As discussed in many other chapters in this book, injury is a major problem in
sport at all levels and also in other physical performance activities, such as
dance. Further, physical trauma alone cannot account for the extent of injury
that is observed (Petrie & Perna, 2004). A number of researchers have
approached injury from a psychological perspective, proposing that psychoso-
cial stress is a significant factor influencing injury in sport (Andersen &
Williams, 1988; Smith, Smoll, & Ptacek, 1990; Wiese-Bjornstahl, Smith,
Shaffer, & Morrey, 1998). The model proposed by Andersen and Williams has
gained popularity, acting as the framework for a range of research. Andersen
and Williams proposed that three classes of variable influence the occurrence
of psychological stress. These are personality variables, such as competitive
trait anxiety, hardiness, and locus of control; history of stressors, including life
event stress, daily hassles, and past injury history; and coping resources, such
as coping behaviors, stress management, and social support. According to the
model, as stress increases in performance contexts, muscles become tight and
tense and attentional focus is disrupted. These changes make the performer
more vulnerable to injury. Researchers have published a substantial amount of
evidence supporting the influence of the key variables in this model on injury
(Petrie & Perna, 2004; Williams & Andersen, 1998). History of stressors, espe-
cially life stress and daily hassles have been widely studied, whereas coping
resources have received less research attention. Most coping research is sup-
portive, but researchers have generally reported the influence of coping to be
less strong than life stress and daily hassles (Petrie & Perna, 2004).

In their model, Andersen and Williams (1988) proposed that psychological
interventions can be used to reduce the impact of psychosocial stress, so that
athletes experience lower levels of muscle tension and less attentional distrac-
tion, hence there is less risk of injury. To date, intervention research has been
limited. Nonetheless, studies in which athletes were trained in stress manage-
ment have shown favorable results (e.g., Davis, 1991; Kerr & Goss, 1996). The
application of general stress management programs may not be best practice in stress reduction and injury risk management, however. One reason why we argue that a generalized stress management program might not be maximally effective is because it does not target the specific sources of stress in that context. For example, young female gymnasts living away from home in a highly disciplined environment might primarily experience stress because of the absence of social support. We might expect the impact of stress inoculation training in this case to be limited. To reduce their stress substantially, what these young gymnasts need is social support, preferably from their family! Another reason we would consider general stress management programs to be less than best practice is because they might be wasteful of time, effort, and money. Whatever the level of injury-risk reduction that is achieved with such a program, it could be that as much or more could be attained with a more targeted intervention. An example here might be the application of a general stress management program when the main concern for the performers is that their coaches place a lot of stress on them and they do not know how to handle stress emanating from that highly influential source. Training in specific coping skills to manage that stressor would probably be much less time-consuming and more readily effective than a generalized stress management intervention.

In research and practice on injury-risk reduction, sport psychologists might not be aware of the specific contextual factors, so general stress management programs could be claimed to offer the best way to cover all the possibilities. We propose that researchers should devise studies to examine the relative effectiveness of different interventions, based on information gleaned from in-depth qualitative studies about stressors in that specific context. Similarly, exploration by practitioners, using discussion and observation, could form the basis for customized interventions. To support our argument for the adoption of techniques that can help researchers and practitioners to direct interventions more effectively, we describe here two studies we conducted to identify the sources of stress and show how we used the information gleaned from these studies to devise a context-specific intervention.

Given the extent of coverage of the theory and research on sport injury, we only briefly review research on the prevalence of injury, leading to a limited description of the Andersen and Williams (Williams & Andersen, 1998) model of psychosocial stress and injury. Then we provide a summary of the main research supporting the model. In the largest part of the chapter, we discuss the principle of using research or evaluation to guide intervention design and report the two studies that we conducted with dancers to identify sources of stress and ways of coping. Then we describe the intervention study in which we examined an intervention designed to address the stressors we identified. Finally, we make some recommendations for practitioners and researchers, based on our research.

**Prevalence of Injury in Sport and Dance**

As the number of people participating in physical activity to promote health has increased, sport and exercise can present an inevitable danger, involving accidents and injuries. Consequently, physical injury is considered to be one of the major factors for concern related to the risks of sport/exercise participation, a factor that can cause people to stop exercising or not to start at all. Despite advances in equipment, physical conditioning techniques, and coaching expertise, sport injury has not decreased (Bond, Miller, & Chrisfield, 1988; Petrie & Perna, 2004).

Uitenbroek (1996) reported that 32.5% of participants in the United Kingdom were injured as a result of engaging in sport or exercise. In the United States, an esti-
mated 3 to 17 million sport- and recreation-related injuries are incurred among adults and children per year. A recent population survey conducted by the National Institutes of Health in the USA reported that adults who were over 25 years old had experienced 2.29 million injuries related to physical activities annually from 1997 to 1999 (Ruibal, 2005). Finch, Valuri, and Ozanne-Smith (1998) reported that, in Australia, 20% of child visits and 18% of adult visits to hospital emergency rooms were associated with sport-related injuries. Further, serious injuries can lead to long-term health problems and increased medical expenses. High school athletes participating in 12 sports sustained injuries and produced medical costs of $19 million during one year, in the state of North Carolina (Weaver et al., 1999).

Because dance is similar to sport in terms of the levels of physical and performance demands, at high levels in particular, injuries are also common in dance. Dancers undertake a number of practice sessions, rehearsals, and performances at progressively higher levels of intensity to maintain their position in the group. Because of demanding workloads, the pursuit of perfection, and the quest to perform advanced techniques, dancers often incur overuse injuries and syndromes (Hamilton, 1999; Ryan & Stephens, 1989; Teitz, 1991). Dance injuries produce substantial financial and emotional costs to individual dancers, the health system, and insurance companies. Bowling (1989) found that dance injuries, at the elite level, were often caused by the demands of performing advanced techniques. He reported that those who had chronic injuries experienced severe pain continually, and just over two-fifths of the dancers studied had sustained at least one injury in the previous six months that had affected their dancing. Recently, Kim and Heo (2003) reported that 95% of a large sample of ballet dancers in Korea had experienced injuries during practice and performance since they had started dancing.

Garrick and Requa (1993) found that 104 professional ballet dancers incurred 309 injuries, for which insurance disbursed nearly USD $400,000 for medical costs, during a three-year period. Dancers had 2.97 injuries on average, but the data were skewed. In particular, Garrick and Requa stated it was remarkable that 23% of these dancers incurred 52% of all injuries. Similarly, Solomon, Micheli, Solomon, and Kelley (1995) reported that 137 injuries occurred among 70 professional ballet dancers. Ten percent of these dancers accounted for a total of 23% of the injuries, that is, around 4.6 injuries each. The rest of the dancers in the study by Solomon et al. averaged 1.7 injuries for two years (1993-1994). For these 137 injuries, insurance companies paid USD $249,272. Efforts to reduce the frequency of injuries in sport and dance are warranted, both to ensure the long-term health of individuals and to reduce the substantial financial and emotional costs for families and insurance companies.

Models of Psychosocial Stress and Injury in Sport and Dance

Over the past three decades, sport science researchers have made efforts to discover how to prevent sport injuries. Examination of physical and biomechanical factors has led to the conclusion that these variables alone cannot account for all the injuries that occur, so psychological factors have been examined (Andersen & Williams, 1988, 1999; Maddison & Praparessis, 2005; Petrie, 1992, 1993a, 1993b; Smith, Ptacek, & Smoll, 1992).
According to the stress-injury model proposed by Andersen and Williams (1988), when athletes experience stressful situations, they react with a stress response. Increases in stress are likely to be associated with

- narrowing attention,
- greater distractibility, and
- higher levels of muscle tension.

These changes increase the probability of injuries. Andersen and Williams suggested that psychosocial factors, such as

- personality,
- history of stressors, and
- coping resources

influence the stress response and, thus, the likelihood of injury occurrence.

Williams and Andersen (1998) reviewed the substantial research that tested aspects of their psychosocial model. The vast majority of this work supported the model, especially with respect to the roles of history of stressors, life event stress, and daily hassles. The involvement of coping resources, such as coping skills and social support, has been shown to moderate the effects of stress on sport injuries (Hardy, O’Connor, & Geisler, 1990; Maddison & Prapavessis, 2005; Petrie, 1993b; Smith, Smoll, & Ptacek, 1990).

In dance, many researchers have investigated the physical factors related to injuries:

- pathogenesis,
- epidemiological, mechanical, and anatomical characteristics, and
- environmental factors.
In spite of the substantial research into dance-related injuries, injuries have become more prevalent and have affected the financial status or professional careers of dancers more seriously. Some researchers have begun to look elsewhere for injury risk factors (Hamilton, Hamilton, Meltzer, Marshall, & Molnar, 1989; Krasnow, Mainwaring, & Kerr, 1999; Liederbach & Compagno, 2001; Liederbach, Gleim, & Nicholas, 1994; Mainwaring, Kerr, & Krasnow, 1993; Patterson, Smith, Everett, & Ptacek, 1998; Smith, Ptacek, & Patterson, 2000).

In particular, dance researchers have begun to focus on psychosocial factors, such as
• stress,
• social support, and
• anxiety,
which have been studied in sport in relation to injury for 30 years. The previous research has given a broad description of the value of examining psychosocial variables, but the research has not explained the relationship between psychosocial factors and injury in dance (Noh, Morris, & Andersen, 2003). Much research is still needed to identify individuals at high risk of injury and explain various avenues/mechanisms by which psychosocial factors influence injury occurrence in dance.

Research on Psychosocial Stress and Injury in Sport and Dance

Although some research has demonstrated no significant relationship between psychosocial factors and injury, numerous studies have supported the stress-injury model (Williams & Andersen, 1998), which has provided a theoretical framework for the prediction and prevention of injury in sport, since Holmes (1970) conducted the first study of stress and injury in football players.

The most frequently repeated finding is that negative life events are associated with increased risk of injuries in athletes (Andersen & Williams, 1999; Petrie, 1992, 1993b; Smith et al., 1992; Smith, Smoll, & Ptacek, 1990). Many of the previous studies examined contact sports like football and high risk sports, such as gymnastics and skiing. These studies showed that athletes who experienced high levels of life stress were more likely to experience injury occurrence than athletes who experienced low levels of life stress (Blackwell & McCullagh, 1990; Bramwell, Masuda, Wagner, & Holmes, 1975; Coddington & Troxell, 1980; Kerr & Minden, 1988; Passer & Seese, 1983; Petrie, 1992, 1993a, 1993b). Relationships, however, between minor life events (daily hassles) and injury have not received consistent research support, due to methodological problems.

A particular concern has been the approach of measuring daily hassles only once, either before the start of the season or at the end of the season (Blackwell & McCullagh, 1990; Hanson, McCullagh, & Tonymon, 1992). The study by Fawkner, McMurray, and Summers (1999) examined the relationship between daily hassles and athletic injuries, with a measure of minor stressful events administered on a weekly basis repeatedly over the course of a competitive season. Fawkner et al. found that a high rate of injury occurred among athletes who had increased minor life events for the week prior to injury. Fawkner et al. suggested that daily hassles should be measured frequently, for example, on a weekly basis, and hassles should be related to injuries incurred during the following week, because minor life events are changing continuously.
Recently, Maddison and Prapavessis (2005) examined prospective correlations between psychosocial factors and injury (the number of injuries and the time missed) among 470 rugby players. Maddison and Prapavessis found that psychosocial factors (i.e., social support, coping skills, and previous injury) interacted with the relationship between life stress and injury.

The different measures used to assess injury may have contributed to the varied results of research on psychosocial stress and injury in sport. Many researchers used the National Athletic Injury/Illness Reporting System (NAIRS), which records severity of injury. The NAIRS classifies injuries that disturbed athletes’ training only by the amount of time-loss due to injury. When athletes have minor injuries, they might ignore them and practice or compete, because of differences in personality or pain tolerance levels. The measurement of injury severity might have added some confusion to examination of the stress-injury relationship.

A number of guidelines have been introduced for psychological interventions to enhance performance in sport. Psychological intervention for the prevention of injury, based on changing the levels of antecedents in the model or “inoculating” athletes against stress, has been limited, however (Cupal, 1998), even though researchers are aware that psychosocial factors play a role in injury occurrence.

Kerr and Goss (1996) examined the effect of stress inoculation training (SIT) on injury in 24 gymnasts (16 males, 8 females). Kerr and Goss monitored levels of stress and injury for 8 months, during which the gymnasts practiced SIT. Kerr and Goss randomly divided the gymnasts into SIT and control groups, according to sex, age, and performance. Kerr and Goss found that each gymnast had at least one injury during the 8-month period and most of the injuries were chronic or overuse. Kerr and Goss reported that the SIT group spent less time injured than the control group, but the difference was not statistically significant. Moreover, the SIT group had significantly lower levels of negative stress than the control group from mid-season to peak-season. Kerr and Goss concluded that the stress management program helped the gymnasts to cope with negative stress.

In a recent study, Kolt, Hume, Smith, and Williams (2004) examined the potential role of stress-management interventions to reduce injury risk among 20 gymnasts (17 girls, 3 boys). Kolt et al. divided participants into two groups (i.e., stress-management group and placebo). The stress-management group \((n = 10)\) received a 12-session stress-management program, which focused on cognitive behavioral techniques over 24 weeks. The placebo group \((n = 10)\) attended 12-session programs, which included nine lectures on nutrition and three anthropometric measurement sessions, over 24 weeks. Kolt et al. found that the stress-management group reported 25 injuries (4.8 injuries per 1,000 hours of training) and the placebo group had 32 injuries (5.7 injuries per 1,000 hours of training). The stress-management group and the placebo group, however, did not differ significantly on either stress (positive or negative general stress and gymnastic-related stress) or injuries (training hours lost to injury).

The Kerr and Goss (1996) and Kolt et al. (2004) studies showed that general stress management intervention programs had little effect on injury or stress. A key reason for these results is that the researchers used general stress management intervention programs to reduce injury rate or stress levels without any consideration of participants’ situations or needs. There is no doubt that people are willing to do intervention...
programs, which are tailored for them with strong volition. Therefore, psychosocial intervention research needs to target injury reduction, based on research with well-defined instruments that identify specific psychosocial variables related to injury occurrence in that context.

In dance, some researchers have tried to explore aspects of the relationship between psychosocial factors and injury across a number of domains. There have been controlled studies on the relationship of injury in dance with stress, social support, and anxiety. Aside from the empirical studies by Hamilton et al. (1989), Krasnow et al. (1999), Mainwaring et al. (1993), Patterson et al. (1998), Smith et al. (2000), and Noh, Morris, and Andersen (2005), few studies have examined variables, such as

- daily hassles,
- life events,
- history of injury,
- performance anxiety,
- muscle tension,
- attention,
- coping skills, and
- social support,

all of which are predicted by the psychosocial stress-injury model in sport to be related to injury outcome. Only one study (Noh, Morris, & Andersen, 2005) has examined whether psychosocial factors, based on the stress-injury model in sport (Williams & Andersen, 1998), could predict dance injuries (frequency and duration) using a prospective research design. Noh et al. (2005) found that coping was the most important factor related to frequency of injury in Korean ballet dancers. Furthermore, except for the study by Noh, Morris, and Andersen (under review), there is no research on psychological interventions for reducing injuries in dance.

Recently, Noh and Morris (2004) proposed an approach to planning more efficient and effective intervention programs, using a combination of quantitative and qualitative research methods. Noh and Morris suggested that careful assessment of factors associated with stress in the specific context could help in the design of effective intervention programs for dancers. Differences from one context to another in the psychosocial stress variables that have the greatest influence on stress and injury mean that such assessment is always recommended to fine-tune interventions.

From Confirmatory Research to Efficient and Effective Practice

Much of the research on psychosocial variables and sports injury consists of confirmatory studies. As reflected in the previous sections, the largest body of research has focused on the relationship between life event stress and sport injury risk. Some of the early studies were criticized because researchers employed retrospective research designs. Athletes were asked to report on their life stress during a period of time, such as the previous year, and their injury history was examined for the same period. This research was criticized because the injuries sustained would have increased perception of life stress, producing a high correlation for the wrong reason. Researchers were interested in the impact of stress on injury, not the effect of injury on stress. Prospective studies followed in which
researchers measured psychosocial variables and then monitored injuries over a period of months after the psychosocial variables had been recorded. The results of these more meaningful prospective studies have largely been positive (e.g., Williams & Andersen, 1998), as we, and others in this book, have discussed. Other studies have focused on daily hassles and some have targeted social support or coping resources.

The vast majority of this research has been directed at confirming elements of the psychosocial stress and sport injury model. Although most studies have provided support for the model, they offer only limited guidance for practitioners. One reason for this is that most studies have employed general measures of life stress, daily hassles, social support, and/or coping. Some measures of the psychosocial variables give us a hint at what might be the general issues that are of concern to performers in particular contexts, but most measures provide little information that is sufficiently specific to guide practice. For example, an instrument that has been used widely to measure coping resources is the Athletic Coping Skills Inventory–28 (ACSI-28; Smith, Schutz, Smoll, & Ptacek, 1995). The ACSI has seven subscales, which measure

- coping with adversity,
- peaking under pressure,
- goal setting/mental preparation,
- concentration,
- freedom from worry,
- confidence and achievement motivation, and
- coachability.

High and low scores on these subscales clearly provide information at a meaningful level about coping strengths and weaknesses of individuals, respectively, and indicate whether a clear pattern emerges from group data about the strengths and weaknesses of a group of athletes in a particular context.

Nonetheless, ACSI-28 scores alone do not provide sufficient information to design a targeted intervention. For example, if an especially low score is found on coping with adversity among players in a young, professional football team, this suggests that an intervention aimed at enhancing the footballers’ coping skills should contain a substantial component that addresses coping with adversity. To this point, the use of a measure like the ACSI-28 helps by directing the focus of intervention strategies to coping skills and, more specifically, to coping with diversity. This is certainly more useful to practitioners (and, we would hope and expect, more effective for the footballers) than simply applying generalized stress management techniques, but it still doesn’t identify the kinds of adversity that those footballers have to face. We might surmise that the main adversity faced by this team is losing. More precisely, we might look at the team and see that it has lost the last five games, so maybe the players in this team do not cope well with a series of consecutive losses. What we are not aware of is that, prior to the series of defeats, the team had lost several key players because of long-term, crippling injuries, and a couple of those injured players may never play high-level football again. The players in this tight-knit team are grieving for their teammates and, at the same time, the sudden spate of terrifying injuries, observed by the players in all its graphic horror, has shocked the players and made them fearful for their own careers and physical well-being. The players do not know how to cope with these adverse
events; each is keeping his fears to himself, given the tough, “manly” culture of football, and the club has no idea that this represents an issue that is affecting performance, let alone psychological health. Armed with this information a psychologist might act quite differently in developing intervention strategies for the players. Specific aspects of the support the psychologist would give could include

- assuring the players that grieving about their friends and colleagues is a natural, if not essential, process;
- encouraging players to reflect on their personal reactions;
- addressing the fears about their own well-being raised by the traumatic events;
- explaining to the players that it is good to talk to other people about issues like the grieving, the shock, and the fear, especially to talk to each other, because their colleagues are likely to be going through similar experiences; and
- suggesting that the players might like to support their injured colleagues by maintaining contact with them, visiting them, and including them in social activities, where possible.

In addition, the psychologist should inform and educate the club coaching and administration staff, to ensure that they create a culture in which issues like grieving and fear are recognized and discussed in an open and positive atmosphere. We would expect that strategies like these would have a much bigger impact than a general coping skills intervention.

The position we are proposing does not glean a great deal of support from research, because there is little research in sport or other performance areas that has examined the application of targeted interventions, based on knowledge gleaned from the study of the key psychosocial variables in that specific context and the stressors that are preeminent in the context. As noted earlier in this chapter, the relatively few intervention studies in the sport injury literature mainly employed generalized stress management interventions. We have recently conducted a set of studies in the context of dance that we feel illustrates the approach we are advocating. More specifically, we carried out three studies with ballet dancers in Korea:

- In the first study, we explored the relationship between psychosocial variables and injury.
- The second study was an in-depth, qualitative examination of sources of stress and coping strategies in the same context.
- In the third study, we tested the effectiveness of an intervention designed on the basis of the knowledge we acquired in the preceding studies.

In the following section we describe the studies to show how we used findings from the first two studies to develop an intervention customized for elite ballet dancers in the Korean context. Although what we report in the following section represents a program of formal research, it is clear that practitioners could use equivalent procedures less formally in applied settings.

An Example: Dancers in Korea

Dancers are always concerned about injury, because serious injuries not only disturb their techniques, but they can also influence the opportunities they have during their
limited careers. Many dance researchers have focused on the physical or environmental factors that are related to injuries, such as anatomical characteristics, overtraining, technique problems, and equipment failure (Hardaker et al., 1986; Kadel & Teitz, 1992; Kim, K., 1997; Liederbach & Compagno, 2001; Stephens, 1989; Teitz, 1991). Recently, however, some researchers have recognized that psychological factors play a role in dance injuries. In particular, research supporting this proposition has been conducted in Korea (Kim, E., 2001; Kim & Park, 2004; Kim, K., 1997; Lee, 1998; Noh, 1998).

Although psychological factors have been shown to have an impact on dance injury outcome, surprisingly, no psychosocial intervention research, which is aimed at reducing the risk of injury, has been reported in dance. There is vast potential for research to discover the roles of psychosocial factors through the combination of qualitative and quantitative research methods and research on the reduction of injury risk, using well-designed intervention programs. In this example, we describe a process for developing psychosocial interventions, extending application of the Williams and Andersen (1998) model of stress and injury from sport to dance, with the goal of reducing incidence of injury among ballet dancers in Korea.

- First, we examined whether psychosocial factors predict dance injuries (frequency and duration), based on the psychosocial stress-injury model in sport (Williams & Andersen, 1998), using a prospective, correlational research design, among Korean ballet dancers (Noh, Morris, & Andersen, 2005). In that quantitative study, we found that low levels of coping skills were associated with injury frequency and duration of injury, with dancers who had low levels of coping skills being injured more often and for longer periods of time.

- Second, we identified the major sources of stress associated with practice and performance in dance and explored the coping strategies used by performing dancers, based on a qualitative research method, using in-depth interviews (Noh, Morris, & Andersen, 2003). From the qualitative study, we found that Korean ballet dancers experienced substantial stress from many sources, such as their relationships with dance directors and with peers, weight and appearance issues, and the pressure of auditions and performances. The dancers used various coping strategies, including dysfunctional strategies like drinking alcohol or overeating.

- Finally, we conducted a study to examine the effects of two psychosocial interventions designed to reduce injury among dancers, based on the findings from the quantitative and qualitative studies integrated into the psychosocial stress-injury model (Noh, Morris, & Andersen, under review). The first two studies provided the information for designing interventions to focus the development of coping skills, perceived by performers. To illustrate this approach to the design of interventions, we now describe our recent research with dancers.

**Psychosocial Factors Related to Ballet Injuries**

To gain specific information about elite ballet dancers in Korea, based on the body of theoretical knowledge regarding whether and which psychosocial factors predicted dance injuries, we first conducted a prospective, correlational study, in which we