The Relationship of Personality Characteristics, Life Stress, and Coping Resources to Athletic Injury

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In 1988, Andersen and Williams proposed a model to explain the stress-injury relationship. The present study tested portions of this framework by investigating frequency and severity of injury occurrence in track and field athletes from four NCAA Division I and II universities. Personality characteristics (locus of control and sport competition trait anxiety), history of stressors (life stress, daily hassles, and past injury), and moderating variables (coping resources and social support) were assessed before the season began. Discriminant analyses indicated that four variables (coping resources, negative life stress, social support, and competitive anxiety) differentiated the severity groups. For injury frequency, coping resources and positive life stress differentiated the groups.

Key words: history of stressors, personality, coping resources, injury

The number of injuries in sport and recreation has been estimated to be as high as 3 or 4 million each year, with the injury rate in interscholastic sport representing about one third of these figures (Kraus & Conroy, 1984). Despite the technological advances in safety equipment, improved coaching, and emphasis on proper physical conditioning, athletic injuries continue to increase in all sports (Bergandi, 1985; Yaffe, 1983). Unfortunately, the variables that predispose an athlete to injury are still not clearly defined (Bergandi, 1985; Bramwell, Musada, Wagner, & Holmes, 1975; Taerk, 1977).

Past research has examined physical and environmental factors that may predispose one to injury. However, psychosocial factors, including the influence of life stress on physical outcomes, have received increased attention. For example, in 1967, Holmes and Rahe developed the Social Readjustment Rating Scale and found that the risk for illness was higher for individuals with high, as opposed to low, life-stress scores. A decade later, Sarason, Johnson, and Siegel (1978) developed the Life Experience Survey and found that negative life stress, but not positive life stress, was significantly related to several physical and psychological dependent measures.
Researchers have extended this early work on life stress and illness to the athletic domain. The Social Athletic Readjustment Rating Scale and the Athletic Life Experience Survey (Bramwell et al., 1975; Passer & Seese, 1983) were developed to increase the appropriateness of life-event measures for an athletic population. Using these measures, primarily with collegiate football players, several investigators have found positive correlations between life stress and athletic injury (Bramwell et al., 1975; Cryan & Alles, 1983). However, most early studies examining the life stress-injury relationship used contact sports. This limitation was addressed in a study conducted by Williams, Tonyon, and Wadsworth (1986) using male and female collegiate volleyball players. The findings did not replicate the life stress-injury relationship found in past work. Specifically, in this noncontact sport, athletes with high life-stress scores experienced no greater injury occurrence than athletes with low stress scores. In contrast, Hardy and Riehl (1988) examined life stress and injury among male and female athletes in baseball, softball, tennis, and track and found that total life change and negative life change were significant predictors of injury frequency, though not of injury severity. Taken collectively, there seems to be sufficient research to warrant the conclusion that life stress is positively related to injury. Several researchers have suggested that assessing minor life events may provide additional information about the effects of stress (Kanner, Coyne, Schaefer, & Lazarus, 1981; Monroe, 1983). To date, no clear relationship between minor life events and injury occurrence has been established.

As early as the 1960s, Lazarus (1966) had proposed a relationship between psychological factors and illness, and in 1985, Smith and Ascough proposed a mediational model of stress. This model proposed that both personality and motivational factors would influence the individual’s cognitive appraisal of a situation, as well as the individual’s arousal level, which in turn would influence behavior. Interventions leading to an integrated coping response were proposed. The subsequent model of stress and athletic injury proposed by Andersen and Williams (1988) is similar to this model.

The stress and injury model (Andersen & Williams, 1988) addresses various predictor variables of athletic injury, examines possible mechanisms underlying the stress-injury relationship, and suggests specific interventions for reducing the risk of athletic injury. Three broad categories in the model are hypothesized to influence the stress response. The first category pertains to certain personality characteristics, such as hardiness, locus of control, trait anxiety, achievement motivation, and sensation-seeking, that influence how an individual reacts to stress. In general, these characteristics are hypothesized to influence the stress response directly or to influence the cognitive appraisal of a history of stressors, which in turn influences the stress response. The second category is an individual’s history of stressors, which includes major and minor life events and past injuries. These variables are thought to directly influence the stress response by increasing injury risk. The third antecedent in the model includes coping resources and social support, which have been shown to moderate the effects of life stress on physical and psychological outcomes (e.g., Smith, Smoll, & Ptacek, 1990).

The core of Andersen and Williams’s (1988) model is the stress response, which is the result of a person’s appraisal of a potentially stressful situation. If, for example, the athlete perceives that adequate resources are not available to meet the demands of a situation, then the stress response will be activated.
and manifested physiologically, cognitively, emotionally, or behaviorally. It is proposed that physiological responses due to stress, such as increases in muscle tension or physical fatigue, may mediate the relationship between perceived psychological stress and physical injury (Andersen & Williams, 1988). Similarly, attentional changes that occur under stressful conditions may influence the cognitive responses to stress. As stress increases, it is thought that a narrowing of the visual field occurs and that relevant cues in the environment may be overlooked, increasing the likelihood of injury (Andersen & Williams, 1988). Recent evidence from laboratory experiments has supported the notion of peripheral narrowing under stress for individuals with high life stress (Williams, Tonymon, & Andersen, 1990, 1991).

Although numerous studies have examined the stress-injury relationship, limitations of past research are evident. First, investigating only a single cause of injury precludes the complexity of potential responses. A second limitation of early research was its almost exclusive attention to football, which restricted generalizability of results to male contact-sport athletes. A third criticism of past research has been the lack of a sensitive-injury reporting system. For example, most previous studies were only concerned with injuries that led to missed practice time. To overcome some of these limitations, the present study examined a wide range of personal, social, and environmental factors. Although the subject population in stress-injury studies has recently been extended beyond football players (e.g., Hardy & Riehl, 1988; Williams et al., 1986), further generalization is warranted. Thus, the present study employed male and female track and field athletes across a wide range of activities and over a broad geographical area. In addition to recording injuries that resulted in missed practice time, the present study used the Colorado Injury Reporting System (Blackwell & McCullagh, 1990) and employed certified athletic trainers to document injuries and illness. This system included all illness and injuries that required the attention of an athletic trainer or a team physician and allowed a wider range of severity to be assessed.

In summary, the purpose of this study was to partially test the theoretical framework proposed by Andersen and Williams (1988) while also attempting to address previous limitations. Thus, the effects of antecedent variables of personality traits (competitive trait anxiety and locus of control), history of stressors (major and minor life events and previous injury), and coping resources (social support and general coping behaviors) on severity and frequency of injury were examined to determine which variables were most highly related to injury.

Method

Subjects

A total of 181 subjects (123 males, 58 females) participated in the study. The subjects ranged in age from 17 to 22 (M=19.9, SD=1.7). Subjects were recruited from four universities. The three NCAA Division I schools were located in the West (A), Midwest (B), and South (C), and the Division II school (D) was located in the West. The gender distribution by university was as follows: University A (40 males, 34 females), University B (40 males, 0 females), University C (16 males, 9 females), and University D (27 males, 15 females). The
subjects were classified into 5 groups according to event. The subgroups consisted of 48 (31 males, 17 females) distance runners (3,000–10,000 m), 35 (26 males, 9 females) middle-distance runners (800–1,500 m), 36 sprinters/hurdlers (24 males, 12 females), 51 field event athletes (35 males, 16 females), and 11 heptathletes/decathletes (7 males, 4 females).

*Measures*

At a preseason meeting at each university, a background questionnaire and all the psychological inventories were administered to the volunteers. The background questionnaire included age, height, weight, academic major, course load, track event, and injury history. For past injuries, subjects reported (a) any injuries that had occurred in the previous 12 months, (b) the severity of injuries that hampered their training, and (c) the number of months since they considered themselves recovered.

**Life Stress.** Passer and Seese’s (1983) Athletic Life Experience Survey (ALES) was administered to measure positive, negative, and total life stress. The ALES is a 67-item inventory divided into various stress subscales (including relationships, family, personal changes, school, and team) and an open-ended category. Subjects were asked to respond only to those items that had occurred in their lives over the past 12 months. Each life event was scored by the subject on a scale from -3 to +3, depending on the desirability of the event (negative vs. positive) and the severity of the impact. A score of 0 indicated that the event occurred but had no impact. To score the ALES, three separate scores were obtained by summing the negative, positive, and total life-stress values (absolute values of all items). Also, an object-loss score was calculated as the sum of the absolute value from 12 questionnaire items that dealt with either the real or imagined loss of a close friend or relative.

**Minor Life Events.** A minor life event scale, based on Burks and Martin’s (1985) Everyday Problems Scale (EPS), was administered to the subjects. The original EPS is a 34-item inventory that lists various sources of daily stress. The original scale was developed to assess the ongoing problems and chronic hassles most likely to be experienced by undergraduate students. Several modifications were made on the EPS to increase its appropriateness for a college athlete population. Similar to the original scale, the modified 20-item inventory included daily hassles from 7 areas: schoolwork, employment, finances, family, living situation, romantic relationships, and other social relationships. Subjects were asked to choose the items that they had experienced in the previous 2 weeks. The total number of marked items was each subject’s score.

**Competitive Trait Anxiety.** Competitive trait anxiety was measured by Martens’s (1977) Sport Competition Anxiety Test (SCAT). The SCAT is a 15-item inventory with scores ranging from 10 to 30. A higher score represents a higher level of trait anxiety. The SCAT has been found to have high internal consistency (r=.95) and test-retest reliability (r=.77). In addition, content, concurrent, and construct validity have been fairly well established (see Martens, 1977).

**Locus of Control.** To assess athletes’ perceptions of control over their environment, Rotter’s (1966) Internal-External Locus of Control Scale was administered as a 29-item inventory, including 6 filler items. A high score represents a high level of external orientation. Rotter’s Locus of Control Scale has shown
moderately high test-retest reliability ($r=.70-.79$) and internal consistency ($r=.60-.78$) (Rotter, 1966).

**Social Support.** Social support was measured by Neeman and Harter’s “People in My Life” Inventory. The five subscales of the questionnaire include close friend, mother, father, campus organizations, and instructors. On a scale of 1 to 4, scores reflected the subjects’ perceptions of available support. A higher score represents a greater amount of perceived social support. Internal consistency of the subscales ranges from $r=.76$ to $.90$, and convergent validity of the subscales, when correlated with other subscales designed to assess similar support systems, varies from $r=.51$ to $.67$ ($p<.001$) (Neeman & Harter, 1986).

**Coping Resources.** A modified version of the Coping Resource Section of the Stress Audit Questionnaire (Miller & Smith, 1982) was administered. The original scale is a 20-item inventory developed for a middle-age population to assess the types of activities individuals use to cope with the stresses and demands of life. A modified 14-item scale was created by adding team- and coach-related items and by deleting several items not relevant to collegiate athletes (e.g., smoking habits, exercising at least twice weekly). These items were deleted based on the recommendation of an assistant track coach. Subjects were asked to respond, yes or no, to each item. Also, an open-ended question was added to the inventory, asking subjects to list any additional activities they used as coping resources on a regular basis (such as biofeedback, imagery, and other stress-management techniques). The subject’s overall score was computed by summing the total number of yes items and the total number of coping resources listed in the open-ended question.

**Procedure**

Permission to recruit their athletes as subjects was requested from the head track coaches at each university. One coach of a female team declined. Athletes had the option of participating without ramifications on team status, and no athletes refused to be tested. The same general procedures and verbal protocols were used at each university. The athletes attended a preseason meeting to complete all questionnaire measures. The purpose of the study was presented to the athletes as a research project investigating psychological traits relating to physical outcomes. Complete anonymity was guaranteed for each athlete. Instructions were printed on the top of each questionnaire and were read aloud by the investigator. Athletes were allowed as much time as necessary to complete the questionnaires. The order of questionnaires in each packet was random.

During the season (18 weeks), injuries were recorded at the time of occurrence and were tabulated daily by certified athletic trainers at each university. Trainers recorded the number of days an athlete missed practice or had to modify his or her activity. Also, illness and subsequent practice modifications that were reported to the athletic trainers or team doctors were recorded. To accurately assess the severity of each injury, the Colorado Injury Reporting System was used. Injuries were classified as mild (treatment required, no modification of activity), moderate (treatment and activity modification), Severe 1 (nonparticipation for 1–7 days), Severe 2 (nonparticipation for 1–4 weeks), or Severe 3 (nonparticipation for more than 4 weeks). This recording system is a more sensitive method of classifying injuries than the National Athletic Injury Recording System (NAIRS), which has been used in past research (Coddington &
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Troxell, 1980; Passer & Seese, 1983; Williams et al., 1986). The NAIRS classifies injuries only according to the number of days the athlete misses practice and does not report injuries that require treatment or practice modifications but that do not require time out from participation.

To determine if the independent variables could discriminate subjects based on frequency and severity of injury, two stepwise discriminant function analyses were performed. Predictor variables were measured using the previously described inventories and included negative life stress, positive life stress, object loss, recovery from past injuries, minor life events, competitive trait anxiety, locus of control, social support, and coping resources. In the discriminant analyses, groups for severity of injury were (a) no injuries, (b) injuries classified as minor and moderate, and (c) injuries classified as Severe 1, 2, or 3. Groups for frequency of injury were categorized as (a) no injuries, (b) one injury, and (c) two or more injuries.

Results

Injury Statistics

Results from the background questionnaire indicated that of the 99 subjects (54.7%) who were previously injured, 31 were still not recovered prior to initial testing. The remaining subjects had recovered, on average, 10.3 months (SD=5.0) prior to questioning. Of the 99 subjects who were previously injured, 92 felt their training had been hampered due to their injuries. The overall injury rate indicated that 66.3% of the 181 athletes were injured during the indoor and outdoor track seasons. Of the 123 males, 66.7% were injured, and 65.5% of the 58 females were injured.

Prediction of Injury

Chi-square tests on gender differences in severity and frequency of injury produced no significant difference, so the data were pooled for the discriminant analyses. For injury severity, subjects were divided into three groups: no injuries, minor and moderate injuries, or severe injuries. Only the first discriminant function analysis for severity of injury was significant, Wilks's lambda=.90, \( F(8,316)=2.07, p<.05 \), which accounted for 87% of the variance. Four of the nine predictor variables emerged from this analysis. Standardized discriminant coefficients suggested that coping resources (−.68) contributed most to maximizing group differences, followed by negative life stress (.60), social support (.51), and competitive trait anxiety (.31). Follow-up ANOVAs to compare mean differences between groups revealed significant differences for coping resources, \( F(2,179)=4.06, p<.02 \), and negative life stress \( F(1,175)=3.83, p<.02 \). Post hoc analysis indicated that the no-injury group had significantly more coping resources and less negative life stress than the severely injured group.

For frequency of injury, subjects were divided into three groups: no injuries, one injury, and more than two injuries. Only the first discriminant function analysis was significant, Wilks's lambda=.94, \( F(2,161)=3.13, p<.05 \), which accounted for 76% of the variance. Two of the nine variables that entered the analysis to discriminate between the groups were significant; standardized discriminant coefficients suggested that coping resources (1.01) contributed most to maximizing group differences, followed by positive life stress (−.48). See Table 1 for
Table 1
Means (and Standard Deviations) on Predictor Variables
by Injury Severity and Frequency

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Injury outcome</th>
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<td>1</td>
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<tr>
<td>Injury severity</td>
<td></td>
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<tr>
<td>n</td>
<td>59</td>
</tr>
<tr>
<td>Coping resources</td>
<td>11.4 (2.8)</td>
</tr>
<tr>
<td>Negative life stress</td>
<td>13.7 (10.2)</td>
</tr>
<tr>
<td>Social support</td>
<td>62.8 (3.9)</td>
</tr>
<tr>
<td>Competitive trait anxiety</td>
<td>22.4 (7.7)</td>
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<tr>
<td>Injury frequency</td>
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<tr>
<td>n</td>
<td>59</td>
</tr>
<tr>
<td>Coping resources</td>
<td>11.4 (2.7)</td>
</tr>
<tr>
<td>Positive life stress</td>
<td>9.8 (7.5)</td>
</tr>
</tbody>
</table>

Note. Injury severity: 1 = no injuries, 2 = minor and moderate injuries, and 3 = Severe 1, 2, and 3 injuries. Injury frequency: 1 = no injuries, 2 = 1 injury, and 3 = 2 or more injuries.

mean values of the significant discriminating variables. Follow-up univariate ANOVAs and Tukey post hoc tests indicated that only coping resources differed across groups, $F(2,179)=4.5, p<.01$. Those subjects with no injuries had greater coping resources than athletes with one injury.

Discussion

Results from the present investigation support past stress-injury research with football players that found life stress to be an important antecedent of injury occurrence (Blackwell & McCullagh, 1990; Bramwell et al., 1975; Cryan & Alles, 1983; Passer & Seese, 1983) and with a variety of noncontact sport participants (e.g., Hardy & Riehl, 1988; Kerr & Minden, 1988; May, Veach, Reed, & Griffey, 1985; Smith et al., 1990). Negative life stress discriminated between injury-severity groups and showed a linear relationship with severity. As negative life stress increased, so did severity of injury. The same linear relationship was shown for injury frequency and positive life stress. An important consideration in comparing these results with other research is an examination of the life events assessments. Many different instruments are available, but validity and reliability have not always been clearly established (McCullagh, Starek, & Prestwich, 1991; Williams & Roepke, in press). This lack of published psychomet-

1It was of interest to test the moderating effects of social support and coping resources on stress and injury. However, when the extremes on these independent variables were calculated, the resulting cell sizes were extremely small (1 to 12), making tests of these relationships inadequate.
ric data has led Petrie (1990) to develop the Life Events Survey for College Athletes (similar to the inventory employed by Passer and Seese, 1983), which he is attempting to validate. Future researchers are urged to carefully examine their inventories as well as report available psychometric data.

The present results did not support the expected relationship between minor life events (daily hassles) and frequency of injury. One limitation was the one-time assessment of this variable. Repeated measurements over the course of the season would better indicate ever-changing minor events. Furthermore, the desirability of daily hassles (positive vs. negative) is crucial in determining the amount of perceived associated stress (Monroe, 1983). Also, validity and reliability need to be established for the minor life events that are assessed. A suggested improvement over the present inventory would be the daily hassles and uplifts scales developed by Kanner et al. (1981) or the development of a sport-specific instrument that is administered throughout the season. The third stress-history variable investigated was past injuries. Time since injury recovery was not related to frequency or severity of injury occurrence.

Regarding personality variables, results of the present study failed to support a relationship between locus of control and injury occurrence and is in agreement with past research that has used a general measure for locus of control (Kerr & Minden, 1988; Passer & Seese, 1983). Perhaps a sport-specific measure would be more appropriate in future research, as demonstrated by Dalhauser and Thomas (1979). The second personality variable investigated was competitive trait anxiety. A relationship was found between competitive trait anxiety and severity, as indicated by the discriminant analysis, but a clear linear relationship with severity was not found. Also, an examination of the discriminant coefficients indicated that competitive trait anxiety was the weakest of the predictor variables. As studies become more refined and perhaps as psychological variables begin to be assessed over time, it may be possible to increase the predictive value of anxiety by turning to more state, as opposed to trait, dependent measures.

Social support has previously been hypothesized to enhance health by reducing or preventing the psychological consequences of stress (Sarason, Levine, Basham, & Sarason, 1983). For the present investigation, social support was a significant discriminator for the severity, though not the frequency, of injuries. However, examination of mean scores across severity groups does not provide a clear picture. All categories displayed reasonably high levels of perceived social support, and there was little difference among group means across the severity conditions. The lack of a strong relationship between social support and injury is in opposition to recently reported findings across a wide range of college sports (Hardy, Richman, & Rosenfeld, 1991). The inventory used by Hardy et al. was very different from the present one and may account for some differences. Although some social support categories in the two studies overlap, the types of information gleaned from each is quite different. Regarding general measures of coping, the present study indicated that a high number of coping resources available to an athlete may have had a protective effect. Those athletes with higher perceived coping resources were more likely not to be injured than were athletes with fewer perceived coping resources.

The findings of the present investigation indicate that several aspects of Andersen and Williams’s model (1988) are important in predicting the severity and frequency of injury in track and field athletes. Several recommendations are
provided for future research. First, modifying inventories, creating sport-specific measures, and psychometric testing of these instruments is called for. Second, repeated measurements of psychological variables are recommended, especially of variables that are highly susceptible to change (such as minor life events, major life events, social support, and coping resources) so that a pattern of change over time can be observed. Third, not all the variables in the model were assessed, preventing determination of their impact. Future research may benefit from including these additional variables.

It is also recommended that investigators take a multivariable approach because it is the combination of variables, not their singular influence, that must be deemed important. Finally, future research involving athletes should perhaps focus on physical as well as psychosocial variables. The inclusion of factors such as training schedules and biomechanical abnormalities may provide additional information concerning injury-prone athletes (Taerk, 1977). The present investigation explored new ground in this evolving research area, but there are still numerous questions to be addressed. The influence of the antecedent variables studied here, as well as in most other studies, was directly related to the outcome of athletic injury. Thus, the link from antecedents to injury through the stress response is still in need of verification.

References


Manuscript submitted: January 7, 1991
Revision received: April 19, 1992

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April 28–May 1, 1993, Sonesta Beach Hotel, Key Biscayne, FL, USA
Presented by the United States Tennis Association

Directors: Jack Groppel, PhD; Robert Leach, MD; and Paul Roetert, PhD
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