VIRUSES ARE THE MOST COMMON INFECTIOUS AGENTS AFFECTING HUMANS. SOME INVESTIGATORS CONTEND THAT VIRAL UPPER RESPIRATORY ILLNESS (URI), OR THE COMMON COLD, CAUSES MORE FREQUENT ACUTE DISABILITY AMONG ATHLETES THAN ALL OTHER DISEASES COMBINED (RYAN ET AL., 1975).

Disease patterns among Summer and Winter Olympic athletes are remarkably consistent. Respiratory infections head the list, followed by gastrointestinal disorders and skin infections (Hanley, 1976). During the 1992 Winter Olympics some of the world's greatest athletes were unable to compete or did not perform well because of a URI (Nieman, 1992).

Upper respiratory illnesses are associated with major socioeconomic expense in the U.S., due to missing work or school and to medical expenses. The cost is said to be $5 billion a year (Turner, 1990).

Although heavy exercise may increase the risk of acquiring an upper respiratory infection (Nieman, 1992), athletes and exercise enthusiasts tend to continue participating in competitive and recreational sports during a URI. Therefore it is important to understand the essential changes in cardiac, pulmonary, and skeletal muscle functions during a URI.

The implications for continued sport and exercise participation relative to illness complications and susceptibility need to be considered. Protracted courses of URI, performance levels, and subsequent participation guidelines during illness also warrant discussion.

Physiological Effects of URI

Three studies on the effects of URI on the pulmonary function of subjects at rest were completed in the 1970s, and all three suggested that peripheral airway abnormalities are associated with URI. One study concluded that large airways were involved during URI (O'Connor et al., 1979). The other two investigations found no dysfunction in the large airways (Blair et al., 1976; Cate et al., 1973).

Respiratory muscle strength was studied in 12 subjects who had developed an upper respiratory infection (Mier-Jedrzejowicz et al., 1988). Maximum static respiratory and expiratory pressures fell significantly during these infections. The investigators concluded that weakness of the inspiratory muscles may contribute to breathlessness during exertion. To make matters worse, weakness of the expiratory muscles might affect the cough mechanism and subsequent clearing of pulmonary secretions.

Mier-Jedrzejowicz et al. suggest that those who suffer from either lower respiratory tract infections or from exercise-induced asthma should also refrain from sports during URIs or episodes of exercise-induced asthma.

Reduced functional capacity of skeletal and cardiac muscle has been demonstrated during URI. Astrom et al. (1976) examined tissue from patients recovering from recent viral or mycoplasma illnesses and found significantly reduced muscle enzyme activity in infected patients. Moreover, electron microscopy revealed abnormalities in muscle ultrastructure.

Roberts (1986) suggests that during URI there is a decrease in muscle glycogen utilization. Ardawi and Newsholme (1985) report that a decrease in muscle glutamine release occurs with URI during prolonged physical training. Other researchers have also reported that myositis ossificans may be the result of hematoma infection following a respiratory tract infection (Zarins & Ciullo, 1983).

Fever and Muscle Soreness

The effects of myalgia and fever on muscle and circulatory function have also been examined.
Friman et al. (1985) found that during a fever, subjects exhibited decreased isometric and dynamic strength and endurance. Severity of myalgia (muscle pain), as rated by each subject, correlated significantly with reduced muscle function. Cardiac stroke volume was lower during and after fever. During fever, an increase in heart rate maintained cardiac output at preinfection values, whereas cardiac output fell during early recovery. This decrease in cardiac output correlated significantly with the severity of fever.

The actual influence of fever and myalgia from a URI has not been determined. A variety of complications may be associated with URI, including protracted courses of infection and even sudden death. The predilection of the Coxsackie cold virus to produce myocarditis or pericarditis may increase the risk of acute arrhythmias leading to sudden death (Roberts, 1986). In a study of 78 sudden deaths during or immediately after exercise, Jokl and McClellan (1971) found a history of URI in 5 of the victims; cardiovascular problems accounted for most of the rest.

Roberts (1986) comments that there are numerous anecdotal reports of death in healthy young people who undertake vigorous exercise during a viral illness. He also reports that numerous case studies have identified viral infections as a cause of sudden death.

**Impact of URI on Sport Performance**

The impact of URI on sport performance has not been clearly identified. In related work by Friman et al. (1985), a decrease in muscle performance correlated to the subjects' own ratings of the intensity of myalgia and fever. Friman et al. concluded that a person's perception or experience of a febrile illness seems to influence his or her ability and/or willingness to perform exercise.

Roberts (1986) presented 4 case reports of athletes who experienced a loss of stamina and ability to manage a normal training schedule during subclinical episodes of URI. All had laboratory evidence of recent viral infections. Roberts concluded that inquiry about minor illness should be standard practice in athletes who have an unexplained loss of stamina. Infections that are subclinical in the population at large may greatly affect maximum performance in athletes.

In a study on the self-reported behaviors and activity levels of intercollegiate athletes with URI, Weidner (1994) attempted to discern which URI symptoms are the most problematic for athletes. Distinctions among symptoms were assessed by examining which ones the athletes reported first to their athletic trainers, team physicians, or coaches.

Also examined were those cold symptoms that prevented athletes from participating in a practice or game or that affected perceptions of physical performance. Athletes who experienced symptoms of cough, fever, laryngitis, aching joints or muscles, and nasal discharge were more likely to report their illness. These symptoms also caused athletes to reduce their activity levels, and their own perceived physical performance dropped.

Weidner et al. (1995b) found changes in running gait during a URI. In particular, stride length increased and stride frequency decreased significantly between illness and convalescent running trials. The perception of fever was an important indicator for changes in running performance.

However, in an investigation completed by Anderson et al. (1995), it appears that a URI does not necessarily limit one's ability to perform exercise on a treadmill. That is, changes may be seen in physiological responses to exercise during longer submaximal exercise bouts as opposed to acute maximal bouts of exercise. For example, in a submaximal exercise bout of 45 min, a URI may have an impact on performance.

The impact of URI on sport performance has not been clearly identified. Certainly, alterations in cardiac, respiratory, and skeletal muscle functions as discussed above may individually or collectively alter performance. Further research is needed.