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Psychosocial Work Environment Stressors, Health, and Health Disparities: Findings from the 2002 to 2014 General Social Surveys

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Psychosocial Work Environment Stressors, Health, and Health Disparities: Findings from the 2002 to 2014 General Social Surveys

by

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Dedication

To my wife Missy for loving me for who I am, 100%.

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Psychosocial Work Environment Stressors, Health, and Health Disparities: Findings from the 2002 to 2014 General Social Surveys

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In the U.S. poorly understood changing patterns of work limit our ability to determine if the prevalence of factors threatening worker safety and health are changing as well as shifting in their distribution across occupations and worker demographics such as sex and race/ethnicity. The National Institute for Occupational Health & Safety (NIOSH) recognizes the burden job stress imposes across several aspects of well-being, increased healthcare usage, and lost productivity. Concomitantly, the U.S. is relatively unusual among industrialized countries in that it reports the health status of its population based on race/ethnicity while most other countries focus on social class differences. One of the overarching goals of the U.S. Department of Health and Human Services (DHHS) Healthy People initiatives has been addressing health disparities; for 2020, it aimed to achieve health equity, eliminate disparities, and improve the health of all groups. Health disparities have been shown to result from of a variety of causes, including those attributable to a society's values and attitudes, its legal and political systems, and social institutions. Unfortunately, few U.S. researchers utilize information on works role in the existence or

perpetuation of health disparities. This is somewhat due to the data challenges faced by researchers, at least relative to the data collected by many European nations. The General Social Survey (GSS) NIOSH Quality of Worklife (QWL) data enables us to investigate and contribute new information to both NIOSH and DHHS research priorities. Using the 2002, 2006, 2010, and 2014 GSS QWL data, pursuing this dissertation's aims produced the following findings (a) psychosocial work stressor exposures were consistent in the years studied and associated with respondents' occupation, (b) respondents' sex was not associated with work stressor exposures while non-Hispanic blacks reported higher levels than non-Hispanic whites, (c) increasing work stressor exposure is associated with poorer mental and physical and self-rated health, and (d) work stressor exposure was not a factor in mediating sex or race/ethnicity health disparities. These results contribute evidence pertaining to priority research areas of multiple U.S. government agencies and suggest the need for continued examination of the impact of psychosocial work environment factors on health.

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List of Abbreviations

UTMB	University of Texas Medical Branch
GSBS	Graduate School of Biomedical Science
TDC	Thesis and Dissertation Coordinator
NIOSH	National Institute for Occupational Health and Safety
CDC	Centers for Disease Control
HWD	Healthy Work Design and Well-Being Program
QWL	Quality of Worklife
GSS	General Social Survey
QES	Quality of Employment Survey
O*Net	Occupational Information Network
DOT	Dictionary of Occupational Titles
NORA	National Occupational Research Agenda
EWCS	European Working Conditions Survey
DCS	Demand-Control-Support
GAS	General Adaptation Syndrome
IP	Information Processor
HPA	Hypothalamic-Pituitary-Adrenal
SAM	Sympathetic-Adrenal-Medullary
D-C	Demand-Control
S-D	Stress-Disequilibrium
CNS	Central Nervous System

ATP	Adenosine Triphosphate
REM	Rapid-eye-movement
HR	Heart Rate
BP	Blood Pressure
JD-R	Job Demands-Resources
C-E	Cognitive Energetic
PPS	Performance Protection Strategy
EPS	Effort Protection Strategy
COR	Conservation of Resources
JCQ	Job Content Questionnaire
PSC	Psychosocial Safety Climate
NORC	National Opinion Research Center
NSF	National Science Foundation
CAPI	Computer Assisted Personal Interviewing
PSU	Primary Sampling Units
MSA	Metropolitan Statistical Areas
CMSA	Consolidated Metropolitan Statistical Areas
NECMA	New England County Metropolitan Areas
HU	Housing Units
SSU	Secondary Sampling Units
USPS	United States Postal Service
TEA	Type of Enumeration
BLS	Bureau of Labor Statistics

SOC	Standard Occupational Classification System
CFA	Confirmatory Factor Analysis
SRMR	Standardized Root Mean Square Residual
CFI	Comparative Fit Index
RMSEA	Root Mean Square Error of Approximation
LISREL	Linear Structural Relations
χ^2	Pearson Chi-square
CMH χ^2	Cochran-Mantel-Haenszel Chi-square
ANOVA	Analysis of Variance
SRH	Self-Rated Health
LR χ^2	Likelihood Ratio Chi-square

Chapter 1 Introduction

General Introduction

The National Institute for Occupational Health & Safety (NIOSH) within the Centers for Disease Control (CDC) and Prevention is a research agency focused on worker health, safety, and supporting employers to create healthy workplaces. The Healthy Work Design and Well-Being Program (HWD) seeks to advance worker safety by improving the design of work, management practices, and the physical and psychosocial work environment. Current focal areas are working hours and fatigue, non-standard work arrangements, and occupational stress. NIOSH recognizes the burden job stress imposes across several aspects of well-being, increased healthcare usage, and lost productivity due to stress. Reducing job stress is a key approach to improving worker well-being. Prior to the addition of the Quality of Worklife (QWL) questions to the General Social Surveys (GSS) beginning in 2002, NIOSH undertook the Quality of Employment Survey (QES) to gather broad data of the working conditions in the United States. The Demand-Control theory of job strain (Karasek, 1979), perhaps the most well-known work stress theory, originated from the QES data. The revival of QES in the form of the cross-sectional Quality of Worklife data enables researchers to resume their broad evaluation of working life of the U.S. labor force and address the needs identified by the HWD program.

The United States is relatively unusual among industrialized countries in that it reports the health status of its population based on race (Williams & Collins, 1995). Most other countries focus on social class differences. For most of the 20th century the contrast between whites and non-whites (a category which consisted almost exclusively of blacks) was the basis of differentiation. However, since the 1970's there has been a growing emphasis on collecting data on the numerous racial and ethnic minority populations that constitute an increasing proportion of the American population. In light of the rapidly changing U.S. demographics the goal of understanding race based health inequalities continues to be a priority initiative of the public health research establishment in the United States (Dressler, Oths, & Gravlee, 2005; Woolf, Johnson, Fryer, Rust, & Satcher, 2004) and the approach is being adopted globally as well (Dressler et al., 2005; Almeida-Filho, Kawachi, Filho, & Dachs, 2003). Health inequalities, also referred to as "health disparities" have been well examined and shown to be the result of a variety of causes, including those attributable to a society's values and attitudes which guide its legal system (laws), political system (policies), and social institutions (education and healthcare systems, etc.) (Lipscomb, Loomis, McDonald, Argue, & Wing, 2006). The underlying social determinants of health are often attributable to individuals' differences in socio-economic status or position, with "advantaged" groups having greater economic power, resources, influence, prestige, and social networks to protect or "buffer" them from risk factors of poor health (Braveman, Egerter, Cubbin, & Marchi, 2004; Dressler et al., 2004). These inequalities are shown to manifest as differences in rates of co-morbidity, mortality, life expectancy, and number of quality-of-life years (Lipscomb et al., 2006).

Ahonen, Fujishiro, Cunningham, and Flynn (2018) began by referencing Lipsomb et al. (2006) and their sharp observation that researchers seldom utilize information on the role of work in the existence or perpetuation of health disparities in the United States. They drew attention to the fact that sex and race influences who participates in which roles within the U.S. labor force resulting a differential exposure to the positive and negative effects of work. Unfortunately, Ahonen et al. point out that despite the centrality of work to most adults' lives and the multiple means by which it impacts life and health, little progress has been made since Lipscomb et al. described a conceptual framework for studying work and health disparities. This is somewhat due to the data challenges faced by U.S. researchers, at least relative to the data collected by many European nations. The authors mentioned the General Social Survey, the data used for this dissertation, as having relatively detailed sociodemographic and occupational information but suffering from limited health data; a statement we would agree with. The Occupational Information Network (O*Net), a replacement for the Dictionary of Occupational Titles (DOT) represents a recent effort to develop a significant body of information on occupational characteristics in the U.S. but is also limited in additional data and linking or otherwise transferring its data surveys is challenging (Handel, 2016). Historically, traditional occupational safety and health data has otherwise been patched together from a variety of sources and largely focused on occupational exposures (physical hazards) leading to clearly identifiable illnesses and injuries straightforwardly attributable to the work environment; missing most of the model factors described by Lipscomb et al.. Krieger's 2010 commentary in a special issue of the American Journal of Industrial Medicine characterized the ten articles' two dominant themes as lack of available, relevant data regarding occupational health inequities and little understanding of how the patterns of occupational exposures vary by social groups, e.g., race/ethnicity, sex, or socioeconomic status. As an example of what limited work has been undertaken, Dieker et al. (2019) completed a systematic review of 27 articles showing strong evidence supporting the role of physical and psychosocial work characteristics together impacting health inequalities. Evaluating psychosocial work factors separately, 12 of 14 cross-sectional studies supported the belief that psychosocial work factors partly explain health inequalities. They stated the few longitudinal studies available produced mixed results with significant data challenges playing a central limiting role in making claims.

STUDY PURPOSE

The National Institute for Occupational Safety and Health (NIOSH) established the National Occupational Research Agenda (NORA) in 1996 to stimulate innovative research and improve workplace practices (Baron, Cone, Markowitz, & Souza, 2010). One of the 21 priority areas for research under the NORA is to fill the gap in knowledge that had developed because of insufficient data collection efforts and revolutionary changes in the organization of work outpacing our knowledge about their implications for the quality of working life, safety, and health on the job (Bond et al., 2007). Poorly understood changing patterns of work have limited our ability to determine whether work factors that present known threats to worker safety and health are becoming more or less prevalent; to identify emergent trends in the organization of work that may pose risk; and the distribution of organizational hazards across industry, occupation, worker demographic, and other relevant sectors. Furthermore, at the time of the report no federal or other systematic efforts existed to capture information about changes in specific job characteristics that are known risks for stress, illness, an injury. This dissertation aims to improve our understanding of these changing patterns of work.

The Healthy People initiative, a project within the U.S. Department of Health and Human Services, has been tracking public health issues and providing guidance for population health improvements for over thirty years. A data-driven project with measurable objectives, it functions as a roadmap for individuals and institutions working to contribute to improving the health of the nation. During the previous two decades, one of Healthy People's overarching goals has been focusing on disparities. In Healthy People 2000, it was to reduce health disparities among Americans. In Healthy People 2010, it was to eliminate, not just reduce, health disparities. In Healthy People 2020, the goal was expanded further: to achieve health equity, eliminate disparities, and improve the health of all groups. This dissertation aims to investigate the role working environments play in U.S. health disparities using the cross-sectional data from the General Social Survey.

SPECIFIC AIMS

This dissertation's aims and hypotheses seek to produce insights into the work environment experiences of U.S. employees since the beginning of the new millennium. Pursuing evidence linking work experiences to the health of U.S. employees is also a significant feature of this research. The dissertation concludes by assessing the contribution of work environment experiences to U.S. health disparities. Accomplishing these aims and hypothesis is conducted by analyzing nationally representative cross-sectional surveys of U.S. workers responses to questions evaluating their perceptions of the psychosocial work conditions and health.

Specific Aim One

Investigate U.S. employees' experience of psychosocial work environment characteristics in 2002, 2006, 2010, and 2014.

Description of Specific Aim One

The purpose of this aim is to provide a direct answer to a principal National Occupational Research Agenda question: are work factors that present known threats to worker safety and health becoming more or less prevalent? A significant body of evidence links psychosocial work factors to morbidities such cardiovascular disease, mental disorders, and indicators of health such as self-reported health, quality of life, sickness, and employment absences. Many Western European nations such as Denmark, Finland, France, and Sweden have implemented their own national surveys to ascertain the prevalence of condition exposure (Niedhammer et al., 2012). The inclusion of the NIOSH Quality of Worklife questionnaire module into the 2002, 2006, 2010, and 2014 General Social Survey makes possible the operationalization of a robust measure of work environment characteristics in a representative sample of U.S. adults.

Representative Hypotheses

1. Exposure to psychosocial work environment characteristics is associated with individuals' occupation.
2. Exposure to psychosocial work environment characteristics is associated with changes in the U.S. job market over time.
3. Exposure to psychosocial work environment characteristics is associated jointly with individuals' occupation and changes in the U.S. job market over time.

Specific Aim Two

Investigate if exposure to psychosocial work environment characteristics, namely those whose presence in the work environment contributes to its stressfulness, differed according to respondents' sex and/or race/ethnicity in 2002, 2006, 2010, and 2014.

Description of Specific Aim Two

Specific aim two is a continuation of the first aim but shifts focus comparable to the NIOSH NORA report's (Baron et al., 2007) initial focus on the lack of knowledge regarding the prevalence of known unhealthy workplace conditions and moves onto evaluating the prevalence of these psychosocial conditions across industries, occupations, worker demographics, and other relevant sectors. Findings from the European Working Conditions Survey (EWCS) showed women being more likely than men to be exposed to low skill discretion, low decision authority and low decision latitude conditions while men were more likely to be exposed to high psychological demands and low social support (Niedhammer, Sultan-Taieb, Chastang, Vermeylen, & Parent-Thirion, 2012). The 2005 EWCS data also showed intra- and international differences of the prevalence of exposure among males and females. For example, Denmark, Netherlands, and Norway had a lower prevalence of exposure to four or more factors for males and females while countries such as Spain, Ireland, and Austria only for females. Race/ethnicity-based disparities in work environment exposures in the U.S., primarily between non-Hispanic whites and non-Hispanic Blacks or Hispanics of Mexican Americans in terms of psychosocial environmental factors, has been understudied.

REPRESENTATIVE HYPOTHESES

1. Exposure to psychosocial work environment characteristics is associated with respondents' sex and race/ethnicity.
2. Exposure to psychosocial work environment characteristics is associated jointly with respondents' sex or race/ethnicity and occupation.
3. Exposure to psychosocial work environment characteristics is associated jointly with respondents' sex or race/ethnicity and changes in the U.S. job market over time.

Specific Aim Three

Investigate if exposure to psychosocial work environment characteristics, specifically those whose presence in the work environment contributes to its stressfulness, are related to health and health disparities.

DESCRIPTION OF SPECIFIC AIM THREE

Since the 1980s, the demand-control-support (DCS) model of iso-job strain has been used to estimate the relationship between work environment characteristics and numerous health outcomes. Published literature reviews summarizing the model's relationship with cardiovascular disease or its risk factors (Kristensen, 1995; Schnall, Landsbergis, & Baker, 1994), several aspects of psychological well-being (van der Doef & Maes, 1998), and musculoskeletal problems (Ariens, Mechelen, Bongers, Bouter, van der Wal, 2001; Bongers, Kremer, & Laak, 2002; Bongers, Ijmker, van den Heuvel, & Blatter, 2006). Furthermore, researchers have shown the dimensions of the DCS model to be associated with body-mass-index and weight change (Kivimaki et al., 2006; Kouvonen, Kivimaki, Cox, S.J., Cox, T., & Vahtera, 2005) and health behaviors such as smoking, diet, and exercise (Gimeno et al., 2009; Hellerstedt & Jeffery, 1997; Smith, Frank, Mustard, & Bondy, 2008). Unfortunately, these studies mostly come from outside the U.S. while the few findings from largely older U.S. data may be invalid due to changes of the U.S. economy and employment market. Since the U.S. and Western European economies are relatively similar, it is likely yet unknown if the U.S. labor force's experiences of psychosocial working conditions will resemble that its European counterparts. Moreover, there is the U.S. phenomenon of heightened attention to race/ethnicity dependent exposure differences, which may or may not be contributing to persistent disparities in health. Establishing a clear link between U.S. work environment characteristics and health is necessary if psychosocial work characteristics are to mediate, i.e., explain sex and/or race/ethnicity-based differences in health. The presence of race/ethnicity-based health disparities in the U.S., primarily between non-Hispanic whites and non-Hispanic Blacks or Hispanics of Mexican descent, is a multifactorial social issue and little is known regarding the role of workplace psychosocial factors.

REPRESENTATIVE HYPOTHESES

1. Exposure to psychosocial work environment characteristics is associated with more reported days of poor mental and physical health.
2. Exposure to psychosocial work environment characteristics is associated with more reported days of limited engagement in usual activities due to poor health.
3. Exposure to psychosocial work environment characteristics is associated with poorer self-rated health.

4. Exposure to psychosocial work environment characteristics mediates the relationship between health measures and sex and race/ethnicity.

RESEARCH SIGNIFICANCE

At the end of the twentieth century the National Research Council published *The Changing Nature of Work: Implications for occupational analysis* (1999) in which four emerging themes were discussed: 1.) a growing diversification of the workforce with respect to sex, race, education, and immigrant status; 2.) reduced boundaries and increased fluidity with respect to who performs which jobs, employment outcomes, and the work experience across occupations; 3.) increasing range of workplace structuring; and 4.) the need for a systematic approach to understanding these changes. Lipscomb et al. observed in 2006 and Ahonen et al. continued to lament in 2018 the persistent lack of interest or resource investment (or both) into determining how work contributes to health disparities in the United States. The point was well characterized by Gordon and Schnall in *Unhealthy Work: Causes, Consequences, Cures* (2009) that in striking contrast to the well-developed study of work and health in nations such as Canada, Scandinavia, and Italy who routinely collect data connecting specific working conditions to health, the United States has *"no national database assessing work and health conditions of the same person exist[s], making the scientific documentation of connections between workplace characteristics and health effects extremely difficult"* and *"the tendency to ignore the potential impact of work on health is most strikingly demonstrated in the near complete absence of questions about work and working conditions in the routine medical history taken by physicians in the United states, whereas 'job strain' is illegal in a number of European countries".* (p. 9-10). Although NIOSH added the Quality of Worklife questionnaire to the GSS nearly two decades ago as a means to update our understanding of the workplace experiences since the conclusion of the Quality of Employment survey, the data has yet to be exhaustively used following a review of the available literature. Furthermore, usage of this data to operationalize a robust model of the psychosocial work environment, health relationship or examining the role work stress plays in sex and/or race/ethnicity-based health disparities in the U.S. has not been published. In this way, the research conducted for this dissertation begins to fulfill multiple gaps in the work-stress-health relationship literature in the United States.

DISSERTATION OUTLINE

This dissertation is presented as follows. The second chapter reviews the concepts of stress and work stress from the mid-twentieth century to present. It also identifies a framework for work stress and health disparities research. The third chapter describes the methods used to address the aims and evaluate the hypotheses. The fourth contains the results of testing these hypotheses. The fifth chapter discusses and summarizes the findings of the fourth chapter and concludes the dissertation.

Chapter 2 Background

STRESS

Dr. Hans Selye's research on the subject and concept of stress provided the basis for much of the stress research that followed his work. Selye (1950, 1975, 1976, 1977) considered stress as inseparable from human existence yet challenging to define. He referred to the constant pressure on businessmen, competitive athletes, and air traffic controllers' need for multitasking while being responsible for hundreds of lives, and the experience of spouses helplessness while bearing witness to the ailing of a loved one as being seemingly dissimilar yet "…*in some respects their bodies respond in a stereotyped pattern with identical biochemical changes, which essentially involve coping with any type of increased demand on vital activity, particularly adaptation to change*" (1975, p. 2140). Defining stress as a nonspecific response of the body to any demand with stressors being anything eliciting this response was consistent with it as a universal human phenomenon. He emphasized the nonspecific nature of the response because all stressors demanded a reaction, a readjustment or adaptation. The demand for activity, and thus energy utilization, is the essence of stress. He clarified that a nonspecific stress response does not manifest itself randomly each time; a specific set of underlying biological mechanisms are elicited to produce the measurable aspects of the stress response. Selye proposed a 3-stage stress response occurring chronologically beginning with an immediate reaction (alarm) followed by a period of resistance (adaptation) and if the precipitating stressors were sufficiently chronic and/or sizable in magnitude, a final state of exhaustion; he labeled it General Adaptation Syndrome (GAS). The state of exhaustion was evidence of the body's finite adaptability but also with the possibility to remain in a state of perpetual adaptation, conditioned on the persistent availability of energy.

The adaptive energy consumed in response to stressors was considered a finite resource depleted during the second phase of the GAS. He analogized its consumption with the depletion of an initial familial material inheritance continuously expended over a lifetime and no means to increase the net balance. Periods of convalescence, i.e., sleep and rest following prolonged adaptation or exhaustion permitted a slowing or cessation of the withdraw and permitting restoration of our resistive capacity, but replenishment of the adaptive energy was likely impossible; thus, a need for our judiciousness and avoidance of reckless squandering of our finite resources. Selye also considered the notion of "wear and tear" as legitimate and manifested by irreversible "chemical scars" that we accumulate in form of signs of aging.

Selye referred to diseases of adaptation as "stress diseases" for which their classification as such are functions of the degree to which maladjustment to stressors contributed to the pathologies. Insufficient, excessive, or faulty reactions to stressors characterize this maladjustment. The effect of any stressor to solicit the stress response is moderated by various "conditioning factors" that may be innate or acquired. He believed a stressor's effect magnitude will vary from person to person, but the absolute magnitude and range of the variability is significantly determined by the nature of the stressor. Subjective assessment (appraisal) plays a role in the adaptive stress response. "Eustress" represents the adaptive response to stressors when appraised as desirable, beneficial, and/or healthy while "distress" encompasses alternative responses. Selye wrote "*we must not suppress stress in all its forms, but diminish distress and facilitate eustress… total* *elimination of stress- that is, cessation of demands made upon any part of the body, including the cardiovascular, respiratory and nervous systems – would be equivalent to death*" (Selye, 1976, p. 56).

Despite the continuing challenge of effectively defining the characteristics primarily responsible for stress, McEwen and Stellar (1993) summarized the subsequent progress towards understanding the stress response as a contributor to disease. Increasingly popular was stress as a situation where threat(s), real or implied is/are perceived as jeopardizing homeostasis. However, the authors favored the concept of allostasis (Stearling & Eyer, 1988) over homeostasis because of the latter's historical relationship with the notions of constancy and inflexibility while allostatic systems have range of optimal function, wider when younger and in better health.

McEwen and Stellar also considered "wear and tear" but defined it as representing additional burdens or exposures alongside repeated stress rather than it being a consequence of chronic adaptation induced by repeated stressors as described by Selye. Over time, stress and wear and tear predispose and/or increase individuals' susceptibility to disease by pushing biological systems into new, heightened operating levels accompanied by "counters-balancing" responsibilities. The authors described two identical seesaws, both weighted on each end and both in balance. However, one seesaw is balancing heavier weights on its ends than the other is. The size of the weights represent the total *allostatic load* on the system while the balancing of the load represents the operating levels and counter balancing behaviors of the biological systems. It is not explicitly stated but it is reasonable to presume there is a threshold where the load becomes unacceptable and that this threshold delineates Selye's eustress from distress. For McEwen and Stellar, strain ultimately predisposes humans to disease because of "*repeated ups and downs of physiological response, as well as by the elevated activity of physiologic systems under challenge, and the changes in metabolism and the impact of wear and tear on a number of organs and tissues*". (McEwen and Stellar, 1993, p. 2094). Regardless of the load, it takes time for the allostatic response to the stressor to resolve and systems resuming their normal, basal state.

McEwen and Stellar (1993) provide a useful flow diagram of the response to stimuli, i.e., stressors. First are the physical, psychological, and social contexts in which the stimulus presents itself. The stimulus is perceived by its effect on the "information processor" (IP), i.e., the nervous system. The stimulus's effect is conditioned on factors such as genetics, point in the lifecycle, gender, and prior learning and social experiences. If the IP deems the stimuli as non-threatening, there is no stress. Alternatively, if there is difficulty accurately identifying the source/nature of the threat, a state of heightened of arousal (vigilance, anxiety) persists until the uncertainty is resolved and responses enacted. Otherwise, if the source/nature of the threat is familiar, response options are considered, ranging from low- to higher-cost in terms of effort, preference, and resources required for effective response. The potential for preferred responses to be infective or unavailable represent another factor in determining the effect the stressor has in terms of the biological response, which is itself influenced by many of the same factors influencing the stimuli's effect on the IP.

The biological responses to stressors are represented by three components: 1.) mediators (neural and neuroendocrine system including the brain) which impact the, 2.) effectors, namely the immune system, cardiovascular system, and body fat and protein (muscle) which in due time leads to, 3.) altered high-level decreased system functioning, clinical conditions, and ultimately disease and premature death. The authors acknowledge wide individual variations in responding to stressful situations and that much needs to be learned about the heterogeneity of resiliency across individuals. McEwen (1998) expounded on allostasis as stability through sustained changes facilitated by the autonomic nervous system, hypothalamic-pituitary-adrenal (HPA) axis, cardiovascular, metabolic, and the immune system actions while responding to internal and external stress. The resulting wear and tear, i.e., allostatic load is a consequence of chronic system over or under activity. All sources of stressful experiences, either acute or chronic, significant or mundane, have long-term consequences and potentially moderated by health behaviors, e.g., poor diet, smoking, and insufficient exercise. The mentioning of genetic factors as playing a role, but less so than might be expected, McEwen discusses "sensitivity to stress" as having been shown to be inconsistent among studies involving identical twins.

In light of these finding, McEwen considered individuals' perception and state of physical health as the primary factors for the observed heterogeneous stress responses. Additionally, a subset of individuals may be at greater risk of appropriately adapting to stressors which makes them at higher risk of allostatic load related physiologic damage, all else being equal. McEwen argued the core of allostasis effective activation and deactivation of the sophisticated interrelated biological systems comprising the general stress response. McEwen described four archetype allostatic scenarios likely responsible for one's allostatic load: frequent stress (absolute volume), lack of adaptation to repeated stressors, unnecessarily prolonged allostatic response, and an unbalanced allostatic system. Although McEwen almost exclusively discusses the biological mechanisms of allostasis, he did mention “feelings of anticipation and worry” as contributing to allostatic load. Anticipation is regarded part of worry, anxiety, and cognitive preparation for a threat which are drivers of mediator (corticotropin, cortisol, and epinephrine) production. However, the challenge of quantifying allostatic load is formidable and similar to most multifaceted constructs, its inconsistent operationalization makes comparative judgments across studies difficult.

Prompted by Romero, Dickens, and Cyr (2009) introducing yet another stress model and terminology, McEwen and Wingfield (2010) made another effort to clarify the conceptual issues and the semantics of stress research. Foremost was the restatement of allostasis as the achievement of stability through change while allostatic load is the result of cumulative allostatic processes. Described as a “cardinal” feature of allostasis is the quantitative difference between mediators serving allostasis versus those serving homeostatic mechanisms. The latter operate within a narrow band of variability and are unavailable for challenge response, i.e., not accessible to facilitate adaptive activity. Furthermore, homeostatic regulation is a self-limiting process aiming for resumption of a pre-existing, permanent biologically preferred optimal set point while allostatic regulation may require setting new balance point using processes that are not actively involved resuming homeostatic set points. Once allostatic processes are completed, routine homeostatic mechanisms may resume sufficient control to move the system back within the narrower, pre-existing homeostatic biological set point.

Not explicitly discussed by McEwen previously, McEwen and Wingfield (2010) placed the concept of energy at the center of the allostatic model. The sum total of all energy and nutrients needed by an organism to sustain life and respond to routine, unpredictable, stressful, and/or potentially stressfully challenges is E_g (energy gained by intake of food from the environment and/or its availability for use) while E_o represents the total energy demanded for all daily activities (energy output/demand). E_o is synonymous with allostatic load, i.e., demand for response/action. Successful allostatic responses occur when the energy goal is met or exceeded. Ideally the relationship between E_o and E_g is linear, i.e., as E_o increases the organism obtains/mobilizes sufficient E_g to avoid a negative balance. Unfortunately, the relationship between allostatic mediators and allostasis and allostatic (over) load are non-linear. Allostatic *overload* occurs because E_o exceeds E_g, referred to as type I overload or E_o (allostatic load) is persistent but balanced with $\mathrm{E_g}$, overload type II. Mediators confer protective effects during short periods of either overload type but persistent overload ultimately results in the negative wear and tear, akin to Selye's exhaustion phase of the GAS. The authors reiterate that allostatic load is "*the result of the cumulative metabolic (energy) demand of daily routines, seasonal routines and additional contributions such as age, gender, social status, disease, injury and not the action of the mediators themselves*" (p. 109). They also repeatedly state their belief in overload as a function of $\mathrm{E_g}$ relative to $\mathrm{E_o}$ and allostatic load in and of itself does not result in wear and tear or disease. Wear-and-tear and pathology are results of prolonged actions and dysregulation brought about by the mediators of allostasis. The authors go a step further stating unavailability of food (E_g) does not increase allostatic load per se, rather factors that increase allostatic load exacerbate the significance and effects of inadequate energy intake/availability. In this regard, the authors assert the model addresses actual energy demand relative to its availability. As previously mentioned, fear and anticipatory anxiety are also proposed as primary examples of psychoemotional statuses which are functions of individuals' interactions with their environment, i.e., effects of stimuli on the information processor (neurological systems). Indirectly these two states may alter behavior, resulting in reduced E_g availability and thus increase the likelihood of energy shortfall (E_o exceeding E_g). They acknowledge these physiological processes in and of themselves require little to no energy in the absolute sense but their influence on behavior may limit resource acquisition (food, shelter, potential mates, etc.), reducing E_g, potentially increasing E_o, and eliminating surpluses and exacerbating shortfalls which is by definition allostatic overload (or its probability). The behaviors undertaken to achieve or maintain status requires the effort, and the allostatic concept is designed characterize the energetic demand (allostatic load) and the required E_g to undertake it.

Juster, McEwen, and Lupien (2010) begin by reciting Sterling's and Eyer's (1988) highly biological, perhaps overly medical yet useful explanation of allostasis as "*the process whereby an organism maintains physiological stability by changing parameters of its internal milieu by matching them appropriately to environmental demands*" (p. 2). Further referencing Sterling and Eyer and perhaps suggesting the homeostatic models are outdated, the authors contrast the "traditional" homeostasis as a state of health where all physiological parameters operate within normal limits with allostasis as a state of responsiveness and optimal protective fluctuation for adaptive demand response. Relative to homeostasis, allostasis is distinguished and praised for emphasizing dynamism over inflexibility, the nervous system's (brain) role in regulation (particularly feedback mechanisms) and using a concept of health nested within the context of whole-body adaptation to demands, i.e., stressors. Juster et al., (2010) restated McEwen's and Stellar's 1993 claim that allostatic load is nothing more than "wear and tear", an accumulation of an innumerable series of allostatic responses to stressful situations. All stimuli, i.e., stressors require action/reaction and coping but threating situations only require allostatic responses when no low-cost response options exist, leaving ineffective and high cost response options. Regardless of the threats being real or interpreted, objective or subjective the sympathetic-adrenal-medullary (SAM) axis releases catecholamines and the hypothalamic-pituitary-adrenal (HPA) axis secretes glucocorticoids, allostatic mediators. The brain is responsible for the evaluation of threats (hippocampus, amygdale, prefrontal cortex) and subsequently eliciting the appropriate physiological responses. These are conditional on everyone's "constitution" (genetics, development, experience), behavior (coping and habits), and experience history (trauma/abuse, major life events, stressful environments). Chronic (over) activation of the SAM and HPA axes are believed to eventually "collapse on themselves" raising susceptibility to stress-related disease while altered brain structure may result in diminished cognitive processing and sub-optimal physiological responses to stressors. This could mean a failure to reach peak physiological response or delayed return to baseline physiological functioning, each with its own ramifications for health.

Since described by McEwen (1993) the biological mediators of adaptation have been key to the concepts of allostasis and allostatic (over)load. Stress hormones (epinephrine, norepinephrine, cortisol) and inflammatory cytokines (IL-6, TNF-a) are a short list of primary mediators having the foremost effects on cellular functions and actions thought to comprise allostatic mechanisms (Beckie, 2012). Adaptation to the presence of prolonged and/or excessive exposure to these primary mediators is believed to result in alterations of homeostatic operating ranges necessary to maintain unabated chemical, tissue, and organ functioning. Secondary outcomes such as changes in insulin, glucose, circulating lipids and cholesterol levels, blood pressure, and immune system activation (fibrinogen, CRP) represent altered sub-clinical states. Tertiary outcomes manifest in physiological systems evidencing disorganization, disease, and ultimately organism death as the result of chronic allostatic overload. Because the allostatic model presupposes an interconnected network of sometimes non-linear feedback loops among mediators, the measurement of primary and secondary mediators/biomarkers to identify those in allostatic overload and tertiary outcomes has proven to be challenging. Detecting, quantifying, and establishing critical thresholds for risk gradients necessarily requires the measurement of multi-systemic interactions among primary mediators and effects in conjunction with sub-clinically relevant biomarkers representing secondary outcomes. The authors admit the challenge of accomplishing this goal given the potential technical challenge of mediator measurement at the sub-clinical level, the mediators' non-linear interactions, and the expected difficulty in specifying a precise relationship between periodic fluctuations of mediators' and their contributions to overall progress (time-course) towards partial or complete system dysregulation. However, as the challenges in measuring these primary and secondary markers of allostatic load are overcome and become less costly and more widely available the allostatic load model should prove to be a successful predictor of the tertiary outcomes.

Karasek's Demand-Control (D-C) model describing job strain (1979) is undoubtedly the most notable work stress theory but his Stress-Disequilibrium (S-D) theory (2008) addresses physiological stress in general. The S-D theory uses the language and mechanisms described by Newton's three laws of thermodynamics, particularly the concept of entropy, i.e., the amount of order, disorder, and/or chaos in thermodynamic systems. It also characterizes how close a system is to equilibrium and total amount of disorder, with higher degrees of entropy signifying greater disorder in a system. Work is only performed using ordered energy, i.e., negative entropy, a term attributed to Erwin Schrodinger and its abbreviation, negentropy, attributed to Leon Brillouin. Mahulikar and Herwig (2009) defined negentropy of a dynamically ordered sub-system as the specific entropy deficit of the ordered sub-system relative to its surrounding chaos. Thus, like Selye's and McEwen's and Wingfield's focus on action and adaptation to stressors and threats requiring energy expenditure, Karasek's S-D theory emphasizes how energy is stored, organized, and our ability to direct it (control) to meet demands.

Understanding the relationship between individuals' control within and over their environment, i.e., social control, and disease could be assessed by examining the limitations on physiological "ordering capacity", i.e., limitations of an organism's ability to internally organize its adaptive interactions given changing environments. Control (decision latitude) is the freedom for people to act using their repertoire of skills within the social structures in which they have made their main investments and have gained their major life-sustaining rewards. Lack of control, i.e., the inability to maintain high-level equilibriums via social control, ultimately leads to unstable systems devolving toward lower (sub-optimal) levels of functioning; chronic disease develops via this physiological deregulation. True stability (equilibrium) of a complex organism is a constancy of "flows", the continual input and output demands for energy made by the environment and represents homeostasis in within the S-D theory. This is consistent with the allostatic concepts of E_o, E_g described by McEwen and Wingfield.

Karasek asserts our ordering capacity (control) has an efficiency limit consistent with the second law of thermodynamics, i.e., transformation of disordered energy into ordered energy is not lossless, i.e., there is always less useful ordered energy available for work (action) than was initially available. This is true because energy expended as mechanical work is necessary to induce energy to change from disordered to ordered and heat is lost as unproductive energy, i.e., waste. The second law indicates everything tends towards disorder, eventually complete disorder. At maximal disorganization and randomness, complete equilibrium is achieved which, for living organisms, means death because “flows” would cease, in the absence of demands. This mirrors Selye’s assertion that an organism experiencing no stressors (stimuli) is dead. Because living organisms are open systems, they must maintain a constant flow of negentropy [increasingly ordered energy available to perform (mechanical) work] into the system and entropy exported to the environment, the process being labeled as work.

The S-D theory’s central controller, i.e., the brain and by extension the central nervous system, is responsible for coordinating actions that are exactly (precisely) appropriate to the environmental challenge. This is remarkably similar if not identical to McEwen and Stellar’s information processor interpreting stimuli as threating and requiring action. Total internal physiological workload requirement is equal to the sum of the internal energy that expended to perform work on the environment (negentropy transfer to the environment) and energy/ordering capacity expended for internal ordering coordination requirements which encompasses both the environmental response and homeostatic maintenance needs. Environments requiring both an energetic response (action) and high degree of precision (avoidance of over or under response) implies high demand and low control situations. The controller increases the ordering capacity of the system by coordinating the numerous and diverse subsystems allowing an organism to achieve maximum readiness, i.e., maximum number of degrees of freedom by which the system can respond to the environment. Control in this discussion – the term control, when used without greater specificity, denotes the central nervous system's (CNS) ability to sustain subsystem coordination and homeostasis in the context of facing an adaptive challenge. External control on the other hand describes the limitations of the "degrees to freedom" of the organism to operate, as determined by factors outside the control of the organism in its environment. For example, external organizational or environmental restrictions can interfere with the execution of the strategy that the organism has chosen – or – they can limit internal physiological possibilities, limiting internal control (i.e., self-regulation). This is consistent with the McEwen and Stellar's information processor threat assessment triaging and subsequent analysis of low-cost to high-cost options, each with varying degrees of effectiveness and biological responses in terms of mediator magnitude.

Based on work published by W.R. Ashby in the mid-1950's on what was cybernetics at the time, Karasek makes use of a conceptual framework relating simultaneous challenges: internal stability maintenance (coordination/regulation) and responding to environmental challenges (demands). A matrix is used where each row is a demand, the exact nature of which and total number of are unknowable and infinitely variable, while the columns are possible responses. Whole system stability is maintained when an organism has a response column applicable to the row demand and has the capacity to implement the response effectively. In this example stability is exemplified by the ability to maintain the same output while preserving the most desirable internal state.

Only the existence of a very large number of columns (possible responses) can ensure the greatest likelihood of maintaining stable output (internal stability + desired output) in the face of environmental challenges/demands and only a well-equipped controller/regulator can respond to all environmental disturbances in such a manner that all outcomes fall within an acceptable range. To maximize the potential for successful maintenance of optimal equilibrium flows the CNS adopts long-term high-level strategies to assure the greatest surplus ordering capacity for high-level strategic actions. The conscious CNS is tasked with maintaining the equilibrium of flows with selectively chosen adaptive actions based on optimality. However, Karasek argues these are not completely automatic selections or actions. Maintaining equilibrium for organism level, externally focused work action in a complex and variable physical and social environment represents full-time planning despite the false impression of "automaticity" the routine equilibrium maintenance may appear to have at high-level observation.

Karasek (2008) used seven principles in describing the S-D theory. The above information comes from the first principle which presumes living systems' stress experience is represented by the flow of energy, order, and material between the living system, e.g., a human, its environment, and the central system controller, i.e., the brain and by extension the central nervous system. Principle two addresses work, ordering capacity, and coordination of action. Every level of a system coordinates the level beneath it and in so doing expends ordered energy, gains entropy, and facilitates work at lower levels. For the S-D theory, ordering capacity hinges on the number of independent control systems available to facilitate responses to the environmental (external demands) or homeostatic adjustment and degree of variability each system has open for manipulation. Karasek asserted that greater independence among systems and greater range of operating capacity which does not jeopardize maintenance of homeostatic states the greater likelihood health will be maintained in the face of challenges (demands).

Principle three is a presumption that each system-environment, system-subsystem level pairing may be treated as independent; each determining their own flows of energy, order, and material according to the laws of thermodynamics. At the lowest level basic biological materials such as amino acids, oxygen, and adenosine triphosphate (ATP) are considered cheap, abundant, and contain the greatest amount of entropy (relatively speaking). These are organized, stored, and utilized in precise processes as dictated by the needs of higher level systems. On the other hand, imprecise organization, storage, and utilization diminish or eliminate higher level systems' capacity to perform work. The "precision" of organization, storage, and utilization at every system-subsystem level defines the *constraint structure* contributing to optimal functioning at higher levels. Each step builds on the prior and results in a pump like system moving negentropy upwards and can produce and sustain high level organized action/work from a foundation of abundant, disorganized energy. At the peak is the CNS which, with an abundance of high-level action potential, can respond to environmental challenges in a maximal manner (can implement desired action so as to minimize negative impact of the challenge).

The fourth principle is defined by the series constraint structures which support and enable the creation of work capacity at the next higher level. The succeeding level uses the output (ordering capacity) from the previous level as input for its own negentropy generation/production to carry out its own work which in turn enables the growth of work capacity and the next level. Principle four is perhaps the most important because it in effect summarizes the entire experience of exhaustion. High level expenditure of negentropy in response to environmental challenges may require negentropy expenditure an multiple levels and result in exhaustion of the lower levels' ability to be in the state of readiness sufficient to maintain the system within desired parameters, i.e., these levels are in states which necessarily preclude them from switching to typically available alternatives (reduced degrees of freedom). Depleting high level negentropy faster than it can be gained necessarily requires periods where expenditure drops, and net gains may occur. Systems' anabolic periods are necessary for construction and rehabilitation of physical structures as well as creating (repletion) the ordered (stored) energy following catabolic periods which associate with periods of work. High level systems are responsible for the context in which the lower levels function. High level systems cannot efficiently operate their constraint structures to produce ordered energy for work if lower level systems haven't produced their own constraint structures and generated negentropy "inputs" for the higher levels systems. Karasek clearly states the S-D theory does not distinguish between homeostasis and allostasis. Allostasis is described as pertaining to environmentally adaptive physiological systems while homeostatic systems are platform systems.

Principle five states high-level systems must protect the contexts in which the levels below function, i.e., higher levels must act to provide a stable internal environment to ensure the lower levels may easily maintain homeostasis and engage in allostasis if/when necessary. This dependence is one way in which poor ability to exert control at higher levels deteriorates the effectiveness of the body's environment resulting in sub-optimal control structures and lower ability to facilitate the negentropy pump necessary to support high-level actions with optimal degrees of freedom (ability to meet all challenges as desired). The sixth principle of the S-D theory necessitates the restoration of all gradients by temporary suspension of ordering capacity and imputation of high entropy energy. Some systems, particularly the high-level systems, require protected time to reset back to optimal gradient status. Rapid-eye-movement (REM) sleep should be considered an example of such a period. After returning to a preferred base state the many physiological subsystems are at their maximal operating capacity implying homeostatic and allostatic indicators (HR, BP, various circulating compounds, hormones, cytokines, etc.) are within normal limits, if not at optimal levels. Stress physiology typically focuses on molecular and psycho endocrine processes which are considered intermediate biological levels (e.g., HR control). Karasek points out cardiac control is coordinated by multiple but independent physiological systems and considers this a means of having robust control over heart rate variability (homeostatic and allostatic potential).

Homeostatic instability is a function of environmental demands – stressors – in which their magnitude, frequency, or duration exceeds adaptive (allostatic) capacity. The S-D theory explicitly accounts for this problem with the reduced ordering capacity of the central controller (i.e., CNS). Insufficient ordering capacity, assumed to be secondary to reduced inefficiency constraint structures not producing conditions by which adequate high-level negentropy generation is possible, results in diminished degrees of freedom of action/response aimed at effective response to challenges. This initiates or exacerbates system deregulation and ultimately disease. The role of *control* in stress theories necessarily implies coordination as fundamental to stressor mitigation; therefore, the efficiency limitations expressed by the second law of thermodynamics supplements are relevant but also supplement Selye's notions of finite adaptive energy. Chronic high-level demands without opportunity for (successful) relaxation as well as overwhelmed or restricted control capacities both contribute to equilibrium shifts of disease processes. In total, Karasek argues the S-D theory could be thought of as a more elaborated yet generalized explanation of the job strain hypotheses of the demand-control model.

Karasek addresses Selye's description of the stress-related disease process in which chronic stressors result in exhaustion. This is a result of an inability to respond in a desirably the stressor and ultimately requires the involvement of alternative subsystems, a "compensation" to "discompensation". This is accounted for in McEwen's and Stellar's (1993) diagram of thwarted threat response options. The costs related to the inefficient responses mount as the secondary response mechanisms are more difficult to coordinate and are increasingly less efficient. Eventually the ordering capacity of one or more levels cannot be supported and the feasibility of coordinating the entire systems becomes untenable and the overtaxed (overloaded) systems become "stressed". Here Karasek quotes Karasek and Theorell (1990) "*Stress is a systemic concept"* (p. 87) and adds "*Stress is an overload of the system's internal control capabilities. It is an inability to maintain the coordination and regulation of the subsystems needed for effective performance*" (Karasek, 2008, p. 128). When systems fall out of equilibrium, either within or across systems, their ordering capacity cannot be sufficiently sustained to conduct work (maintain homeostasis or responsive allostasis) or support higher level work capacity generation. Failure to effectively maintain homeostasis of one or more systems leads to collapse which causes harm. A complete failure, e.g., heart attack isn't necessarily the result for a strong, healthy system with little wear and tear but rather a smaller but permanent change in an equilibrium, perhaps operating variation or range of variation become more labile. For example, inability to maintain BP consistently within normal levels (increased frequently exceeding optimal levels) results in damage to the renal tubules and nephrons which require a narrow range of routine BP for optimal filtration. Losing of filtration capacity slowly over time leads to increasing levels of intravascular waste products which further increases the coordination burden of all systems and cells to maintain intra- and inter-system homeostasis. These are the preliminary, sub-clinical beginnings of hypertension, cardiovascular disease, and chronic kidney disease which go unnoticed and untreated for years, even decades before catastrophic failure necessitates medical and pharmacological interventions.

Finally, principle seven accounts for the phenomenon of chronic disease. Overloaded systems may eventually return to a non-optimal homeostatic state where there is a loss of effectiveness. However, even if the loss is minimal, due to the dependence each higher-level system has on the one before it to generate ordering capacity there is a domino effect up the hierarchy of systems and ultimately compromises (limits) environmental response options the controller may select (enact) given an environmental challenge. What follows over time is the development of alternative sub-element integration at a diminished level of environmental function (i.e., chronic disease). Since high-level systems and high-level actions are responsible for maintaining the context of functioning for the lower levels, the “internal milieu”, control failure at high levels may instigate lower levels’ movement towards sub-optimal homeostatic equilibriums which in turn may compromise high level coordinating capacity, choice of action, and ultimately environmental control, a positive feedback loop. Just as our position within the larger social world limits our choices, the work environment too places constraints on our choices, i.e. control.

In 2001 Demerouti, Bakker, Nachreiner, and Schaufeli proposed the job demands-resources (JD-R) model aiming to predict the dimensions of Maslach's & Johnson's (1981) burnout syndrome. Maslach, Schaufeli, and Leiter (2001) defined burnout as "*a prolonged response to chronic emotional and interpersonal stressors on the job, and is defined by three dimensions of exhaustion, depersonalization (cynicism), and inefficacy*" (p. 397). Demerouti et al. used the cognitive-energetic (C-E) framework proposed by Hockey (1993) to explain the mechanisms underlying their demands concept and its role in leading to burnout and ill health. Karasek's demands construct aligns with that of Demerouti et al., therefore Hockey's proposed model is applicable. The cognitive energetic approach combines energy-based constructs with information processing models. The theory aims to account for the differences in performance observed among individuals under stress and high workloads. The C-E model functions as a framework for research involving psychological health, strain, coping, fatigue, and individual differences of adjustment, particularly in relation to adjustment to the demands of human work; thus, it is applicable to stress in general.

The constructs involved in the C-E model include arousal, activation, effort, stress, fatigue, and resources. Arousal involves the initial perceptual processing, encoding, and feature extraction of stimuli with motor control adjustment and response preparation comprising the activation concept. Like Karasek's controller, effort is centrally located as a coordinating process adjusting the balance of input and output operations, mediating feedback from response outcomes, possibly also computational control for central decision processes. The model assumes (energetic) resources are subject to control and allocation in the interest of strategic resource-management and emphasizes motivation-based guidance for controlling action. The C-E model assumes (a) behavior is essentially goal-directed, (2) control of goal states is normally a self-regulatory process, and (3) regulatory activity attracts costs to other parts of the system. Hockey asserts that this approach reflects the insistence by previous authors that motivation must be recognized as more than just a driving or energizing force. Instead, it involves the whole cycle of initiation, maintenance, and regulation of action. The self-regulatory characteristic of control means behavior is modified by reference to internal standards or set points, e.g., homeostatic preferences (through negative feedback) so that currently active goals may be maintained, and purposeful behavior promoted. Here the C-E approach assumes such regulatory activity may attract costs to emotional and physiological sub-systems, particularly when carried out under conditions of chronic perturbation from stress and environmental load. Karasek's central controller was also a source of regulatory costs, a constant drain on negentropy. These costs may be interpreted as an expenditure of mental resources and often experienced subjectively as mental effort and high levels of subjective strain while physiologically there are increased levels of sympathetic dominance and adreno-medullary activation.

Understanding and thus making clear the differing patterns in human performance under stress requires referencing the concept of resources. Hockey adopts the conceptualization of resources as "*the availability of one or more pools of general-purpose processing units capable of performing elementary operations across a range of tasks and drawing upon common 'energy' sources*" and is fundamental to the C-E process model (Hockey, 1997, p. 75). This fits well with Karasek's S-D theory, especially his notion of common energy sources. Because resources are finite the implication is that scarcity is ever-present, i.e., limited (resource) capacity may result multiple mental operations simultaneously demanding processing units from the same pool of resources, demands which may be half-met or denied. The resources concept is also used in the sense of mobilization of energy which has its own costs and (mental) effort and that effort and resources are typically regarded as essentially synonymous. Increased effort temporarily boosts the overall resources to meet prevailing demands but still has costs in terms of sympathetic activation. The effort construct is associated chiefly with variations between tasks in processing demands (effort as controlled processing), while also considering effortful regulation. The latter refers to the attempt to maintain a specific task state under stress, overload or external distraction (effort as compensatory control). Whether or not these are the same doesn't change the fact both generate the need/problem of resource management.

Stress states are identifiable in the presence of mismatch between required and prevailing task states, normally arising from an external disturbance (challenge/stimuli/stressor) attracting processing resources. An effort-based compensatory control mechanism may be needed to maintain (protect) tasks (performance) disturbed/impeded by stressors but also for preventing the loss of achieving task goals under all circumstances, including those posed by increasing processing demands and competitions from other tasks. Compensatory effort undertaken to maintain performance under stressful conditions has resource costs. Human performance may be characterized as the effectiveness of specific skills in meeting (typically externally imposed) cognitive goals, or the underlying mental operations associated with such behavior. The observation of designed performance tasks is often used by investigators as indirect measures of underlying mental activity. When processes are functioning less effectively, e.g., when under stress or illness or competing mental operations, the reduction in measured performance is thought to reflect the influence of these conditions/states via overt degradation of performance. This assumes the construct being measured is sensitive to fluctuations in resource deployment rather than a function of limits of information.

Unlike testing and measurement settings where a participant is directing/prioritizing his or her attention to the task at the expense of a limited number of competing tasks largely dictated by the prescribed environment, human lives are normally filled with multiple short, intermediate, and long-term goals which are not consistently prioritized in importance. For example, sufficiently preparing for successful passage of an academic examination may be temporarily prioritized behind watching TV given an immediate assessment of his or her own needs and availability of resources to undertake the latter versus the former despite the intermediate to long-term implications of insufficient exam preparation, i.e., failure. This is an example whereby the demanding mental task (studying) conflicted with the more general goal of maintaining well-being and desirable emotional dispositions occurring while watching TV. Different than temporary goals whose associated actions may be highly vulnerable to displacement by a variety similarly valued actions, the higher valued actions underlying personal and biological goals are, in many cases, driven by powerful, self-sustaining motivational systems not easily overcome. The maintenance of task involvement would be futile if we could not exercise control to overcome the demands of competing tasks. Since we must possess the capacity to maintain reliable, distraction resistant performance for highly prioritized tasks to achieve our goals, all performance models should contain a plausible mechanism for attention control.

The C-E approach to performance analysis as characterized by three key features: (a) primary task performance is remarkably stable under stress and high demands, (2) effective performance under stress is typically accompanied by high levels of physiological activation and subjective strain and; (3) overt performance decrements are normally quite small in magnitude, and more common under laboratory conditions than in natural work settings, the last of which requires further validation. The C-E framework maintains that performance stability under demanding conditions is a controllable active process necessitating the management of cognitive resources via mobilization of mental effort. Effort management permits individuals to control task behavior effectiveness in the face of competing goals, shifting demands, and current levels of energetic resources. An individual may adopt a "performance protection strategy" (PPS) which maintains the performance of tasks associated with high priority goals within acceptable limits by incurring extra costs or accept "effort protection strategy" (EPS) resulting in overt performance loss but incurring no additional costs. Under most circumstances the choice to adopt a PPS implies the individual's acceptance of the reduced relevancy of competing personal or biological goals, such as those concerned with leisure, rest, or well-being.

Effort expenditure is a function of conscious control requirements for task performance maintenance. Hockey's model is a two-tiered system of control with the lower level regulating routine tasks (loop A) while the upper level (loop B) is engaged for effort-based regulation (Figure 1.) (1997, p. 79).

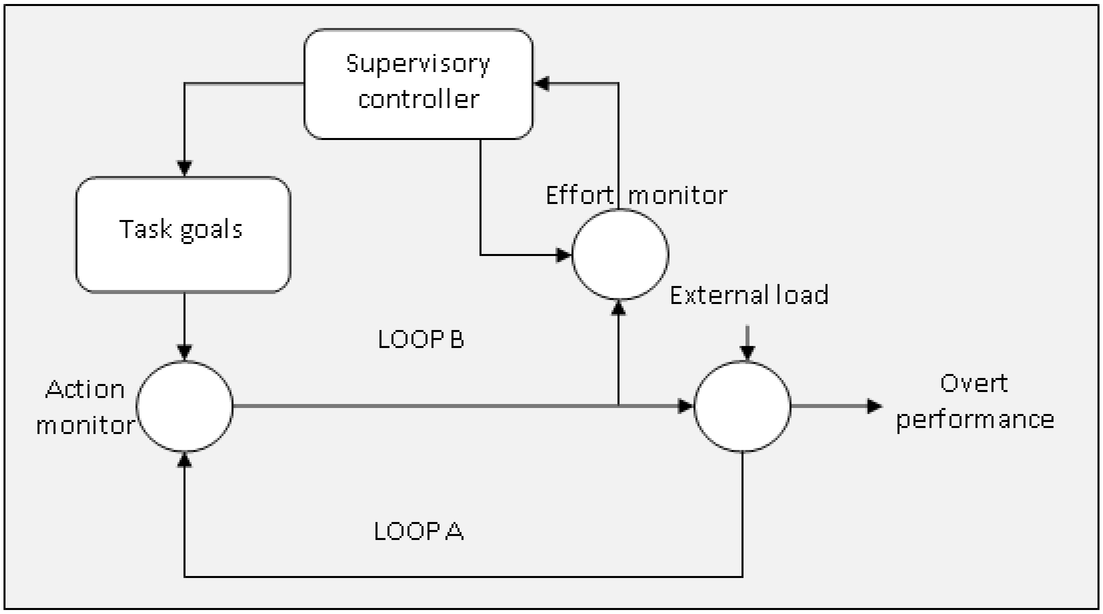

Figure 1. Compensatory control model of performance regulation. Adapted from 'Compensatory control in the regulation of human performance under stress and high workload: A cognitive-energetical framework,' by Hockey, G.R.J., 1997, *Biological Psychology*, 45, p.79.

The driving force underlying overt performance are short- and long-term goals dictating maintenance of specific internal states believed to be optimal for achieving the target or expected performance. The target or expected performance output determines how fast to work, degree of monitoring (attention requirements) for accuracy, choice of action or sequence of actions, etc. The individual continually adjusts these behaviors (physiology responds accordingly) to maintain the necessary performance target to achieve desired, often necessary goals. While engaged in energetical, action-oriented behaviors individuals are sensitive to the costs and benefits of alternative states or actions by way of negative feedback. The action monitor is responsible for continuous comparisons between target output and that being produced by current activities. Actions or states are modified aligning actual to target performance when external loads are applied (demands, challenges, stressors, etc.). Easily adopted actions or alternative states stem from a loop A process assessment and are akin to “automatic” changes in that there is a negligible perception of increased effort in the new state or action. The likelihood of an external load (demand) requiring an adaptation via a loop A process is highest when the knowledge, skills, and abilities are well learned and/or there is a high degree of familiarity with the performance goals and what it will take to meet them. A loop B process handles modifying states or actions when loop A changes have failed to eliminate the disparity between actual and target performance. Effortful, conscious awareness of resource utilization defines loop B and involves cost-benefit assessments aimed at prioritizing goals and allocating the finite amounts of effort and resources. The effort monitor perceives the failure of modifications via loop A processes and the supervisory controller becomes engaged to decide if the discrepancy is acceptable. Acceptability is likely a function of multiple factors, closely related to the importance and implications short- and long-term strategic goals.

The two-loop model implies a threshold by which the effort monitor triggers conscious involvement of the supervisory controller to engage in decision making regarding effort and resource expenditure. Hockey asserts the existence of upper and lower set-points for the effort monitor. The lower set-point is the standard default for any given task considering the environment and anticipated resources, skill usage, etc. Headroom exists for variability in these factors so as not to require conscious effort every time one or more condition changes. This range below the lower set-point is termed the working effort budget. The upper set-point and the difference between the two setpoints constitutes the reserve effort budget designed to meet additional demands, unpredictable changes in the demands-resources balance, or additional burdens associated with stressful environments. Performance targets, which necessitate actions or states requiring effort exceeding the lower-threshold limit but below the upper set-point limit, are not considered to induce distress. Unlike the lower set-point threshold, the upper threshold does not have a fixed minimum. The upper limit effort budget may be increased in anticipation of greater situational or environmental unpredictability or criticality of the outcome achievement; the belief being heightened anticipation to potential challenges or demands despite not knowing their specifics increases the prospect for distress is mitigated when the challenges do arise. At the same time, a reduced reserve budget may be a function of many issues including illness or exposure to chronic stressors. Hockey argues the upper limit set point for the effort budget more strongly associated with patterns of performance degradation under stress and high workload. A small reserve budget will typically give rise to overt decrements under stress, while a larger budget is more likely to be associated with sustained performance and increased costs.

The acute, occasional need for supervisory controller involvement to address periodic unresolved discrepancies between desired/expected performance and actual performance induce little to no effort-based stress. However, the working effort budget can be modified when a frequent task or environmental experience occurs regularly and the individual desires to reduce the conscious effort needed (likely due to the discomfort of effort). This is possible by practicing skills for proficiency so that they (the task(s)) are less susceptible to environmental changes or demands. Mental activity (energy) is increased when the amount of effort extends into the reserve budget; this is coping requiring effort without (dis)-stress. This state of coping is to be characterized by increased catecholamine response (epinephrine, norepinephrine, dopamine) but negligible glucocorticoid release (cortisol). In cognitive terms, active control involves increased working memory or executive control, or the use of rule- or knowledge-based levels of responding and may be considered a standard feature of non-routine mental work. A more serious problem for the effort control system are challenges/stimuli/stressors for which the perceived level of difficulty is too great to be met by small adjustments to the working effort budget. Operating at this or higher levels of effort for any length of time is known to be uncomfortable and avoided whenever possible. Such conditions are also regarded as a major source of fatigue associated with cognitive work.

Associated with the C-E model are two broad coping options for resolving the discrepancy between increasing demands and the upper point of reserve effort expenditure, each featuring disparate consequences for task performance and energetical cost (Figure 2). Adopting a strain coping mechanism, the reserve effort budget is elevated beyond its desirable maximum and target performance criteria is maintained but only at the expense of an increase in energetical costs. Hockey references the 'effort with distress' (Frankenhaeuser, M. 1986) pattern of coping. Affective state features of anxiety and fatigue are present with high levels of sympathetic dominance (fight or flight system) and increased excretion of both catecholamines and cortisol. The alternative is to adopt a passive coping strategy which leaves the upper-limit of the reserve effort budget in place resulting in performance which is insufficient to achieve desired goals. Like strain coping, passive coping results in distress but only because desired goals aren't being met. Evidence would be reduced levels of accuracy or speed, reduced attention to auxiliary tasks, adoption of behaviors or strategies which are perceived to be less demanding (reduced supervisory control input required). This is often found in environments where there are limited opportunities for control (helplessness). Karasek's notion of control being central to stressor response and strain migration is consistent with this assertion. An extreme form of passive control is complete disengagement from the pursuit of task goals. Where demands are excessive (such that they exceed the set upper limit of effort expenditure), some variant of the indirect strategy would normally be more appropriate. Active coping is almost always possible (and necessary in critical emergency situations) but likely maladaptive as a habitual response.

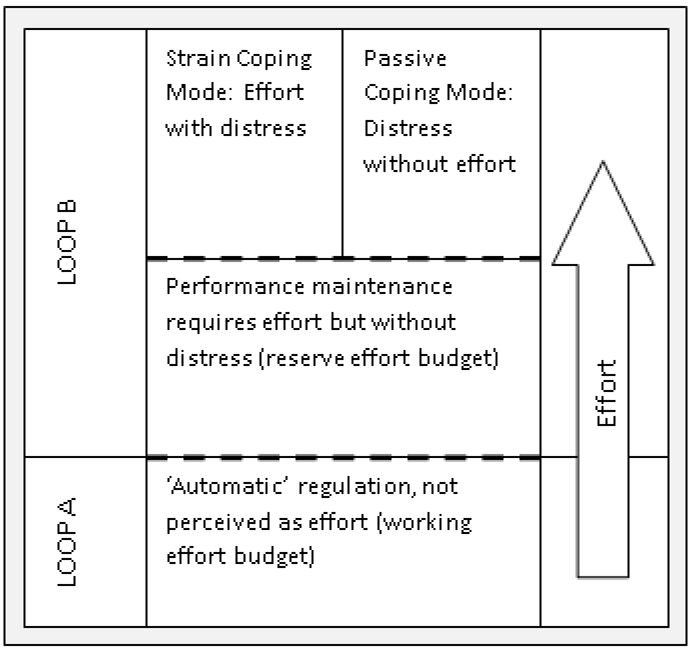

Figure 2.

An understanding of the compensatory trade-off between cognitive goals and effort is central to an explanation of performance changes under stress. Where primary performance is maintained (in the face of excessive effort, distress, a result of increased demands or presence of negative environmental factors) the increased strain of performance protection results in changes in other aspects of overall performance. For example, attention resources may be withdrawn from the central task to deal with perceived threats to emotional stability. In all cases, however, primary goals may be maintained, either by reconfiguration of remaining resources (allowing secondary tasks to incur errors or delays), or by recruitment of additional resources. This second option is likely to be associated with increased effort allocation and corresponding metabolic activity and lead to further indirect costs. Where reconfiguration cannot achieve the desired effect or further effortful response is not possible (or desirable), primary task decrements may be observed. The observed protection of primary performance applies especially to the work environment because of the external support for task-oriented motivation and the typically high level of task skills. Although degradation (or enhancement) of primary task activity is therefore unusual, the operation of such regulatory processes implies that we should be able to observe changes which reflect increased or decreased costs under different conditions.

Different patterns of performance observed under stress can be interpreted in terms of the compensatory control options available for maintaining stability of the system in response to the changing balance of goal priorities and environmental flux. Maintenance of primary task goals requires an active compensatory process to protect vulnerable cognitive goals from disruption by (stronger) emotional and biological goals. Although primary performance is typically maintained under stress, this compensatory activity normally results in disruption to secondary or auxiliary features of the integrated system performance, and to increased involvement of energetic resources (compensatory effort). Adjustment to adverse environmental or internal conditions (through the choice of coping mode) must consider not only external performance goals but also the need to satisfy personal goals, and to maintain an adequate state of general well-being. While the postulated control process allows individuals considerable flexibility in the choice of coping mode, many work environments, through their intolerance of errors and slow rates of work, naturally encourage the adoption of direct coping. In cases where effort demands are already high e.g., hospital doctors, nurses, air traffic controllers, chronic use of this high strain mode may be maladaptive, since there is little opportunity for recovery from the fatigue associated with such coping of this type.

Demerouti's & Bakker's (2011) job resources concept is necessary to address job demands as well as intrinsically valuable. This is consistent with Hackman & Oldham (1975) and Hackman & Lawler (1971) job characteristics model and Hobfoll's (1989, 2001) theory of conservation of resources (COR). Losing resources (or the expectation thereof) is a mechanism by which individuals experience stress. Resource gain is important but only when contextualized by loss, i.e., loss is displaced, its likelihood reduced with resource gains. Individuals' appraisals are one avenue to assess resources loss, but Hobfoll considers most resources as objectively determinable or observable. However, a notable body of research lead by Lazarus (2000) has repeatedly supported the position that the best proximal indicator on the individual level of stress is personal appraisal. In general, resource loss for one individual in most cases is perceived as a loss by others in similar circumstances; the ranking of resources' importance is a product of culture. Even though sensitivity to stress is considered a product of one's personality, it is still regarded as compatible with the objective stress standard.

Hobfoll (1989, 2001) proposed COR as alternative to appraisal-based theories because of the primacy of "objective and culturally construed" environmental characteristics determining stress and less on individuals' personal idiosyncrasies. Resource-based theories of stress (versus appraisal) are believed to maintain that the fit, i.e., the applicability, usefulness, effectiveness of personal, social, economic, and environmental resources with external demands determines the stress response and resultant outcomes. He reports McGrath's (1970) definition of stress (largely based on Lazarus's work) as "*substantial imbalance between environmental demand and the response capability of the focal organism*" and Lazarus's and Folkman's (1984) definition as "*a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being*". Hobfoll (1989) does not support these definitions and agrees with Kasl who argued that when perceptions are used to establish independent and dependent variables, as in the transactional model, the two variables "*are sometimes so close operationally that they appear to be simply two similar measures of a single concept.*" (Cooper & Payne, p. 13, 1978). The basic tenet of COR theory is the stress generating factor underlying the perception of threat is the belief in an undesirably high level of potential to loss of valued resources or actual loss. Stress only concerns a loss or potential loss of resources and will occur where resources are threatened, lost, believed to be unstable, or where individuals and groups cannot see a path to the fostering and protection of their resources through their individual or joint efforts. Loss is central to the theory and as such must be part of all psychological stressors if the theory is to be universally applicable. Psychological stress is proposed to be the reaction to an environment which (a) increases the threat of a net loss of resources, (b) induces net loss of resources, or (c) insufficient resources are gained following resource investment (a net loss). A definition of stress endorsed by Hobfoll (2001) posited by Kaplan is that stress is an internal state which *"…reflects the subject's inability to forestall or diminish perception, recall, anticipation, or imagination of disvalued circumstances, those that in reality or fantasy signify great and/or increased* *distance from desirable (valued) experiential states, and consequently, evoke a need to approximate the valued states."* (Kaplan, 1983, p. 196).

The net loss of resources is significant because resources have instrumental value as well as a symbolic value in that they help people define who they are. Hobfoll specifies four types of resources: objects, personal characteristics, conditions, or energies. The primary value of objective resources is in their physical properties or the secondary value they provide due to rarity or procurement expense. Hobfoll considers resources of condition to be what I would call relational states, e.g., being a spouse, an employee, a teammate, a familiar "somebody" at an establishment. Personal characteristics are considered resources as they are believed to aid in stress resistance. Finally, time, money, and knowledge are energy resources and they exercise their value in the acquisition of other valued resources.

Hobfoll's COR theory predicts that when individuals are confronted with stress, i.e., loss of resources, they endeavor to minimize the loss which he considers consistent with Lazarus & Folkman's model of coping. In the absence of stressors individuals seek to build up resource surpluses as a protection or buffer against future losses. We employ our resources to draw on resources within our environment to offset and/or reduce resource loss or augment resource accumulation. This accumulation of resources is believed to result in positive well-being, which the author calls eustress. Individuals facing limited opportunities or possessing abilities which aren't conducive to resource accumulation develop self-protective styles of coping, i.e., mitigating and preventive coping methods that less about overall health or long-term health but weight the beneficial value of coping in the near term much higher than the true cost long term. This tends to be detrimental over the lifespan, e.g., smoking, drinking, other negative and/or high (health) risk behavior.

STRESSORS IN THE WORK ENVIRONMENT

Aiming to address contradictory findings in the literature stemming from several parallel and often isolated research traditions, Karasek (1979) proposed and tested his job strain model using the Quality of Employment survey data. The focus centered on a specific paradoxical finding whereby consistent levels of job demands across multiple dissimilar jobs yet employee's resiliency to were heterogeneous across occupations. The hypothesized cause: either the omission of job control measures or the failure to distinguish between job demands and the opportunity for control. Karasek noted prior research with the job demands control concepts largely dealt with one or the other due to researchers pursuing different agendas. The solution afforded by job strain model was a joint effect of the two concepts where the highest negative outcomes, initially mental strain, were associated with simultaneously higher demands and lower control.

The job strain model's sources of workplace stressors are embodied in the job demands construct. Karasek consistently characterizes the construct as measure of task level stressors which are a function of pressure to produce output but also stressors which impede work load accomplishment, represent unexpected assignments, and are the result interpersonal conflict (Karasek, 1979; Karasek et al., 1998). The release guide for the Job Content Questionnaire (JCQ) summarized the job demands construct more simply in that it is essentially a measure of "how hard workers work" (Karasek et al., 1985). The job demands construct excludes measures of physical stressors thus it is customary to use the term "stressors" as a shortened phrase for "psychosocial stressors" and the descriptive title of “job demands” as a truncated term for “psychosocial” job demands. Equally important to the job strain model is the measurement of workers control and/or authority over their assigned tasks and conduct while on the job. Karasek (1979) conceptualized job control encompassing decision authority and intellectual discretion, two constructs regarded as relevant to work, similar in meaning, and empirically established as being related. Karasek also framed control in terms of its converse, namely, as an indicator of restraint inhibiting workers’ ability to respond to job demands. Thinking of lack of control as synonymous with high level restriction (lack of autonomy) is necessary because unresolved strain is ultimately due to demands which are not effectively mitigated, a result of workers being restricted to a limited number of response options. If the available response options are viewed as ineffective, inefficient, or undesirable then the risk of illness is thought to increase.

The U.S. Quality of Employment Survey (QES) questions used to establish evidence for the job strain paradigm have also been notably instructive as well. The Job Content Questionnaire (JCQ) is a self-administered survey and may be considered the reference instrument by which all other job strain model questionnaires were developed and compared. A core set of questions, which the JCQ users guide refers to as the “Framingham” version, includes 9 questions assessing decision latitude and 9 questions on psychological workload. These scales are said to be nationally standardizable because the core replicates QES questions of the late 1960s and 70s and are those utilized in 1979. The JCQ guide also recommends 11 social support questions be added. Karasek, Triantis, and Chaudhry (1982) acknowledged coworker and supervisor support as potential moderators between job characteristics and stress/strain. Johnson and Hall (1988) firmly established social support as the third dimension of what is now the job demand-control-support (DCS) model measuring iso-job strain. Those with traditional job strain (high demands, low control) who were classified with low social support were considered socially isolated and thus had iso-job strain. Even though the JCQ serves as the most well-known template for operationalizing the iso-job strain model there remains a high amount of heterogeneity in terms of the information sought by the selected or available questions, number of questions selected or available, and the wording and response methodology. Yet the findings from these varying surveys largely confirm the hypothesized relationships. Despite these generally supportive findings the theory and models have been subjected to intense criticism, much of which is justified given the impact the sheer volume of inferential statements which have been made on their behalf. Perhaps because of the job strain model's successfulness in terms of the extent it has been used to study the relationship between work and health, scrutiny of the model's theoretical underpinnings and concepts is also well documented. Focusing on the job demands construct, Karasek and Theorell (1990) admitted the job demands construct continued to be difficult to clearly conceptualize and thus measure because of the likelihood of diverse subcomponents and yet to be resolved theoretical problems. Task requirements (work load) remain central to the psychological job demands construct but the measurement of work load remains largely unstandardized due to the necessarily broad nature of the phrase and despite the example set by the items used from the QES for the JCQ.

Demerouti et al. (2001) proposed the job demands-resources (JD-R) model to study the burnout phenomenon outside the human services sectors where the theory originated. Empirical evidence had shown the presence of stressors associated with burnout as essentially common in that any and all occupations characterized by chronic, excessive job demands and inadequate job resources are considered psychologically and emotionally hazardous and result in decreased or poor levels of energy and motivation. A specific and empirically validated definition of burnout for employment in the human services was first described by Maslach (1982). Burnout is a syndrome of exhaustion, depersonalization, and reduced personal accomplishment for workers whose work is to largely process "people" rather than equipment and/or data. Demerouti et al. made the case for a conceptually broader definition of the burnout syndrome by noting strong similarities between the burnout constructs of emotional exhaustion and depersonalization and the stress reactions of fatigue, depression, and psychosomatic complaints, etc. studied in other occupational research fields.

Demerouti et al. (2001) conceptual model adopted the following broad definition of job demands: "*those physical, social, or organizational aspects of the job that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs*." (p. 501) The mechanism linking work organization characteristics and human costs (physical, emotional, etc.) are the up regulation of the sympathetic nervous system (autonomic and endocrine) and/or perceived increase in effort necessary for adaptation to maintain a desired level of performance (Hockey, 1993). Similarly, job resources are described as: "*those physical, psychological, social, or organizational aspects of the job that do any of the following: (a) be functional in achieving work goals; (b) reduce job demands at the associated physiological and psychological costs; (c) stimulate personal growth and development"*. Resources may include job control, potential for qualification, involvement in decisions, task variety, and social support from a variety of sources, e.g., supervisors or colleagues. Without adequate external resources individuals have increased difficulty obtaining goals, completing tacks, and adapting to work environment demands. The effect is worker demotivation and withdrawal, which may be coping and preventive measures aimed at diminishing future frustration and anxiety over failing to meet expectations or achieve goals. Later, Demerouti and Bakker (2011) asserted the main assumption of the JD-R model is that every occupation has its own specific risk factors associated with job-related stress. These factors can be classified in two general categories, i.e., job demands and job resources, thus constituting an overarching model that may be applied to various occupational settings irrespective of the particular demands and resources involved. Another aspect of the psychosocial work environment is the emerging concept of psychosocial safety climate. Psychosocial safety climate (PSC) refers to shared perceptions of organizational policies, practices, and procedures for the protection of worker psychological health and safety that are largely driven from senior management. Psychosocial safety climate reflects management values, attitudes and philosophy regarding worker psychological health, and the management of psychosocial risks (Dollard & Bakker, 2010; Dollard & Karasek, 2010). In summary, researchers have successfully operationalized the job demands, control, resources, social support, and safety climate concepts in several forms over the past four decades and they encompass most of the critical psychosocial work environment characteristics used by work stress researchers today.

HEALTH DISPARITIES

Despite notable improvements in overall health in the United States during the past two decades, there continues to be striking disparities in the burden of illness and death experienced by African Americans, Hispanics/Latinos, American Indians and Alaska Natives, and several other groups. These are believed to result from a complex interaction of genetic variations, environmental factors, and health behaviors. The causes of these disparities are not fully understood. In outlining the importance of data on race, ethnicity, and socioeconomic position in understanding U.S. health disparities the authors stated *"differences in economic conditions across racial and ethnic groups probably contributes to disparities, as they are likely to result in less access to health care, inability to afford higher-quality care, and greater exposure to harmful occupational and environmental factors"* (Ver Ploeg & Perrin, 2004, p. 22). The Healthy People initiative, a project within the U.S. Department of Health and Human Services, was briefly mentioned in the introduction of this dissertation. In 2008, the phase I report of the secretary's advisory committee on health promotion and disease prevention produced objectives for Healthy People 2020. Continuing the work of previous Healthy People initiatives begun in 2000 with the goal of reducing health disparities and the 2010 goal of eliminating health disparities that occur by race and ethnicity, sex, education, income, etc. they set four goals, the second to achieve health equity, eliminate disparities, and improve the health of all groups and a third to create social and physical environments that promote good health for all. To reach these goals, all important determinants of health disparities susceptible to influence by our institutions needed to be involved, especially because health and health behaviors are determined by influences at multiple levels, including personal, organizational/institutional, environmental, and political.

The committee referenced Carter-Pokras & Baquet (2002) for their definition of health disparity. At the time, these researchers discussed the conceptual issues surrounding the term "disparity". According to the Minority Health and Health Disparities Research and Education Act of 2000, a health disparity populations is "*a population where there is a significant disparity in the overall rate of disease incidence, prevalence, morbidity, mortality, or survival rates in the population as compared to the health status of the general population*" (p. 7). Adler & Rehkopf (2008) commented that the phrase "health disparity" stands out in terms of its rapid rise from being a key word for a single article in the 1980s, a key word in less than 30 in the 1990s, to a key word in more than 400 articles published between 2000 and 2004. They too mentioned Carter-Pokras's and Baquet's identification of 11 definitions of health disparities, including the National Institutes of Health definition "*… differences in the incidence, prevalence, mortality, and burden of diseases and other adverse health conditions that exist among specific population groups in the United states. Research on health disparities related to socioeconomic status is also encompassed in the definition"* (p. 430). Dressler et al. (2005) characterized health disparities as referring "*to differences in morbidity, mortality, and access to health care among population groups defined by factors such as socioeconomic status, gender, residence, and especially 'race' or 'ethnicity'"* (p. 232). Generally, they share the notion of one group being at a disadvantage to a reference group, usually a majority, due to beginning life with social disadvantages or position, from which subsequent undesirable (negative) differences in health or other opportunities and outcomes are unjust and avoidable. Social advantage or position is reflected by resources, occupation, education, racial/ethnic group, gender, sexual orientation, and other characteristics associated with greater resources, influence, prestige, and social inclusion. (Braveman, 2006).

CONCEPTUAL MODEL OF WORK AND HEALTH DISPARITIES

Occupational safety and health are also a topic of Healthy People 2020. Because work is one of the most important determinants of a person's health, the goal for this topic is to craft and disseminate preventive and early interventions that promote the health and safety of people at work based on findings from the National Occupational Research Agenda (NORA). The U.S. labor force is increasing in its diversity and some workers, e.g., racial and ethnic minorities, women, younger and older workers may be at increased risks for work related conditions relative to Caucasians, males, and young and middle-aged workers. The failure to adequately monitor, prevent, or address the differential exposures the effects are likely to contribute to health disparities. Lipscomb et al. (2006) articulated a conceptual model of work and health disparities guiding us in terms of where this research fits into the broader picture of social determinants of health (Figure 3). The "work we do" exposes us to physical, chemical, psychosocial, biological, and mechanical risks that may lead to illness or injury; this dissertation seeks to add new information and insights into the extent of these psychosocial exposures. Several factors influence the opportunities to pursue and choose the work we do as well as what is ultimately available to us. This dissertation attempts to evaluate exposures across occupations as well as considering sex and race/ethnicity given that social determinants influence "what we do" and thus likely impact the risk workplace exposures. In the end, multiple factors influencing the risks and chances that workplace exposures will lead to illness or injury. Eventually, if these go unrecognized, they will negatively impact long term physical, mental, emotional, and economic health and quality of life. Krieger concluded her commentary in the American Journal of Industrial Medicine (2010) by declaring work on occupational health inequities as vital, being good for science, policies, and public health. That because "workers are people too", we are obligated to ensure conditions, especially in the workplace, enable people to live their best lives and realize their max potential. We agree and thus this dissertation ultimately examines the relationship between work environment stressor exposures and health as well as exploring work's role in mediating sex and race/ethnicity-based health disparities.

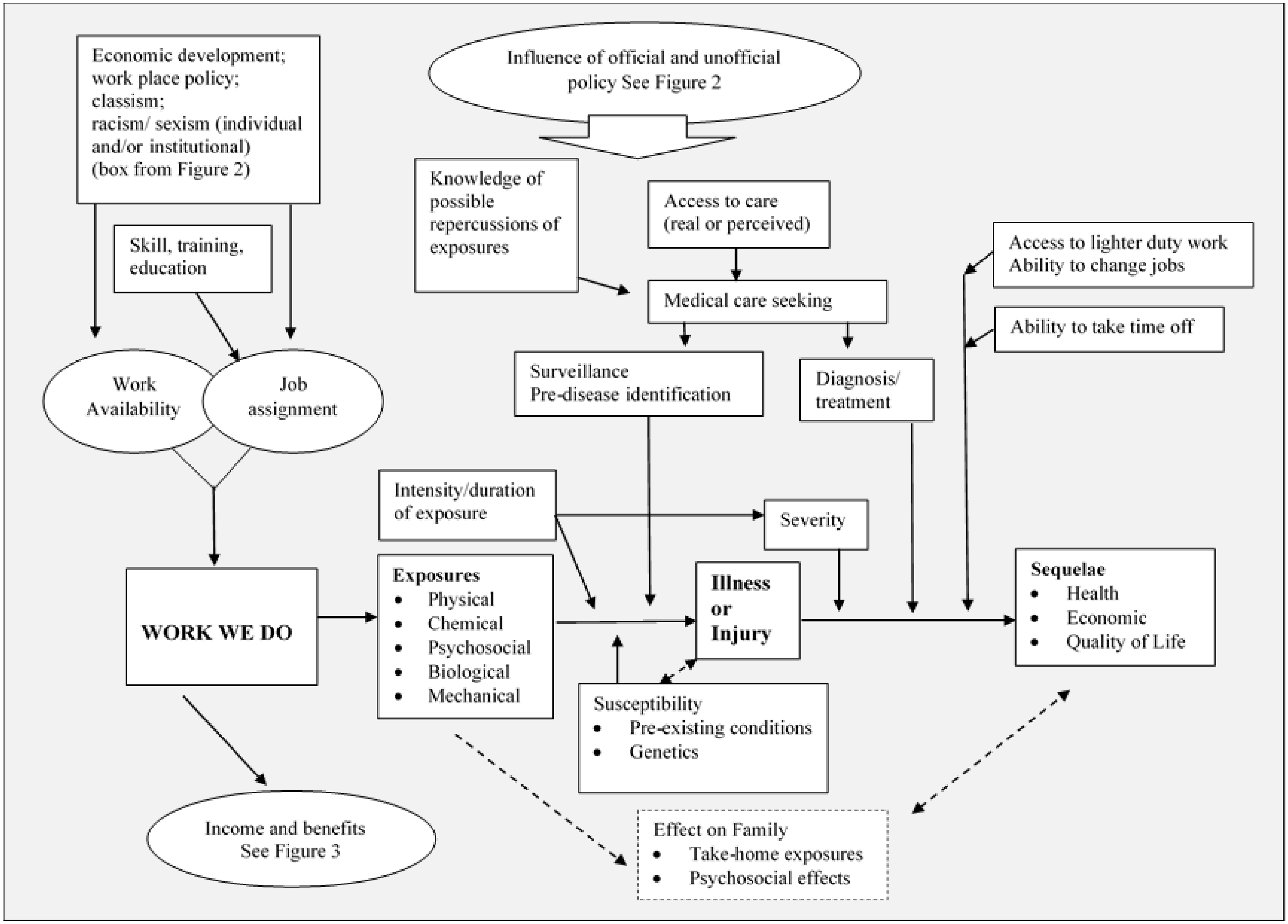

Figure 3. Conceptual model: work and health disparities. Adapted from 'A conceptual model of work and health disparities in the United States,' by Lipscomb, Loomis, McDonald, Argue, & Wing, 2006, *International Journal of Health Services*, 36, p. 27,29.

Chapter 3 Methodology

The General Social Survey Data

The General Social Survey (GSS) is the data collection instrument of the National Data Program for the Social Sciences, which are administered by the National Opinion Research Center (NORC) to its national samples (Smith et al., 2017). Established in 1941, NORC is the oldest not-for-profit, university affiliated national survey research center and retains the GSS data while the Roper Public Opinion Research Center reproduces and distributes the data and codebook. The GSS are part of the National Data Program for the Social Sciences, a project supported by the National Science Foundation (NSF). Initially fielded in 1972, the GSS is conducted February through April and only during even years since 1996. The median length of the interview has been about one and a half hours. Each survey from 1972 to 2004 was an independently drawn sample of English-speaking persons 18 years of age or over, living in non-institutional arrangements within the United States. As defined for the GSS in 1983-1987, 98% of the U.S. adult household population was English speaking, with Spanish speakers representing 60-65% of the language exclusions. Beginning in 2006, Spanish-speakers were added to the sample population.

From 1977 to 2012 the GSS used full-probability sampling of households designed to give each household an equal probability of being included in the GSS. For person level data the results may be weighted by the number of adults in the household for all years. Beginning in 2004 the GSS began using a two-stage sub-sampling design for non-response. Cases from which no response has been obtained after the initial stage of the field period are sub-sampled. The sub-samples may be weighted to represent all of those who had not responded by the time the subsample was drawn. From 2002 onward the GSS data is to be collected using computer assisted personal interviewing (CAPI).

THE GENERAL SOCIAL SURVEY SAMPLE FRAMES

The 2002 GSS sample was collected using the 1990 national sample frame. The sample was selected using a two-stage process. One hundred primary sampling units (PSUs) containing a metropolitan area or one or more counties were selected out of 2,489 PSUs. Prior to selection the PSUs were sorted into strata containing groupings of metropolitan and nonmetropolitan PSUs within each of the four Census regions. The non-metropolitan PSUs were further sorted by state, then within state, by percent minority, and finally, within percent minority groupings, by per capita income. Percent minority groupings were formed by classifying each PSU according to percent minority quartiles within its major strata.

The metropolitan PSUs include all three types delineated in the 1990 Census- Metropolitan Statistical Areas (MSAs), Consolidated Metropolitan Statistical Areas (CMSAs), and New England County Metropolitan Areas (NECMAs) and sorted by Census division, minority quartile, and per capita income. The sample PSUs were selected in a manner for the probability of selection to be proportional to the number of housing units to ensure proportionate representation along the sorting variables. Nineteen PSUs were included with certainty due to their size (Smith et al., 2017, p. 3114-3115)

The second stage of selection was based on a PSUs segment- an area consisting of one or more adjoining blocks. Three to 26 segments were selected within each of the 19 certainty PSUs and 3 segments selected from within each of the remaining 81 PSUs with a final total segment count of 384. Prior to their selection the segments were sorted successively by location within or outside the metropolitan area (for metropolitan area PSUs), state (where PSUs spanned multiple state lines), county, place, percent minority quartile within PSU, and census tract or block numbering area. Again, the probability of a segment being selected was proportional to the size of the segment (in housing units). In cases where segments were selected more than once (e.g., in small or high-density PSUs) a third stage was employed which further subdivided segment selections.

From 2004 onward NORC implemented a new approach to sampling frame construction and sample design. There were five changes from the 1990 sampling frame: 1). usage of a new list-assisted sampling frame for 72% of the population; 2.) the size of the certainty stratum (the proportion of the population covered by the certainty area selections) was increased, now 45% of the housing units (HU) are included in this stratum; 3.) the new PSUs for the list-assisted parts of the population certainty stratum are tracts (tract = 1,000-2,000 HUs); tracts have lower intra-cluster correlation coefficients than blocks/block groups; 4.) new secondary sampling units (SSUs) for any remaining "urban" areas; and 5.) the assignment of larger SSUs for any remaining areas.

NORC obtained access to the frame of addresses maintained by the United States Postal Service (USPS) and it was deemed superior to the listings obtained from traditional field listing methods. Census geographies were classified into two categories- blocks with street-style addresses (type A) and other (type B). The classification is based in US Census Bureau Type of Enumeration (TEA) code to classify blocks as suitable for mail-out/mail-back data collection in Census 2000. The recent improvement in the quality of mapping software permitted accurate geocoding of almost all street-style addresses. The MSA/county is the basic frame area and was stratified into three categories based on HU density (% of housing units in % of the MSA/county area). For category 1 MSAs/counties stratum 1 includes only type A tracts which contain 90% of category 1 MSAs/counties populations. Category 2 MSAs/counties type A tracts are assigned to stratum 2 and contain 75% of the population of category 2 MSA/counties. Finally, stratum 3 contains all other parts of the population where the USPS address list is inadequate for use as a sampling frame. Stratum 3 has two sub-stratum: 3.1.) type B tracts from category 2 MSAs/counties; and 3.2.) type B tracts from category 1 MSAs/counties (Smith, 2017, p. 3119).

NON-RESPONSIVE SUB-SAMPLING

The 2002 sample did not utilize non-responsive sub-sampling. In 2006 there were 4,209 temporary non-respondents who were sampled again at 45%. These 2,068 were perused for ten weeks along with 283 partial cases and appointments resulting in a final 4,510 completed cases. In 2010 there were 1,695 temporary non-respondents who were sampled again at 47%. Of these 800 cases, another 137 partial interview/appointment/Spanish-language cases were pursued for seven weeks. At that time, another 137 of the 895 that were initially dismissed (of the 53%) were added and all were pursued for four additional weeks resulting in a total complete case count of 2,044. (Smith, 2017, p. 3124). Finally, in 2014 there were 269 partial interview/appointment/Spanish-language/special situation cases along with 2532 temporary non-respondents. The latter were sampled at 65% resulting in 1653 cases to be re-sampled. All the aforementioned cases were pursued and ultimately 2,538 completed cases were obtained.

DATA WEIGHTING

In a household with n eligible respondents, each has probability Ph of being in a selected household, and $\frac{1}{n} \cdot Ph$ of being interviewed. Persons living in large households are less likely to be interviewed, because one and only one interview is completed at each preselected household. The GSS variable ADULTS properly weights an individual for their chance of being interviewed. Prior to 2004 the only weight to be considered is for number of adults in the household. The GSS variable WTSSNR may be used for post-2002 surveys and takes into consideration: 1.) the sub-sampling of non-respondents; 2.) number of adults in the household; and 3.) adjustment for area non-response for surveys 2004 and beyond (Smith, 2017, p. 3125-3128).

THE GENERAL SOCIAL SURVEY FINAL CASE DISPOSITION AND RATES

This project used the 2002, 2006, 2010, and 2014 GSS data because the National Institute for Occupational Safety and Health (NIOSH) Quality of Working Life (QWL) module was used during these years. The response rates were 70.01%, 70.12%, 70.03%, and 69.2%, respectively (table 1). The rates reported for the 2004 and beyond are weighted for the non-response sub-sampling. The eligibility rate was calculated by NORC by taking the N of Net Sample A and dividing it by the Original Sample. The response rate was calculated by taking the Completed Cases and dividing it by Net Sample A.

Table 1 Description of the sampling results for the 2002-2014 GSS

	Surveys			
	2002	2006	2010	2014
Original Sample	4890	9535	4093	5125
Net Sample A.	3943	7987	3418	3464
Net Sample B.	3943	5730	2682	2538
Completed Cases	2765	4510	2044	2538
Eligibility Rate	80.63%	83.77%	83.51%	81.60%
Response Rate	70.01%	70.12%	70.03%	69.20%
Refusal Rate	26.10%	23.30%	24.50%	26.40%
Unavailable Rate	1.50%	1.10%	1.80%	1.20%

THE STUDY SAMPLE

As previously discussed, this research used the responses collected from four independent cross-sectional samples of the U.S. population gathered in 2002, 2006, 2010, and 2014. Although all completed cases received a core set of permanent questions, not every GSS interviewee received the same survey version in accordance with NORC adopting a split-ballot design for the GSS in 1998. Within each survey year there exists three rotations and each of these has ballot versions A, B, and C. These are randomly allocated and each covers one-third of the sample. The rotating question modules, e.g., the Quality of Worklife (QWL) module, appears on two of three rotations. However, QWL module was a part of all six possible rotations during these survey years (sample A, rotation 1,2,3; sample B, rotation 4,5,6).

The GSS cumulative data file contained data on 59,599 respondents, with 11,857 representing the respondents surveyed in 2002, 2006, 2010, and 2014; 2,765, 4,510, 2,044, and 2,538, respectively. The permanent core GSS question of “Last week were you working full time, part time, going to school, keeping house, or what?" determined if the respondent was eligible for the QWL module (table 2). The respondent had to affirm they were working full-time, part-time, or with a job, but not at work because of temporary illness, vacation, strike to be administered the module. A total of 4,482 respondents (37.9%) responded otherwise and were deemed ineligible. The exclusionary answers were unemployed, laid off, looking for work, retired, in school, keeping house, other (specify and ask if ever worked for as long as one year?) or no answer leaving 7,375 respondents eligible to complete the QWL module.

Table 2 Respondents labor force status in the 2002-2014 GSS surveys (N=11857)

	Survey Year			
	2002	2006	2010	2014
Working full-time	1432	2322	917	1230
Working part-time	312	440	234	273
Temp not working	52	90	33	40
Unemployed, laid off	121	148	145	104
Retired	414	715	319	460
School	78	140	93	90
Keeping house	268	496	235	263
Other	88	155	65	76
No answer	0	4	3	2

This research included only respondents with a race/ethnicity of non-Hispanic white, non-Hispanic black, and Hispanic's of Mexican origin; there were several reasons to focus exclusively on these three groups. First, these groups represent most of the U.S. population, making a stronger case for meaningful generalizability of the findings. Second, non-Hispanic blacks and Mexican Americans have a documented history of health inequalities relative to non-Hispanic whites, making them appropriate for evaluation.

Finally, these racial/ethnic groups are believed to have been sufficiently sampled as to achieve suitable confidence in the results of the quantitative analyses, particularly in terms of population descriptive statistics as well as the analytical statistics. Excluding 644 respondents who self-reported as something other than non-Hispanic White, non-Hispanic Black, or Hispanic of Mexican origin reduced the sample to 6,731 individuals. Finally, the sample was focused on those describing their work arrangement as being a regular, permanent employee left 4,303 respondents (table 3).

Table 3 Respondents work arrangements with their main employer in the 2002-2014 GSS (N=6731)

	Survey Year			
	2002	2006	2010	2014
Regular, permanent employee	1328	1260	833	882
Independent contractor/consultant/freelance worker	227	220	138	151
On-call, work only when called to work	40	41	38	31
Paid by a temporary agency	12	20	14	5
Work for contractor who provides workers/services	40	55	27	33
*Dont know/No Answer/Not applicable	17	1018	28	273

*In the GSS online data explorer the "Don't know" and "No Answer" have an N=82 with the remaining as "not applicable". The raw dataset does not distinguish these categories.

The other work arrangement choices were independent contractor/consultant/freelance worker, on-call, work only when called to work, paid by a temporary agency, work for contractor who provides workers/services, don’t know, no answer, and not applicable. These were excluded from analysis because they represent unique sub-sets of the broader labor force and likely experience the workplace somewhat differently given the intermittency and/or inconsistency of their work environments. Even grouped together they represented a small proportion of all work arrangements responses when compared to the classification of regular, permanent employee. Like the rationale for limiting the sample to those who were non-Hispanic white, non-Hispanic black, or

Hispanic of Mexican American heritage, the reliability and validity of inferences made about the broader population of alternative work arrangements from such small numbers of individuals may suffer difficulties in credibility.

General Social Survey Variable Description and Missing Data Procedures

The primary analyses used 27 GSS Quality of Work Life (QWL) variables, nine respondent characteristic variables, and four self-reported measures of mental and physical health (table 4). The response options for the GSS variable year corresponded to the year of survey but were limited to the QWL model years of 2002, 2006, 2010, and 2014. The response options for the GSS variable sex were male or female. The GSS variable for age was recorded continuously in years. The response options for the GSS variable race were white, black, or other. The question associated with the GSS variable Hispanic was read as "Are you Spanish, Hispanic, or Latino/Latina? If yes, Which group are you from?" with options of "not Hispanic", "Mexican, Mexican American, Chicano/a", and 25 additional choices, mostly comprised of ancestry from Caribbean, Central American, and South American countries. The responses of "not Hispanic" and "Mexican, Mexican American, Chicano/a" were by a large margin the dominant categories. For this project, race/ethnicity was evaluated as a single variable with categories of non-Hispanic white (race = white and Hispanic = not Hispanic), non-Hispanic black (race = black and Hispanic = not Hispanic), and Mexican American (race = white, black, other and Hispanic = Mexican, Mexican American, Chicano/a) as the categories. The GSS education variable (degree) permitted options of less than high school, high school, junior college, bachelor, graduate, don't know, and no answer. The GSS gave respondents marital status options of married, widowed, divorced, separated, never married, or no answer. The question associated with the GSS income variable was: “In which of these groups did your total family income, from all sources, fall last year before taxes?” with response options of less than $1000, $1,000 to $2,999, $3,000 to $3,999, $4,000 to $4,999, $5,000 to $5,999, $6,000 to $6,999, $7,000 to $7,999, $8000 to $9,999, $10,000 to $14,999, $15,000 to $19,999, $20,000 to $24,999, $25,000 or more, refused, don’t know, and no answer. An income variable with better specificity was unavailable for the QWL module survey years. The GSS variable “occ10” coded the occupations described by the U.S. Census Bureau’s Occupational Classification System, which is based on the Bureau of Labor Statistics (BLS) 2010 Standard Occupational Classification System (SOC). These were categorized into the SOC high-level aggregation categories of “Management, Business, and Financial”, “Professional and Related”, “Service”, “Sales and Office”, “Natural Resources, Construction, and Maintenance”, “Production, Transportation, and Material Moving”, and “Military Specific”.

The GSS variable “health1” is a self-rated general health question with response options of excellent, very good, good, fair, and poor. The three other health assessment variables are coded as continuous integers between zero and thirty and options of don’t know, and no answer. The question associated with the GSS variable “mntlhlth” is: “Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the last 30 days was your mental health not good?” The question associated with the GSS variable “physhlth” is: “Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?” Finally, the question associated with the GSS variable “hlthdays” is: “During the past 30 days, for about how many days did your poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?".

Table 4 Description of the variables used from the 2002-2014 GSS.

Quality of Worklife Variables	Variable Question
Wrktime	I have enough time to get the job done[b]
Overwork	I have too much work to do everything well[a]
Toofewwk	How often are there not enough people or staff to get all the work done?[c]
Condemnd	I am free from the conflicting demands that other people make of me[b]
Famwkoff	How hard is it to take time off during your work to take care of personal or family matters?[f]
Productiv	Conditions on my job allow me to be about as productive as I could be[a]
Wksmooth	The place where I work is run in a smooth and effective manner[a]
Haveinfo	I have enough information to get the job done[b]
Hlpequip	I receive enough help and equipment to get the job done[b]
Supcares	My supervisor is concerned with the welfare of those under him or her[b]
Suphelp	My supervisor is helpful to me in getting the job done[b]
Manvsemp	In general, how would you describe relations in your work place between management and employees?[d]
Trustman	I trust the management at the place I work[a]
Respect	At the place where I work, I am treated with respect[a]
Wkpraise	When you do your job well, are you likely to be praised by your supervisor or employer?[e]
Promtefr	Promotions are handled fairly[b]
Cowrkhlp	The people I work with can be relied on when I need help[b]
Cowrkint	The people I work with take a personal interest in me[b]
Safehlth	The safety and health conditions where I work are good[a]
Safetywk	The safety of workers is a high priority with management where I work[a]
Safefrst	There are no significant compromises or shortcuts taken when worker safety is at stake[a]
Teamsafe	Where I work, employees and management work together to ensure the safest possible working conditions[a]
Workdiff	I get to do a number of different things on my job[a]

[a]Strongly disagree to strongly agree (1-4); [b]Not at all true to very true (1-4); [c]Never to often (1-4); [d]Very bad to very good (1-5); [e]No, maybe, yes (1-3); [f]Not at all hard to very hard (1-4)

Table 4 Description of the variables used from the 2002-2014 GSS (continued)

Variables	Variable Question
Quality of Worklife	
Opdevel	I have an opportunity to develop my own special abilities[b]
Learnnew	My job requires that I keep learning new things[a]
Wkdecide	In your job, how often do you take part with others in making decisions that affect you[c]
Wkfreedm	I am given a lot of freedom to decide how to do my own work[b]
Demographics	
Year	GSS year for this respondent
Sex	Respondents sex
age	Respondents age
Race	What race do you consider yourself?
Hispanic	Are you Spanish, Hispanic, or Latino/Latina? If yes, which group are you from?
Marital	Are you currently--married, widowed, divorced, separated, or have you never been married?
Income	In which of these groups did your total family income, from all sources, fall last year before taxes, that is? Just tell me the letter.
Degree	Respondents degree
Occ10	Rs census occupation code (2010)
Health	
Health1	Would you say that in general your health is Excellent, Very good, Good, Fair, or Poor?
Hlthdays	During the past 30 days, for about how many days did your poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?
physhlth	Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?
Mntlhlth	Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?

[a]Strongly disagree to strongly agree (1-4); [b]Not at all true to very true (1-4); [c]Never to often (1-4); [d]Very bad to very good (1-5); [e]No, maybe, yes (1-3); [f]Not at all hard to very hard (1-4)

Table 5 lists the number of missing values for all the variables. Beginning with missing values, three respondents had missing data for all 27 GSS QWL variables and where excluded. Thirty-seven respondents were missing one or more of health measures values and were excluded, after which 4,263 respondents remained. Those with missing values for age (N = 12), marital status (N = 1), and income (N = 313) received an imputed value; the mode value of the respondent's race/ethnicity, sex, education, marital status, and income matched group was imputed. The missing values for income were further investigated. Bivariate analyses were conducted examining the relationship between having a missing income value and a respondent's sex, race/ethnicity, marital status, education, and work status. Missing an income value was only statistically related with a respondent work status (p-value = .003). Regular permanent employees working part-time represented had a larger proportion of missing income values compared with those working full-time, 19.5% vs 12.4%, respectively. The dominant income response choice was "$25,000 or more," ranging between 72.2% and 80.6% across the four surveys periods. For imputation purposes, even matching a respondent on multiple characteristics, all the imputed income values were the $25,000 or more category. This increases the average percentage of respondents in this category from 75% to 82.3% of the cumulative sample.

Table 5 Description of the frequency of missing values for the variables following deletions and imputations in the 2002-2014 GSS reponses.

	Missing[1] N=4300	Missing[2] N=4263	Missing[3] N=4263	Missing[4] N=4236
Work Environment Variables				
Wrktime	6	0	0	0
Overwork	12	9	9	0
Toofewwk	11	5	5	0
Condemnd	95	85	85	0
Famwkoff	9	8	8	0
Productiv	15	9	9	0
Wksmooth	18	11	11	0
Haveinfo	3	0	0	0
Hlpequip	5	0	0	0
Supcares	53	31	31	0
Suphelp	39	23	23	0
Manvsemp	14	6	6	0
Trustman	23	14	14	0
Respect	7	5	5	0
Wkpraise	25	13	13	0
Promtefr	240	211	211	0
Cowrkhlp	9	3	3	0
Cowrkint	27	18	18	0
Safehlth	13	2	2	0
Safetywk	23	11	11	0
Safefrst	43	23	23	0
Teamsafe	33	12	12	0
Workdiff	4	3	3	0
Opdevel	14	7	7	0
Learnnew	5	1	1	0
Wkdecide	6	1	1	0
Wkfreedm	5	0	0	0

Missing[1] = Initial missing values count

Missing[2] = Frequency of missing values following listwise deletion of those with missing health values.

Missing[3] = Frequency of missing values following imputation of missing demographic variables

Missing[4]= Frequency of missing values following removal of respondents with >3 missing work environment values and imputation of missing values for respondents with ≤3 missing values

Table 5 Description of the frequency of missing values for the variables following deletions and imputations in the 2002-2014 GSS reponses (continued)

	Missing[1] N=4300	Missing[2] N=4263	Missing[3] N=4263	Missing[4] N=4236
Demographics				
Age	12	12	0	0
Sex	0	0	0	0
Race/Ethnicity	0	0	0	0
Income	329	313	0	0
Marital	1	1	0	0
Degree	0	0	0	0
Health				
Mntlhlth	23	0	0	0
Physhlth	23	0	0	0
Hlthdays	12	0	0	0
Health1	4	0	0	0

Missing[1] = Initial missing values count

Missing[2] = Frequency of missing values following listwise deletion of those with missing health values.

Missing[3] = Frequency of missing values following imputation of missing demographic variables

Missing[4]= Frequency of missing values following removal of respondents with >3 missing work environment values and imputation of missing values for respondents with ≤3 missing values

A total of 3,840 respondents had values for all 27 GSS QWL work environment variables (table 6). Given that only .67% (N = 27) of the 4,263 respondents had four or more missing values, they were removed from the analyses rather than being given imputed values. Respondents with one (307, 7.2%), two (63, 1.48%), or three (26, 0.61%) missing values received imputed values of zero. Because the minimum valid value for each question was one, zero values did not add information. Lower scored values represent working in a lower stress work environment, thus imputing zeros potentially biases the analyses towards null results by reducing an individual's total potential work stressor exposure. The GSS QWL variable with the most missing values, representing 41.3% of the total number of missing values was promtefr (*N* = 211) and the question was read as "Now I'm going to read you another list of statements about your main job. For each, please tell me if the statement is very true, somewhat true, not too true, or not at all true with respect to the work you do. Question: Promotions are handled fairly". The 85 missing responses to the question: "I am free from conflicting demands that other people make of me." (GSS variable: condemnd) represented 16.6% of all missing values. No other variables had missing values in excess of 10%, with the next highest being 6.1%.

Table 6 Frequency of missing values for the work environment variables in the 2002-2014 GSS responses (N=4263)

# Missing	N
0	3840
1	307
2	63
3	26
4	10
5	10
6	1
7	3
8	1
10	1
25	1
Total	4263

GENERAL SOCIAL SURVEY QUALITY OF WORKLIFE WORK ENVIRONMENT VARIABLES

In 2000, the National Institute for Occupational Safety and Health (NIOSH) requested NORC add the Quality of Worklife (QWL) module to the GSS as a kind of follow-up to the 1970's Quality of Employment surveys (QES). NIOSH selected 76 questions addressing a wide range of work organization issues including hours of work, workload, worker autonomy, job security, job satisfaction, stress, and well-being. The 2002 and 2006 QWL modules were identical while the 2010 and 2014 modules included of four new questions, one revision, and five questions removed. It is worthwhile to note that half of the QWL questions selected by NIOSH appeared in the 1977 QES because Karasek (1979) used several of the QES questions to operationalize the job demands and job control constructs with many later adopted as core items in the proprietary Job Content Questionnaire (JCQ) (Karasek, 1985).

Selecting GSS QWL variables for this dissertation was guided by the well-established constructs of job demands, job control, job resources, social support, and safety climate (Alfredsson, Karasek, & Theorell, 1982; Bakker & Demerouti, 2007; Bakker & Demerouti, 2017; Demerouti et al., 2001; Dollard & Karasek, 2010; Griffin & Neal, 2000; Johnson & Hall, 1988; Karasek, 1979; Karasek, 2008; Karasek, Baker, Marxer, Ahlbom, & Theorell, 1981; Karasek et al., 1988; Karasek et al., 1998; Karasek & Theorell, 1990; Neal & Hart, 2000; Theorell & Karasek, 1996; Zohar, 1980). To remain consistent with the literature these variables were grouped together to mimic these constructs as they have been previously operationalizations in surveys in countries such as the Netherlands (van der Doef & Maes, 1999), Belgium (Pelfrene et al., 2001), Sweden (Sanne, Mykletun, Dahl, Moen, & Tell, 2005), France (Niedhammer, 2002), Japan (Kawakami, Kobayashi, Araki, Haratani, & Furui, 1995), Brazil (Hokerberg et al., 2010), and Thailand (Phakthongsuk & Apakupakul, 2008) to name few. In accordance with Selye (1977), McEwen & Stellar (1993), Hobfoll (1989), and Folkman, Lazarus, Dunkel-Schetter, DeLongis, Gruen (1986) conceptions of stress, the constructs these GSS QWL variables represent for this research are work load stressors, work structure(-al) stressors, work relation(-al) stressors, work safety stressors, and work development(-al) stressors. These are sub-constructs of a single overarching total work environment t(-al) stressors construct. Table 7 displays the work environment constructs with their respective GSS QWL variable names, question wordings, and response options.

Table 7 Allocation of the GSS QWL variables to their work environment stressor constructs.

Work Environment Stressor Construct	Variable Question
Work Load Stressors	
Wrktime	I have enough time to get the job done[b]
Overwork	I have too much work to do everything well[a]
Toofewwk	How often are there not enough people or staff to get all the work done?[c]
Condemnd	I am free from the conflicting demands that other people make of me[b]
Famwkoff	How hard is it to take time off during your work to take care of personal or family matters?[f]
Work Structural Stressors	
Productiv	Conditions on my job allow me to be about as productive as I could be[a]
Wksmooth	The place where I work is run in a smooth and effective manner[a]
Haveinfo	I have enough information to get the job done[b]
Hlpequip	I receive enough help and equipment to get the job done[b]
Work Relational Stressors	
Supcares	My supervisor is concerned with the welfare of those under him or her[b]
Suphelp	My supervisor is helpful to me in getting the job done[b]
Manvsemp	In general, how would you describe relations in your work place between management and employees?[d]
Trustman	I trust the management at the place I work[a]
Respect	At the place where I work, I am treated with respect[a]
Wkpraise	When you do your job well, are you likely to be praised by your supervisor or employer?[e]
Promtefr	Promotions are handled fairly[b]
Cowrkhlp	The people I work with can be relied on when I need help[b]
Cowrkint	The people I work with take a personal interest in me[b]

[a]Strongly disagree to strongly agree (1-4); [b]Not at all true to very true (1-4); [c]Never to often (1-4); [d]Very bad to very good (1-5); [e]No, maybe, yes (1-3); [f]Not at all hard to very hard (1-4)

Table 7 Allocation of the GSS QWL variables to their work environment stressor constructs (continued)

Work Environment Stressor Construct	Variable Question
Work Safety Stressors	
Safehlth	The safety and health conditions where I work are good[a]
Safetywk	The safety of workers is a high priority with management where I work[a]
Safefrst	There are no significant compromises or shortcuts taken when worker safety is at stake[a]
Teamsafe	Where I work, employees and management work together to ensure the safest possible working conditions[a]
Work Developmental Stressors	
Workdiff	I get to do a number of different things on my job[a]
Opdevel	I have an opportunity to develop my own special abilities[b]
Learnnew	My job requires that I keep learning new things[a]
Wkdecide	In your job, how often do you take part with others in making decisions that affect you[c]
Wkfreedm	I am given a lot of freedom to decide how to do my own work[b]

[a]Strongly disagree to strongly agree (1-4); [b]Not at all true to very true (1-4); [c]Never to often (1-4); [d]Very bad to very good (1-5); [e]No, maybe, yes (1-3); [f]Not at all hard to very hard (1-4)

WORK ENVIRONMENT STRESSOR CONSTRUCT VALIDATION

Correlations & Reliability

The work environment stressor scale unstandardized total sum scores represents a continuum of work stressor exposure, with lower sum scores representing lower total work environment stressor exposure, i.e., a lower stress work environment and conversely, high sum scores representing a high stress work environment. A low stress work environment is one in which the respondent believes they have enough time, staffing, equipment, proper workplace organization, communication, managerial and co-worker support, feedback, trust, fairness, safety prioritization, involvement in decision making, autonomy, task variety, and opportunities for personal growth. A few of the GSS QWL variables used were reversed coded to support this unidirectional conceptualization. Correlation coefficients were calculated between all GSS QWL variables as well as evaluation of item-total scale relationships. Coefficient of reliability (Cronbach's alpha) using both unstandardized and standardized data were calculated for the 27-item work environment stressor total sum scale and for each of the five individually summed sub-scales. Serial reliability coefficients were calculated where one of the variables was removed from a sub-construct scale or with one of the sub-constructs removed from the total work environment stressor scale. Additionally, Cronbach's alpha was calculated for the 27-item work environmental stressors total sum scale and five individually summed sub-scales stratified by sex, race/ethnicity, and survey year. J.C. Nunnally's (1978) statement that researchers in early stages *"saves time and energy by working with instruments that have only modest reliability, for which purpose reliabilities of .70 or higher will suffice."* (p. 245) is a broadly accepted heuristic for coefficient alpha, but not one that necessarily renders unreliable an operationalization of a construct. Thus, alone a constructs inability to meet this threshold was not considered enough cause to modify the construct, especially if prior operationalizations showed similar reliability.

Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) is a statistical method relying upon theoretical relationships hypothesized to exist among manifest (observed) and latent (unobserved) variables (Schreiber, Stage, King, Nora, & Barlow, 2006). Existing theory and/or empirical research serves as the basis for a model which is subsequently tested for its validity using data. (Byrne, 1998). Latent variable models estimate correlations and/or path coefficients between factors; these are analogous to true scores without measurement error. This unique advantage is a primary reason for using covariance structure models (Brannick, 1995). The measurement invariance (equivalence) of a model is also critically important if used to make comparisons among multiple groups. Interpreting the meaning of such comparisons depends upon the model operating equivalently across groups (Byrne & Stewart, 2006). If measurement invariance cannot be established, finding between-group differences may be biased by unknown factors (Cheung & Rensvold, 2002). LISREL (Joreskog & Sorbom, 2004) is a statistical tool for analyzing covariance matrices and permits CFA and invariance testing in most circumstances (Marsh & Hocevar, 1985). We will test the fitness of the proposed 27-item work environment stressor unstandardized total sum scale with LISREL, along with parameter invariance across multiple groups, sex, race/ethnicity, and survey year.

Hu and Bentler (1998, 1999) and Cheung and Rensvold (2002) recommended the descriptive fit indices of standardized root mean square residual (SRMR), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA) for CFA model assessment. The research suggests obtaining RMSEA values of less than .05 as an indication of good model fit. A CFI value close to .95, a SRMR value close to .08, and a RMSEA value close to .06 reportedly result in lower type II error rates. To minimize both type I and II error rates Hu and Bentler (1998, 1999) recommended a combinational approach in assessing adequate model fit- use a CFI cutoff value of .95 in combination with a SRMR cutoff value of .09.

Measurement Invariance

Measurement invariance refers to the property an individual question or composite multi-item scale possesses when the observed scores reflect respondents' true level of latent trait (immeasurable) or construct free from influence or bias by the characteristic selected to stratify the respondents into their respective groups. The assumption is the numerical values under consideration are on the same scale: the test has 'measurement invariance' across the groups (Widaman & Reise, 1997). Determining measurement invariance requires testing the equivalence of measured constructs in two or more independent groups to assure the same constructs are assessed (Chen, Sousa, & West, 2005). The analysis of covariance structures using LISREL software provides a means to test for invariance (Byrne et al., 1989). An extension of CFA, multi-group confirmatory factor analysis, tests the invariance of estimated parameters of two nested models across groups (Cheung and Rensvold, 2002). The nested models contain parameters fixed to be equal across groups and the generated model fit indices are compared with the values generated by a less restricted model where fewer parameters are specified as identical. A non-statistically significant difference implies cross-group response consistency for the fixed parameters.

The two forms of measurement invariance (equivalence) are non-metric and metric invariance. Non-metric invariance, otherwise known as configural invariance, appears when the pattern of zero and non-zero loadings are identical across multiple groups, i.e., the hypothesized configuration of item and factor relationships are the same across multiple groups (Steenkamp and Baumgartner, 1998; Widaman and Reise, 1997). Assessment of the second form of invariance, metric invariance, were evaluated at three levels (a) weak, (b) strong, and (c) strict (Meredith, 1993; Widaman and Reise, 1997). Testing weak metric invariance requires factor loadings fixed to be the same across groups (Steenkamp and Baumgartner, 1998). Testing for strong factorial invariance involves constraining the intercepts of both measured and first-order factors, otherwise considered an indication of scalar invariance. If strong factorial invariance holds, differences in mean and variance values between the groups on the latent variable appropriately reflect mean and variance differences on the manifest variables (Widaman and Reise, 1997). Obtaining evidence of strict metric invariance, where there are no statistically significant differences in either the factor disturbances or indicator variable residual error values, is seldom achieved or expected. Therefore, demonstration of non-metric (configural) and weak and strong metric invariance is typically enough evidence that the item or survey instrument is valid for the groups under consideration.

Chen et al. (2005) and Byrne and Stewart (2006) recommended similar methodological approaches to test the measurement invariance of a second-order factor model for multiple groups. First, the initial or base model establishes non-metric invariance (with no parameter invariance constraints specified by the researcher). Second, another model follows with the parameters of the first-order factor loadings (weak metric invariance) constrained to be equal for all groups. Third, placement of invariance constraints are imposed on the second-order factor loadings. Fourth, the intercepts of the manifest variables are specified to be invariant, followed by constraining the intercepts of the first-order factors (Chen et al., 2005).

Finally, constraining the disturbances (unique variances) of the first-order factors and then specifying the unique residual variances of the manifest variables as equivalent ends the sequence for strict invariance testing. A difference in the CFI value between two nested models of less than or equal to .01 indicates the null hypothesis of invariance should be accepted (Chung & Rensvold, 2002). Finally, invariance of the first and second-order factor loadings (weak factorial invariance) and invariance of the intercepts for the manifest and the first-order factor intercepts (strong factorial invariance) was also evaluated.

Criterion Validity

The question: “How often during the past month have you felt used up at the end of the day?” (GSS variable: usedup) with responses of always, often, sometimes, hardly ever, and never was used to assess the 27-item work environment stressor sum scale for criterion validity and each of the five sub-scales separately. Being “used-up” is a key feature of burnout. Respondents’ 27-item work environment stressors total sum score and five individually summed sub-scales score were modeled as a function of their GSS usedup variable responses with “never” being used up as the reference category.

Convergent Validity

The GSS question: “How often do you find your work stressful?” (GSS variable: stress) with response options of always, often, sometimes, hardly ever, and never was used to assess the 27-item work environment stressor sum scale and each of the five individually summed sub-scales separately for convergent validity. Respondents 27-item work environment stressors total sum scores and five separate summed sub-scales scores were modeled as a function of their GSS stress variable responses with never finding work stressful as the reference category. The more frequently someone reported finding work stressful, the higher their work environment stressor scale total sum score should be.

SPECIFIC AIM ONE HYPOTHESES AND ANALYSIS PLAN

The first specific aim for this dissertation investigated U.S. employees' experience of psychosocial work environment characteristics, namely those whose presence in the work environment contributes to its stressfulness. To investigate the specific aim, the following three hypotheses were proposed:

1. Exposure to psychosocial work environment stressors is associated with individuals' occupation.
2. Exposure to psychosocial work environment stressors is associated with changes in the U.S. job market over time.
3. Exposure to psychosocial work environment characteristics is associated jointly with individuals' occupation and changes in the U.S. job market over time.

Hypothesis One

The bivariate relationship between responses to each of the 27 GSS QWL variables and the respondents' occupational classification were assessed with Pearson Chi-square (χ^2) and Cochran-Mantel-Haenszel Chi-square (CMH χ^2) test statistics. Next, generalized linear models evaluated the relationship between the work environment stressor total sum scale scores and occupational classification. The work environment stressor scale total sum score or one of its individually summed sub-scales were the dependent variables and occupational group was the sole independent variable. The reference category for occupational group was business & finance.

Hypothesis Two

The bivariate relationship between responses each of the 27 GSS QWL and the year of the survey were assessed with Pearson Chi-square (Pearson χ^2) and Cochran-Mantel-Haenszel Chi-square (CMH χ^2) test statistics. Next, generalized linear models were used to study the relationship between the work environment stressor total sum scale scores and survey year. The work environment stressors total sum scale score or its sub-scales were dependent variables. The survey year variable was treated as a nominal categorical variable with 2010 survey data selected as reference category due to it being collected immediately post the Great Recession of 2007-2009 and the expectation of differences with the pre-Great Recession 2006 survey data as well as the 2002 and 2014 surveys both being five years removed the Great Recession period.

Hypothesis Three

A series of four cumulative logit models were used to study the relationship between each of the 27 GSS QWL variables and joint effect of the respondents' occupation classification and survey year. The dependent variable in each model was a GSS QWL variable. These models evaluated the odds of a respondent indicating a higher degree of work stressor exposure relative to the reference category. The first model included occupational classification as the only independent variable to examine the bivariate relationship, with the Wald χ^2 results expected to be consistent with the Pearson χ^2 and CMH χ^2 results from the first hypothesis of this aim. The reference occupational category reference was business & finance. The second model was similar to the first except it used survey year as the only independent variable. The survey year reference category was 2010. The third model included both occupational classification and survey year with the same reference categories used in prior models. Model four was model three with the addition of an occupation*survey year interaction term. The proportional odds assumption was evaluated using the Score test, which is a chi-square based test. If the proportional odds assumption was violated, an alternative model allowing for non-proportional odds was substituted.

A series of four generalized linear models were used to study the relationship between the work environment stressor scale total sum scores or its individually summed sub-scales scores and occupational classification and survey year. The reference categories for occupation and survey year were business & finance and 2010, respectively. The first model included occupation as the only independent variable to examine the bivariate relationship, with the Wald χ^2 results expected to be consistent with the Pearson χ^2 and CMH χ^2 results from the first aim of this hypothesis. The second model was similar to the first except it used survey year as the only independent variable. The third model included both occupation and survey year with the same reference categories used in prior models. Model four was model three with the addition of an occupation*survey year interaction term.

SPECIFIC AIM TWO HYPOTHESES AND ANALYSIS PLAN

The second specific aim for this dissertation investigated if the exposure to psychosocial work environment characteristics, namely those whose presence in the work environment contributes to its stressfulness, differed according to respondents' sex and/or race/ethnicity. To investigate the specific aim, the following three hypotheses were proposed:

1. Exposure to psychosocial work environment characteristics is associated with respondents' sex and race/ethnicity.

2. Exposure to psychosocial work environment characteristics is associated jointly with respondents' sex or race/ethnicity and occupation.
3. Exposure to psychosocial work environment characteristics is associated jointly with respondents' sex or race/ethnicity and changes in the U.S. job market over time.

Hypothesis One

The bivariate relationship between responses to each of the 27 GSS QWL variables and the respondents' sex and race/ethnicity were assessed with the Pearson Chi-square (Pearson χ^2) and the Cochran-Mantel-Haenszel Chi-square (CMH χ^2). Next, a series of four cumulative logit models were used to study the relationship between each of the 27 GSS QWL variables and joint effect of the respondents' sex and race/ethnicity. The dependent variable in each series of models was a GSS QWL variable. These models evaluated the odds of a respondent indicating a higher degree of work stressor exposure relative to the reference category. The sex and race/ethnicity reference categories were male and non-Hispanic white, respectively. The first model included sex as the only independent variable to examine the bivariate relationship, with the Wald χ^2 results expected to be consistent with the Pearson χ^2 and CMH χ^2 results. The second model included race/ethnicity as the only independent variable. Model three included both sex and race/ethnicity with the same reference categories used in prior models. Model four was model three with the addition of a sex*race/ethnicity interaction term. The proportional odds assumption was evaluated using the Score test, which is a chi-square based test. If the proportional odds assumption was violated, an alternative model allowing for non-proportional odds was substituted. The

Wald χ^2 test was used to assess the statistical significance of the independent variables' coefficients.

Next, generalized linear models were used to study the relationship between the work environment stressor total sum scale scores or its individually summed sub-scale scores and respondents' sex or race/ethnicity. The reference categories for sex and race/ethnicity were male and non-Hispanic white, respectively. The first model included sex as the only independent variable to examine the bivariate relationship. The second model included race/ethnicity the only independent variable. Model three included both sex and race/ethnicity with the same reference categories used in prior models. The fourth model was model three with the addition of a sex*race/ethnicity interaction term. The Wald χ^2 test was used to assess the statistical significance of the independent variable's coefficients.

Hypothesis Two

The relationship between responses to the 27 GSS QWL variables and occupational classification and sex or race/ethnicity were assessed using a series of four cumulative logit models. The dependent variable in each series of models was a GSS QWL variable. These models evaluated the odds of a respondent indicating a higher degree of work stressor exposure relative to the reference category. The occupation, sex, race/ethnicity reference categories were business & finance, male, and non-Hispanic white, respectively. The first model included either sex or race/ethnicity as the only independent variable to examine the bivariate relationship. The second model included occupation as the only independent variable. The third model included occupation and either sex or race/ethnicity with the same reference categories used in prior models. The fourth model was model three with the addition of a sex*occupation or race/ethnicity*occupation interaction term. The proportional odds assumption was evaluated using the Score test, which is a chi-square based test. If the proportional odds assumption was violated, an alternative model allowing for non-proportional odds was substituted. The Wald χ^2 test was used to assess the statistical significance of the independent variables' coefficients.

Next, a series of four generalized linear models were used to study the relationship between the work environment stressor scale total sum score scores or its individually summed sub-scale scores and respondents' occupational classification and sex or race/ethnicity. The reference categories for occupation, sex, and race/ethnicity were business & finance, male and non-Hispanic white, respectively. The first model included sex or race/ethnicity as the only independent variable to examine the bivariate relationship. The second model included occupation as the only independent variable. The third model included occupation and either sex or race/ethnicity with the same reference categories used in prior models. Model four was model three with the addition of a sex*occupation or race/ethnicity*occupation interaction term. The Wald χ^2 test was used to assess the statistical significance of the independent variable's coefficients.

Hypothesis Three

The relationship between responses to each of the 27 GSS QWL variables and survey year and sex or race/ethnicity were assessed using a series of four cumulative logit models. The dependent variable in each series of models was a GSS QWL variable. These models evaluated the odds of a respondent indicating a higher degree of work stressor exposure relative to the reference category. The survey year, sex, race/ethnicity reference categories were 2010, male, and non-Hispanic white, respectively. The first model included either sex or race/ethnicity as the only independent variable to examine the bivariate relationship. The second model included survey year as the only independent variable. The third model included survey year and either sex or race/ethnicity with the same reference categories used in prior models. Model four was model three with the addition of a sex*survey year or race/ethnicity*survey year interaction term. The proportional odds assumption was evaluated using the score test, which is a chi-square based test. If the proportional odds assumption was violated, an alternative model allowing for non-proportional odds was substituted. The Wald χ^2 test was used to assess the statistical significance of the independent variable's coefficients.

Next, a series of four generalized linear models were used to study the relationship between the work environment stressor scale total sum score or its individually summed sub-scales scores and respondents' survey year and sex or race/ethnicity. The reference categories for survey year, sex, and race/ethnicity were 2010, male and non-Hispanic white, respectively. The first model included sex or race/ethnicity as the only independent variable to examine the bivariate relationship. The second model included survey year as the only independent variable. Model three included survey year and either sex or race/ethnicity with the same reference categories used in prior models. Model four was model three with the addition of a sex*survey year or race/ethnicity*survey year interaction term. The Wald χ^2 test was used to assess the statistical significance of the independent variable's coefficients.

Specific Aim Three Hypotheses and Analysis Plan

The third and final specific aim for this dissertation investigated if the exposure to psychosocial work environment characteristics, namely those whose presence in the work environment contributes to its stressfulness, are related to health measures. To investigate the specific aim, the following four hypotheses were proposed:

1. Exposure to psychosocial work environment characteristics is associated with more reported days of poor mental and physical health.
2. Exposure to psychosocial work environment characteristics is associated with more reported days of limited engagement in usual activities due to poor health.
3. Exposure to psychosocial work environment characteristics is associated with poorer self-rated health.
4. Exposure to psychosocial work environment characteristics mediates the relationship between health measures and sex and race/ethnicity.

Hypothesis One

The bivariate relationship between responses to each of the 27 GSS QWL variables and responses to the GSS questions “Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?” and “Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?” were assessed using negative binomial regression modeling. The GSS QWL variable reference category was always the lowest stress response option. The Wald χ^2 test was used to assess the statistical significance of the independent variable’s coefficients.

Next, three negative binomial regression models were used to assess the relationship between the 27-item work environment stressors scale total sum scores or individually summed sub-scales scores and days or poor mental or physical health during the past 30 days; days of poor mental or physical health were the dependent variables. In the first model, the 27-item work environment stressor scale total sum score was the independent variable. In the second model, the five individually summed sub-scale scores were separately and simultaneously included in the model, i.e., five separate variables. In the third model, individuals were grouped by quintiles according to their 27-item work environment stressor scale total sum scores, the lowest quintile (lowest stressor exposure) used as the reference category. The Wald χ^2 test was used to assess the statistical significance of the independent variable's coefficients.

Hypothesis Two

The bivariate relationship between responses to each of the 27 GSS QWL variables and responses to the GSS question "During the past 30 days, for about how many days did your poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?" was assessed using negative binomial regression modeling. A model was generated for each of the 27 GSS QWL variables. The GSS QWL variable reference category was always the lowest stress response option. The Wald χ^2 test was used for evaluating statistical significance of the coefficients.

Next, three negative binomial regression models were used to assess the relationship between the 27-item work environment stressor scale total sum score or individually summed sub-scales scores and days of limited engagement in usual activities during the past 30 days; days of limited activity was the dependent variable. In the first model, the 27-item work environment stressors scale total sum scores was the independent variable. In the second model, the five individually summed sub-scale scores were simultaneously included in the model, i.e., five separate variables. In the third model, individuals were grouped by quintiles according to their 27-item work environment stressors scale total sum scores, the lowest quintile (lowest stressor exposure) used as the reference category. The Wald χ^2 test was used to assess the statistical significance of the independent variable's coefficients.

Hypothesis Three

The bivariate relationship between responses to each of the 27 GSS QWL variables and the respondents' self-rated general health were assessed with Pearson Chi-square (χ^2) and Cochran-Mantel-Haenszel Chi-square (CMH χ^2) test statistics. Next, generalized linear models were used to study the relationship between the 27-item work environment stressors scale sum scores or the individually summed five sub-scale scores and respondents' self-rated general health. The 27-item work environment stressor scale total sum score or five individually summed sub-scale scores were the dependent variables while self-reported general health was the independent variable. The reference category for self-reported health was excellent. Finally, three cumulative logit models were used to study the relationship between self-rated health and work environment stressors scale scores. The first model included the continuous 27-item work environment stressors scale total sum scores as the independent variable. The second model replaced the 27-item total score variable with five separately summed sub-scale scores simultaneously. The last model included individuals grouped by quintiles according to their 27-item work environment stressors scale total sum scores with the lowest quintile (lowest stressor exposure) used as the reference category. The Wald χ^2 test was used to assess the statistical significance of the independent variable's coefficients.

Hypothesis Four

A series of ten negative binomial or cumulative logit models were used to assess the mediating effect of work environment stressors on the relationship between each of the four measures of health and sex and/or race/ethnicity. Days of poor mental health, physical health, limited engagement in usual activity due to poor health were modeled with negative binomial regression while self-rated general health with cumulative logit models. The independent variables in each sequence of models was the same for all four health measures. In model one, sex was the only independent variable. The reference category was male. In model two, individuals' sex and their 27-item work environment stressor scale total sum score were the two independent variables. In model three, race/ethnicity was the only independent variable and the reference category was non-Hispanic white. In model four the independent variables were individuals' race/ethnicity and their 27-item work environment scale total sum scores. In the fifth model, sex and race/ethnicity were both included using the same reference categories as before. In model six, the 27-item work environment stressors scale total sum scores were included with sex and race/ethnicity. Model 7 was the same as the fifth model but included age, education, marital status, income, and survey year as independent variables. Model eight was the same as the seventh model but included the 27-item work environment stressors scale total sum scores. Models nine was the same as model seven but included the five separately summed work environment stressor sub-constructs simultaneously. Model ten was the same as model seven but included individuals grouped by quintiles according to their 27-item work environment stressors scale total sum scores with the lowest quintile (lowest stressor exposure) used as the reference category. The Wald χ^2 test was used to assess the statistical significance of the independent variables' coefficients. For the cumulative logit models, the proportional odds assumption was evaluated using the score test, a chi-square-based test. If the proportional odds assumption was violated, an alternative model allowing for non-proportional odds was substituted.

Chapter 4 Results

SAMPLE CHARACTERISTICS

Table 8 displays the descriptive statistics of the 2002, 2004, 2010, and 2014 GSS NIOSH QWL respondents. Overall, females represented 53.4% of the respondents, a low of 52.7% in 2002 and a high of 56.8% in 2010. The overall mean age was 41.8 years, with a low of 40.4 years in 2002 and a high of 43.1 years in 2010. Slightly more than half of the overall sample obtained a high school degree (51.5%), the highest in 2002 (54.4%) and the lowest in 2014 (49.3%). Married respondents accounted for 48.3% of the overall sample while never married respondents were the second largest at 28.2%. Stated in the methods chapter, most respondents reported an income of at least $25,000 per year, i.e., 75% of the original sample. Although this is not an optimal measure of income due to its low variability, the GSS did not include an income question with greater granularity for these survey years.

Table 8 Descriptive characteristics of the 2002, 2006, 2010, and 2014 GSS NIOSH QWL module respondents

	Overall†		Overall‡		2002		2006		2010		2014	
	N	%	N	%	N	%	N	%	N	%	N	%
	3840		4236		1315		1240		813		868	
Age (years)	41.7*	12.7§	41.8*	12.8§	40.4*	12.6§	41.6*	12.6§	43.1*	13.1§	43.0*	13.1§
Sex (Female)	2074	54.0	2304	53.4	693	52.7	676	54.5	462	56.8	473	54.5
Race/Ethnicity												
Non-Hispanic White	2946	76.7	3259	76.9	1043	79.3	964	77.7	633	77.9	619	71.3
Non-Hispanic Black	642	16.7	698	16.5	216	16.4	204	16.5	120	14.8	158	18.2
Mexican American	252	6.6	279	6.6	56	4.3	72	5.8	60	7.4	91	10.5
Highest Degree												
Less than HS	284	7.4	310	7.3	124	9.4	71	5.7	55	6.8	60	6.9
HS	2007	52.3	2182	51.5	715	54.4	632	51.0	401	49.3	434	50.0
Junior College	381	9.9	414	9.8	120	9.1	143	11.5	68	8.4	83	9.6
Bachelor	755	19.7	847	20.0	239	18.2	253	20.4	173	21.3	182	21.0
Graduate	413	10.8	483	11.4	117	8.9	141	11.4	116	14.3	109	12.6
Marital Status												
Married	1848	48.1	2044	48.3	609	46.3	620	50.0	402	49.4	413	47.6
Widowed	112	2.9	131	3.1	38	2.9	40	3.2	24	3.0	29	3.3
Divorced	663	17.3	724	17.1	226	17.2	222	17.9	140	17.2	136	15.7
Separated	124	3.2	141	3.3	54	4.1	38	3.1	27	3.3	22	2.5
Never Married	1093	28.5	1196	28.2	388	29.5	320	25.8	220	27.1	268	30.9
Total Family Income												
≥ $25K	3165	82.4	3489	82.4	1053	80.1	1036	83.5	655	80.6	745	85.8
$20K to $24.9K	245	6.4	262	6.2	87	6.6	68	5.5	56	6.9	51	5.9
$15K to $19.9K	138	3.6	154	3.6	61	4.6	47	3.8	27	3.3	19	2.2
$10K to $14.9K	148	3.9	161	3.8	60	4.6	47	3.8	32	3.9	22	2.5
$8K to $9.9K	37	1.0	45	1.1	16	1.2	11	0.9	9	1.1	9	1.0

† = No imputated data; ‡ = Contains imputated data; * = Mean; § = Standard deviation

Table 8 Descriptive characteristics of the 2002, 2006, 2010, and 2014 NIOSH GSS QWL module respondents (continued)

	Overall†		Overall‡		2002		2006		2010		2014	
	N	%	N	%	N	%	N	%	N	%	N	%
	3840		4236		1315		1240		813		868	
Total Family Income												
$7K to $7.9K	17	0.4	20	0.5	7	0.5	5	0.4	2	0.2	6	0.7
$6K to $6.9K	14	0.4	16	0.4	3	0.2	3	0.2	5	0.6	5	0.6
$5Kto $5.9K	14	0.4	21	0.5	9	0.7	4	0.3	5	0.6	3	0.3
$4K to $4.9K	13	0.3	14	0.3	3	0.2	6	0.5	2	0.2	3	0.3
$3K to $3.9K	19	0.5	20	0.5	7	0.5	8	0.6	4	0.5	1	0.1
$1K- $2.9K	18	0.5	19	0.4	5	0.4	3	0.2	9	1.1	2	0.2
< $1K	12	0.3	15	0.4	4	0.3	2	0.2	7	0.9	2	0.2

† = No imputated data; ‡ = Contains imputated data; * = Mean; § = Standard deviation

Tables 9 shows the reported frequencies of 2010 Census/BLS standard occupational classifications (SOC) overall and stratified by sex and race/ethnicity. For males, the dominant category was production & transportation at 20.3%; only 5% of females reported jobs within this SOC. For females, the dominant category was sales & office occupations representing 33.1% followed by professional & related at 26.1%; conversely, these categories only represented 17.1% and 17.8% of males' jobs. The results of Pearson χ^2 tests indicated males were statistically overrepresented in production & transportation and construction & maintenance occupations and underrepresented in sales & office and professional & related occupations while females' representations in these occupations are opposite in terms of over and under-representation (χ^2 p-value < .0001).

For non-Hispanic whites the dominant occupational classifications were the sales & office (25.1%) and professional & related (23.9%). For non-Hispanic blacks the dominant categories were sales & office (28.9%) and service (26.4%). The dominant occupations for Mexican Americans were the same as those for non-Hispanic blacks but with percentages of 25.2% and 23.2%, respectively. Like the distribution of occupations across the sexes, the proportions of occupations across the race/ethnicities was also different than would have been expected against the belief of each group being equally likely to fill the various occupations (χ^2 p-value < .0001). Non-Hispanic whites are overrepresented in business & finance and professional & related occupations while underrepresented in service & production & transportation occupations (table 3). Non-Hispanic blacks are underrepresented in business & finance, professional & related, and construction & maintenance occupations and overrepresented in service & production & transportation occupations. Finally, Mexican Americans are underrepresented in business

& finance occupations and overrepresented in service and construction & maintenance occupations.

Table 9 Distribution of the 2002, 2006, 2010, and 2014 GSS QWL module respondents across the U.S. Census occupational classifications overall and stratified by sex and race/ethnicity (N=3819)

	Total		Male		Female	
	N	%	N	%	N	%
Business & Finance	538	14.1%	237	13.5%	301	14.6%
Professional & Related	852	22.3%	313	17.8%	539	26.1%
Service	666	17.4%	262	14.9%	404	19.6%
Sales & Office	983	25.7%	300	17.1%	683	33.1%
Construction & Maintenance	286	7.5%	260	14.8%	26	1.3%
Production & Transportation	460	12.0%	356	20.3%	104	5.0%
Active Military	34	0.9%	27	1.5%	7	0.3%
Total	3819	100.0%	1755	100.0%	2064	100.0%
	Non-Hispanic White		**Non-Hispanic Black**		**Mexican American**	
	N	%	N	%	N	%
Business & Finance	467	15.9%	51	8.0%	20	8.0%
Professional & Related	701	23.9%	109	17.1%	42	16.8%
Service	440	15.0%	168	26.4%	58	23.2%
Sales & Office	736	25.1%	184	28.9%	63	25.2%
Construction & Maintenance	225	7.7%	29	4.6%	32	12.8%
Production & Transportation	339	11.6%	87	13.7%	34	13.6%
Active Military	25	0.9%	8	1.3%	1	0.4%
Total	2933	100.0%	636	100.0%	250	100.0%

Tests of association: occupation & sex χ^2 p-value <0.0001; occupation & race/ethnicity χ^2 p-value <0.0001.

Table 10 Differences between observed and expected counts of the 2002, 2006, 2010, 2014 GSS QWL module respondents U.S. Census occupational classifications stratified by sex and race/ethnicity (N=3819)						
			Male		Female	
			N	%	N	%
Business & Finance			-9.4	-4.2	9.4	3.9
Professional & Related			-61.9	-18.5	61.9	16.9
Service			-27.6	-13.2	27.6	12.0
Sales & Office			-111.6	-31.8	111.6	28.9
Construction & Maintenance			100.8	94.1	-100.8	-85.6
Production & Transportation			101.5	62.9	-101.5	-57.2
Active Military			8.1	68.0	-8.1	-61.8
	Non-Hispanic White		Non-Hispanic Black		Mexican American	
	N	%	N	%	N	%
Business & Finance	24.4	12.9	-14.1	-45.3	-10.3	-59.5
Professional & Related	22.9	9.2	-19.0	-46.4	-3.8	-16.8
Service	-26.6	-12.7	19.7	57.3	6.9	36.1
Sales & Office	0.2	0.1	3.7	9.4	-3.9	-17.7
Construction & Maintenance	1.0	0.5	-11.1	-32.5	10.0	52.9
Production & Transportation	-20.4	-7.2	18.3	39.3	2.0	7.8
Active Military	-1.5	-6.9	2.5	69.6	-1.0	-49.2

Negative values represent counts less than expected while positive values represent counts more than expected.

WORK ENVIRONMENT CHARACTERISTICS

Table 11 displays the means, standard deviations, item-total correlations, and a matrix of polychoric correlation coefficients of the 27 GSS QWL variables used to construct the work environment stressor total sum scale. The three lowest item-total correlation coefficients were .22, .24, and .25 for the GSS QWL variables learnnew, workdiff, and overwork, respectively while the three highest were .7, .67, and .65 for the GSS QWL variables trustman, wksmooth, and manvsemp, respectively. The mean of the correlation coefficients was .5 (*SD* = .14). Regarding the correlation matrix, only four coefficients were statistically non-significant (p-values > .5), those for the GSS QWL variables of worktime*wkdecide, overwork*wkdecide, famwkoff*learnnew, and haveinfo*learnnew.

Table 11 Means, standard deviations, item-total correlations, and polychoric correlation matrix for the 2002, 2004, 2010, and 2014 GSS QWL module respondents (N=3840)

		Std.	Item-total	Work Load Stressors					Work Structural Stressors			
	Mean	Dev.	Correlation	wrktime	overwork	toofewwk	condemnd	famwkoff	prodctiv	wksmooth	haveinfo	hlpequip
wrktime	1.84	0.85	0.43	1.00								
overwork	2.28	0.72	0.24	0.47	1.00							
toofewwk	2.81	0.93	0.30	0.46	0.35	1.00						
condemnd	2.15	0.87	0.44	0.48	0.25	0.29	1.00					
famwkoff	1.95	0.98	0.27	0.25	0.25	0.21	0.23	1.00				
prodctiv	1.91	0.68	0.56	0.30	0.20	0.19	0.31	0.18	1.00			
wksmooth	2.12	0.75	0.67	0.40	0.19	0.32	0.38	0.17	0.64	1.00		
haveinfo	1.51	0.65	0.49	0.49	0.26	0.29	0.37	0.15	0.41	0.50	1.00	
hlpequip	1.73	0.80	0.58	0.54	0.32	0.41	0.39	0.22	0.45	0.53	0.63	1.00
supcares	1.71	0.87	0.60	0.31	0.17	0.20	0.39	0.23	0.40	0.48	0.39	0.44
suphelp	1.72	0.85	0.60	0.44	0.18	0.22	0.40	0.23	0.41	0.50	0.45	0.50
manvsemp	2.11	0.97	0.65	0.39	0.16	0.32	0.38	0.22	0.43	0.62	0.43	0.49
trustman	2.02	0.82	0.70	0.32	0.17	0.28	0.35	0.18	0.57	0.72	0.45	0.48
respect	1.74	0.66	0.63	0.25	0.17	0.21	0.34	0.22	0.56	0.60	0.39	0.42
wkpraise	1.65	0.77	0.52	0.28	0.10	0.22	0.29	0.22	0.35	0.41	0.31	0.38
promtefr	2.13	0.97	0.58	0.32	0.12	0.23	0.36	0.18	0.37	0.49	0.39	0.46
cowrkhlp	1.60	0.73	0.50	0.42	0.18	0.25	0.33	0.19	0.35	0.45	0.39	0.47
cowrkint	1.77	0.79	0.53	0.25	0.09	0.17	0.32	0.16	0.36	0.41	0.35	0.35
safehlth	1.72	0.63	0.58	0.24	0.14	0.16	0.23	0.17	0.57	0.60	0.33	0.40
safetywk	1.69	0.69	0.57	0.19	0.15	0.14	0.22	0.15	0.52	0.54	0.33	0.36
safefrst	1.72	0.71	0.54	0.22	0.16	0.15	0.24	0.14	0.52	0.53	0.30	0.34
teamsafe	1.76	0.67	0.63	0.26	0.14	0.17	0.28	0.15	0.57	0.62	0.34	0.41
workdiff	1.70	0.68	0.25	-0.07	-0.07[a]	-0.06[a]	0.00	0.05[a]	0.31	0.22	0.09	0.06[a]
opdevel	1.90	0.86	0.53	0.15	0.06[a]	0.11	0.23	0.15	0.43	0.40	0.33	0.38
learnnew	1.73	0.76	0.22	-0.13	-0.15	-0.09	-0.04[b]	0.01[f]	0.23	0.16	0.02[g]	0.07[c]
wkdecide	1.83	0.88	0.31	0.02[d]	-0.0007[e]	-0.06[a]	0.09	0.11	0.22	0.21	0.14	0.15
wkfreedm	1.65	0.82	0.45	0.26	0.13	0.12	0.35	0.28	0.31	0.35	0.41	0.35

a = p-value <0.01; b = p-value < 0.05; c = p-value <0.001; d = p-value = 0.32; e = p-value = 0.97; f = p-value = 0.59; g = p-value = 0.27;
All other polychoric correlation coefficient p-values <0.0001

Table 11 Means, standard deviations, item-total correlations, and polychoric correlation matrix for the 2002, 2004, 2010, and 2014 GSS QWL module respondents (N=3840) (continued)

		Std.	Item-total	Work Relational Stressors								
	Mean	Dev.	Correlation	supcares	suphelp	manvsemp	trustman	respect	wkpraise	promtefr	cowrkhlp	cowrkint
wrktime	1.84	0.85	0.43									
overwork	2.28	0.72	0.24									
toofewwk	2.81	0.93	0.30									
condemnd	2.15	0.87	0.44									
famwkoff	1.95	0.98	0.27									
prodctiv	1.91	0.68	0.56									
wksmooth	2.12	0.75	0.67									
haveinfo	1.51	0.65	0.49									
hlpequip	1.73	0.80	0.58									
supcares	1.71	0.87	0.60	1.00								
suphelp	1.72	0.85	0.60	0.69	1.00							
manvsemp	2.11	0.97	0.65	0.54	0.54	1.00						
trustman	2.02	0.82	0.70	0.56	0.53	0.67	1.00					
respect	1.74	0.66	0.63	0.48	0.46	0.53	0.73	1.00				
wkpraise	1.65	0.77	0.52	0.52	0.54	0.48	0.48	0.46	1.00			
promtefr	2.13	0.97	0.58	0.55	0.53	0.56	0.53	0.42	0.45	1.00		
cowrkhlp	1.60	0.73	0.50	0.45	0.51	0.46	0.41	0.41	0.39	0.42	1.00	
cowrkint	1.77	0.79	0.53	0.54	0.49	0.46	0.45	0.46	0.47	0.49	0.49	1.00
safehlth	1.72	0.63	0.58	0.42	0.36	0.45	0.62	0.61	0.36	0.40	0.34	0.36
safetywk	1.69	0.69	0.57	0.43	0.37	0.43	0.62	0.56	0.34	0.38	0.31	0.33
safefrst	1.72	0.71	0.54	0.38	0.34	0.40	0.55	0.52	0.29	0.36	0.29	0.31
teamsafe	1.76	0.67	0.63	0.46	0.42	0.50	0.65	0.59	0.38	0.43	0.36	0.39
workdiff	1.70	0.68	0.25	0.16	0.16	0.13	0.25	0.33	0.20	0.14	0.16	0.24
opdevel	1.90	0.86	0.53	0.43	0.40	0.41	0.42	0.42	0.42	0.46	0.35	0.45
learnnew	1.73	0.76	0.22	0.17	0.12	0.10	0.21	0.30	0.17	0.16	0.15	0.22
wkdecide	1.83	0.88	0.31	0.24	0.24	0.21	0.25	0.28	0.27	0.23	0.22	0.31
wkfreedm	1.65	0.82	0.45	0.40	0.32	0.36	0.38	0.40	0.32	0.37	0.30	0.40

a = p-value <0.01; b = p-value < 0.05; c = p-value <0.001; d = p-value = 0.32; e = p-value = 0.97; f = p-value = 0.59; g = p-value = 0.27;
All other polychoric correlation coefficient p-values <0.0001

Table 11 Means, standard deviations, item-total correlations, and polychoric correlation matrix for the 2002, 2004, 2010, and 2014 GSS QWL module respondents (N=3840) (continued)

		Std.	Item-total	Work Safety Stressors				Work Developmental Stressors				
	Mean	Dev.	Correlation	safehlth	safetywk	safefrst	teamsafe	workdiff	opdevel	learnnew	wkdecide	wkfreedm
wrktime	1.84	0.85	0.43									
overwork	2.28	0.72	0.24									
toofewwk	2.81	0.93	0.30									
condemnd	2.15	0.87	0.44									
famwkoff	1.95	0.98	0.27									
prodctiv	1.91	0.68	0.56									
wksmooth	2.12	0.75	0.67									
haveinfo	1.51	0.65	0.49									
hlpequip	1.73	0.80	0.58									
supcares	1.71	0.87	0.60									
suphelp	1.72	0.85	0.60									
manvsemp	2.11	0.97	0.65									
trustman	2.02	0.82	0.70									
respect	1.74	0.66	0.63									
wkpraise	1.65	0.77	0.52									
promtefr	2.13	0.97	0.58									
cowrkhlp	1.60	0.73	0.50									
cowrkint	1.77	0.79	0.53									
safehlth	1.72	0.63	0.58	1.00								
safetywk	1.69	0.69	0.57	0.78	1.00							
safefrst	1.72	0.71	0.54	0.75	0.80	1.00						
teamsafe	1.76	0.67	0.63	0.84	0.83	0.82	1.00					
workdiff	1.70	0.68	0.25	0.31	0.29	0.28	0.28	1.00				
opdevel	1.90	0.86	0.53	0.36	0.34	0.34	0.37	0.38	1.00			
learnnew	1.73	0.76	0.22	0.26	0.25	0.21	0.26	0.56	0.43	1.00		
wkdecide	1.83	0.88	0.31	0.27	0.26	0.22	0.27	0.31	0.39	0.32	1.00	
wkfreedm	1.65	0.82	0.45	0.27	0.28	0.24	0.30	0.20	0.48	0.15	0.28	1.00

a = p-value <0.01; b = p-value < 0.05; c = p-value <0.001; d = p-value = 0.32; e = p-value = 0.97; f = p-value = 0.59; g = p-value = 0.27;
All other polychoric correlation coefficient p-values <0.0001

Tables 12 through 16 contain descriptive statistics, several correlation coefficients, coefficients of reliability (Cronbach's α) of the individually summed work environment stressors sub-scales. The work load stressor sum scale comprises five GSS QWL variables with unstandardized and standardized Cronbach's α of .63 and .64, respectively (table 12). All the scale's items demonstrated positive and statistically significant (p-values < .0001) correlation coefficients. The item-item polychoric correlation coefficients ranged from .2 (famwkoff*condemnd & famwkoff*toofewwk) to .47 (wrktime*overwork & worktime*toofewwk) while the item-total correlation coefficients from .3 (famwkoff) to .59 (wrktime).

Table 12 Descriptive statistics, correlations, and coefficients of reliability of the work load stressors scale for the 2002-2014 GSS responses (N=4236)

	Mean	SD	Median	IQR	Range	Mode	Max	Min
Work Load Stressors (5-items)	10.98	2.83	11	4	16	11	20	4
wrktime	1.84	0.85	2	1	3	2	4	1
overwork	2.27	0.73	2	1	3	2	4	1
toofewwk	2.80	0.94	3	2	3	3	4	1
condemnd	2.11	0.92	2	1	3	2	4	1
famwkoff	1.96	0.99	2	2	3	1	4	1

Table 12 Descriptive statistics, correlations, and coefficients of reliability of the work load stressors scale for the 2002-2014 GSS responses (N=4236) (continued)

	Correlations				
	wrktime	overwork	toofewwk	condemnd	famwkoff
Work Load Stressors (5-items)	0.59	0.44	0.43	0.39	0.30
wrktime	1.00	0.47	0.47	0.45	0.25
overwork	0.39	1.00	0.34	0.23	0.24
toofewwk	0.39	0.30	1.00	0.27	0.20
condemnd	0.39	0.21	0.24	1.00	0.20
famwkoff	0.21	0.21	0.17	0.18	1.00

Spearman correlations: all p-values <0.0001; Polychoric correlations (gray): all p-values <0.0001

Table 12 Descriptive statistics, correlations, and coefficients of reliability of the work load stressors scale for the 2002-2014 GSS responses (N=4236) (continued)

	Unstandardized		Standardized	
Work Load Stressors (5-items)	Item-total Pearson Correlations	Cronbach α (with item removed)	Item-total Pearson Correlations	Cronbach α (with item removed)
wrktime	0.53	0.51	0.54	0.52
overwork	0.41	0.58	0.41	0.59
toofewwk	0.40	0.58	0.40	0.59
condemnd	0.37	0.59	0.37	0.60
famwkoff	0.27	0.64	0.27	0.65

5-item summed scale Cronbach's α: unstandardized = 0.63; standardized = 0.64

The work structural stressor sum scale comprises four GSS QWL variables with unstandardized and standardized Cronbach's alpha both equal to .74 (table 13). All the scale's items demonstrated positive and statistically significant (p-values < .0001) correlation coefficients. The item-item polychoric correlation coefficients ranged from .43 (hlpequip*prodctiv) to .62 (hlpequip*haveinfo) and the item-total polychoric correlation coefficients ranged from .58 (prodctiv) to .65 (wksmooth).

Table 13 Descriptive statistics, correlations, and coefficients of reliability of the work structural stressors scale for the 2002-2014 GSS responses (N=4236)

	Mean	SD	Median	IQR	Range	Mode	Max	Min
Work Structural Stressors (4-items)	7.27	2.18	7	2	12	6	16	4
prodctiv	1.91	0.69	2	1	3	2	4	1
wksmooth	2.11	0.76	2	1	3	2	4	1
haveinfo	1.51	0.65	1	1	3	1	4	1
hlpequip	1.74	0.80	2	1	3	1	4	1

Table 13 Descriptive statistics, correlations, and coefficients of reliability of the work structural stressors scale for the 2002-2014 GSS responses (N=4236) (continued)

	Correlations			
	prodctiv	wksmooth	haveinfo	hlpequip
Work Structural Stressors (4-items)	0.58	0.65	0.59	0.61
prodctiv	1.00	0.61	0.47	0.43
wksmooth	0.54	1.00	0.47	0.51
haveinfo	0.30	0.36	1.00	0.62
hlpequip	0.36	0.43	0.50	1.00

Spearman correlations: all p-values <0.0001; Polychoric correlations (gray): all p-values <0.0001

Table 13 Descriptive statistics, correlations, and coefficients of reliability of the work structural stressors scale for the 2002-2014 GSS responses (N=4236) (continued)

	Unstandardized		Standardized	
Work Structural Stressors (4-items)	Item-total Pearson Correlations	Cronbach α (with item removed)	Item-total Pearson Correlations	Cronbach α (with item removed)
prodctiv	0.50	0.70	0.50	0.70
wksmooth	0.58	0.65	0.58	0.65
haveinfo	0.50	0.70	0.50	0.70
hlpequip	0.55	0.67	0.55	0.67

4-item summed scale Cronbach's α: unstandardized = 0.74; standardized = 0.74

The nine GSS QWL variable sum scale of work relational stressors had unstandardized and standardized Cronbach's alpha of .85 and .86, respectively (table 14). All the correlation coefficients were positive and statistically significant (p-values < .0001). The item-item polychoric correlation coefficients ranged from .35 (promtefr*respect) to .67 (suphelp*supcares) while the item-total polychoric correlation coefficients ranged from .54 (promtefr) to .69 (trustman).

Table 14 Descriptive statistics, correlations, and coefficients of reliability of the work relational stressors scale for the 2002-2014 GSS responses (N=4236)

	Mean	SD	Median	IQR	Range	Mode	Max	Min
Work Relational Stressors (9-items)	16.31	5.19	16	7	29	12	36	7
supcares	1.70	0.88	1	1	3	1	4	1
suphelp	1.72	0.89	2	1	3	1	4	1
manvsemp	2.10	0.98	2	2	4	2	5	1
trustman	2.01	0.82	2	1	3	2	4	1
respect	1.73	0.67	2	1	3	2	4	1
wkpraise	1.65	0.78	1	1	2	1	3	1
promtefr	2.03	1.05	2	2	3	2	4	1
cowrkhlp	1.60	0.73	1	1	3	1	4	1
cowrkint	1.76	0.79	2	1	3	2	4	1

Table 14 Descriptive statistics, correlations, and coefficients of reliability of the work relational stressors scale for the 2002-2014 GSS responses (N=4236) (continued)

Work Relational Stressors (9-items)	Correlations								
	supcares	suphelp	manvsemp	trustman	respect	wkpraise	promtefr	cowrkhlp	cowrkint
	0.68	0.68	0.68	0.69	0.62	0.58	0.54	0.55	0.58
supcares	1.00	0.67	0.51	0.53	0.46	0.49	0.45	0.42	0.48
suphelp	0.57	1.00	0.52	0.51	0.43	0.52	0.42	0.50	0.45
manvsemp	0.44	0.45	1.00	0.65	0.51	0.46	0.47	0.44	0.44
trustman	0.44	0.43	0.57	1.00	0.68	0.46	0.45	0.39	0.42
respect	0.36	0.35	0.41	0.60	1.00	0.42	0.35	0.39	0.42
wkpraise	0.40	0.41	0.39	0.37	0.32	1.00	0.36	0.37	0.43
promtefr	0.41	0.39	0.44	0.42	0.29	0.32	1.00	0.36	0.41
cowrkhlp	0.35	0.41	0.38	0.32	0.30	0.28	0.31	1.00	0.47
cowrkint	0.41	0.38	0.39	0.36	0.35	0.35	0.37	0.38	1.00

Spearman correlations: all p-values <0.0001; Polychoric correlations (gray): all p-values <0.0001

Table 14 Descriptive statistics, correlations, and coefficients of reliability of the work relational stressors scale for the 2002-2014 GSS responses (N=4236) (continued)

	Unstandardized		Standardized	
Work Relational Stressors (9-items)	Item-total Pearson Correlations	Cronbach α (with item removed)	Item-total Pearson Correlations	Cronbach α (with item removed)
supcares	0.64	0.83	0.63	0.84
suphelp	0.63	0.83	0.63	0.84
manvsemp	0.65	0.83	0.65	0.83
trustman	0.66	0.83	0.66	0.83
respect	0.56	0.84	0.57	0.84
wkpraise	0.53	0.84	0.53	0.85
promtefr	0.53	0.85	0.53	0.85
cowrkhlp	0.49	0.85	0.49	0.85
cowrkint	0.54	0.84	0.54	0.85

9-item summed scale Cronbach's α: unstandardized = 0.85, standardized = 0.86

The work safety stressor sum scale comprises four GSS QWL variables with unstandardized and standardized Cronbach's alpha of .89 for both (table 15). All the correlation coefficients were positive and statistically significant (p-values < .0001). The item-item polychoric correlation coefficients ranged from .7 (safefrst*safehlth) to .8 (teamsafe*safehlth) while the item-total polychoric correlation coefficients ranged from .78 (safefrst) to .85 (teamsafe).

Table 15 Descriptive statistics, correlations, and coefficients of reliability of the work safety stressors scale for the 2002-2014 GSS responses (N=4236)

	Mean	SD	Median	IQR	Range	Mode	Max	Min
Work Safety Stressors (4-items)	6.87	2.34	7	4	15	8	16	1
safehlth	1.72	0.63	2	1	3	2	4	1
safetywk	1.68	0.69	2	1	3	2	4	1
safefrst	1.71	0.71	2	1	3	2	4	1
teamsafe	1.76	0.68	2	1	3	2	4	1

Table 15 Descriptive statistics, correlations, and coefficients of reliability of the work safety stressors scale for the 2002-2014 GSS responses (N=4236) (continued)

	Correlations			
	safehlth	safetywk	safefrst	teamsafe
Work Safety Stressors (4-items)	0.81	0.80	0.78	0.85
safehlth	1.00	0.73	0.70	0.80
safetywk	0.64	1.00	0.72	0.78
safefrst	0.64	0.68	1.00	0.76
teamsafe	0.72	0.69	0.71	1.00

Spearman correlations: all p-values <0.0001; Polychoric correlations (gray): all p-values <0.0001

Table 15 Descriptive statistics, correlations, and coefficients of reliability of the work safety stressors scale for the 2002-2014 GSS responses (N=4236) (continued)

	Unstandardized		Standardized	
Work Safety Stressors (4-items)	Item-total Pearson Correlations	Cronbach α (with item removed)	Item-total Pearson Correlations	Cronbach α (with item removed)
safehlth	0.72	0.86	0.72	0.86
safetywk	0.75	0.85	0.75	0.85
safefrst	0.74	0.86	0.73	0.86
teamsafe	0.80	0.83	0.80	0.84

4-item summed scale Cronbach's α: unstandardized = 0.89; standardized = 0.89

Finally, the five GSS QWL variable work developmental stressor sum scale had unstandardized and standardized Cronbach alphas of .67 for both (table 16). All the correlation coefficients were positive and statistically significant (p-values < .0001). The item-item polychoric correlation coefficients ranged from .16 (wkfreedm*learnnew) to .55 (learnnew*workdiff) while the item-total polychoric coefficients ranged from .39 (wkfreedm) to .57 (opdevel).

Table 16 Descriptive statistics, correlations, and coefficients of reliability of the work developmental stressors scale for the 2002-2014 GSS QWL responses (N=4236)

	Mean	SD	Median	IQR	Range	Mode	Max	Min
Work Developmental Stressors (5-items)	8.84	2.66	9	3	14	7	19	5
workdiff	1.71	0.69	2	1	3	2	4	1
opdevel	1.91	0.87	2	1	3	2	4	1
learnnew	1.73	0.76	2	1	3	1	4	1
wkdecide	1.84	0.89	2	1	3	1	4	1
wkfreedm	1.65	0.82	1	1	3	1	4	1

Table 16 Descriptive statistics, correlations, and coefficients of reliability of the work developmental stressors scale for the 2002-2014 GSS QWL responses (N=4236) (continued)

	Correlations				
	workdiff	opdevel	learnnew	wkdecide	wkfreedm
Work Developmental Stressors (5-items)	0.49	0.57	0.49	0.43	0.39
workdiff	1.00	0.37	0.55	0.30	0.21
opdevel	0.31	1.00	0.42	0.38	0.49
learnnew	0.47	0.35	1.00	0.32	0.16
wkdecide	0.24	0.31	0.26	1.00	0.28
wkfreedm	0.16	0.39	0.12	0.22	1.00

Spearman correlations: all p-values <0.0001; Polychoric correlations (gray): all p-values <0.0001

Table 16 Descriptive statistics, correlations, and coefficients of reliability of the work developmental stressors scale for the 2002-2014 GSS QWL responses (N=4236) (continued)

	Unstandardized		Standardized	
Work Developmental Stressors (5-items)	Item-total Pearson Correlations	Cronbach α (with item removed)	Item-total Pearson Correlations	Cronbach α (with item removed)
workdiff	0.42	0.62	0.43	0.62
opdevel	0.54	0.56	0.53	0.57
learnnew	0.43	0.62	0.44	0.61
wkdecide	0.40	0.63	0.39	0.64
wkfreedm	0.35	0.65	0.34	0.66

5-item summed scale Cronbach's α: unstandardized = 0.67, standardized = 0.67

Table 17 displays the Cronbach's alpha of reliability for the 27-item work environment stressor sum scale and individually summed sub-scales using unstandardized variables with (N = 4236) or without (N = 3840) imputation for missing data. The table also includes reliability coefficients for these scales following stratification by respondents' sex, race/ethnicity, and survey year. The overall sample 27-item work environment stressor total sum scale coefficients were .90 and .91 for the samples with and without imputation, respectively. The mean differences between the coefficients with and without imputed data ranged between .005 and .011, i.e., the effect of imputed data was negligible. The coefficients for the 27-item scale following stratification ranged from .89 for Mexican Americans to .91 for females, non-Hispanic whites & blacks, and the 2002, 2010, and 2010 survey year respondents. The work safety stressor and work structural stressor sub-scales demonstrated the greatest consistency across the strata while the former had the highest values, ranging between .87 for Mexican Americans to .91 for females. The work structural stressor scale coefficients ranged between .74 and .75. The work relational stressor scale coefficients of reliability were almost as high as the work safety stressor scale and desirably consistent, ranging between .82 for Mexican Americans and .88 for non-Hispanic blacks; all other stratifications coefficients between these two. The work developmental stressors scale coefficients ranged between .62 for Mexican Americans and .68 for the 2006 survey year. Finally, the work load stressors construct coefficients ranged from .54 for Mexican Americans to .69 for the 2010 survey year.

Table 17 Reliability coefficients for the work environment stressors total sum scale scores and individually summed sub-scale scores overall and stratified by sex, race/ethnicity, and year of survey for the 2002, 2006, 2010, and 2014 GSS QWL responses

	Work Environment Stressors (27-items)		Work Load Stressors (5-items)		Work Structural Stressors (4-items)	
Category	No Imputation	Imputation	No Imputation	Imputation	No Imputation	Imputation
All	0.91	0.90	0.64	0.63	0.75	0.74
Males	0.90	0.89	0.63	0.62	0.74	0.74
Females	0.91	0.91	0.65	0.65	0.75	0.74
Non-Hispanic White	0.91	0.90	0.66	0.65	0.75	0.74
Non-Hispanic Black	0.91	0.91	0.58	0.58	0.75	0.75
Mexican American	0.89	0.89	0.54	0.50	0.74	0.74
2002	0.91	0.90	0.64	0.63	0.75	0.75
2006	0.90	0.90	0.62	0.60	0.74	0.74
2010	0.91	0.91	0.69	0.68	0.74	0.71
2014	0.91	0.90	0.65	0.63	0.75	0.75

Reliability coefficients calculated using unstandardized variables.
Non-imputed sample: All = 3840; Males = 1766, Females = 2074; Non-Hispanic Whites = 2946, Non-Hispanic Blacks = 642, Mexican Americans = 252; Year 2002 = 1209, year 2006 = 1100, year 2010 = 736, year 2014 = 795
Imputed sample: All = 4236; Males = 1932, Females = 2304; Non-Hispanic Whites = 3259, Non-Hispanic Blacks = 698, Mexican Americans = 279; Year 2002 = 1315, year 2006 = 1240, year 2010 = 813, year 2014 = 868

Table 17 Reliability coefficeints for the work environment stressors total sum scale scores and individually summed sub-scale scores overall and stratified by sex, race/ethnicity, and year of survey for the 2002, 2006, 2010, and 2014 GSS QWL responses (continued)

	Work Relational Stressors (9-items)		Work Safety Stressors (4-items)		Work Developmental Stressors (5-items)	
Category	No Imputation	Imputation	No Imputation	Imputation	No Imputation	Imputation
All	0.86	0.85	0.90	0.89	0.67	0.67
Males	0.85	0.85	0.88	0.87	0.67	0.67
Females	0.87	0.86	0.91	0.90	0.66	0.67
Non-Hispanic White	0.86	0.85	0.90	0.89	0.67	0.68
Non-Hispanic Black	0.88	0.87	0.90	0.89	0.65	0.63
Mexican American	0.82	0.80	0.87	0.85	0.62	0.64
2002	0.86	0.85	0.89	0.89	0.67	0.66
2006	0.87	0.85	0.90	0.88	0.68	0.70
2010	0.86	0.86	0.90	0.89	0.66	0.66
2014	0.87	0.86	0.89	0.88	0.65	0.64

Reliability coefficients calculated using unstandardized variables.
Non-imputed sample: All = 3840; Males = 1766, Females = 2074; Non-Hispanic Whites = 2946, Non-Hispanic Blacks = 642, Mexican Americans = 252; Year 2002 = 1209, year 2006 = 1100, year 2010 = 736, year 2014 = 795
Imputed sample: All = 4236; Males = 1932, Females = 2304; Non-Hispanic Whites = 3259, Non-Hispanic Blacks = 698, Mexican Americans = 279; Year 2002 = 1315, year 2006 = 1240, year 2010 = 813, year 2014 = 868

Table 18 shows the results of generalized linear models describing the relationship between the work environment stressor total sum scale scores or five individually summed sub-scale scores and the GSS work orientation module question: “How often do you find your work stressful?” (GSS variable: stress). The work environment stressor scale or sub-scales scores are the dependent variables while the GSS stress variable is the single independent variable. The GSS stress variable response options were never (ref. category), hardly ever, sometimes, often, always. Compared to those who reported never finding their work stressful (mean work environment stressor total sum score of 44.6 (*SD* = 10.7)), all four comparison categories had higher mean work environment stressor total sum scores, i.e., higher exposure to work stressors. The increase was monotonic from hardly ever to always, stepping up from 2.3 to 3.9 to 8.6 to 14.8 points higher on the total work environment stressor scale over those reporting they never find their work stressful. This pattern was the same for the work load stressors, work structural stressors, and work relational stressors sub-scale sum scores. The pattern was also the same for the work safety stressors sum scale but there was no statistical difference between those reporting never and hardly ever finding work stressful. Finally, for the work developmental sub-scale, compared to those reporting never finding work stressful, those reporting hardly ever and always were not statistically different in terms of mean work developmental stressor sum scores while sometimes and often categories reported statistically lower scores, .52 and .64 points lower, respectively.

Table 18 Relationship between the work environment stressors total sum scale score or individually summed sub-scale scores and the GSS work orientation module "stress" variable for the 2002-2014 GSS responses (N=4236)

	Reference Category	Category	Estimate	SE	p-value
Model A: Work Environment Stressors (27-items)	Never	Hardly ever	2.30	0.81	0.0047
		Sometimes	3.94	0.76	<0.0001
		Often	8.63	0.79	<0.0001
		Always	14.87	0.88	<0.0001
Model B: Work Load Stressors (5-items)	Never	Hardly ever	0.65	0.19	0.0005
		Sometimes	1.77	0.17	<0.0001
		Often	3.61	0.18	<0.0001
		Always	4.61	0.20	<0.0001
Model C: Work Structural Stressors (4-items)	Never	Hardly ever	0.58	0.16	0.0002
		Sometimes	0.95	0.14	<0.0001
		Often	1.80	0.15	<0.0001
		Always	2.68	0.17	<0.0001
Model D: Work Relational Stressors (9-items)	Never	Hardly ever	0.90	0.37	0.016
		Sometimes	1.40	0.35	<0.0001
		Often	3.20	0.36	<0.0001
		Always	5.75	0.40	<0.0001
Model E: Work Safety Stressors (4-items)	Never	Hardly ever	0.20	0.17	0.24
		Sometimes	0.35	0.16	0.031
		Often	0.65	0.17	0.0001
		Always	1.62	0.19	<0.0001
Model F: Work Developmental Stressors (5-items)	Never	Hardly ever	-0.04	0.20	0.85
		Sometimes	-0.52	0.18	0.005
		Often	-0.64	0.19	0.001
		Always	0.21	0.22	0.33

GSS variable stress: "How often do you find your work stressful?"

Table 19 contains the results of generalized linear models describing the relationship between the work environment stressor total sum scale scores or five individually summed sub-scale scores and the GSS QWL module question: “How often during the past month have you felt used up at the end of the day?” (GSS variable: usedup).

The work environment stressor sum scale or sub-scales are the dependent variables while the GSS QWL usedup variable is the single independent variable. The GSS QWL usedup variable response options were never (ref. category), rarely, sometimes, often, very often. Compared to the scores for those who reported never feeling used up at the end of the day (mean work environment stressor total sum score of 45.7 (*SD* = 10.4)), the sometimes, often, and very often comparison categories had higher mean work environment stressor total sum scale scores, i.e., higher exposure to work stressors. The increase was monotonic from sometimes to often to very often, stepping up from 3.38 to 6.41 to 9.59 points higher than those reporting never feeling used up at the end of the day. This pattern was the same for the work relational and work safety stressor sub-scales although the difference between sometimes and never was not statistically different for the latter sub-scale. For the work load and work structural sub-scales the mean differences between the reference category and the rarely category were statistically significant but the magnitude of the difference was negligible. Finally, the work development stressor sub-scale mean scores for those responding as sometimes, often, and very often feeling used-up were statistically no different than those who reported never feeling used up while the coefficient for the rarely group was -.47 (χ^2 p-value = .016).

Table 19 Relationship between the work environment stressors total sum scale score or individually summed sub-scale scores and the QWL "usedup" variable for the 2002-2014 GSS responses (N=4235)

	Reference Category	Category	Estimate	SE	p-value
Model A: Work Environment Stressors (27-items)	Never	Rarely	0.56	0.82	0.49
		Sometimes	3.38	0.76	<0.0001
		Often	6.41	0.79	<0.0001
		Very often	9.59	0.81	<0.0001
Model B: Work Load Stressors (5-items)	Never	Rarely	0.61	0.19	0.002
		Sometimes	1.70	0.18	<0.0001
		Often	2.64	0.19	<0.0001
		Very Often	3.58	0.19	<0.0001
Model C: Work Structural Stressors (4-items)	Never	Rarely	0.31	0.16	0.046
		Sometimes	0.69	0.15	<0.0001
		Often	1.28	0.15	<0.0001
		Very Often	1.76	0.15	<0.0001
Model D: Work Relational Stressors (9-items)	Never	Rarely	0.24	0.37	0.52
		Sometimes	1.07	0.35	0.002
		Often	2.26	0.36	<0.0001
		Very Often	3.53	0.37	<0.0001
Model E: Work Safety Stressors (4-items)	Never	Rarely	-0.13	0.17	0.46
		Sometimes	0.20	0.16	0.22
		Often	0.42	0.16	0.011
		Very Often	0.68	0.17	<0.0001
Model F: Work Developmental Stressors (5-items)	Never	Rarely	-0.47	0.20	0.016
		Sometimes	-0.27	0.18	0.14
		Often	-0.19	0.19	0.32
		Very Often	0.05	0.19	0.80

GSS variable usedup: "How often during the past month have you felt used up at the end of the day?"

Table 20 shows the results of generalized linear models describing the relationship between the work environment stressor total sum scale scores or five individually summed sub-scale scores and the GSS QWL question: “All in all, how satisfied would you say you are with your job?” (GSS variable: satjob1) The work environment stressor sum scale or sub-scales are the dependent variables while the GSS QWL satjob1 variable is the single independent variable. The GSS QWL satjob1 variable response options were not at all satisfied (reference category), not too satisfied, somewhat satisfied, very satisfied. Compared to the scores of those reporting being not at all satisfied with their job (mean work environment stressor total sum score of 71.4 (*SD* = 12.2)), the three other comparison categories had lower mean work environment stressor total sum scale scores, i.e., lower exposure to work stressors. The decrease was monotonic from not too satisfied to very satisfied, with mean scores being 8.84 to 17.9 to 27.65 points lower than those not at all satisfied with their job. The pattern was repeated for all five sub-scales and all coefficients had statistically significant coefficients (p-values < .01).

Table 20 Relationship between the work environment stressors total sum scale scores or individually summed sub-scale scores and the QWL "satjob1" variable for the 2002-2014 GSS responses (N=4234)

	Reference Category	Category	Estimate	SE	p-value
Model A: Total Work Environment Stressors (27-items)	Not at all satisifed	Not too satisfied	-8.84	0.94	<0.0001
		Somewhat satisfied	-17.90	0.81	<0.0001
		Very satisfied	-27.65	0.81	<0.0001
Model B: Work Load Stressors (5-items)	Not at all satisifed	Not too satisfied	-0.75	0.28	0.007
		Somewhat satisfied	-1.89	0.24	<0.0001
		Very satisfied	-3.19	0.24	<0.0001
Model C: Work Structural Stressors (4-items)	Not at all satisifed	Not too satisfied	-1.25	0.19	<0.0001
		Somewhat satisfied	-2.76	0.16	<0.0001
		Very satisfied	-4.38	0.16	<0.0001
Model D: Work Relational Stressors (9-items)	Not at all satisifed	Not too satisfied	-4.11	0.43	0.002
		Somewhat satisfied	-7.99	0.38	<0.0001
		Very satisfied	-12.05	0.38	<0.0001
Model E: Work Safety Stressors (4-items)	Not at all satisifed	Not too satisfied	-1.26	0.22	<0.0001
		Somewhat satisfied	-2.21	0.19	<0.0001
		Very satisfied	-3.40	0.19	<0.0001
Model F: Work Development Stressors (5-items)	Not at all satisifed	Not too satisfied	-1.47	0.25	<0.0001
		Somewhat satisfied	-3.06	0.21	<0.0001
		Very satisfied	-4.62	0.21	<0.0001

GSS variable "satjob1": "All in all, how satisfied would you say your are with your job?"

Table 21 contains the confirmatory factor analysis parameter estimates of a 27-item second-order confirmatory factor model. The left panel contains the factor loadings of all 27 GSS QWL indicator variables on their first-order factors. All the factor loadings were positive and statistically significant. The highest factor loading was .94 for the GSS QWL variable teamsafe (work safety stressor factor indicator) describing how respondents agree on employees and management working together to ensure the safest possible working conditions while the lowest factor loading was .37 for the GSS QWL famwkoff variable describing how hard it is to take time off during work to take care of personal or family matters (work load stressor factor indicator). The factor loadings of the first-order factors (sub-scales) on the second-order factor (total work environment stressors) were also all statistically significant and positive, ranging from .63 for the work load stressors construct to .96 for the work structural stressors construct. The indicators of model's overall fitness, RMSEA, CFI, and SRMR were .062, .97, and .077, respectively. All suggest the variance-covariance matrix produced by the proposed second-order factor model with five first-order factors, no indicator cross-factor loadings, and no error covariances adequately replicates the sample's variance-covariance.

Table 21 Confirmatory factor analysis parameter estimates of the twenty-seven item second-order factor model for the 2002, 2006, 2010, 2016 GSS responses (N=3840)

QWL Variables	First-Order Factors: Work Load Stressors	Work Structural Stressors	Work Relational Stressors	Work Safety Stressors	Work Developmental Stressors	Error Variances
wrktime	0.80					0.35
overwork	0.54					0.71
toofeww	0.57					0.68
condemnd	0.60					0.64
famwkoff	0.37					0.87
prodctiv		0.71				0.49
wksmooth		0.83				0.31
haveinfo		0.64				0.59
hlpequip		0.70				0.52
supcares			0.74			0.46
suphelp			0.73			0.46
manvsemp			0.77			0.41
trustman			0.82			0.32
respect			0.74			0.45
wkpraise			0.64			0.59
promtefr			0.69			0.53
cowrkhlp			0.60			0.64
cowrkint			0.64			0.59
safehlth				0.88		0.23
safetywk				0.89		0.21
safefrst				0.86		0.26
teamSafe				0.94		0.11
workdiff					0.52	0.73
opdevel					0.81	0.34
learnnew					0.52	0.72
wkdecide					0.50	0.75
wkfreedm					0.57	0.68

First-Order Factors	Second-Order Factor: Total Work Environment Stressors	Disturbances
Work Load Stressors	0.63	0.6
Work Structural Stressors	0.96	0.08
Work Relational Stressors	0.94	0.11
Work Safety Stressors	0.74	0.45
Work Developmental	0.67	0.55

$S\text{-}B_X^2 = 5015.35$, df = 319, RMSEA = 0.062 (90% CI: 0.06, 0.063), CFI = 0.97, SRMR = 0.077

The model's goodness-of-fit was also evaluated after stratification by sex, race/ethnicity, and year of survey (table 22). The RMSEA, CFI, and SRMR values are the most suggested tests for evaluating model fit. RMSEA below .08 is desirable, preferably below .05. The RMSEA values range between .077 for Mexican Americans to .056 for the 2002 sample. All the CFI values are above the recommended threshold of .95. Finally, the SRMR values range between .093 Mexican American to .07 for the 2002 sample. A desirable SRMR is close to .08 (smaller is preferable) with an upper cutoff of .09 being suggested. The Mexican American sample had an N of 252, which given the number of indicators and factors of the model is possible contributing factor to the marginal fit indices, at least relative to the other groups. However, the combination of the RMSEA, CFI, SRMR values suggest the relationships specified by this confirmatory factor model are, based on current standards, are at worst mediocre for the Mexican American respondents or better across the other race/ethnicities, the sexes, and survey years.

Table 22 Confirmatory factor analysis model fit statistics of the twenty-seven item second-order factor model for the total sample and stratified by sex, race/ethnicity, and survey year for the 2002, 2006, 2010, 2014 GSS responses (N=3840)

	N	df	NT_X2	$S\text{-}B_X2$	RMSEA	95% CI	p-value	CFI	SRMR
Total Sample	3840	319	12183.81	5015.35	0.062	0.060-0.063	0.00	0.97	0.077
Males	1766	319	5820.78	2417.72	0.061	0.059-0.063	0.00	0.97	0.078
Females	2074	319	7096.72	2889.22	0.062	0.060-0.064	0.00	0.98	0.080
Non-Hispanic White	2946	319	8990.75	3675.66	0.060	0.058-0.062	0.00	0.98	0.078
Non-Hispanic Black	642	319	3091.21	1249.26	0.067	0.064-0.071	0.00	0.97	0.084
Mexicam American	252	319	1871.58	793.46	0.077	0.070-0.084	0.00	0.96	0.093
2002	1209	319	3507.11	1509.27	0.056	0.053-0.058	0.00	0.98	0.070
2006	1100	319	3743.84	1541.32	0.059	0.056-0.062	0.00	0.98	0.082
2010	736	319	3669.81	1431.93	0.069	0.065-0.073	0.00	0.97	0.091
2014	795	319	3958.77	1553.92	0.070	0.066-0.073	0.00	0.97	0.091

NT_X2 = Normal theory chi-square; $S\text{-}B_X2$ = Satorra-Bentler chi-square; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; SRMR = Standardized Root Mean Square Residual

AIM ONE, HYPOTHESIS ONE RESULTS

It was hypothesized that the degree of exposure to work environment stressors would be associated with the respondents' job as classified by Census/Bureau of Labor Statistics (BLS) Standard Occupations Classifications (SOC). Analyses provided evidence of statistically significant differences in reporting exposures to work environment characteristics by respondents' occupational classification for a majority of the 27 GSS QWL work environment stressor indicators (table not shown). The relationships were evaluated with Pearson χ^2 and CMH χ^2, the former test statistic evaluating general associations and the latter row-mean-score differences across the occupational categories, analogous to a Kruskal-Wallis non-parametric test (ANOVA based on rank scores). Agreements between the two test statistics for 23 of the 27 GSS QWL work environment variables. For variables having too few workers to get the job done variable and the working in an environment that is run smoothly and effectively the χ^2 p-values were .008 & .008, respectively while the CMH χ^2 p-values were .064 and .92, respectively. For the receiving enough help and equipment to get the job done variable and the perception of supervisors being helpful in getting their jobs done variables, neither the χ^2 nor CMH χ^2 were statistically significant (p-value > .05).

Table 1.1.2 shows the results of bivariate generalized linear models with the work environment stressor total sum scale scores or individually summed sub-scale scores as the dependent variable and occupational classification as the independent predictor variable. Compared to the business & finance reference category (mean work environment stressors total sum score of 48.1 (*SD* = 10.8)), those with service, sales & office, construction & maintenance, and production & transportation jobs reported statistically higher work environment stressor total sum scale scores (higher exposure), mean scores 2.84, 2.31, 4.02, and 5.72 points higher, respectively. In terms of the sub-scales, the Wald χ^2 p-value of .08 for the work structural stressors scale indicates the scores did not vary statistically according to respondents occupational classifications. Like the lack of statistically significant mean work environment stressor total sum scale score difference between the professional & related and business & finance categories, mean scores for these two occupational categories did not differ in four of five sub-constructs; only score differences for the work safety stressors scale (χ^2 p-value = .0001). The differences between the occupational categories for the work load stressors scale scores were in the opposite direction compared to the other sub-scales, i.e., the other occupational classification categories had statistically mean lower work load stressors sum scores compared to the business & finance category. Overall, the work environment stressor total sum scale score differences were mainly attributable to differences in exposure to work relational stressors and work developmental stressors.

Table 1.1.2 Relationship between work environment stressors total sum scale scores or individually summed sub-scales scores and the 2010 BLS standard occupational classifications in the 2002-2014 GSS responses (N=3785)

Dependent Variable	Reference Category	Category	Estimate	SE	χ^2 p-value
Model A: Work Environment Stressors (27-items)	Business & Finance	Professional & Related	1.19	0.63	0.059
		Service	2.84	0.66	<0.0001
		Sales & Office	2.31	0.61	0.0002
		Construction & Maintenance	3.02	0.84	0.0003
		Production & Transportation	5.72	0.73	<0.0001
Model B: Work Load Stressors (5-items)	Business & Finance	Professional & Related	0.15	0.15	0.33
		Service	-0.65	0.16	<0.0001
		Sales & Office	-0.64	0.15	<0.0001
		Construction & Maintenance	-0.62	0.20	0.003
		Production & Transportation	-0.37	0.18	0.038
Model C: Work Structural Stressors (4-items)	Business & Finance†	Professional & Related	0.16	0.12	0.18
		Service	0.04	0.13	0.78
		Sales & Office	0.07	0.12	0.54
		Construction & Maintenance	0.33	0.16	0.04
		Production & Transportation	0.32	0.14	0.02
Model D: Work Relational Stressors (9-items)	Business & Finance	Professional & Related	0.43	0.28	0.13
		Service	1.17	0.30	<0.0001
		Sales & Office	0.97	0.27	0.0004
		Construction & Maintenance	1.64	0.37	<0.0001
		Production & Transportation	2.50	0.33	<0.0001
Model E: Work Safety Stressors (4-items)	Business & Finance	Professional & Related	0.50	0.13	0.0001
		Service	0.72	0.14	<0.0001
		Sales & Office	0.48	0.13	0.0001
		Construction & Maintenance	0.62	0.17	0.0003
		Production & Transportation	0.97	0.15	<0.0001

Active military respondents were excluded (n=34).

Table 1.1.2 Relationship between work environment stressors total sum scale scores or individually summed sub-scales scores and the 2010 BLS standard occupational classifications in the 2002-2014 GSS responses (N=3785) (continued)

Dependent Variable	Reference Category	Category	Estimate	SE	χ^2 p-value
Model F: Work Developmental Stressors (5-items)	Business & Finance	Professional & Related	-0.05	0.14	0.74
		Service	1.57	0.14	<0.0001
		Sales & Office	1.44	0.13	<0.0001
		Construction & Maintenance	1.05	0.18	<0.0001
		Production & Transportation	2.31	0.16	<0.0001

Active military respondents were excluded (n=34).

AIM ONE, HYPOTHESIS TWO RESULTS

The second hypothesis expected the exposure to work environment stressors to be associated with changes in the U.S. job market over time. Responses to 14 of the 27 GSS QWL variables were statistically associated with survey year using the Pearson and CMH χ^2 tests; specifically, all five of the work load stressors variables, three of four work structural stressors variables, two of the nine work relational stressors variables, two of the four work safety stressors variables, and two of the five work developmental stressors variables (table not shown). The two χ^2 tests agreed for the having too much work to do everything well, freedom from conflicting demands made by others, workplace conditions permitting the respondent to be productive, the workplace being run in smooth and effective manner, and how good the safety and health conditions were at the workplace. For the other nine GSS QWL variables, the χ^2 test indicated a statistical relationship (p-value < .05) while the CMH χ^2 test for row mean score differences did not. The results of bivariate generalized linear models testing for survey year differences in the work environment stressor total sum scale scores or its individually summed sub-scale scores showed no statistical differences. The reference category for survey year was 2010, i.e., the year immediately following 2007-2009 Great Recession, with comparison categories immediately prior to the Great Recession (2006), and five years pre- and post-Great recession, i.e., 2002 and 2014, respectively.

AIM ONE, HYPOTHESIS THREE RESULTS

The third hypothesis of this aim was that exposure to work environment stressors would be associated jointly with respondents' occupational classification and changes in the U.S. job market over time. Evaluating this hypothesis with cumulative logit models using GSS QWL variable responses as dependent variables and occupational category and survey year as independent predictors. The reference categories for occupation and survey year were business & finance and 2010, respectively. These models tested if comparison categories reported statistically different odds of being in a higher (worse) GSS QWL stressor response category relative to their reference categories. For each GSS QWL variable, the first and second models only included occupational category or survey year as predictors, respectively. The third model included both variables simultaneously. The fourth model added an occupation, survey year interaction term to the third model. A statistically significant interaction term was found for three of the 27 GSS QWL variables: how likely the respondent was to receive praise for doing their job well, the goodness of the safety and health conditions at their work, and how often they take part with others in making decisions that affect them (table not shown).

Further analyses of these responses using bivariate cumulative logit models following stratification by occupational categories showed that workers in professional & related and service jobs had statistically significant different degrees of reporting of receiving praise by management at work relative to those working in 2010. For professional & related jobs the global Wald χ^2 p-value = .035 for any of coefficients being no different than zero but examination of the individual survey year coefficients showed no statistically significant coefficient (all p-values > .05). The coefficient for 2014 had a p-value = .0503 and an odds ratio of 1.505 (95% CI [1.00, 2.27]). For service jobs, the Wald χ^2 p-value = .0054 with coefficients of -.57, -.62, -.68 and p-values = .006, .004, and .002, respectively. Put differently, service employees in 2002, 2006, and 2014 were more likely to receive praise from their supervisors for doing their job well than were those employed in the same category of jobs in 2010.

For the GSS QWL variable evaluating the perception of safety and health conditions at work, only those employed in professional & related occupations reported statistically different degrees of safety and health conditions across the survey years. The Wald χ^2 p-value for the global survey year variable was .0001 but the only survey year with a statistically significant coefficient was 2002. The coefficient was .84 with a p-value < .0001. In 2002, those working in professional & related jobs were 2.31 (95% CI [1.57, 3.42]) times more likely to report disagreeing that the safety and health conditions at their workplace were good compared to those working in 2010.

For the GSS QWL variable addressing how often the respondent takes part with others in making decisions that affect them, construction & maintenance and production & transportation employees had statistically different reporting of their frequency of being able to take part compared to those responding in 2010. For the construction & maintenance employees, the score test for proportional odds indicated the need for a model permitting unequal slopes, i.e., a coefficient for each year comparison for each level of the dependent variable. The model allowing this produced a global Wald χ^2 p-value = .008 for the survey year variable. However, none of the nine coefficients were statistically significant (p-value < .05). For the production & transportation employees, workers in 2006 were 1.89 (95% CI [1.13, 3.16]) times more likely to report a lower frequency of being involved in decision making than those working in 2010. Table 1.3.2 displays the counts, means, and standard deviations of the work environment stressor total sum scale scores and the individually summed sub-scale scores overall and stratified by occupational classification and survey year.

Table 1.3.2 Mean work environment stressors total sum scale scores and individually summed sub-scale scores stratified by 2010 BLS Standard Occupational classifications and survey year for the 2002-2014 GSS responses (N=3819)

	Overall			2002			2006		
	N	mean	SD	N	mean	SD	N	mean	SD
Work Environment Stressors (27-items)		50.44	11.61		50.48	11.91		50.72	11.63
Business & Finance	538	48.13	10.78	162	47.42	10.32	142	48.08	10.96
Professional & Related	852	49.32	10.94	256	50.58	11.16	256	49.22	10.95
Service	666	50.98	12.13	191	50.66	12.47	162	51.09	12.40
Sales & Office	983	50.44	11.54	322	49.70	11.28	290	51.21	11.88
Construction & Maintenance	286	51.15	11.49	104	52.05	12.62	91	50.95	10.85
Production & Transportation	460	53.85	11.92	163	53.45	12.44	144	54.88	11.38
Active Military	34	47.56	13.94	3	77.67	19.55	10	39.70	7.90
Work Load Stressors (5-items)		11.03	2.81		10.98	2.87		11.07	2.74
Business & Finance	538	11.36	2.96	162	11.27	3.11	142	11.53	2.84
Professional & Related	852	11.51	2.86	256	11.62	2.88	256	11.56	2.81
Service	666	10.71	2.75	191	10.73	2.73	162	10.75	2.83
Sales & Office	983	10.72	2.74	322	10.47	2.81	290	10.74	2.62
Construction & Maintenance	286	10.74	2.48	104	10.96	2.63	91	10.49	2.43
Production & Transportation	460	10.99	2.77	163	10.76	2.61	144	11.11	2.70
Active Military	34	10.85	3.12	3	17.67	2.08	10	10.20	1.69
Work Structural Stressors (4-items)		7.27	2.18		7.31	2.25		7.42	2.38
Business & Finance	538	7.14	2.21	162	7.03	2.21	142	7.25	2.35
Professional & Related	852	7.30	2.21	256	7.41	2.12	256	7.47	2.40
Service	666	7.18	2.22	191	7.16	2.40	162	7.42	2.35
Sales & Office	983	7.21	2.13	322	7.19	2.10	290	7.31	2.15
Construction & Maintenance	286	7.47	2.28	104	7.63	2.61	91	7.55	2.05
Production & Transportation	460	7.46	1.99	163	7.46	2.11	144	7.67	1.96
Active Military	34	7.06	2.46	3	12.33	3.21	10	5.70	1.83

Table 1.3.2 Mean work environment stressors total sum scale scores and individually summed sub-scale scores stratified by 2010 BLS Standard Occupational classifications and survey year for the 2002-2014 GSS responses (N=3819) (continued)

	Overall			2002			2006		
	N	mean	SD	N	mean	SD	N	mean	SD
Work Relational Stressors (9-items)		16.45	5.18		16.47	5.27		16.50	5.27
Business & Finance	538	15.46	4.68	162	15.03	4.37	142	15.19	4.87
Professional & Related	852	15.89	4.74	256	16.47	4.98	256	15.77	4.54
Service	666	16.63	5.45	191	16.30	5.31	162	16.57	5.70
Sales & Office	983	16.43	5.26	322	16.21	5.21	290	16.70	5.45
Construction & Maintenance	286	17.09	5.26	104	17.39	5.60	91	17.14	5.28
Production & Transportation	460	17.96	5.45	163	17.71	5.57	144	18.33	5.46
Active Military	34	15.59	5.48	3	26.67	6.51	10	12.10	2.85
Work Safety Stressors (4-items)		6.89	2.35		7.02	2.46		6.82	2.35
Business & Finance	538	6.36	2.19	162	6.33	2.18	142	6.21	2.18
Professional & Related	852	6.86	2.37	256	7.28	2.41	256	6.79	2.43
Service	666	7.08	2.44	191	7.17	2.66	162	7.02	2.40
Sales & Office	983	6.84	2.27	322	6.76	2.67	290	6.92	2.38
Construction & Maintenance	286	6.99	2.50	104	7.18	2.69	91	6.84	2.45
Production & Transportation	460	7.33	2.35	163	7.46	2.47	144	7.17	2.12
Active Military	34	5.88	2.66	3	9.67	6.03	10	4.60	1.26
Work Developmental Stressors (5-items)		8.80	2.62		8.80	2.66		8.92	2.71
Business & Finance	538	7.80	2.19	162	7.76	2.32	142	7.89	2.22
Professional & Related	852	7.76	2.11	256	7.81	2.32	256	7.63	2.08
Service	666	9.38	2.69	191	9.30	2.73	162	9.33	2.62
Sales & Office	983	9.24	2.67	322	9.07	2.55	290	9.54	2.79
Construction & Maintenance	286	8.86	2.43	104	8.88	2.53	91	8.92	2.49
Production & Transportation	460	10.12	2.76	163	10.07	2.70	144	10.58	2.86
Active Military	34	8.18	2.41	3	11.33	2.08	10	7.10	2.18

Table 1.3.2 Mean work environment stressors total sum scale scores and individually summed sub-scale scores stratified by 2010 BLS Standard Occupational classifications and survey year for the 2002-2014 GSS responses (N=3819) (continued)

	2010			2014		
	N	mean	SD	N	mean	SD
Work Environment Stressors (27-items)		50.34	11.58		49.91	11.13
Business & Finance	117	49.70	11.20	117	47.61	10.72
Professional & Related	163	46.58	10.05	177	50.17	11.03
Service	146	51.64	12.17	167	50.63	11.50
Sales & Office	183	51.64	11.73	188	49.35	11.18
Construction & Maintenance	38	50.03	11.12	53	50.55	10.64
Production & Transportation	76	53.57	12.61	77	53.08	11.14
Active Military	10	51.00	9.09	11	43.36	8.32
Work Load Stressors (5-items)		11.09	2.87		10.99	2.76
Business & Finance	117	11.86	3.07	117	10.78	2.70
Professional & Related	163	11.11	2.82	177	11.65	2.91
Service	146	10.62	2.70	167	10.71	2.77
Sales & Office	183	10.98	2.81	188	10.85	2.70
Construction & Maintenance	38	10.68	2.42	53	10.79	2.22
Production & Transporation	76	11.18	3.14	77	11.06	2.85
Active Military	10	10.80	2.82	11	9.64	2.33
Work Structural Stressors (4-items)		7.18	2.08		7.10	2.06
Business & Finance	117	7.26	2.13	117	7.05	2.15
Professional & Related	163	6.77	1.95	177	7.39	2.22
Service	146	7.02	2.02	167	7.11	2.01
Sales & Office	183	7.48	2.22	188	6.86	2.04
Construction & Maintenance	38	7.18	2.28	53	7.21	1.96
Production & Transportation	76	7.46	1.88	77	7.05	1.83
Active Military	10	7.40	1.51	11	6.55	1.51

Table 1.3.2 Mean work environment stressors total sum scale scores and individually summed sub-scale scores stratified by 2010 BLS Standard Occupational classifications and survey year for the 2002-2014 GSS responses (N=3819) (continued)

	2010			2014		
	N	mean	SD	N	mean	SD
Work Relational Stressors (9-items)		16.47	5.11		16.31	5.01
Business & Finance	117	16.06	4.73	117	15.78	4.76
Professional & Related	163	14.88	4.37	177	16.16	4.86
Service	146	17.37	5.64	167	16.42	5.16
Sales & Office	183	16.74	5.14	188	16.06	5.17
Construction & Maintenance	38	16.76	5.22	53	16.66	4.66
Production & Transportation	76	17.79	5.43	77	17.95	5.27
Active Military	10	17.40	4.43	11	14.09	3.30
Work Safety Stressors (4-items)		6.88	2.34		6.77	2.20
Business & Finance	117	6.59	2.10	117	6.37	2.29
Professional & Related	163	6.34	2.33	177	6.84	2.15
Service	146	7.16	2.45	167	6.96	2.19
Sales & Office	183	7.14	2.31	188	6.57	2.02
Construction & Maintenance	38	6.55	2.19	53	7.17	2.34
Production & Transportation	76	7.46	2.45	77	7.23	2.41
Active Military	10	6.80	2.25	11	5.18	1.66
Work Developmental Stressors (5-items)		8.72	2.59		8.73	2.47
Business & Finance	117	7.93	2.19	117	7.63	1.98
Professional & Related	163	7.48	1.78	177	8.13	2.09
Service	146	9.46	2.82	167	9.43	2.61
Sales & Office	183	9.30	2.75	188	9.01	2.55
Construction & Maintenance	38	8.84	2.15	53	8.72	2.36
Production & Transportation	76	9.67	2.82	77	9.78	2.56
Active Military	10	8.60	1.78	11	7.91	2.59

Table 1.3.3 shows the results of a series of generalized linear models examining the relationship between the work environment stressor total sum scale scores or five individually summed sub-scale scores and occupational classification, survey year, and their joint effect. Using work environment stressor total sum scale scores or sub-scale scores dependent variables (separate models), the first and second models included

occupational category or year as predictors, respectively. The third model included both variables simultaneously. The fourth model added an occupational classification and survey year interaction term to the prior model (model 3). The results of model one indicate work environment stressor total sum scale scores are associated with occupational category, the results being consistent with the findings presented in table 1.1.2. Model two shows, as previously discussed for the second hypothesis of this aim, that survey year was unrelated to the work environment stressor total sum scale scores. The relationships remains the same when both variables are together (model 3). Interestingly, the Wald χ^2 for the interaction term in model 4 was statistically significant with a p-value = .046. A review of the relationships of the sub-scales shows a statistically significant (p-value = .047) interaction term for the work safety stressors scale. Recalling the results of the cumulative logit models using GSS QWL variable responses as dependent variables and occupational category and survey year as independent predictors , three QWL variables with an occupation-survey year interaction effect but only safehlth variable was in the work safety stressors sub-scale.

Additional analysis using bivariate generalized linear models following stratification by occupational classification showed that employees in professional & related occupations had statistically different work environment stressor total sum scale scores using 2010 as the reference category. Compared to those working in 2010, workers in 2002, 2006, and 2014 on average scored 4.01, 2.65, and 3.59 points higher (more stressor exposure) than those working in 2010, respectively. Examining the model with the work safety stressors as the dependent variable, again the professional & related category had statistically different scores across the survey years. The global Wald χ^2 p-value = .001 for survey year with the 2002, 2006 and 2014 coefficients being .93, .44, and .50 and p-values < .0001, .06, and .0502. Workers in professional & related jobs in 2002 had higher work safety stressors scale scores (more stress) than workers in 2010.

Table 1.3.3 Relationship between work environment stressors total sum scale scores or individually summed sub-scales scores and the 2010 BLS standard occupation classifications and survey year for the 2002-2014 GSS responses (N=3785)

		Model 1		Model 2		Model 3		Model 4	
Dependent Variable	Independent Variable	χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value
Work Environment Stressors (27-items)	Occupation	75.37	<0.0001			72.91	<0.0001	28.49	<0.0001
	Year			2.16	0.54	1.53	0.68	3.10	0.38
	Year*Occupation							25.31	0.046
Work Load Stressors (5-items)	Occupation	57.28	<0.0001			56.95	<0.0001	14.41	0.01
	Year			1.57	0.67	1.25	0.74	9.75	0.02
	Year*Occupation							20.77	0.14
Work Structural Stressors (4-items)	Occupation	9.71	0.08			8.41	0.135	11.63	0.04
	Year			11.46	0.01	10.16	0.017	1.35	0.72
	Year*Occupation							21.23	0.13
Work Relational Stressors (9-items)	Occupation	75.45	<0.0001			75.38	<0.0001	26.85	<0.0001
	Year			0.53	0.91	0.46	0.93	3.61	0.31
	Year*Occupation							22.87	0.09
Work Safety Stressors (4-items)	Occupation	49.30	<0.0001			48.91	<0.0001	20.59	0.001
	Year			5.04	0.17	4.65	0.20	1.66	0.65
	Year*Occupation							25.21	0.047
Work Development Stressors (5-items)	Occupation	431.74	<0.0001			431.77	<0.0001	87.19	<0.0001
	Year			3.81	0.28	3.84	0.28	1.11	0.77
	Year*Occupation							21.36	0.13

The reference categories for occupation and survey year were business & finance and 2010, respectively. Active military respondents were excluded (n=34).

AIM TWO, HYPOTHESIS ONE RESULTS

The first hypothesis of the second aim was belief that exposure to stressful work environment characteristics is associated with respondents' sex and/or race/ethnicity. The frequency responses to the 27 GSS QWL variables following stratification by sex were reviewed Pearson and CMH χ^2 tests completed. Sixteen of the 27 GSS QWL variables had statistically significant χ^2 p-values < .05, specifically four of the five work load stressors variables, two of the four structural stressors variables, seven of the nine relational stressors variables, one of the four safety stressors variables, and three of the five development stressors variables showed sex-based response frequency differences (table not shown). The same was done for race/ethnicity (table not shown). Sixteen of the 27 GSS QWL variables had statistically significant χ^2 p-values < .05, specifically, all five of the work load stressors variables, two of the four work structural stressors variables, five of the nine work relational stressors variables, one of the four work safety stressors variable, and three of the five work developmental stressors variables. The two χ^2 tests in disagreement were for the variables measuring the perception of having too few workers to get the job done and how hard it is for the respondent to take time off during work to take care of personal or family matters, with the Pearson χ^2 having p-values < .05 while the CMH χ^2 for row mean score differences p-values > .05.

Multiple cumulative logit models using GSS QWL work environment stressor variable responses as dependent variables and sex and/or race/ethnicity as independent predictors were evaluated for interaction effects. The reference categories for sex and race/ethnicity were male and non-Hispanic white, respectively. These models tested if comparison categories reported statistically different odds of being in a higher (worse) GSS

QWL stressor response category relative to their reference categories. For each GSS QWL work environment stressor variable, the first and second models only included sex or race/ethnicity as predictors, respectively. The third model included both variables simultaneously. The fourth model added a sex, race/ethnicity interaction term to the prior model (model 3). A statistically significant interaction term produced for three of the 27 GSS QWL variables: the degree to which the workplace is run in a smooth and effective manner, coworkers taking a personal interest in the respondent, and how often they take part with others in making decisions that affect them (table not shown)

Further analyses using bivariate cumulative logit models following stratification by sex showed that the race/ethnicity differences for responses to the wksmooth variable were statistically different for males (Wald χ^2 p-value < .0001) but not females (Wald χ^2 p-value = .23). For males, relative to non-Hispanic whites, non-Hispanic blacks responses were statistically no different while Mexican Americans had a coefficient of -.78 (p-value < .0001), meaning they were less likely to agree that their workplace was run in a smooth and effective manger. Put differently, Mexican Americans males were more likely to say their workplace was run in a smooth an effective manner compared to non-Hispanic white males. For the GSS QWL variable regarding coworkers taking a personal interest in the respondent, the statistical difference in reporting was seen for females (Wald χ^2 p-value < .0001) but not males (Wald χ^2 p-value = .46). For females, relative to non-Hispanic whites, non-Hispanic blacks were 1.79 (95% CI [1.45, 2.2]) times more likely to report not feeling the people that they work with take a personal interest in them. There was no difference for Mexican Americans (p-value = .12). For the GSS QWL variable addressing the degree to which respondents are involved with others in making decisions that affect them there were statistically significant differences in responses across the race/ethnicities. For males, compared to non-Hispanic whites, non-Hispanic blacks were 1.77 (95% CI [1.47, 2.29]) times more likely to report not being involved in taking part in making decisions that affect them while there was no difference for Mexican Americans (p-value = .46). For females, the score test for proportional odds indicated the need to use a model permitting unequal slopes, i.e., estimating six coefficients. The global Wald χ^2 p-value = .014 while the coefficient for non-Hispanic black (vs. non-Hispanic white) and never (vs. often) was .69 (p-value = .0007), non-Hispanic black and rarely was .32 (p-value = .019), Mexican American and rarely was .48 (p-value = .026). Rephrased, non-Hispanic blacks were 2 (95% CI [1.34, 2.99]) and 1.37 (95% CI [1.05, 1.79]) times more likely to state "never" or "rarely" being involved in workplace decision making that affects them rather than reporting "often" when compared to non-Hispanic whites. Mexican Americans were 1.62 (95% CI [1.06, 2.47]) times more likely to report rarely than often when compared to non-Hispanic whites.

Table 2.1.4 shows the results of general linear models evaluating the relationship between the work environment stressor total sum scale scores or five individually summed sub-scale scores and respondents' sex and/or race/ethnicity. There were no statistical differences between the sexes in the work environment stressor total sum scale scores or five individually summed sub-scale scores. Relative to non-Hispanic whites, non-Hispanic blacks had mean scores 1.37 points higher on the work environment stressor total sum scale (p-value = .007) while Mexican Americans scores were statistically no different (p-value = .69). For the sub-scale scores, non-Hispanic blacks differed statistically from non-Hispanic whites in all but work structural stressors scale scores (p-value = .98).

Interestingly, although Mexican Americans mean work environment stressor total sum scale score was not statistically different from non-Hispanic whites, they did report less work structural stressors (coefficient = -.40; χ^2 p-value = .006). This same scale had a statistically significant interaction term for sex and race/ethnicity, χ^2 p-value = .013. Stratifying by sex, the differences between non-Hispanic white males and Mexican Americans males persisted with a coefficient = -.75 (χ^2 p-value = .0001) while there is no race/ethnicity difference for females (χ^2 p-value = .4).

Table 2.1.4 Relationship between work environment stressor total sum scale scores or individually summed sub-scale scores and sex and/or race/ethnicity in the 2002-2014 GSS responses (N=3840)

			Model 1			Model 2		
Dependent Variable	Reference Category	Category	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value
Work Environment	Male	Female	-0.02	0.38	0.96			
Stressors (27-items)	Non-Hispanic White	Non-Hispanic Black				1.37	0.51	0.007
		Mexican American				-0.30	0.76	0.69
Work Load	Male	Female	0.13	0.09	0.14			
Stressors (5-items)	Non-Hispanic White	Non-Hispanic Black				-0.42	0.12	0.001
		Mexican American				-0.15	0.18	0.41
Work Structural	Male	Female	-0.13	0.07	0.06			
Stressors (4-items)	Non-Hispanic White	Non-Hispanic Black				0.002	0.09	0.98
		Mexican American				-0.40	0.14	0.006
Work Relational	Male	Female	-0.13	0.17	0.44			
Stressors (9-items)	Non-Hispanic White	Non-Hispanic Black				0.94	0.23	<0.0001
		Mexican American				-0.03	0.34	0.92
Work Safety	Male	Female	0.05	0.08	0.50			
Stressors (4-items)	Non-Hispanic White	Non-Hispanic Black				0.28	0.10	0.007
		Mexican American				0.13	0.15	0.40
Work Development	Male	Female	0.06	0.09	0.49			
Stressors (5-items)	Non-Hispanic White	Non-Hispanic Black				0.57	0.11	<0.0001
		Mexican American				0.15	0.17	0.37

Model 4 work environment stressors total sum scale χ^2 p-value for sex*race/ethnicity interaction = 0.09

Model 4 work load stressors sub-scale χ^2 p-value for sex*race/ethnicity interaction = 0.61

Model 4 work structural stressors sub-scale χ^2 p-value for sex*race/ethnicity interaction = 0.013

Model 4 work relational stressors sub-scale χ^2 p-value for sex*race/ethnicity interaction = 0.08

Model 4 work safety stressors sub-scale χ^2 p-value for sex*race/ethnicity interaction = 0.1

Model 4 work developmental stressors sub-scale χ^2 p-value for sex*race/ethnicity interaction = 0.46

Table 2.1.4 Relationship between work environment stressor total sum scale scores or individually summed sub-scale scores and sex and/or race/ethnicity in the 2002-2014 GSS responses (N=3840) (continued)

			Model 3		
Dependent Variable	Reference Category	Category	Estimate	SE	χ^2 p-value
Work Environment Stressors (27-items)	Male	Female	-0.11	0.38	0.76
	Non-Hispanic White	Non-Hispanic Black	1.38	0.51	0.006
		Mexican American	-0.30	0.76	0.69
Work Load Stressors (5-items)	Male	Female	0.16	0.09	0.08
	Non-Hispanic White	Non-Hispanic Black	-0.44	0.12	0.0003
		Mexican American	-0.15	0.18	0.43
Work Structural Stressors (4-items)	Male	Female	-0.14	0.07	0.05
	Non-Hispanic White	Non-Hispanic Black	0.02	0.10	0.847
		Mexican American	-0.40	0.14	0.005
Work Relational Stressors (9-items)	Male	Female	-0.19	0.17	0.25
	Non-Hispanic White	Non-Hispanic Black	0.96	0.23	<0.0001
		Mexican American	-0.04	0.34	0.903
Work Safety Stressors (4-items)	Male	Female	0.04	0.08	0.64
	Non-Hispanic White	Non-Hispanic Black	0.27	0.10	0.008
		Mexican American	0.13	0.15	0.40
Work Development Stressors (5-items)	Male	Female	0.02	0.09	0.78
	Non-Hispanic White	Non-Hispanic Black	0.57	0.11	<0.0001
		Mexican American	0.16	0.17	0.37

Model 4 work environment stressors total sum scale χ^2 p-value for sex*race/ethnicity interaction = 0.09

Model 4 work load stressors sub-scale χ^2 p-value for sex*race/ethnicity interaction = 0.61

Model 4 work structural stressors sub-scale χ^2 p-value for sex*race/ethnicity interaction = 0.013

Model 4 work relational stressors sub-scale χ^2 p-value for sex*race/ethnicity interaction = 0.08

Model 4 work safety stressors sub-scale χ^2 p-value for sex*race/ethnicity interaction = 0.1

Model 4 work developmental stressors sub-scale χ^2 p-value for sex*race/ethnicity interaction = 0.46

AIM TWO, HYPOTHESIS TWO RESULTS

The second hypothesis proposed that exposure to stressful work environment characteristics is associated jointly with respondents' sex or race/ethnicity and occupational classification. A series of cumulative logit models with GSS QWL work environment stressor variable responses as dependent variables and sex and/or occupation as independent predictor variables. The reference categories for sex and occupation were male and business & finance, respectively. These models tested if comparison categories reported statistically different odds of being in a higher (worse) GSS QWL stressor response category relative to their reference categories. For each dependent GSS QWL variable, the first and second models only included sex or occupation as predictors, respectively. The third model included both variables simultaneously. The fourth model added a sex, occupation interaction term to the third model. Statistically significant interaction terms were found for three of the 27 GSS QWL variables: receiving enough help and equipment to get the job done, level of agreement regarding no significant compromises or shortcuts being taken when worker safety is at stake, and the respondent's job requiring them to keep learning new things (table not shown).

Additional bivariate cumulative logit models following stratification by occupational classification showed sex based statistical differences in responses to the hlpequip variable for professional & related and sales & office jobs. For the professional & related jobs, compared to males, females were 1.34 (95% CI [1.03, 1.75]) times more likely to report not receiving enough help and equipment to get their jobs done. For sales & office jobs, the score test for the proportional odds assumption indicated the need for a model permitting non-proportional odds, i.e., coefficients for female (vs. male) and not at all true (vs. very true), not too true (vs. very true), and somewhat true (vs. very true). Only the coefficient for not at all true vs. very true was -.92 and statistically significant (p-value = .0098). The odds ratio for the difference was .399 (95% CI [.199, .8]). Stated differently, females were 2.51 times more likely to respond “very true” than “not at all true” compared to males regarding receiving enough help and equipment to get their jobs done.

For the GSS QWL variable safefrst, females working in professional & related jobs were 1.40 (95% CI [1.07, 1.83]) times more likely to disagree that there were no significant compromises or shortcuts taken when worker safety was at stake than males. For females working in construction & maintenance jobs, the odds of a female disagreeing regarding no compromises with safety were .38 (95% CI [.17, .85]). Stated another way, females were 2.67 times more likely to agree that no significant compromises or shortcuts were being taken compared to males. For those with service occupations, the score test for proportional odds indicated the need for a model allowing non-proportional odds. The model permitting non-proportional odds produced a global Wald χ^2 p-value = .034 but none of the three coefficients for comparisons with 2010 were statistically significant, i.e., no p-values < .05.

Table 2.2.2 shows the results of the general linear models evaluating the relationship between the work environment stressor total sum scale scores and five individually summed sub-scales scores and sex and occupation. There was no joint effect between sex and occupation for the 27-item work environment stressor sum scale or its sub-scales (model 4).

Table 2.2.2 Relationship between work environment stressors total sum scale scores or individually summed sub-scale scores and sex and/or 2010 BLS standard occupation classifications for the 2002-2014 GSS responses (N=3785)

		Model 1		Model 2		Model 3		Model 4	
Dependent Variable	Independent Variable	χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value
Work Environment Stressors	Sex	0.11	0.74			2.95	0.09	0.86	0.35
(27-items)	Occupation			73.55	<0.0001	76.45	<0.0001	47.16	<0.0001
	Sex*Occupation							2.4	0.79
Work Load Stressors	Sex	1.89	0.17			1.5	0.22	0	0.96
(5-items)	Occupation			57.28	<0.0001	56.88	<0.0001	12.67	0.03
	Sex*Occupation							5.4	0.37
Work Structural Stressors	Sex	4.71	0.03			1.71	0.19	0.02	0.88
(4-items)	Occupation			9.71	0.084	6.7	0.2435	5.81	0.32
	Sex*Occupation							2.87	0.72
Work Relational Stressors	Sex	0.88	0.35			1.94	0.16	0.21	0.65
(9-items)	Occupation			75.45	<0.0001	76.53	<0.0001	39.68	<0.0001
	Sex*Occupation							3.65	0.60
Work Safety Stressors	Sex	0.14	0.71			2.72	0.10	2.67	0.10
(4-items)	Occupation			49.30	<0.0001	51.93	<0.0001	40.93	<0.0001
	Sex*Occupation							8.27	0.14
Work Development Stressors	Sex	0.16	0.69			10.65	0.001	2.57	0.11
(5-items)	Occupation			431.74	<0.0001	443.42	<0.0001	222.87	<0.0001
	Sex*Occupation							4.53	0.48

The reference categories for sex and occupational category were male and business & finance, respectively. Active military respondents were excluded (n=55).

The results from a series of cumulative logit models where the GSS QWL variables responses are the dependent variable and race/ethnicity and/or occupation are the independent predictors. The reference categories for sex and occupation were non-Hispanic white and business & finance, respectively. These models tested if comparison categories reported statistically different odds of being in a higher (worse) GSS QWL stressor response category relative to their reference categories. For each dependent GSS QWL variable, the first and second model only included race/ethnicity or occupation as predictors, respectively. The third model included both variables simultaneously. The fourth model added a race/ethnicity, occupation interaction term to the third model. A statistically significant interaction term was found for four of the 27 GSS QWL variables: perception of the work place being run in a smooth and effective manner, trusting the management at work, promotions being handled fairly, and coworkers taking a personal interest in the respondent (table not shown).

Further exploration of these relationships using bivariate cumulative logit models following stratification by occupation showed race/ethnicity based statistical differences in responses to the GSS QWL variable wksmooth for those working in sales & office and construction & maintenance jobs. Compared to non-Hispanic whites, non-Hispanic blacks were 1.49 (95% CI [1.09, 2.03]) times more likely disagree that the place where they worked was run in a smooth and effective manner. For those working in construction & maintenance jobs, Mexican Americans were less likely to disagree (odds ratio: .42, 95% CI [.21, .85]). Stated differently, Mexican Americans were 2.4 times more likely to agree that the place they work was run in a smooth and effective manner compared to non-Hispanic whites.

For the GSS QWL variable trustman, statistical differences in responses between the race/ethnicities occurred in business & finance, professional & related, sales & office occupations. Within the business & finance occupation, compared to non-Hispanic whites, the odds ratio for Mexican Americans to disagree that they trusted the management where they worked was .35 (95% CI [.14, .82]). Worded differently, Mexican Americans were 2.96 times more likely to agree that they trusted management at work than non-Hispanic whites. Within the professional & related occupations, non-Hispanic blacks and Mexican Americans were 1.47 (95% CI [1.0, 2.15]) and 1.8 (95% CI [1.001, 3.24]) times more likely disagree that they could trust management compared to non-Hispanic whites. Within the sales & office occupations, non-Hispanic blacks were 1.74 (95% CI [1.29, 2.36]) times more likely to disagree that they could trust management compared to non-Hispanic whites.

There were statistical differences between race/ethnicities within the professional & related and sales & office occupations for the GSS QWL variable promtefr. The Non-Hispanic blacks working in sales & office jobs were 1.75 (95% CI [1.3, 2.35]) times more likely than non-Hispanic blacks to report that it was less true that promotions are handled fairly. For professional & related jobs, the score test for the proportional odds assumption indicated the need for a model permitting non-proportional odds, i.e., coefficients for non-Hispanic black (vs. non-Hispanic white) and not at all true (vs. very true), not too true (vs. very true), and somewhat true (vs. very true) and Mexican American (vs. non-Hispanic white) and not at all true (vs. very true), not too true (vs. very true), and somewhat true (vs. very true). The only statistically significant coefficients were for non-Hispanic black and "not too true", Mexican American and "not at all true" and Mexican American and "not too true" compared to non-Hispanic whites and "very true". Non-Hispanic blacks were

1.87 (95%CI [1.22, 2.86]) times more likely to state not too true than very true while Mexican Americans were 2.67 (95% CI [1.22, 5.82]) and 2.66 (95% CI [1.42, 5.01]) times more likely to state not at all true and not too true than very true compared to non-Hispanic whites when it comes to believing promotions are handled fairly.

Finally, models for the GSS QWL variable cowrkint indicated professional & related, service, sales & office, construction & maintenance demonstrated statistically significant differences in responses according to race/ethnicity. For professional & related jobs, the score test for the proportional odds assumption indicated the need for a model permitting non-proportional odds, i.e., coefficients for non-Hispanic black (vs. non-Hispanic white) and not at all true (vs. very true), not too true (vs. very true), and somewhat true (vs. very true) and Mexican American (vs. non-Hispanic white) and not at all true (vs. very true), not too true (vs. very true), and somewhat true (vs. very true). Compared to non-Hispanic whites, non-Hispanic blacks were 3.0 (95% CI [1.8, 5.05]) and 1.64 (95% CI [1.08, 2.5]) times more likely to state "not too true" and "somewhat true" than "very true" regarding believing the people they work with take a personal interest in them. Mexican Americans were 5.43 (95% CI [1.9, 15.5]) times more likely to state "not at all true" than "very true" that people at work take an interest in them. For those in service occupations, Mexican Americans were 1.78 (95% CI [1.06, 2.99]) times more likely to report it was less true that people at work took a personal interest in them relative to non-Hispanic whites. For those in the sales & office occupations, non-Hispanic blacks were 1.76 (95% CI [1.3, 2.39]) times more likely to report it was less true that people at work took a personal interest in them relative to non-Hispanic whites. For construction & maintenance jobs, the score test for the proportional odds assumption indicated the need for a model permitting non-proportional odds; however, a properly converging model could not be produced.

Table 2.2.4 shows the results of the general linear models evaluating the relationship between the work environment stressor total sum scale scores or five individually summed sub-scales scores and race/ethnicity and occupational classification. The reference categories for race/ethnicity and occupation were male and business & finance. For the cumulative work environment stressor total sum scale scores, no joint effect for race/ethnicity & occupation was found (model 4). Regarding the sub-scales, the interaction term for race/ethnicity and occupation for the work relational stressors scale scores was statistically significant (Wald χ^2 p-value = .003) indicating the need for further examination of the relationship. The generalized linear models following stratification by occupation showed race/ethnicity differences in work relational stressors scale scores within the professional & related and sales & office occupations. Compared to non-Hispanic whites, non-Hispanic blacks and Mexican Americans working within the professional & related jobs had scores that were on average 1.32 and 2.02 points higher than expected, Wald χ^2 p-values = .006 and .007, respectively. Within the sales & office jobs, non-Hispanic blacks had average scores 1.43 points higher than non-Hispanic whites (Wald χ^2 p-value = .0009).

Table 2.2.4 Relationship between the work environment stressors total sum scale scores or individually summed sub-scale scores and race/ethnicity and/or 2010 BLS standard occupational classifications for the 2002-2014 GSS responses (N=3785)

		Model 1		Model 2		Model 3		Model 4	
Dependent Variable	Independent Variable	$\chi2$	p-value	$\chi2$	p-value	$\chi2$	p-value	$\chi2$	p-value
Work Environment	Race/ethnicity	7.11	0.03			4.84	0.09	3.91	0.14
Stressors (27-items)	Occupation			73.55	<0.0001	71.25	<0.0001	67.82	<0.0001
	Race/ethnicity*Occupation							17.33	0.067
Work Load	Race/ethnicity	13.03	0.002			7.91	0.02	4.02	0.13
Stressors (5-items)	Occupation			57.28	<0.0001	52.1	<0.0001	48.25	<0.0001
	Race/ethnicity*Occupation							6.25	0.79
Work Structural	Race/ethnicity	7.33	0.03			8.00	0.02	2.45	0.29
Stressors (4-items)	Occupation			9.71	<0.0001	10.37	0.0654	16.35	0.006
	Race/ethnicity*Occupation							14.28	0.16
Work Relational	Race/ethnicity	17.52	0.0002			13.84	0.001	4.64	0.10
Stressors (9-items)	Occupation			75.45	<0.0001	71.72	<0.0001	73.44	<0.0001
	Race/ethnicity*Occupation							26.26	0.003
Work Safety	Race/ethnicity	7.85	0.02			4.40	0.11	3.17	0.20
Stressors (4-items)	Occupation			49.30	<0.0001	45.81	<0.0001	52.01	<0.0001
	Race/ethnicity*Occupation							17.54	0.06
Work Developmental	Race/ethnicity	22.68	<0.0001			7.57	0.023	1.55	0.46
Stressors (5-items)	Occupation			431.74	<0.0001	415	<0.0001	337.59	<0.0001
	Race/ethnicity*Occupation							6.99	0.73

The reference categories for race/ethnicity and occupation were non-Hispanic white and business & finance, respectively. Active military respondents were excluded (n=55).

AIM TWO, HYPOTHESIS THREE RESULTS

This hypothesis was evaluated with a series of cumulative logit models testing the relationship between the GSS QWL variables responses and respondents' sex and the survey year. The reference categories for sex and survey year were male and 2010, respectively. These models tested if comparison categories reported statistically different odds of being in a higher (worse) GSS QWL stressor response category relative to their reference categories. Only one of the 27 GSS QWL variables produced a statistically significant interaction term for sex and survey year, the QWL variable regarding to get to do a number of different things on the job (model 4, coefficient Wald χ^2 p-value = .003) (table not shown). Further investigation following stratification by survey year showed that in 2002, the odds ratio for female versus male reporting "disagree" rather than "strongly disagree" was .72 (95% CI [.75, .91]). Stated differently, compared to males, females were 1.39 times more likely to say they disagree rather than strongly disagree that they get to do a number of different things on their job. In 2006, the odds ratio for females to more strongly disagree that they get to do a number of different things at their job was .66 (95% CI [.53, .83]), i.e., females were 1.51 times more likely to disagree that they get to do a number of different things on their job compared to males.

Table 2.3.2 shows the results of general linear models evaluating the relationship between the work environment stressor total sum scale scores or five individually summed sub-scales scores and sex and survey year. The interaction terms for the joint effects of sex and survey year were not statistically significant for the 27-item work environment stressor total sum scale nor its sub-scales.

Table 2.3.2 Relationship between work environment stressor total sum scale scores or individually summed sub-scale scores and sex and/or survey year for the 2002-2014 GSS responses (N=3840)

		Model 1		Model 2		Model 3		Model 4	
Dependent Variable	Independent Variable	$\chi 2$	p-value	$\chi 2$	p-value	$\chi 2$	p-value	$\chi 2$	p-value
Work Environment Stressors (27-items)	Sex	0.00	0.96			0.00	0.97	0.2	0.65
	Survey Year			2.57	0.46	2.57	0.46	2.11	0.55
	Sex*Survey Year							0.48	0.92
Work Load Stressors (5-items)	Sex	2.13	0.14			2.05	0.15	0.21	0.65
	Survey Year			1.07	0.78	0.99	0.80	0.62	0.89
	Sex*Survey Year							0.9	0.83
Work Structural Stressors (4-items)	Sex	3.61	0.06			3.60	0.06	3.07	0.08
	Survey Year			11.26	0.01	11.25	0.01	5.31	0.15
	Sex*Survey Year							1.17	0.76
Work Relational Stressors (9-items)	Sex	0.58	0.44			0.59	0.44	0.65	0.42
	Survey Year			0.71	0.87	0.72	0.87	1.17	0.76
	Sex*Survey Year							0.61	0.89
Work Safety Stressors (4-items)	Sex	0.46	0.50			0.52	0.47	0.4	0.53
	Survey Year			6.96	0.07	7.01	0.07	3.68	0.30
	Sex*Survey Year							0.15	0.98
Work Development Stressors (5-items)	Sex	0.48	0.49			0.50	0.48	0.0	1.00
	Survey Year			3.50	0.32	3.51	0.32	6.97	0.07
	Sex*Survey Year							4.51	0.21

The reference categories for sex and survey year were male and 2010, respectively.

A series of cumulative logit models were created testing the relationship between the GSS QWL variables and respondents' race/ethnicity and the survey year. The reference categories for race/ethnicity and survey year were non-Hispanic white and 2010, respectively. These models tested if comparison categories reported statistically different odds of being in a higher (worse) GSS QWL stressor response category relative to their reference categories. Only one of the 27 GSS QWL variables produced a statistically significant interaction term for race/ethnicity and survey year, GSS QWL variable describing respondents perception of their supervisors helpfulness in getting their job done (Wald χ^2 p-value = .012) (table not shown). Further investigation following stratification by survey year showed that in 2010, Mexican Americans were 2.49 (95% CI [1.48, 4.18]) times more likely to state it was less true that their supervisor was helpful to them in getting their job done compared with non-Hispanic whites. Table 2.3.4 shows the results of the general linear models evaluating the relationship between the work environment stressor total sum scale scores or five individually summed sub-scales and race/ethnicity and survey year. The interaction terms for the joint effects of race/ethnicity and survey year were not statistically significant for the 27-item work environment stressor sum scale or sub-scales (model 4).

Table 2.3.4 Relationship between work environment stressors total sum scale scores or individually summed sub-scale scores and race/ethnicity and/or survey year for the 2002-2014 GSS responses (N=3840)

		Model 1		Model 2		Model 3		Model 4	
Dependent Variable	Independent Variable	$\chi2$	p-value	$\chi2$	p-value	$\chi2$	p-value	$\chi2$	p-value
Work Environment	Race/ethnicity	7.86	0.02			7.93	0.02	1.84	0.40
Stressors (27-items)	Survey Year			2.57	0.46	2.64	0.45	2.16	0.54
	Race/ethnicity*Survey Year							1.38	0.97
Work Load	Race/ethnicity	12.02	0.003			11.92	0.003	2.1	0.35
Stressors (5-items)	Survey Year			1.07	0.78	0.97	0.81	2.12	0.55
	Race/ethnicity*Survey Year							4.81	0.57
Work Structural	Race/ethnicity	7.81	0.02			6.64	0.04	2.21	0.33
Stressors (4-items)	Survey Year			11.26	0.01	10.08	0.02	7.41	0.06
	Race/ethnicity*Survey Year							1.58	0.95
Work Relational	Race/ethnicity	17.84	0.0001			18.03	0.0001	5.53	0.06
Stressors (9-items)	Survey Year			0.71	0.87	0.91	0.82	0.66	0.88
	Race/ethnicity*Survey Year							3.87	0.69
Work Safety	Race/ethnicity	7.60	0.02			8.24	0.016	4.89	0.09
Stressors (4-items)	Survey Year			6.96	0.07	7.6	0.06	4.13	0.25
	Race/ethnicity*Survey Year							3.36	0.76
Work Development	Race/ethnicity	24.93	<0.0001			25.09	<0.0001	2.81	0.25
Stressors (5-items)	Survey Year			3.50	0.32	3.66	0.30	2.87	0.41
	Race/ethnicity*Survey Year							7.77	0.26

The reference categories for race/ethnicity and survey year were non-Hispanic white and 2010, respectively.

AIM THREE, HYPOTHESES ONE & TWO RESULTS

The first hypothesis of the third aim proposed an association between exposures to stressful work environment characteristics and days of poor mental and physical health reported in the last thirty, specifically, more work stress equating to more days of poor health. Days of poor mental health were statistically associated with 24 of 27 GSS QWL work environment stressor variables while days of poor mental health were associated with 25 of 27 GSS QWL variables (table not shown). For both health variables, the GSS QWL variables describing respondents' perception of getting to do a number of things on their jobs and being required to learning new things on the job were unrelated to the number of reported days. Additionally, for poor mental health, responses to GSS QWL variable regarding the frequency respondents get to take part in making decisions that affect them decide were not statistically associated. These three variables are part of the work developmental stressors sub-scale. The second hypothesis proposed that exposure to stressful work environment characteristics is associated with more reported days of limited engagement in usual activities due to poor health. Like the analyses for days of poor mental health, days of limited engagement in usual activities in the past thirty days was statistically associated with 24 GSS QWL variables but unassociated with responses for getting to do a number of different things on the job, being required to learn new things on the job, and being involved with others in making decisions that affect the respondent.

Table 3.1.2 presents the mean scores for the work environment stressor total sum scale and five individually summed sub-scales stratified by the levels of the four health measurement variables. The poorer the self-rated health or greater the frequency of reporting days of poor mental, poor physical health, or days of limited usual activity due to poor health the higher the mean work environment stressor total sum scale score, i.e., increasing work stress is positively associated with increasingly poor health. The third hypothesis of this aim will address self-rated health more thoroughly but briefly, those reporting excellent health had a mean work environment stressor total sum scale score of 46.84 (*SD* = 10.54) while those reporting very poor health had a mean score of 56.04 (*SD* = 16.74). Those reporting zero days of poor mental health had a mean work environment stressor total sum scale score of 48.40 (*SD* = 10.75) while those reporting 29+ days of poor mental health in the last thirty had a mean score of 58.30 (*SD* = 13.96). Those reporting zero days of poor physical health in the last thirty had a mean work environment stressor total sum scale score of 49.26 (*SD* = 11.06) while those with 29+ days of poor physical health in the last thirty had a mean score of 55.15 (*SD* = 14.68). Finally, those reporting zero days of activity limited by health in the last thirty had a mean work environment stressor total sum scale score of 49.44 (*SD* = 11.05) while those with 29+ days of activity limited by health in the last 30 had a mean score of 60.40 (*SD* = 16.91).

Table 3.1.2 Mean work environment stressor total sum scale scores or individually summed sub-scale scores stratified by self-rated health, days of poor mental or physical health or limited days of usual activities due to poor health in the 2002-2014 GSS responses (N=4236)

		Work Environment Stressors (27-items)		Work Load Stressors (5-items)		Work Structural Stressors (4-items)	
Health Measure	N	mean	SD	mean	SD	mean	SD
Self-Rated Health							
Excellent	1081	46.8	10.5	10.6	2.8	6.8	2.1
Very Good	1286	49.8	10.7	10.9	2.7	7.3	2.1
Good	1339	51.9	11.5	11.1	2.8	7.5	2.2
Fair	477	54.1	13.0	11.5	3.0	7.8	2.4
Poor	53	56.0	16.7	12.0	3.8	8.0	2.8
Days of Poor Mental Health							
0	2521	48.4	10.8	10.5	2.7	6.9	2.1
1	183	49.7	11.0	11.2	2.8	7.3	2.1
2	296	52.0	11.4	11.6	2.8	7.7	2.2
3	187	49.8	10.6	10.7	2.9	7.4	2.2
4	124	51.0	12.2	11.9	2.9	7.5	2.4
5	227	52.4	11.3	11.8	2.9	7.7	2.2
6	22	53.0	13.4	11.6	3.7	7.8	2.8
7	80	53.0	12.3	11.3	2.9	7.9	2.4
8-14	191	54.0	11.5	12.0	3.0	7.8	2.1
15-21	203	56.0	12.2	12.0	3.0	8.1	2.3
22-28	27	60.2	14.7	12.6	3.2	8.9	2.6
29+	175	58.3	14.0	12.2	3.1	8.4	2.5
Days of Poor Physical Health							
0	2717	49.3	11.1	10.7	2.8	7.1	2.1
1	264	50.1	10.6	11.2	2.6	7.3	2.2
2	339	50.9	11.3	11.1	2.7	7.4	2.2
3	181	52.0	11.5	11.3	2.7	7.6	2.3
4	112	50.7	12.5	11.0	3.2	7.4	2.3
5	145	54.7	12.6	11.9	3.1	8.2	2.5
6	20	49.2	11.4	11.8	2.9	7.1	2.0
7	81	51.6	13.7	11.7	3.2	7.5	2.6
8-14	152	51.5	11.7	11.1	3.0	7.5	2.4
15-21	90	57.2	11.9	12.1	3.2	8.3	2.2
22-28	17	56.3	18.1	12.4	3.1	8.3	3.0
29+	118	55.2	14.7	11.9	3.2	7.9	2.3

Table 3.1.2 Mean work environment stressor total sum scale scores or individually summed sub-scale scores stratified by self-rated health, days of poor mental or physical health or limited days of usual activities due to poor health in the 2002-2014 GSS responses (N=4236) (continued)

		Total Work Environment Stressors		Work Load Stressors		Work Structural Stressors	
Health Measure	N	mean	SD	mean	SD	mean	SD
Days of Limited Usual Activity							
0	3350	49.4	11.1	10.8	2.8	7.1	2.1
1	183	51.3	11.0	11.4	2.7	7.7	2.2
2	172	52.2	12.3	11.6	2.9	7.6	2.3
3	120	52.6	11.3	11.5	2.8	7.8	2.3
4	68	50.0	11.3	11.3	3.0	7.5	2.2
5	98	56.1	13.4	12.3	3.0	8.3	2.7
6	8	54.6	13.1	10.6	3.9	7.9	3.1
7	37	50.9	13.1	11.1	3.3	7.1	2.0
8-14	71	55.6	13.3	11.9	3.0	8.3	2.7
15-21	74	56.4	13.9	11.8	3.2	8.3	2.5
22-28	9	58.3	16.1	13.2	3.4	8.3	3.3
29+	46	60.4	16.9	12.9	3.6	9.2	3.0

Table 3.1.2 Mean work environment stressor total sum scale scores or individually summed sub-scale scores stratified by self-rated health, days of poor mental or physical health or limited days of usual activities due to poor health in the 2002-2014 GSS responses (N=4236) (continued)

		Work Relational Stressors (9-items)		Work Safety Stressors (4-items)		Work Developmental Stressors (5-items)	
Health Measure	N	mean	SD	mean	SD	mean	SD
Self-Rated Health							
Excellent	1081	15.0	4.7	6.4	2.2	8.1	2.4
Very Good	1286	16.1	4.8	6.8	2.2	8.8	2.7
Good	1339	17.1	5.3	7.1	2.4	9.2	2.7
Fair	477	17.8	6.0	7.4	2.6	9.6	2.7
Poor	53	18.6	7.3	8.0	3.1	9.5	2.7
Days of Poor Mental Health							
0	2521	15.6	4.8	6.7	2.2	8.8	2.7
1	183	16.0	4.7	6.9	2.3	8.3	2.4
2	296	16.8	5.1	7.1	2.5	8.7	2.5
3	187	16.1	5.0	6.9	2.2	8.7	2.5
4	124	16.2	5.5	6.7	2.2	8.7	2.8
5	227	17.2	5.1	6.8	2.3	8.9	2.7
6	22	17.4	5.6	6.7	2.1	9.5	2.5
7	80	17.6	5.8	7.3	2.5	8.9	2.7
8-14	191	17.9	5.3	7.2	2.3	9.0	2.6
15-21	203	18.6	6.0	7.8	2.5	9.5	2.6
22-28	27	20.4	6.3	8.4	3.3	9.9	2.6
29+	175	20.0	6.7	7.9	2.8	9.8	3.0
Days of Poor Physical Health							
0	2717	16.0	5.0	6.7	2.3	8.8	2.7
1	264	16.2	4.6	6.9	2.3	8.4	2.4
2	339	16.4	5.2	7.0	2.3	8.9	2.6
3	181	17.0	5.4	7.2	2.3	9.0	2.5
4	112	16.5	5.6	7.0	2.4	8.8	2.6
5	145	18.2	5.9	7.4	2.4	9.0	2.7
6	20	14.8	5.4	6.4	2.0	9.1	2.5
7	81	16.9	5.8	6.9	2.5	8.5	2.7
8-14	152	17.0	5.4	6.9	2.3	9.1	2.5
15-21	90	18.7	5.6	8.3	2.8	9.7	2.5
22-28	17	18.8	8.0	7.7	2.9	9.1	3.0
29+	118	18.0	6.7	7.8	2.9	9.6	3.1

Table 3.1.2 Mean work environment stressor total sum scale scores or individually summed sub-scale scores stratified by self-rated health, days of poor mental or physical health or limited days of usual activities due to poor health in the 2002-2014 GSS responses (N=4236) (continued)

		Work Relational Stressors		Work Safety Stressors		Work Developmental Stressors	
Health Measure	N	mean	SD	mean	SD	mean	SD
Days of Limited Usual Activity							
0	3350	16.0	5.0	6.8	2.3	8.8	2.6
1	183	16.4	4.8	7.1	2.3	8.7	2.6
2	172	16.9	5.3	7.1	2.4	9.1	2.8
3	120	17.1	5.6	7.3	2.5	8.8	2.4
4	68	15.7	5.0	7.2	2.5	8.4	2.4
5	98	18.6	5.8	7.6	2.7	9.3	2.7
6	8	17.1	5.4	7.0	2.1	12.0	2.0
7	37	16.8	6.0	6.7	2.6	9.2	2.8
8-14	71	18.3	5.9	7.5	2.9	9.7	2.6
15-21	74	18.3	6.7	8.1	3.1	9.9	2.8
22-28	9	20.3	8.2	7.3	2.1	9.1	1.8
29+	46	20.7	7.1	7.9	3.2	9.9	3.6

The results of the analyses evaluating the relationship between work environment stressor total sum scale scores (first models), the five individually summed sub-scales included simultaneously but as separate independent predictors (second models), the work environment stressor total sum scale scores split into quintiles (third models), and the days of poor mental or physical health or days of limited usual activity due to poor health (hypotheses 1 & 2) are presented in table 3.1.3. First, work environment stressor total sum scale scores were statistically associated with days of poor mental health, poor physical health, and days of limited engagement in usual activity. The coefficients represent log-days of poor health or limited activity and exponentiation of the coefficients returns the values in the original units, i.e., number of days in the previous thirty. For every one-point increase in the work environment stressor total sum scale score the number of days of poor mental health, poor physical health, and days of limited engagement in usual activity due to poor health increased by 3.7%, 2.3%, and 3.4%, respectively.

For days of poor mental health, model 2 included the five individually summed work environment stressor sub-scales as separate independent variables; the work load stressors and work relational stressors scale scores were statistically related to days of poor mental health. For every one-point increase in the work load stressors scale the number of days of poor mental health increased by 7% while the number of days increased by 4.1% with a one-point increase in the work relational stressors scale. The workload stressors and work safety stressors scale scores were statistically associated with days of poor physical health. For the former, the days of poor physical health increased by 5.2% per one-point increase while the latter increased the days by 5.5% per one-point increase. Work load stressors and work structural stressors scale scores were statistically associated with days of limited usual activity due to poor health. A one-point increase in the work load stressors scale score was associated with a 6.3% increase in days while a one-point increase in the work structural stressors scale score was associated with a 9.3% increase in days of limited usual activity due to poor health.

Finally, the third model describing the relationship between the health variable work stressors used an ordered category version of the work environment stressor total sum scale split into score quintiles, with the lowest scores representing those with the least total work stressor exposure and reference category. For days of poor mental health, relative to the lowest quintile, all four of the other quintiles reported a greater number of days of poor mental health. The effect was monotonic in that each higher quintile (increasing work stress exposure) was associated with increasingly higher reported days of poor mental health. For the second, third, fourth, and fifth quintiles the number of days of poor mental health were 58.2%, 79.7%, 104%, and 260% greater than those with work environment stressor total sum scale scores in the first quintile (table 3.1.3, third models). For days of poor physical health and days of limited engagement in usual activity due to poor health, only those with work stress scores in the fourth and fifth quintiles of had statistically different days compared with those with scores in the first quintile. Those in the fourth quintile had 41% more days while those in the fifth quintile had 99% more days of poor physical health compared to those with scores in first quintile. For days of limited engagement in usual activity due to poor health, those with scores in the fourth quintile had 68% more days while those in the fifth quintile had 188% more days than those with scores in the first quintile.

Table 3.1.3 Relationship between days of poor mental or physical health or limited usual activities due to poor health and work environment stressors total sum scale score or individually summed sub-scale scores for the 2002-2014 GSS responses (N=4236)

	Days of Poor Mental Health								
	Model 1			Model 2			Model 3		
Characteristic	Estimate	SE	p-value	Estimate	SE	p-value	Estimate	SE	p-value
Work Environment Stressors (27-items)	0.037	0.003	<0.0001						
Work Load Stressors (5-items)				0.068	0.015	<0.0001			
Work Structural Stressors (4-items)				0.033	0.025	0.19			
Work Relational Stressors (9-items)				0.040	0.010	<0.0001			
Work Safety Stressors (4-items)				0.015	0.020	0.45			
Work Developmental Stressors (5-items)				0.020	0.016	0.23			
Work Environment Stressors (27-items) Quintiles									
2nd							0.458	0.122	0.0002
3rd							0.586	0.117	<0.0001
4th							0.695	0.119	<0.0001
5th							1.281	0.117	<0.0001

Days of poor mental health, days of poor physical health, and days of limited usual activity were modeled using negative binomial regression and coefficient estimates represent log-days of their respective measure. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).

Table 3.1.3 Relationship between days of poor mental or physical health or limited usual activities due to poor health and work environment stressors total sum scale score or individually summed sub-scale scores for the 2002-2014 GSS responses (N=4236) (continued)

	Days of Poor Physical Health								
	Model 1			Model 2			Model 3		
Characteristic	Estimate	SE	p-value	Estimate	SE	p-value	Estimate	SE	p-value
Work Environment Stressors (27-items)	0.023	0.003	<0.0001						
Work Load Stressors (5-items)				0.050	0.016	0.0012			
Work Structural Stressors (4-items)				0.020	0.027	0.45			
Work Relational Stressors (9-items)				0.003	0.011	0.7949			
Work Safety Stressors (4-items)				0.053	0.021	0.01			
Work Developmental Stressors (5-items)				0.022	0.018	0.20			
Work Environment Stressors (27-items) Quintiles									
2nd							0.123	0.131	0.35
3rd							0.102	0.126	0.42
4th							0.343	0.127	0.007
5th							0.688	0.125	<0.0001

Days of poor mental health, days of poor physical health, and days of limited usual activity were modeled using negative binomial regression and coefficient estimates represent log-days of their respective measure. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).

Table 3.1.3 Relationship between days of poor mental or physical health or limited usual activities due to poor health and work environment stressors total sum scale score or individually summed sub-scale scores for the 2002-2014 GSS responses (N=4236) (continued)

	Days of Limited Usual Activity Due to Poor Health								
	Model 1			Model 2			Model 3		
Characteristic	Estimate	SE	p-value	Estimate	SE	p-value	Estimate	SE	p-value
Work Environment Stressors (27-items)	0.033	0.004	<0.0001						
Work Load Stressors (5-items)				0.061	0.022	0.005			
Work Structural Stressors (4-items)				0.089	0.035	0.01			
Work Relational Stressors (9-items)				0.012	0.015	0.42			
Work Safety Stressors (4-items)				0.010	0.027	0.70			
Work Developmental Stressors (5-items)				0.027	0.024	0.27			
Work Environment Stressors (27-items) Quintiles									
2nd							0.282	0.179	0.12
3rd							0.188	0.173	0.28
4th							0.521	0.174	0.003
5th							1.059	0.171	<0.0001

Days of poor mental health, days of poor physical health, and days of limited usual activity were modeled using negative binomial regression and coefficient estimates represent log-days of their respective measure. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).

AIM THREE, HYPOTHESIS THREE RESULTS

The third hypothesis also focused on the relationship between work environment stressor exposure and health but with the self-rated general health (SRH) measure. The hypothesis was exposure to greater levels of stressful work environment characteristics is associated with poorer SRH. All 27 GSS QWL variables were statistically related to SRH and there were no disagreements between the Pearson χ^2 test for general association and the CMH χ^2 for row-mean score-differences, the latter analogous to a Kruskal-Wallis non-parametric test (ANOVA based on rank scores) (table not shown). Table 3.3.2 shows the results of bivariate general linear models evaluating the relationship between SRH and work environment stressor total sum scale scores or five individually summed sub-scale scores. Compared to those indicating their SRH was excellent, there is a statistically significant monotonic increase in the work environment stressor total sum scale scores as responses transition from “very good” to “poor”. Stated another way, increasing work stressor exposure was associated with increasingly poor self-rated general health. The relationship was also the consistent for all five sub-scales.

Table 3.3.2 Relationship between work environment stressors total sum scale scores or individually summed sub-scale scores and self-rated health for the 2002-2014 GSS responses (N=4236)

Dependent Variable	Reference Category	Category	Estimate	SE	χ^2 p-value
Model A: Work Environment Stressors (27-items)	Excellent	Very Good	2.91	0.47	<0.0001
		Good	5.08	0.46	<0.0001
		Fair	7.26	0.62	<0.0001
		Poor	9.20	1.59	<0.0001
Model B: Work Load Stressors (5-items)	Excellent	Very Good	0.28	0.12	0.015
		Good	0.54	0.12	<0.0001
		Fair	0.88	0.15	<0.0001
		Poor	1.43	0.40	0.0003
Model C: Work Structural Stressors (4-items)	Excellent	Very Good	0.49	0.09	<0.0001
		Good	0.73	0.09	<0.0001
		Fair	1.02	0.12	<0.0001
		Poor	1.22	0.30	<0.0001
Model D: Work Relational Stressors (9-items)	Excellent	Very Good	1.10	0.21	<0.0001
		Good	2.10	0.21	<0.0001
		Fair	2.80	0.28	<0.0001
		Poor	3.63	0.72	<0.0001
Model E: Work Safety Stressors (4-items)	Excellent	Very Good	0.43	0.10	<0.0001
		Good	0.67	0.09	<0.0001
		Fair	1.11	0.13	<0.0001
		Poor	1.58	0.32	<0.0001
Model F: Work Development Stressors (5-items)	Excellent	Very Good	0.61	0.11	<0.0001
		Good	1.04	0.11	<0.0001
		Fair	1.45	0.14	<0.0001
		Poor	1.33	0.37	0.0003

Table 3.3.3 contains the results of analyses like those conducted for days of poor mental health, physical health, and limited engagement in usual activity due to poor health (see table 3.1.3). For every one-point increase in the work environment stressor total sum scale score, the odds of being in a poorer SRH category increased by 3.6% (model 1: odds

ratio 1.036; 95% CI [1.031, 1.041]). The result of the score test was a failure to reject the proportional odds assumption. Model 2 included each of the five sub-scales as separate independent variables. Only the work structural stressors scale scores were not statistically associated with SRH. Alternatively, for every one-point increase in the work load stressors, work relational stressors, work safety stressors, and work developmental stressors scale scores the odds of being in a poorer SRH increased by 2.6%, 3.2%, 3.8%, and 8%, respectively. Finally, using the work environment stressor total sum scale scores split into quintiles and the lowest quintile (lowest work stress) as the reference category, all four other quintiles had higher odds of reporting poorer self-rated health. The result of the score test was a failure to reject the proportional odds assumption. Those with scores in the second, third, fourth, and fifth quintiles were 30%, 58%, 91%, and 205% more likely to report being in a poorer self-rated health category relative to the those with scores in the first quintile.

Table 3.3.3 Relationship between work environment stressors total sum scale scores or individually summed sub-scale scores and self-rated health for the 2002-2014 GSS responses (N=4236)

	Self-Rated Health								
	Model 1			Model 2			Model 3		
Characteristic	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value
Work Environment Stressors (27-items)	0.035	0.002	<0.0001						
Work Load Stressors (5-items)				0.025	0.012	0.03			
Work Structural Stressors (4-items)				0.013	0.019	0.51			
Work Relational Stressors (9-items)				0.031	0.008	0.0001			
Work Safety Stressors (4-items)				0.037	0.015	0.01			
Work Developmental Stressors (5-items)				0.077	0.012	<0.0001			
Work Environment Stressors (27-items) Quintiles									
2nd							0.264	0.092	0.004
3rd							0.456	0.089	<0.0001
4th							0.648	0.090	<0.0001
5th							1.115	0.090	<0.0001

Self-rated health is modeled using cumulative logit regression. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).

AIM THREE, HYPOTHESIS FOUR RESULTS

The fourth and final hypothesis of the third aim proposed that a relationship between sex or race/ethnicity and the health measures would be mediated by accounting for work environment stressor exposure. A series of ten negative binomial regression models evaluated for each of the health indicator variables with responses treated as counts, i.e., days of poor mental health, days of poor physical health, and days of limited engagement in usual activities due to poor health. Another series of ten cumulative logit models were created for the self-rated general health measure. The sequence of these ten models was as follows:

- Model 1: Sex is the only independent variable.
- Model 2: Model 1 with the addition of work environment stressor total sum scale score as an independent variable.
- Model 3: Race/ethnicity is the only independent variable (like model 1).
- Model 4: Model 3 with the addition of work environment stressor total sum scale score as an independent variable.
- Model 5: Sex and race/ethnicity as independent variables.
- Model 6: Model 5 with work environment stressor total sum scale score added as an independent variable.
- Model 7: Model 5 with the covariates of age, education, marital status, income, and survey year added as independent variables.
- Model 8: Model 7 with the work environment stressor total sum scale score added as an independent variable.

- Models 9: Model 7 with five individually summed work environment stressor sub-scales as independent variables.
- Model 10: Model 7 with work environment stressor total sum scale scores split into quintiles as an independent variable.

Beginning with the health measure of days of poor mental health in the previous thirty days (table 3.4.1), model 1 shows females reported 41.6% more days of poor mental health than males (p-value < .0001). The results in table 3.1.3 demonstrated work environment stressor total sum scale scores as statistically associated to days of poor mental health. The results in tables 2.2.2 & 2.3.2 established that respondents' sex was not statistically associated with work environment stressor total sum scale scores. Given these findings, the addition of work environment stressor total sum scale scores cannot not mediate the relationship between respondent sex and days of poor mental health; model 2 shows that to be true. The coefficient for sex increased to .347 in model 1 to .397 in model 2 (p-values < .0001 for both coefficients). Moving to race/ethnicity, the p-values for the coefficients in model 3 indicate there were no statistically significant differences in days of poor mental health between non-Hispanic whites and non-Hispanic blacks or Mexican Americans (LR χ^2 p-value = .23). The results in tables 2.2.4 & 2.3.4 indicated respondents' race/ethnicity was statistically related to work environment stressor total sum scale scores. Given that model 3 in table 3.4.1 did not provide evidence of statistical a relationship between race/ethnicity and days of poor mental health, the addition of work environment stressor total sum scale scores to model 3 cannot mediate the relationship. That addition, as demonstrated by model 4, shows work environment stressor total sum scale scores resulting in a statistically significant coefficient for a difference between non-Hispanic blacks and non-Hispanic whites, however, the p-value for likelihood-ratio (LR) χ^2 test for the variable as a whole was .074.

Model 5 with only sex and race/ethnicity as independent variables indicates the coefficient for sex changed slightly from model 1, .357 up from .347 and remained statistically significant while respondents' race/ethnicity remained unassociated with days of mental health (LR χ^2 p-value = .14). Adding covariates into the model with sex and race/ethnicity (model 7) did little to change the relationship between sex and days of poor mental health. However, non-Hispanic blacks reported 26% fewer days than non-Hispanic whites (p-value = .003). These differences persisted with the addition of work environment stressor scores regardless of how the scale's scores were used in the model, i.e., continuous scale, multiple sub-scales, or quintiles of scores (models 8-10). In all cases, females reported more days than males while non-Hispanic blacks reported fewer days of poor mental health than non-Hispanic whites while there was no difference for Mexican Americans.

Table 3.4.1 The relationship between days of poor mental health in the last 30 days and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236)

	Model 1			Model 2			Model 3		
Characteristic	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value
Sex									
Female	0.348	0.07	<0.0001	0.397	0.07	<0.0001			
Race/Ethnicity									
Non-Hispanic Black							-0.159	0.10	0.12
Mexican American							0.085	0.15	0.58
Work Environment Stressors (27-items)				0.038	0.003	<0.0001			
Work Load Stressors (5-items)									
Work Structural Stressors (4-items)									
Work Relational Stressors (9-items)									
Work Safety Stressors (4-items)									
Work Developmental Stressors (5-items)									
Work Environment Stressors (27-items) Quintiles									
2nd									
3rd									
4th									
5th									

Days of poor mental health in the last 30 were modeled using negative binomial regression and coefficient estimates represent log-days. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).

Models 1-6 are unadjusted for additional covariates

Models 7-10 are adjusted for age, education, marital status, income, and survey year

† = LR χ^2 p-value for the race/ethnicity variable was >0.05

Table 3.4.1 The relationship between days of poor mental health in the last 30 days and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236) (continued)

	Model 4			Model 5			Model 6		
Characteristic	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value
Sex									
Female				0.36	0.08	<0.0001	0.41	0.07	<0.0001
Race/Ethnicity									
Non-Hispanic Black	-0.222	0.10	0.025†	-0.19	0.10	0.06	-0.27	0.10	0.006†
Mexican American	0.060	0.15	0.68	0.08	0.15	0.61	0.06	0.15	0.69
Work Environment Stressors (27-items)	0.037	0.003	<0.0001				0.04	0.003	<0.0001
Work Load Stressors (5-items)									
Work Structural Stressors (4-items)									
Work Relational Stressors (9-items)									
Work Safety Stressors (4-items)									
Work Developmental Stressors (5-items)									
Work Environment Stressors (27-items) Quintiles									
2nd									
3rd									
4th									
5th									

Days of poor mental health in the last 30 were modeled using negative binomial regression and coefficient estimates represent log-days. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).

Models 1-6 are unadjusted for additional covariates

Models 7-10 are adjusted for age, education, marital status, income, and survey year

† = LR χ^2 p-value for the race/ethnicity variable was >0.05

Table 3.4.1 The relationship between days of poor mental health in the last 30 days and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236) (continued)

	Model 7			Model 8			Model 9		
Characteristic	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value
Sex									
Female	0.34	0.08	<0.0001	0.40	0.07	<0.0001	0.43	0.07	<0.0001
Race/Ethnicity									
Non-Hispanic Black	-0.31	0.10	0.003	-0.41	0.10	<0.0001	-0.41	0.10	<0.0001
Mexican American	-0.06	0.00	0.71	-0.07	0.15	0.65	-0.06	0.15	0.68
Work Environment Stressors (27-items)				0.04	0.00	<0.0001			
Work Load Stressors (5-items)							0.09	0.02	<0.0001
Work Structural Stressors (4-items)							0.06	0.03	0.02
Work Relational Stressors (9-items)							0.04	0.01	0.0001
Work Safety Stressors (4-items)							-0.01	0.02	0.76
Work Developmental Stressors (5-items)							-0.01	0.02	0.72
Work Environment Stressors (27-items) Quintiles									
2nd									
3rd									
4th									
5th									

Days of poor mental health in the last 30 were modeled using negative binomial regression and coefficient estimates represent log-days. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).

Models 1-6 are unadjusted for additional covariates

Models 7-10 are adjusted for age, education, marital status, income, and survey year

† = LR χ^2 p-value for the race/ethnicity variable was >0.05

Table 3.4.1 The relationship between days of poor mental health in the last 30 days and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236) (continued)

Characteristic	Model 10 Estimate	SE	χ^2 p-value
Sex			
Female	0.42	0.07	<0.0001
Race/Ethnicity			
Non-Hispanic Black	-0.38	0.10	0.0002
Mexican American	-0.05	0.15	0.72
Work Environment Stressors (27-items)			
Work Load Stressors (5-items)			
Work Structural Stressors (4-items)			
Work Relational Stressors (9-items)			
Work Safety Stressors (4-items)			
Work Developmental Stressors (5-items)			
Work Environment Stressors (27-items) Quintiles			
2nd	0.40	0.122	0.001
3rd	0.58	0.117	<0.0001
4th	0.64	0.118	<0.0001
5th	1.27	0.116	<0.0001

Days of poor mental health in the last 30 were modeled using negative binomial regression and coefficient estimates represent log-days. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).
Models 1-6 are unadjusted for additional covariates
Models 7-10 are adjusted for age, education, marital status, income, and survey year
† = LR χ^2 p-value for the race/ethnicity variable was >0.05

The next health measure evaluated was reported days of poor physical health reported in the previous thirty (table 3.4.2). Model 1 showed females reported 45.6% more days of poor mental health than males (p-value < .0001). The results in table 3.1.3

established that work environment stressor total sum scale scores were statistically related to days of poor physical health. The results in tables 2.2.2 & 2.3.2 established that respondents' sex was not statistically associated to work environment stressor total sum scale scores. Given this evidence, the addition of work environment stressor total sum scale scores to model 1 cannot not mediate a relationship between respondents' sex and days of poor physical health. Model 2 shows that to be true. The coefficient for sex increases to .393 (p-value < .0001) from .376 (model 1, p-value < .0001) indicating females reported 48.3% more days of poor mental health than males after adjusting the model for work environment stressor total sum scale scores. Model 3 substituted race/ethnicity for sex as the sole independent variable and shows no statistically significant differences in days of poor mental health between non-Hispanic whites and non-Hispanic blacks or Mexican Americans (LR χ^2 p-value = .20). The results in tables 2.2.4 & 2.3.4 established that respondents' race/ethnicity was statistically related to work environment stressor total sum scale scores. Given that model 3 in table 3.4.2 did not provide evidence of a statistical relationship between respondents' race/ethnicity and days of poor mental health, the addition of work environment stressor total sum scale scores cannot mediate the relationship. Demonstrated in model 4, although the coefficient for non-Hispanic blacks had a χ^2 p-value = .017 for a coefficient of -.26, the LR χ^2 p-value for the race/ethnicity variable with two degrees of freedom was .053.

Model 5 with only sex and race/ethnicity as independent variables indicates the coefficient for sex changed slightly from model 1, .38 from .376 and remained statistically significant while race/ethnicity remained unassociated with days of physical health (LR χ^2 p-value = .16). Adding covariates into the model with sex and race/ethnicity (model 7) did little to change the relationship between sex and days of poor physical health. However, non-Hispanic blacks reported 27% fewer days than non-Hispanic whites (p-value .004). These differences persisted with the addition of work environment stressor scores regardless of how the scale's scores were used in the model, i.e., continuous scale, multiple sub-scales, or quintiles of scores (models 8-10). In all cases, females reported more days than males while non-Hispanic blacks reported fewer days of poor mental health than non-Hispanic whites while there was no difference for Mexican Americans.

Table 3.4.2 The relationship between days of poor physical health in the last 30 days and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236)

	Model 1			Model 2			Model 3		
Characteristic	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value
Sex									
Female	0.376	0.08	<0.0001	0.394	0.08	<0.0001			
Race/Ethnicity									
Non-Hispanic Black							-0.194	0.11	0.07
Mexican American							-0.073	0.16	0.65
Work Environment Stressors (27-items)				0.024	0.003	<0.0001			
Work Load Stressors (5-items)									
Work Structural Stressors (4-items)									
Work Relational Stressors (9-items)									
Work Safety Stressors (4-items)									
Work Developmental Stressors (5-items)									
Work Environment Stressors (27-items) Quintiles									
2nd									
3rd									
4th									
5th									

Days or poor physical health in the last 30 were modeled using negative binomial regression and coefficient estimates represent log-days. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).
Models 1-6 are unadjusted for additional covariates
Models 7-10 are adjusted for age, education, marital status, income, and survey year
† = LR χ2 p-value for the race/ethnicity variable was >0.05

Table 3.4.2 The relationship between days of poor physical health in the last 30 days and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236) (continued)

	Model 4			Model 5			Model 6		
Characteristic	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value
Sex									
Female				0.38	0.08	<0.0001	0.40	0.08	<0.0001
Race/Ethnicity									
Non-Hispanic Black	-0.257	0.11	0.02†	-0.21	0.11	0.05	-0.27	0.11	0.012
Mexican American	-0.145	0.16	0.36	-0.04	0.16	0.82	-0.10	0.16	0.53
Work Environment Stressors (27-items)	0.023	0.003	<0.0001				0.02	0.003	<0.0001
Work Load Stressors (5-items)									
Work Structural Stressors (4-items)									
Work Relational Stressors (9-items)									
Work Safety Stressors (4-items)									
Work Developmental Stressors (5-items)									
Work Environment Stressors (27-items) Quintiles									
2nd									
3rd									
4th									
5th									

Days or poor physical health in the last 30 were modeled using negative binomial regression and coefficient estimates represent log-days. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).

Models 1-6 are unadjusted for additional covariates

Models 7-10 are adjusted for age, education, marital status, income, and survey year

† = LR $\chi 2$ p-value for the race/ethnicity variable was >0.05

Table 3.4.2 The relationship between days of poor physical health in the last 30 days and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236) (continued)

	Model 7			Model 8			Model 9		
Characteristic	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value
Sex									
Female	0.37	0.08	<0.0001	0.38	0.08	<0.0001	0.37	0.21	<0.0001
Race/Ethnicity									
Non-Hispanic Black	-0.32	0.110	0.00	-0.36	0.11	0.001	-0.33	-0.55	0.003
Mexican American	-0.09	0.16	0.59	-0.15	0.16	0.36	-0.14	-0.46	0.38
Work Environment Stressors (27-items)				0.024	0.00	<0.0001			
Work Load Stressors (5-items)							0.053	0.02	0.001
Work Structural Stressors (4-items)							0.053	0.03	0.05
Work Relational Stressors (9-items)							0.005	0.011	0.64
Work Safety Stressors (4-items)							0.040	0.02	0.05
Work Developmental Stressors (5-items)							0.000	0.02	1.00
Work Environment Stressors (27-items) Quintiles									
2nd									
3rd									
4th									
5th									

Days or poor physical health in the last 30 were modeled using negative binomial regression and coefficient estimates represent log-days. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).
Models 1-6 are unadjusted for additional covariates
Models 7-10 are adjusted for age, education, marital status, income, and survey year
† = LR $\chi 2$ p-value for the race/ethnicity variable was >0.05

Table 3.4.2 The relationship between days of poor physical health in the last 30 days and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236) (continued)

	Model 10		
Characteristic	Estimate	SE	χ^2 p-value
Sex			
Female	0.38	0.081	<0.0001
Race/Ethnicity			
Non-Hispanic Black	-0.35	0.11	0.001
Mexican American	-0.13	0.16	0.43
Work Environment Stressors (27-items)			
Work Load Stressors (5-items)			
Work Structural Stressors (4-items)			
Work Relational Stressors (9-items)			
Work Safety Stressors (4-items)			
Work Developmental Stressors (5-items)			
Work Environment Stressors (27-items) Quintiles			
2nd	0.182	0.133	0.17
3rd	0.26	0.128	0.046
4th	0.48	0.129	0.0002
5th	0.75	0.126	<0.0001

Days or poor physical health in the last 30 were modeled using negative binomial regression and coefficient estimates represent log-days. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).
Models 1-6 are unadjusted for additional covariates
Models 7-10 are adjusted for age, education, marital status, income, and survey year
† = LR $\chi 2$ p-value for the race/ethnicity variable was >0.05

The results of the analyses displayed in table 3.4.3 demonstrate that work environment stressor total sum scale scores do not mediate the relationship between sex or race/ethnicity and days of limited engagement in usual activity due to poor physical health.

Model 1 shows females reported 37% more days of limited engagement in usual activities due to poor health than males (p-value = .005). The results in table 3.1.3 established that work environment stressor total sum scale scores were statistically associated with days of limited activity due to poor health while the results in tables 2.2.2 & 2.3.2 established that sex was not statistically associated with work environment stressor total sum scale scores. Therefore, work environment stressor total sum scale scores cannot mediate the relationship between sex and days of limited engagement in usual activities. Model 2 results confirm the relationship is not mediated and instead the difference between females and males increased to 42.5% more days of limited activity, up from 37% in the unadjusted bivariate model. Model 3 shows that race/ethnicity was not statistically related to days of limited engagement in usual physical activities due to poor health (LR χ^2 p-value = .21). The results in tables 2.2.4 & 2.3.4 established respondents' race/ethnicity as statistically related to work environment stressor total sum scale scores. Given model 3 did not provide evidence of statistical relationship between race/ethnicity and days of limited engagement in usual activities, the addition of work environment stressor total sum scale scores cannot mediate the relationship. The coefficients for model 4 show that concomitant inclusion of race/ethnicity and work environment stressor scale total sum scores as variables in the model indicate Mexican Americans reported 45% fewer days of limited engagement in usual activities due to poor health relative to non-Hispanic whites (coefficient p-value = .006). Model 5 included only sex and race/ethnicity as independent variables relationship and respondents' sex continued to be associated with days of limited activity while race/ethnicity was not (LR χ^2 p-value = .14). Including sex and race/ethnicity along with and covariates as independent variables continued to show respondents' sex but not race/ethnicity were not statistically associated with days of limited activity. Finally, models 8-10 provided evidence that the sex differences in reporting days of limited engagement in usual activity were not impacted by covariates as well as work stressor measures. These models also provided further evidence that work stressor measures suppress the difference between non-Hispanic whites and Mexican Americans, i.e., Mexican Americans report fewer days of limited engagement in usual activities due to poor health compared to non-Hispanic whites.

Table 3.4.3 The relationship between days of limited activity due to poor health in the last 30 days and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236)

	Model 1			Model 2			Model 3		
Characteristic	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value
Sex									
Female	0.307	0.11	0.005	0.355	0.11	0.001			
Race/Ethnicity									
Non-Hispanic Black							0.001	0.15	0.996
Mexican American							-0.416	0.22	0.06
Work Environment Stressors (27-items)				0.034	0.004	<0.0001			
Work Load Stressors (5-items)									
Work Structural Stressors (4-items)									
Work Relational Stressors (9-items)									
Work Safety Stressors (4-items)									
Work Developmental Stressors (5-items)									
Work Environment Stressors (27-items) Quintiles									
2nd									
3rd									
4th									
5th									

Days of limited activity due to poor health in the last 30 were modeled using negative binomial regression and coefficient estimates represent log-days. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).

Models 1-6 are unadjusted for additional covariates

Models 7-10 are adjusted for age, education, marital status, income, and survey year

† = LR $\chi 2$ p-value for the race/ethnicity variable was >0.05

Table 3.4.3 The relationship between days of limited activity due to poor health in the last 30 days and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236) (continued)

	Model 4			Model 5			Model 6		
Characteristic	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value
Sex									
Female				0.32	0.11	0.0032	0.37	0.11	0.0006
Race/Ethnicity									
Non-Hispanic Black	-0.045	0.15	0.75	-0.003	0.15	0.98	-0.06	0.14	0.67
Mexican American	-0.605	0.22	0.006	-0.47	0.22	0.036†	-0.66	0.22	0.003
Work Environment Stressors (27-items)	0.034	0.004	<0.0001				0.04	0.004	<0.0001
Work Load Stressors (5-items)									
Work Structural Stressors (4-items)									
Work Relational Stressors (9-items)									
Work Safety Stressors (4-items)									
Work Developmental Stressors (5-items)									
Work Environment Stressors (27-items) Quintiles									
2nd									
3rd									
4th									
5th									

Days of limited activity due to poor health in the last 30 were modeled using negative binomial regression and coefficient estimates represent log-days. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).
Models 1-6 are unadjusted for additional covariates
Models 7-10 are adjusted for age, education, marital status, income, and survey year
† = LR $\chi 2$ p-value for the race/ethnicity variable was >0.05

Table 3.4.3 The relationship between days of limited activity due to poor health in the last 30 days and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236) (continued)

	Model 7			Model 8			Model 9		
Characteristic	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value
Sex									
Female	0.30	0.11	0.008	0.33	0.11	0.003	0.35	0.11	0.002
Race/Ethnicity									
Non-Hispanic Black	-0.11	0.15	0.49	-0.16	0.15	0.29	-0.14	0.15	0.36
Mexican American	-0.52	0.23	0.025†	-0.69	0.23	0.002	-0.66	0.23	0.004
Work Environment Stressors (27-items)				0.04	0.00	<0.0001			
Work Load Stressors (5-items)							0.079	0.023	0.001
Work Structural Stressors (4-items)							0.098	0.036	0.007
Work Relational Stressors (9-items)							0.020	0.016	0.19
Work Safety Stressors (4-items)							-0.002	0.028	0.94
Work Developmental Stressors (5-items)							-0.0004	0.025	0.99
Work Environment Stressors (27-items) Quintiles									
2nd									
3rd									
4th									
5th									

Days of limited activity due to poor health in the last 30 were modeled using negative binomial regression and coefficient estimates represent log-days. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).

Models 1-6 are unadjusted for additional covariates

Models 7-10 are adjusted for age, education, marital status, income, and survey year

† = LR $\chi 2$ p-value for the race/ethnicity variable was >0.05

Table 3.4.3 The relationship between days of limited activity due to poor health in the last 30 days and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236) (continued)

	Model 10		
Characteristic	Estimate	SE	χ^2 p-value
Sex			
Female	0.34	0.11	0.003
Race/Ethnicity			
Non-Hispanic Black	-0.13	0.15	0.39
Mexican American	-0.66	0.23	0.004
Work Environment Stressors (27-items)			
Work Load Stressors (5-items)			
Work Structural Stressors (4-items)			
Work Relational Stressors (9-items)			
Work Safety Stressors (4-items)			
Work Developmental Stressors (5-items)			
Work Environment Stressors (27-items) Quintiles			
2nd	0.31	0.18	0.09
3rd	0.30	0.18	0.09
4th	0.62	0.18	0.0004
5th	1.14	0.17	<0.0001

Days of limited activity due to poor health in the last 30 were modeled using negative binomial regression and coefficient estimates represent log-days. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).

Models 1-6 are unadjusted for additional covariates

Models 7-10 are adjusted for age, education, marital status, income, and survey year

Finally, table 3.4.4 presents the results of a series of cumulative logit models evaluating if work environment stressor exposure mediates the relationship between sex or race/ethnicity and self-rated general health. Model 1 shows that females were 1.14 (95%

CI [1.02, 1.27]) times more likely to rate themselves as having poorer self-rated health compared to males. The results in table 3.1.3 established work environment stressor scale total sum scores as statistically associated with days of limited activity due to poor health while the results in tables 2.2.2 & 2.3.2 established that sex was not statistically related to work environment stressor scale total sum scores. Model 3 shows that relative to non-Hispanic whites, non-Hispanic blacks and Mexican Americans are more likely to report having poorer self-reported health, specifically, they are 1.22 (95% CI [1.06, 1.42]) and 1.41 (95% CI [1.13, 1.76]) times more likely to report being in a poorer self-reported health category relative to non-Hispanic whites, respectively. The results in tables 2.2.4 & 2.3.4 established that respondents' race/ethnicity was statistically related to work environment stressor scale total sum scores . The results of model 4 suggest that the difference between non-Hispanic whites and non-Hispanic blacks is partially mediated work environment stressor scale total sum scores as evidenced by the coefficient decreasing in size by 25%, from .2 in model 3 to .15 in model 4. The coefficient for Mexican Americans remained statistically significant and increased to .35, up from .34 in model 3. Model 5 includes only sex and race/ethnicity in the model race/ethnicity is no longer statistically significant while the coefficient for sex remained statistically significant but was reduced .06, down from .13 in model 1 where sex was the only independent variable in the model. The addition of covariates to the model along with sex and race/ethnicity resulted in no statistically significant relationship between sex or race/ethnicity and self-reported general health.

Table 3.4.4 The relationship between self-rated health and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236)

	Model 1			Model 2			Model 3		
Characteristic	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value
Sex									
Female	0.13	0.06	0.02	0.13	0.06	0.02			
Race/Ethnicity									
Non-Hispanic Black							0.20	0.08	0.01
Mexican American							0.34	0.11	0.002
Work Environment Stressors (27-items)				0.035	0.002	<0.0001			
Work Load Stressors (5-items)									
Work Structural Stressors (4-items)									
Work Relational Stressors (9-items)									
Work Safety Stressors (4-items)									
Work Developmental Stressors (5-items)									
Work Environment Stressors (27-items) Quintiles									
2nd									
3rd									
4th									
5th									

Self-rated heath was modeled using negative binomial regression. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).

Models 1-6 are unadjusted for additional covariates

Models 7-10 are adjusted for age, education, marital status, income, and survey year

† = LR $\chi 2$ p-value for the race/ethnicity variable was >0.05

Table 3.4.4 The relationship between self-rated health and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236) (continued)

	Model 4			Model 5			Model 6		
Characteristic	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value
Sex									
Female				0.06	0.03	0.03	0.06	0.06	0.03
Race/Ethnicity									
Non-Hispanic Black	0.15	0.08	0.04	0.007	0.06	0.91	-0.03	-0.03	0.66
Mexican American	0.35	0.11	0.002	0.17	0.08	0.03	0.19	0.19	0.013
Work Environment Stressors (27-items)	0.035	0.002	<.0001				0.035	0.002	<0.0001
Work Load Stressors (5-items)									
Work Structural Stressors (4-items)									
Work Relational Stressors (9-items)									
Work Safety Stressors (4-items)									
Work Developmental Stressors (5-items)									
Work Environment Stressors (27-items) Quintiles									
2nd									
3rd									
4th									
5th									

Self-rated heath was modeled using negative binomial regression. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).
Models 1-6 are unadjusted for additional covariates
Models 7-10 are adjusted for age, education, marital status, income, and survey year
† = LR $\chi 2$ p-value for the race/ethnicity variable was >0.05

Table 3.4.4 The relationship between self-rated health and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236) (continued)

	Model 7			Model 8			Model 9		
Characteristic	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value	Estimate	SE	χ^2 p-value
Sex									
Female	0.11	0.06	0.10	0.11	0.06	0.05	0.11	0.06	0.06
Race/Ethnicity									
Non-Hispanic Black	0.06	0.08	0.44	0.04	0.08	0.64	0.04	0.08	0.57
Mexican American	0.17	0.12	0.16	0.20	0.12	0.09	0.20	0.12	0.09
Work Environment Stressors (27-items)				0.034	0.003	<0.0001			
Work Load Stressors (5-items)							0.038	0.012	0.002
Work Structural Stressors (4-items)							0.048	0.019	0.014
Work Relational Stressors (9-items)							0.022	0.008	0.008
Work Safety Stressors (4-items)							0.037	0.015	0.014
Work Developmental Stressors (5-items)							0.043	0.013	0.001
Work Environment Stressors (27-items) Quintiles									
2nd									
3rd									
4th									
5th									

Self-rated heath was modeled using negative binomial regression. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).
Models 1-6 are unadjusted for additional covariates
Models 7-10 are adjusted for age, education, marital status, income, and survey year
† = LR $\chi2$ p-value for the race/ethnicity variable was >0.05

Table 3.4.4 The relationship between self-rated health and sex and/or race/ethnicity while accounting for work environment stressors and covariates in the 2002-2014 GSS QWL responses (N=4236) (continued)

	Model 10		
Characteristic	Estimate	SE	χ^2 p-value
Sex			
Female	0.11	0.06	0.045
Race/Ethnicity			
Non-Hispanic Black		0.04	0.65
Mexican American		0.18	0.13
Work Environment Stressors (27-items)			
Work Load Stressors (5-items)			
Work Structural Stressors (4-items)			
Work Relational Stressors (9-items)			
Work Safety Stressors (4-items)			
Work Developmental Stressors (5-items)			
Work Environment Stressors (27-items) Quintiles			
2nd	0.23	0.094	0.014
3rd	0.46	0.090	<0.0001
4th	0.64	0.091	<0.0001
5th	1.05	0.092	<0.0001

Self-rated heath was modeled using negative binomial regression. The work environment stressor scale total sum score or indvidually summed sub-scale scores were treated as continuous variables. The reference category for work environment stressor scale total sum score quintiles was the first quintile (lowest scores = lowest total work stress).

Models 1-6 are unadjusted for additional covariates

Models 7-10 are adjusted for age, education, marital status, income, and survey year

† = LR $\chi 2$ p-value for the race/ethnicity variable was >0.05

Chapter 5 Discussion & Conclusion

This dissertation aimed to advance our understanding of Americans psychosocial work conditions and their potential role in perpetuating health disparities. Using a large body of research to guide the selection of variables, 27 items believed to reflect psychosocial working conditions were selected from the 2002, 2006, 2010, and 2014 General Social Survey (GSS) Quality of Worklife (QWL) modules. The unstandardized Cronbach's alpha of .91 for the 27-item sum and confirmatory factor analysis second-order factor model fit-statistics supported the scaling of the items into a single scale or five individually summed sub-scales (tables 10 & 14). The same evaluation methods following stratification by sex, race/ethnicity, and survey year also supported the items' scalability. Analyses evaluating the bivariate relationships between the total scale or sub-scales scores and GSS questions regarding finding work stressful, feeling used up at the end of the day (burnout), and being satisfied with one's job each produced evidence supporting the scales' validity (tables 11-13).

SPECIFIC AIM ONE DISCUSSION

This dissertation's first specific aim investigated: 1.) if exposure to work environment stressors is associated with individuals' occupation; 2.) if exposure to work environment stressors is associated with changes in the U.S. job market over time; 3.) if exposure to stressful work environment characteristics is associated jointly with individuals' occupational classification and changes in the U.S. job market over time, i.e., an interaction effect. Using business & finance occupations as the reference group, service, sales & office, construction & maintenance, and production & transportation occupations all reported statistically higher mean work environment stressor total sum scale scores (tables 1.1.2 & 1.3.2). Business & finance occupations had the lowest mean score of 48.1 while production & maintenance occupations had the highest at 53.9. The differences were mirrored in all but the work structural stressors sub-scales where professional & related, service, and sales & office employees reported similar exposure with those in business & finance occupations.

Work relational stressors and work developmental stressors sub-scale scores were the primary contributors the occupational psychosocial exposure differences. Work relational stressors contributed 2.5 points or 38.7% while work developmental stressors contributed 2.31 points or 35.8% to the 5.72 point mean difference between the business & finance (lowest mean score) and production & transportation occupations (highest mean score). The work structural stressor scores contributed the least to work environment stressor scale total sum score differences. Dissimilar from the other four sub-scales and excluding the non-statistically different scores of the professional & related occupations, the remaining occupational categories had statistically lower mean work load stressor scores, albeit small coefficients of -.65, -.64, -.62, and -.37 for service, sales & office, construction & maintenance, and production & maintenance, respectively (table 1.1.2). These values represented 11.6%, 15.8%, 17.9%, 14.5%, and 5.7% of the absolute total score differences for professional & related, service, sales & office, construction & maintenance, and production & transportation occupations, respectively.

In summary, these findings support the hypothesis of occupational classification-based differences in work environment stressors exposure. Business & finance and professional & related occupations generally reported the same and lowest levels of total work environment stressors exposure while production & transportation occupations consistently reported the highest levels of exposure. Work developmental stressors and work relational stressors were the largest contributors to these differences. Work relational stressors were most negatively impactful for production & transportation followed by construction & maintenance occupations while work developmental stressors were most negatively impactful for production & transportation followed by service occupations.

The evaluation of the second hypothesis yielded insufficient evidence supporting the belief that differential exposure to work environment stressor occurred during the surveyed years. General linear models using respondents' survey year as a predictor of their work environment stressor total sum scale scores (ref. category 2010) produced a χ^2 p-value = .54 (table 1.3.3). Sub-scale analyses showed only work load stressor scores as being associated with respondents' survey year, which is consistent with additional analyses of the individual items comprising the sub-scale. These findings do not support the theory of broad changes in work stressor exposure in the U.S. labor force in the surveyed years of 2002, 2006, 2010, and 2014. Approximately half the work stressor variables were associated with survey year but only work load stressors had a degree of consistency. A lack of a relationship between work environment stressor total sum scores and survey year further supported the conclusion of insufficient evidence supporting the hypothesis. These findings are additionally highlighted by the fact that the surveys occurred near several remarkable economic periods in the U.S., specifically the first survey following one year after September 11, 2001, in 2006 just prior to the U.S. Great Recession, immediately following the end of the Great Recession in 2010, and finally several years into the recovery in 2014.

Analyses evaluating the final hypothesis of this aim produced insufficient evidence supporting the belief that psychosocial work stressors exposure varied according to the joint effects of occupation and survey year. This is not surprising given the results of the second hypothesis, i.e., respondents' survey year being unassociated with their work stressors exposure level. Interestingly, table 1.3.3 shows a statistically significant interaction effect between occupational category and survey year (p-value = .046) in predicting work environment stressor total sum scale scores. Stratifying by occupation and using 2010 as the reference year, professional & related reported a mean work environment stressor total sum scale score 3.6 points higher in 2104 than in 2010 but no other occupations demonstrated statistically significant differences. Additional sub-scale analyses showed a statistically significant interaction effect for survey year and occupation on work safety stressors sub-scale scores (p-value = .047). However, in total there is a little evidence to support the hypothesis that exposure to work environment stressors changed differently over time depending on the respondents' occupation. This finding is consistent with the results from the second hypothesis of this aim showing similar work stressor exposure reporting across the four surveyed years.

In conclusion, this dissertation's first specific aim investigated U.S. employees' experience of psychosocial work environment characteristics in 2002, 2006, 2010, and 2014. Evaluation of the first hypothesis demonstrated significant occupation-based differences in reporting work stressor exposures. Business & finance and professional & related occupations generally reported the same and lowest level of work stressor exposure while production & transportation jobs consistently reported the highest levels of exposure. Work developmental stressors and work relational stressors were the largest contributors to the differences. Work relational stressors were most negatively impactful for production & transportation followed by construction & maintenance occupations while work developmental stressors were most negatively impactful for production & transportation followed by service occupations. Evaluation of the second hypothesis produced insufficient evidence to conclude there were significant changes in the work environment stressor exposure in the U.S. labor force between 2002 and 2014. Few of the work stressor variables were associated with survey year there was no readily apparent pattern. Finally, there was little evidence supporting the hypothesis that exposure to work environment stressors significantly changed over time or differently depending on the respondents' occupation. Overall, these findings suggest exposures to well-known work environment psychosocial stressors is significantly influenced by occupation and insufficient evidence for broad changes in psychosocial work stressor exposure reporting over time or within occupational categories, i.e., the exposure differences between occupations remained consistent and little evidence of intra-occupational group changes between 2002 and 2014.

SPECIFIC AIM TWO DISCUSSION

This dissertation's second specific aim investigated: 1.) if exposure to work environment stressors is associated with respondents' sex and/or race/ethnicity; 2.) if exposure to stressful work environment characteristics is associated jointly with respondents' sex or race/ethnicity and occupation; 3.) if exposure to stressful work environment characteristics is associated jointly with respondents' sex or race/ethnicity and changes in the U.S. job market over time. Evaluating the first hypothesis produced some evidence supporting work environment stressor exposure levels relationship with respondents' race/ethnicity and minimal evidence of its relationship with sex or a joint effect for the two. Generalized linear models evaluating the relationships between work environment stressor total sum scale scores or sub-scales and respondents sex produced non-statistically significant results (table 2.1.4). This was true for the total sum scale and all five individually summed work stressor sub-scales. Regarding race/ethnicity, non-Hispanic blacks mean work environment stressor total sum scale score was 1.37 points higher than non-Hispanic whites (p-value = .007) while Mexican Americans was .3 points lower but not statistically different (p-value = .69). Sub-scale analyses showed non-Hispanic blacks reported higher mean work stressor scale scores than non-Hispanic whites for work relational stressors, safety stressors, and developmental stressors while reporting statistically lower mean work load stressor scores and statistically similar structural stressors scores. The only instance where Mexican Americans had a statistically difference mean score was for the work structural stressors scale and it was .4 points lower than that of non-Hispanic whites (p-value = .006). When sex and race/ethnicity were included in the models simultaneously but independently, the results were meaningfully the same (table 2.1.4 model 3). Finally, there was insufficient evidence of an interaction effect for sex and race/ethnicity in predicting work environment stressor total sum scale scores (table 2.1.4 full model details not shown, p-value = .09). However, analyses with the sub-scales produced a statistically significant interaction effect for sex-race/ethnicity predicting work structural stressor sub-scale scores (p-value = .013). Stratifying by sex, Mexican American males reported lower mean work structural stressor scores compared to non-Hispanic whites males while there were no statistical race/ethnicity differences for females.

Overall, we found little evidence supporting the belief in sex-based differences in work environment stressors exposure. In terms of race/ethnicity, relative to non-Hispanic whites, non-Hispanic blacks reported higher total work environment stressors exposure, largely driven by higher levels of work relational stressors, safety stressors, and developmental stressors; they also reported a lower exposure level to work load stressors. Mexican Americans reported experiencing total work environment stressor exposures statistically similar to non-Hispanic whites with exception of a slightly lower exposure to work structural stressors. There was little evidence for a joint effect of sex and race/ethnicity on work environment stressors exposure.

The evaluation of the second hypothesis produced insufficient evidence supporting the belief that exposure to psychosocial work environment characteristics is associated jointly with respondents' sex or race/ethnicity and occupational classification. Using general linear modeling, work environment stressors total sum scale scores or its five individually summed sub-scale scores were not statistically associated with the sex-occupational classification interaction terms (table 2.2.2 model 4), i.e., males and females reported similar work stressor environment exposures within the same occupational categories. This is unsurprising given the lack of a relationship between respondents' sex and work stressor scale scores. Regarding the interaction effect for race/ethnicity and occupation, the two characteristics did not function jointly to predict work environment stressor total sum scale scores. A statistically significant interaction term was produced predicting work relational stressors scale scores (table 2.2.4 model 4, p-value = .003). However, ultimately the respondents' sex or race/ethnicity did not interact with their occupational classification in predicting work environment stressors exposure, i.e., their reporting primarily reflects respondents' occupation as identified the first aim with sex or race/ethnicity generally not modifying the relationship.

Insufficient evidence was produced supporting the hypothesis respondents' sex or race/ethnicity and changes in the U.S. job market between 2002 and 2014 function jointly to predict their work environment stressor scores. Neither males nor females reported experiencing a change in their work environment stressor exposure level in the years surveyed even though the years included the year following September 11th, 2001, the year preceding the U.S. Great Recession (2006), immediately following the end of the Great Recession (2010), and 2014 being several years into the post-recession recovery. Only two of 27 work environment stressor variables demonstrated a sex or race/ethnicity and survey year interaction, specifically those indicating respondents' ability to do a number of different things on the job. This finding is consistent with the previously demonstrated lack of sex-based differences or survey year effect on work environment stressors exposures as described by this aim's first hypothesis and the first aim's second, respectively. Additionally, there was insufficient evidence supporting survey year being associated with work environment stressors exposure and there were no statistically significant interaction effects predicting work environment stressor scale total sum scores or sub-scale scores.

In summary, this dissertation's second specific aim investigated the extent to which exposure to psychosocial work environment characteristics varied according to respondents' sex and/or race/ethnicity. Generalized linear models considering respondents' sex or race/ethnicity separately or sex and race/ethnicity simultaneously but independently (no-interactions) demonstrated no sex based statistical differences in total work environment stressors exposure. Relative to non-Hispanic whites, non-Hispanic blacks reported higher total work environment stressors exposure driven largely by reporting higher levels of work relational stressors, safety stressors, and developmental stressors while reporting lower work load stressor exposure. Mexican Americans work environment stressor scale score scores were similar to those of non-Hispanic whites except for reporting lower work structural stressor exposure. There was little evidence supporting a joint effect of sex and race/ethnicity on work environment stressors exposure. The second hypothesis analyses showed respondents' sex or race/ethnicity did not interact with their occupational classification to predict their work environment stressors exposure, i.e., exposure to work environment stressors is largely a result of the respondents' occupation and unmodified by sex or race/ethnicity. Finally, there was insufficient evidence of survey year being associated with work environment stressor exposure and statistically significant interaction effects predicting work environment stressor scale total sum scores or sub-scale scores were lacking. Overall, this evidence suggests exposure to well-known work environment psychosocial stressors is similar for males and females and somewhat different by race/ethnicity, specifically non-Hispanic blacks reported experiencing higher levels while Mexican Americans reported exposure similar to non-Hispanic whites. Finally, there was insufficient evidence that sex or race/ethnicities modified the work environment stressor experiences between 2002 and 2014 or intra-occupationally.

SPECIFIC AIM THREE DISCUSSION

The final specific aim of this dissertation investigated psychosocial work environment characteristics and their association with several health measures and their role in mediating respondent sex and race/ethnicity-based health disparities. The hypothesis evaluated: 1.) if exposure to stressful work environment characteristics are associated with more reported days of poor mental and physical health; 2.) if exposure to stressful work environment characteristics are associated with more reported days of limited engagement in usual activities due to poor health; 3.) if exposure to stressful work environment characteristics are associated with poorer self-rated health; 4.) if exposure to stressful work environment characteristics mediates the relationship between health measures and sex and race/ethnicity.

Several analyses produced evidence supporting the hypotheses that increasing exposure to stressful work environment characteristics is associated with increasing days of poor mental and physical health. Generally, most GSS QWL work environment stressor variables were associated with days of poor mental and physical health. Every one-point increase in work environment stressor total sum scale score was associated with 1.037 or 1.023 times as many reported days of poor health, i.e., 3.7% and 2.3% more reported days poor mental or physical health in the last thirty per one-point increase, respectively (table 3.1.3, model 1). Additionally, higher work load and work relational stressors sub-scale scores were primarily responsible for the increased frequency of days of poor mental health while higher work load and relational stressors sub-scale scores were largely responsible for increased days for poor physical health (table 3.1.3, model 2). Work environment stressor total sum scale quintile score comparisons demonstrated monotonic increases in days of poor mental health, with the second, third, fourth, and fifth quintiles reporting 1.58, 1.8, 2, and 3.6 times as many days of poor mental health than respondents with first quintile scores, respectively (table 3.1.3, model 3). For days of poor physical health, only those with work environment stressor scale total sum scores in the fourth and fifth quintiles experienced a statistically greater number of days of poor physical health in the last thirty, i.e., 1.41 and 1.99 times as many days as respondents with scores in first quintile, respectively.

Given these results it is not surprising that hypothesis tests involving psychosocial work environment characteristics and reported days of limited engagement in usual activities due to poor mental and physical health produced evidence of an association between the two measures. Each one-point increase in work environment stressor total sum scale score was associated with respondents reporting 1.03 times or 3% more days of inability to engage in usual activities due to poor health (table 3.1.3 model 1). Higher work load and structural stressors sub-scale scores were primarily responsible for the positive association. Comparisons across quintiles of work environment stressor total sum scale scores showed only those in the fourth and fifth quintiles reported more days of limited engagement in usual activities, specifically, 1.68 and 2.88 times or 68% and 188% more activity limited days than respondents with scores in the first quintile, respectively. This may indicate a middling threshold where adequate adaptation to the increasing effects of work environment stressors exposure occurs to preserve these activities, however, adaptive capacity is eventually exhausted and the negative effects are manifested.

Establishing an association between psychosocial work environment characteristics exposure and self-rated health (SRH) was the objective of the third hypothesis. Compared to the mean total work environment total sum scale score of 46.8 for those reporting excellent SRH, respondents in all other categories had statistically higher mean work environment stressors total sum scale scores. Those reporting very good, good, fair, and poor SRH had mean scores of 2.91, 5.08, 7.26, and 9.2 points higher than those reporting excellent SRH, respectively (table 3.3.2). This pattern held for all five of the sub-scales. Likewise, for every one-point increase in the work environment stressor scale total sum score, the odds of being in a poorer SRH category increased by 3.6% (table 3.3.3, model

1). Each one-point increase in work load stressors, work relational stressors, work safety stressors, and work developmental stressors sub-scale scores increased the odds of being in a poorer SRH category by 2.6%, 3.2%, 3.8%, and 8%, respectively; work structural stressor scores were not statistically associated with self-rated health (p-value = .51). Finally, using work environment stressor total sum quintile scores as categories, respondents with second through fifth quintile scores were 30%, 58%, 91%, and 205% more likely to report being in a poorer SRH category relative to those with first quintile scores.

Mental Health

Evidence supporting the hypotheses that psychosocial work environment characteristics mediate the relationships between the number of days of poor mental or physical health or limited engagement in usual activities and respondents' sex or race/ethnicity remained elusive while some evidence was found for an attenuating effect on the relationship between respondents race/ethnicity and their general SRH. Results of evaluating this aim's first hypothesis produced evidence of an association between increasing work environment stressor exposure and days of poor mental health. We also demonstrated respondents sex as being associated with days of poor mental health, specifically, females reported 41.6% more days of poor mental health than males (model 1 of table 3.4.1). Results of the second aim's second hypothesis produced insufficient evidence of respondents' sex being associated with work environment stressors exposure. This relationship was necessary to test a mediating model of work environment stressors exposure, i.e., work environment stressor exposure must be associated with respondents' sex and days of poor mental health if it is to mediate a relationship between respondents' sex and days of poor mental health. The results of bivariate regression of days of poor mental health regressed on race/ethnicity indicated the two were statistically unrelated (race/ethnicity coefficient p-value = .23). Like before, three relationships must be established to test for a mediating effect, specifically relationships between race/ethnicity and days of poor mental health, race/ethnicity and work environment stressors exposure, and days of poor mental health and work environment stressors exposure. The focal relationship between race/ethnicity and days of poor mental health was not established and thus was unavailable for mediated.

Additional analyses with respondents' sex, race/ethnicity, work environment stressor total sum scale scores, and covariates predicting days of poor mental health were completed (table 3.4.1, models 8-10). Females reported 50-54% more days of poor mental health than males and non-Hispanic blacks reported 32-34% fewer days of poor mental health than non-Hispanic whites, all statistically significant differences. Comparisons by work environment stressors total sum scale quintile scores (table 3.4.1 model 10) indicated respondents with second, third, fourth, and fifth quintile scores reported 48%, 78%, 90%, and 257% more days of poor mental health versus those with scores in first quintile (lowest stress). The prior model (table 3.4.1 model 9) included the same variables as model 10 but with individually summed sub-scale scores and for each one-point increase in work load stressors, work structural stressors, and work relational stressor scale scores there were 8.9%, 6.1%, and 4% increased days of poor mental health in the previous thirty. This suggests interventions targeting the improvement or mitigation of work environment stressor exposure may be more effective if employers and program and policy developers take care to identify employee stressors before implementing strategies for work stress management.

Physical Health

Like days of poor mental health, discerning if work environment stressors exposure mediates the relationship between respondents' sex or race/ethnicity and number of days of poor physical health experienced in the past thirty necessitated establishing three relationships. The results of the first hypothesis of this aim indicated an association between work environment stressors and days of poor physical health. Model 1 results in table 3.4.2 supports the hypothesis that respondents' sex is associated with days of poor physical health, specifically, females reported 45.6% more days of poor physical health in the last thirty than did males. However, evaluating the second aim's second hypothesis did not produce evidence supporting respondents' sex as being associated with work environment stressors total sum scale scores or sub-scale scores. Similar with days of poor mental health, the inability to demonstrate this relationship means we were unable to evaluate work environment stressors potential as mediators. Model 3 results in table 3.4.2 are from a bivariate negative binomial regression model of days of poor physical health regressed on race/ethnicity and the two were statistically unrelated. As previously stated, three relationships must be established to test for mediating effects, specifically the relationships between race/ethnicity and days of poor physical health, race/ethnicity and work environment stressor exposure, and days of poor physical health and work environment stressor exposure. The focal relationship between race/ethnicity and days of poor physical health was not established and thus could not be mediated.

Additional analyses were performed with sex and race/ethnicity along with work environment stressors scale scores and covariates predicting days of poor physical health (table 3.4.2 models 8-10). Females reported 45-46% more days of poor physical health than males and non-Hispanic blacks reported 28-30% fewer days of poor physical health than non-Hispanic whites, all statistically significant effects. Work environment stressor scale total sum quintile scores (model 10) indicated respondents with second, third, fourth, and fifth quintile scores reported 29%, 61%, and 211% more days of poor physical health compared respondents with first quintile scores (lowest stress exposure). The prior model included the same variables but with five individually summed sub-scale variables and it showed work load stressors and work structural stressors scales were each associated with 5.4% increases in days of poor mental health per one point increase, respectively. This suggests different work environment stressors impact physical health differently; furthermore, the exposure effect of work environment stressors on physical health appears to be somewhat less than was the case for the similarly measured mental health.

Days of Limited Activity

Evaluating the mediating effect of work environment stressors on the relationship between sex or race/ethnicity and days of limited usual activity due to poor mental or physical health was conducted in the same manner as the previous two investigations. Testing this aim's first hypothesis indicated an association between work environment stressors scales scores and days of limited usual activity (table 3.1.3). Model 1 of table 3.4.3 showed sex to be associated with days of poor physical health, i.e., females reported 36% more days of limited usual activity due to poor mental or physical health than males. However, evaluating the second aim's second hypothesis produced insufficient supporting evidence of respondents' sex being associated with work environment stressor exposure. This was necessary to investigate the mediating effects of work environment stressor exposure. Like with days of poor mental health and physical health, not finding a statistical association between work environment stressors scale scores sex means work stressors cannot mediate a relationship between sex and days of limited usual activity.

Table 3.4.3 model 3 is a bivariate negative binomial regression model regressing days of limited usual activity on respondents' race/ethnicity and it showed no statistical differences between non-Hispanic whites and non-Hispanic blacks or Mexican Americans. The inability to demonstrate a relationship (disparity) between the three race/ethnicities for days of limited activity means no additional statistical testing could be conducted regarding the potential mediating effects of work environment stressors. However, additional analyses were performed with sex and race/ethnicity along with work environment stressors scale scores and covariates to predict days of limited usual activity (table 3.4.3 models 8-10). Females reported 40-42% more days of limited usual activity than males and Mexican Americans reported 51.5% fewer days of limited usual activity than non-Hispanic whites, all statistically significant effects. Work environment stressor scale total sum quintile scores (model 10) indicated respondents with scores in the fourth and fifth quintiles reported 86.7% and 211% more days of limited usual activity due to poor mental and physical health compared to first quintile respondents (lowest exposure), respectively. The prior model included the same variables but with five individually summed work environment stressor sub-scale variables and showed work load stressors and work structural stressors scales were associated with 8.2% and 10% increases in days of limited usual activity per one-point increase, respectively. This pattern was like the findings for days of poor physical health in the past 30 days and may indicate that although the question specified both mental and physical health as etiologies, being prevented from engaging in usual activity is largely related physical health limitations.

Self-Rated Health

Finally, multiple cumulative logit models were used to evaluate if work environment stressors mediated a relationship between sex or race/ethnicity and general self-rated health (SRH). The results of the first third hypothesis of this aim indicated work environment stressors scale scores were associated with days SRH. Model 1 results in table 3.4.4 shows respondents' sex is associated with their SRH, specifically, females were 1.14 times more likely to rate themselves as having poorer SRH than their male counterparts. However, testing the second aim's second hypothesis failed to produce sufficient evidence of respondents' sex being associated with their work environment stressor scale scores. This was necessary before proceeding with mediation testing and thus we could not produce evidence of work environment stressors mediating effects. Moving to race/ethnicity, the results of the first hypothesis of this aim indicated work environment stressors scores were associated SRH. Table 3.4.4 model 3 is a bivariate model of race/ethnicity and self-reported health showing that non-Hispanic blacks and Mexican Americans are 1.22 and 1.41 times more likely to report being in a poorer SRH category relative to non-Hispanic whites. The second hypothesis of the second aim demonstrated that race/ethnicity is associated with work environment stressor exposure. The first hypothesis of this aim established the relationship between work environment stressors and self-reported health. With all three necessary relationships established, table 3.4.4 model 4 indicates work environment stressors do mediate the race/ethnicity–SRH relationship, specifically, attenuates the relationship. Compared to model three, the coefficient for non-Hispanic blacks decreased from .2 to .154 or 25% but remained statistically significant. The coefficient for Mexican Americans remained statistically significant but approximately unchanged, .343 versus .349, approximately 1.8% increase. These results suggest differences in work environment stressor exposure plays a role accounting for the difference in self-reported health differences between non-Hispanic blacks and whites.

Finally, performing additional analyses with sex and race/ethnicity together along with work environment stressors and covariates to SRH (table 3.4.4 models 8-10) produced additional findings. Females were 1.12 times more likely to report being in a lower SRH category than males when work environment stressor scores were categorized by quintiles. Alternatively, when included in the model as a total continuous scale or multiple individually summed sub-scales the relationships between sex and SRH were not statistically significant. The models did not show statistically significant differences between the race/ethnicities. Compared to respondents with work environment stressor scores in the first quintile (lowest stress), those in the second, third, fourth, and fifth were 1.26, 1.58, 1.9, and 2.85 times more likely to report being in a poorer self-reported health category, respectively. The prior model (table 3.4.4 model 9) included the same variables but with five individually summed work stressor sub-scale variables. One-point increases in each of the five sub-scales, i.e., work load stressors, work structure stressors, work relation stressors, work safety stressors, and work development stressors increased the odds of reporting poorer SRH by 1.039, 1.049, 1.022, 1.038, and 1.043, alternatively described as 3.9%, 4.9%, 2.2%, 3.8%, and 4.3% higher odds of being in a poorer SRH category per one-point increase, respectively.

Overall, the results of evaluating this hypothesis demonstrated work environment stressor exposures as largely not a mediating factor of the relationship between several health measures and respondents sex or race/ethnicity. Even though respondents' work environment stressor scores and sex were associated with days of poor mental health, respondents' sex was not associated with their work environment stressor exposure and therefore work stressors cannot mediate the sex, mental health relationship. This same set of relationship was applicable for days of poor physical health, days of limited engagement in usual activity activities, and self-reported health. Regarding race/ethnicity, there was a lack of evidence supporting the focal relationship between race/ethnicity and days of poor mental health, physical health, and days of limited usual activity. Without this relationship there can be no mediating by work environment stressors even though work environment stressor exposure was associated with race/ethnicity and all three count measures of health. However, work environment stressors mediated (attenuated) the relationship between race/ethnicity, specifically; they reduced the difference in the odds of reporting of being in poorer self-reported health between non-Hispanic blacks and whites.

Increasing work environment stressor total sum scale scores demonstrated a cumulative effect on days of poor health, i.e., there is a positive relationship between work environment stressor exposure and days of poor mental and physical health. Total work environment stressor exposure is associated with days of limited usual activity. Work environment stressor scores demonstrated a cumulative effect of increasing work environment stressor exposure, i.e., a positive relationship between work environment stressor exposure and days of inability to engage in usual activity. However, a potential threshold existed where the difference did not occur until work stressor exposure scores reached a certain level. Increasing work environment stressor scale total sum scores were associated with increasing odds of reporting poorer self-reported health and this relationship was consistent for all five of the sub-scales as well. Finally, work environment stressors were largely not a mediating factor of relationships between several health measures and respondents' sex or race/ethnicity. Even though respondents' work environment stressor scores and sex were both associated with days of poor mental health, respondents' sex was not associated with their work environment stressor exposure and therefore work stressors cannot mediate the sex, mental health relationship. This same set of relationship was applicable for days of poor physical health, days of limited engagement in usual activity activities, and self-reported health. Regarding race/ethnicity, there was a lack of evidence supporting the focal relationship between race/ethnicity and days of poor mental health, physical health, and days of limited usual activity. Without this relationship there can be no mediating by work environment stressors even though work environment stressor exposure was associated with race/ethnicity and all three count measures of health. However, work environment stressors mediated (attenuated) the relationship between race/ethnicity, specifically; they reduced the difference in the odds of reporting of being in poorer self-reported health between non-Hispanic blacks and whites.

STUDY LIMITATIONS

The goal of virtually all research is generalizing from sample to target population. Explicitly stated by NIOSH was its intention for the Quality of Worklife module to update our understanding of Americans' working life and experiences since the Quality of Employment surveys ended in the 1970s. However, there are several challenges working with national survey data, even data collected as expertly as the GSS. First, the response rate for the four surveyed years was approximately 70%. The researchers conducting the GSS extensively detailed their sampling methodology but it remains a challenge to evaluate if the sample generalizes to the population when three of ten did not complete any part of the survey. We further used a sub-sample of the respondents and this has the additional potential to diminish our sample's representativeness. Second, considering respondents' employment status, i.e., that they needed to be employed to be eligible for the QWL module, means that although we may adequately represent those in the sample, those less likely to be employed are underrepresented. Since we are interested in the health of populations and health disparities, having unemployed persons be underrepresented when they may be unemployed due to poorer health is problematic for accurately gauging the size of the problem.

We evaluated if females or non-Hispanic blacks and Mexican Americans were more likely than males or non-Hispanic whites to be employed (work status) or regular, permanent employees (work type) in the GSS. First, we found non-Hispanic blacks and Mexican Americans were 1.72 and 4.35 times more likely to not be working (unemployed, retired, school, keeping house, other) than non-Hispanic whites, respectively. Next, we found Mexican Americans were 1.35 times more likely to *not* be regular, permanent employees. Combining the overall 70% response rate and non-Hispanic blacks and Mexican Americans being more likely to have been left out of our analytic sample due to being not-in-the-workforce means limitations on the accuracy of the estimated effects work stress exposure has on population level health and health disparities.

Third, accurate representation of a population as large as U.S. working adults is also a significant challenge. In January 2002 the BLS estimated 136.5 million employed

Americans, approximately 62.3% of the civilian non-institutionalized population while in 2014 there were an estimated 145 million representing 59%. Our sample of employed individuals (including all employment options) in 2002 was N = 1796, 65% of the year's sample total and N = 1543 or 60.8% in 2014. That is a sample to population ratio of approximately 1:100,000. At that ratio a lot of detail is poorly represented, if not completely obscured. Further still is that each of the Census Occupational Classifications (SOC) contains a variety of jobs that may still be considerably different with respect to their work environments. For example, the Management, Business, & Financial operations occupations (codes 0010 to 0950) contain chief executives, industrial production mangers, farmers, ranchers, and other agricultural managers, human resource workers, financial analysts, and insurance underwriters. Service occupations (codes 3600 to 4650) include occupational and physical therapy assistants and aids, dental and medical assistants, firefighters, animal control workers, janitors and building cleaners, pet control workers, and waiters and waitresses. Production, transportation, and material moving occupations (codes 7700 to 9750) include structural metal fabricators and fitters, machinist, bakers, butchers, aircraft pilots and flight engineers, bus drivers, ship engineers, and railroad conductors and yardmasters. These classification categories likely contain employees who largely perform their occupational specific tasks as well as those who are supervisors or even managers, or at least have these responsibilities, whose work environment experiences are different as a result but are not classified in the managerial category. This potentially obscures valuable information about intra- and inter-occupational differences in work environment stressor exposure.

Fourth, considering representation of non-Hispanic blacks and Mexican Americans, looking at only 2014, our sample included 91 Mexican Americans. The Hispanic population 20 years and older in that year was estimated to be 34.5 million, a sample to population ratio of 1:580,000. Looking at 2010 there were 121 non-Hispanic blacks in our sample while the census estimated approximately 39 million blacks, a sample to population ratio of 1:320,000. Like the challenge of adequately representing employed vs. not employed, here is an even greater loss of representative fidelity. Certainly 91 Mexican Americans and 121 non-Hispanic blacks cannot effectively represent the rich variety of persons within these populations. Additionally, because of the complex convergence of factors such as politics, immigration, nativity, and employment regulations it is rightful to be extra suspicious that the claims made about Mexican American workers included in this research generalize well to the broader Mexican American population.

The motivating factor to demonstrate psychosocial work characteristics as causally affecting health and contributing to broader health disparities in the U.S. (and elsewhere) is to in turn provide motivating evidence to governing bodies to act in publishing guidance for employers and enacting policies that may improve working life. Unfortunately, the challenge of effectively demonstrating causality in this research as well as in the U.S. more broadly remains daunting for at least two reasons: (a) although the GSS is now a robust source of job characteristic information it remains a cross-sectional survey; even with theoretical justification for a causal claim and published evidence of a causal effect of work stress on health (de Lange, Taris, Kompier, Houtman, & Bongers, 2004; Stansfeld, Shipley, Head, & Fuher, 2012; Theorell et al., 2015), it is not a definitively justifiable claim we can make with this research and, (b) disentangling and isolating the health effects from the reverse causal effect of individuals' prior health, particularly the potential for mental health influencing perceptions of the workplace's stressfulness (de Lange et al, 2004; de Lange, Taris, Kompier, Houtman, & Bongers, 2005; Dalgard et al., 2009), persists as an issue requiring expanded interdisciplinary research efforts.

Selye asserted that the only instance where an individual is free from stressors is when he or she is deceased. Reducing workers exposures to undesirable stressors is of vital importance yet the complementary approach of supporting workers with stress mitigating/management interventions (SMI) is essential to improving workers resilience to unavoidable stressors and/or modifying perceptions of the work environment. Bunce (1997) and van der Klink, Blonk, Schene, and van Dijk (2001) listed the common individual-focused SMI as educational, cognitive-behavioral, arousal reduction strategies (relaxation techniques), personal skills, changing work procedures, organization-focused interventions, or multicomponent. A 2008 meta-analysis of 36 experimental interventional studies by Richardson & Rothstein on effectiveness of stress management interventions in occupational studies found an overall weighted effect size (Cohen's *d*) of 0.53, with cognitive-behavioral relaxation methods being the most common. Public health agencies are in a position to assume the responsibility of boosting the public's awareness of known sources of employee' stress, particularly psychosocial stress since this aspect of the work environment receives less attention than hazardous workplace exposures or physical injuries. Then, once employees are aware of the workplace stressors affecting them the most, learn to improve their stress management strategies with the SMI's.

STUDY STRENGTHS

Several strengths of this dissertation are worth mentioning. First, the General Social Survey is a well-designed data collection instrument in terms of national sampling for representativeness, response rates, content, and consistency. Second, NIOSH introducing the Quality of Worklife module into the GSS produced a rich collection of work environment questions, many identical or nearly identical to the Quality of Employment survey, particularly those evaluating psychosocial factors. The result was our ability to produce a robust psychosocial work environment measure in a large nationally representative dataset, a longtime challenge for work stress researchers in the United States. Third, by design the survey includes respondents from a significant variety of occupations. This is an advantage over the more common situation where researchers study a specific occupation in detail, either in one location, company or single profession. Fourth, the module has been used four times over 12 years during which several remarkable events have occurred affecting the U.S. economy and likely labor markets. Although the data is not longitudinal, there is considerable value in the survey's consistent assessment working life using the same questions repeatedly over the 12-year interval. Fifth, our evaluation of psychosocial work factors as potentially explaining race/ethnicity disparities in several measures of health at the population level is unique while evaluating work's role in sex-based health disparities helps in catching up to our leading Western European peers. The rationale, the purpose of the NIOSH QWL module was to evaluate and update our understanding of the findings from the Quality of Employment surveys some thirty years ago. We believe the strengths of the survey's design and the thoughtfulness of the module's question items has allowed us to contribute to and partially realize its mission.

CONCLUSION

What you choose to do, or perhaps what you have no choice but to do, appears to be associated with your psychosocial work stress exposure risk, i.e., your job matters. This research demonstrated that U.S. employees' working experiences essentially remained unchanged between 2002 and 2014, i.e., how people characterized their jobs working environments in 2014 was how they described them 2002, 2006, and 2010. For the most part, males and females are reporting the same psychosocial work environment stressor exposures and the lack of difference persisted over the 12-year interval. Non-Hispanic whites, non-Hispanic blacks, and Mexican Americans are reporting similar psychosocial work environment stressor exposures and that has also consistent over time. Finally, increasing psychosocial work environment stressor exposure is associated with increasing days of poor mental health, physical health, days of limited engagement in usual activity, and poorer self-rated health. Females reported more days of poor health and greater odds of having poorer self-rated health than males even after accounting for work stress exposure and adjusting models for covariates. Work stress did not mediate this sex disparity difference because respondents' sex as not associated with their work stress experiences. Race/ethnicity was largely unassociated with days of poor health, but it was associated with self-rated health. Work stress partially mediated (attenuated) the race/ethnicity, self-rated health association but further adjustment of the models for covariates produced statistically non-significant differences between the race/ethnicities. Ultimately, the exposure to undesirable psychosocial working conditions is not evenly distributed across occupations and the data indicates the differences remaining stagnant. Because work stress exposure is associated with poorer health, it seems appropriate to examine why the occupational differences exist, persist, and devise solutions for lowering psychosocial stress and reducing occupational disparities to improve health.

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Vita

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PRESENT POSITION

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BIOGRAPHICAL

Born January 14th, 1981
Rockford, IL
Father: John M. Messenger
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EDUCATION

2019	**Ph.D. Population Health Sciences** Graduate School of Biomedical Sciences University of Texas Medical Branch, Galveston, Texas
2009	**M.S. Preventive Medicine & Community Health** Graduate School of Biomedical Sciences University of Texas Medical Branch, Galveston, Texas
2004	**Dietetic Internship, Iowa State University Dietetics Academy** Iowa State University of Science and Technology, Ames, Iowa
2004	**B.S. Dietetics** College of Family and Consumer Sciences Iowa State University of Science and Technology, Ames, Iowa
2004	**B.S. Nutrition Sciences** College of Family and Consumer Sciences Iowa State University of Science and Technology, Ames, Iowa

PRACTICE INFORMATION

Registration:

Mar. 2005 – present	Registered Dietitian (RD), Commission on Dietetic Registration

Licensure:

Sept. 2005 – present	Licensed Dietitian (LD), Texas State Board of Examiners of Dietitians

Board Certification(s):

Sept. 2006 – present	Certified Nutrition Support Clinician (CNSC), National Board of Nutrition Support Certification (last exam April 2017, CNSC valid through 2022)

PROFESSIONAL AND ACADEMIC EXPERIENCE

Academic:

Nov. 2012 – Nov. 2016	Adjunct Instructor Appointment, Department of Nutrition & Metabolism, School of Health Professions, University of Texas Medical Branch, Galveston, TX
Aug. 2012 – Aug. 2013	Graduate Assistant, Department of Preventive Medicine & Community Health, Graduate School of Biomedical Sciences, University of Texas Medical Branch, Galveston, TX
Mar. 2002 – June 2004	Research Assistant, Center for Designing Foods to Improve Nutrition, Iowa State University, Ames, IA

Non-Academic:

Aug. 2013 Nov. 2016	Clinical Nutrition Manager, Morrison Management Specialists at the University of Texas Medical Branch, Galveston, TX
Feb. 2010 – Nov. 2016	PRN Dietitian, Shriners Hospitals for Children (Burns), Galveston, TX
Mar. 2007 – Sept. 2007	Interim Clinical Nutrition Manager, Morrison Management Specialists at the University of Texas Medical Branch, Galveston, TX
May 2006 –	PRN Dietary Services Consultant, Hospice Care Team, Inc., Texas City, TX
Apr. 2005 – Aug. 2013	Clinical Dietitian (Nutrition Specialist), Morrison Management Specialists at the University of Texas Medical Branch, Galveston, TX

RESEARCH ACTIVITIES

Area of Research / Interests:
Advanced Practice Dietetics / Nutrition Support / Dietetics Instruction
Social Determinants of Health / Health Disparities
Psychosocial Stress / Workplace Stress
Psychometrics / Scale Development / Research Methods / Causal Inference
Structural Equation Modeling / Latent Variable Analysis / Factor Analysis

Clinical:

Feb. 2014 — nutritionDay study on the J10C ACE Unit

- Participation in the international nutritionDay research project examining nutrition in hospitals and its relationship to patient outcomes, specifically 30-day readmission. A multidisciplinary effort with the ACE unit staff for IRB approval, nurse and dietitian training for human subject research, and finally data collection for uploading and benchmarking with hundreds of institutions worldwide.

Education:

Sept. 2017 – April 2019 — UTMB Scholars in Education, class of 2019

- Scholars in Education is a 21-month interdisciplinary faculty develop program designed to connect, cultivate, and inspire educators at UTMB to become scholars, leaders, and innovators in their fields. It includes completion of a mentored capstone project to be disseminated among the academic community, April 2019.

August 2019 — Academy of Master Teachers Medical Education Research Certificate Program Workshop

- Session 1: Hypothesis Driven Research
- Session 2: Qualitative Methods

August 2018 — Academy of Master Teachers Medical Education Research Certificate Program Workshop

- Session 1: Data management and Preparing for Statistical Consultation
- Session 2: Measuring Educational Outcomes with Reliability & Validity

August 2017 — Academy of Master Teachers Medical Education Research Certificate Program Workshop

- Session1: Program Evaluation and Evaluation Research
- Session 2: Questionnaire Design and Survey Research

COMMITTEE RESPONSIBILITIES

University of Texas Medical Branch:

April 2018 – present	Member, Malnutrition initiative committee
June 2017 – present	SHP Representative, Ad Hoc Interprofessional Faculty Committee, then co-chair
August 2018 – present	Member, What's Wrong with Warren? Leadership/planning committee
June 2015 – Nov. 2016	Member, Regulatory Accreditation, and External Reporting Committee
Feb. 2013 – Nov. 2016	Member, Commission on Cancer Committee
Sept. 2013 – Nov. 2016	Member, Stroke Committee
Jan. 2008 – Nov. 2016	Member, Adult ICU Multidisciplinary Committee
Aug. 2005 – Nov. 2016	Member, Blocker Burn ICU Quality Committee
June 2005 – Nov. 2016	Member, Skin Care Committee

School of Health Professions:

August 2018 – present	Chair-Elect, 2018-2019, SHP Faculty Assembly
Jan. 2017 – present	Member, SHP Causeway FundRun logistics committee

Department of Human Nutrition & Metabolism:

July 2013, 2015	Member, Dietetic Internship Candidate Interview, Evaluation, and Selection Panel
July 2011 – Nov. 2016	Member, Dietetic Internship Advisory Committee

American Society for Parenteral & Enteral Nutrition:

June 2019 – present	Member, Abstract Review Committee
June 2017 – present	Member, Education and Professional Development Committee
June 2018 – June 2019	Member, Clinical Nutrition Informatics Committee

June 2017 – June 2018 Member, Publications Review Committee

Dietitians in Nutrition Support Practice Group:

Aug. 2016 – present Member, Web Research Network Committee

Academy of Nutrition & Dietetics (AND)

June 2018 – June 2021 Member, AND Quality Management Committee (QMC)

- The QMC is an Academy Standing Committee reporting to the Board of Directors and provides direction for monitoring, developing, approving, evaluating, revising, educating, and maintaining quality in the practice of nutrition and dietetics in collaboration with various Academy organizational units and committees. The appointment term is three-years.

Commission on Dietetic Registration (CDR):

Apr. 2016 CDR Advanced Practice in Clinical Nutrition Certification Test Item Writing Meeting

- A three-day confidential meeting of 14 registered dietitians selected by a special task force to write test items for use in an advanced practice credential examination.

Feb. 2015 CDR Advanced Practice in Clinical Nutrition Certification Test Item Review Meeting

- A two-day confidential meeting of 12 registered dietitians selected by a special task force to review/revise test items for use in an advanced practice credential examination.

Nov. 2014 CDR Advanced Practice in Clinical Nutrition Certification Test Item Review Meeting

- A two-day confidential meeting of 14 registered dietitians selected by a special task force to review/revise test items for use in an advanced practice credential examination.

June 2014 CDR Advanced Practice in Clinical Nutrition Certification Test Item Design Meeting

- A two-day confidential meeting of 15 registered dietitians selected by a special task force to design test item templates for use by question writers for an advanced practice credential.

Apr. 2014 CDR Advanced Practice in Clinical Nutrition Certification Test Content Outline Development Meeting

- A two-day confidential meeting of 24 registered dietitians selected by a special task force to develop the test specifications for an advanced practice credential.

TEACHING RESPONSIBILITIES

Current:

Fall Semester	Instructor, NUTR 6402 Quality Management & Informatics in Dietetics, Department of Nutrition & Metabolism, School of Health Professions, University of Texas Medical Branch, Galveston, TX
Spring Semester	Instructor, NUTR 6503 Advanced Medical Nutrition Therapy, Department of Nutrition & Metabolism, School of Health Professions, University of Texas Medical Branch, Galveston, TX
Fall/Summer/Spring	Instructor, NUTR 5411 Clinical Nutrition I, Department of Nutrition & Metabolism, School of Health Professions, University of Texas Medical Branch, Galveston, TX
	Instructor, NUTR 5412 Clinical Nutrition II, Department of Nutrition & Metabolism, School of Health Professions, University of Texas Medical Branch, Galveston, TX
	Instructor, NUTR 5413 Food Service Management, Department of Nutrition & Metabolism, School of Health Professions, University of Texas Medical Branch, Galveston, TX
Jan. 2016 – Apr. 2016	Co-instructor, Advanced Medical Nutrition Therapy, Department of Nutrition & Metabolism, School of Health Professions, University of Texas Medical Branch, Galveston, TX
Aug. 2013 – Nov. 2016	Preceptor, Clinical Rotation, University of Texas Medical Branch dietetic internship
2012	Preceptor, Clinical Rotation, Morrison Management Specialists dietetic internship
2005 – 2007	Preceptor, Clinical Rotation, University of Houston dietetic internship

MEMBERSHIP IN SCIENTIFIC SOCIETIES/ PROFESSIONAL ORGANIZATIONS

Academy of Nutrition and Dietetics
- Affiliate(s): Texas Academy of Nutrition and Dietetics
- Practice Group(s): Dietitians in Nutrition Support
  - Clinical Nutrition Management
  - Nutrition and Dietetic Educators and Preceptors

American Society of Parenteral and Enteral Nutrition
- Affiliate(s): Texas Gulf Coast Chapter

HONORS

Nov. 2013 Jason E. Perlman Research Award, UTMB Graduate School of Biomedical Sciences, November 21, 2013, Awards luncheon at the San Luis Grand Ballroom.

- This award recognizes a student who has made a significant contribution toward the advancement of knowledge in the area of behavioral sciences or the humanities.

Apr. 2013 2nd Place for Best Poster Presentation in Public Health Sponsored by UTMB Department of Preventive Medicine & Community Health, 54th Annual National Student Research Forum hosted by UTMB at the San Louis Hotel & Convention Center, Galveston, TX

- Poster presentation – Not just a case of the Monday's: Work and Mental Health in the 21st Century

Apr. 2009 American Medical Association Foundation Award for Overall Excellence in Clinical Research, 50th Annual National Student Research Forum hosted by UTMB at the San Louis Hotel & Convention Center, Galveston, TX

- Poster presentation – Race differences in self-assessed health: The role of job strain

PUBLICATIONS

Messenger, C.M. Question: In the context of parenteral nutrition support, what is the glucose infusion rate and why is it evaluated? *Support Line*, 2016;38(6):20-23.

Race differences in self-assessed health: The role of job strain (Thesis, 2009)

POSTER PRESENTATIONS:

May 2019 TEACH-S Educational Symposium

- Annual regional conference organized by the UTMB Academy of Master Teachers, UT Health Academy of Master Educators, and Baylor College of Medicine.
- Poster title: Critical Thinking: Student Self-Appraisal Versus Actual Performance.

INVITED PRESENTATIONS – ON CAMPUS

Mar. 2016 - 2019 Interprofessional Education Day (IPE day) (2016, 2017, 2018, 2019)

- "What's Wrong with Warren" was a campus wide student exercise involving students from the school of medicine, nursing, allied health, pharmacy, and clinical life sciences. Each profession studied and discussed the case independently and subsequently sent members across campus to "consult" the other professionals. I facilitated the nutrition & metabolism (MS/DI) student group.

Sept. 2014 School of Medicine 2-week "mini-mester", University of Texas Medical Branch, Galveston, TX

- "A Chance to Cut is a Chance to Cure – Introduction to Clinical Skills in the Care of Surgical Patients" with Dr. Kimberly Brown, Assistant Professor, Department of Surgery – 24 second year medical students had the opportunity to be exposed to surgical patients and procedures to assist with clerkship selection, research options, etc.. An interdisciplinary team worked with the students covering their respective discipline's responsibilities as they applied to a thermally injured patient and a GI cancer patient.

May 2014 Special Topics in Geriatrics: Health Care and the Older Patient, East Texas Geriatric Education Center-Consortium

- "Older Adult Nutrition: Practitioner Knowledge, Common Challenges, and Insights for Improving Care" – 1 hour live broadcast and taped presentation regarding the evidence of health provider knowledge of nutritional assessment in acute care and how it may influence patient care and outcomes.

Mar. 2014 Interprofessional Education Day (IPE day) (March 26th, 2014)

- "Tumor is the Rumor... the Inter-Professional Answer to Cancer" with Dr. Kimberly Brown, Assistant Professor, Department of Surgery, Director, Sealy and Smith Laboratory for Surgical Assessment Training and Research (LSTAR) – 20 students split into 4 groups of 5 rotating every 15 minutes to a variety of allied health professionals involved in providing care to a GI cancer patient; the session was repeated for two 20 student groups, eight 15 minute discussions.

Nov. 2012 Pulmonary and Critical Care Symposium, Department of Pulmonology, University of Texas Medical Branch, Galveston, TX

- Total Parenteral Nutrition – 1 hour presentation for the pulmonary faculty and fellows

Nov./Dec. 2012 Advanced Critical Care Concepts Day, University of Texas Medical Branch, Galveston, TX

- Nutrition Priorities in Critical Care – 30 minute presentation provided on 2 occasions to registered nurses. The presentation was part of a series of 30 minute lectures; nurses received 7.25 continuing education hours

Oct./Nov. 2011/2010 School of Nursing, University of Texas Medical Branch, Galveston, TX

- Nutritional Support of the Acutely Ill Adult – 3 hour presentation provided to the acute care nurse practitioner students as part of a UTMB course.

May 2009 Department of Internal Medicine – Division of Geriatric Medicine, University of Texas Medical Branch, Galveston, TX

- Nutrition/Malnutrition – 1 hour presentation to a multidisciplinary team at UTMB and teleconferenced to the Oceanview Transitional Care Center.

Aug. 2006	Geriatric Medicine Fellowship Program Geriatric Core Lecture, University of Texas Medical Branch, Galveston, TX • Malnutrition in the Acute Elderly – 1 hour presentation provided to the geriatric medicine fellows, residents, faculty, and associated multidisciplinary staff, teleconferenced off site as well
July 2005	Skin Care Resource Team, University of Texas Medical Branch, Galveston, TX • Nutritional Role in Skin Care Management – 1 hour presentation to the multidisciplinary skin care resource team

INVITED PRESENTATIONS – OFF CAMPUS

Apr. 2007	Hospice Care Team, Inc., Texas City, TX • Nutrition at the End of Life – 30 minute presentation provided to a multidisciplinary team on the role of oral intake and nutrition for individuals nearing the end-of-life.

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This dissertation was typed by Christopher M. Messenger.