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Measuring Postinjury Depression Among Male and Female Competitive Athletes

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Depression is common among athletes following sport injury, yet few studies have explored the severity of postinjury depression. Among those studies, only one examined gender differences although women in the general population are more likely than men to experience depression. No research to date has used interviews to assess depression despite their standard use among mental health professionals. In a quasi-experimental design, we used a self-report checklist and a clinical interview to compare depression among male and female athletes at 1 week, 1 month, and 3 months postinjury. Results revealed significant effects of group (injured vs. control) and time (since injury), and these effects were different for the two depression measures. We also explored the sensitivity and specificity of the user-rated checklist in identifying severely depressed athletes compared with the interview. Findings underscore the importance of multimodal approaches and clinical judgment when evaluating athletes' postinjury depression symptoms.

Keywords: measurement, major depressive disorder, mental health, sport injury, psychological response

An athlete may experience a wide range of psychosocial reactions in response to athletic injury. Although some literature suggests that athletes can have an adaptive or even mixed (i.e., concurrent positive and negative) response to injury (Brewer, Linder, & Phelps, 1995; Smith, Scott, O'Fallon, & Young, 1990; Udry, 1999; Udry, Gould, Bridges, & Beck, 1997), the majority of research thus far has focused on negative postinjury reactions. It has been well documented that athletes with injuries experience greater levels of psychological distress than athletes

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without injures (Brewer, 2001; Petrie & Perna, 2004), with depression emerging as one of the most common emotional reactions to injury (Brewer, 2001).

Sport scientists have used the term *depression* to reflect both negative affect (i.e., depressed mood) and psychiatric disturbance (i.e., major depression). However, there are important distinctions between depressed mood and major depression. Depressed mood is a transient state of feeling sad or down, whereas major depression is a medical condition consisting of an array of symptoms beyond merely depressed mood. Individuals diagnosed with a major depressive disorder (MDD) exhibit multiple symptoms, including decreased motivation and/or interest in activities, low energy, a loss of pleasure, impaired concentration, changes in sleep and/or appetite, and feelings of worthlessness or hopelessness (APA, 2000; NIMH, 2000a). This constellation of symptoms, in turn, impairs somatic, cognitive, psychomotor, and social and/or occupational functioning for at least a 2-week duration (APA, 2000). Major depression has been associated with subsequent physical illness, disability, and death in the general population (NIMH, 2000b). Moreover, women are almost twice as likely as men to experience major depression each year (Blehar & Keita, 2003; NIMH, 2000a). Severe psychological disturbance following sport injury has been suggested to increase risk of suicide among athletes (Smith & Milliner, 1994). Suicidal ideation, which is itself a clear indication of hopelessness, is another hallmark symptom of major depression (APA, 2000). Despite these serious risks, no research to date has examined major depression among athletes following sport injury. To our knowledge, four published articles and one published abstract have examined depression symptoms among athletes with injuries (Brewer et al., 1995; Brewer & Petrie, 1995; Leddy, Lambert, & Ogles, 1994; Manuel et al., 2002; Petrie, Brewer, & Buntrock, 1997).

In a retrospective study, Brewer and Petrie (1995) surveyed collegiate football players from a nationally representative sample of National Collegiate Athletic Association (NCAA) Division I universities. Using the Center for Epidemiological Studies Depression (CES-D) Scale (Radloff, 1977), they compared depression symptom totals between athletes who had reported an injury the previous academic year (n = 488) and those who had reported no injuries (n = 428). Results indicated that athletes who sustained an injury during the previous year reported significantly higher depression symptom scores than athletes who had not been injured in the past year. Using an established cutoff of CES-D total score > 16 (Husani, Neff, Harrington, Hughes, & Stone, 1980), authors estimated that 33% of athletes with injury histories and 27% of those without injury histories could be classified as depressed. No statistical comparison was made between athlete groups, as results were merely reported as clinically meaningful to sport scientists and health care professionals. In a related study with other collegiate athletes that also included women, Petrie, Brewer, & Buntrock (1997) reported higher depression scores on the CES-D among women who had been injured during the previous year than those women who had not been injured. In contrast to the previous study, they did not find any between-group difference in depression among men in this sample. Despite the large athlete sample in these studies (combined N = 2924), depression symptom scores and injury status in this study were obtained using a retrospective design. Fortunately, subsequent researchers

have minimized the time between injury occurrence and measuring athletes' depression.

To explore a variety of theoretically based situational factors associated with athletes' emotional adjustment to injury, Brewer, Linder, and Phelps (1995) examined a cross-section of both men and women who were being seen in a community-based sports medicine clinic. Participants completed the Beck Depression Inventory (BDI) during a visit to the clinic. Among their sample (N = 121), an estimated 4.8% had BDI scores within the clinical range, although the specific cut-off score used to determine the range was not provided. Nonetheless, this suggests that a small percentage of athletes with injuries may experience severe depressive symptoms. Consistent with theory, participants' depression symptom severity was significantly related to self-reported impairment in sport participation and physician-rated recovery status. However, participants' depression symptom severity was not related to their injury severity. Unlike the previous two studies, there was no comparison group of healthy participants. Moreover, no data were offered relative to any potential gender differences in depression symptoms despite the inclusion of both men and women in their sample.

In one of only two studies using a prospective design, Leddy et al. (1994) examined depression symptoms with the BDI among collegiate male athletes (N = 313). Compared with a matched healthy control group, athletes who sustained a sport injury reported significantly greater depression symptoms at 1 week postinjury. At 2 months postinjury, athletes who were unable to participate reported greater depression symptoms than both healthy athletes and those who were injured but had returned to sport participation. Over half (51%) of athletes who sustained injuries during the study exhibited depression symptoms of at least mild severity (i.e., BDI scores ≥ 10), and an estimated 12% of their sample exhibited depression symptoms of comparable severity to adults in outpatient treatment for depression. This study, while improving upon several important design limitations in previous research, examined depression symptoms only among men.

Manuel et al. (2002) used the BDI to prospectively examine postinjury depression symptoms in 48 adolescent boys and girls. They collected data immediately following injury and again at 3, 6, and 12 weeks postinjury. Using a cutoff of BDI total score ≥16, they reported depression symptoms of at least moderate severity among athletes immediately postinjury as high as 27%. They reported approximately 21%, 17%, and 13% of athletes exhibited mild-to-moderate depression symptom severity at 3 weeks, 6 weeks, and 12 weeks postinjury, respectively. Compared with Leddy et al.'s (1994) 1 week and 2 months postinjury follow-up, this study included more frequent postinjury assessment (i.e., 4 total), which occurred across a longer duration (i.e., up to 3 months postinjury). However, no information was included regarding athletes' recovery status across the duration of the study, nor was a comparison group of healthy athletes included in this study.

Among the five studies reviewed here, three were retrospective designs and only two (i.e., Leddy et al., 1994; Manuel et al., 2002) used a prospective design. Situational factors, such as athletes' recovery/participation status, likely impact emotional adjustment to injury (Brewer, 2001), yet little is known about how this influences depression symptom severity. Among the two prospective studies, only Leddy et al. (1994) examined current sport participation status. Furthermore,

researchers have rarely included female athletes in their sample (i.e., Manuel et al., 2002; Petrie et al., 1997) despite the increased risk of depression among women (Blehar & Keita, 2003). Petrie et al.'s (1997) study was the only one to date that provided findings relative to gender differences in depression symptoms, where women with previous injury histories reported greater depression symptoms than women without a recent injury history. Both girls and boys were included in the Manuel et al. (2002) study, and although gender was significantly related to preinjury depression symptoms and subsequently used as a covariate in postinjury analysis, no data were provided to determine whether girls or boys reported greater depression symptoms.

Collectively, estimated rates of athletes' moderate-to-severe postinjury depression symptoms in these studies range between 5% and 21%, where an estimated 6.6% among the U.S. population aged 18 years and older suffers from MDD during any given year (Kessler et al., 2003). Brewer and Petrie (1995) acknowledged that symptom checklists like the CES-D are not typically used to diagnose clinical depression, while Leddy et al. (1994) provided evidence to support using the BDI as a clinical tool. Although the BDI and CES-D are well validated and widely used depression symptom checklists, the use of a clinician-administered interview is the conventional tool for assessing depression. This approach involves a trained professional who evaluates the presence and severity of depression symptoms across multiple domains, and also evaluates symptom duration and breadth of impairment, all of which are based upon the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV-TR) criteria for MDD (APA, 2000). To our knowledge, an interview-based approach to examine athletes' postinjury depression has not been attempted.

Therefore, our purpose was to examine athletes' postinjury depression symptoms using two different measurement strategies while addressing some of the design and sample limitations in previous literature. We sought to examine depression symptoms among healthy men and women and those with injuries using a paper-and-pencil symptom checklist and a clinician-based semistructured interview across three different occasions from 1 week to 3 months postinjury. We also evaluated the sensitivity and specificity of a depression symptom checklist, compared with a semistructured clinical interview, in identifying severely depressed athletes postinjury. Guided by current theory (Brewer, Andersen, & Van Raalte, 2002; Wiese-Bjornstal, Smith, Shaffer, & Morrey, 1998), we also explored the relationship between athletes' participation (recovery) status, total days missed due to injury, and postinjury depression symptom severity derived from the two measures.

Method

Participants

Our sample consisted of 164 student athletes (108 men and 56 women) ranging in age from 14 to 24 years (M = 19.7, SD = 2.0). Approximately 28% of the sample identified themselves as ethnic minorities (mainly African American or Hispanic/Non-White). Participants competed across nine varsity sports at two universities (NCAA Division I and II) and three area high schools located in the eastern United

States. Most of our participants were starters (71%) and competing at the collegiate level (85%). Sports in which participants were involved included football (46%), basketball (17%), soccer (15%), volleyball (9%), baseball (6%), gymnastics (4%), track and field (3%), and wrestling (1%).

Procedure

We obtained approval from all institutional and scholastic review boards in addition to athletes' informed consent (or assent and parental consent for minors) before the start of the project. As part of a larger multisite research project, athletes who were deemed healthy by their sports medicine staff were contacted and consented for participation during preseason training camps. As part of this larger study, athletes completed a battery of self-report questionnaires and had their injury and participation status monitored for one year (i.e., from preseason through the end of the current academic year).

Established injury definition criteria (AAOS, 1991; NCAA, 1996; Noyes, Lindenfeld, & Marshall, 1988; Shultz, Houglum, & Perrin, 2000) typically involves physical trauma or damage to the body that results in at least one day of missed sport participation. Because we sought to examine the impact of injuries beyond a mild severity for this study, we included a longer time-loss criteria than established injury definitions. We defined *injury* as physical trauma that resulted in restricted (no) participation for a minimum of one week. Once an athlete was referred to our research staff for postinjury interviews, a noninjured athlete was randomly selected, after matching on school, sport, gender, playing status, academic class standing (freshmen / sophomores vs. juniors / seniors), and ethnicity. Selected healthy controls were yoked to the identified athlete with injury, where each athlete-pair (injured and control) was interviewed at 1 week, 1 month, and 3 months postinjury.

Although we attempted to maintain equal *n*s for control ($n = 80$) and injury groups ($n = 84$) and to retain all participants across the duration of the study, this did not occur (see Table 1). Occasionally, athletes were unavailable for a postinjury assessment, and sometimes athletes with injuries were not referred to the research staff in time for a 1–week postinjury assessment, thus beginning their participation at 1 month postinjury. Matched healthy controls who sustained an injury during the study were moved to the injury group, and another matched healthy athlete was selected. As can be seen in Table 1, sample sizes at each fol-

Table 1 Sample Size Across Three Postinjury Assessments

Complete Assessments	1 Week	1 Month	3 Months
Injury Group ($n = 84$)	63	76	66
Healthy Group ($n = 80$)	74	73	54
Subtotal	137	149	120
Missing Data and/or Follow-up	27	15	44
Total	164	164	164

Note. Sample size is greater at the 1 month assessment because some athletes entered the study at that follow-up.

low-up were 134 (61 healthy athletes and 73 athletes with injuries) at 1 week follow-up, 149 (73 healthy athletes and 76 athletes with injuries) at 1 month follow-up, to 120 (54 healthy and 66 athletes with injuries) at 3 month follow-up, where 92 athletes completed all three postinjury assessments.

For those athletes who had available medical records on file (n = 155), two members of our research staff who were certified athletic trainers and blind to study data obtained information from athletes' medical records and/or sports medicine staff to validate that athletes included in the study had indeed sustained moderate or severe injuries. Severity of injury was rated on a 3-point scale (1: *mild*, 2: *moderate*, or 3: *severe*), and as expected, the majority (95%) of athletes' current injuries were rated as moderate or severe in nature. Types of injuries involved joints (e.g., ligaments and dislocations), muscle, bone (e.g., fractures), head (e.g., concussion), neck (i.e., cervical spine), and/or low back (i.e., disc). The most common injury sustained by participants involved the knee, including bone bruises or tears to the medial collateral and/or anterior cruciate ligaments (MCL, ACL). At each of the three postinjury assessments, athletes' medical staff provided us with their current recovery status (i.e., not returned to participation, modified/limited participation, full participation with no restrictions). Once an athlete had returned to full participation, we obtained the date of return and calculated the total days missed due to injury based on the original date of injury.

Measures

Two depression measurement approaches, a self-rated checklist and a clinician-rated semistructured interview, were administered at 1 week, 1 month, and 3 months postinjury. The first was the Center for Epidemiologic Studies Depression (CES-D) Scale. The CES-D is a widely used and reliable paper-and-pencil checklist of cognitive, affective, somatic, and behavioral aspects of depression (Radloff, 1977). The CES-D has been well validated with both adolescents and adults, and it has an established cut-off score criterion (total >16) that has been reliably associated with MDD (Husani et al., 1980). The second measure was part of the Hamilton Rating Scales (Hamilton, 1967; Schwab, Bialow, Clemmons, & Holzer, 1967), which are widely used and well-validated clinical interviews based upon the diagnostic criteria for a mood and/or anxiety disorder (APA, 2000). We used the semistructured interview guide for the Hamilton Rating Scale for Depression, or SIGH-D (Williams, 1988). The SIGH-D provides a continuous numerical rating reflective of the presence and severity of depression symptoms and yields a cutoff score (>16) that can be used to diagnose MDD (Moberg et al., 2001; Williams, 1988). Although diagnostic interviews for depression are typically conducted by a mental health provider, evidence supports that interviews could be administered by nonclinical personnel after appropriate training (Moberg et al., 2001; Williams, 1988). In our study, interviews were conducted by three doctoral students who were trained to criterion ($k \geq .90$) by a licensed psychologist with extensive experience in psychiatric assessment and the SIGH-D in particular.

Although neither the CES-D nor SIGH-D were administered before injury, we did have access to athletes' preinjury mood state for a subset of our sample as part of preseason screenings conducted for the larger study. Athletes' preinjury mood state was ascertained from a shortened version of the Profile of Mood States,

or POMS (Shacham, 1983), which, compared with the original 65-item POMS (McNair, Lorr, & Droppleman, 1992), has 37 items across the same six subscales (i.e., Tension, Anger, Depression, Confusion, Fatigue, and Vigor). On the basis that depressed mood is one of the hallmark symptoms of MDD, we tested for preexisting between-group differences on the POMS Depression (POMS-D) subscale among athletes in our sample with preseason data (90 of 164 athletes).

Data Analyses

Analyses of variance were conducted on athletes' POMS-D scores with injury group status and gender as independent variables. We used a repeated measures mixed-model design to evaluate the main and interactive effects of injury group (healthy and injured), time (1 week, 1 month, and 3 month follow-up) and gender on CES-D and SIGH-D total scores. Based upon existing literature, we expected that athletes with injuries, particularly women, would exhibit greater depression symptoms than healthy athletes, and we also expected both depression symptoms and severity to decline over time. A simple 2×2 classification table was used to estimate the sensitivity and specificity of the established CES-D cut-off ($\leq$16, >16) in identifying depression, considering the SIGH-D clinical cut-off of >16 as the gold standard definition of depression. Sensitivity is a statistical measure of how well a binary classification test correctly identifies a condition (i.e., major depression in this study), and this is calculated by comparing the results of a screening test (i.e., CES-D) to some absolute or gold standard (i.e., SIGH-D). Specificity, on the other hand, reflects the probability of correctly identifying the absence of a condition. For example, in this study, we calculated specificity to determine how well the CES-D classified athletes as *not depressed* when they were truly not depressed (according to the SIGH-D). Finally, we calculated Pearson correlations between depression scores (on the CES-D and SIGH-D) and the variables of recovery status and total days missed due to injury.

Results

No significant differences in preinjury POMS-D scores were found between healthy ($n = 47$) athletes and those who ultimately sustained injuries ($n = 43$), $F(1, 89) = 0.11$, $p = .74$, or between women and men (Ms = 7.13 and 4.99, SDs = 5.34 and 5.44, respectively), $F(1, 89) = 3.51$, $p = .06$, although the latter approached significance. Injury groups did not differ with respect to playing status, $F(1, 157) = 0.07$, $p = .80$. Among athletes with injuries, men sustained more severe injuries ($M = 2.71$, $SD = 0.64$) than women ($M = 2.36$, $SD = 0.73$), $F(1, 67) = 4.24$, $p < .05$, yet there was no significant gender difference in total days of missed participation, $F(1, 75) = 0.56$, $p = .46$.

The repeated measures analysis on CES-D scores showed a significant main effect for time, $F(2, 160) = 19.21$, $p < .001$, and a significant injury group by time interaction, $F(2, 160) = 5.48$, $p < .01$. There was no significant main effect of injury group or main effect for gender. Unadjusted mean CES-D scores by injury group, time, and gender are shown in Table 2. As can be seen in this table, mean CES-D scores declined across time in both groups (main effect of time), but they declined much more steeply for the athletes with injury than for those without

Table 2 Unadjusted CES-D Means (With Standard Deviation) for Healthy Athletes and Those With Injuries Across Postinjury Follow-Up

		Group			
		Healthy Athletes		Athletes with Injuries	
Time	Gender	Mean (*SD*)	*N*	Mean (*SD*)	*N*
1 Week	Women	16.83 (9.64)	23	18.56 (14.33)	25
	Men	12.34 (8.83)	38	17.17 (9.27)	48
	Total	14.03 (9.32)	61	17.64 (11.18)	73
1 Month	Women	13.11 (9.01)	26	11.59 (10.00)	27
	Men	11.89 (7.51)	47	12.63 (10.22)	49
	Total	12.33 (8.03)	73	12.26 (10.08)	76
3 Months	Women	11.29 (7.55)	17	10.45 (7.25)	20
	Men	11.51 (9.03)	37	9.48 (8.02)	46
	Total	11.44 (8.52)	54	9.77 (7.75)	66

Note. Significant differences across time, $p < .001$, and group $\times$ time, $p < .01$. $N = 164$; three athletes (1 injured and 2 healthy) had invalid survey data at 1 week postinjury.

injury. There were no statistically significant ($p < .05$) simple effects for group within any of the time periods. The difference between injury groups at Week 1 on the CES-D score approached significance at $p = .06$ (Cohen's $d = 0.35$), whereas at 1 month and 3 months between-group differences were not significant, ps = 0.96 and 0.32, respectively (ds = 0.007 and 0.21, respectively). Effect sizes for the significant main effect of time were $d = 0.38$ (1 week vs. 1 month), 0.58 (1 week vs. 3 months), and 0.20 (1 month vs. 3 months). In athletes with injury, the simple effect of time was significant at $p < .0001$; effect sizes for differences across time among athletes with injuries were $d = 0.51$ (1 week vs. 1 month), 0.81 (1 week vs. 3 months), and 0.27 (1 month vs. 3 months). However, among healthy controls, the corresponding simple effect of time was $p = .068$.

The repeated measures analysis on SIGH-D scores showed significant main effects for both injury group and gender, Fs (1, 160) = 13.01 and 6.91, ps < .0001 and .001, respectively, and a significant main effect for time, $F(2, 160) = 32.16$, $p < .0001$. There was also a significant injury group by time interaction, $F(2, 160) = 4.01$, $p < .05$. As can be seen in Table 3, the injured group had higher scores than the uninjured ($d = 0.46$), and women had higher scores than men ($d = .34$). Further, mean SIGH-D scores declined across time for both genders and in both groups (i.e., main effect of time), and as with the CES-D, the SIGH-D scores declined over time by a greater degree for those in the injured group compared with controls. Effect sizes for the main effects of time were $d = 0.45$ (1 week vs. 1 month), 0.87 (1 week vs. 3 months), and 0.37 (1 month vs. 3 months). The simple effects of time in both groups were highly significant; in the injury group, the simple effect of time was associated with a p value < 0.0001 (ds = 0.60, 1.06, and 0.38, respectively, for 1 week vs. 1 month, 1 week vs. 3 months, and 1 month vs. 3 months), whereas the simple effect of time in the healthy control group was $p = .0009$ (ds = 0.05, 0.72, and 0.42, respectively, for the above three comparisons). With respect to the simple effects of group within time, there were statistically significant differences in the SIGH-D scores between the two groups at 1 week and 1 month, $p < .0001$ and $p = .045$, respectively (ds = 0.75 and 0.33, respectively) but not at 3 months, $p = .10$ ($d = 0.40$).

Because our semistructured clinical interview conducted with athletes at 1 month and 3 months postinjury was based upon diagnostic criteria for MDD, we examined the sensitivity and specificity of the established CES-D cut-off for depression using the SIGH-D cutoff as the gold standard for defining depression. Classification of all athletes as depressed (≥16) or not depressed (<16) using the CES-D and SIGH-D at 1 month and 3 months postinjury are provided in Table 4. Out of the 13 athletes who were labeled as depressed at 1 month according to the gold standard (i.e., SIGH-D), 12 were identified as depressed on the CES-D. Thus, CES-D sensitivity was high (92.3%) at 1 month postinjury but rather poor at 3 months (40%; out of 5 classified as depressed on the SIGH-D, 2 were classified as depressed on the CES-D). The specificity of the CES-D appeared to be relatively consistent from 1 to 3 months postinjury. At 1 month, out of the 136 labeled as not depressed on the SIGH-D, 104 were identified as not depressed on the CES-D, for a specificity of 76.5%. The corresponding numbers for 3 months were 115 not depressed on the SIGH-D, and 90 not depressed on the CES-D (specificity of 78.3%).

Table 3 Unadjusted SIGH-D Means (With Standard Deviation) for Healthy Athletes and Those With Injuries Across Gender And Postinjury Follow-Up

		Athlete Group			
		Healthy		Injured	
Time	Gender	Mean (*SD*)	*N*	Mean (*SD*)	*N*
1 Week	Women	9.28 (5.65)	25	11.69 (5.93)	26
	Men	6.11 (4.66)	38	11.70 (6.39)	48
	Total	7.37 (5.27)	63	11.70 (6.19)	74
1 Month	Women	7.92 (6.96)	26	9.19 (7.37)	27
	Men	4.96 (3.75)	47	7.24 (5.73)	49
	Total	6.01 (5.28)	73	7.93 (6.38)	76
3 Months	Women	5.82 (4.26)	17	6.35 (4.82)	20
	Men	3.30 (2.71)	37	5.54 (4.83)	46
	Total	4.09 (3.44)	54	5.78 (4.80)	66

Note. Significant main effects for time and group, $ps < .0001$, and gender, $p < .001$; significant interaction effect for group by time, $p < .05$.

Table 4 SIGH-D and CES-D Classification of Athletes as Not Depressed or Depressed

		CES-D		
Time	SIGH-D	Not Depressed	Depressed	Total
1-month	Depressed	1	12	13
	Not Depressed	104	32	136
	Total	105	44	149
3-months	Depressed	3	5	5
	Not Depressed	90	25	115
	Total	93	27	120

Note. Total scores < or ≥ 16.

Zero-order Pearson correlations between athletes' CES-D and SIGH-D scores were significant at 1 week, 1 month, and 3 months postinjury assessments (rs = .72, .56, and .29, $p < .001$ for all). Athletes with injuries missed an average of 52.62 (± 48.46) days of sport participation due to their injury. The majority (86%) of those athletes had not yet returned to participation by 1 week postinjury. By 1 and 3 months postinjury, approximately half (55% and 48%, respectively) had returned to sport with either no or limited participation restrictions. Athletes' postinjury SIGH-D and CES-D scores were unrelated to total days missed but were significantly associated with their recovery status. At 1 month postinjury, greater restriction of participation (no or limited status) was significantly related to higher scores on both the CES-D and SIGH-D at 1 week postinjury (rs = –.29 and –.30, respectively, $p < .05$ for both). At 3 months postinjury, greater restriction of participation was significantly related to higher SIGH-D scores at that same time period ($r = –.31$, $p < .05$).

Discussion

It was our intent to compare postinjury depression symptoms between healthy men and women and those with injuries using two measurement strategies. Our data provided support for the expected chronological pattern of postinjury depression, wherein both athlete- and clinician-rated depression symptoms decreased over time. This finding is in agreement with previous research demonstrating a similar temporal pattern of depression across multiple postinjury assessments using healthy control athletes (Leddy et al., 1994). Clinician-based depression ratings for athletes with injuries exceeded those of healthy athletes at 1week and remained elevated above healthy controls up to 1 month postinjury, which is consistent with previous research on depression (Leddy et al., 1994) as well as other forms of emotional distress (see reviews by Brewer, 2001; Brewer & Cornelius, 2003).

We also expected female athletes to experience greater postinjury depression than their male counterparts, and this hypothesis was supported through the clinical interview. Women, regardless of injury status, exhibited greater depression

symptom severity than men in clinical interviews. It is interesting to note that mean SIGH-D scores for women and men with injuries were basically equivalent (i.e., 11.70) at 1 week (refer to Table 3). Although the group × gender interaction was not statistically significant, this may still be clinically meaningful to practitioners. A worthy consideration is that self-rated depression symptoms among the men and women in our athlete sample, regardless of injury status, differed from clinician-based ratings. Concurrent validity is high between self- and clinician-rated depression scales with nonathlete adolescent and adult samples; however, coefficients tend to be higher among females than males (Carroll, Feinberg, Smouse, Rawson, & Greden, 1981; Robbins, Alessi, Colfer, & Yanchyshyn, 1985; Shain, Naylor, & Alessi, 1990). Subsequent research on postinjury reactions should continue to include both men and women, especially considering potential coping differences (Anshel, 2001; Gould, Udry, Bridges, & Beck, 1997) and scholarly work on gender and the culture of physical risk and injury in sport (Nixon, 1996, 1994; Young & White, 1995).

This study was the first to use a clinical interview based upon criteria for the diagnosis of MDD in an athlete sample, and thus provided a first look at effectiveness of a user-rated depression symptom checklist in identifying severely depressed athletes postinjury. Considering the significant simple effects for group on the SIGH-D, athletes, regardless of gender, experienced an immediate elevation in depression symptoms after sustaining a severe sport injury that remained elevated up to 1 month. This between-group difference was not detected by the paper-and-pencil symptom checklist, although differences approached significance at 1 week ($p = .068$). Specificity of the checklist relative to the clinician interview was relatively stable from 1 to 3 months postinjury, whereas the CES-D consistently overestimated the prevalence of moderate-to-severe depression in our athlete sample. In contrast, however, CES-D sensitivity was initially high (>90%) and subsequently poor (<50%) at 1 month and 3 months, respectively. It is possible that athletes who experienced prolonged postinjury depression symptoms that were moderate to severe in nature were not accurately disclosing their status on the paper-and-pencil checklist. Athletes may have also become comfortable and therefore more open about their symptoms during interviews, particularly given the culture of competitive sport to minimize or even shame reactions perceived as mental weaknesses. Therefore, it is likely that athletes perceived their research participation as a therapeutic experience. Based on our findings, mixed-method designs (i.e., qualitative and quantitative inquiry) may be particularly useful to assess postinjury reactions.

Previous studies using symptom checklists have reported moderate-to-severe depression prevalences between 5% and 21% among athletes with injuries (Brewer et al., 1995; Leddy et al., 1994; Manuel et al., 2002; Petrie et al., 1997). In our sample, approximately 9.6% and 4.4% of athletes would likely meet criteria to warrant a diagnosis of MDD at 1 month and 3 months, respectively. Although these prevalences may be relatively low, elevated psychological distress (even of mild-to-moderate severity) may have important health implications for athletes. Evidence from previous research suggests that some athletes may experience postinjury psychological distress that remains elevated throughout rehabilitation and beyond physical recovery after returning to sport (LaMott, 1995; Leddy et al., 1994; Morrey, Stuart, Smith, & Wiese-Bjornstal, 1999; Newcomer & Perna, 2003;

Podlog & Eklund, 2006; Wiese-Bjornstal et al., 1998). In light of stress-mediated injury risk (Williams & Andersen, 2007), the presence of severe depression symptoms likely contributes to subsequent injury risk. Moreover, history of depression is a primary risk factor for future depression, and depression can impair treatment outcomes, lead to medical adherence behaviors (NIMH, 2000b), and induce immune dysregulation (Kiecolt-Glaser & Glaser, 2002). Considering the central role of the immune system for athletes' injury risk, rehabilitation and recovery, and adaptation to physical training (Clow & Hucklebridge, 2001), future research is sorely needed to explore depression-related health and recovery implications among sport and other physically active populations.

From a practical standpoint, we acknowledge the considerable cost of an interview-based assessment of athletes' depression, and most sports medicine clinics likely have no or limited access to sport psychologists that are trained in psychological assessment. Based upon our findings, there is clearly some degree of overlap in these two assessment strategies within the broad scope of postinjury depression. Therefore, a useful approach may include using depression symptom checklists such as the BDI or CES-D during preseason physicals and again with those athletes who sustain an injury. If athletes' depression symptoms exceed cutoff for moderate-to-severe depression, then further assessment by an appropriately trained professional could be made available. This is common practice within primary care settings that often do not have resources to perform mental health screenings, and ideally, sports medicine staff should work directly with a sport psychologist and/or certified consultant whenever available.[1]

Our study had limitations that are important to mention. We did not control for preexisting depression, and although our preliminary analyses confirmed there were no preexisting group differences in depressed mood, we cannot prove the direction of causality in these data. Nonetheless, the nature and pattern of our findings over the three time periods lends strong support to the hypothesis that in this sample, injury was a causal determinant of depression, rather than vice versa. In addition, our sample was drawn from both high school and collegiate settings and included athletes ranging in age from middle adolescence to adulthood (i.e., ages 14–24 years). While age was not examined in this study and little research has examined depression in child and adolescent athletes, findings from general research suggest that younger athletes (i.e., <18 years) may be more vulnerable to injury-related psychological distress such as depression than college athletes (i.e., ≥18 years) and depression symptoms may be exhibited differently across age or developmental status (Birmaher, Brent, & Benson, 1998). In fact, depression among adolescents has been associated with increased risk of illness as well as prolonged social impairment and psychological disturbance and is a risk factor for adult depression (Lau, Rijsdijk, Gregory, McGuffin, & Eley, 2007; Pine, Cohen, Cohen, & Brook, 1999). In sport, major negative life-event stress has been prospectively associated with sport injury incidence among adolescent athletes (Maddison & Prapavessis, 2005; Smith, Smoll, & Ptacek, 1990); hence, future research is needed to examine depression as both a psychological risk factor for sport injury and subsequent postinjury depression, particularly among adolescents. In addition

to age and developmental considerations, our sample was located in the mid-Atlantic United States and competed at the varsity level; therefore, findings from our study may not generalize to athletes competing on different levels or in other geographical locations.

Another limitation of this study was the operational definition of injury, which differed from previous research on postinjury depression. Among the five previous studies of postinjury depression, *injury* has been defined in one of three ways, including: athletes' retrospective recall of an injury during the previous year (i.e., Brewer & Petrie, 1995; Petrie et al., 1997), staff identification of athletes' sustained bodily harm or pain resulting in 1 missed day of sport participation (i.e., Brewer et al., 1995, Leddy et al., 1994), or staff identification of athletes who missed at least 3 weeks of sport participation (i.e., Manuel et al., 2002). Although injury criteria differed, our injury group closely resembled that of Manuel et al. (2002): athletes with injuries in our sample missed over a month of sport participation due to their injuries. Although discrepancies in the operational injury definition are clearly problematic (Petrie & Falkstein, 1998), this is quite common and by no means unique to psychological studies (Brooks & Fuller, 2006; Finch, 1997; Noyes et al., 1988). Studies using injury criteria that stray from existing definitions or those used in similar research should discuss findings relative to the injury criteria used.

In summary, we extended current literature in several noteworthy ways. First, our study is the first to use a clinician-administered diagnostic interview to assess athletes' postinjury depression. In addition, the use of a multimodal assessment strategy provided an opportunity to examine the sensitivity and specificity of depression symptom checklist in identifying athletes most likely to receive a MDD diagnosis. Furthermore, we employed a quasi-experimental design with multiple postinjury follow-ups, which surprisingly has only been used once to date (i.e., Leddy et al., 1994). Last, our sample included both men and women, which enabled a direct comparison of gender differences in depression symptom severity following sport injury that has rarely been examined by previous research. Future research utilizing quasi-experimental studies with both women and men may extend our findings and add to existing literature regarding the nature of athletes' reactions to injury. In addition, it is highly unlikely that any single factor accounts for a large proportion of variability in athletes' postinjury adjustment (Brewer et al., 1995), and as such, future research needs to explore multiple personal (e.g., personality, coping behavior) and situational factors (e.g., social support, life stress, sport and rehabilitation environment). With integrated models available (Brewer et al., 2002; Wiese-Bjornstal et al., 1998), research also needs to assess athletes' postinjury reactions in conjunction with physical and biological indices. In turn, findings from integrated research may provide clear support for the role of psychological factors in athletes' health maintenance and restoration. This, in turn, may guide the continued development and evaluation of psychological interventions as adjuvant therapy to physical injury prevention and rehabilitation programs, where positive effects of psychological interventions have already emerged (Cupal, 1998; Johnson, 2007).

Note

1. *Sport psychologist* refers to individuals who are licensed psychologists and have adhered to the standards for sport psychology proficiency set forth by the American Psychological Association and the Commission for the Recognition of Specialties and Proficiencies in Professional Psychology, whereas *certified consultant* refers to those who have met criteria (i.e., graduate degree and course requirements in addition to supervised practica in sport and exercise psychology) set forth by the Association of Applied Sport Psychology.

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