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Preliminary communication

Are adults with bipolar disorder active? Objectively measured physical activity and sedentary behavior using accelerometry

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ABSTRACT

Background: Little is known about physical activity and sedentary behavior of adults with bipolar disorder (BP). Physical activity and sedentary behaviors may be modifiable factors associated with elevated rates of obesity, diabetes, cardiovascular disease, metabolic syndrome, and mortality in adults with BP.

Methods: Sixty adult outpatients treated for BP (> 18 yr) wore accelerometers for seven consecutive days. Each minute epoch was assigned an activity level based on the number of counts per minute; sedentary(< 100 counts), light(101–1951 counts), or moderate/vigorous(> 1952 counts). Adults with BP were matched 1:1 to users and non-users of mental health services (MHS) (NHANES 2003–2004) by gender, closest BMI, and age.

Results: On average, adults with BP wore actigraphs over 17 h/day. The majority of monitoring time (78%) was classified as sedentary (approximately 13.5 h/day). Light physical activity accounted for 21% of the monitoring time/day (215 min/day). None achieved 150 min/wk of moderate/vigorous activity as recommended by national guidelines. Adults with BP were significantly less active and more sedentary than MHS users and non-users in NHANES 2003–2004 ($p < 0.01$).

Limitations: Majority of the participants were relatively asymptomatic with most (87%) having no more than mild depressive symptoms and none experiencing severe manic symptoms. The sedating effects of medications on physical activity were not investigated.

Conclusion: From clinical perspectives, these findings justify physical activity interventions targeting adults with BP as a possible means to improve their physical and mental health and to reduce the elevated risk of commonly observed medical comorbidities in this high-risk population.

1. Background

The medical and economic burden of bipolar disorder (BP) is substantial. The World Health Organization ranks BP as "the sixth most disabling medical condition" (Murray and Lopez, 1997). In addition, BP is the most expensive behavioral health care diagnosis for patients and insurance plans (Peele et al., 2003) with mental as well as non-mental healthcare contributing to the 4-fold increase in total medical costs for patients with BP compared to patients without BP (Fagiolini et al., 2008; Bryant-Comstock et al., 2002). Hence public health efforts to reduce the tremendous health burden of BP on the individual and society are warranted.

BP is a chronic mood disorder characterized by episodes of depression, and hypomania or mania. Individuals with this disorder are symptomatic about half of their lives (Judd et al., 2003a, 2003b). Changes in mood are accompanied by extreme shifts in energy, activity, sleep, and behavior. Compared to the general population, adults with BP experience elevated rates of obesity, diabetes, cardiovascular disease, metabolic syndrome, and mortality (Kupfer, 2005; Fagiolini et al., 2003, 2005; Kilbourne et al., 2007;). Lack of physical activity may be one modifiable factor associated with increased risk of these common medical comorbidities in adults with BP.

To date, physical activity studies of adults with BP have relied on self-reported rather than objective measures of physical activity (Cairney et al., 2009; Strohle et al., 2007; Elmslie et al., 2001).

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Interestingly, differences between individuals with BP and individuals with and without other mental disorders were only noted if self-reported physical activity included occupational and leisure activities (Elmslie et al., 2001) but not leisure activities alone (Cairney et al., 2009; Strohle et al., 2007). Unfortunately, self-reported measures of physical activity are problematic in general populations (Sallis and Saelens, 2000), but may even be less reliable and valid in individuals with BP due to high symptom burden and significant neurocognitive impairment associated with the disorder (Joffe et al., 2004; Sole et al., 2012). Hence, objectively measured physical activity studies are necessary to confirm and/or refute these self-reported findings in adults with BP (Cairney et al., 2009).

2. Purpose

The objectives of this report are (1) to provide a profile of objectively measured physical activity and sedentary behavior among adult outpatients with BP, for the first time, and (2) to compare objective physical activity levels of adult outpatients with BP with a national sample of users and non-users of mental health services (MHS) matched on age, gender and BMI. It was hypothesized that adults with BP would have significantly lower physical activity levels than a national sample of MHS users and MHS non-users who represent a broader and less severe spectrum of mental health disorders.

3. Methods

3.1. Studies

This report is based on data from the physical activity and function in adults with bipolar disorder (PARC2) study and the National Health and Nutrition Examination Survey (NHANES) 2003–2004. All research procedures were approved by the Institutional Review Board at the University of Pittsburgh. PARC2 participants were recruited between January 2009 to November 2011 and signed informed consent documents prior to engaging in research procedures. Individuals were eligible for PARC2 if they were receiving treatment for BP at Western Psychiatric Institute and Clinic (WPIC) at the University of Pittsburgh, Pittsburgh, and were age ≥ 18 years. They were eligible for the study regardless of their clinical status (euthymic, depressed, hypomanic, or manic) or bipolar subtype (BP I, BP II, BP Not Otherwise Specified (NOS), BP NOS/Schizoaffective (SA) disorder). Participants were compensated $10 from January 2009 to July 2011 and $30 from August 2011 to November 2011. PARC2 data collection occurred between January 2009 and November 2011. Data was analyzed in 2012–2013.

NHANES 2003–2004 is a cross-sectional observational study using a stratified, multistage probability design to obtain a nationally representative sample of the civilian, non-institutionalized US population (Department of Health and Human Services Center for Disease Control and Prevention, 2005). NHANES data was collected in 2003–2004. The NHANES sample was restricted to those adults (≥ 18 years) with at least 3 days of valid actigraph data to match the eligibility criteria of the PARC2 study.

3.2. Assessments

PARC2 replicated the NHANES 2003–2004 physical activity monitoring protocol (Department of Health and Human Services Center for Disease Control and Prevention, 2006). Participants were instructed to wear the ActiGraph AM-7164 monitoring device (ActiGraph, Ft. Walton Beach, FL) on an elasticized belt over the non-dominant hip for seven consecutive days. ActiGraphs were set to measure the duration and intensity of uniaxial movement within one-minute epochs. If there were no activity counts for ≥ 60 min, the accelerometer was considered not worn for that interval of time. Each minute epoch was assigned an activity level based on the number of counts per minute; sedentary(<100 counts), light(101–1951 counts), or moderate/vigorous(≥ 1952 counts) (Hagstromer et al., 2007; Freedson et al., 1998; Matthews et al., 2008). Daily totals of sedentary behavior and activity levels (minutes/day) were averaged. Percentages of monitoring time were calculated by dividing the minutes engaged in each category by the total monitoring minutes for each participant. Valid and reliable data was defined as an accelerometer worn for 10 h a day for 3 or more days (Trost et al., 2005; Matthews et al., 2012).

PARC2 participation involved 2 clinic visits scheduled one week apart. At study entry, participants received Actigraphs and completed self-assessments. At the second visit, participants returned the Actigraph and completed additional self-assessments. For descriptive purposes, the prior week's mood symptoms were assessed by independent evaluators using the 17-item Hamilton Depression (HRSD17) scale (Hamilton, 1960) and an expanded 25-item Hamilton Depression (HRSD25) scale that includes reverse neurovegetative symptoms (Thase et al., 1991). The HRSD17 and HRSD25 yields scores that range from 0–52 to 0–72, respectively. Higher scores for HRSD17 and HRSD25 indicate a greater burden of depressive symptoms. HRSD17 symptoms were defined as ≤ 7 not depressed; 8–13 mild depressive symptoms; 14–19 moderate depressive symptoms; ≥ 20 severe depressive symptoms. Mania/hypomania was assessed with the Young mania rating scale (YMRS) (Young et al., 1978) that yields scores from 0 to 60 with higher scores indicating higher levels of mania/hypomania. YMRS symptoms were defined as <6 not experiencing mania; 7–14 mild mania; 15–19 moderate mania; and ≥ 20 for severe mania. Psychiatric diagnoses were obtained from participants' research records. All research diagnoses were made in accordance with DSM IV criteria using the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders (SCID) ($n=55$, 92%), Fourth edition (First et al., 1996) or Mini International Neuropsychiatric Interview (MINI) ($n=5$, 8%) (Sheehan et al., 1998).

3.3. Data analysis

For descriptive purposes, BMI was categorized as healthy (18.5–24.9 kg/m^2), overweight (25 to <30 kg/m^2), obese (30 to <40 kg/m^2), and extreme obesity (≥ 40 kg/m^2). *T*-tests and Chi-square exact tests were used to compare the continuous and categorical variables, respectively, by gender. PARC2 participants were 1:1 matched to users and non-users of MHS in NHANES 2003–2004 by gender, closest BMI, and age to account for the potential residual effects of these demographic variables on actigraphy comparisons. Conditional logistic regression models were used to determine if actigraphy measures and demographics differed between the PARC2 participants matched to (1) users of MHS, and (2) non-users of MHS. Descriptive summaries and statistical analyses were performed using Stata (release 9, StataCorp, College Station, TX) and SAS (version 9.2, SAS Institute, Triangle Park, NC).

4. Results

Sixty-nine of the 101 PARC2 participants were asked to participant in the actigraphy monitoring. Nine participants were excluded from the analysis due to either providing less than 3 days of valid actigraphy data ($n=3$), BP diagnosis relied on clinical diagnosis and not SCID or MINI ($n=5$), or both ($n=1$). Mean symptom scores for HRSD17, HRSD25, and YMRS did not clinically