
OERC Framework: Upper-Extremity Musculoskeletal Disorders Research, Theory and Management

Abstract

Upper Extremity Musculoskeletal Disorders (UEMSD's) are complex in terms of causation, identification, treatment, intervention and management. In March 1992, the Office Ergonomics Research Committee (OERC) published its preliminary finding that many factors are involved in these disorders; that the association between these factors and office work is not clearly understood; and that little research existed or was underway on this reported association. The OERC Framework was developed to aid in understanding the multi-factorial nature of these disorders and the potential relationships among the various factors. It provides a context in which UEMSD causation and intervention theory, research and management can be discussed.

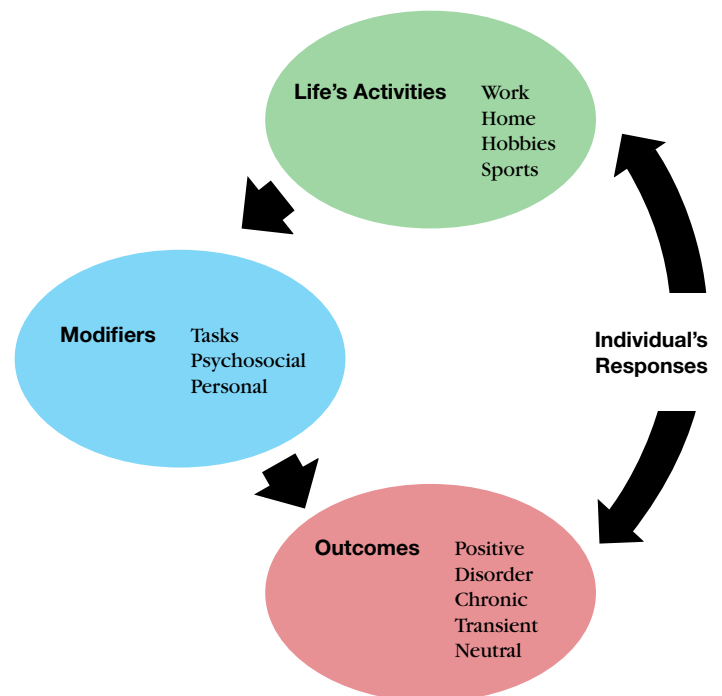
The framework is composed of three elements: Life's Activities, Modifiers, and Outcomes. It proposes a continuous, cyclical loop, which represents an individual's responses to the physical and cognitive demands of life's activities (work, home, hobbies and sports). The effect of these activities are modified by task, personal, and psychosocial factors resulting in various health outcomes. The framework espouses a chain of events and effects which shows the potential complexity of the interactions between the factors and their influence on outcomes.

The OERC Framework

In order to effectively deal with the complexity of the formation of these disorders, the OERC developed this framework. It provides a systems approach and a structure to understand the multifactorial nature of UEMSDs and to discuss UEMSD theory and research with common terminology and to identify areas for future research. It also provides a context and communication tool in which UEMSD management can be discussed. Researchers can better recognize and promote the

contribution their work makes to increase the understanding of UEMSD's. Ergonomists, safety professionals, workplace supervisors, manufacturers of workplace equipment and individuals can also apply the framework to their decision-making.

The framework, described in Figure 1, is composed of three primary elements: Life's Activities, Modifiers and Outcomes. It shows that an individual's response to life's activities (work, home, hobbies, and sports) can be modified by several occupational, personal and cultural physiological and psychological factors and result in various health outcomes.



Summary of the Framework

Individual's responses during an event cycle - physical and mental Goals of life's activities - physical and cognitive attributes of work, home, sports and hobbies Modifiers - Task, Personal (physiological, medical, work style, ergo knowledge, psychological), Psychosocial Health Outcomes - neutral or no effect, positive, transient, chronic, disorder The framework proposes a cyclical loop, which represents an individual's responses to Life's Activities, Modifiers, and Outcomes, that is continuously repeated as all life's activities are accomplished. Both the physical state and mental state of the individual are considered. The cycle is repeated whenever there is a change in activity: in seconds, an hour, or a day. Along this loop, the physical characteristics of activities and environments are filtered and/or amplified by the presence of individual predisposing or protective factors, resulting in health outcomes. The framework espouses a chain of events and effects that shows the relationship between the factors that contribute to the development of a UEMSD. Even at this most basic level, the framework demonstrates the potential complexity of the interactions between the factors, which may or may not result in a UEMSD.

The framework starts with the goals of Life's Activities. These activities can be work-related or non-work related such as house work, sports and hobbies. Life's activities can be described through physical and cognitive requirements. Physical requirements include such measures as the following: the rate of repetition of the activity, the static or dynamic force required to perform the activity, the acceleration, velocity and range of motion required, the static or dynamic postures incurred in performing the activity, and the exposure to vibration or contact stress points. The cognitive requirements describe the mental workload and attention demands required.

The Modifiers can either filter or amplify (prevent, reduce or promote) the development of various health outcomes that result from the above physical and cognitive demands of the tasks being performed. These filters and amplifiers can be task modifiers, personal modifiers, or psychosocial modifiers. Some of the task modifiers include the task design, methods, and schedules; the design and maintenance of tools and equipment used; and the design, layout and environmental conditions of the area in which the activity is performed. Personal modifiers include those factors that impact the way an activity is performed that are specific to an individual. They may be physiological, medical, or psychological. Personal modifiers can also be the result of work style or ergonomics knowledge. Psychosocial modifiers, that are cultural, organizational or social in nature, may also exert an effect on the

outcome of performing life's activities. These modifiers must be known before the activity can be quantified.

The third component of the framework, the Outcomes, represents the health outcomes that an individual experiences in response to the performance of life's activities in the presence of personal, task and psychosocial modifiers. These outcomes are variable, idiosyncratic, and occur along a spectrum of severity ranging from positive, to neutral, to transient or chronic effects or to a disorder. It is important to note that positive outcomes as well as negative outcomes are possible from all of life's activities. A positive effect may be strengthening. A transient effect may be temporary stiffness, muscle fatigue, or non-specific discomfort. Some of the transient physiologic effects may progress to become chronic effects, such as tendonitis, tenosynovitis and carpal tunnel syndrome. This progression from transient to chronic effects occurs through the mediation of some set of modifiers. The framework does not presume that discomfort will lead to chronic outcomes.

Life's Activities

physical requirements
activity type
volume
repetition rates
duration
cycle time: force required, static and dynamic
acceleration
velocity
range of motion: posture required, static and dynamic
pressure points
contact points: vibration, strength required
cognitive requirements: mental workload, attention, demand

Modifiers

Task
task design
task methods
task schedules
tool and equipment design: e.g. keyboard, keyswitches
area design and layout
performance/rest cycle
ambient environment: e.g. lighting, noise, temperature
contact stresses

Personal: Physiological

capabilities
limitations
fitness: e.g. strength, reach, vision, hearing
gender
physical state
work history
life history

Personal: medical

prior injury
prior fitness
prior wellness
smoking and caffeine
oral contraceptives
genetics
medical condition: e.g. diabetes, obesity, arthritis, pregnancy
diagnostic certainty
treatment availability

Personal: Work Style

styles at: work, home, hobbies, sports
repetition rates
duration
cycle time
force applied: static and dynamic
acceleration
velocity
range of motion
posture assumed: static and dynamic
pressure points
contact points
overexertion

Personal: Ergonomics Knowledge

ergonomics training received
informally acquired
ergonomics knowledge
ergonomics beliefs and practices

Personal: Psychological

psychological fitness
stress coping
personality dependency; self-esteem
psychological state
emotional state
anxiety level
work history
life history

Psychosocial

cultural: workman's comp, benefits, litigation, climate, work ethic
organizational culture
job climate
organizational attitudes towards: employees, monitoring performance, job security, supervisor/co-workers support and interactions
social: family support, workplace support

Outcomes

neutral/no effect
positive strengthening physically and/or mentally
TRANSIENT DISORDER: temporary stiffness, tendon fatigue, muscle fatigue
CHRONIC DISORDER: CTS, tenosynovitis, tendonitis, neuropathy, aptcondylitis

Discussion

This framework can assist the understanding of the multi-factorial nature of these disorders and the potential relationships among the various factors. It provides a context in which UEMSD causation and intervention theory, research and management can be discussed. It can be useful to researchers, ergonomists, other professionals, equipment suppliers, management and individuals as they try to address these disorders.