

CHAPTER 1: INTRODUCTION

Background to the Thesis

In the pursuit of excellence, athletes push themselves to the limits of their physical capacities, and many athletes and coaches have tended to equate large volumes of training with success. Such heavy training, however, can lead to the undesirable outcomes of decreased performance levels, illness, and injury. Athletes and coaches in this situation commonly respond to drops in performance by increasing the training load still further (O'Toole, 1998). In many sports, athletes are under substantial pressure to perform from coaches, parents, administrators, and themselves, and often will do “whatever it takes” to win (Gould, Tuffey, Udry, & Loehr, 1997; Krane, Greenleaf, & Snow, 1997). Although the intuitions of coaches and athletes alike drive them to this *more is better* philosophy in training for peak performance, the risk for an athlete to descend to a state of physiological exhaustion or injury escalates with mounting pressures and increasing workloads.

The negative processes and outcomes associated with excessive training load have been called *overtraining* (OT) and *overtraining syndrome* (OT syndrome), respectively (Kellmann, 2002). OT has been an identifiable issue in competitive sport since the 1920s (Parmenter, 1923). Griffith (1926) first referred to negative outcomes associated with intensive training as *staleness*. Research on OT did not begin to accumulate, however, until the mid-1970s and early 1980s, when competitive athletes began to train at substantially greater volumes and higher intensities than previously. Bompa (1983) estimated 10-22% increases in yearly training hours for a variety of sports during the five years from 1975 to 1980. Between 1972 and 1995, American Olympic level swimmers increased training loads from around 9000 meters to 36,000 meters per day (Peterson, 2005). Raglin and Wilson (2000) also estimated an increase of 20% in physical training across the 1990's.

In response to the increases in training volumes and intensities, potentially leading to illness, injury, and other OT outcomes, prevalent in today's competitive sports, athletes, coaches, and researchers seem to be improving awareness for the importance of balancing training with adequate recovery (Botterill & Wilson, 2002; Davis IV, Botterill, & MacNeill, 2002; Gould & Dieffenbach, 2002; Hanin, 2002; Hogg, 2002; Kellmann, 2002; Kellmann, Patrick, Botterill, & Wilson, 2002; Kenttä & Hassmén, 2002; Norris & Smith, 2002), acknowledging, perhaps, that more is not always better. Noting this shift in awareness, Kellmann (2002) quoted statements made by several professional athletes to German newspapers. A tennis player reported, "My recent successes are due to less tennis, more regeneration, and the forced break (due to injuries); I'm less exhausted and burnt out than the other players," (p. 4) and a cyclist reported, "I'm better this year because I train less; in other years, I was already tired before the race" (p. 4).

The previous quotes provide examples where athletes seem to have responded positively to potential OT situations. Nonetheless, it is likely that there are many athletes and coaches who are still risking OT and its negative outcomes. What I was interested in with this thesis was to present descriptive research on athletes', coaches', and sport scientists' experiences with OT processes and outcomes in elite sport. With the two studies in this thesis, the first an interview study with sports experts, and the second with athletes, I planned to illustrate different perspectives and experiences with OT. In congruence with these different perspectives, I have presented the interviews from the experts and the athletes in styles that fit the stories told by these two distinct groups.

Perspectives on Telling Tales

In deciding how to present the perspectives of the experts and tell the tales of athletes' experiences with OT and injury, I have considered Sparkes' (2002) descriptions

of the different ways of representing knowledge in qualitative research traditions. Sparkes noted the following:

Some suggest that researchers-as-authors need to indicate their positioning in relation to the research process and the other people involved. They also suggest that researchers engage in a self-reflexive analysis of the social categories to which they belong, since these enter into and shape what constitutes knowledge in any project. Consequently, for them, the author needs to be written into, and not out of, the text.

My life in sport as a competitor, a coach, an observer, and a sport psychologist, and my own experiences with the phenomena of OT and injury, have positioned me as an active participant in the research process and affected the way that knowledge will be represented in this thesis. As an author, I have been written into the text.

I began this thesis believing I would be telling a realist tale, highlighting the voices of the experts and the athletes. The results sections of the thesis are dominated by quotations from the participants. As Sparkes (2002) noted:

Realist tales are characterized by extensive, closely edited quotations. These are used to convey to the reader that the views expressed are not those of the researcher but are rather the authentic and representative remarks transcribed straight from the mouths of the participants. (p. 44)

With the extensive use of participants' quotations, I hope to invite the reader to take part in the stories, perhaps to identify with the athletes' experiences of overtraining or the experts' experiences of working with overtraining athletes. Nonetheless, with my own story of OT to tell, and with the changing viewpoints I encountered conducting this research, I have also included my voice, the confessional element of telling the tale, especially with respect to telling the stories of the athletes. As Sparkes remarked:

Even though there is a set of key conventions that frame realist tales, this frame is not rigid or impermeable. Those who feel increasingly uncomfortable about producing author-evacuated tales might consider writing more of themselves into the text when, for certain purposes, they feel this to be appropriate. (p. 54)

I identified with Sparkes' comments on how confessional tales allow researchers to describe how their points of view evolved through the research process:

The field worker's point of view is often represented in confessional tales as part of the character-building conversion tale in which the researcher, who had a view of how things might happen at the start of the study, comes to see things very differently as the study progresses. (p. 60)

I am not sure how often this evolution occurs in most qualitative studies, but I found that my views of how my research on OT might progress changed substantially during the course of the project. I still feel that the main thrust of my story comes from the participants' voices, from the experts' tales of working with OT athletes, and from the athletes' tales of OT and injury. I have, however, couched the experts' perspectives more in the realist tale mode, whereas, I have filtered the tales of the athletes' experiences through my own confessions. I hope that, by including my own voice in telling the tale, the reader may understand more clearly the perspectives presented and find the journey through the complex phenomena of OT experience more interesting and informative.

Rationale for the Thesis

Despite research findings that have linked changes in psychological and physiological variables to alterations in intensity and volume of training (Lehmann, Foster, & Keul, 1993; O'Toole, 1998; Rowbottom, Keast, & Morton, 1998, Steinacker & Lehmann, 2002), the research on OT has not clearly distinguished between markers that identify intense training and those that identify OT (Martin, Andersen, & Gates, 2000; Rowbottom et al., 1998, Steinacker & Lehmann, 2002). This lack of clarity about markers of OT seems to indicate that OT may not be identified easily during its onset, making it difficult for coaches and athletes to monitor training stress accurately. Nonetheless, coaches and athletes could benefit from more knowledge about the process of, and experiences with, OT to anticipate the situations that might put athletes at greater risk.

The most recent literature suggests that OT is a complex issue requiring a broad understanding of many factors, both training and non-training, in athletes' lives. Kenttä and Hassmén (2002) have described a conceptual model of the OT and recovery processes

in which they emphasised a holistic approach to understanding the stress/recovery balance in athletes. Kenttä and Hassmén outlined the importance of “focusing on the individual athletes and their perceptions of training and recovery” (p. 74). Through observation, case studies, and anecdotal reports, other researchers have also identified circumstances under which the balancing act is upset, or where personal and situational variables (sport and non-sport), lead to states of OT, illness, or injury (Gould, Guinan, Greenleaf, Medbery, & Peterson, 1999; Gould, Tuffey, Udry, & Loehr, 1997; Krane, Greenleaf, & Snow, 1997; Uusitalo, 2001).

Research efforts could be concentrated on looking at the development of OT behaviour among athletes before the onset of OT syndrome, how and why athletes begin these behaviours in the first place, and what sorts of internal and external variables influence the OT process. Kenttä and Hassmén’s (2002) conceptual model provides a useful framework to describe the interactions among stressors, individual stress tolerance, and recovery processes. This model could be augmented with experts’ observations of athletes who have overtrained and stories describing athletes’ experiences with OT. In researching the multiple perspectives on and experiences with OT, I hope that we will gain a better understanding of what got athletes to the point of OT in the first place, what are the myriad possibilities that upset the balance of training and recovery, and to what sorts of situations or personal variables coaches and athletes might be alerted in the future to avoid upsetting the balance.

Purpose of the Thesis

The purpose of this thesis is to present in-depth descriptions of experts’ perspectives on overtraining and of athletes’ experiences with OT behaviours and outcomes. Hopefully, with increased understanding of the OT experience, athletes, coaches, parents, and sport administrators may be equipped with greater knowledge and

awareness to make better decisions about training and recovery. I am guided by the following research questions: What do experts, such as coaches and sport scientists, say about overtraining? What are their experiences of working with athletes who have overtrained? What factors may predispose athletes to OT behaviour and outcomes in the first place, even before a cycle of training has commenced? How would one describe athletes susceptible to OT? What situations and intra- and interpersonal variables push athletes to overtraining?

Evolution and Changes in Research Perspective

There has been a shift in goals for the outcomes of this project from producing a checklist of risk factors for OT to presenting detailed descriptions of experts' perspectives on OT and rich accounts of athletes' experiences with OT. Originally, I thought I might develop a neat checklist that could be applied to athletes in most situations; I have found, however, through the interviews with experts and athletes, that athlete behaviour, whether in sports or other areas of life, is too detailed and too complex to describe adequately in a checklist. Instead of an ostensibly exhaustive list, the interviews provided stories of athletes, and people who have worked with athletes, which tell us about the human experience with adversity (injury, illness, OT syndrome) in competitive sport.

There also has been a shift in focus of the research from one on OT syndrome, a singular outcome, to one on OT processes and behaviours with multiple negative outcomes. I can most accurately describe the changes in my perspective by saying my views have broadened and deepened. At the outset, I thought I would be exploring only the risk factors for *overtraining syndrome* (a negative outcome associated with fatigue and underperformance) in competitive sport, and that the research would be limited to sports typically associated with very high volumes and intensities of physical training, such as swimming, cycling, or rowing. The focus has broadened, however, from trying to identify

risk factors for this relatively infrequent outcome in elite sport, OT syndrome, to looking at risk factors for an entire process encompassing OT behaviour and outcomes, illness and injury, which are common experiences for most athletes. My view has deepened in that I have seen OT as an elaborate set of behaviours, with multiple outcomes, resulting from interactions among many variables in athletes' lives. I have observed that OT is about more than just understanding how athletes handle a given training load; it encompasses seeing athletes as complex beings, characterised by ontogenetic histories, influenced by significant others, and driven by intrapsychic conflicts. What I realised when I began talking to athletes was that, regardless of sport and intensity of training, most athletes have stories to tell of times when they have gone too hard, not recovered enough, got overstressed, returned too early from injury, turned a blind eye to a niggle that eventually got worse, acted desperately to achieve a goal that may not have been realistic, or made poor decisions about health, training, and injury, in general, when physically or psychologically vulnerable. The similarity among many of the stories is that they are connected by an underlying behaviour pattern (that of doing too much given the individual's capacity to cope). With an OT process-focussed perspective, one can see that it is possible for athletes to overtrain without high training volumes or intensities, and to risk negative outcomes beyond just OT syndrome, such as illness or injury, if they are compromised in other areas of their lives.

Summary

Understanding OT in elite sport is a complex issue. Many researchers have commented on risk factors for OT and injury in athletes; some have offered illuminating anecdotes, and others have presented case study findings illustrating some experiences with OT. Kenttä and Hassmén (2002) have proposed a comprehensive model for understanding the overtraining/underrecovery process in terms of a stress/recovery

balance. I developed a plan to interview elite athletes, coaches, sport doctors, psychologists, and exercise scientists. I thought I could get significant insight into the personal and situational factors surrounding OT processes and outcomes by exploring multiple perspectives from athletes in the field who have experienced OT and from experts who have worked with athletes who overtrained.

I endeavoured to continue the trend Kenttä and Hassmén started (2002), distinguishing causes and consequences of OT, and extending the understanding of personal and situational risk factors. The field is moving from research on identifying OT once it has happened to research focusing on anticipating OT behaviours and outcomes by looking at risk factors. With risk factor research, it might be possible to answer the question: Can one identify, and take steps to change, OT behaviour before it damages an athlete too severely? My aim with this thesis is to provide insight into OT experiences, so that athletes and people working with athletes can take such steps.

CHAPTER 2: REVIEW OF LITERATURE

This chapter comprises a review of the literature pertaining to OT in sport, including sections on definitions of terminology, research findings, and evidence of expert and athlete perspectives on and experiences with OT.

Definitions

As mentioned in the introduction, I started out this project thinking I would be examining something specific, called *overtraining syndrome*, a relatively infrequent (Urhausen & Kindermann, 2002), albeit significant, outcome in exercise and sports. With the broadening of my research focus, as guided by the interviews I conducted with experts and athletes, I began to stumble over the uses of *overtraining* terminology. *Overtraining* did not seem sufficient to describe what was going on with athletes in their everyday battles to balance their stressors with recoveries, their illnesses and injuries with good health practices, their intra- and interpersonal conflicts with well-being and quality of life. In workshops and presentations of my research, I started to talk about *over-doing-it behaviour* in athletes because I wanted to move away from stereotypes that people in the sport world, such as coaches and athletes, seemed to hold about *overtraining*. Nonetheless, I still felt challenged to look for adequate terms to describe what was going on, and I felt anxious about creating new terms that people in the field would understand and accept. Perhaps, where this process brings me is to a place where I will use certain terms in this thesis for descriptive purposes, while maintaining a shared awareness with the reader that OT processes and outcomes may elude comprehensive (and agreed upon) definitions. I will attempt, however, to present the different terminology that has been applied to the various aspects of OT in the literature.

In defining OT, it seems that researchers in the field have used many terms in different ways to describe both processes and outcomes associated with OT (Kellmann,

2002). Terms that have been used to describe, define, or have been associated with OT include the following: overreaching, staleness, burnout, overfatigue, overwork, overload, underperformance, underrecovery, and short- and long-term OT (Kreider et al., 1998b; Kellmann, 2002). There has been confusion, however, about whether OT may have positive or negative sequelae, about whether it should be considered a process, an outcome, or both, about whether different aspects of OT are causes or consequences, and about the varied usage of different terms in the field associated with OT. I have presented definitions in the following sections, illustrating some of the subtle differences among usage of OT terminology.

To begin with, it may be useful to look at a description of how the training process is viewed today. Steinacker and Lehmann (2002) outlined what training includes:

Athletic training consists of repetitive phases of normal training, high-load training, overload training, overreaching, and recovery. During the training program, training load -- defined by the intensity, duration, and frequency of exercise -- varies and should gradually increase in response to the training-induced adaptation of various physical systems. This increase in training load is necessary to ensure further responses to a training program. Coaches often organize training in alternating cycles of increasing training load and enhancing regeneration. Such training cycles, which are relatively safe, allow the training load to reach a high, sustainable level for a short time. During the process (which is called supercompensation, or overreaching) the exhaustion and fatigue resulting from the high-load training phases elicit corresponding cellular stresses and consecutively raises [sic] performance in the recovery phases as an adaptation to the training overload. (p. 103)

What seems evident from the above description of the training process is that athletes are intentionally pushing their training hard to get optimum results; high levels of fatigue and physiological adaptations are to be expected, and peak performance after a period of recovery, usually referred to as a *taper*, is the objective of the process.

Overtraining

The following represent definitions of OT presented by various researchers in the field. Steinacker and Lehmann (2002) have stated:

Overtraining is a long-lasting performance incompetence due to an imbalance of sport-specific and nonsport-specific stressors and recovery with atypical cellular adaptations and responses. Besides performance incompetence, many other clinical problems may arise as a result of overtraining, including sports injuries, infections, or mood disturbances such as fatigue or depression. Imbalance of stress (training-specific, psychological, and non-specific) and recovery determines the outcome of a given training situation. Most clinical problems are observed in training with a high metabolic load of more than 4000 kilocalories per day. Training with lower metabolic demands may also result in performance incompetence and clinical symptoms; however, these problems result mainly from non-metabolic causes rather than sport-specific stressors and incomplete recovery. (pp. 103-104)

Steinacker and Lehmann have provided a definition that describes OT as both a process and an outcome, and have included several other possible adverse outcomes associated with the process of OT. Similarly, Hooper and Mackinnon (1995) and O'Toole (1998) outlined many of the possible outcomes of OT, describing OT as a process, or behaviour, that leads to a state of non-adaptation associated with negative outcomes, such as prolonged fatigue, depression, illness, injury, and long-term disruption of general physical and psychological well-being. Nonetheless, Hooper and Mackinnon indicated that *overtraining* is a process, whereas *overtraining syndrome* is an outcome, representing the extreme end state of non-adaptation that results from OT behaviour.

In contrast to authors who have presented OT in a negative light, Raglin (1993) originally described OT as an “integral and necessary aspect of endurance training”, where it is regarded as a “stimulus consisting of a systematic schedule of progressively intense physical training of a high absolute and relative intensity” (p. 842). Hackney et al. (1990) viewed OT as part of the training process, but described it as an abnormal extension that leads to a state of “staleness” or “being overtrained” (p. 22). Kreider et al. (1998b), however, focussed on OT as a state of stress accumulation, not distinguishing OT as a process from OT as an outcome, with the following definition:

Overtraining is an accumulation of training and non-training stress resulting in a long-term decrement in performance capacity with or without related physiological and psychological signs and symptoms of overtraining in which restoration of performance capacity may take from several weeks to months. (p. viii)

Lehmann et al. (1999) presented OT in both positive and negative terms, distinguishing the definitions by time frame, short- or long-term:

Short-term overtraining (also called overreaching or supercompensation training) is a common part of athletic training, which leads to a state of overreaching in affected athletes. This state of overreaching is characterized by transient underperformance, which is reversible within a short-term recovery period of one to two weeks and can be rewarded by a state of supercompensation (an increase in performance ability following one to two weeks of regeneration after a short-term phase of overtraining); therefore, short-term overtraining, or overreaching, is a regular part of athletic training. (p. 2)

Long-term overtraining occurs when overreaching is too profound or is extended for too long; this occurs if the necessary regeneration period is inappropriately short or recovery therefore remains incomplete and is additionally associated with too many competitions and non-training stress factors. The athlete clearly runs the risk of a resulting overtraining syndrome (p. 2).

With the above definitions, Lehmann et al. have still attached positive implications to OT, equating short-term OT with overreaching, and seeing it as a necessary process in achieving optimal performance. Armstrong and VanHeest (2002) noted the ongoing debate about positive and negative uses of the terms *overtraining* and *overreaching*, stating that “some authorities view overreaching as a deliberate attempt to induce optimal performance” and “others view it as an unplanned, undesirable outcome of strenuous training.” (p. 187). Armstrong and VanHeest indicated that, although they saw overreaching as positive, defining it in terms of a process that brings about supercompensation, they viewed OT, short- or long-term, as negative, and associated with chronic performance decrement.

Overreaching

Looking at definitions of overreaching, there is, once again, confusion about whether it is positive, negative, whether it is to be equated with OT, and whether it is necessary to achieve optimal performance. The following are definitions found in the literature:

Overreaching refers to training that involves a brief period of overload, with inadequate recovery, that [sic] exceeds the athlete's adaptive capacity. This process involves a temporary performance decrement lasting from several days to several weeks. (Armstrong & VanHeest, 2002, p. 187)

Overreaching is an accumulation of training and non-training stress resulting in a short-term decrement in performance capacity with or without related physiological and psychological signs and symptoms of overtraining in which restoration of performance capacity may take from several days to several weeks. (Kreider et al., 1998b, viii)

Although some coaches, researchers, and others might claim overreaching is necessary during the training process, a consensus statement, outlined at a USOC/ACSM human performance summit, concluded that overreaching should be avoided because of its unpredictable outcomes (Urhausen & Kindermann, 2002). Such comments, questioning the necessity of overreaching, may be at odds with many training practices; it seems that in using these terms, researchers are juggling semantics and artificial categories. Having been a competitive athlete in several different sports throughout my life, I have yet to hear a coach or other athlete refer to a planned process of training as *overreaching* or *overtraining*. Elite athletes train hard, often extremely hard, and get tired during heavy training; fatigue is expected no matter what it is called. Following heavy training, if the training and recovery have been well managed, athletes will recover and perform well. If the training and recovery have not been handled well, athletes will not recover sufficiently to perform at their peaks.

Staleness

If there was not already enough confusion about overreaching and OT, researchers often use the term *staleness* to refer to the state of sustained fatigue or underperformance experienced by athletes. Staleness ostensibly represents a less severe stage in the development of the OT syndrome (Silva, 1990). Staleness has been regarded as an undesirable response that is a consequence or product of OT (Raglin, 1993). Staleness has

also been equated with OT syndrome (Hooper & Mackinnon, 1995), and Hackney et al.

(1990) defined staleness as:

A state in which the athlete has difficulty maintaining standard training regimens and can no longer achieve previous performance results (i.e., performance decline). The terms "staleness" or "being overtrained" are commonly used interchangeably. This term can be defined as the end "result." (p. 22)

Silva (1990) described staleness as “an initial failure of the body’s adaptive mechanisms to cope with psychological and physiological stress” (p. 10). Perhaps, like croissants, stale athletes could be described as a little mouldy, dry, and crusty around the edges. Although most researchers appear to be in agreement that staleness is an outcome of the OT process, and is pretty much the same thing as OT syndrome, there does not seem to be any good reason to use the term, aside from adding more jargon to an already confusing lexicon in the field. It might be important to acknowledge the usage of staleness by researchers throughout history; yet, to promote understanding among future researchers and readers, it appears parsimonious to use only the terms *overtraining syndrome* to describe the outcome state of fatigue, resulting from overtraining processes.

Burnout

If there were not enough terms used to describe athletes’ changes in performance and struggles with fatigue, researchers have added the term *burnout* to the list of descriptors associated with OT. After having read much of the literature on burnout in sport, and the original burnout literature in the sphere of human services, I am left with the sense that *burnout* and *overtraining* are terms that can be confused because they both describe processes surrounding, and responses to, stress overload. Furthermore, *burnout* is a term that I have heard used frequently among athletes and coaches, alike, to describe feelings of being fed up with some, or all, aspects of their sports. Looking at the original definitions, however, the most significant distinction seems to be that *burnout* was used to describe stress responses among people working in human services and *overtraining* was

used to describe stress responses among athletes training in competitive sports. I am not sure that using the term *burnout* in overtraining research does more than add confusion; nonetheless, the large amount of research on, and the seeming similarities between, the two concepts justify a more thorough examination of the terms.

The term *burnout* was coined by clinical psychologist Herbert Freudenberger (1974), who used it to describe stress responses among staff members of clinical institutions, such as free clinics and halfway houses. Most burnout research has continued to focus on people in human services occupations, and has been based on Maslach and Jackson's (1981) definition of burnout as a stress reaction syndrome comprised of three dimensions, emotional exhaustion, depersonalisation, and feelings of low personal accomplishment. Maslach (1982) suggested that burnout:

Is a response to the chronic emotional strain of dealing extensively with other human beings, particularly when they are troubled or having problems. Thus, it can be considered one type of job stress. Although it has some of the same deleterious effects as other stress responses, what is unique about burnout is that the stress arises from the *social* interaction between helper and recipient. (p. 3)

Furthermore, Maslach also commented:

A pattern of emotional overload and subsequent emotional exhaustion is at the heart of the burnout syndrome. A person gets overly involved emotionally, overextends him- or herself, and feels overwhelmed by the emotional demands imposed by other people. (p. 3)

According to Maslach's descriptions, it seems that, similar to *overtraining*, *burnout* is about experiencing an overload in some way, and reacting negatively to that overload. Nonetheless, Maslach makes a clear point that burnout is unique, distinguishable from other experiences of stress, in that it is about *job stress*, and, in particular, stress arising from human services employment. This issue regarding job stress seems to be the clearest point of departure from similarities to OT, which would not be described as a stress response arising from a helper-recipient relationship.

If the original definitions do not seem clear enough to warrant keeping *burnout* and *overtraining* separate, questions surrounding the conceptualisation of *burnout* detract from the already uncertain association between the two terms. Although Maslach's conception of burnout included three dimensions, emotional exhaustion has often emerged in research as the most significant component of the burnout response (Jackson, Schwab, & Schuler, 1986; Posig & Kickul, 2003). Various researchers (Evans & Fischer, 1993; Lee & Ashforth, 1990; Meier, 1984) have called into question the dimensionality and construct validity of the Maslach Burnout Inventory (MBI; Maslach & Jackson, 1981), suggesting that support for the three-component model has been equivocal. It seems, therefore, that if there is disagreement in the burnout research about the construction of the *burnout* concept, it would make sense not to apply the term to a new domain, at least until questions within the original field have been settled.

Nonetheless, having derived some parallels between stress responses among human services workers and athletes, coaches, and other sport staff, researchers in sport have adopted the burnout concept and examined it within the sport world, often using the MBI, or adaptations of it, as a measure of burnout (e.g. Dale & Weinberg, 1990; Gould, Tuffey, Udry, & Loehr, 1996, 1997; Gould, Udry, Tuffey, & Loehr, 1996; Kelley, 1994; Kelley & Gill, 1993; Martin, Kelley, & Eklund, 1999; Raedeke, 1997; Raedeke & Smith, 2001; Schmidt & Stein, 1991; Smith, 1986; Udry, Gould, Bridges, & Tuffey, 1997; Vealey, Armstrong, & Comar, 1998; Vealey, Udry, Zimmerman, & Soliday, 1992). Many of the researchers of burnout in sport may be applauded for their efforts to test, measure, and describe complex phenomena surrounding athletes', coaches', and others' stress reactions in sport. That coaches and human services workers both are in helper-recipient positions seems to be justify the use of *burnout* in examining the coaching population. There still

seems to be no reason, however, to use the term *burnout* with athletes, at least based on how it has been defined.

Looking for ways to integrate the concept of *burnout* into sport, Smith (1986) presented a theoretical cognitive-affective model of athletic burnout, which might be applied to athletes and people, such as coaches, working with athletes. Smith suggested that *burnout* is more severe than *staleness* and defined burnout as a psychological, emotional, and, often, physical withdrawal from a formerly pursued and enjoyable activity as a result of chronic stress. Smith described the major components of burnout with several key statements, outlined here in Table 1:

Table 1.

Major Components of the Burnout Syndrome (adapted from Smith, 1986, pp. 37-42)

Statements Regarding Burnout
Burnout is a reaction to chronic stress.
People suffering burnout experience low energy, chronic fatigue, and an increased susceptibility to illness.
At an emotional level, feelings of depression, helplessness, and anger are frequently reported.
Tension and irritability occur . . . and increasingly negative attitudes toward the activity may generalize to other areas of life as well.
At a behavioural level, decreased efficiency and inconsistent performance occur, and at extreme levels . . . withdrawal may result.
In most cases of burnout, the person feels outweighed by the demands of the situation, although boredom experienced when resources greatly exceed demands can also be involved.
A state of learned helplessness can result that undermines still further the person's motivation and ability to cope.
A final cognitive characteristic of burnout is a loss of meaningfulness concerning what one is doing and a subsequent devaluation of the activity.

Here, Smith (1986) provided a description of burnout that could, conceivably, fit with the concept of OT in some ways. A few of the symptoms of burnout, such as fatigue, susceptibility to illness, and inconsistent performance, echo those observed in OT, and perhaps have prompted OT researchers to integrate the two terms. Nevertheless, descriptions of OT differ from those of burnout in significant ways. OT is often associated with extremely high levels of motivation, as opposed to the loss of motivation proposed with burnout; boredom, where resources exceed demands, is the antithesis of OT; and, athletes who are overtraining do not seem to devalue their activities, rather they pursue them vehemently. Despite apparent differences between OT and burnout, Smith's model seems applicable to coaches and other employees in sport. In a review of the burnout in sport literature, Dale and Weinberg (1990) noted, "coaches fit into the framework of the human service or helping professions and seem to be a prime candidate [sic] for burnout" (p. 74). Several researchers in sport, thus, have chosen to explore the burnout concept within these sport employment related contexts (e.g., Kelley, 1994; Kelley & Eklund, 1999; Kelley & Gill, 1993; Rainey, 1995; Vealey et al., 1992)

Returning to looking at burnout in athletes, McCann (1995) identified the substantial confusion about the differences between OT syndrome and burnout, but stated "the most obvious overlap between the overtraining and burnout syndromes is that stress appears to play a major role in the aetiology of each. A salient difference between the two syndromes, as typically defined, is the specific theoretical role of cognitive factors posited for burnout" (p. 352). In other words, McCann noted that classic definitions of burnout and OT syndrome tend to separate the two along physical and psychological lines. OT, on the one hand, involves stress overload from a physical stressor (training load) and may not necessarily involve overload from cognitive/emotional sources. Athletes may overtrain physically, while maintaining high levels of emotional investment and motivation, but

cannot overtrain without the presence of the physical stressor. In contrast, burnout seems to involve overload primarily from psychological stressors, which leads to emotional exhaustion and loss of motivation.

More recently, researchers in overtraining have begun to talk about burnout within stress-recovery based approaches (Kallus & Kellmann, 2000; Kellmann & Kallus, 2000; Kentta & Hassmen, 2001), where athletes may be considered to be at higher risk for burnout if they do not have resources to manage the balance between their stress and recovery states. Looking at the parallels in processes preceding both overtraining syndrome and burnout, researchers (e.g., Kallus & Kellmann, 2000; Kentta & Hassmen, 2002) have suggested OTS and burnout result from stress-recovery imbalances. Hassmen (2001) depicted burnout, however, as a more severe outcome than overtraining syndrome. Describing burnout as a result of stress-recovery imbalances fits with McCann's (1995) illustrations of burnout as resulting primarily from psychological stress; nonetheless, suggesting that burnout follows from OTS obscures the clear distinction between the two terms as resulting from either primarily physical or psychological sources. Burnout happens because people get emotionally overloaded, which can happen to athletes. Overtraining syndrome occurs because people have overloaded their bodies, physically. The two terms are most clearly distinguished along these lines – stress recovery imbalances may lead to either state, with similarities in symptomatology. Why not call the state *burnout* when the imbalance results from psychological stressors and leads to an emotional overload, and overtraining syndrome when the imbalance results from primarily physical stressors and leads to a physiological breakdown?

Reviewing this previous discussion of burnout, it appears that *burnout* shares similarities with respect to origins, signs, and symptoms of OTS. Burnout sounds like an appealing term to apply to athletes because it describes how people get exhausted in

response to chronic stress – similarly, overtrained athletes can be characterised as being exhausted in response to chronic stressors. The emphasis on the psychological stressors in burnout, in contrast to the emphasis on the physical stressors in OTS, seems to be a key factor in distinguishing the two concepts. Burnout may be considered one outcome of a stress-recovery imbalance – athletes get fed up with stress overloads and feel like they don't want to do their sports anymore – but burnout does not necessarily involve the physical break-downs associated with OT. It is the physical element of OTS that leads me to feel uncomfortable suggesting that burnout is the most severe end stage of OTS; it seems that the term *overtraining syndrome* adequately describes the state of physical exhaustion, and associated symptoms, experienced from a prolonged imbalance between sport-related stressors and recovery. Burnout might occur as part of a stress-recovery imbalance but only where the resulting exhaustion could be attributed primarily to emotional/cognitive stressors. Therefore, burnout could be seen to be a possible outcome of overtraining processes, but I do not see it as a more severe outcome than OTS on a linear continuum of overtraining outcomes. Given the original definitions of burnout, the applications of the term in sport, and previous discussions of OT terminology, it seems that there might be some benefit to using the term burnout to describe emotional overload from stress-recovery imbalances, but not as a descriptor of a severe end-state following OT syndrome.

Underrecovery

Finally, in an attempt to shift attention away from training, OT, and the confusion surrounding these terms, Kellmann (2002) has moved to a focus on the recovery aspect of athletic experience. According to Kellmann's view, instead of OT, athletes can be described as experiencing "underrecovery":

Underrecovery is the failure to fulfil current recovery demands. Underrecovery can be the result of excessively prolonged and/or intense exercise, stressful

competition, or other stressors. Underrecovery can result from training mistakes, such as monotonous training programs, more than three hours of training per day, more than a 30 percent increase in training load each week, ignoring the training principle of alternating hard and easy training days or by following two hard days with an easy day, no training periodization and respective regeneration micro-cycles after two or three weeks of training, or no rest days (p. 3).

The introduction of the term *underrecovery* might draw attention away from the “over” terminology, and take the heat off some coaches for training athletes too intensively.

Kellmann even suggested that “insufficient and/or lack of recovery time between practice sessions is the main cause of the overtraining syndrome” (p. 12). Budgett (1998) supported this statement, proposing that underrecovery, not necessarily too much training, leads to the overtraining syndrome.

The shift in focus from training to recovery might also be useful in emphasising neglected areas of athletes’ lives, as well as for highlighting individual differences in recovery needs. Kellmann (2002) defined *recovery* as an “inter- and intra-individual multilevel (e.g., psychological, physiological, social) process. . . for the reestablishment of performance abilities” (p. 10). It involves physiological factors (restoring nutritional resources, and getting sufficient sleep), psychological components (feelings of relaxation, sense of well-being and positive moods), and social activities (getting together with friends, healthy relationships with others). Looking at all of these different aspects of recovery broadens the focus on what might be leading athletes to feel fatigued, beyond the volume and intensity of the training program. Furthermore, as Kellmann noted, “recovery is specific to the individual and depends on individual appraisals” (p. 7); each athlete might have different recovery strategies; what works for one athlete might not work for another. Kellmann referred to an individual’s response to training and non-training stressors as the *recovery-stress state*, a term that encompasses Lehman et al.’s (1993) earlier description of factors that threaten to imbalance athletes’ lives:

Inter-individual differences in recovery potential, exercise capacity, non-training stressors, and stress tolerance may explain the different degrees of vulnerability experienced by athletes under identical training conditions. (p. 16)

Kellmann concluded his discussion of underrecovery, suggesting that it has the same impact as OT in that performance declines, but Kellmann noted that underrecovery is the precursor/cause of the OT syndrome. Using the term *underrecovery* seems to have highlighted some important factors on which coaches, athletes, researchers, and others might focus to ensure a holistic and healthy approach to athletic training; nonetheless, the concept of balancing stress and recovery behaviours may still elude definition by a single term.

Review of OT Terminology

Labels and definitions may be helpful to keep an area of research focussed; although, it seems that defining OT processes and outcomes has created some confusion, or, at least disagreement, among researchers and others. Perhaps the confusion and disagreement have arisen because the process of balancing stressors and different forms of recovery, life issues, and intra- and inter-psycho challenges is not easy to describe with a few concise terms. Generally, in OT research, there has been a focus on one outcome, OT syndrome. Many of the definitions presented, except for those offered by Steinacker and Lehmann (2002) and Hooper and Mackinnon (1995), whether describing OT processes or outcomes, exclude reference to other significant outcomes, such as injury and illness, which researchers (e.g. Kibler & Chandler, 1998; Steinacker & Lehmann, 2002) have also related to the same underlying behaviours.

Furthermore, based on my experiences as a competitive athlete, it seems to me that many coaches and athletes in Canada and Australia interpret any usage of terms, such as *overtraining*, *overreaching*, or “over“ anything, as negative. Coaches and athletes may not be happy to say that they are engaging athletes in *short-term overtraining* or *overreaching*,

even if researchers are using these terms to describe effective forms of training. For the coaches and athletes, there is just “training,” and either athletes are training well or they are not. Coaches seem particularly defensive about using any such terms because the implication for them is that there is something wrong with their training programs.

What seems pragmatic is to look at how competitive athletes and coaches work with these terms. As mentioned, in sport, there is training, which is either effective or ineffective in bringing about improved performance. There is an assumption that training has to be pushed, or increased, as fitness and performance improve, to stimulate further gains. Armstrong and VanHeest (2002) referred to this approach as *overload training*, “a planned, systematic, progressive increase in training stimuli that is required for improvements in strength, power and endurance” (p. 187). The overload principle is implicit, however, in contemporary athletic training program design. To use the terms *overtraining*, *overreaching*, or *overload training* to describe this process of challenging the body with increased loads seems superfluous, and can be confusing to many, because the use of “over” as a prefix implies that one has done something excessively. To talk about positive aspects of OT, therefore, seems contradictory. On the one hand, there is effective training, and, on the other hand, if OT is involved, short- or long-term, there is ineffective training. The sticking point seems to come from the original usage of the term to describe the process of overload training that is required for optimal performance (Morgan et al., 1987; Raglin, 1993). This usage may have reflected a shift in the way athletic training was approached when overloading, as a principle, was first taken on board by athletes, coaches, and sport scientists. It seemed that there was a need to differentiate regular training, which now might be seen as maintenance training or under-training, from the more effective form of overload training.

Perhaps, the most useful approach to understanding athletes' experiences with OT processes and outcomes is to stay focussed on effective and ineffective training and recovery processes and behaviours in the context of the stress/recovery balance. Kenttä and Hassmén (2002) have emphasised this focus, making distinctions between optimal training and negative OT, and viewing optimal training as an ongoing *psychosocial-physiological* balancing act. Kenttä and Hassmén suggested essential components of optimal training include physical adaptation to the training performed and the possibility for athletes to practice at the highest level of performance (optimal technique, speed, strength, aerobic power, and mental abilities). Ideally, general well-being is maintained despite heavy training loads, and performance capacity increases in a steady fashion. Optimal training is contrasted with negative OT, during which

a number of less desirable outcomes will become obvious. For example, the potential for high-quality performance or technique training becomes limited, and training increasingly psychologically demanding. The immune system becomes negatively affected, resulting in more infections and the resultant absence from training. Uncertainty exists as to whether the body will adapt only to a previous level of performance or accomplish a super compensation after recovery. (Kenttä & Hassmén, p. 59)

In looking at the stress/recovery balance and OT/underperformance issues, Kenttä and Hassmén (2002) also attempted to broaden understanding of what constitutes stress in athletes' lives:

Physiological stress is usually described in the literature as the predominant cause of underperformance associated with staleness and burnout. However, nontraining stressors have more recently gained a wider acknowledgment in regard to overtraining and burnout among athletes. (p. 69)

Furthermore, without a focus on the whole stress/recovery process, one might misattribute some of the outcomes of OT, such as illness and injury, to different causes, at the risk of making harmful decisions about training and recovery. For example, if athletes, coaches or others have decided that injuries or illnesses were the results of bad luck or bad timing,

rather than consequences of too much stress and/or not enough recovery, they may be more likely to repeat the maladaptive behavioural patterns, however inadvertently.

Some of the difficulty with defining OT is illustrated by the lack of clear indicators of OT. Hawley and Schoene (2003) suggested “some level of fatigue, depression, feelings of burnout, anxiety, irritability, and difficulty concentrating or sleeping is normal for athletes undergoing heavy training or competition” (p. 25). Furthermore, they stated that “athletes may also experience persistent muscle soreness, decreased coordination, reduced libido, and frequent upper respiratory infections. This training state is . . . an expected part of vigorous training” (p. 25).

The apparent lack of clarity regarding signs and symptoms of OT syndrome illustrates that when one uses the term *overtraining* in reference to athletes displaying certain signs and symptoms, it may not be clear whether those athletes are actually overtraining or simply going through a necessary adaptation phase of training, from which they will recover. It also seems important to make a decision about the positive versus negative uses of the term. What happens to the credibility for this field of research if some proponents are saying athletes need to overtrain/overreach to achieve optimal performance and others are saying these processes must be avoided at all costs? How can we identify athletes at risk for adverse outcomes, before they occur, if we are equating OT behaviour with the one outcome of OT syndrome? It seems that researchers could stumble with the singular focus on OT syndrome as an outcome, when they are trying to describe OT as a process. With a stress/recovery imbalance, if that is how OT is to be described, there is the possibility of several different major adverse outcomes, including injury, illness, and OT syndrome, with associated physical and psychological symptoms. In this context of stress/recovery balance, OT can be viewed as a behavioural pattern, with personal and situational predisposing factors that lead to a variety of negative outcomes.

Conclusion on Terminology

In this thesis, the term *overtraining* is used to refer to a negative process or pattern of behaviour. Outcomes of the OT process are identified separately, whether they are OT syndrome, injury, illness, or other forms of maladaptation. Other terms, such as staleness, overreaching, short- or long-term OT, and burnout, are used only when making reference to statements by other authors. I acknowledge that my usage of terms is consistent with the views of some, but not all, researchers.

Research Findings on Overtraining

Prevalence

The prevalence of OT syndrome in different sports has not yet been clearly established. There is a number of studies with some prevalence data for OT (Hooper, Mackinnon, Howard, Gordon, and Bachmann 1995; Morgan, Brown, Raglin, O'Connor, & Ellickson, 1987; Morgan, O'Connor, Ellickson, and Bradley, 1988; Morgan, O'Connor, Sparling, and Pate, 1987), which have been regularly cited, despite weaknesses in that the statistics were often based on unclear classifications of OT syndrome, or on very small sample sizes. In two studies examining characteristics of elite distance runners, Morgan et al. (1988) and Morgan, O'Connor, Sparling et al. (1987) reported that 64% of males and 60% of females, respectively, indicated they had experienced *staleness* (OT syndrome) at some point during their careers. In both studies, researchers used the same definitions of OT syndrome to gather frequency data. Morgan et al. (1988) suggested that *staleness* is “usually characterized by a variety of behavioral, psychometric, and physiologic symptoms with perhaps the most salient features being: a) performance decrements or the inability to train at customary levels, b) chronic fatigue, and c) depression of clinical significance” (p. 251). Looking at this description of staleness/OT syndrome, I am not sure if a symptom of OT syndrome could be described as “psychometric.” Furthermore, from what was reported

in the studies, there did not seem to be any clinical assessment of depression in the athlete participants, although this was deemed to be an important component of the staleness definition. The researchers also did not state if *staleness* was explained or described to athletes before being asked to respond to the question of whether they had experienced staleness at some point during their careers. Based on an unclear description, even if the researchers did explain the concept of staleness to the athletes, it seems that the athletes may not have been in the position to make reliable statements about their OT experiences, leaving the reported frequencies in question. In a series of studies spanning 10 years, Morgan, O'Connor, Ellickson et al. (1987) monitored mood states, using the Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1992), in college swimmers, and suggested that, during peak, twice-daily training, "it is not uncommon for 5-10% of the swimmers to experience what we regard as staleness" (p. 108). Although Morgan, O'Connor, Ellickson et al. (1987) may have developed sensitivities for which swimmers were overtraining during their 10 years of observing such athletes, the prevalence statistics presented were only from an estimate made in passing, and not a frequency value derived from systematic inquiry. In contrast to the previously mentioned studies, where athletes were classified as stale/overtrained based on general definitions of OT syndrome, Hooper et al. (1995) derived an OT syndrome frequency statistic in a small group of swimmers, from a specific classification of OT syndrome, which they also referred to as *staleness*. Hooper et al. stated that swimmers were classified as stale if all of the following occurred:

- (a) failure of performance in the maximal effort swim to improve from early- to late-season;
- (b) failure of performance in the trials to improve from previous best times;
- (c) fatigue ratings in the [training] logs > 5 (scale 1-7) for more than 7 d consecutively;
- (d) comments in the page provided in each log that the athlete was feeling as though he or she was responding poorly to training;
- (e) a negative response to a question regarding presence of illness in the swimmer's log, together with normal leukocyte count and ESR [erythrocyte sedimentation rate] at testing time. (p. 108)

Based on these specific staleness/OT syndrome classification criteria, Hooper et al. found three out of the 14 swimmers (approximately 21%) could be identified as stale by the end of the season, that is following the Australian National swim titles. Here, Hooper et al. provided some idea of prevalence of OT syndrome, based on clear, specific criteria, among a group of elite swimmers. Unfortunately, the small sample size makes it difficult to generalise the finding to other athletes.

In examining much larger samples of athletes, Gould et al. (2002) noted that 28 percent of 296 U.S. Atlanta Olympians and 10 percent of 83 Nagano Olympians reported that they were overtrained in the 90 days prior to the Games and that the overtraining had a negative effect on performances. In all cases, Olympians in the Gould et al. studies were identified as overtrained if they answered *yes* to the statement “I overtrained in preparation for the Olympics” (p. 181). The researchers, however, appeared not to have given either the Atlanta group or the Nagano group definitions or explanations of OT. Given the concerns already discussed about clearly defining OT, it would seem that these prevalence statistics are not reliable; self-reports of OT, without any reference to OT criteria or definitions, do not seem to provide much useful data.

In a recent investigation, looking at the problem of overtraining in adolescent athletes, Raglin, Sawamura, Alexiou, Hassmén, and Kenttä (2000) asked 231 young swimmers from Greece, Japan, Sweden, and the United States if they had ever had a loss of performance sometime during their swimming careers, for at least two weeks, which was not a result of injury or illness, but due to training. Raglin et al. used this definition (i.e., perceived loss of performance) as the criterion for classifying athletes as having experienced OT, which the researchers referred to as *staleness*. Across the four countries, an average of 35% of the young swimmers reported experiencing the perceived performance losses, 20% from Sweden, 24% from US, 34% from Japan, and 45% from

Greece. Subsequently, the researchers classified these 35% as having experienced *staleness* at some point during their swimming careers. Although, Raglin et al. employed a more specific question than simply asking if athletes had been overtrained, it is not clear how reliable athletes might be for retrospectively assessing episodes of performance loss. How did these athletes decide what constituted a loss of performance? There could be any number of variables that affected the athletes' perceptions; for example, maybe some did not do as well as they hoped to do at certain swim meets, but were physically healthy. The comparison to others might have given them the impression that they were not performing well for a period of time. Maybe other young swimmers had pressure from their parents that made them feel they were not doing so well, but, objectively, they could have been performing adequately. In these examples, one would probably not want to attribute any perceived performance decrement to OT. It seems that it may have been helpful if the retrospective recall of performance losses was augmented with corroborating evidence from the coaches and others (competition results, training results, objectively identified episodes of performance decrement). With retrospective recall, which is a dubious method for gathering performance data, even asking athletes to refer to objective markers of performance in answering questions about performance decrements might help to produce more valid data, especially if backed up by coaches' reports, training data, and competitive performance results.

When I think back across my athletic career, I realize that it is quite difficult to answer a question about episodes of overtraining because there are some times where I may not have been aware of performance plateaus or decrements, and other times where I might have thought I was not performing well, but I was physically quite healthy. There are probably times where my performance was suffering because of an undetected illness or post-viral situation of which I was not aware. Now, with research background in this

field, I seem better equipped than previously to examine, retrospectively, different episodes of my own potential overtraining experiences, but I would still question how accurate I might be with such recall. There are difficulties defining overtraining in the first place, and therefore, it would follow that reliable prevalence data for overtraining may be hard to obtain. It might be acceptable to speculate that perceived performance decrements stand as preliminary evidence of OT syndrome prevalence, especially when athlete reports of performance losses are augmented with objective measures. Nonetheless, it might still be too big a leap to label such data on performance decrement as clear evidence of OT frequency in the athlete population.

Summarising the prevalence research reported here, given very specific criteria for judging OT syndrome, or what most researchers have called *staleness*, it seems that quite a small percentage of athletes may be classified as having experienced the syndrome. Given vague definitions, however, or none at all, for OT syndrome or *staleness*, and varying the targeted time span of retrospective recall (anywhere from the previous few months to a whole season to a whole athletic career), quite a large percentage of athletes may be classified as having experienced the syndrome. It seems that research has to become more rigorous in this area before one can make more definitive comments about the prevalence of OT syndrome in competitive sport.

Variations in Overtraining Processes and Outcomes

OT is an issue that affects athletes in many sports, whether it is in endurance activities like rowing and long-distance running or power events like weightlifting. Furthermore, OT affects athletes in various ways, with some incurring injury or suffering illness and others experiencing OT syndrome. Steinacker and Lehmann (2002) noted some of the potential variations in OT with the following statement:

Besides performance incompetence, many other clinical problems may arise as a result of overtraining, including sports injuries, infections, or mood disturbances such as fatigue or depression. (p. 103)

There also has been some suggestion in the literature that OT can be broken down into sympathetic and parasympathetic classifications (Kellmann, 2002; Lehmann et al. 1998; Lehmann et al., 1993). Sympathetic OT has been associated with such characteristics as increased resting heart rate and blood pressure, decreased appetite, loss of body mass, disturbed sleep, and irritability; parasympathetic OT has been associated with such patterns as low resting heart rate and blood pressure, long periods of sleep, and depression (Kellmann, 2002; Lehmann et al., 1993; Mackinnon & Hooper, 1994). Sympathetic OT has been linked to power and speed sports; parasympathetic OT has been linked to endurance sports (Kellmann, 2002; Lehmann, Dickhuth, & Gendrisch, 1991; van Borselen, Vos, & Fry, 1992). The distinctions between sympathetic and parasympathetic classifications appear clean, and make intuitive sense: if an athlete overloads the body in distinctly different ways (aerobic vs. anaerobic), one might expect to see distinctly different physiological responses. Nonetheless, based on the research findings, it is not clear whether such distinctions add clarity or increase confusion in trying to understand OT processes and outcomes. Fry (1998) made a clear statement that aerobic and anaerobic exercises should be considered differently in the context of overtraining:

It is quite evident that the adaptations to aerobic, or endurance, types of exercise are quite different from the adaptations to anaerobic exercise . . . [such as] resistance exercise. . . . What has not been as apparent in the overtraining literature is that overtraining with endurance exercise is also quite different from overtraining with resistance exercise. . . . As a result, one must be wary of using the endurance-overtraining literature to infer what happens during overtraining with resistance exercise.

In a study looking at increased volume training with US national-level judo athletes over 6 weeks, Callister, Callister, Fleck, and Dudley, (1990) suggested that intensive anaerobic training may present a different set of symptoms than endurance overtraining. Nonetheless,

with increased volumes of anaerobic training and concomitant decreases in performance, expected changes in sympathetic nervous system activity did not occur; there were no significant increases in resting heart rate and blood pressure.

In a pilot study on intensive resistance (anaerobic) training, Fry, Kraemer, Lynch, Triplett, and Koziris (1994) found no decrease in performance for maximal strength following an overload protocol, but did observe decreases on other physical tasks, such as speed-controlled strength and sprint speed. The investigators concluded that an overload stimulus in resistance training might create an OT response in non-training specific musculature, which is important for athletes and coaches to consider when designing training programs. To gain greater insight into the types of overtraining associated with anaerobic overloads, Fry, Kraemer, van Borselen et al. (1994) conducted a follow up study, during which they tested participants' responses to an even more intensive resistance training protocol than the one from the pilot study. In the follow up study, the researchers also looked at endocrine adaptations to the training. With higher intensities of resistance training, all participants experienced both decreased maximal strength on the training specific task and decreased performance on non-training specific tasks. To differentiate this type of overtraining from endurance types of overtraining, the investigators noted that participants did not display symptoms normally associated with aerobic overtraining (i.e., changes in sleep patterns, resting heart rate, or body composition). Furthermore, Fry, Kraemer, van Borselen et al. noted that endocrine profiles of these athletes were quite different than those associated with athletes training under endurance overloads:

With high relative intensity exercise overtraining, resting concentrations of both epinephrine and norepinephrine were unaffected, but acute concentrations exhibited considerable increases. . . . In general, the elevated catecholamine response to the resistance exercise stimulus during high relative intensity resistance exercise overtraining is evidence of the sympathetic overtraining syndrome. . . . It is also quite different from the attenuated catecholamine levels (i.e., parasympathetic

overtraining) reported for overtrained endurance athletes, again indicating the unique differences of training and overtraining with different modalities and protocols. (p. 118)

Although the results of these resistance training studies and of other anaerobic studies (e.g., Fry, Barnes, Kraemer, & Lynch, 1996) seem to provide some support for differentiating OT into sympathetic and parasympathetic classifications, it is difficult to reconcile such clean classifications of OT with much of the other research findings on physiological markers of OT. If no physiological marker, or group of markers, has been unequivocally identified for the OT syndrome, and if none of the changes in physiological markers can differentiate intensive, but effective, training from OT, then how can such markers be used to classify different types of OT? Fry (1998) mentioned that elevated catecholamine levels together with attenuated muscular performance may be indicative of the onset of a sympathetic OT syndrome; yet, he also pointed out that resistance trained subjects, who were not overtrained, exhibited significant positive relationships between immediately post-exercise circulating concentrations of catecholamines and muscular strength performance. Therefore, in the cases of both OT and non-OT outcomes, there may be elevations in catecholamines, but in OT there is a decrease in performance with no significant associations to levels of circulating catecholamines. It sounds like catecholamine levels are not predictive of performance decrements; rather such levels may be associated with high training loads. Similar to many endurance-training athletes, it seems, when resistance-training athletes increase intensities, they experience physiological changes, which seem to be specific to the type of activities in which they are involved. Such physiological changes occur whether one is overtraining or not, and there is no clear boundary line that may be indicated by the changes. The sympathetic and parasympathetic distinctions, thus, seem to be more about describing the differences in response to different types of heavy training that could lead to OT, than about classifying or predicting different

types of OT syndrome. Similar to aerobically-trained athletes, anaerobically-trained athletes might also display the same array of physiological signs and symptoms while engaging in effective training as they would while engaging in OT.

The key element for any type of OT syndrome seems to be performance decrement, and although there are a number of physiological signs and symptoms OT athletes might display, there are no clear physiological markers of OT syndrome, whether athletes are training aerobically or anaerobically. Nonetheless, the research looking at different types of training in the OT context appears to have been important in illustrating that it is possible to overtrain (as defined by sustained performance decrement) in different ways, and with different outcomes. Sometimes, athletes will feel heavy, fatigued, want to sleep a lot, other times, athletes may seem jittery and agitated in responding to different forms of training, but in all cases, with overtraining, there will be some clear indicators of sustained performance decrement or stagnation, which do not improve, even after a substantial period of recovery.

With regard to the variations in outcomes, it seems that it may be important to consider injury and illness along with OT syndrome as possible consequences of OT. Flynn (1998) suggested that, in some sports, OT might lead to musculoskeletal breakdown before the onset of OT syndrome. For example, excessive training volumes in swimming might lead to OT syndrome, whereas running at comparable volumes would more likely lead to joint or other musculoskeletal injury due to the high impact activity of the sport. Despite differences among sports, it seems possible that overtraining, as defined by an imbalance between stressors and recovery, might lead to injuries in any sport. Kibler and Chandler (1998) have discussed the potential interaction between OT and musculoskeletal breakdown:

Inappropriate volume or intensity of exercise may cause maladaptive cellular or tissue responses due to an imbalance between load and recovery. These

maladaptive responses occur to some extent in most all sports; however, they can certainly become part of the overtraining syndrome. The maladaptive responses may be objectively documented as distinct musculoskeletal injuries, such as alterations in muscle strength, flexibility, or balance, changes in joint range of motion, or stress reactions in bone. (p. 169)

Although Kibler and Chandler suggested that the precise mechanisms of musculoskeletal overtraining are not comprehensively understood, they pointed out that the maladaptations seem to originate from disruptions in cellular homeostasis (p. 169). Furthermore, Kibler and Chandler noted that, although “cellular disruptions occur in all athletes, the overtrained athlete is particularly susceptible to maladaptation and injury as the result of chronic overloads and disruptions” (p. 170). From this description of musculoskeletal breakdown in the context of overtraining, one might infer that athletes with the highest training loads and intensities are most likely to be at risk for OT and its outcomes. Nonetheless, Kibler and Chandler also were careful to clarify that the training load is only important as a “relative load compared to the muscle’s ability to protect itself against strain. Normal loads on weakened muscles, a relative force overload, are as capable of causing strain as supernormal loads on normal muscles, an absolute force overload” (p. 171).

Reviewing Kibler and Chandler’s (1998) discussions of musculoskeletal adaptations to training overloads, it seems that the relationship between overtraining and injury is subtle, sometimes hard to detect. According to these authors, adaptations associated with overload training may not appear as overt clinical symptoms, but may manifest in the system as mechanical alterations or decreases in performance efficiency (p.173). Furthermore, injuries from overload often arise from an accumulation of stress, with a gradual onset, making detection difficult and increasing the likelihood of misattributions about the causes of injuries. Kibler and Chandlers pointed out how overtraining in the musculoskeletal system can lead to injury, a process they described as a “cascade-to-overload injury”:

Tissue compromise can more frequently create functional biomechanical deficits as a result of alterations in flexibility, strength, strength balance, or skeletal reaction. The athlete attempts to compensate for these deficits by adopting alternate patterns of movement, position, and activity. These patterns are usually less efficient, creating even more overload, thereby closing the circle. (p. 174-175)

If athletes begin a training cycle with muscle weaknesses, muscle imbalances, or areas of inflexibility, they may be predisposed to overload types of injuries. Kibler and Chandler noted that such athletes would be susceptible to OT when exposed to the extrinsic demands of their sports, and may experience tissue failure and clinical symptoms if they continued to train in this susceptible state. In particular, Kibler and Chandler remarked that stress fractures may be manifestations of OT because the fractures often occur as the skeletal system cannot keep up with the demands of overload training (p. 177). In describing the potential mechanisms of skeletal injury, Kibler and Chandler suggested that weakened or fatigued muscles may not be able to handle either absolute or relative force overloads, thus transferring those forces to the skeletal system, producing stress reactions (p. 177-178). In relation to soft tissue injuries, the authors also noted that “inappropriate overload can be a causal factor in the acute muscle strain both in the form of abnormal biomechanics and a decrease in the ability of the muscle to protect itself” (p. 178). Timing also seems to be a crucial factor in the aetiology of OT injuries; often times, athletes returning from previous injuries will begin intense training too soon, risking further overloads, and chronic OT injury problems. It seems that coaches and athletes may not always be aware of the myriad ways that stress/recovery imbalances may occur, and may not look at OT as playing a role in the lead up to injury. Kibler and Chandler noted that OT might be overlooked in analysing common sports injuries:

Even in a situation where a hamstring injury is seemingly unrelated to overtraining, hamstring tightness from continued use or a muscle strength imbalance may be a hidden contributor to the injury. . . . Sub-clinical soft tissue injuries are injuries that may not be recognized as injuries by the athlete or the coach and are often overlooked as a possible causative factor [*sic*] of more severe injuries. (p. 179)

In reviewing the OT literature, the interactions between injury and OT are often not emphasised; yet, it appears that injury can be both a possible outcome of, and a contributing factor to, OT. In highlighting some of the potential injury/OT interactions, Kibler and Chandler noted, “musculoskeletal maladaptations and injuries can be a warning signal to the athlete and coach that the volume or intensity of training is too high, and overtraining is a possible causative factor” (p. 186).

Apart from injury, OT has also been associated with illnesses, such as increases in head colds, allergic reactions, and upper respiratory tract infections (Armstrong & VanHeest, 2002; Costill, 1986; Jokl, 1974; Mackinnon & Hooper, 1994; Niemen, 1998; Steinacker & Lehmann, 2002; Weinstein, 1973). In contrast to findings that regular physical activity has positive effects on immune function, there is evidence that high training loads will increase the risk of infections (Steinacker & Lehmann, 2002). It appears that prolonged, exhaustive exercise taxes the immune system and may result in clinically significant alterations in immune function.

Nieman (1998) noted that “epidemiological data suggest that endurance athletes are at increased risk for upper respiratory tract infections (URTI) during periods of heavy training and the 1-2 week period following prolonged and intensive aerobic exercise” (p. 193). Similarly, in reviewing the literature on illness in sport and exercise, Weidner (1994) showed that URTIs are the most common infection among elite athletes. Looking more closely at illness/OT interactions, Mackinnon (1998) posed the question, “Does illness due to intensive training cause or contribute to overtraining?” (p. 234). Mackinnon stated that frequent illnesses are considered common outcomes or symptoms of OT, and noted that there are similarities among symptoms of OT syndrome and infectious illness, such as persistent fatigue, decreased performance, inability to train effectively, muscle soreness, and lethargy (p. 234). Nonetheless, Mackinnon suggested that “the presence or absence of

infectious illness should be discounted or documented when diagnosing OT among athletes” (p. 234). Mackinnon did not seem to answer the question of whether illness contributes to OT syndrome, rather she seems to say that the consequences of illness mimic those of OT syndrome, and goes on to say that the presence of illness should be discounted in diagnosing OT. I am somewhat confused because OT syndrome seems to result from the inability of the body to adapt to stressors; if one of those stressors could be considered illness, then how would illness not contribute to OT syndrome?

In conclusion, it seems that illness might be both a contributing factor and an outcome of OT. When athletes are in a state of stress/recovery imbalance, they become more susceptible to infections and illnesses, which further stress their bodies, leading to higher risk for greater imbalances and OT syndrome. The initial stress/recovery imbalance is a manifestation of an OT process; the interaction of this OT process with illness is circular, each one may contribute to and be an outcome of the other. Gotovtseva, Surkina, and Uchakin (1998) made a clear statement that illness is part of the OT aetiology: “Along with the other classic symptoms of overreaching and overtraining, immune dysfunction and frequent colds have been found in overreached and overtrained athletes, and thus may be considered as markers of this athletic pathology” (p. 265).

Markers of Overtraining

Although underperformance is regarded as the hallmark of OT syndrome, it is not clear how much performance has to drop to indicate a state of OT, or whether the performance decrement is the result of OT or of other precipitating factors (Hooper & Mackinnon, 1995; O’Connor, 1998; Raglin, 1993). Athletes, coaches, and sport scientists have been interested in finding valid early warning signals upon which they can act to prevent undesired underperformance. Much of the research has focussed on assessing the onset of OT syndrome, and, although no single marker, or group of markers, have been

identified, the following represent physiological factors demonstrated to have a significant association with OT (where OT was determined by performance decrement): (a) hormonal responses to exercise load (plasma adrenaline, serum cortisol; Uusitalo, Huttunen, Hanin, Uusitalo, & Rusko, 1998); (b) changes in free testosterone/cortisol ratio (FTCR; Chicharro et al., & Vaquero, 1998); (c) maximal lactate concentration of incremental graded exercise (Jeukendrup & Hesselink, 1994; Urhausen, Gabriel, Weiler, & Kindermann, 1998); (d) hypothalamo-pituitary dysregulation (Urhausen, Weiler, & Kindermann, 1998); (e) lowered urinary norepinephrine (Mackinnon, Hooper, Jones, Gordon, & Bachmann, 1997); (f) changes in plasma glutamine (Rowbottom, Keast, Garciawebb, & Morton, 1997); (g) deterioration in neuromuscular excitability (Lehmann, Baur, Netzer, & Gastmann, 1997); (h) decreases in secretory immunoglobulin (IgA; Mackinnon & Hooper, 1994); (i) decreased heart rate variability during orthostatic challenge (Uusitalo, 2001); (j) decreased heart rate during maximal exercise (Hedelin, Kenttä, Wiklund, et al., 2000); (k) decreased muscle glycogen levels (Snyder, 1998); (l) and reduced sleep efficiency, as measured by wrist actigraph (Wall, Mattacola, & Levenstein, 2003).

The psychological research on OT has added to the physiological perspective, focussing primarily on the relationships among mood, as measured by the Profile of Mood States (POMS), training load, and subjective ratings of well-being. Researchers have suggested that mood disturbance and self-reports of well-being may be valuable indicators of impending OT syndrome (Berghlund, & Säfström, 1994; Fry et al., 1994; Hooper, Mackinnon, & Hanrahan, 1997; Hooper et al., 1995; Morgan, Costill, Flynn, Raglin, & O'Connor, 1988). Given that the research on psychological variables in overtraining has focussed almost exclusively on the POMS, I will attempt to review some of the more salient past, and most recent, research pertaining to POMS and overtraining.

Much of the POMS research has evolved from Morgan, Brown et al.'s (1987) series of studies looking at mood states in collegiate swimmers across a ten-year period. The researchers monitored mood states using the POMS across the competitive seasons for different groups of male and female swimmers, and reported that mood state disturbances increased in a dose-response manner in accordance with training loads. With increased training loads, POMS global mood disturbance scores increased, as measured by an aggregate of all the subscales (with the vigour subscale negatively weighted). Morgan et al. suggested, "monitoring of mood states during a given macro-cycle offers a potential method of quantifying distress and titrating training loads on an individual basis" (p. 113). Although, it appears that Morgan et al. took significant steps to initiate research on the relationships among mood states and training loads, some issues stand out from this research that have been carried through much of the subsequent investigations of the POMS in sport performance, and overtraining. From the series of studies Morgan et al. conducted, it appears that something is going on with POMS scores in relation to training load; generally, as training loads increase, scores on negative POMS subscales, tension-anxiety, depression-dejection, anger-hostility, fatigue, and confusion-bewilderment, tend to increase as well, while scores on vigour tend to decrease. Nonetheless, it is unclear what POMS scores reveal about specific individuals and how such scores might be most useful to coaches and athletes. Except for two cases out of approximately 400 swimmers, Morgan et al. did not provide any individual profiles. The researchers also did not provide any performance data, nor did they demonstrate any links between POMS profiles and individual performance. Using group norms to suggest what is going on with the POMS and athletic training obscures what is happening at the individual level. Reading this research, I do not have much idea what an individual POMS profile might tell me about any particular athlete. The authors emphasised that athletes who became *stale* displayed

high levels of mood disturbance, but did not indicate if there were athletes who became *stale* without the corresponding mood disturbance, or if there were athletes with high mood disturbance who did not become *stale*. Therefore, with no links to performance, and with observations reported only on a group basis, coaches looking at individual POMS profiles would not be certain about whether they were observing athletes who were coping well with training or were not coping well with training.

Morgan, Costill, Flynn, Raglin, and O'Connor (1988) conducted a study with swimmers looking at effects of short-term (12 days), high intensity training on mood states. The researchers found that for the group, mood disturbance increased significantly from day one to day five of training and then remained elevated for the following 7 days. The increases in mood disturbance, however, seemed to be mostly attributable to three out of the nine swimmers who displayed markedly higher profiles on average than the rest of the group. These three swimmers were also found to have significantly lower muscle glycogen levels and were not able to tolerate the prescribed training load. The authors reported that these three swimmers were not ingesting enough carbohydrate and were training at a caloric deficit up to 1000 calories less than the other swimmers. In this study there were no correlations reported among POMS scores and performance parameters. From what I can gather from the results, the simplest explanation for the increases in POMS scores and the inability to tolerate training load seems to be that these three swimmers were not eating enough.

Murphy, Fleck, Dudley, and Callister (1990) followed 15 Judo athletes training at the US Olympic Training Center (OTC) for a 10-week training cycle, monitoring mood states during different phases of high volume and high intensity training. The researchers found no significant changes in total mood disturbance scores; although, they did report significant increases in the fatigue subscale scores after week eight, compared to baseline.

They also reported a significant difference between week 2 of baseline and week ten after intense training for the anger subscale (although the anger subscale was similarly elevated after week four of baseline as well). Performance on strength and anaerobic endurance tasks declined during the study, but authors were not able to measure actual judo performance in the study. No performance parameters were linked to POMS scores. The authors commented that for these athletes “the typical signs of overtraining reported in the literature were not observed in response to a 50% increase in conditioning training volume” (p. 48). The authors also stated, however, that “the increased sport specific training had no demonstrable beneficial effects on psychological or performance measures” other than athletes reporting they felt “close to their peaks” (p. 48).

Verde, Thomas, and Shepherd (1992) administered the POMS to ten highly trained male distance runners on three occasions over 9 weeks of training, involving a period of deliberately increased training. The researchers reported significant increases in total mood disturbance during the increased training phase, with subsequent reductions in mood disturbance during the recovery phase. The researchers stated that none of the runners could be classified as overtrained during the study; nonetheless, they noted that six out of the ten reported symptoms indicating they were close to a threshold of excessive training, “which most coaches would like to detect” (p. 173). Similar to other studies, no links were tested or illustrated between POMS scores and performance parameters; individual POMS score patterns were also not discussed in relation to performance. Once again, it seems one is left with a vague picture of what POMS scores might be revealing in the context of overtraining.

Berglund and Säfström (1994) were perhaps some of the first researchers to use individual POMS scores in a meaningful way to modulate training. With a group of canoeists training for the Olympics, the researchers used POMS scores to titrate training

loads. If athletes scored more than 50% higher than their own basal off-season global mood disturbance, training was reduced. For athletes who scored lower than their own off-season global POMS + 10%, training was increased. None of the athletes developed signs of OT in connection with the Olympics, and, thus, the researchers concluded that “the monitoring of psychological mood disturbances is useful in reducing the risk of staleness in canoeists undergoing hard training” (p. 1036). From an athlete’s perspective, I would say that any attempt to give some control to the athletes in terms of making decisions about changes in training volume according to how they feel could be useful. From my experience, it seems that a lot of athletes will not speak up about how they are tolerating a given training program for fear of how coaches and other athletes might react. Setting up a training model where changes in the training, either to reduce, or to increase, training according to how athletes report feeling appears unique. Such an approach changes the whole dynamic of the training environment, which all too often leaves athletes feeling pressured into doing more than they can handle at certain times, and perhaps responding by doing less than what is optimal at other times. From an applied perspective, this use of the POMS to modulate training appeared to be beneficial to the training outcomes of the athletes. Nonetheless, from a research perspective, the lack of a control group, and the lack of objective links made between POMS measures and performance parameters, leaves one wondering if perhaps the POMS, in and of itself, was useful as an indicator of overtraining. It is not clear whether these athletes may not have had the same results or better, even without the changes that had been made to training in accordance with POMS scores. I have trained with a number of coaches who might read the results of this study in a very different light, saying that the athletes probably would have done even better if their training had not been reduced at any time (although such coaches would probably have agreed with all training increases).

In one of the first studies to examine, statistically, the link between POMS scores and performance after intense training, Hooper, Mackinnon, and Hanrahan (1997) found no significant correlations between POMS scores and maximal effort swimming performance for a group of eight male and eleven female, nationally ranked swimmers. Looking at the pattern of POMS scores across a six-month season, the researchers also found no significant changes in any of the POMS measures with tapering. They did classify three swimmers in their study as *stale* according to quite strict criteria, but only two out of these three *stale* swimmers displayed elevated mood disturbance profiles. Furthermore, these two swimmers with elevated mood disturbance reported such disturbances during early season, tapering and post-competition, not during the high intensity, high volume cycles of training, suggesting that their mood disturbance was probably not linked to excessive training loads. Hooper et al. stated, “the data suggest the POMS may not be a sensitive indicator of staleness under all circumstances and may not necessarily differentiate between stale and intensely trained, but not stale, athletes” (p. 9). They also noted. “the decrease in physiological stress of training with tapering may have coincided with an increase in psychological stress with impending competition, making changes in mood states unlikely until after competition ceased” (p. 10). This seems to suggest that there may be all kinds of different variables that affect POMS scores; some athletes show elevated scores with intense training that is effective; some show elevated scores with intense training that is excessive and may lead to overtraining syndrome; some show elevated scores because of the stress of upcoming competition; some show elevated scores for reasons completely unrelated to training or competition; and, some athletes do not show any corresponding elevations of POMS scores in all of the previously-mentioned situations. It seems, therefore, that POMS scores are not reliable markers of OT. Hooper et al. commented, “while it appears that the POMS may be useful for monitoring those

athletes predisposed to staleness, it may not reliably differentiate between stale and non-stale athletes under all circumstances” (p.11). The difficulty still remains, however, with determining how to classify an athlete as predisposed to overtraining in the first place.

In another study testing the relationship between POMS scores and performance after intense training, Hooper, Mackinnon, and Howard (1999) reported significant correlations between POMS Confusion subscale scores and changes in maximal swim effort after a taper for a group of ten nationally ranked swimmers. There were no significant correlations, however, between performance changes for any of the other POMS subscales, or the global mood disturbance scores, and performance. The authors concluded that the “addition of a psychological variable (i.e., the POMS measure of Confusion) in the prediction battery is consistent with previous research suggesting that mood states are useful in monitoring training loads” (p. 1208). Contrary to the findings of this study, the subscales of Vigour and Fatigue have emerged as the most salient in terms of links to training load in much of the research (e.g., Morgan et al., 1987); researchers have also suggested that the Depression subscale might be particularly important in relation to OT (e.g., Morgan et al., 1987). Hooper et al. have now reported a significant link between the Confusion subscale and performance for a small sample size; it may lead one to question whether this one significant correlation was spurious. If one were to make recommendations to a coach about using the POMS, it would be difficult to say how to use to the POMS results. I would not be confident in saying that elevation on any one particular subscale was predictive of overtraining, or indicative of poor recovery during taper, or related to performance in any way. From the results of this study, with only ten participants, the authors seemed to suggest that one might be able to use mood disturbance to predict performance outcomes after taper. This suggestion, however, was based on a significant correlation between only one subscale of the POMS and change in swimming

performance, when all other subscales and the global mood score showed no significant associations to performance.

Attempting to clarify some of the disparity in the POMS and overtraining research, Martin et al. (1999) examined the usefulness of the POMS for monitoring training stress in 15 cycling athletes in a well-controlled, prospective study. Martin et al. presented both group patterns and individual patterns with respect to POMS profiles, and tested links between POMS scores and precise performance parameters. The researchers found that neither the group global mood disturbance scores, nor any of the subscales, changed significantly in response to increases in training, or following a taper period. The global mood disturbance tended to increase for the group following the heaviest weeks of training, but this increase was not statistically significant. With respect to individual analyses, Martin et al. reported that there were no distinct patterns between mood profiles and performance outcomes, during training or after taper. Among athletes who had favourable POMS profiles, some had good performance outcomes, and some had poor performance outcomes. Among athletes who had negative POMS profiles, some had good performance outcomes, and some had poor. Out of the 15 cyclists in the study, two were classified as overtrained according to the criteria that performance became suppressed and remained suppressed despite apparently adequate recovery. Martin et al. pointed out that neither the global mood disturbance scores nor any of the subscale scores for these two cyclists appeared unique during the study. Interestingly, one of the *overtrainers* had some of the lowest recorded mood disturbance scores in the final weeks of the study; whereas, an athlete with somewhat elevated global POMS scores had his best performance during the taper. The researchers concluded that the POMS was “not useful for differentiating whether the cycling training program represented productive overreaching or

counterproductive overtraining” (p. 154). Furthermore, Martin et al. made an appeal to carefully consider the choice of dependent measures in overtraining research:

The primary goal of training for most coaches and athletes is performance. Psychological and physiological changes during high-intensity training are, therefore, primarily of interest for monitoring training stress when they are related in some way to performance. Without performance measures it is difficult to establish whether “mood disturbances” indicate overtraining or instead, that overreaching is going as planned. Using predictor variables (e.g., POMS scores) as dependent variables instead of performance outcome (the real dependent variable of interest) may lead to statistically significant findings, but those findings may be of little value to coaches and athletes interested in optimizing training strategies on an individual basis. (p. 154)

Although the Martin et al. study looked at a small sample of athletes, and results might differ when larger samples of athletes are tested, the researchers have set a standard for more rigorous testing of psychological and physiological parameters in the context of overtraining and sport performance.

Naessens, Chandler, Kibler, and Driessens (2000) examined the relationships among nocturnal noradrenaline excretion measurements and POMS scores in ten high-level soccer players. Attempting to evaluate the utility of nocturnal urinary noradrenaline (NA) excretion patterns in screening for signs of overtraining, Naessens et al. used NA measurements to predict outcomes on the total mood disturbance score of a shortened version of the POMS, as well as on the Fatigue subscale alone. The investigators found that nocturnal NA excretion was moderately predictive of POMS Fatigue scores ($R^2 = 0.53$). Although, the researchers included a measure of performance, however imprecise (mean of weekly rated game performances by two sports journalists), they did not report any links between POMS scores and performance. Furthermore, in contradiction to Martin et al.’s (1999) recommendations, Naessens et al. used the POMS total mood disturbance and POMS Fatigue subscale as dependent measures. What strikes me about this study is that the POMS subscale of fatigue appeared to have been indicative more of physiological

fatigue than of mood disturbance; the consistent reference to mood states as markers of overtraining, therefore, remains to be questioned.

Kenttä, Hassmén, and Raglin (2001) used a 7-Item version of the POMS called the Training Distress Scale, derived from previous research (Raglin & Morgan, 1994), to determine the incidence of overtraining syndrome (referred to in the study as *staleness*) in a group of 272 young Swedish athletes. The researchers asked the athletes to respond to a precise question regarding their experiences of staleness at some point in their careers, and then instructed them to complete the TDS according to how they recalled feeling at different stages of their training (easiest, average, and heaviest levels of training), as well as how they felt during the periods of *staleness*. The authors reported increases in mood disturbance following increases in training intensity, with recalled TDS values significantly higher for athletes during periods of *staleness*. Kenttä et al. stated that the “results are consistent with previous research indicating that mood disturbance consistently increases during hard training with stale athletes exhibiting greater mood disturbances than healthy individuals who undergo the same training” (p. 464). With the retrospective approach in this study, there were no reported measurements of performance, nor links made between mood scores and performance. There were also no reports of individual patterns of mood disturbance and how such patterns related to training and performance. With the large numbers of athletes used in this study, it appears that, on average, athletes recalled an association between mood and training intensity and recalled experiences of performance decrement, but it is not clear if such recall accurately reflected the individual athletes’ moods and overtraining experiences. Although it may be very helpful to begin to get a picture of overtraining using retrospective introspection, one cannot draw any firm conclusions from such a method of data collection.

In a recent study, Pierce (2002) investigated the links between POMS scores and training volumes across a 24-week season in 29 collegiate swimmers. Pierce reported significant, albeit moderate, correlations between training volumes and several POMS subscale scores (i.e. Anger, Vigour, and Fatigue). No significant correlations were found between training volumes and global mood scores, or the remaining subscales, Tension, Depression, and Confusion. Furthermore, the anger subscale was negatively correlated with training volume, a result contrary to the expected direction. No performance parameters were reported in this study, and, therefore, the author made no links between POMS scores and performance.

Halson, Lancaster, Jeukendrup, and Gleeson (2003) examined changes in several physiological and psychological parameters, including the POMS, for a group of eight endurance-trained cyclists over a six-week training protocol. Although researchers gathered data on a number of objective performance parameters, there were no links reported between POMS scores and performance; rather, POMS scores were treated as dependent measures, indicative of states of overreaching or overtraining. It appears as though researchers have continued to refer to POMS scores as unequivocal markers of overtraining, despite the apparent lack of clarity in POMS/OT research results.

Broadening the focus in OT research from mood disturbance to multiple behavioural and situational measures, Kellmann, Altenburg, Lormes, and Steinacker (2001) investigated the use of the Recovery-Stress-Questionnaire for athletes (RESTQ-Sport, Kellmann & Kallus, 2001) as an alternative to the POMS for evaluating the impact of athletic training. The RESTQ-Sport was constructed to measure the frequency of current stress and recovery-associated activities from multiple perspectives (i.e., emotional, physical, and social), addressing a more complete picture than the POMS of athletes' experiences with training and overtraining processes. Kellmann et al. looked at response

patterns on the RESTQ-Sport and the POMS, and at performance changes among 54 German Junior National Team rowers over six weeks leading up to the Junior World Championships. Similar to previous POMS research, the authors reported a dose-response pattern between RESTQ-Sport scores and training loads; unfortunately, also similar to previous POMS research, the researchers did not test or report statistical links between RESTQ-Sport scores and performance. Nevertheless, the research on the RESTQ-Sport is very recent and it may just be a matter of time before the RESTQ-Sport is tested rigorously in association with meaningful performance parameters. Kellmann et al. pointed out the advantages of the RESTQ-Sport in applied settings in terms of providing much more information about athletes' behaviours, stressors, and recovery states, than the POMS:

For the POMS, we have the “iceberg profile,” which primarily consists of negative mood states and only one aspect dealing with positive states of mood, while the RESTQ-Sport gives us a detailed picture of the athletes' state [sic]. Concrete solutions to current problems can be derived from the up-to-date recovery-stress profile and this profile might obviously be used to derive specific intervention strategies. . . . The RESTQ-Sport provides coaches, sport psychologists, and athletes with important information during the process of training. (p. 163-164)

Although the efficacy of the RESTQ-Sport for predicting performance has yet to be established, it seems that it could be a useful tool at the individual level to provide important parties with information about how athletes may or may not be coping with a training program.

Taken as a whole, the POMS in OT literature does not provide a clear picture of what is going on with mood states and performance during intense training and competition. It seems that it may be important to monitor psychological variables in athletes, while they are training intensely, in order to identify areas where athletes may not be coping with training loads, and to provide information in addition to performance and physiological measures for coaches and others. The POMS has not proven to be a reliable tool for predicting how athletes will perform after a cycle of training and recovery;

although, it may still have some clinical utility for opening a discussion between, for example, a sport psychologist and an athlete, with a significantly elevated mood disturbance score. The RESTQ-Sport might be an important step to developing a more holistic picture of an athlete's psychosocial and physical responses to training and recovery; nonetheless, the predictive capabilities of RESTQ-Sport for performance outcomes remain to be established.

Comments on the Research

With respect to markers and diagnosis of OT, researchers have noted that none of the hypothetical markers for OT syndrome is unequivocal (Armstrong & VanHeest, 2002), and a recent "critical review of existing scientific literature leads to the disappointing conclusion that the tools available for overtraining syndrome diagnosis have not improved much in the last years of overtraining research" (Urhausen & Kindermann, 2002, p. 100). Although the physiological assessment research is an invaluable contribution to the body of knowledge on OT, some of the equivocality in research findings may have resulted from adherence to a dose-response model of training and recovery (Morton, 1997). From this perspective, it is assumed that, if the body is pushed too hard with high workloads (*dose*), physiological and psychological disruptions will occur (*response*), from which an athlete needs time to recover. The dose-response model, however, puts the focus mostly on what is happening with the training load (or dose), excluding some issues significant to OT, such as individual differences in stress tolerance, existence of multiple stressors beyond the training program, and potential causal mechanisms driving the maladaptive OT behaviours. Furthermore, often the responses that are being measured (physiological or psychological markers, or performance decrements) have turned out to be inaccurate indicators of OT. Although it would be useful for coaches, athletes, and sport scientists to have a precise selection of specific markers that would indicate when an athlete is

beginning to overtrain, the processes underlying athletic training, recovery, and OT, appear to be too complex to be measured easily. Nonetheless, more recently, researchers have moved to a more holistic view of the training process looking at the balance between stress and recovery (Kellmann, 2002; Kenttä & Hassmén, 2002), emphasising the recovery aspects of training, and assessing many aspects of athletes' lives, both inside and outside of physical training.

With respect to the psychological assessment research, some researchers have argued that psychological testing is the most effective in detecting OT at an early stage (Kellmann & Günther, 2000; O'Connor, 1998; Shephard & Sheck, 1994). Nonetheless, similar to the physiological research, the results of psychological assessment research, especially POMS research, have proven equivocal, as many of the markers have also been associated with intense training that did not lead to performance decrement (Rowbottom et al., 1998). Steinacker and Lehmann (2002) stated, "performance is the most important parameter for monitoring training adaptation. Maximum performance during a standardized test is therefore the gold standard for evaluating exercise capacity and monitoring training" (p. 107). Along these lines of emphasising performance, Kaplan (1990) put forward an important message about behavioural outcomes in health care research and delivery that is relevant to OT contexts. He pointed to behaviour as the central outcome for health care, asking if patients could improve on practical things in their lives, such as walking, talking, or caring for themselves, as the result of some intervention. In the OT context, Martin et al. (2000) commented on Kaplan's emphasis on behavioural outcomes, stating the following:

This same focus on behavioral outcomes should apply to overtraining research. Changes in POMS scores and physiological variables are only of interest to the coach and the athlete if they relate to performance. If POMS scores or blood chemistry (e.g., cortisol levels) change significantly over the course of an intense training program and taper, they are of little practical interest to coaches and athletes unless they are related to the outcome of interest, performance. (p. 142)

Some researchers (Martin et al., 2000; Rowbottom et al., 1998) have suggested that methodological flaws, such as conducting overload training research without a taper and not measuring performance and OT markers after a taper, may render many supposed OT markers as no more than indicators of current training load. Without knowing what happens to performance after taper, one cannot say anything more than the assessment markers are good indicators of intense training (e.g., a negative POMS profile or skewed physiological assays associated with intense training loads before taper could be associated with either performance improvement or decrement after taper, depending on the individual).

Psychological and physiological assessment might continue to prove useful in applied settings to inform athletes and coaches when *something* is going on in athletes' lives, in terms of stress or recovery responses to training. Future research, however, could be directed at uncovering causal antecedents of, or risk factors for, OT. Moving away from the dose-response approach, and with the emphasis on stress/recovery balance as described in their conceptual model, Kenttä and Hassmén (2002) have helped initiate the move to more holistic understanding of athletes' experiences with OT. Several researchers (Kellmann, 2002; Kenttä & Hassmén, 1998; Meyers & Whelan, 1998; Raglin, 1993) have emphasised the individual differences among athletes in response to training and life stressors; further research into the meanings, experiences, and causes of OT among different athletes could, thus, prove fruitful.

Overtraining Experiences and Risk Factors

Although there have not been qualitative studies conducted specifically on OT risk factors, interviews with, and case studies and observations of, athletes by researchers have provided hints about what the OT experience is like for athletes, and what kinds of personal and situational variables add to the stress loads that put them at risk for OT and

injury. In the following sections, I outline perspectives on the personal and situational variables, affecting athletes' training and recovery, from both experts, mostly researchers and coaches, and athletes.

Expert Perspectives

Researchers in a large number of OT studies and review articles have made anecdotal comments about the potential risk factors for overtraining, and in some cases have presented interview data that suggests potential OT risk factors. Krane et al. (1997) reported that an elite gymnast who overtrained was characterized by disordered eating, high levels of ego-involved goal orientation, perfectionism, a win-at-all-costs attitude, maladaptive responses to failure (e.g., increasing an already excessive training load), and an ability to rationalise excessive training practices. The gymnast also was surrounded by parents and coaches who always pressured her to win and supported her rationalising and other maladaptive behaviours. In an interview study, Gould et al. (1997) identified overtraining as a major contributing factor to *burnout* in junior tennis players, where one player who overtrained was characterized by a high level of perfectionism and unrealistic expectations, and was subjected to elevated parental criticism, expectation, and emphasis on winning. Gould et al. observed that this athlete believed that increasing her training load when it was already very heavy was the only route to success. They also discovered that a second tennis player who overtrained did not report such high levels of perfectionism or parental pressure as other players, but displayed a profile suggesting "super-motivation" combined with unrealistic goals. Gould et al. reported that this second tennis player held the belief that hard work, rather than talent, would bring him success. Finally, in an interview study of Olympic athletes, Gould et al. (1999) revealed that, among many athletes who identified overtraining as a major contributor to their failures, lack of good coach-athlete communication and poor timing of selection processes were cited most

commonly as damaging factors. Other researchers have noted similar qualities among athletes they have observed and have commented on circumstances that may put athletes at risk for overtraining (e.g., Kenttä & Hassmén, 2002).

Fry, Morton, and Keast (1991) stated, “lack of recovery time in the training schedule is the most important risk factor for overtraining” (p. 123). There may be many factors, however, that affect recovery. For some athletes, the training stimulus may be the most important factor affecting recovery, if the workload is of a high volume and intensity. For others, factors outside of training may impede adequate recovery, such as work, school, or family commitments. Lehmann et al. (1993) suggested that it is important to look at each athlete individually, stating that “inter-individual differences in recovery potential, exercise capacity, non-training stressors, and stress tolerance may explain the different degrees of vulnerability experienced by athletes under identical training conditions” (p. 25). There also may be subtle influences on attitudes towards, and behaviours surrounding, recovery, such as coach and parental input, sport culture pressures, or attitudes of peers, training partners, and other athletes. Brustad and Ritter-Taylor (1997) noted that coaches and others frequently endorse attitudes, such as *no pain, no gain* and *more is always better*, which create cultures of risk instead of promoting self-awareness. Kenttä and Hassmén (2002) noted that sudden increases in non-training stressors add to the total stress, which can reach a level where a person experiences a lack of recovery; therefore, overtraining can occur even during moderate levels of physical training, if there are coexistent high levels of psychosocial stress.

Botterill and Wilson (2002) observed that “guilt about not working hard enough and being intense all the time” (p. 144) often appear to be important risk factors for overtraining, and can impede recovery and rehabilitation. Circumstances, such as the lead up to, or the time following, big competitions may also increase the risk of overtraining,

possibly due to the addition of heightened mental and emotional demands to the already existing physical demands of preparing for, and performing in, competitions (Botterill & Wilson, 2002). Botterill and Wilson also recognised the potential harm of emotional build up, commenting that “repressed, denied, or unprocessed emotions” can be sources of conscious and unconscious conflict and stress (p.150).

Kellmann (2002) noted that sometimes a simple change in environment can have a profound effect on an athlete’s recovery:

If an athlete's accommodation is close to a loud street, her rest may be disturbed day and night. However, if an athlete is used to living in a loud neighbourhood, she might have no problem sleeping through loud noises, but instead may get irritated by an absolutely quiet environment. (p. 9)

Kellmann (2002) suggested that a disruption of sleep also can be a direct result of emotional disturbances in an athlete’s life, such as family or relationship conflicts.

Kellmann recognised that although athletes can compensate for a lack of sleep, or other recovery activities in the short term, without addressing the lack of recovery, they will eventually risk developing an overtraining syndrome in the long term.

In many sports, competitive environments and intra-team rivalries can lead to disruptions in recovery, exemplified in the following anecdote, cited by Kellmann (2002):

The coach of the Canadian male speed skating team planned a training schedule that included a day off as the key element for recovery purposes. The coach did not tell the athletes what to do for recovery, so they decided to go for a bike ride in the mountains. The purpose of the bike ride was to relax, be with the team, and get refreshed by the scenery of the Canadian Rocky Mountains. However, the athletes soon turned the relaxing bike ride into a competition that left no room for physiological recovery at all.

. . . Since the athletes knew that the coach would not appreciate their bike ride competition, they did not tell him, and the next day practice continued based on the regular schedule. The next physiological stressor was set, and some days later the coach was surprised by the performance decline. (p. 9)

Kenttä and Hassmén noted that although the athletes in this anecdote may have experienced some social recovery from the fun ride, their competitiveness resulted in a physiological stressor that could have disrupted the program prescribed by the coach. In

this example with the speed skaters, the coach appeared to be unaware of the risk for OT; in other cases, however, coaches might even acknowledge that they are risking OT with aggressive approaches to training, illustrated by the following quote from Gould and Dieffenbach (2002):

If five is good then 50 is better . . . The year before the Olympics, they (my athletes) would do sets of 50 jumpies and this year they are doing sets of 700 jumpies. If I can push them more and more, when they finally get there, they will be great. However, this pushing can blow up in your face -- like you finally get to the Olympics and are exhausted. (p. 26)

From this particular quote, one can identify the stereotyped *more is better* approach promoted by this coach.

Similar to comments by Fry et al. (1991) about lack of recovery, Hanin (2002) described risk factors for OT in terms of barriers to effective recovery and rest. He suggested that athletes and coaches may underestimate the importance of systematically matching workload with adequate rest, and pointed out that this underestimation may be reinforced by the values held by some sport cultures, subcultures, and athletes, where quantity (intensity, and volume) is emphasised over quality. Hanin also observed that athletes' responses to their own performances can affect how they balance training and recovery, potentially motivating them to push excessively in training. He stated,

In the case of poor performance (underperformance due to fatigue or problems with technique), an athlete continues to work intensively to eliminate uncertainty and to enhance self-confidence. However, athletes usually are unable to break this vicious circle and even do not dare to take a good break and correct this situation. In the case of successful (better-than-expected) performance, an athlete can be so over-excited with positive emotions that he does not notice the signs of fatigue and . . . continues to do excessive work until it is too late. (p. 210)

Similarly, Hawley and Schoene (2003) noted how athletes might display maladaptive responses to poor performance, where frustration with performance may lead athletes to train harder in response to plateaus or declines in performance. Often the problem with the response of increasing training efforts, in the cases where the stress loads are already high,

is that it increases fatigue and results in further decrements in performance, thus initiating a vicious cycle of heavy training, chronic fatigue, poor performance, and frustration.

In summary, the preceding observations, made recently by researchers, indicate that understanding what puts athletes at risk for OT may require looking into many different aspects of athletes' lives, both personal and situational. Although there have been no systematic investigations into OT risk factors, it is possible to summarise the observations made by researchers and experts, thus far. Looking at a number of OT review articles in the literature over the past 15 years, a picture of the factors, as perceived by researchers and experts in the field, that contribute to OT can begin to be developed. On the following pages (see Table 2) I have presented an outline of some of the personal and situational risk factors identified for OT.

Table 2.

OT Risk Factors Identified in the Literature by Researchers

Risk Factor	Sources
<i>Training issues (program & schedule)</i>	
High volume/high intensity training	Brown, Burke, Frederick, Falsetti, & Ryan (1983); Budgett (1990); Derman et al. (1997); Foster (1998); Hollander & Meyers (1995); Kenttä & Hassmén (2002); Kuipers (1996); Kuipers & Keizer (1988); Lehmann et al. (1993); Uusitalo (2001); Wallace (1998)
High training monotony; lack of periodisation	Armstrong & VanHeest (2002); Budgett (1990); Foster (1998); Hollander & Meyers (1995); Wallace (1998)
Failure to include recovery in training program; lack of rest days	Kenttä & Hassmén (2002); Kuipers (1996); Kuipers & Keizer (1988); Wallace (1998)
Sudden increases in training load or intensity (particularly lactate training, and especially following breaks due to injury or illness)	Brown et al. (1983); Budgett (1990); Hooper & Mackinnon (1995); Kuipers & Keizer (1988)
Lack of seasonal lay-offs	Hooper & Mackinnon (1995)
High volume of dry-land or cross-training	Hooper et al. (1995)
Frequent competition, and/or year-round competition	Brown et al. (1983); Derman et al. (1997); Kuipers (1996); Kuipers & Keizer (1988); Wallace (1998)
Transitions in training programs – usually from winter low intensity to spring interval and higher intensity programs	Budgett (1990)
Time of season – especially just prior to competition and during competition; competition & selection	Budgett (1990); Hawley & Schoene (2003); Uusitalo (2001)
New training environment	McCann (1995)
Lack of training program flexibility and individualisation: team sports where coaches do not have leeway to take individual training tolerance into consideration when planning practice; or, individual sports with one training program for all athletes	Hooper & Mackinnon (1995); Levin (1991)
Lack of proper taper	Gould et al (2002); Levin (1991)
Lack of objectivity when athlete is doing their own training, Training without coach or partner, or training with significantly more skilled or physically fit athletes	Brown et al. (1983)
Lack of monitoring for signs of overtraining	Hooper & Mackinnon (1995); Committee on Sports Medicine and Fitness (2000)

Table 2. (continued)

<i>Situational & environmental stressors</i>	
Travel (especially across time zones), jet lag	Gould et al. (2002); Derman et al. (1997); Kuipers (1996); Uusitalo (2001); Wallace (1998)
Changes in training environment, altitude, temperature, humidity	Armstrong & VanHeest (2002); Kuipers & Keizer (1988); Uusitalo (2001); Wallace (1998)
Moving house, or other economic stressors	Beil (1988); Uusitalo (2001)
New national team status	McCann (1995)
Increases in employment workload & other occupational stressors	Armstrong & VanHeest (2002); Kenttä & Hassmén (2002); Kuipers & Keizer (1988); Lehmann et al. (1993)
Poor performance at competition	
Problems and obligations in school, increases in academic workload	Armstrong & VanHeest (2002); Kuipers & Keizer (1988); Kellmann (2002); Kenttä & Hassmén (2002); Lehmann et al. (1993)
Sport specialisation at an early age	Committee on Sports Medicine and Fitness (2000)
Participating at too high a level for ability (especially among youth athletes)	Committee on Sports Medicine and Fitness (2000)
<i>People issues (coaches, parents & others)</i>	
Conflicts with coaches, relationship problems with friends, team-mates, staff or parents	Armstrong & VanHeest (2002); Hollander & Meyers (1995); Kenttä & Hassmén (2002); Kuipers & Keizer (1988); Wallace (1998)
Excessive expectations from a coach or family; unrealistic goals from coach or parents	Armstrong & VanHeest (2002); Hollander & Meyers (1995); Kuipers & Keizer (1988)
Emotional stress from major life events (e.g., illness, conflicts with partners, parents' divorce).	Kellmann (2002); Hollander & Meyers (1995); Kenttä & Hassmén (2002)
<i>Athlete - physical issues</i>	
Premature return from injury	Budgett (1990)
Physical illness, allergies, disease, or infections	Kuipers (1996); Kuipers & Keizer (1988); Raglin (1993); Uusitalo (2001); Wallace (1998)
Poor or inadequate sleep	Derman et al. (1997); Kenttä & Hassmén (2002); Uusitalo (2001)

Table 2. (continued)

Poor or inadequate nutrition; possibly inadequate caloric intake (especially carbohydrates); potential nutrient – vitamin/mineral deficiency, iron deficiency, dehydration	Committee on Sports Medicine and Fitness (2000); Derman et al. (1997); Hollander & Meyers (1995); Hooper et al. (1995); Kenttä & Hassmén (2002); Kuipers (1996); Kuipers & Keizer (1988); Uusitalo (2001); Wallace (1998)
Adolescent athletes during growth spurts; overloading developing bodies	Beil (1988); Committee on Sports Medicine and Fitness (1990)
Athletes with a substantial injury history or experiences with overtraining	Hollander & Meyers (1995); Raglin (1993)
Prolonged amenorrhea in female athletes leading to diminished bone mass	Committee on Sports Medicine and Fitness (2000); Beil (1988)
Low tolerance for physical and/or psychological stress loads (predisposition); poor recovery potential	Kenttä & Hassmén (2002); Lehmann et al. (1993); Uusitalo (2001)
Athletes at their physiological peaks are on the threshold of overtraining	Armstrong & VanHeest (2002)
<i>Athlete - beliefs, behaviours, & attitudes</i>	
Success – rapid rise in sport to the elite level (especially for young athletes); new PBs may cause athletes to believe that training harder will bring them even greater success	Budgett (1990); McCann (1995)
Unrealistic role models - athletes may compare themselves to and try to keep up with faster, better skilled athletes – or comparison to successful others who train at high volumes, beyond the current capacity of the athlete	Brown et al. (1983); Budgett (1990)
Desperation in response to mediocre performance	Budgett (1990)
Very high levels of motivation to achieve success; motivation to set a new standard (e.g., world record)	Budgett (1990); Hollander & Meyers (1995); Kuipers & Keizer (1988); Levin (1991)
Maladaptive responses to underperformance (e.g. increasing training load or not decreasing other stressors when loads are already high)	Foster (1998); Kenttä & Hassmén (2002); Raglin (1993)
Belief that feeling fatigued is equivalent to being unfit, requiring increases in training (when training loads are already high)	Levin (1991)
Unrealistic goals set by athlete	Hollander & Meyers (1995)
Fear of failure	Kuipers & Keizer (1988)
Personality structure – ongoing personal or emotional problems	Hollander & Meyers (1995)
Difficulties with time management (practice/school/friends)	Kellmann 2002
Fear of being under-trained – <i>more is better</i> philosophy	Brown et al. (1983); McCann (1995)

The summary presented in Table 2 illustrates many of the variables that may arise in relation to risk for OT. Some of the factors seem obvious, such as high volume/intensity training and/or inadequate recovery. Other factors might not be so obvious, such as an athlete being at risk when at a physiological peak, highlighting the importance of gathering as much information as possible about athletes when assessing the risk for OT.

Athlete Perspectives

In addition to the expert perspectives on OT, many athletes have talked about their experiences with stressors by which they were confronted during training and recovery. In several different studies and reviews related to OT, researchers have presented direct quotations from athletes, illustrating some of the experiences with high pressure situations, pushy coaches, and over-involved parents, as well as some of the athletes' own attitudes toward training and recovery.

With respect to situational variables, the coach seems to have a significant influence on how hard athletes push in training, how they pursue and experience recovery activities, and how they feel about themselves, emotionally and physically. Some athletes are aware that their coaches may push too hard, risking adverse outcomes, illustrated here by an athlete quoted in Gould and Dieffenbach (2002): "My coach is a real pusher, to the point where I think he pushes too hard. I think I would be better if I did not train as hard" (p. 25). Athletes might be aware of their coaches' behaviours; nonetheless, the following excerpt from Krane et al. (1997) illustrates how an athlete will continue to follow the, often abusive, practices of her coach despite being aware of the negative impact:

[Coach 2 had an] extremely different concept. This woman, Russian born, would place bottle caps on the bottoms of your feet; if you fell on your heels off the balance beam, then you would have them, the Pepsi bottle caps, go into your heels. [She was] excruciating, die-hard; she was wonderful. You either love her or hate her. I was a person who loved her because she made me so infuriated sometimes and because she was good, and that's why I liked her. (p. 59)

The young gymnast quoted here expressed some major contradictions in the way she viewed her coach, *excruciating*, yet *wonderful*, *infuriating*, yet *likeable*. From the description of the coach-athlete situation, it appears that this gymnast was trapped in a dynamic with her coach where she would do anything that the coach said, no matter how difficult or abusive; it sounds like a situation that was very high risk for OT.

In some cases, coaches might not account for individual difference among athletes in training and recovery capacities, exemplified in the following athlete quote from Wrisberg and Johnson. (2002):

I think the coach failed to see the individual needs of players. Some people just couldn't practice for three hours in 90-degree heat. It got to them. Quite a few were sick, off and on, and half our team was injured. (p. 264)

In other cases, athletes have reported that their coaches were simply abusive. The following quote from Wrisberg and Johnson (2002) illustrates how an abusive coach denigrated her athletes:

All [the coach] knew how to do was bitch at us. She made us feel like we were fat... real big. She called me names and told me how mentally disabled I was. She had something for everybody -- I just happened to be the retarded one in her eyes. She liked to make cracks about our bodies. We were already pretty self-conscious about being big. So around her, we always felt so fat -- just horrible and ugly. And the uniforms didn't help us one bit because they were real short... We just never felt very good about ourselves and she had a lot to do with that. (p. 264)

The emotionally charged environment described above could prompt some athletes go to extremes in either training, eating behaviours, or other potentially harmful activities. Other forms of abusive behaviour by coaches include pressuring athletes to perform when they might be unfit to do so. Wrisberg and Johnson (2002) noted that, as an outcome of OT, injury poses a serious threat to the long-term well-being of athletes, especially when coaches do not handle injured athletes well. They quoted one athlete who stated, "When I had that groin injury [the coaches] made me scrimmage anyway... I mean, I had no business being out there" (p. 258). The coaches' attitudes and behaviours toward injury

appear to be a significant risk factor for OT and re-injury, exemplified in the following quote from a gymnast (Krane et al., 1997):

[Coach 1] would get mad if I got an injury. He would be so pissed off. He'd be like, 'oh no, not again,' and then he'd want me in the gym working out and everything. . . [He] thought that [an injury] was a lack of concentration. So, he was mad at me because, if I was concentrating better, I wouldn't have [gotten injured]. (p. 59)

For some athletes, coaches in conflict with one another can add to the stress load already experienced in the training environment: "There was miscommunication between the coaches; coaches were yelling at each other... it was really disorganized and it had a negative impact on me and the other players" (Wrisberg and Johnson, 2000, p. 264).

Coaches play a significant role in the way athletes respond to the training environment and make decisions about recovery; given many of the previous examples, it appears that coaches may increase the risk for OT depending on how they interact with their athletes.

Athletes may feel that they do not have enough, or any, opportunities for down time away from their sport. Reflecting such feelings, Gould et al. (1997) provided the following quote from an athlete

My biggest problem was there was no separation between the role of the father and the coach. So you wouldn't talk about anything else but tennis whether we were eating or if there was a match on television everyone had to watch it and he'd comment, and whether or not you agreed with him, it didn't matter 'cause, you know, he was always right. You had to do it this way and, you know, he always made us do certain exercises when he wanted and was very strict on getting things done the way he thought, and he didn't leave any room for personal feelings. (p. 265)

Another significant stressor for athletes can come from the demands inherent in the sport culture. For example, in figure skating, athletes might feel extra pressure to train harder or experience stress that disrupts their recoveries, because of the constant concern about appearance:

You should do a whole story on weight in figure skating; it is such an appearance sport. You have to go out there with barely anything on... it's not like I'm really skinny or anything, but I'm definitely aware of it. I mean I have dreams about it sometimes. So it's hard having people look at my thigh and say, "oops, she's an

eighth of an inch bigger, " or something. It's hard to do. Weight is continually on my mind. I am never, never allowed to be on vacation. Weight is always on my mind. (Gould, Jackson, & Finch, 1993a, p. 149)

This type of concern about appearances and weight, ostensibly, may lead athletes to push harder in their training, neglect important recovery strategies, especially those related to nutritional intake, and, thus, put themselves at greater risk for OT and its negative outcomes.

There often may be situational stressors outside of the sport and training environments, as well, that put athletes at risk for OT. In some cases, friends can be significant sources of stress, noted here in a quote by an athlete from Wrisberg and Johnson (2002): "My roommate is one of those people who seems to need some sort of chaos in her life all the time. I just become a victim of the chaos she needs in her life. I dread going home at night" (p. 260). In other cases, athletes, such as the following one quoted in Wrisberg and Johnson (2002), may experience their significant relationships to others as contributing to the overall stress load: "My relationship with my girlfriend was such a roller coaster. She'd let me in close and then just push me away. It just about drove me crazy" (p. 262). For some athletes, the family financial circumstances can elevate already high levels of stress: "My family was always under financial burdens, sacrificing everything so I can skate. We didn't have the money, and things are going really bad, and it was like... caused a lot of tension, you know" (Scanlan, Stein, & Ravizza, 1991, p. 114). For other athletes, family crises may become overwhelming. Wrisberg and Johnson (2002) provided the following quote from an athlete, illustrating a particularly difficult home environment:

My father had gotten laid off, you know, from his job and everything and that was really tough on my family and all that... that's when he started his drug use, he started experimenting with the "crack." He and my mother weren't getting along and my sister was just a teenager and had no guidance from my folks at all. It was just awful (p. 261).

In such cases where athletes go home to stressful situations and relationships, the overall stress loads are increased, and the capacities for recovery diminished, contributing significantly to OT risk.

OT risk might also increase when athletes experience stress or feel pressure from the expectations of others around them. Gould et al. (1993a) presented the following excerpt, illustrating an athlete's perception of expectations:

Expectations are definitely a concern and they are not a superficial one. Will I measure up to other people's expectations? It is much easier when you don't have any expectations, because if you don't do very well, people just don't notice you; you can always do better next year. But if you do bad with expectations upon you, they condemn you, so that's a stress factor. (p. 147)

In other cases, athletes might perceive excessive pressure coming from an institutional level, illustrated in the following athlete quote from Wrisberg and Johnson (2002):

The athletic department standards are so high here. The beginning of the season we came home from our first road trip and we were ashamed to tell people we lost. We felt like we let the whole department down. (p. 263)

In yet other situations, athletes might find that the presence of more experienced or talented athletes can create overwhelming stress, as one college swimmer from Wrisberg and Johnson (2002) described it:

I went to NCAA's and it was unbelievable the people I saw there. It was huge names in swimming and I felt so out of place... like I didn't belong in the same pool with them. I had a really bad asthma attack and I think maybe part of that could have been the anxiety. I was completely psyched out. (p. 263)

In all of the above scenarios, the expectations of others, or the pressure from comparison to others, can add to the stress load from which athletes need to recover. For some athletes, this added pressure may also lead to pushing excessively in training in order to compensate for perceived shortcomings.

With respect to personal variables, it seems that certain attitudes, personalities, and personal experiences may elevate stress levels in athletes, prompt excessive training practices, interfere with recovery, or put them at greater risk for injury. Although

motivation to train hard may be important in sport, some athletes at risk for OT seem to display super-motivation, wanting to succeed so badly they are not aware of their own limits. A college tennis player voiced his concern about a team-mate's seemingly excessive level of motivation (Wrisberg & Johnson, 2002):

One guy on the team doesn't know when to stop with his training. He's a great guy but he works too hard and now he has a stress fracture in his back. Last year he broke a foot. He goes too much. He wants it too bad. (p. 258).

Athletes at risk for OT may also express concern about taking time off, despite that regular recovery should be an integral part of a training program. With the following athlete quote, Wrisberg and Johnson (2002) provided an example of a college distance runner expressing the irrational thought that rest is a sign of weakness:

I feel like I'm weak if I decide to take a day off. It's like, I'm not, you know -- I set pretty high standards, you know -- if you can't get out there and run, then what are you doing running [NCAA] Division I track? (p. 258).

Although many athletes may be described as having perfectionist tendencies, it seems that, at the more extreme end of those tendencies, athletes may react maladaptively to their performances. The following comment by an elite figure skater shows how perfectionist thought processes might create frustration for the athlete: "I was a perfectionist That's probably the hardest thing; I was just a perfectionist all the time. . . . I would never accept myself not doing it perfectly" (Scanlan, Stein, & Ravizza, 1991, p. 115). At the extremes of perfectionism, some athletes will show great dissatisfaction with anything less than winning. Krane et al. (1997) illustrated how a gymnast, with extreme perfectionist tendencies, could become incredibly self-deprecating in response to any performance that did not result in a win:

I would be like, 'all of that hard work is down the drain and here you are in 3rd place. You are such an idiot. You are so low; I cannot believe you are here; you are supposed to be up there.' . . . I pictured 2nd or 3rd to be, I don't know, what I pictured as a loser. I only knew how to envision a winner because a loser was not even, was not in my world. That picture may be weird but that's the way it was. It was just tops; everything's always gotta be the top. (p. 63)

For other athletes, displaying obsessive-compulsive types of behaviours in sport could lead them to poor decisions about life choices that increase stress, disrupt recovery, or threaten their health. One college swimmer admitted turning to substance abuse as a coping strategy, exemplified here in the following quote from Wrisberg and Johnson (2002):

One year I didn't perform well at all. I felt like I was missing something. I wasn't really part of the team. That's when I started drinking. I don't know this just my personality being kind of obsessive-compulsive... once I started to drink, I couldn't stop. (p. 265)

Athletes at risk for OT and injury may also display unhealthy attitudes toward training, sometimes engaging in excessive, damaging practices. The following quote from a gymnast (Krane et al, 1997) illustrates the extent to which one athlete might go in self-damaging thoughts and behaviours:

In my mind, practice made perfect. I had believed that pain is gain. . . . And the more it hurt, the better it was; and I don't know why it was like that, and sometimes I think about that and I think I was becoming psychotic, but I would purposely hurt myself to make myself better. To almost make myself feel like I was existing. (p. 65)

Evident in the previous quotations from athletes, there appear to be numerous sources of stress and driving factors in athletes' lives, which may add to the total stress load, prompt poor decisions about training and recovery, and push them over the edge from healthy training to OT. In some cases, it seems that athletes might feel pushed by coaches or parents; in other cases, the pressure, and/or maladaptive behaviours, may be driven by the athletes' own personalities. Understanding a complete picture of athletes' lives seems to be an important step in minimizing the risk for OT.

Summary of Risk Factor Research

As many researchers have remarked, Armstrong and VanHeest (2002) stated, "the border between optimal performance and a performance impairment due to overtraining is subtle" (p. 341). Such subtlety might prompt exploration at an individual level to gain an

understanding of the meaning of overtraining experiences for athletes, including *why* athletes may risk overtraining or neglect their recovery. It seems that understanding risk factors for OT might be enhanced by a holistic approach that encompasses fleshing out the many factors, personal and situational, affecting athletes' lives. Botterill and Wilson (2002) stated, "since the phenomena involved in overtraining and recovery are clearly multifactorial, qualitative descriptive case studies and research can assist us in understanding the complex relationships involved" (p. 143). From the above examinations of the literature, it appears there have been a number of qualitative studies, and several review articles, that have initiated investigation into overtraining risk factors, providing data from both experts' and athletes' perspectives; it seems that the time is right for further in-depth, qualitative research into OT phenomena.

Conclusions of Literature Review

Gould and Dieffenbach (2002) stated that, "it is evident that researchers must look beyond mere physical training as a cause of overtraining and burnout . . . Other factors such as psychological stress, inadequate rest, the type of recovery activity, travel, personality, and sociological issues must be examined in multifaceted models" (p. 33). Furthermore, Kenttä and Hassmén (2002) noted that, "only the individual athlete knows exactly in which way the training affects her body and mind and how she perceives recovery actions" (p. 67). Therefore, it could be useful to conduct more research that looks at as many variables as possible in athletes' lives, and that provides insight into the individual athletes' experiences from the athletes' perspectives.

Kenttä and Hassmén (2002) noted the difficulties with holistic research approaches: "it may be frustrating to include and consider the individual's whole life situation" (p. 67). Nonetheless, in stating "performance development and optimal training depend heavily on the ability to integrate and react to as many relevant variables as possible" (p. 67), they

supported the rationale for an idiographic approach to examining athletes' experiences with OT and outcomes. Kenttä and Hassmén also stated "more research is needed in order to help establish to what extent psychosocial stress interacts with training-induced stress in the development of the overtraining syndrome" (p. 73). With such research, one may be able to "increase the understanding of why the same athlete responds differently to a given training stimulus under different conditions, why homogeneous groups of athletes display different responses to a given training stimulus, and why some athletes seem to be more vulnerable to staleness" (Kenttä & Hassmén, 2002, p. 74). There is an implicit demand here to understand the individual, providing the rationale for in-depth studies of individual athletes' experiences with overtraining processes and outcomes. This thesis is about gathering information on, and identifying, the many relevant variables, available cues, and early warning signs connected to overtraining processes and outcomes.

Susceptibility to overtraining and potential risk factors, has been identified as an important area for research, especially the focus on individual differences (Flynn, 1998; Raglin, 1993; Uusitalo, 2001), and some researchers have suggested a number of personal and situational risk factors for overtraining (Gould et al., 1999; Gould et al., 1997; Krane et al., 1997; Uusitalo, 2001). There is no published research, however, that has been conducted systematically to uncover, understand, and test such potential risk factors. Currently, many top coaches and athletes appear to have access to sport science knowledge that may enable them to minimize or avoid OT. Nonetheless, many athletes are still pushing too hard and are at risk for serious OT outcomes. Idiographic research that is directed toward revealing what is being experienced at the individual athlete level could be helpful in presenting a more complete understanding of the OT process, including the risk factors, actual causes, and potential consequences.

It may be important to identify predisposing personal variables of athletes, and

situational variables experienced by athletes, that are present before a particular training cycle commences. It then might be possible for athletes, coaches, doctors, and sport psychologists to be more sensitive to the risk factors and act to minimize negative outcomes. Flynn (1998) and Raglin (1993) have suggested that future research should examine susceptibility to overtraining. Raglin and Morgan (1989) found that, among college swimmers, 91% who became stale in their first season became stale in one or more subsequent seasons, whereas, only 30% of the swimmers who did not become stale during their first season developed staleness in another season. Raglin (1993) concluded that this finding “suggests that athletes display consistent differences in their propensity toward becoming stale by the age of 18 and indicates that some individuals are at greater risk of suffering the disorder than others” (p. 843). O’Toole (1998) has stated that the individual variability in responses to a given training load is such that a particular training load that is optimal for one athlete may lead to overtraining syndrome in another; it could be important to ask what are the sources of this variability. With OT potentially affecting athletes in most sports, it could be important to examine personal and situational factors that lead to OT and help predict susceptibility to OT. Identifying which athletes are at higher risk for OT and its negative outcomes could be one of the first steps toward prevention. Perhaps, with more research on risk factors, it might be possible to predict what types of situations are most likely to lead to overtraining and what types of people in certain situations are most likely to overtrain.

CHAPTER 3: MY INTEREST IN AND EXPERIENCE WITH OVERTRAINING

My Story of Overtraining

To initiate the examination into the meanings of overtraining for athletes, and to understand some of the direct and indirect drivers of overtraining behaviours and processes, I realised that a good way to start would be to look at my own competitive sport experiences.

I have been an athlete for much of my life, as an elite rower, professional windsurfer, and as a competitor in road and track cycling and several other sports. Before embarking on my PhD journey, I had believed that I had never overtrained at any time in any of my sports. In my initial review of the OT literature for my PhD proposal, however, I started to identify issues that seemed to be related to my experiences as an athlete, especially as a rower. In rowing, I had been training from 1997 to 1999 to go to the Sydney Olympics, and I had been in a good position to make the Canadian team. Unfortunately for me, I sustained a serious wrist injury in 1999, ending my hopes of competing at the Sydney Games. While I was training, I had been aware of OT issues, but thought that I kept them under control. At the time of my injury, I did not consider it to be a result of OT, but rather a result of an error made in lifting too heavy weights. Nonetheless, during the following year, with my exploration into OT, I began to identify my training practices, attitudes, and beliefs as indicative of OT behaviour. I recall that preceding my wrist injury, I had basked in feelings of invincibility; I had been on a high of super-motivation, and I had set short terms goals to break through new anaerobic and aerobic barriers, which looking back, had been unrealistic given my timeframe. Just before the injury, I had returned to full training after a break for Christmas, and I had increased my training load upon my return by twenty-five percent (from 12 workouts per week to 16 workouts per week). Looking at my thoughts and behaviours now, I feel a bit ridiculous that I could not see that I was setting

myself up for disaster, but it seemed that I had to go through the whole OT experience to have a sense of what it was all about.

As a researcher, I recognised my own experiences as overtraining, and I wanted answers to a number of questions: I had good knowledge about training and recovery needs, about nutrition, about sport science; why did I take risks and push that extra bit harder when I knew it could be detrimental? What was getting me to the position where I was tired, but did not want to tell my coach? Why did I not want to share my goals with others? It led me to thinking that there is a lot going on at the intrapsychic and interpersonal levels that is not being tapped by the current research. I hoped that I might conduct research that could answer these questions for me, as well as answering questions that other athletes might have about their own experiences with OT.

Maybe I should have stopped after my first experiences with OT and injury, but I could not let go of the feeling that I had been so close to the Olympics and had not made it; I had to try again. I had another chance to try out for the rowing team in 2003, this time backed by my research experience, increased personal insight, and lessons from my previous disappointment. I took a leave of absence from my PhD and went to train with the Canadian Team again, thinking I would know how to do it better this time around. Despite my awareness and knowledge, however, I sustained another serious injury, which was likely related to OT behaviours, while training to make the team, this time a herniated disc in my lower spine. What I learned from this second attempt was that all the knowledge and insight I had with respect to OT did not stop me from getting drawn into the coercive dynamics of the competitive sport environment, in which I felt both explicit and implicit pressures from coaches and teammates to push myself harder than my body could sustain, to shut out the early signs of injuries and illnesses, and to keep silent about pain. Once again, I was left with the sense that there is a lot more going on at so many levels of human

experience in the context of OT that is not being tapped by the research. I wanted to know what drives athletes to overtraining. I suppose I wanted to understand what drove me.

CHAPTER 4: INTRODUCTION TO STUDY 1 AND STUDY 2 METHODS

Choosing an Approach

As stated in the introduction section, the approach I have chosen to write this thesis might be described as a mix of realist tales with confessional elements. In that regard, I have also been informed by a range of qualitative approaches in choosing the methods of the thesis, particularly in presenting the results of the two groups of interviews, those for experts and those for athletes. Although I began my approach to coding both the experts' and athletes' interviews with the aim of doing inductive content analyses, I found that I was going in two directions in accordance with differences in interview material from the two participant groups. Tight coding and thematic organisation of an inductive content analysis seemed to work well with the experts' interview data, which most often represented a report on experts' opinions or perspectives on OT, whereas thematic analyses seemed to detract from the richness of the athlete interview data, which most often represented detailed stories of the athletes' many experiences with OT. For the experts' interviews, Study 1, the choice to write a realist tale was best supported by the inductive content analysis, where data collection, analysis, display, and discussion rendered a product of coded and arranged themes and categories representing the interview materials. For the athletes' interviews, Study 2, I was drawn to writing narrative case studies, integrated with confessional tales, where my own voice as an athlete with overtraining experiences would feature in presenting the stories of the athletes. Furthermore, I did not want to lose the richness of the athletes' tales by trying to make them fit into any particular categories. With this divergence from thematic analysis, the athlete tales could be described as representing lived experiences, allowing the reader to identify with the athletes. Based on this difference in the approaches to handling the data for the experts compared to the athletes, I have presented the Methods sections for the two groups of

participants separately, written up as Study 1 and Study 2 Methods, at the beginnings of chapters 5 and 6, respectively.

Role of the Researcher

Sparkes (2002) stated, “some suggest that researchers-as-authors need to indicate their positioning in relation to the research process and the other people involved” (p. 17).

As an elite athlete myself, with a significant experience of OT, I have been intimately connected with the phenomenon under investigation. As mentioned in Chapter 3, I made two serious attempts to qualify for the Olympics in rowing and injured myself as a result of OT. These particular experiences have advantages for my research in that they give me first-hand insight into OT, which has helped in conceptualising the research and understanding the outcomes. My status as an elite rower has also helped me to gain credibility with, and access to, my research samples in both Study 1 and Study 2.

Nonetheless, my experiences also might have created some disadvantages. I have had to be cautious of biases that I may bring to the interview sessions. In particular, I have had to be aware that I was not leading the athletes or the experts to confirm my own experiences, rather I had to let them tell their own stories. I also have had to be careful to make efficient use of the interview time and not be drawn into telling the details of my own story.

Although my experiences create potential biases, I have attempted to take appropriate steps to reduce those biases. Such steps included extensive interview role-plays with my supervisors before beginning actual interviews with athletes or experts, continual supervision throughout the data collection phases to discuss the interview processes and outcomes, and continual self-monitoring of my own behaviour during the interviews, as well as during transcription.

Rigour/Trustworthiness

The following tactics for verification of findings (see Miles & Huberman, 1994) guided my approach to establishing rigour/trustworthiness in both Study 1 and Study 2: checking for representativeness, checking for researcher effects, triangulating, weighing the evidence, checking out rival explanations, and getting feedback from the informants.

In checking for representativeness, Miles and Huberman suggested that one constantly ask oneself about, and make adjustments to account for, common pitfalls and sources of error, such as sampling non-representative informants, generalising from non-representative events or activities, or drawing inferences from non-representative processes. In this thesis, my purpose was to describe the overtraining experiences of elite athletes; by sampling expert informants from elite sport organisations, discussing overtraining experiences of National and International level performers, and drawing conclusions based on these discussions, I hoped to cover the issue of representativeness.

In checking for researcher bias, Miles and Huberman advocated that one needs to examine the study for possible biases (stemming from researcher effects on the case, and effects of the case on the researcher), seek colleague feedback, and then generate and apply safeguards. As mentioned in the section on Role of the Researcher, I implemented interview role-plays, continual supervision, colleague feedback, and self-monitoring as safeguards to reduce researcher bias. These processes operated to reduce researcher bias primarily by challenging me to be aware of, account for, and at times step away from my own point of view on the research processes and outcomes. In the interview role-plays and supervision sessions, I was guided by a model of psychodynamic supervision, in which my supervisor constantly asked me to be aware of how my inquiries and interpretations were influenced by my own “stuff” and to maintain a focus on the interviewees as the key sources of data.

For colleague feedback, I presented my research methods and findings at multiple local and international workshops and conferences throughout my degree, during which I received multiple perspectives on my research, helping me to keep my views broad and to steer me away from biased approaches and interpretations.

For triangulation, the process of double-checking findings using multiple sources and modes of evidence, Miles and Huberman recommended displaying the different sources in a matrix for easy comparing and contrasting. Using the NVIVO qualitative data analysis software, I was able to display the data in tree diagrams, coding reports, and organised document outputs. I presented these displays to my supervisors and colleagues and used their inputs as sources of triangulation and double-checking.

In weighing the data, Miles and Huberman suggested being aware of the quality of the data by keeping a running log identifying stronger and weaker data, and by summarising one's views on the quality as one approaches the final write-up. I kept an ongoing journal of reflective thoughts throughout the analysis and writing processes to maintain a level of awareness for data quality.

In checking out rival explanations, Miles and Huberman advised involving someone else to play devil's advocate, focussing on discrepant information in order to generate alternative explanations, and checking out the merits of other reasonable explanations. The continual supervision process with my thesis committee members and colleagues, and multiple conference and workshop presentations of the ongoing research project, provided me with ample opportunity for critical review of the processes of data analysis and the resulting products. Throughout the writing of my PhD, I addressed several coaches, doctors, psychologists, and other experts at conferences who were more than willing to play devil's advocate with regard to my interpretations of my research findings; such challenges by others prompted me to consider, and in some cases accept, other

reasonable explanations. Furthermore, on several occasions I shared the verbatim quotes from athletes' stories with conference and workshop attendees, both experts and athletes; in these instances, the attendees corroborated the themes emerging from the athletes' tales with stories of their own.

With respect to getting feedback from the informants regarding the research findings, I spoke with, and received corroboration from, several participants in both the expert and athlete interview groups about the major themes emerging from, and my interpretations of, the research findings. Additionally, I had corroborating feedback from other informants in the sport world, who were not interviewed, regarding the major findings of the research. Working on placement as a training sport psychologist, I presented my findings in workshop format to several different groups of athletes and coaches. In many cases, athletes and coaches identified with the tales emerging from my research and supported the findings I summarised.

Standards for the Quality of Conclusions

In connection with rigour/trustworthiness and the tactics for verification of findings, Miles and Huberman (1994) suggested, "it's not enough to say that well-carried out tactics make for good conclusions" (p. 277). Miles and Huberman commented on the history of tension within the field of qualitative inquiry: interpretivist researchers often face a crisis of legitimation, where qualitative research is evaluated against the standards applied by the reductionist/positivist frameworks of quantitative inquiry. Commenting on this tension, Miles and Huberman explored some practical standards that can help judge the quality of conclusions from qualitative inquiry. Specifically, these authors discussed five, "somewhat overlapping" issues: objectivity/confirmability of qualitative work; reliability/dependability/auditability; internal validity/credibility/authenticity; external validity/transferability/fittingness; and utilization/application/action orientation.

Furthermore, the authors suggested some practical guidelines in the form of a series of questions related to each of these issues that can be applied to judging the standard of a qualitative study. In this section, I will discuss how I addressed these guidelines in relation to Study 1 and Study 2.

Objectivity/Confirmability

Miles and Huberman stated “the basic issue here can be framed as one of relative neutrality and reasonable freedom from unacknowledged researcher biases – at the minimum, explicitness about the inevitable biases that exist” (p. 278). Answering questions about objectivity (see Miles & Huberman, p. 278) in Studies 1 and 2, I have described my background and biases in both Chapter 3, my story of overtraining, and the section in this chapter on role of the researcher. With respect to the methods, I have provided a step-by-step breakdown of the procedures I took in each study, showing a clear “audit trail”. Finally, my conclusions for each chapter and my general conclusions were linked explicitly to the data, which was presented in summaries of the verbatim quotes in Chapter 5 and embedded in the athlete stories of Chapter 6.

Reliability/Dependability/Auditability

The issue identified here is whether the process of the study was “consistent, reasonably stable over time and across researchers and methods” (Miles & Huberman, p. 278). Answering questions about quality control (see Miles & Huberman, p. 278) in Studies 1 and 2, the findings showed “meaningful parallelism” across the different interview participants; coding checks were made throughout the analysis of the expert interviews, and there were several forms of peer and expert review, as discussed in the section on rigour/trustworthiness.

Internal Validity/Credibility/Authenticity

Miles and Huberman stated that this issue is about “truth value” of qualitative research findings, looking at whether the findings make sense, are credible, and present an authentic portrait of what is being studied (p. 278). Considering the truth value of Studies 1 and 2, the most significant validation has come from discussing, and receiving support for, the research findings with athletes, coaches, and experts, external to the studies, at workshops, conferences, in sport psychology practice, and at informal meetings. For example, numerous athletes have voiced massive identifications with the tales of overtraining portrayed in Chapter 6.

External Validity/Transferability/Fittingness

The issue outlined here is whether the findings are transferable to other contexts, how far they can be generalised (Miles & Huberman, p. 279). With respect to Studies 1 and 2, one could say that I might be restricted to applying the findings only to elite athletes, training at the national and international levels, as represented by the research sample; nonetheless, I have found myself in various discussions with people outside of elite sport who felt that the findings could apply to their lives as well. In particular, I have worked with persons in performing arts, both opera and ballet, who have found that the descriptions of overtraining, presented in my research, may apply to their domains as well. It seems that the processes and outcomes described in the conclusions are “generic enough to be applicable in other settings, even ones of a different nature” (Miles & Huberman, p. 279).

Utilization/Application/Action Orientation

Miles and Huberman commented that “pragmatic validity” or usefulness of the study for its participants, researchers, and its consumers might be considered in evaluating a study. Since the completion of my thesis, I have been involved and continue to be

involved in delivery of educational seminars and workshops that are a direct result of the outcomes of my research. Sport organisation, professional and amateur, as well as performing arts organisations have asked me to work with them in developing a greater understanding for overtraining risk and for possible intervention strategies. Furthermore, my thesis has been seriously considered as the basis for a publishable book, and book contract negotiations are underway.