

## **The Relationship Between Outdoor Recreation and Depression Among Individuals With Disabilities**

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### **Abstract**

The purpose of this study is to identify the relationship between outdoor recreation participation and depressive symptoms among individuals with disabilities. The current paper compares three outdoor recreation predictors (dichotomized participation, participation index score, and participation frequencies) to two depression dependents (dichotomized current major depression and raw depression index score). Results reveal a negative relationship between outdoor recreation participation and depression, outdoor recreation participants had lower overall depression scores than nonparticipants, and lower depression scores were related to more frequent outdoor recreation participation. Future experimental studies are needed in order to fully understand the causal relationship between outdoor recreation and depression among different subgroups of individuals with disabilities.

*KEYWORDS: Outdoor recreation, disability, depression, accessibility*

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## Introduction

Participation in outdoor recreation has been shown to reduce depression among different demographics (Buettner & Fitzsimmons, 2002; Frances, 2006; Rawson, 1994; Sheare, 1975; Townsend, 2006; Wassman & Iso-Ahola, 1985). Individuals with disabilities are at increased risk for depression (Blazer, 2009; Bruce, 2000; Kinne, Patrick, & Doyle, 2004; Okoro et al., 2010; Schillerstrom, Royall, & Palmer, 2008; Weich et al., 2002), and outdoor recreation may help reduce that risk. Because no studies have yet explored this assumption, the purpose of this study is to identify the relationship between outdoor recreation participation and depression among individuals with disabilities.

### Depression

An estimated 16.6% of Americans have a lifetime history of a major depressive disorder (MDD) (Kessler et al., 2003), and 6.6% have experienced MDD within the past 12 months (Kessler, Chiu, Demler, Merikangas, & Walters, 2005). Symptoms associated with MDD that are present nearly every day include diminished interest or pleasure in daily activities, significant changes in appetite, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or excessive guilt, diminished ability to think or concentrate, and recurrent thoughts of death or suicide (American Psychiatric Association, 1994). Furthermore, depression may be a risk factor for decreased physical activity or a sedentary lifestyle (Roshanaei-Moghaddam, Katon, & Russo, 2009). Depression is also highly correlated with suicide, and approximately 50%–60% of suicide victims meet the requirements for current depressive disorders (Cavanagh, Carson, Sharpe, & Lawrie, 2003; Kim et al., 2003; Marttunen, Aro, Henriksen, & Lonnqvist, 1991). Depression also causes roughly \$83.1 billion per year in economic burden in the United States (Greenberg et al., 2003). Because of its high prevalence, its comorbidity with other conditions, and its affect on worker performance, depression accounts for \$44 billion per year in lost productive time (Stewart, Chee, Ricci, Hahn, & Morganstein, 2003), making the treatment of mood disorders less expensive than the secondary costs associated with depression (Greenberg et al., 2003; Rihmer, 2001). Although treatments such as antidepressant medications and electroconvulsive therapy appear to be effective in treating depression, these treatments can have troublesome side effects, may be costly to continue or maintain, and do not have an enduring effect (Hollon, Thase, & Markowitz, 2002). Psychotherapies, such as cognitive behavioral therapy, behavior activation, and interpersonal therapy, have performed as well as antidepressants in treating moderate to severe depression (Dimidjian et al., 2006; Roth & Fonagy, 2005) and often have longer lasting effects (Hollon et al., 2002; Spates, Pagato, & Kalata, 2006). However, persons with depression commonly receive no treatment and only 7%–30% receive adequate treatment in the United States (Harman, Edlund, & Fortney, 2004; Kessler et al., 2003; U.S. Department of Health and Human Services, 1999; Weilburg, O'Leary, Meigs, Hennen, & Stafford, 2003; Young, Klap, Sherbourne, & Wells, 2001).

## **Disability**

Disability is often explained using two different theoretical approaches. The first approach identifies disability as an individual pathology resulting from a biological characteristic or functional capacity, and the nature and degree of functional impairment is used as a tool for measuring the disability. The second approach views disability as a social pathology resulting from environmental factors or social organization (Rioux & Valentine, 2006). This study follows the first approach by defining disability as a limitation in any activity due to a physical, mental, or emotional problem or a chronic health impairment that requires the use of special equipment. This definition of disability is based upon the definition used to identify disability within the secondary data source as explained in the methods section of this article.

## **Depression and Disability**

Research has shown a strong relationship between depression and disability (Blazer, 2009; Bruce, 2000; Kinne et al., 2004; Okoro et al., 2010; Schillerstrom et al., 2008; Weich et al., 2002). Although studies disagree on whether depression is a risk factor for disability (Field & Jette, 2007; Kroenke et al., 2010; Penninx, Deeg, van Eijk, Beekman, & Guralnik, 2000) or if disability is a risk factor for depression (Hollon et al., 2002; Ormel et al., 1993; Von Korff, Ormel, Katon, & Lin, 1992), longitudinal studies have indicated that a change in one condition results in a complementary change in the other condition (Barry, Allore, Bruce, & Gill, 2009; Koenig & George, 1998; Ormel, Rijdsdijk, Sullivan, van Sonderen, & Kempen, 2002). Just as Penninx et al. (1998) explains that the mutual reinforcing natures of depression and poor physical function can cause “a progressive downward spiral in physical and psychological health” (p. 1725), a review of the disability and depression literature suggests that treating or preventing depression may likewise prevent onset disability or reduce secondary conditions associated with disability (Lenze, Martire, Rollman, & Schulz, 2001).

## **Outdoor Recreation**

National participation levels in a wide range of outdoor recreation activities (camping, backpacking, walking, fishing, bird watching, golfing, hunting, swimming, boating, etc.) has increased over the past 25 years (National Survey on Recreation and the Environment, 2009). Recent studies have indicated that outdoor recreation can positively impact an individual's physical, psychological, and social health (Maller, Townsend, Pryor, Brown, & St. Leger, 2006; Norman, Annerstedt, Boman, & Mattsson, 2010; Rosenberger, Bergerson, & Kline, 2009; Townsend, 2006). Outdoor recreation activities often include physical activity that provides cardiovascular benefits, weight loss, and quicker recovery from illness (Warburton, Nicol, & Bredin, 2006). Outdoor recreation can likewise provide social interaction, which often has positive psychological effects on participants (Denissen, Penke, Schmitt, & van Aken, 2008). However, outdoor recreation is not merely a subclass of physical activity or just a form of social interaction. Outdoor recreation serves as a venue for combining the benefits of physical activity and/or social interaction with the positive impacts of nature. Studies have found natural environments improve attention capacity (Berto, 2005; Cimprich & Ronis, 2003) and cognitive

functioning (Berman, Jonides, & Kaplan, 2008), increase self-discipline (Taylor, Kuo, & Sullivan, 2002), and enhance personal satisfaction (Pothukuchi & Bickes, 2001) while reducing stress, anger, blood pressure levels (Hartig, Evans, Jamner, Davis, & Garling, 2003; Rodiek, 2002), and anxiety and depression symptoms (Mooney & Milstein, 1994).

Although there has been an increase in outdoor recreation programs aimed at improving psychological health (Frances, 2006), only a few studies have specifically measured the impacts of outdoor recreation on depression (Buettner & Fitzsimmons, 2002; Frances, 2006; Rawson, 1994; Sheare, 1975; Townsend, 2006; Wassman & Iso-Ahola, 1985). Furthermore, no such studies have been conducted specifically among individuals with disabilities. Therefore, the purpose of this study was to determine the relationship between outdoor recreation participation and depression among individuals with disabilities. This study is significant in that its findings can aid in improving the quality of life of individuals with disabilities, a demographic that represents a significant percentage (18.7%) of the United States population (Brault, 2008). Furthermore, unipolar depressive disorders are projected to become the second leading cause of disability-adjusted life years lost in the world before 2030 (Mathers & Loncar, 2006). This study contributes to the available body of knowledge concerning depression treatment and will help identify the role that outdoor recreation might play in the treatment of individuals with disabilities that have depression.

## Methods

### Framework

This study employed a socioecological approach that suggests that the environment influences individuals' physical and mental health (Stokols, 1995). In this study, outdoor recreation is the environmental independent factor and the depression levels of individuals with disabilities are the dependent factor. Using nonexperimental correlational analysis, we explored the following research question: "Is participation in outdoor recreation related to reported symptoms of depression among individuals with disabilities?"

### Sample

This study used data collected by the Behavioral Risk Factor Surveillance System (BRFSS), an annual survey conducted by the Centers for Disease Control and Prevention (CDC) to track health trends and risk factors on local and national levels. The study population included all noninstitutionalized Montana residents aged 18 and older who participated in the 2006 BRFSS. As part of its 2006 nationwide core questions, BRFSS included a *Disability* module to survey respondents' physical, mental, and emotional health. Also in 2006, the state of Montana included a question module titled *Anxiety and Depression*, which was designed to measure depression symptom frequencies among respondents. In addition, Montana included a question module titled *Outdoor Recreation Questions* to collect information regarding respondents' participation in outdoor recreation (CDC, 2006).

## Measures

**Disability.** Disability status for this study was determined by a *yes* response to one of the following BRFSS core questions: “Are you limited in any activities because of physical, mental, or emotional problems?” or “Do you now have any health problem that requires you to use special equipment, such as a cane, a wheelchair, a special bed, or a special telephone?” Following the recommendations found in *Healthy People 2010* (U.S. Department of Health and Human Services, 2000), the CDC, the Montana BRFSS, and other related studies employing BRFSS data used this method of determination (Rimmer, 2007; Strine, Kroenke, & Dhingra, 2009; Wolf, Armour, & Campbell, 2008).

**Income and employment status.** A previous study using the 2006 Montana BRFSS found that current major depression is significantly related to a household income less than \$50,000 per year and unemployment or being unable to work (Oreskovich & Cummings, 2009). Therefore, these demographic variables were controlled for in this study. During the BRFSS survey, respondents were asked to indicate their annual household income from all sources. Participants were dichotomized into two groups: those with annual household incomes less than \$50,000 and those with \$50,000 or greater. Respondents were also asked to indicate their employment status. From their responses, participants were classified as employed (including employed for wages or self-employed), unemployed, or other (including students, homemakers, retired individuals, and those unable to work).

**Age.** In this study, age plays a complex role. Studies have identified a negative relationship between age and depression symptoms (Blazer, 2009; Charles, Reynolds, & Gates, 2001; Schieman, van Gundy, & Taylor, 2002) including one report conducted specifically among Montana adults (Oreskovich & Cummings, 2009). Age also is related to outdoor recreation participation, but the relationship is unclear. National trends indicate that time spent participating in outdoor recreation decreases with age (Siikamäki, 2009). However, smaller studies show that the healthy baby-boomer generation is more likely to be engaged in outdoor activities than younger generations (Preister, Malone, & James Kent Associates, 2009). In a Montana based study, Christensen, Holt, and Wilson (2011) found that fewer older adults participate in outdoor recreation than adults under age 65. However, the same study showed that older adults average more outdoor recreation participation days than the younger cohort. Furthermore, Montana’s Statewide Comprehensive Outdoor Recreation Plan (SCORP) has urged local outdoor recreation managers to increasingly focus on facilities and programs that will accommodate the increasing number of mature adults who are living longer and moving to Montana to retire (Montana Fish, Wildlife & Parks, 2008). Additionally, age has been identified to be interrelated with disability (Martin, Schoeni, Freedman, & Andreski, 2007; Zack, Moriarty, Stroup, Ford, & Mokdad, 2004). Considering these complications, this study controlled for age by aggregating the data into six different age groups (18–24 years, 25–34 years, 35–44 years, 45–54 years, 55–64 years, and 65 years old or more).

**Depression symptoms.** An adaptation of the Patient Health Questionnaire eight-item depression scale (PHQ-8) was used to assess depression among 2006 Montana BRFSS survey participants. The PHQ-8 resembles the widely used PHQ-9 that consists of nine criteria for depression derived from the *Diagnostic and Statistical Manual of Mental Disorders, fourth edition* (DSM-IV) (American Psychiatric Association, 1994). The PHQ-9 asks how often an individual has been bothered by nine different depression symptoms in the last 2 weeks, allowing the respondents to answer *not at all*, *several days*, *more than half the days*, and *nearly every day* (Kroenke, Spitzer, & Williams, 2001). The PHQ-8 differs from its predecessor in that it omits a question that assesses suicidal or self-injurious thoughts. This omission was due to interviewers' inability to provide adequate intervention over the phone (Kroenke et al., 2009). When using the PHQ-8 in 2006, BRFSS surveyors asked respondents to quantify the number of days they experienced each depressive symptom (as opposed to asking how often) during the past 2 weeks. The change in phrasing was made to better reflect the format of other similar BRFSS questions. As recommended by Kroenke et al. (2009), the respondents' answers were recategorized to match the original PHQ-8 response set and scoring method as follows: 0–1 day = *not at all* (0 points), 2–6 days = *several days* (1 point), 7–11 days = *more than half the days* (2 points), 12–14 days = *nearly every day* (3 points). The total points accumulated from the eight symptom-related questions produced a raw index score for each respondent. In past studies, scores  $\geq 10$  have been found to accurately predict current major depression or other depression (Kroenke & Spitzer, 2002). Furthermore, the PHQ-8 in conjunction with BRFSS data has been identified as an effective method for predicting depression in the United States (Kroenke et al., 2009). For this study, the raw depression index score and the dichotomized cut point for current major depression (depression scores  $\geq 10$ ) were used as the dependent variables in determining depression's relationship with outdoor recreation.

**Outdoor recreation.** Before asking respondents a series of outdoor recreation-related questions, interviewers were required to explain that they were only interested in "OUTDOOR recreational activities....[and] not interested in INDOOR activities, such as bowling, line-dancing, weight-lifting, or other exercise activities" (CDC, 2006). Montana respondents were then asked the following question: "What was the primary outdoor recreational activity you participated in during the past 12 months?" If a respondent answered *none*, they were identified as not having participated in outdoor recreation. All other outdoor activities qualified as a *yes* response. Surveyors matched respondents' answers to a provided list of 33 various outdoor activities, which included backpacking, bird watching, boating, camping, fishing, golfing, hunting, motorized recreation, team sports, walking, and other. Individuals who participated in outdoor recreation also reported the frequency of their participation per week, month, and year. Indicated frequencies were then developed into two separate scales. The first scale produced a raw participation index score for each respondent based on a 365-day year, using the assumptions that there are 12 months or 52 weeks in a year, 4 weeks or 30 days in a month, and 7 days in a week. The second scale, using the same assumptions,

categorized each respondent as participating in outdoor recreation daily (7+ times per week), at least four times a week (4–6 times per week), weekly (1–3 times per week), monthly (1–3 times per month), yearly (1–11 times per year), or never (*none* response to the first question). The dichotomized participation variable, the raw participation index score, and the participation frequencies were used in this study as the independent outdoor recreation variables.

### **Analysis**

The first set of analyses compared persons with and without disabilities by using descriptive frequencies of common demographic variables and by determining percentages for participation in outdoor recreation. An independent samples *t*-test was also conducted to compare mean outdoor recreation participation index scores between the two groups. The same independent samples *t*-test was then replicated for six different age groups in order to tease out variances by age.

The second set of analyses was conducted only among persons with disabilities and sought to determine the relationship between outdoor recreation and depression among this group. This set included multiple regression analyses with outdoor recreation participation index scores to predict depression index scores while controlling for age, income, and employment. Additionally, a logistic regression analysis was conducted to predict current major depression from the dichotomized outdoor recreation participation variable while controlling for age, income, and employment. We also used an independent sample *t*-test to compare mean depression index scores for individuals who did and did not participate in outdoor recreation. Finally, a one-way analysis of variance (ANOVA) was conducted to evaluate the relationship between participation frequencies and mean depression index scores. To investigate and control for the effect of age, income, and employment, a two-way ANOVA was subsequently conducted. Statistical significance was set at  $\alpha = .05$ , and analyses were conducted using SPSS Version 17 (Green & Salkind, 2008).

## **Results**

### **Set I: Comparing Individuals With and Without Disabilities**

**Descriptive frequencies.** In 2006, 6,059 noninstitutionalized Montana citizens over age 18 participated in the BRFSS survey. For this study, participants with incomplete answers regarding disability status ( $n = 40$ ), depression ( $n = 773$ ), or participation in outdoor recreation ( $n = 154$ ) were excluded from the analyses. Of the remaining respondents ( $n = 5,092$ ), 25.7% reported a disability ( $n = 1,310$ ). Individuals with disabilities included in this study were predominantly white (90.4%) and mostly female (60.5%) with the largest percentage being over age 65 (32.1%). When compared to individuals without disabilities, individuals with disabilities were less likely to participate in outdoor recreation (81.8% compared to 93.0%). Table 1 compares the descriptive frequencies of all the variables considered for individuals with and without disabilities.

**Table 1**  
*Participant Description by Disability Status*

Variable	Individuals with Disabilities <sup>a</sup>		Individuals without Disabilities	
	N	P <sup>b</sup>	N	P <sup>b</sup>
Total	1,310	25.7	3,782	74.3
Sex				
Male	517	39.5	1566	41.4
Female	793	60.5	2216	58.6
Age				
18–24	16	1.2	191	5.1
25–34	65	5.0	504	13.4
35–44	143	11.0	663	17.7
45–54	301	23.2	872	23.3
55–64	353	27.2	726	19.4
65+	421	32.4	794	21.2
Race/Ethnicity				
White	1177	90.4	3339	88.9
Black	3	0.2	7	0.2
Other	85	6.5	307	8.2
Multiracial	20	1.5	32	0.8
Hispanic	17	1.3	70	1.9
Education				
Not High School Graduate	108	8.3	204	5.4
High School Graduate	420	32.1	1126	29.8
Attended College or Technical School	414	31.7	1089	29.0
Graduated from College	366	27.9	1355	35.8
Income				
< \$15,000	249	21.6	279	8.3
≥ \$15,000, < \$25,000	266	23.0	582	17.4
≥ \$25,000, < \$35,000	170	14.7	517	15.5
≥ \$35,000, < \$50,000	205	17.8	680	20.3
≥ \$50,000	264	22.9	1288	38.5
Participated in Outdoor Recreation				
Yes	1072	81.8	3517	93.0
No	238	18.2	265	7.0

*Note.* Participant information was gathered from the 2006 Montana BRFSS data for noninstitutionalized adults aged 18 and older. Participants unsure about their participation frequencies or refusing to answer were excluded from these analyses.

<sup>a</sup>Disability status is determined by a yes response to one of the following questions: “Are you limited in any activities because of physical, mental, or emotional problems?” and “Do you now have any health problem that requires you to use special equipment, such as a cane, a wheelchair, a special bed, or a special telephone?”

<sup>b</sup>All percentages represent the valid percent of the variable calculated after removing cases with inadequate responses.



**Independent sample t-tests.** A comparison of outdoor recreation participation index scores showed that individuals with disabilities ( $M = 99.63$ ,  $SD = 113.55$ ) on average participated in outdoor recreation 18 fewer days during the year than individuals without disabilities ( $M = 117.76$ ,  $SD = 113.23$ ) ( $t(2, 2,202.34) = 4.90$ ,  $p < 0.001$ ,  $CI = 10.87$  to  $25.39$ ). The eta square index indicates that 0.5% of the variance in raw outdoor recreation scores was attributed to disability status. When controlling for age, the same independent sample *t*-test remains significant only for those between ages 45 and 54 and those who are older than 65. Table 2 further details the results of the independent sample *t*-tests conducted for this analysis while controlling for age.

**Table 2**

*Independent Sample t-Tests for Recreation Participation Index Scores<sup>a</sup> by Disability Status*

		<i>df</i>	<i>t</i>	<i>M</i>	<i>SD</i>	<i>p</i>
Recreation Participation Score <sup>a</sup>	No disabilities	2202.34	4.90*	117.76	113.23	<.001
	Disabilities <sup>b</sup>			99.63	113.55	
<b>By Age</b>						
18–24 years	No disabilities	17.22	-0.20	124.95	107.40	0.84
	Disabilities <sup>b</sup>			131.19	118.97	
25–34 years	No disabilities	85.98	1.60	112.43	102.58	0.11
	Disabilities <sup>b</sup>			93.19	89.18	
35–44 years	No disabilities	202.61	1.83	113.71	108.10	0.07
	Disabilities <sup>b</sup>			94.88	111.06	
45–54 years	No disabilities	523.22	2.34*	110.02	107.27	0.02
	Disabilities <sup>b</sup>			93.39	104.36	
55–64 years	No disabilities	655.70	1.76	114.97	11.94	0.08
	Disabilities <sup>b</sup>			101.66	115.74	
65+ years	No disabilities	858.62	3.59*	132.89	130.49	<.001
	Disabilities <sup>b</sup>			104.98	122.87	

*Note.* Participant information was gathered from the 2006 Montana BRFS data for noninstitutionalized adults aged 18 and older. Participants unsure about their participation frequencies or refusing to answer were excluded from these analyses.

<sup>a</sup>Outdoor Recreation Participation Index Score is based on a scale ranging from 0–365. Respondents were assigned an index number based on their reported participation in their primary outdoor recreational activity (times per week, times per month, or times per year). Index numbers represent the numbers of days spent recreating during a year assuming that there are 365 days in a year, 12 months or 52 weeks in a year, 4 weeks or 30 days in a month, and 7 days in a week.

<sup>b</sup>Disability status is determined by a yes response to one of the following questions: “Are you limited in any activities because of physical, mental, or emotional problems?” and “Do you now have any health problem that requires you to use special equipment, such as a cane, a wheelchair, a special bed, or a special telephone?”

\* $p < .05$ .

**Set II: Outdoor Recreation and Depression Among Individuals With Disabilities**

**Multiple regressions.** An initial multiple regression was conducted to predict the overall depression index score from age, income, and employment status. The results from this analysis showed that these variables accounted for a significant amount of the depression variability,  $R^2 = .11$ ,  $F(3, 1115) = 44.38$ ,  $p < 0.001$ , indicating that older employed individuals with disabilities that make more than \$50,000 per year tend to have lower depression index scores.

A second multiple regression analysis was performed to evaluate whether outdoor recreation participation can predict depression scores over and above the age, income, and employment variables. The outdoor recreation participation index scores accounted for a significant portion of the depression index variance after controlling for age, income, and employment,  $R^2$  change = .007,  $F(1, 1114) = 8.43$ ,  $p = 0.004$ . This finding suggests that individuals with disabilities who are relatively similar in age, income, and employment status tend to have lower depression scores if they participate more in outdoor recreation. The resulting regression equation for predicting depression scores from outdoor recreation participation after controlling for age, income, and employment is as follows:

$$\text{Depression Index Score} = -.004 \text{ Outdoor Recreation Participation Index} + 10.80$$

Table 3 reports the relative strength of age, income, employment status, and outdoor recreation participation when predicting depression index scores. These multiple regressions indicate that age accounts for 6.3%, income accounts for 2.8%, and employment accounts for 2.6% of the variance in depression index scores. Outdoor recreation accounts for a much smaller percentage (> 1%) of the variance in depression index scores.

**Table 3**

*The Bivariate and Partial Correlations of the Predictors With Depression Index*

Predictors	Correlation with depression index	
	Correlation with depression index	controlling for all other predictors
Age <sup>a</sup>	-.188**	-.251**
Income <sup>b</sup>	-.198**	-.168**
Employment <sup>c</sup>	-.141**	-.163**
Outdoor Recreation Participation <sup>d</sup>	-.095**	-.088**

<sup>a</sup>Age was aggregated into six different age groups (18–24 years, 25–34 years, 35–44 years, 45–54 years, 55–64 years, and 65 years old or older).

<sup>b</sup>Participants were dichotomized into two groups: those with annual household incomes less than \$50,000 and those with \$50,000 or greater.

<sup>c</sup>Respondents were classified as employed (including employed for wages or self-employed), unemployed, or other (including students, homemakers, retired individuals, and those unable to work) according to their survey responses.

<sup>d</sup>Outdoor recreation participation frequency was determined as individuals reported their participation per week, month, and year. Indicated frequencies were then developed into a raw participation index score for each respondent based on a 365-day year using the assumptions that there are 12 months or 52 weeks in a year, 4 weeks or 30 days in a month, and 7 days in a week.

\*  $p < .05$ , \*\*  $p < .01$

**Logistic regression.** Our logistic regression for predicting current major depression (index score  $\geq 10$ ) from dichotomized outdoor recreation participation indicated that individuals with disabilities participating in outdoor recreation decreased their odds for having current major depression by a factor of 1.723 ( $p = 0.001$ ,  $CI = 1.24$  to  $2.40$ ) (omnibus chi-square = 9.89,  $df = 1$ ,  $p < 0.001$ ). Even though age, income, and employment status were controlled, yearly participants in outdoor recreation were still less likely to have current major depression than those who never participated (odds ratio = 2.23,  $p < 0.001$ ,  $CI = 1.50$  to  $3.32$ ) (omnibus chi-square = 15.30,  $df = 1$ ,  $p < 0.001$ ).

**Independent sample t-test.** When comparing the mean depression index scores of individuals who did and did not participate in outdoor recreation, our independent sample *t*-test was significant: ( $t(321.28) = -4.06$ ,  $p < 0.001$ ,  $CI = -2.59$  to  $-0.87$ ). On average, individuals with disabilities participating in outdoor recreation ( $M = 4.96$ ,  $SD = 5.19$ ) had lower depression index scores than those not participating in outdoor recreation ( $M = 6.66$ ,  $SD = 5.96$ ). The effect size based on the means was small,  $d = 0.30$  (Green & Salkind, 2008).

**ANOVA.** A one-way analysis of variance was conducted to evaluate the relationship between participation frequencies (daily, four times a week, weekly, monthly, yearly, and never) and mean depression index scores. The ANOVA was significant ( $F(5, 1261) = 5.17$ ,  $p < 0.001$ ), and the strength of the relationship was small with outdoor recreation frequencies accounting for 2.0% of the variance of the depression index. We then conducted a follow-up test to evaluate the pairwise differences among the frequency means. Because the variances between the six groups ranged from 18.56 to 35.57, we assumed them to not be homogenous and thus employed the Dunnett's *C* test for post hoc comparisons. Results showed significant differences between the group that never participated in outdoor recreation ( $M = 6.66$ ,  $SD = 5.96$ ) and those who participated four times a week ( $M = 4.11$ ,  $SD = 4.30$ ), weekly ( $M = 4.94$ ,  $SD = 5.37$ ) and monthly ( $M = 5.67$ ,  $SD = 5.43$ ). However, no significance was found when compared to those who participate daily ( $M = 5.02$ ,  $SD = 4.80$ ) or yearly ( $M = 5.67$ ,  $SD = 5.43$ ). The means, standard deviations, and 95% confidence intervals resulting from the comparisons can be found in Table 4.

**Two-way ANOVA.** A 6 X 6 ANOVA was conducted to evaluate the effects of the six outdoor recreation participation frequencies and the six age groups on mean depression scores. In the previous regressions, age was found to account for the largest variance in depression and thus was the only demographic variable controlled for in the two-way ANOVA. The ANOVA indicated no significant interaction between outdoor participation and age,  $F(24, 1221) = 1.08$ ,  $p = .36$ , partial = .02. However, significant main effects were found for both outdoor recreation participation ( $F(5, 1221) = 4.70$ ,  $p < 0.001$ , partial = .02) and age ( $F(5, 1221) = 7.78$ ,  $p < 0.001$ , partial = .03). The means and standard deviations for depression mean scores as a function of these two variables can be found in Table 5. A follow-up ANOVA exploring the main effect of age on mean depression scores proved signifi-

cant ( $F(5, 1293) = 12.44, p < 0.001$ ), and the strength of the relationship was small, with age accounting for 4.6% of the variance of the depression index. A follow-up Dunnett's *C* test revealed significant differences between the depression scores of adults older than 65 ( $M = 3.80, SD = 5.35$ ) and those aged 25–34 ( $M = 6.80, SD = 5.83$ ), aged 35–44 ( $M = 6.58, SD = 5.86$ ), aged 45–54 ( $M = 6.39, SD = 6.06$ ), and aged 55–64 ( $M = 5.25, SD = 5.46$ ). No other significant differences in mean depression scores were found between the other age groups.

**Table 4**

*95% Confidence Intervals of Pairwise Differences in Mean Depression Index Scores for Participation Frequencies Compared to Never Participated*

Participation Frequency	<i>M</i>	<i>SD</i>	Never <sup>f</sup>
Daily <sup>a</sup>	5.02	4.80	-0.08 to 3.36
At least 4 times a week <sup>b</sup>	4.11	4.31	1.00 to 4.09*
Weekly <sup>c</sup>	4.94	5.37	0.41 to 3.03*
Monthly <sup>d</sup>	5.01	5.23	0.03 to 3.27*
Yearly <sup>e</sup>	5.67	5.43	-0.77 to 2.74
Never <sup>f</sup>	6.66	5.96	-

*Note.* Depression Index Score is based on a scale ranging from 0–24 points. One whole index point represents up to 5 days of a particular depressive symptom, or a combination of symptoms, during a 2-week period.

*Note.* Participant information gathered from the 2006 Montana BRFS data for noninstitutionalized adults aged 18 and older. Participants unsure about their participation frequencies or refusing to answer were excluded from these analyses.

<sup>a</sup> 7+ times per week. <sup>b</sup> 4–6 times per week. <sup>c</sup> 1–3 times per week. <sup>d</sup> 1–3 times per month. <sup>e</sup> 1–11 times per year. <sup>f</sup> no participation in outdoor recreation during the year.

\*  $p < .05$  using Dunnett's *C* procedure.

## Discussion

### Relationship Between Outdoor Recreation and Depression Among Persons With Disabilities

Our findings support our hypothesis that there is a significant relationship between outdoor recreation participation and depression among individuals with disabilities, albeit rather weak. Although our regressions, *t*-tests, and ANOVA all indicate a significant negative relationship, the nature of our data does not allow us to assume causality. Findings that appear to indicate that participation in outdoor recreation reduces depression can likewise be understood to indicate that individuals with depression are less likely to participate in outdoor recreation. Therefore, either variable might be dependent on the other, or it is possible that they are interdependent to some degree, and further study is recommended.

**Table 5***Means and Standard Deviations for Mean Depression Index Scores*

Age	Participation Frequency	Mean	SD
18–24	Daily <sup>a</sup>	1.00	3.65
	≥ 4 times a week <sup>b</sup>	5.00	3.65
	Weekly <sup>c</sup>	3.78	1.72
	Monthly <sup>d</sup>	10.50	3.65
	Yearly <sup>e</sup>	2.00	5.16
25–34	Never <sup>f</sup>	g	g
	Daily	5.00	5.16
	≥ 4 times a week	7.00	1.72
	Weekly	6.61	0.93
	Monthly	5.17	1.50
35–44	Yearly	5.83	2.11
	Never	11.20	2.31
	Daily	6.08	1.43
	≥ 4 times a week	5.50	1.63
	Weekly	6.90	0.68
45–54	Monthly	5.80	1.03
	Yearly	5.67	1.05
	Never	8.58	1.50
	Daily	4.52	1.13
	≥ 4 times a week	4.89	0.99
55–64	Weekly	5.57	0.45
	Monthly	6.05	0.84
	Yearly	6.97	0.90
	Never	9.91	0.80
	Daily	4.52	0.93
65+	≥ 4 times a week	4.45	0.84
	Weekly	5.09	0.47
	Monthly	4.76	0.74
	Yearly	4.61	0.79
	Never	7.58	0.68
65+	Daily	4.75	0.78
	≥ 4 times a week	2.61	0.74
	Weekly	2.97	0.46
	Monthly	3.42	0.84
	Yearly	5.46	1.05
65+	Never	4.59	0.47

*Note.* Depression Index Score is based on a scale ranging from 0–24 points. One whole index point represents up to 5 days of a particular depressive symptom, or a combination of symptoms, during a 2-week period.

*Note.* Participant information gathered from the 2006 Montana BRFSS data for noninstitutionalized adults aged 18 and older. Participants unsure about their participation frequencies or refusing to answer were excluded from these analyses.

<sup>a</sup> 7+ times per week. <sup>b</sup> 4–6 times per week. <sup>c</sup> 1–3 times per week. <sup>d</sup> 1–3 times per month. <sup>e</sup> 1–11 times per year. <sup>f</sup> no participation in outdoor recreation during the year. <sup>g</sup> this level of combination factors was not observed, and thus the corresponding population marginal mean is not estimable.

In our multiple regressions, the negative relationship between outdoor recreation participation and depression appears to be very flat ( $B = -0.004$ ,  $CI = -0.006$  to  $-0.001$ ). The rather inconsequential appearance of this negative relationship is largely due to the different scales used for the two variables (i.e., 0–365 for outdoor recreation, 0–24 for depression). The disproportion in scales also explains why a substantial increase in outdoor recreation frequency (e.g., from never to four times a week) is associated with a disproportionately small reduction in mean depression score (e.g., from 6.66 to 4.11) as found in our ANOVA. In this instance, it is important to remember that an individual's depression score is determined by the prevalence of eight different depressive symptoms over a 2-week period. There-

fore, a lower depression score indicates fewer depressive symptoms during the past 2 weeks. Additional studies are needed to quantify the change in depression symptoms according to outdoor recreation participation frequency.

When attempting to predict current major depression from outdoor recreation participation, our logistic regression indicated that individuals with disabilities participating in outdoor recreation were less likely to have current major depression than those who never participated even while controlling for age, income, and employment status. The recreation variable for this analysis was dichotomized for greater significance, but finer detail could be added to this analysis by running several additional regressions that attempt to predict current major depression from the six categories of outdoor recreation participation frequency.

Our ANOVA indicates that the lowest mean depression score was found among those participating in outdoor recreation four to six times per week ( $M = 4.11$ ,  $SD = 4.30$ ) and that all recreation participation frequency groups have lower mean depression scores than those never participating. However, a significant relationship was not found for those participating daily ( $M = 5.02$ ,  $SD = 4.80$ ) or yearly ( $M = 5.67$ ,  $SD = 5.43$ ). Although the lack of a significant relationship might be expected among the yearly participants, further research is needed to understand its absence among those who daily participate in outdoor recreation.

As we had expected from our literature review, age, income, and employment status were also related to depression. As we controlled for these variables in the multiple regressions and logistic regression, the relationship between outdoor recreation participation and depression remained significant. Also, when controlling for the age in the two-way ANOVA, we found no significant interaction between age and outdoor recreation participation. However, there was a significant relationship between mean depression scores and the age categories. In particular, adults over age 65 had significantly lower mean depression scores than individuals between ages 25 and 64. Further exploration into this relationship, in combination with outdoor recreation, would contribute to the findings of this study. Age also was found to be important when comparing the mean outdoor recreation participation scores of persons with disabilities with the scores of persons without disabilities. Individuals with disabilities over age 65 or between ages 45 and 54 were found to participate significantly less in outdoor recreation than individuals without disabilities of a similar age. This significance was not found among those aged 18–44 or aged 55–64.

### **Recommendations**

The findings of this study identify a negative correlation between outdoor recreation participation and depression symptoms. However, all of the analyses indicate that the effect size is rather weak. Future experimental studies aimed at identifying causality and the strength of the effect size will add significant understanding to some of our findings. For instance, if future evidence shows that increased outdoor recreation participation can significantly reduce depression scores, our findings would recommend that individuals with disabilities engage in outdoor recreation at least four times per week. Therefore, it is our recommendation that controllable, experimental studies be conducted to identify causality

while focusing on particular subgroups identified in this study (e.g., older adults, persons participating daily in outdoor recreation, and certain types of outdoor recreation). Given the small effect, we suggest that these studies be experimental with adequately sized sample populations chosen to control for confounding variables that may mask the relationship, such as age, income, and type of outdoor recreation. Studies of these types could help support the disability initiative found in *Healthy People 2010*, which focuses on the reduction of feelings of sadness, unhappiness, or depression that interfere with the life activities of persons with disabilities (U.S. Department of Health and Human Services, 2000).

### **Limitations**

The data collected for this study by the BRFSS survey allow only for correlational analyses, and thus we cannot determine any causal relationship between depressive symptoms and outdoor recreation. The BRFSS also makes it difficult to achieve accurate estimates because phone surveys may exclude individuals of low socioeconomic status, people with severe mental or physical disabilities, and institutionalized individuals. As such, this study may have excluded persons likely experiencing higher levels of depression and disability. Furthermore, the adaptation of the PHQ-8 used in the 2006 BRFSS survey required that respondents' answers be recategorized to match the original structure of the PHQ-8. It is possible that this recategorization could misrepresent the respondents' intended answers and subsequently skew the results. However, the BRFSS adaptation of the PHQ-8 has been validated as an accurate measure of depression prevalence in the United States (Kroenke et al., 2009). Another limitation arises from the BRFSS methods for collecting and evaluating outdoor recreation participation. In the survey, individuals were asked to report how often they participated in their most common outdoor recreational activity. This method of measurement does not allow respondents to report days spent engaged in various outdoor recreation activities and also assumes that each activity is equal (both a 30-minute walk and an all-day canoeing trip count as 1 day of outdoor recreation). Due to this limitation, while the findings in this study suggest that there is a weak relationship between *frequency* of participation in outdoor recreation and depression ratings, this study isn't able to definitively address the *nature* of participation in outdoor recreation and depression ratings. Further research that explores the nature and type of participation in outdoor recreation is encouraged. Finally, the phrasing of the BRFSS disability questions does not allow us to identify particular disability types or limitations. Therefore, it is possible that individuals were included in this study as having a disability because they felt limited in their activities due to "mental or emotional problems" (CDC, 2006). If we were to select only those who use equipment as our disability group, we would also be selecting those who are less likely to participate in outdoor recreation due to accessibility issues. Furthermore, the selection of those only using equipment provides an inaccurate representation of individuals with disabilities in Montana. Using a broader designation of disability consistent with *Healthy People 2010* (U.S. Department of Health and Human Services, 2000) and other reports (Rimmer, 2007; Strine et al., 2009; Wolf et al., 2008), this study more accurately represents all disability types in Montana.

## Conclusion

This study shows that there is a negative relationship between outdoor recreation and depression among individuals with disabilities. From this demographic, outdoor recreation participants decreased their odds of having current major depression by a factor of 1.723 when compared to individuals who did not participate in outdoor recreation during the past year. Also, individuals with disabilities who participated monthly, weekly, and four to six times per week had significantly lower overall depression scores than those who never participated in outdoor recreation. The strongest negative correlation was found among individuals who participated in outdoor recreation four to six times per week. However, the relationship between outdoor recreation and depression among individuals with disabilities was relatively weak. Future experimental studies are needed in order to fully understand the causal relationship between outdoor recreation and depression among different subgroups of individuals with disabilities.

## References

- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4<sup>th</sup> ed.). Washington, DC: Author.
- Barry, L.C., Allore, H. G., Bruce, M. L., & Gill, T. M. (2009). Longitudinal association between depressive symptoms and disability burden among older persons. *Journal of Gerontology Series A Biological Sciences: Medical Sciences*, *64*, 1325-1332.
- Berman, M. G., Jonides, J., & Kaplan, S. (2008). The cognitive benefits of interacting with nature. *Psychological Science*, *19*, 1207-1212.
- Berto, R. (2005). Exposure to restorative environments helps restore attention capacity. *Journal of Environmental Psychology*, *25*, 249-259.
- Blazer, D. (2009). Depression in late life: Review and commentary. *Journal of Lifelong Learning in Psychiatry*, *12*, 118-136.
- Brault, M. (2008). *Americans with disabilities: 2005*. Washington, DC: U.S. Census Bureau.
- Bruce, M. (2000). Depression and disability. In G. Williamson, P. Parmelee, & D. Shaffer (Eds.), *Physical illness and depression in older adults—A handbook of theory, research, and practice* (pp. 11-29) New York, NY: Kluwer Academic/Plenum Publishers.
- Buettner, L. L., & Fitzsimmons, S. (2002). AD-venture program: Therapeutic biking for the treatment of depression in long-term care residents with dementia. *American Journal of Alzheimer's Disease and Other Dementias*, *17*, 121-127.
- Cavanagh, J. T., Carson, A. J., Sharpe, M., & Lawrie, S. M. (2003). Psychological autopsy studies of suicide: A systematic review. *Psychological Medicine*, *33*, 395-405.
- Centers for Disease Control and Prevention. (2006). *2006 behavioral risk factor surveillance system Montana state questionnaire*. Atlanta, GA: Author.
- Charles, S., Reynolds, C., & Gatz, M. (2001). Age-related differences and changes in positive and negative affect over 23 years. *Journal of Personal Social Psychology*, *80*, 136-151.



- Christensen, K. M., Holt, J. M., & Wilson, J. F. (2011). *The relation between outdoor recreation and depression among older adults*. Manuscript submitted for publication.
- Cimprich, B., & Ronis, D. L. (2003). An environmental intervention to restore attention in women with newly diagnosed breast cancer. *Cancer Nursing, 26*, 284-292.
- Denissen, J. J. A., Penke, L., Schmitt, D. P., & van Aken, M. A. G. (2008). Self-esteem reactions to social interactions: Evidence for sociometer mechanisms across days, people, and nations. *Journal of Personality and Social Psychology, 95*, 181-196.
- Dimidjian, S., Hollon, S. D., Dobson, K. S., Schmalzing, K. B., Kohlenberg, R. J., Addis, M. E., . . . Jacobson, N. S. (2006). Randomized trial of behavioral activation, cognitive therapy, and antidepressant medication in the acute treatment of adults with major depression. *Journal of Consulting and Clinical Psychology, 74*, 658-670.
- Frances, K. (2006). Outdoor recreation as an occupation to improve quality of life for people with enduring mental health problems. *British Journal of Occupational Therapy, 69*, 182-186.
- Field, M. J., & Jette, A. M. (Eds.). (2007). *The future of disability in America*. Washington, DC: National Academic Press.
- Green, S. B., & Salkind, N. J. (Eds.). (2008). *Using SPSS for Windows and Macintosh: Analyzing and understanding data* (5<sup>th</sup> ed.). Upper Saddle River, NJ: Pearson Education.
- Greenberg, P. E., Kessler, R. C., Birnbaum, H. G., Leong, S. A., Lowe, S. W., Berglund, P. A., & Corey-Lisle, P. K. (2003). The economic burden of depression in the United States: How did it change between 1990 and 2000? *Journal of Clinical Psychiatry, 64*, 1465-1475.
- Harman, J. S., Edlund, M. J., & Fortney, J. C. (2004). Disparities in the adequacy of depression treatment in the United States. *Psychiatric Services, 55*, 1379-1385.
- Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., & Garling, T. (2003). Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology, 23*, 109-123.
- Hollon, S. D., Thase, M. E., & Markowitz, J. C. (2002). Treatment and prevention of depression. *American Psychological Society, 3*, 39-77.
- Kessler, R. C., Berglund, P., Demler, O., Jin, R., Koretz, D., Merikangas, K. R., & Wang, P. S. (2003). The epidemiology of major depressive disorder: Results from the National Comorbidity Survey Replication (NCS-R). *Journal of the American Medical Association, 289*, 3095-3105.
- Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walter, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry, 62*, 593-602.
- Kessler, R. C., Chiu, W. T., Demler, O., Merikangas, K. R., Walter, E. E. (2005). Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry, 62*, 617-627.

- Kim, C., Lesage, A., Seguin, M., Lipp, O., Vanier, C., & Turecki, G. (2003). Patterns of comorbidity in male suicide completers. *Psychological Medicine, 33*, 1299-1309.
- Kinne, S., Patrick, D. L., & Doyle, D. L. (2004). Prevalence of secondary conditions among people with disabilities. *American Journal of Public Health, 94*, 443-445.
- Koenig, H. G., & George, L. K. (1998). Depression and physical disability outcomes in depressed medically ill hospitalized older adults. *American Journal of Geriatric Psychiatry, 6*, 230-247.
- Kroenke, K., & Spitzer, R. L. (2002). The PHQ-9: A new depression and diagnostic severity measure. *Psychiatric Annals, 32*, 509-521.
- Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine, 16*, 606-613.
- Kroenke, K., Strine, T. W., Spitzer, R. L., Williams, J. B. W., Berry, J. T., & Mokdad, A. H. (2009). The PHQ-8 as a measure of current depression in the general population. *Journal of Affective Disorders, 114*(1-3), 163-173.
- Kroenke, K., Theobald, D., Wu, J., Loza, J. K., Carpenter, J. S., & Tu, W. (2010). The association of depression and pain with health-related quality of life, disability, and health care use in cancer patients. *Journal of Pain and Symptom Management, 40*, 327-341.
- Lenze, E. J., Martire, L. M., Rollman, B. L., & Schulz, R. (2001). The association of late life depression and anxiety with physical disability: A review of the literature and prospectus for future research. *American Journal of Geriatric Psychiatry, 9*, 113-135.
- Maller, C., Townsend, M., Pryor, A., Brown, P., & St. Leger, L. (2006). Healthy nature healthy people: 'Contact with nature' as an upstream health promotion intervention for populations. *Health Promotion International, 21*, 45-54.
- Marttunen, M. J., Aro, H. M., Henriksson, N. M., & Lonnqvist, J. K. (1991). Mental disorders in adolescent suicide: DSM-III-R axes I and II diagnoses in suicides among 13 to 19 year olds in Finland. *Archives of General Psychiatry, 48*, 834-839.
- Martin, L. G., Schoeni, R. F., Freedman, V. A., & Andreski, P. (2007). Feeling better? Trends in general health status. *Journal of Gerontology, 62B*, 511-521.
- Mathers, C. D., & Loncar, D. (2006). Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Medicine, 3*, e442. doi:10.1371/journal.pmed.0030442
- Montana Fish, Wildlife & Parks. (2008). *Montana statewide comprehensive outdoor recreation plan 2008 to 2012*. Retrieved from <http://fwpiis.mt.gov/content/get-Item.aspx?id=17907>
- Mooney, P. F., & Milstein, S. L. (1994). Assessing the benefits of a therapeutic horticulture program for seniors in intermediate care. In M. Francis, P. Lindsay, & R. J. Stone (Eds.), *The healing dimension of people-plant relations: Proceedings of a research symposium* (pp.173-187). Davis, CA: Center for Research and Design.
- National Survey on Recreation and the Environment. (2009). USDA Forest Service and University of Georgia, Athens, GA. In H. K. Cordell, G. T. Green, & C. J. Betz, *Long-term national trends in outdoor recreation activity participations 1980*

- to now: A recreation research report in the Internet Research Information Series*. Retrieved from <http://warnell.forestry.uga.edu/nrrt/nsre/IRISRec/IRISRec12rpt.pdf>
- Norman, J., Annerstedt, M., Boman, M., & Mattsson, L. (2010). Influence of outdoor recreation on self-rated human health: Comparing three categories of Swedish recreationalists. *Scandinavian Journal of Forest Research*, *25*, 234-244.
- Okoro, C. A., McKnight-Eily, L. R., Strine, T. W., Crews, J. E., Holt, J. B., & Balluz, L. S. (2010). State and local area estimates of depression and anxiety among adults with disabilities in 2006. *Disability and Health Journal*, *4*(2), 78-90. doi:10.1016/j.dhjo.2010.05.001
- Oreskovich, J., & Cummings, S. J. (2009). Depression and anxiety among Montana adults—BRFSS 2006 findings. *Montana Fact[or]s*, Winter.
- Ormel, J., Rijdsdijk, F. V., Sullivan, M., van Sonderen, E., & Kempen, G. I. J. M. (2002). Temporal and reciprocal relationship between IADL/ADL disability and depressive symptoms in late life. *Journal of Gerontology Series B Psychological Sciences: Social Sciences*, *57*, 338-347.
- Ormel, J., Von Korff, M., Vanden Brink, W., Katon, W., Brilman, E., & Oldehinkel, T. (1993). Depression, anxiety, and disability show synchrony of change. *American Journal of Public Health*, *83*, 385-390.
- Penninx, B. W. J. H., Deeg, J. H., van Eijk, J. T. M., Beekman, A. T. F., & Guralnik, J. M. (2000). Changes in depression and physical decline in older adults: A longitudinal perspective. *Journal of Affective Disorders*, *61*, 1-12.
- Penninx, B. W. J. H., Guralnik, J. M., Ferrucci, L., Simonsick, E. M., Deeg, D. J. H., & Wallace, R. B. (1998). Depressive symptoms and physical decline in community-dwelling older persons. *Journal of American Medical Association*, *27*, 1720-1726.
- Preister, K., Malone, T., & James Kent Associates. (2009). *A recreation assessment of Northwest Oregon: Current conditions, trends, and opportunities*. Retrieved from [http://www.oregon.gov/ODF/STATE\\_FORESTS/docs/Recreation/Analysis\\_of\\_Rec\\_Needs-Final\\_Report\\_3-09-09.pdf?ga=t](http://www.oregon.gov/ODF/STATE_FORESTS/docs/Recreation/Analysis_of_Rec_Needs-Final_Report_3-09-09.pdf?ga=t)
- Pothukuchi, K., & Bickes, J. (2001). *Youth nutrition gardens in Detroit: A report on benefits, potential, and challenges*. Detroit, MI: Wayne State University.
- Rawson, H. E. (1994). Camping and childhood depression. *Camping Magazine*, *66*, 28-35.
- Rihmer, Z. (2001). Can better recognition and treatment of depression reduce suicide rates? A brief review. *European Psychiatry*, *16*, 406-409.
- Rimmer, J. H. (2007). Physical activity among adults with a disability—United States, 2005. *Morbidity and Mortality Weekly Report*, *36*, 1021-1024.
- Rioux, M. H., & Valentine, F. (2006). Does theory matter? Exploring the nexus between disability, human rights, and public policy. In R. F. Devlin & D. Pothier (Eds.), *Critical Disability Theory* (pp. 47-69) Vancouver: University of British Columbia Press.
- Rodiek, S. (2002). Influence of an outdoor garden on mood and stress in older persons. *Journal of Therapeutic Horticulture*, *13*, 13-21.
- Rosenberger, R. S., Bergerson, T. R., & Kline, J. D. (2009). Macro-linkages between health and outdoor recreation: The role of park and recreation provider. *Journal of Park and Recreation Administration*, *27*, 8-20.

- Roshanaei-Moghaddam, B., Katon, W. J., & Russo, J. (2009). The longitudinal effects of depression on physical activity. *General Hospital Psychiatry, 31*, 306-315.
- Roth, A., & Fonagy, P. (2005). *What works for whom? A critical review of psychotherapy research* (2nd ed.). New York, NY: Guilford.
- Schieman, S., van Gundy, K., & Taylor, K. (2002). The relationship between age and depressive symptoms: A test of competing explanatory and suppression influences. *Journal of Aging and Health, 14*, 260-285.
- Schillerstrom, J. E., Royall, D. R., & Palmer, R. F. (2008). Depression, disability and intermediate pathways: A review of longitudinal studies in elders. *Journal of Geriatric Psychiatry and Neurology, 21*, 183-197.
- Sheare, R. M. (1975). Camping as a therapeutic experience for depressed and schizophrenic patients. *Hospital and Community Psychiatry, 26*, 494-497.
- Siikamäki, J. (2009). *Use of time for outdoor recreation in the United States, 1965-2007* (RFF Discussion Paper No. 09-18). Retrieved from <http://rff.org/RFF/Documents/RFF-DP-09-18.pdf>
- Spates, C. R., Pagoto, S., & Kalata, A. (2006). A qualitative and quantitative review of behavioral activation treatment of major depressive disorder. *The Behavior Analyst Today, 7*, 508-518.
- Stewart, W. F., Chee, E., Ricci, J. A., Hahn, S. R., & Morganstein, D. (2003). Cost of lost productive work time among US workers with depression. *Journal of American Medical Association, 289*, 3135-3144.
- Stokols, D. (1995). Translating social ecological theory into guidelines for community health promotion. *American Journal of Health Promotion, 10*, 282-298.
- Strine, T. W., Kroenke, K., & Dhingra, S. (2009). The associations between depression, health-related quality of life, social support, life satisfaction, and disability in community dwelling US adults. *Journal of Nervous and Mental Disease, 1*, 61-64.
- Taylor, A. F., Kuo, F. E., & Sullivan, W. C. (2002). Views of nature and self-discipline: Evidence from inner-city children [Special issue]. *Journal of Environmental Psychology, 22*, 49-63.
- Townsend, M. (2006). Feel blue? Touch green! Participation in forest/woodland management as a treatment for depression. *Urban Forestry & Urban Greening, 5*, 111-120.
- U.S. Department of Health and Human Services. (1999). *Mental health: A report of the Surgeon General*. Retrieved from <http://www.surgeongeneral.gov/library/mentalhealth/home.html>
- U.S. Department of Health and Human Services. (2000). *Healthy people 2010, 2 vols* (2<sup>nd</sup> ed.). Washington, DC: U.S. Government Printing Office.
- Von Korff, M., Ormel, J., Katon, W., & Lin, E. H. (1992). Disability and depression among high utilizers of health care. A longitudinal analysis. *Archives of General Psychiatry, 49*, 91-100.
- Warburton, D. E. R., Nicol, C. W., & Bredin, S. S. D. (2006). Health benefits of physical activity: The evidence. *Canadian Medical Association Journal, 174*, 801-809.
- Wassman, K. B., & Iso-Ahola, S. E. (1985). The relationship between recreation participation and depression in psychiatric patients. *Therapeutic Recreation Journal, 19*, 63-70.

- Weich, S., Blanchard, M., Prince, M., Burton, E., Erens, B., & Sproston, K. (2002). Mental health and the built environment: Cross-sectional survey of individual contextual risk factors for depression. *British Journal of Psychiatry, 180*, 428-433.
- Weilburg, J. B., O'Leary, K. M., Meigs, J. B., Hennen, J., & Stafford, R. S. (2003). Evaluation of the adequacy of outpatient antidepressant treatment. *Psychiatric Services, 54*, 1233-1239.
- Wolf, L. A., Armour, B. S., & Campbell V. A. (2008). Racial/ethnic disparities in self-rated health status among adults with and without disabilities—United States, 2004–2006. *Morbidity and Mortality Weekly Report, 57*, 1069-1073.
- Young, A. S., Klap, R., Sherbourne, C. D., & Wells, K. B. (2001). The quality of care for depressive and anxiety disorders in the United States. *Archives of General Psychiatry, 58*, 55-61.
- Zack, M. M., Moriarty, D. G., Stroup, D. F., Ford, E. S., & Mokdad, A. H. (2004). Worsening trends in adult health-related quality of life and self-rated health: United States, 1993–2001. *Public Health Reports, 119*, 493-505.