Ecological Model of Occupational Stress

APPLICATION TO URBAN FIREFIGHTERS

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Although stress is often described as ordinary and commonplace, its causes and manifestations are often nebulous and elusive; so elusive, in fact, that many American workers' compensation systems provide little, if any, coverage for persons reporting illnesses related to job stress outcomes (Salazar, 1993). In many instances, managers may not understand or wish to acknowledge adverse stress as a legitimate workplace problem, and organizations may not have policies addressing or preventing excessive occupational stress among their employees. Furthermore, workers themselves may be complacent when they experience stress because they view stress as an inevitable consequence of their jobs. Because of these organizational and individual barriers, the struggle to understand and deal with occupational stress has proven to be a daunting task for occupational health professionals. As a consequence, in many organizations, workers who experience occupational stress related illnesses or disorders have limited recourse, and may experience rejection and even ridicule, if they report a stress related problem.

In spite of this underreporting and the barriers identified above, the ill effects of occupational stress have been clearly documented in both the scientific and popular literature during the past few decades. The more dramatic examples include outbursts of violence by disgruntled workers resulting in death and serious injury to coworkers (Johnston, 1999; Mullins, 1999). Although these violent incidents are horrible and terribly disturbing, there is another side of stress far more common and more subtle, which can be equally destructive. A growing body of scientific research now provides empirical evidence of the relationship of chronic exposures to occupational stressors with various worker health problems, including heart disease, gastrointestinal disturbances, and musculoskeletal disorders (Bigos, 1991; Karasek, 1990; Quick, 1997). Occupational stress has also been implicated in the occurrence of occupational injury (Murphy, 1986), psychological disorders (Corneil, 1999; Sauter, 1990), and even suicide (Liu, 1994).

A recent report by the National Institute for Occupational Safety and Health (NIOSH, 1999) described findings from several studies surveying American workers' views on their job related stress. According to this report, 40% of workers described their job as very or extremely stressful (Northwestern National Life Insurance Company, 1991); and 26% to 29% reported being very stressed at work (Families and Work Institute, 1998; Yale University, 1997). A technical report by St. Paul Fire and Marine Insurance Company (as cited in NIOSH, 1999) concluded problems at work "are more strongly associated with health complaints than are any other life stressors—more so than even financial problems or family problems." In addition, a Princeton survey (as cited in NIOSH, 1999) found "three fourths of employees believe the worker has more on the job stress than a generation ago."

The source of occupational stress has been a topic of debate among workers, managers, and scientists. Two views predominate in the literature (NIOSH, 1999). One view focuses on worker characteristics, such as their personality and their ability to cope. The other view focuses on the conditions of work, such as tight schedules, dead-

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lines, job insecurity, job demands, shift work, and other working conditions (NIOSH, 1999; Spence, 1994). For many years, stress interventions consisted of stress management programs and stress reduction techniques that targeted the individual worker and worker groups. Minimal consideration was given to the occupational context in which the stress occurred. However, more recently numerous lines of research have identified working conditions as the primary culprit for stress outcomes and adverse health effects (Karasek, 1990; Sauter, 1995). Consequently, some occupational researchers have argued for a focus on the workplace rather than on the workers as a means of alleviating or remediating the harmful effects of chronic and excessive workplace stress. To be most effective, it is important to consider the entire spectrum of factors that might contribute to the occurrence of potentially harmful workplace stressors, and tailor interventions to address the identified problems. The ecological model described in this article provides one means of identifying and describing the workplace stressors within specific worker groups.

BACKGROUND OF ECOLOGICAL MODEL

Ecological theory is derived from the biological and sociological sciences. Its biological origins date back to 1859 when Darwin described the complex interrelationships between organisms and their environments. The term "human ecology" was coined in the 1920s in a sociological context in an attempt to systematically apply the basic theoretical scheme of plant and animal ecology to the study of human communities (Hawley, 1950). Ecological theory is similar to system theories describing the interdependence of the various levels and strata existing within systems, and it suggests systems can work together to create equilibrium or homeostasis (McDonald, 1999). The basic premises of ecological theory are that systems are dynamic, change is constant, and "everything is connected to everything else."

In the 1970s, Bronfenbrenner generated a new wave of interest in using an ecological approach to examine human problems. Bronfenbrenner's interest in ecology evolved as a result of his view of the limitations of the prevailing approach used to study human behavior, namely naturalistic observation (Bronfenbrenner, 1977). Naturalistic observation, he argued, is a strategy originally applied to subhuman species, and then applied to humans. While this technique "may be quite adequate for the study of behavior in animals, [it is] hardly sufficient for the human case." He continues by saying the study of humans requires the "examination of multiperson systems not limited to a single setting and must take into account aspects of the environment beyond the immediate situation containing the subject." Bronfenbrenner called his approach "the ecology of human development." He believed human relationships and interactions could be best understood when they were viewed in context, and the context could be viewed at various levels of organizational complexity.

Since Bronfenbrenner's original treatise (1977), many scientists have recognized the value of an ecological approach as a means to understand complex human behaviors. For example, McLeroy et al. (1988) challenged the notion that improvement of health depends on changing the behaviors of individuals. They propose using an ecological approach focusing health promotion efforts not only on behavior, but also on social environmental factors as targets of change. Subsequently, numerous other researchers have applied ecological theory to health promotion (Green, 1996; McLeroy, 1988; Richard, 1996; Ruffing-Rahal, 1993, 1998; Stokols, 1996), family issues (Cochran, 1988; McDonald, 1999), mental health care (Santos, 1995; Windley, 1992), and occupational and environmental health problems (Blix, 1999; Conrad, 1994; Salazar, 1994; Samuels, 1998; Tsuchiya, 1991). The driving forces behind this relatively recent approach to health promotion, disease prevention, and social issues date back to Bronfenbrenner's original contention that traditional approaches focused solely on an individual's knowledge and beliefs are of limited value (Richard, 1996).

ECOLOGICAL APPROACH TO OCCUPATIONAL STRESS

The application of ecological theory to human behavior involves an examination of multiple layers of influence. To systemize the examination process, it is helpful to develop a model describing each of the layers considered. An ecological model typically consists of a nested arrangement of successive structures representing these layers of influence. In his model, Bronfenbrenner (1977) described four layers of influence on human development:

- Microsystems: immediate setting of the person.
- Mesosystems: major settings containing the person (i.e., home, work).
- Exosystems: social structures.
- Macrosystems: culture and subcultures.

In 1994, Salazar and Primomo adapted Bronfenbrenner's four layered approach to environmental health issues. Salazar and Primomo's model (1994) described these layers as:

- Microsystems: immediate environment of client or family.
- Social networks: friends and coworkers.
- Institutional networks: health care system and regulations.
- Macrosystems: political, economic, cultural.

Just as Bronfenbrenner (1977) challenged his colleagues' approach to human development (an approach focused on individual behaviors), in recent years occupational health researchers have challenged the traditional approach to occupational stress (an approach almost exclusively focused on workers' characteristics, as described in an earlier section) (Karasek, 1990; NIOSH, 1999). The ecological model offers a method of examining stress beyond the individual worker. It requires a careful examination of the context in which the job related stress occurs. This approach is consistent with the position that dealing with occupational stress requires looking beyond the individual worker or worker groups to the physical, psychosocial, cultural, and political conditions of work. The ecological model goes one step further, proposing that the broader context in which worker groups are embedded

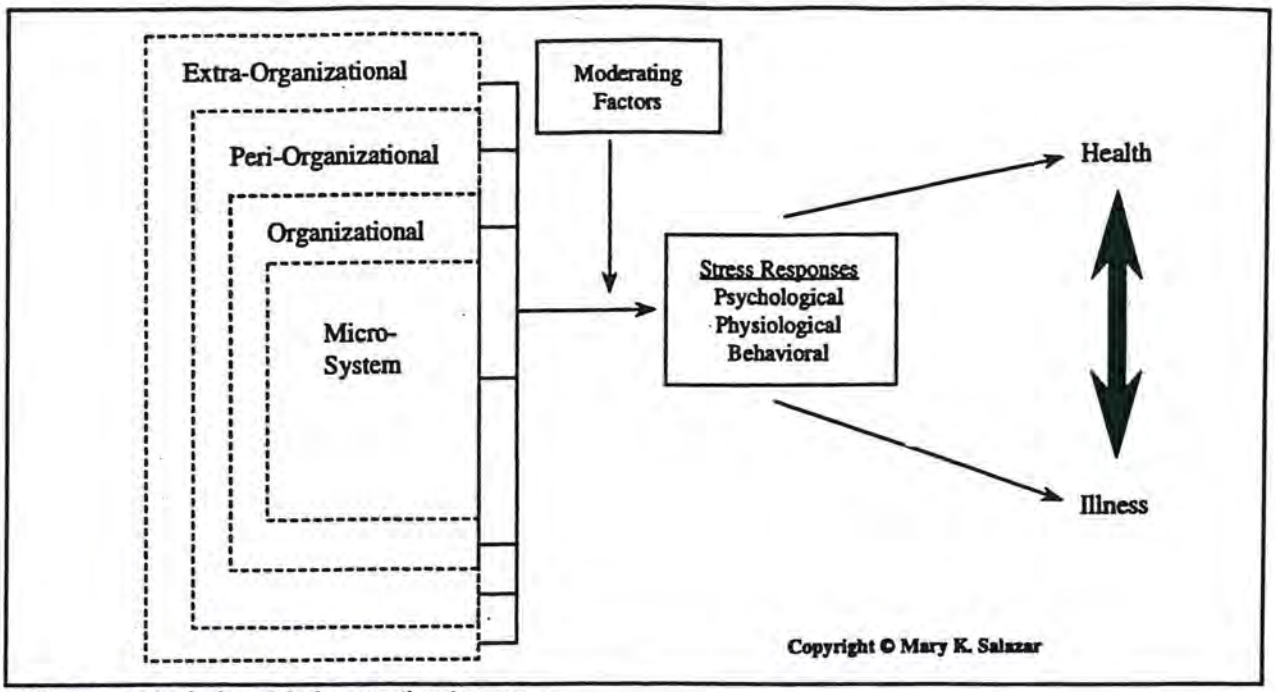

Figure. An ecological model of occupational stress.

may also influence the occurrence of excessive occupational stressors and adverse stress responses and illness outcomes. The model described in this article (see Figure), similar to Bronfenbrenner's model (1977), includes four nested levels of occupational stressors: the microsystems, the organizational system, the peri-organizational system, and the extra-organizational system. The following sections provide a brief description of these levels as well as examples of factors and attributes characterizing each level (summarized in the Table). This model also includes a role for both protective and risk factors, identifies moderating factors and potential stress responses, and considers the implication for worker outcomes. Following a description of the elements of this ecological model of occupational stress, an example of an application of the model to a specific "at risk" worker group is presented.

Microsystem

The microsystem consists of the environment immediately surrounding the worker or group of workers. It includes the physical features of the environment, the interactions a worker experiences, and the activities occurring there. Working conditions that are part of the microsystem include the structure of the job and its content. The job structure often determines how much personal control workers have over their jobs. The content is characterized by the nature of the job. An important consideration when evaluating structure and content is how well the job matches the skills of the worker. If the job does not use the talents, knowledge, and other personal resources of workers, it may result in discontent and a lack of fulfillment. Conversely, if the worker is not well prepared for the job, or if the job requires skills beyond the ability of the worker, it may result in frustration and even anger on the part of the employee.

Another critical aspect of the microsystem is workers' relationships with their coworkers and supervisors. Clearly, workers who feel respected, valued, and supported are likely to experience less occupational symptomology than workers who have conflicted, negative interpersonal relationships and experiences (Beaton, 1997). Another way of viewing the effect of relationships on worker stress is to consider the effect of few or no workplace relationships. The changing workplace has resulted in an increasing number of individuals who work at home or who are constantly on the road. Hence their personal contact with coworkers and managers may be minimal (i.e., consist solely of e-mail exchanges) or entirely absent. A less obvious situation is the worker who is surrounded by coworkers, yet has little opportunity to interact with those workers because of the pace and nature of the job (i.e., an assembly line in a "lean" production facility), or because of the potentially asocial culture of an organization. Either of these latter situations can lead to a sense of isolation, which can result in workers feeling detached or alienated from the organization.

Organizational System

The organizational system is made up of the multiple structures and functions that constitute a work organization. Examples of organizational structures are labor unions, the size of the organization, its physical arrangement, and, of course, its service or product. Culture and organizational policies are also important considerations when evaluating the organizational system. Occupational stress is likely to be minimized in organizations with explicit policies to promote employees' health, and in which this policy is reflected in the attitudes and behaviors of management. Leadership styles have a very direct positive or negative effect on the level of stress within

TABLE

Examples of Stressors and Risk Factors that Characterize Four Levels of Occupational Stress

Level	Work Related Stressors	Worker Risk Factors
Microsystem: Environment immediately surrounding the worker		
	Job structure: work hours, shift work, machine pacing, piecework	Fatigue, boredom, overload
	Travel requirements, amount of control	Time pressures
	Job content: complexity, difficulty/simplicity, monotony	Boredom, lack of appropriate skills
		Lack of fulfillment
	Physical conditions: layout of workstation, lighting, temperature	Inadequate information about hazards
	Personal items	Lack of training/lack of personal protective equipment
	Meaning of work	Fear of failure/error
	Family responsibilities	Fatigue, frustration
	Human contact/relations with coworkers	Feelings of isolation/loneliness
Organizational System: Composed of microsystems		
	Labor unions	Management/supervisor's attitudes
	Role at work (level within structural hierarchy)	Frustration, anger
	Formal and informal work policies	Policies that don't value health
	Role ambiguity/role conflict	Unclear objectives re: roles/responsibilities
	Demands of job	Conflicting demands
	Leadership styles	Inappropriate leadership style

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organizations. For example, an organization in which the predominant leadership style is authoritarian, subordinates' ability to participate in problem solving and decision making may be stifled. On the other hand, a laissez faire leadership style may place too much responsibility on workers and may lead to ambiguity and role conflict, depending on the product or service provided by the organization. Each of these styles may be appropriate in certain situations. However, when the leadership style matches the dynamic needs of the organization and its workers, this source of occupational stress is minimized.

Peri-Organizational System

The peri-organizational system refers to the forces within the societal system in which the individual and organization are imbedded that have an immediate effect on the work organization. These include the regional economic conditions, the political "climate," the prevailing social conditions, and the general health of the community relating directly to the organization. For example, in an economic downturn or recession, an organization may be required to downsize or to restructure, resulting in lost jobs or the relocation of some employees. The level of crime within the local community may also serve to threaten workers within and outside of the organization. In some communities, simply walking to one's car at the end of the workday may pose extreme risk to workers' safety. The presence or absence of community support systems also can make a difference in workers' daily lives. Are day care facilities available for workers who have dependent family members? Are transportation systems within the community safe and dependable? Another peri-organizational factor able to directly affect workers' stress levels is the status of the organization within their communities. For example, if an organization provides an unpopular product or service (i.e., nuclear

TABLE (CONTINUED)

Examples of Stressors and Risk Factors that Characterize Four Levels of Occupational Stress

Level	Work Related Stressors	Worker Risk Factors
Peri-Organizational System: Forces within larger system within which the organization is imbedded		
	Unemployment rates	Job insecurity
	Contributions/status of organization to community (i.e., "bad press")	Feelings of self esteem: pride or embarrassment
	Community's perception of organization's products or services	Feelings of self esteem: pride or embarrassment
	Community apathy when problems exist	Anger, defensiveness, animosity
	Inadequate support systems: Day care facilities	Frustration, irritation, concerns about children
	Transportation	Concerns about getting to work, tardiness
	General safety/health within community	Fear of violence, injury, or illness
Extra-Organizational System: Cultures, traditions, and customs that affect organization		
	Prevalent attitudes/biases	Harassment because of gender or ethnicity
	Work ethics	Feelings of being judged by others' standards; insecurity; inadequacy
	Attitudes toward chronic illnesses	Fear of intolerance if physically or psychologically ill; embarrassment if ill
	Government standards and regulations	Standards that don't adequately protect workers
	Norms that affect organization (for example, related to parental leave)	Exclusionary policies

weapons), or produces a byproduct unacceptable to the community (i.e., chemical pollution), the workers within that organization may feel rejected or scorned by the members of their communities.

Extra-Organizational System

The extra-organizational system includes the cultures, societal norms, and traditions as well as government and economic policies that directly or indirectly affect workers. Direct effects are related to government policies, regulations, and standards. For example, when a standard is passed by the Occupational Health and Safety Administration (OSHA), immediate changes may be required in the workplace that directly affect workers' performance of their jobs. Changing economic and technological trends affecting how most United States organizations are run include outsourcing, global competition, international trade policies, and modern mechanisms of production. Demographic trends considered extra-organizational include the increasing numbers of single parent and dual earner households, an aging work force, and an increase in women and multiethnic workers.

As a result of many of these extra-organizational trends, new options are available to the modern worker. Many workers are opting for job sharing and flextime schedules. Some organizations are setting up offices in worker's homes so these workers can avoid long commutes and reduce office costs (Lusk, 1997). Very little is known about how these trends affect the employees' personal and professional lives. The priority placed on family

relationships, leisure time, and recreational activities has also received more emphasis in recent years (Lusk, 1997; Westman, 1999). As a result, workers may be less willing to work long hours and overtime, and work and career goals may diminish in importance to the modern worker.

Moderating Factors

The impact of various occupational stressors within the context described above will partially depend on a variety of moderating factors that are a part of workers' lives. Moderating factors can partially buffer, intercept, or negate the effects of the identified stressors. Conversely, they can exacerbate these stressors. They include personal attributes, coping strategies, or interactions of these employee variables with ecological stressors. Personal attributes include the worker's age, gender, and marital status; psychological hardiness; their personalities; and their state of health (Hurrell, 1988; Ivancevich, 1990; McAbee, 1991). Consideration should also be given to the individual worker's personal situation that may affect the worker's stress levels, such as conflicting family and job responsibilities. The meaning of one's work is also a personal attribute that can buffer or exacerbate the worker's stressors. A personal factor identified by McAbee (1991) is "fear of error." Although McAbee's study (1991) referred to nurses, workers in many occupations may experience an unrealistic (or not so unrealistic) fear of error or failure, leading to a variety of stress responses. Individual coping strategies can be constructive or destructive. Positive coping styles include, but are not limited to, adequate exercise, relaxation techniques, and good nutrition. On the other hand, excessive alcohol or drug use is often a destructive method of coping. Social support, which may exist in the workplace or the home, is frequently cited as a primary buffer of workplace stress (Harris, 1989; Hurrell, 1988; McAbee, 1991), but a lack of social support may actually serve as a source of occupational stress (Beaton, 1997). Managers who respond to the personal needs of the worker (i.e., adjust schedule to meet family demands, provide opportunity for continuing education) serve as an important means of workplace support. Similarly, workers who are psychologically supported by their families are likely to experience less stress than workers who do not receive family support. However, a lack of off work social support can likewise be conceptualized as a peri-organizational source of occupational stress (Beaton, 1997).

Stress Responses

A multitude of physiological, psychological, and behavioral job related stress responses have been identified in the literature. Physiologic stress indices responsive to job stress include parameters such as blood pressure changes (Karasek, 1990; Schnall, 1994), changes in heart rate and rhythm, biochemical changes (i.e., cortisol levels, glucose, and thyroxine), and musculoskeletal tension (Baker, 1995). It has also been suggested that job strain may have a negative effect on workers' neuroendocrine and immunologic status, resulting in workers being more vulnerable to disease occurrences (Hurrell, 1998; Meijman, 1995).

Adverse psychological responses identified in the occupational stress literature include anxiety, sleep disturbances, performance errors, and burnout (i.e., mental disengagement) (Beaton, 1996a; McAbee, 1991). A study conducted by Schleifer (1995) found that workers whose work was monitored electronically (i.e., organization stressor) experienced a variety of mood disturbances including tension, time pressures, and workload dissatisfaction. This study also found that workers who were monitored were more likely to experience "right hand discomfort," a possible precursor to repetitive strain or carpal tunnel syndrome. Additionally, an array of behavioral responses can occur as a result of work related stress. As described, the most dire and extreme behavioral responses to job stress may include homicide or suicide. Occupational stressors also may contribute to domestic violence and substance abuse. Other more subtle job related stress responses might include constant irritation, self neglect (i.e., poor nutrition, lack of exercise), and interpersonal conflict.

Health/Illness Continuum

The interaction of the ecosystem influences, the moderating factors, and the stress responses leads to some level of health or illness. It is important to recognize that the outcomes are not always adverse, that is, the workplace stressors can have positive as well as negative outcomes. Selye (1974), a pioneer in stress research, used the terms "eustress" and "distress" to distinguish between stress that results in good outcomes from stress that results in bad outcomes. Lazarus (1984) took Selye's notion a step further. He suggested, even in the same circumstances, people can have different experiences of stress. Lazarus (1984) argued a person's cognitive appraisal of an objective event occurring in the workplace is a primary factor in determining health outcomes.

The "health" end of the continuum might be related to the sense of esteem and personal satisfaction one derives from work. Stress may lead to higher levels of motivation, greater productivity, and a resulting sense of accomplishment on the part of workers. Work, for many, tends to be mentally stimulating, and the stresses of work are perceived as invigorating. Conversely, the physical and psychological stressors at work are often associated with multiple health risks and chronic disorders. The "illness" end of the continuum includes ulcers, hypertension, angina, chronic headaches, cardiovascular diseases (i.e., myocardial infarction), and a multitude of mental health disorders (Karasek, 1990; Seward, 1997). Considering the risk to the immune system identified in some studies (Hurrell, 1998; Meijman, 1995), chronic job related stress may also increase the risk for certain immune related diseases.

EXEMPLAR OF ECOLOGICAL MODEL: APPLICATION TO URBAN FIREFIGHTERS

Identifying and describing stressors using the ecological model requires selective data collection and associated analyses. The following section describes the application of the model to one at risk worker group—urban fire-

fighters. The data and analyses described here reflect a series of studies conducted among this worker group (Beaton, 1993, 1995, 1996a, 1996b, 1996c, 1997, 1998, 1999a, 1999b; Murphy, 1994). In addition, they reflect formal and informal interactions with firefighters, administrators, and relevant parties that took place in a decade long program of research and consultation. Numerous assessment approaches were used in the course of the data collection. These included observations (i.e., "ride alongs" with firefighters); informal and formal discussions with line firefighters, paramedics, and fire officers; and interviews with key informants (e.g., fire chief, union leaders). Surveys were used to assess the micro- and macrosystem sources of stress, moderating factors, and stress responses. Relevant department records such as workers' compensation and OSHA logs were also used to examine reported injury and illness rates. Another important source of information monitored over the course of the years consisted of the local media, which served as a means to monitor changes in local government priorities and funding decisions with the potential to affect the peri-organizational stressors. Media can also be an important source of information about national and international developments that might impact the extra-organizational level. The passage of OSHA regulations, for example the ergonomics standard, may have a direct effect on how firefighters perform their jobs, and the subsequent effect on their stress levels.

It is important to note that the collection of information relevant to the ecological model often requires the support of major stakeholders. In the case of the firefighters, these were the fire administration and the International Association of Fire Fighters (IAFF) union leadership. This process invariably involves negotiation, recognition of sensitive and personal nature of certain personnel information, assurance of the researcher's (or clinician's) adherence to confidentiality guidelines, and an identification of positive outcomes or incentives for all involved groups. In the case of the firefighters, the focus of these discussions was to assist all participants in viewing the effort as a "win/win" situation. That is, the information would result in healthier, safer firefighters, and lower costs for the fire administration (health insurance, disability claims, and time loss).

Description of Stressors Using the Ecological Model

The psychosocial microsystem of the urban firefighter consists of a two to four member "crew," with an officer in command, who together perform a variety of urgent medical, fire suppression, and other emergency activities as a team (International Fire Service Training Association [IFSTA], 1998). In some ways, the psychosocial microsystem of the urban firefighter is rather unique because for 24 hour shifts at a time, these crew members live, eat, sleep, and work together. These firefighter crew members also spend the majority of every shift at their fire station or "house" where they perform various housekeeping chores as well as routine maintenance duties to ensure their equipment and vehicles are able to function properly when they are dispatched to an incident.

Because it constantly changes, the physical microsystem of urban firefighters, other than their fire station or the drill field, is virtually impossible to describe. By definition, the firefighter microsystem involves some type of emergent crisis that is ongoing or has recently occurred involving threat to human life, to well being, and to personal property. Outside of the firehouse, the physical microsystem of firefighters at emergency scenes is inherently dangerous, with the potential for acute and cumulative musculoskeletal and psychic trauma, including worker exposures to various chemical toxins, temperature extremes, and pathogens, as well as to the unpredictable actions of victims and even bystanders. The microsystem of firefighters often includes personal protective equipment (PPE) (e.g., self contained breathing apparatus [SCBA], latex gloves, goggles, and high efficiency particulate arresting [HEPA] masks). However, depending on the incident characteristic and other variables, no personal equipment is without inherent barriers to its use, and none is fail proof. Only one published investigation actually asked urban firefighters to rate the relative stressfulness of a wide variety of actual (or potential) duty related incidents. In that study, catastrophic injuries to the firefighters themselves or coworkers were rated as the most stressful. "Gruesome victim incidents" also emerged as another separate source of incident stress (Beaton, 1998). In an earlier investigation with a larger sample of professional firefighters, coworker conflict and perceived discrimination also were identified as factors that reportedly influenced the participating firefighters at the microsystem stress level (Beaton, 1993).

The organizational level of stress in the fire service derives, in part, from the pyramidal hierarchy of authority and chain of command (IFSTA, 1998). In the large scale survey conducted by Beaton (1993), management or labor conflict was cited as the most consistent source of occupational stress associated with job dissatisfaction in urban firefighters and paramedics. The organizational system of most fire service departments is a policy and protocol driven bureaucracy (Gist, 1995) with a "macho tough guy" type of work culture (Glazner, 1992) and a paramilitary incident command structure. Firefighters also cite their concerns about substandard equipment and job skills (i.e., organizational sources of stress) as "somewhat bothersome," according to ratings of a large sample of American firefighters (Beaton, 1993).

Peri-organizational influences on fire service personnel include the local socioeconomic and political factors that directly influence policy, training priorities, as well as hiring and firing of firefighters and the quality of their fire equipment and emergency vehicles. Peri-organizational influences on the fire service include the fiscal support and funding priorities of a municipality controlled by the electorate, mayor, city council, and the city manager.

Extra-organizational influences on firefighters include IFSTA training requirements consistent with the National Fire Protection Association standards and OSHA regulatory guidelines dictating certain health and safety protocols for professional firefighters. The extra-organizational factors impacting firefighters also include cultural

norms placing a high premium on human life and a high level of trust of fire department personnel, according to one recent U.S. public opinion survey (Kohut, 1997).

Moderating factors in firefighters involve both risk and protective factors that potentially buffer or aggravate stress responses. Documented buffering or aggravating mechanisms in firefighters include both social support and network conflict experienced at work as well as off shift (Beaton, 1997). Other moderating factors previously documented in fire service personnel include rank, marital status, and years of service, which all have been shown to influence the rate of Posttraumatic Stress Disorder (PTSD) in U.S. firefighters (Corneil, 1999). Although the mechanisms of influence are unclear, higher ranking, unmarried firefighters, and those with more years of experience have higher rates of PTSD. Individual coping strategies, such as an overreliance on cognitive and behavioral avoidance approaches, for example, "putting one's feelings out of mind" and "withdrawing from people," were also shown in prior investigation to affect the course of future posttraumatic stress symptomology (Beaton, 1999c).

Psychological, physiological, and behavioral stress responses (both acute and chronic) documented as relatively elevated in firefighters include posttraumatic symptomology such as intrusive thoughts, somatic symptomology such as gastrointestinal and muscle tension, and behavioral problems, including sleep difficulties (Beaton, 1995; Murphy, 1999). In terms of firefighter health and illness outcomes, firefighters experience extremely elevated on the job injury rates (IAFF, 1997), a greater prevalence of various pain syndromes (Beaton, 1996c), and proportionately higher mortality rates of cancers of virtually all organ systems (i.e., 50% to 100% greater than community norms) (Guidotti, 1995).

Based on an identification of occupational stressors in firefighters at the microsystem and organizational levels, an intervention targeting these stressors has recently been developed. Because poor leadership and management labor conflict at the microsystem and organizational levels have been identified as potent sources of occupational stress in firefighters, an intervention targeting leaders (officers) in the fire service has been formulated. The need for such an intervention is also highlighted by the at risk nature of the fire service officer group within the organization (Beaton, 1999a). The intervention was tailored to address those microsystem and organizational stressors and buffering mechanisms identified by the officer group. More specifically, fire officers reported more concerns about interpersonal sources of conflict with their subordinates and supervisors alike (at the microsystem level), as well as concerns about their own poor health habits and physiological stress symptoms such as gastrointestinal distress. To address these identified microsystem stressors and identified stress symptoms, several officer training modules focused entirely on leadership training and conflict resolution (to function as potential buffering mechanisms) as well as a tailored stress management module, which included components focused on diet, exercise, and relaxation (also conceptualized as potential buffers). The intervention designed to improve leadership in the department's officers was, in essence, an organizational level intervention.

A number of self reported and objective indices, such as on the job injury from departmental records, are being used to document the impact on the health or illness of this fire department's personnel. This intervention, currently undergoing evaluation at a fire department demonstration site, is based on the premise that a relaxed and competent fire officer is a more capable leader, and one who both incurs and causes less stress at the microsystem and organizational levels. This, in turn, should reduce the stress associated with poor supervision of subordinates and reduce the stress in the supervisor associated with stress related irritability and conflict.

CONCLUSION

This indepth analysis of firefighter stressors provided valuable information used to describe the multiple stressors of firefighters, which subsequently led to the development of appropriate interventions. Although the level of data collection and analysis reflected in the exemplar may not be practical or feasible for many occupational health nurses, the ecological approach described in this article can be used in any workplace situation and with any worker group. The important feature of the ecological model is that it provides a guide for strategically examining stressors in a comprehensive manner. This model also can assist occupational health professionals to recognize and describe the dynamics and interactions occurring within a worker's or worker groups' ecological system, and to define the various sources of stress affecting the worker or worker group from both within and outside of the work environment.

Typically, nurses and other health professionals tend to be very concerned about the micro-environments of the workers, and less concerned about stressors outside of that environment. This model emphasizes that the occurrence of stress often is generated far beyond the microsystem, and, in fact, may be a result of extra-organization factors, such as societal norms or government regulations, which can and do have profound effects on the health, safety, and stressors of various worker groups. When resources are limited, the worksite observations and informal interviews with workers and management can serve as important means of assessing microsystem stressors. In some cases, a brief questionnaire administered to a small sample of the larger organization or to a "high risk" unit or employee group, is a useful tool for understanding workers' experiences and perspectives. It is also important to seek information beyond the organization, to be aware of relevant local events affecting workers, to be attentive the media's apprisal of trends, and to recognize the less tangible but very real influences on stress (e.g., culture and belief systems invariably affecting and touching workers' lives). Through this methodical process, occupational health nurses can determine the types of stressors afflicting specific worker populations, and thus will be better equipped to develop effective and targeted interventions to reduce work related stress.

Ecological Model of Occupational Stress:

Application to Urban Firefighters

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1. Multiple individual and organizational barriers make it difficult for occupational health nurses and other providers to understand and handle stress in the workplace.

2. Recent research suggests adverse health effects resulting from occupational stress are more related to the context or conditions of work than workers' characteristics.

3. The ecological approach described in this article provides a means to examine the context in which stress occurs through an analysis of four levels of influence. The levels of influence include the microsystem, the organizational system, the peri-organizational system, and the extra-organizational system.

4. Through a careful analysis using this approach, an identification of the entire spectrum of factors contributing to the occurrence of workplace stressors can be identified, and more effective interventions addressing existing and potential problems related to occupational stress can be developed.

The ecological model emphasizes the occurrence of worker stress is not a static process. Rather, it is characterized by an ebb and flow related to the amount and types of stressors occurring at each of the various ecological levels. Furthermore, certain levels of the model (i.e., microsystem and organizational) are more amenable to interventions than are the other levels; and interventions at one level may affect some or all of the other levels. The target of interventions (i.e., individual behaviors, organizational policy) also must be malleable if the intervention is to be successful. Because of its dynamic nature, an ecological stress analysis is an ongoing process to be updated and evaluated continually. The interrelationship of the various levels must be factored into these analyses, and interventions must be adjusted accordingly. Although there has been much progress in understanding the complex dimensions of occupational stress in recent years, much remains unknown or is the subject of ongoing research. In addition to its usefulness in guiding and developing stress reducing interventions this model also provides a means of identifying areas fo future occupational stress research endeavors.

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