

# A Survey of Occupational Stress Models, Stressors and Relationship to Injuries

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The construction industry reports one of the highest incidents of fatal and non-fatal accidents/injuries of workers every year. As a high-risk industry, there is a need to investigate factors that affect the occurrence of these accidents to be able to protect workers. Traditional approaches to workers' safety in the construction industry have focused on the physical and biomechanical aspects of work by improving tools, equipment, and task completion methods. However, the impact of psychosocial factors, specifically stress as experienced by construction workers is an area of growing research, which is yielding results that suggest that overall work safety on the construction site, should take into account psychosocial aspects of work. This paper will review existing literature on occupational stress, and elements of work that could potentially act as stressors within the construction industry. Also, a model is proposed that can be used to investigate the relationship existing among occupational stressors, psychosocial/physical symptoms and accident/injury/near-miss and workdays lost outcomes as experienced by construction workers engaged in a range of construction occupations.

**Keywords:** Occupational Stress, construction safety, injury model, psychosocial work factors

## **Introduction and Significance**

According to the Occupational Safety and Health Administration, in the year 2006 the Construction Industry ranked highest among all industries in the United States for fatal injury rates with a total of 1,226 fatalities. The 2006, fatality rate for the construction industry per 100,000 workers was 10.8, the fourth highest after Mining, Agriculture and Transportation industries (Bureau of Labor Statistics, U.S. Department of Labor, 2006). Traditionally, studies on health and safety in the construction industry propose interventions to construction workers' injuries from a physical standpoint, (e.g. making modifications to the biomechanical demands on the job through redesign of tools and equipment) (Hess et al., 2004, De Jong et al., 2003, Bernold et al., 2001), however there is growing amount of research that is focused on investigating and establishing a link between psychosocial factors/occupational stress and construction workers' injuries (Goldenhar et al., 2003, Sobeih et al., 2006). This paper will review the definitions of occupational stress, the major models of stress transactions that exist in literature, as well as identified occupational stressors specifically in the construction industry. A proposed model for the relationship among occupational stressors, psychological/physical symptoms and injury outcomes/work days lost among construction workers is given in this paper based on previous research.

## **Defining Stress**

The definition of stress which will inform the present review is as follows: “[A]n interaction of several variables involving a particular kind of relationship between a person and the environment which is appraised by the person as being taxing or exceeding coping resources and

endangering well-being” (Schlebusch, 1998, 266). This definition of stress characterizes stress as a *relationship* in which there is a *deficit of resources* available to meet the *demands* that the relationship requires. From this definition the characteristic constituents of a stressful process are as follows:

- A domain of an environment and its constituent elements,
- A domain of an individual,
- An interaction between the two (stress process), and
- An appraisal demands of the interaction exceed the resources available resources within the domain of the individual (strain).

The definitions that view stress as a process, relationship or a transaction imply “that stress is neither in the environment nor in the person” (Lazarus, 1990, 3). When individuals appraise a process as being stressful, such a state can be confirmed in one way by physiological changes that the individual experiences which technically refers to *strain*. Strain can be defined as any “deviation from the normal state or responses” of an individual (French et al., 1982).

### **Occupational Stress**

While it has been noted that some amount of stress is necessary for optimal productivity, negative stress or too much stress in working situations is of concern in the work place in terms of worker safety and health (Pulat, 1997). Ill-health, burnout, high workforce turnover, and absenteeism are just some of the detrimental effects of stress noted by Hannigan et al. (2004). Since the appraisal of stressful situations by individuals is very subjective, designing work with optimal stress levels can pose a challenge. One approach is to gather data through subjective responses from individuals (questionnaires, interviews) within a given population. The responses on these questionnaires show workers’ perceptions of how specific factors at work contribute to creating stressful situations. While the identification of stressors is just one facet and probably the most important of designing work with optimal stress levels, evaluation of various stress management interventions is also critical. This is important because there can never be a “one size fits all” approach to effectively managing occupational stress. Another area of consideration when researching occupational stress is the evaluation of coping strategies employed by workers (consciously or subconsciously) who are experiencing the stress process (Hannigan et al., 2004). Ultimately the most important goal of research into occupational stress and its effects is the well being of the worker. Research into modeling stress includes:

- Ability to identify the external factors or *stressors* that initiate or influence the stress process.
- Evaluation of the stress process itself to observe the kinds of interaction between the individual *stressors* in the environment and the physiological, psychological and behavioral outcomes.
- Proposal and evaluation of coping methods, workplace interventions, and preventive measures that can effectively diminish the effects of stress process.

## Overview of models of the stress-strain process

Koslowsky (1998) describes in detail specific models of the stress process in which he categorizes the models into *major* and *minor* models. This paper will provide an overview of the major models.

*Micro-/macro stressors model:* In the micro-/macro stressors approach to theorizing stress, Koslowsky (1998) refers to the study by Kanner et al. (1981) that compares two different approaches to measuring stress: Stress measured through daily hassles (micro-stressors) and stress measured through major life events (macro-stressors) and their impact on physical health. Examples of micro stressors can include hectic daily commutes and project deadlines while examples of macro stressors are life events such as becoming a parent or relocating because of a job.

Koslowsky (1998) likened this model of micro-/macro stressors to the concept of distinguishing between acute and chronic stressors in the workplace. Acute stressors are temporary in nature but may have very long lasting effects while chronic stressors are a permanent part of the work environment. An example of an acute stressor in the construction workplace could be a fatal structural accident, while examples of chronic stressors include harassment from employees, constant malfunction of systems and/or equipment. Chronic stressors likened to micro stressors could be a result of acute stressors or could result independent of them, their effects can only be accurately determined by examining them over time (Koslowsky, 1998). Based on the results in the study by Kanner et al. (1981), if this model of occupational stress is to be the basis of work design, chronic stressors in the work place which could comprise of seemingly minor annoyances need to be minimized as much as possible.

*Person-environment fit model:* French et al. (1982) proposed the first comprehensive person-environment fit model in which they state two types of person-environment fit and two types of accuracy or perception. One of the more popular approaches to modeling the relationship between stressors and psychological/physical functioning, the elements of the model comprise of objective and subjective variables that could either be found in the environment or the domain of the person (Koslowsky, 1998). Within the objective environment there exists real environmental demands (which preempt action by the individual) and these demands supply motives for the individual, likewise, “the subjective environment contains both perceived job demands and perceived supplies for motive”. The domains of the objective and subjective person similarly contain classes that correspond to the classes of variables within the environment; objective abilities and motives within the objective person and perceived abilities and motives within the subjective person domain (French et al., 1982).

In the model of the person-environment fit discrepancies between the variables in the domains of the objective & subjective environment and persons are outlined as follows:

- Objective misfit: which is the inconsistency between objective demands of the environment and the objective abilities of the person,
- Subjective misfit: a situation which is a result of the following:
  - Distortion and elevation of one’s perceived abilities to match objective demands

- Distortion and downgrading of perceived demands to match objective abilities
- Some combination of the two afore mentioned defense mechanisms

The above-mentioned person-environment misfits can initiate the stress process and result in strain.

*Demand–Control model:* This model of stress-strain relationship developed by Karasek (1979) is the “most commonly cited approach in the field of stress and its effects on both psychological and physical health” (Koslowsky, 1998). It has been defined as the “interaction between job demands- defined as the psychological stress involved in accomplishing the workload- and- decision latitude- the workers potential control over his or has task and his or her conduct during the work day” (Meijman et al., 1995).

The premise of this model is that interactions of different levels of psychological demands of a job and decision latitude produce different levels of strain as shown below (Karasek 1979):

High Psychological Demand/High Decision Latitude:	Active
High Psychological Demand/Low Decision Latitude:	High Strain level
Low Psychological Demand/High Decision Latitude:	Low Strain level
Low Psychological Demand/Low Decision Latitude:	Passive

### **Overview of occupational stressors**

Several classifications of occupational stressors exist in literature (Koslowsky, 1998, French et al., 1982) however, the classification of occupational stressor used in this paper is an adaptation from several papers.

*Task related stressors:* At the workplace, elements of the tasks that are carried out could be initiators of the stress process as interaction takes place with the individual. Examples of such task related stressors include issues like task complexity, task completion pace, time pressure, and task ambiguity (Thompson et al., 2006, Wong et al.,2002, Fimian, 1984, Burke, 1976).

*Physical/Environmental stressors:* These stressors as implied are elements of the workplace environment that are inherent to the nature of work like excessive vibration from equipment, excessive noise and heat, (Wong et al.,2002, Koslowsky, 1998) inadequate lighting and unavoidable exposure to weather elements (off-shore workers, fishermen, military personnel, policeofficers, construction workers). Other environmental stressors include crowding, air pollution & toxic fumes (Koslowsky, 1998). Administrative as well as engineering controls can be implemented to diminish most environmental/ physical stressors (Pulat, 1997).

*Individual/Social stressors:* These type of stressors orginate from the domain of the individual and/or interactions with other individuals and could be objective stressors as well as perceived stressors in the workplace. Examples of inividual/social stressor can include lack of coworker support, discrimination and sexual harassment (Thompson et al., 2006).

*Organizational stressors:* These are stressors that arise from the structure of task completion processes, personnel hierarchy and the environment within the workplace. Organizational stressors can also be referred to as “management stress” examples include low level of decision latitude and lack of adequate compensation (Fimian, 1984).

*Occupation specific stressors:* These stressors are usually characteristics of a particular profession that trigger the stress-strain process that are usually unique to that particular profession. For example; academic teaching staff may not have to experience trauma with the same frequency and duration as that of emergency response personnel, doctors, nurses, military personnel and police officers (Fimian, 1984; Thompson et al., 2006).

*Safety stressors:* Stressors concerning safety sometimes overlap with task related stressors like task relevance/urgency (emergency response tasks, medical emergencies) and organizational stressors like inadequate emergency training response (Wong et al., 2002).

*Career and Achievement stressors:* Many career and achievement related stressors were grouped as individual and organizational stressors (Sui, 2002; Wong et al., 2002). The reason for such classification being that sometimes career related stressors could be perceived (ex. Feeling of limited promotion opportunities) and as such originate from the domain of the individual. Other career and achievement stressors could be objective (e.g., “the level of my ability is not being fully utilized”, Wong et al., 2002) and could be a result of poor organizational/managerial structure.

### **Occupational Stress and Accident/Injury Relationships in Construction**

Research in the area of occupational stress and its effect on workers' well being is showing that high levels of occupational stressors in the work place can lead to injury outcomes. Summaries of the findings of some research confirm this among construction workers.

Goldenhar et al. (2003) proposed a model showing the relationship between job stressors and injury/near-miss outcomes for construction workers. The three-part model comprised of job stressors as the predictor variables, psychological/physical symptoms as mediators and injuries/near-misses as final outcomes or results. The model allows the control variables (job stressors) to either directly influence injury/near miss outcomes or to indirectly affect them through the psychological/physical symptoms as intermediates. The main strength of the proposed model is that it takes into account the possibility of all three components of concern in occupational stress modelling: (a) Job stressors (b) Psychological/Physical Symptoms (Strain) (c) Behavioral outcomes (Injuries/ Accidents/ Near-Miss incidents). The investigation was carried out by administering questions adapted from the NIOSH Job Stress questionnaire, the NIOSH Management Commitment to Safety Scale, Profile of Mood States (POMS) and the Northwestern National Life Insurance Company Survey to a sample of construction workers on perceived levels of three classifications of job stressors. The job stressors were categorized as: (a) Job-task demand; (b) Organizational Stressors; (c) Physical/Chemical Hazards; and, a fourth group of potential confounding variables was also included in the questionnaire. The study confirms findings from previous research showing the relationship between job stressors and injuries (Sobeih et al., 2006). A direct relationship was also observed between physical and

psychological symptoms and injuries or near miss outcomes. The authors conclude from their findings that construction workers with elevated levels of psychological symptoms were at a higher risk for near-miss occurrences while higher levels of physical symptoms indicated a higher risk of experiencing injury. Also, a number of the independent variables (job stressors) were shown to be directly related to both psychological and physical symptoms, the most significant ones being skill underutilization (experienced significantly by female construction workers), job certainty, harassment and discrimination (Goldenhar et al., 2003). Some limitations of this study include the use of self-reported injury and near miss data which had to be recalled from memory when it was inquired of the participant to indicate if they had such experience in the past 12 months. Also the sample population used in the study consisted solely of union workers in the Pacific Northwest and there is no distinction in the types of construction industries represented or by the specific types of construction occupations the participants were engaged in.

Findings from a 2006 survey sponsored by The Chartered Institute of Building in the United Kingdom found that construction professionals were increasingly viewing their work as stressful. This survey was aimed at acquiring a better understanding of occupational stress at the professional level and to identify major occupational stressors for construction professionals. Also investigated were the methods construction professional employed to cope with these stressors (Campbell, 2006). The growing number of reported occupational stress related illnesses in the United Kingdom as reported by the Health and Safety Executive (2006) was cited as a justification for carrying out a survey of this kind. This survey deviates from several research investigations in that the sample population for research is construction workers at the professional level and not manual construction workers. As such, several elements of distinct sets of occupational stressors like physical/ environmental stressors e.g. office accommodations, do not apply to manual workers, however in the domain of Job/Task demands the elements that construction professionals perceive to be highly stressful are very similar for manual construction workers as shown in other studies (Gillen et al., 2002, Goldenhar et al., 2003). The survey inquired into the perceptions of levels of specific occupational stressors that were categorized into the following domains: Physical, Organizational, Job Demand, Job Role and Other factors (Campbell, 2006).

In the domain of job/task demands, the elements of “Too much work”, “Pressure” and “Ambitious Deadlines” ranked the highest of all occupational stressors inquired into from the survey questionnaire. Other stressors perceived to be significant were “Conflicting Demands” and several organizational stressors like “Lack of feedback”, “Poor Communication”, “Inadequate Staffing” and “Poor Planning” (Campbell, 2006). Questions were asked on the survey about overall perception of stress levels in the construction industry and the frequency and duration of time taken off from work due to stress. Findings showed that even though 58% of the respondents indicated that the construction industry had become more stressful within the last 5 years and 42% had experienced stress symptoms, only 5.9% of respondents had actually taken time off at all due to stress, with a week reported by half of the respondents who had taken time off. Even though the findings in this survey report significant percentages of respondents who perceive high levels of occupational stress among construction professionals, no statistical analysis was carried out to exclude confounding factors that could initiate stress processes among the participants, and to test for the reliability of the data acquired. However, as earlier

mentioned the survey does show some consistency with other research indicating some occupational stressors to be very dominant in the construction industry.

In response to the dearth of research specifically targeting female construction workers, Goldenhar et al. (1998) carried out an investigation into the impact of specific job stressors on women in the construction industry. The participants were all laborers and the job stressors examined were classified into areas of “Job/Task Demand”, “Organizational Factors” and “Physical Conditions”. The model used for this study was one that allowed for work stressors to produce acute psychological and physiological reactions in the workers which in turn would lead to illness and/or injury. In addition to the importance of targeting female construction workers, this study also is of great interest in that female construction workers differ from female workers in most other industries because their work setting is non-traditional. Therefore, in addition to the effects of classic job stressors that have been studied in women working in traditional jobs, this study investigated the possibility of very different perceptions of dominant job stressors and their levels of effect by female construction workers. Results from the study indicated that skill underutilization as well as having to over-compensate to prove oneself on the job were associated with psychological symptoms in the sample of participants surveyed. Also, while support from co-workers and supervisors did not moderate the association between control and gender based harassment and discrimination, it did have a significant effect of job satisfaction (Goldenhar et al., 1998).

The previous papers cited and reviewed provide statistical insight into how psychosocial factors and stress affect safety outcomes for construction workers. However, the very specific participant samples highlight the need for more research in other geographic regions. Also these cross-sectional studies do not consider the type of profession as a factor in statistical analysis of the data. The study carried out by Goldenhar et al. (1998) with a strictly female population was a significant step forward in meeting Federal regulations enforced by Institutional Review Boards that research carried out in any sample population must abide by protocol to include women and minorities (National Institute of Health, Office of Extramural Research, 2007). Statistically in research studies, women and minority groups constitute small percentages, (which only reflects the reality of the construction demographics- Women- 2.7%, African Americans-6.7%, Asians-1.2%, Hispanics-29.9% (U.S. Department of Labor, 2007), however, they are still required to be represented in research studies.

### **Future Research Model**

The relationship model used by Goldenhar et al. (2003) will be adapted to model the relationships existing among occupational stressors, physical/psychological symptoms and injury outcomes among construction workers in a construction setting. The independent variables in the model will be the psychosocial elements of work, the specific occupations that groups of workers are engaged in as well as years of experience in respective occupations. The study will be a cross sectional study and participants will include but will not be limited to laborers, ironworkers, carpenters, supervisors, and pipe fitters. However, the model will go a step further and take into consideration the effect of the type of occupation on perceived levels of psychosocial factors. Dependent variables in the model are all records of accidents/near-misses/injuries from OSHA- 300/301 forms as well as employee self reports and workdays lost due to injury. Like the

Goldenhar et al. (2003) model, the physical as well as psychological symptoms have an intermediate role in linking job stressors to the occurrence of accidents/near-misses/injuries and work days lost. However, the model is not restricted to “stressor-symptom-outcome” path as the model allows for job stressors to directly impact injury/near-miss/accidents and lost days at work outcomes. An illustration of the model is given in figure 1.

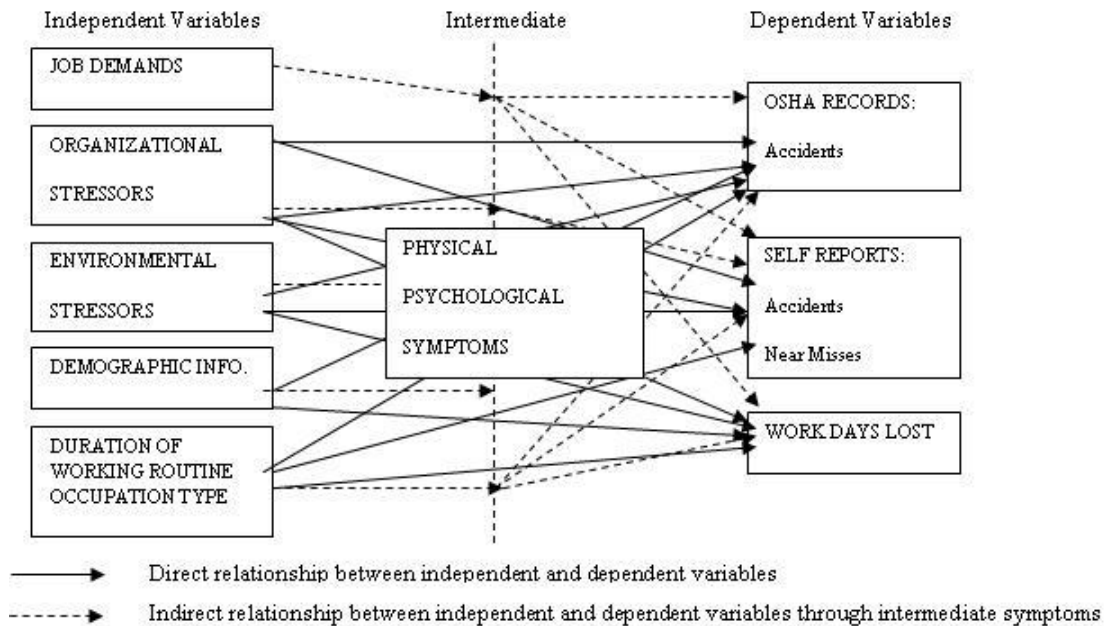


Fig. 1: Partially mediated stressor-injury/near-miss/work days lost model (adapted from Goldenhar et al., 2003)

## Conclusion

Occupational stress and its effects on injury outcomes are gaining more research attention, as existing research is showing that direct and indirect relationships exist among occupational stressors, physical and/or psychological symptoms and injury outcomes. One major benefit from research findings in the field of occupational stress and its link to injuries at work is an approach to occupational safety that is not focused only on physical/biomechanics of work. A holistic approach to safety will impact workers well-being by considering work design both from physical and psychosocial standpoints. This inclusive focus of the various possible factors that affect injuries in the work place will lead to safer working environments, especially in a high risk industry like the construction industry. Also, this study will be an addition to the growing body of research into the effects of stress on workers' health and safety in the construction industry.

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