentary behavior have independent associations with depression. However, as Teychenne et al. (2010a) note, there may also be an interaction effect of physical activity and sedentary behavior on mental health. In other words, physical activity/inactivity may offset or compound the effects of sedentary behavior on mood. To date, two studies have investigated this interaction. Both found low levels of physical activity and high levels of sedentary behavior to be independently associated with greater risk of mental health problems (Sanchez-Villegas et al., 2008) or depression (Teychenne, Ball, & Salmon, 2010b). However, Sanchez-Villegas et al. (2008) found that Spanish undergraduate students had a higher risk of mental health problems when they reported above median levels of sedentary behavior and below median levels of physical activity than when they reported any amount of sedentary behavior, but were physically active above median levels. This suggests that physical activity may protect from some of the negative effects of sedentary behavior on mood. However, Teychenne et al. (2010b) did not find this interaction effect among socially disadvantaged Australian women, suggesting that physical activity may not protect against the increased risk of depression in some sedentary populations. Given these conflicting results, Teychenne et al. (2010b) called for further research.

More information on the interaction between physical activity and sedentary behavior is necessary as knowledge regarding the relative influences of these factors on depression risk will provide important information that can inform the development of depression prevention and intervention programs – an important area of future research (Biddle, 2007; Owen et al., 2011). Furthermore, these relationships have not been studied in a low socioeconomic status, minority population in the United States, despite the fact that some studies suggest that depression may be more common in these communities (Centers for Disease Control and Prevention, 2008), though findings are mixed (e.g., Menselson, Rehkopf, & Kubzansky, 2008; Riolo, Nguyen, Greden, & King, 2005). Replicating findings across cultures may be especially important for research on sedentary behavior as its effects appear to differ across countries, for example, the built environment seems to affect the sedentary behaviors of those in Belgium differently than those in Australia or the United States (e.g., Menselson et al., 2008; Riolo et al., 2005). Additionally, few studies have investigated physical activity, sedentary behavior and depression in overweight and obese populations, an important area of research as there is evidence of a strong connection between depression and obesity (Dave, Tennant, & Colman, 2011; Markowitz, Friedman, & Arent, 2008) that may affect the relationships among sedentary behavior, physical activity and depression. Further, both obesity and sedentary behaviors have been associated with a number of negative health outcomes, including all cause mortality (Proper, Singh, van Mechelen, & Chinapaw, 2011; Thorp, Owen, Neuhaus, & Dunstan, 2011). Therefore, understanding the relationships among these factors may allow for the development of prevention and intervention programs that could address both physical and mental health problems.

The goal of this study was to examine the relationships among sedentary behavior (measured as screen time), physical activity and depression risk in socioeconomically disadvantaged, overweight and obese, minority women. Studying these relationships in this population is important for several reasons. First, disadvantaged minority women may be at a greater risk for depression (Beydoun & Wang, 2010; Centers for Disease Control and Prevention, 2008). Additionally, this population is more obese and at greater risk for chronic health conditions that are exacerbated by obesity and sedentary behavior, such as hypertension, diabetes and coronary artery disease (Centers for Disease Control and Prevention, 2011). Finally, rates of television viewing may have a stronger association with rates of other sedentary behaviors among women than men (Sugiyama, Healy, Dunstan, Salmon, & Owen, 2008), that is, television viewing may be a marker of an overall sedentary lifestyle in women, but not in men. Thus, the current study increased the generalizability of the findings by limiting the sample to female participants.

Therefore, the current study investigated the associations between screen time and depression risk, physical activity and depression risk and whether there was an interaction effect between screen time and physical activity on depression risk. It was hypothesized that participants who reported engaging in five or more hours of daily screen time would have a higher risk of depression and that those reporting weekly physical activity would have a lower risk of depression. Given that the current study used depression risk as an outcome variable, as opposed general mental health, it was hypothesized that the findings would

support those of Teychenne et al. (2010b). That is, that there would not be an interaction effect between physical activity and sedentary behavior on depression risk.

2. Methods

2.1. Study design

These data come from a baseline assessment of 641 overweight and obese male and female participants recruited for a diabetes prevention program in East Harlem, New York. The 106 male participants were excluded from analyses conducted for this study because depression is more common among women (Centers for Disease Control and Prevention, 2008) and because the female-only sample made it easier to compare the present results with past research that included only women (e.g., Sanchez et al., 2008; Teychenne et al., 2010b). Therefore, the final sample included 535 female participants.

The intervention and outcome measures were developed using a community-based participatory research approach described elsewhere (e.g., Horowitz, Eckhardt, Talavera, Goytia, & Lorig, 2011; Parikh et al., 2010). All surveys were piloted by an evaluation subcommittee made up of academic and community partners. Surveys were written for a fourth grade reading level and translated into Spanish. All procedures were approved by the participating academic medical centers' Institutional Review Boards and all participants gave informed consent to participate.

2.2. Participants

Participants were 535 female East Harlem, New York residents over the age of 18 with body mass indices (BMI) greater than or equal to 25 kg/m² (i.e., overweight or obese). At the time of the survey, participants could not have any cognitive or physical impairments that would preclude participation in an educational group and had to be English or Spanish-speaking individuals without terminal illnesses or diabetes (as they were joining a diabetes prevention program). Further, participants could not be pregnant or taking medications to raise or lower blood sugar.

2.3. Outcome measures

2.3.1. Demographic information—Participants answered questions about their gender, age, race, level of education (which was used as a proxy for socio-economic status), and marital status. Height and weight were measured to calculate BMI. Weights were captured with a digital scale when participants were wearing light clothing, fasting, and not wearing shoes. A professional stadiometer was used to measure height.

2.3.2. Physical activity—Participants answered a single, unvalidated item regarding physical activity: “At least once a week, do you do any regular activity like brisk walking, jogging, bicycling, etc., long enough to work up a sweat.” We worked with community partners to ensure that participants would understand this question, developing and displaying common avenues for physical activity in the community, such as walking, dancing and gardening. Response choices were: yes or no.

2.3.3. Screen time—Participants answered a single item regarding sedentary behavior: During an average day, how much time do you spend using the computer or sitting down and watching TV, videos, or DVD's? Answer choices were: 0–1/2 h each day, 1–2 h each day, 3–4 h each day, 5–6 h each day, 7–12 h each day, over 12 h each day, don't know or refused. This item is not validated, but has been used and associated with health outcomes in previous work (e.g., Hu, Li, Colditz, Willett, & Manson, 2003). A dichotomous variable representing participants who engaged in more or less than 5 h of sedentary behavior a day was used in analyses. Five hours were used as the cut-point as it represented the seventy-fifth percentile and because, while there are no accepted guidelines for sedentary behavior, 5 h is well above the cut-off for recommended daily levels of sedentary behavior suggested by Owen et al. (2011).

2.3.4. Depression—The PHQ-8 (Kroenke et al., 2009), a validated measure of depression, was used to measure depression. As suggested by the authors, participants with scores greater than or equal to 10 were classified as at risk for depression. A dichotomous variable representing participants at risk for depression or not was used as the primary outcome in analyses.

2.4. Statistical analyses

Descriptives of all variables and chi-square analyses to assess associations between screen time, physical activity and risk of depression were analyzed with IBM SPSS Statistics 19 (2010). Logistic regression was used to calculate crude and adjusted (controlling for demographic variables) odds ratios and 95% confidence intervals for the risk of depression based on screen time, physical activity and the interaction between screen time and physical activity. Multivariate regression analyses were analyzed with StataCorp's Stata Statistical Software: Release 11 (2009).

3. Results

As seen in Table 1, 16% of the women were at risk for depression. Roughly half (51%) reported engaging in no physical activity at least once a week and roughly one quarter (23%) reported 5 or more hours of screen time a day. Almost half of the women reported having less than a high school education (47%). The majority of women were obese (61%), married (60%) and Hispanic (76%). Participants' mean age was 43.72 (18–96; $SD = 15.04$; these data are not reported in Table 1). Table 2 presents the proportion of women at risk for depression based on their reported levels of screen time or physical activity as indicated by the results of the chi-square analyses. A greater proportion of those engaging in five or more hours of screen time per day were at risk for depression than those who engaged in less than 5 h of screen time per day ($\chi^2(1, N = 535) = 9.57, p .002$). Physical activity was not associated with risk of depression in chi square analyses.

Table 3 presents the crude and adjusted odds ratios and 95% confidence intervals from the results of the logistic regression models predicting depression risk. Reporting at least 5 h a day of screen time resulted in an increased risk of depression in both the crude and adjusted models (crude $OR = 2.16$, 95% CI: 1.3–3.54, $p < .01$; adjusted $OR = 2.38$, 95% CI: 1.39–4.07, $p < .01$). Physical activity did not predict depression risk. When screen time and

physical activity were included in the same crude and adjusted models, screen time remained a significant predictor of depression risk (crude OR = 2.05, 95% CI: 1.24–3.38, $p < .01$; adjusted OR = 2.22, 95% CI: 1.29–3.82, $p < .05$) and physical activity did not. The interaction between physical activity and screen time was not significant in crude or adjusted analyses, suggesting that low physical activity does not compound the influence of sedentary behavior on depression. Screen time remained a significant predictor of depression risk in models that included the interaction (crude OR = 2.57, 95% CI: 1.16–5.72, $p < .01$; adjusted OR = 2.71, 95% CI: 1.16–6.33, $p < .05$), indicating that engaging in physical activity did not cancel out the effect of sedentary behavior on depression. Being obese increased the risk of depression in all models. No other demographic variables significantly affected depression risk.

4. Discussion

At 16%, risk of depression in this sample of overweight, minority women was nearly twice the national average (estimated at 9.1%; Centers for Disease Control and Prevention, 2008) and higher than national rates in Black, Latino or obese individuals (Centers for Disease Control and Prevention, 2008; Keddie, 2011). The percentage of participants at risk for depression in the current sample was similar to rates seen in populations with low socioeconomic status (Centers for Disease Control and Prevention, 2008; Everson, Maty, Lynch, & Kaplan, 2002). In addition, over half the sample did not report engaging in regular physical activity at least once a week and a quarter of the sample reported five or more hours a day of screen time. As both sedentary behavior and a lack of physical activity have been linked to numerous negative mental and physical health outcomes (e.g., Proper et al., 2011; Ströhle, 2009; Teychenne et al., 2010a; Thorp et al., 2011) and minority populations are at increased risk for many of these outcomes (Centers for Disease Control and Prevention, 2011), these data demonstrate the importance of focusing on sedentary behavior and physical activity as mental and physical health treatment targets in minority populations.

The results of the logistic regressions suggest that for obese, minority women, engaging in high levels of screen time (i.e., five or more hours of daily screen time) is associated with increased risk of depression. The data also suggest that the effects of screen time are independent of physical activity as women who reported high levels of screen time were more than twice as likely to be depressed than those who did not, even when controlling for physical activity and other demographic variables. These data support previous findings from populations in Australia, Spain and in women of higher socioeconomic status in the United States (Sanchez et al., 2008; Sanchez-Villegas et al., 2008; Teychenne et al., 2010b) and provide the cross-cultural replication called for by others (e.g., Owen et al., 2011). Furthermore, if replicated in prospective and longitudinal studies, these data suggest that sedentary behavior could be a potential depression treatment target, especially since decreasing sedentary behavior may lack the stigma often associated with other forms of mental health care (e.g., talk therapy or medication).

The lack of an independent effect of physical activity is surprising. Several large studies have shown an inverse correlation between depression and physical activity in obese and overweight women (Beydoun & Wang, 2010; Simon et al., 2008). There is also some

evidence that increasing physical activity is associated with decreased depressive symptoms in minority women (e.g., Ayala, 2011; Craft, Freund, Culpepper, & Perna, 2007; Lee et al., 2001; Perrino et al., 2011). However, few of these studies included large numbers of minority participants and therefore it is possible that for overweight or obese minority women, physical activity does not predict depression risk. However, it is more likely that the lack of effect is due to the use of a single item measure of physical activity. Teychenne et al. (2010b) found only leisure time physical activity related to decreased depression risk, thus, the lack of association between depression and physical activity in this study could be the result of using a single item measure of physical activity that did not differentiate between leisure and work-related physical activity. However, further research is merited as relatively few physical activity interventions report participants' ethnicities (Conn, 2010) and it is possible that physical activity or certain kinds of physical activity differentially affect depression risk in different ethnic and racial groups.

The lack of an interaction effect between sedentary behavior and physical activity on depression risk supports our hypothesis and the findings of Teychenne et al. (2010b) as opposed to those of Sanchez-Villegas et al. (2008), possibly because the current study and Teychenne et al. (2010b) assessed depression and Sanchez-Villegas et al. (2008) assessed general mental health. That is, the sedentary behavior–physical activity interaction may affect different mental disorders in different ways. For example, physical activity may be more important than sedentary behavior in ameliorating stress and anxiety as many of the sensations induced by exercise (e.g., racing heart, shortness of breath, light-headedness) are the same as those provoked during empirically-based exposure treatments for anxiety. It is imperative for future work to independently analyze different mental health disorders and their related symptoms in relation to sedentary behavior and physical activity.

To our knowledge, this study is the first to report on the interaction between sedentary behavior and physical activity in relation to depression risk in low socioeconomic status, minority women in the United States. The findings suggest that self-reports of engaging in physical activity at least once a week may not protect against the increased risk of depression related to high levels of screen time. These data once again highlight the fact that sedentary behavior and physical activity are separate correlates of depression that should be considered separately in future research. As noted by Teychenne et al. (2010b), the lack of an interaction effect mirrors the findings that physical activity does not protect against the negative effects of sedentary behavior on physical health.

Also of note is the fact that obesity was significantly associated with increased depression risk in all models. The relationship between depression and obesity is well established, but the direction of the relationship remains to be determined (Dave et al., 2011; Markowitz et al., 2008). The present data suggest that obesity has an independent association with depression risk and that it may play a role in the relationships among physical activity, sedentary behavior and depression. The cross-sectional nature of the current study prevents causal interpretations, however there are several possible explanations. For example, depression may lead to obesity through increased sedentary behavior as many treatments for depression are based on the idea that depression leads to withdrawal and less “activity” (e.g., Behavioral Activation; Addis & Martell, 2004) and a common symptom of depression is

psycho-motor retardation (e.g., the slowing of speech and movement). It is also possible that obesity mediates the relationship between sedentary behavior and depression through inflammatory markers. Engaging in TV and screen-based entertainment has been associated with low levels of fruit and vegetable consumption (Hamer et al., 2010). In turn, poor dietary habits may lead to obesity and increased levels of visceral fat that may increase inflammatory markers associated with depression (Everson-Rose et al., 2009). Future longitudinal work is needed to test these and other hypotheses as more information about these relationships may help determine if, when and how weight loss interventions affect mood.

Limitations of the present study include the cross-sectional design, which prevents conclusions regarding causal pathways and the exclusive use of self-report. Further, the use of unvalidated, single item measures of sedentary behavior and physical activity is problematic as this method has been shown to misclassify a small percentage of participants (Macera et al., 2001) and it does not allow tests for differences among types of sedentary behaviors or physical activities, which may be especially important given that different physical activities and sedentary behaviors may have different effects on mood (Biddle, 2007; Teychenne et al., 2010a). Further, the physical activity measure did not assess the duration of physical activity and therefore could not provide information regarding the effects of different durations of physical activity on depression, which makes it difficult to compare results across studies. Indeed, the lack of information on duration may explain the lack of association between physical activity and depression as there may be a threshold for physical activity's effect on depression that was not adequately captured in this study. However, it should be noted that the sedentary behavior measure has been associated with health outcomes in prior research (Hu et al., 2003) and that the physical activity question was developed to be relevant to the participants' daily lives. Strengths include the diverse ethnic backgrounds of study participants, the relatively large sample size and the inclusion of BMI, which may be an important variable in future work.

The current study offers important preliminary information on the novel finding that high levels of screen time are associated with increased risk of depression in low socioeconomic status, minority women in the United States, especially if they are obese. The fact that physical activity was not associated with lower depression risk in this population suggests that it may be most important to target sedentary behavior when designing and implementing depression prevention and intervention programs for minority women in the United States. However, given the limitations of the physical activity measure, described above, future prospective, intervention and prevention studies are needed to confirm these findings. In addition, the dearth of studies on these relationships in disadvantaged, minority populations prevents us from confirming our hypotheses. These populations are at increased risk for a number of health outcomes (Centers for Disease Control and Prevention, 2011) that could be prevented or treated by targeting sedentary behavior and physical activity. Thus, the findings presented herein highlight the importance and necessity of replicating this and other work in underserved and minority populations. Therefore, we echo the calls of Owen et al. (2011), Biddle (2007) and others, for future programs to assess multiple forms of physical activity and sedentary behavior early and often so that we can learn more about

their potential moderating and mediating effects on depression in order to better treat this expensive and crippling disorder.

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Table 1Characteristics of study participants ($N = 535$).

Variable	<i>N</i>	%
Depression		
Not depressed	447	84
Depressed	88	16
Screen time		
Less than 5 h a day	414	77
Greater than or equal to 5 h a day	121	23
Physical activity		
None	272	51
At least once a week	262	49
BMI		
25–29.9 (overweight)	211	39
Greater than or equal to 30 (obese)	324	61
Race		
Hispanic	408	76
Black	108	20
Other	19	4
Married		
No	212	40
Yes	323	60
Education		
Less than high school	249	47
More than high school	283	53

Table 2

Proportion of participants with depression according to screen time or physical activity.

	<i>N</i>	Not depressed (%)	Depressed (%)	<i>P</i>
Screen time				
Less than 5 h a day	414	357 (86)	57 (14)	0.002
Greater than or equal to 5 h a day	121	90 (74)	31 (26)	
Physical activity				
None	272	220 (81)	52 (19)	0.094
At least once a week	262	226 (86)	36 (14)	

Table 3

Crude and adjusted odds ratios and 95% confidence intervals for risk of depression according to screen time and physical activity.

Variables	Crude OR (95% CI)	Adjusted OR (95% CI)	Crude OR (95% CI)	Adjusted OR (95% CI)	Crude OR (95% CI)	Adjusted OR (95% CI)
Physical activity	0.67 (0.42–1.07)	0.63 (0.40–1.02)			0.66 (0.38–1.16)	0.64 (0.36–1.14)
Screen time						
			2.16 ^{**} (1.32–3.54)	2.38 ^{**} (1.39–4.07)	2.05 ^{***} (1.24–3.38)	2.22 ^{**} (1.29–3.82)
Physical activity × screen time						
					0.69 (0.25–1.92)	0.73 (0.26–2.07)
Obese		1.88 [*] (1.13–3.13)		1.75 [*] (1.05–2.91)		1.81 [*] (1.08–3.03)
High school education		1.26 (0.77–2.07)		1.05 (0.63–1.74)		1.09 (0.65–1.82)
Black		0.62 (0.16–2.48)		0.53 (0.13–2.17)		0.52 (0.13–2.12)
Hispanic		1.08 (0.29–3.97)		1.09 (0.29–4.08)		1.06 (0.29–3.93)
Age		1.00 (0.98–1.01)		1.00 (0.98–1.01)		1.00 (0.98–1.01)
Marital status		0.86 (0.51–1.46)		0.89 (0.53–1.50)		0.9 (0.53–1.52)
<i>N</i>	534	527	535	528	534	527

* $p < .05$

** $p < .01$.