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An Examination of the Conditions Affecting Forensic Scientists' Workplace Productivity and Occupational Stress

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Abstract

The criminal justice system has placed increasing importance on the role of forensic evidence collection and scientific analysis, particularly in support of investigations and prosecution. Forensic scientists and laboratories must deal with rising demands for their services, though they face a chronic lack of resources for training, equipment, personnel, and in some cases, a lack of scientific standards for analyses. These limitations directly hinder the ability of laboratories to hire and train the scientists needed to improve the overall functionality and speed with which evidence is processed. As a consequence, there is a need to identify policies and procedures to improve the overall productivity of current laboratory personnel, as well as understand the factors that affect their work experiences. To date, however, the occupational reactions of the larger forensic science community have not been studied limiting our knowledge of the sources of stress and their effect on scientists' productivity.

This study attempted to explore these issues through a quantitative analysis of survey data collected from 899 forensic scientists in public and private laboratories operating at the local, state, and federal level across the United States. Data collection took place in two waves, with an electronic survey distribution to all ASCLD-LAB accredited laboratory directors in November 2012. A second, paper survey was distributed in May 2013 to 84 agencies in 25 states to increase the overall response rate and the likelihood of responses from under-represented agencies.

The scientists in this sample reported moderate levels of work stress and moderate to high levels of job satisfaction, in keeping with rates reported among law enforcement and correctional officers. There were also no significant differences in the levels of stress and satisfaction reported between sworn and unsworn scientists, or among the scientific disciplines. Occupational responses were primarily influenced by the number of hours worked each week, a

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lack of supervisory support, and role conflicts that make it difficult to consistently do their job. Females reported higher rates of stress, suggesting there may be differences in occupational responses between the sexes. Sample members engaged in a variety of coping mechanisms outside of work, but minimally reported using negative or harmful strategies such as smoking or drinking. Finally, most respondents indicated that they were satisfied with the ergonomic and environmental conditions of their workspaces.

The findings indicate that forensic scientists' levels of stress and satisfaction are similar to that of other criminal justice system employees. Laboratory managers can also directly affect the experiences of their employees through clear policies to increase flexible scheduling, equally distribute overtime, promote communication with supervisors, and better manage interactions with court staff and prosecutors.

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Executive Summary

As the criminal justice system increasingly utilizes forensic evidence collection and scientific analyses in support of investigations and prosecutions, there has been a concurrent rise in the demands placed on forensic scientists and crime laboratories. There is, however, evidence that laboratories are understaffed and have limited budgets for training, equipment, and personnel. These factors slow the processing of evidence and reduce scientist productivity, leading to case backlogs and potentially strained relationships with police and prosecutors. The negative working conditions produced by such an environment may directly affect the experiences of scientists by decreasing productivity and job satisfaction while increasing worker stress and fatigue.

There has been generally little research exploring the occupational experiences of forensic scientists, limiting our knowledge of the sources of stress within the field and their general influence on employee productivity. Such lines of inquiry have substantive value for supervisors and managers in order to identify the sources of stress within their agency and develop policies and guidelines that reduce their influence on employees. Studies of criminal justice system employees in law enforcement and correctional agencies indicate that individuals who report high levels of work stress have generally poor work performance, are less productive, and report negative physical and emotional symptoms due to their experiences. High stress also corresponds to low levels of job satisfaction that reduces their organizational commitment and attitude toward their position as a whole.

In light of the lack of research on the occupational experiences of forensic scientists, this study attempted to assess these issues through a quantitative analysis of survey responses

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collected from 899 forensic scientists working in public and private laboratories at the local, state, and federal level across the United States.

Data collection took place in two waves, beginning with an initial electronic survey distributed in November 2012. The research team worked in conjunction with ASCLD-LAB to distribute an email to all currently certified laboratory directors detailing the project along with informed consent for the study, and an electronic link to the survey instrument. Directors were then asked to forward this message to all scientists working in their laboratories in order to complete the survey. This solicitation method yielded 568 responses from 31 states, with responses from scientists primarily working in state and local police agencies. The second wave of data collection utilized a paper survey distributed to 84 agencies in 25 states in May 2013. These agencies were specifically targeted to increase the response rate from under-represented agencies and generally expand the overall population of scientists included in the study. The paper survey method generated 331 responses from 20 states with most respondents from state and local agencies. The final purposive sample of 899 respondents provided a range of scientific disciplines engaging in evidence handling and collection, and represented most every state in the U.S.

The majority of respondents (62.8%) were female and white (90.7%). Most respondents were married and had at least a four year college degree. The average age of respondents was 39.15 years, and sample members had worked in the field of forensic science for an average of 3.71 years. In addition to demographics, respondents were asked about their involvement with the court system in their area. About 90 percent of scientists received at least one subpoena during the last year, and just over 80 percent testified in court during the same period. Although

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41.6 percent of respondents agreed that they often have to report for court with little notice, 62.6 percent indicated they find it easy to deal with court schedules in their jurisdictions.

The primary goal of this study was to measure levels of work stress and job satisfaction. Four items were used to measure work stress using Likert-scale responses, and approximately 60 percent of scientists agreed that they were emotionally drained by their work. In addition, 57.1 percent felt frustrated by their jobs, while over 60 percent indicated they were under a lot of pressure and were tense or uptight at work. Overall, respondents experienced a moderate amount of work stress which is in keeping with research on various criminal justice system employees and helping professions generally. The scientists sampled also indicated moderate levels of job satisfaction based on responses to five Likert-scale measures. Specifically, 85.6 percent of sample members reported being either somewhat satisfied or very satisfied with their jobs, and 64.1 percent would take the same job again without hesitation. Also, about half of the sample would keep their current jobs regardless of other occupational opportunities or strongly recommend their job to a good friend.

A range of survey items were designed to measure possible sources of work stress and job satisfaction, including relationships with prosecutors and courts, supervisory and top management support, feelings about the work performed, and perceptions of work environments. Additionally respondents were asked about the physical and emotional outcomes they experience as a result of work stress, and the coping strategies they employ to deal with occupational stressors when not at work. Below are key findings regarding these measures:

- Very few respondents felt as though prosecutors doubted their competence.
- Almost 95 percent of respondents felt that judges respected them professionally.

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- More than half of the scientists agreed that they are regularly pressured by police or prosecutors to rush to produce scientific results.
- More than half of respondents agreed that prosecutors do not understand why it takes time to complete the analyses they request.
- Most scientists indicated that prosecutors do not understand that they work very hard on a case even though they end up finding no evidence to support the charges brought against a defendant.
- Respondents reported high levels of supervisory support, with 75.9 percent agreeing or strongly agreeing that their immediate supervisors supported them.
- More than three quarters of scientists felt that their immediate supervisors gave them clear instructions, and had clear expectations of them.
- Over half agreed that supervisors would encourage their co-workers if they did their jobs well, that disputes between coworkers and supervisors were usually handled in a friendly way, and that top managers are responsive to their thoughts and suggestions.
- More than three quarters indicated that their colleagues usually agree on the best way to accomplish something at work and their coworkers listen to what they have to say.
- More than 80 percent of respondents felt their agency's operational guidelines and procedures were clear, though 53.3 percent believed their agency was inconsistent in the application of new rules and policies.
- About half of respondents at least slightly agreed that they received assignments without the manpower to complete them.

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- The majority of respondents believed that it took too long to hire replacements when someone leaves the agency.
- Most respondents were satisfied with the cleanliness of their workplaces, felt their lab space contained efficient lighting and tools to prevent eye strain, considered their space comfortable enough to work in without getting tired, and were satisfied with the privacy in their workspace.
- More than 86 percent of individuals indicated that they could often, mostly, or always complete their daily tasks easily due to the overall environment at work.
- More than 80 percent of scientists indicated that they were unable to control the temperature or airflow in their lab space, and 56.7 percent said the overall temperature in their lab spaces through the year is somewhat uncomfortable or very uncomfortable.
- Approximately 80 percent of the scientists reported that unfavorable environmental conditions (noise, temperature, etc.) decreases their productivity.
- Scientists reported that the most common physical and psychological responses associated with work stress were difficulty falling or staying asleep, a constant feeling of alertness, and feelings of detachment or emotional numbness.
- Fewer respondents reported experiencing feelings of mistrust or betrayal, difficulty concentrating, irritability or outbursts of anger, being easily startled, physical aches and pains with no apparent cause, or nightmares.
- The findings of bivariate correlation analyses indicated that scientists who reported any negative physical or emotional symptoms due to stress were more likely to experience all negative outcomes.

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- There was a significant relationship ($p<.05$) observed between reporting higher levels of work stress and reporting more negative physical outcomes. Those with greater levels of job satisfaction were less likely to experience these symptoms ($p<.05$).
- Scientists most frequently reported employing positive coping mechanisms to manage occupational stressors when not at work, including trying to forget about work, finding an activity to take their mind off things, or talking things over with friends, a spouse or significant other.
- Less than five percent indicated they would engage in negative coping strategies including: taking a tranquilizer, some other form of medicine, or smoking more often.
- 44.4 percent of the scientists said they would at least sometimes have a drink to help them cope.
- Less than 10 percent reported sometimes or more frequently seeking professional help from counselors or therapists.
- Bivariate correlation analyses indicated that individuals with higher levels of work stress were more likely than others to engage in various coping mechanisms ($p<.05$) outside of the workplace.
- Results of a linear regression model examining the effects of demographic characteristics and work-related variables on job stress found females, those working more hours per week, having poor relationships with prosecutors and courts, experiencing less supervisory support, little support from top managers, and high levels of role conflict were associated with higher stress.

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- Results of a linear regression model examining the effects of demographic and work-related variables on job satisfaction found scientists working fewer hours per week, experiencing high levels of support from both supervisors and top management, low levels of role conflict, and having general positive feelings about the job were associated with greater satisfaction.

As a whole, the findings of this study indicate that forensic scientists have many of the same occupational experiences as employees of the larger criminal justice system, and helping professions such as ambulance crews. The findings of the regression analyses for stress and satisfaction suggest that laboratory management can directly affect the working conditions of scientists through policies and programs in order to improve the day-to-day experiences of their employees, and reduce levels of burnout, absenteeism, poor job performance, turnover, and possibly even physical and mental health problems. The significant relationship between the number of hours worked and higher levels of stress indicates the need to develop flexible scheduling policies and distribute overtime equitably across all scientists to ensure that individuals are not working an excessive number of hours each week.

Second, the relationship between scientists' work reactions and their perceptions of support from supervisors and management indicate the need for policies that promote open communication between scientists and management generally. Establishing a direct mechanism for scientists to discuss concerns and voice their needs to their superiors may increase trust and reduce stress. Third, the creation of clear staffing plans that reduce redundant positions and define accepted practices and procedures for all phases of evidence handling, analysis, and report creation can decrease work stress by promoting clear policies to all scientists. Similarly, providing clear expectations and metrics for employee performance can lower stress and increase

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satisfaction by communicating standards for work that can be evaluated and achieved on a regular basis.

Fourth, laboratory directors and management must give careful consideration to the physical environments that their scientists work within on a day-to-day basis. Though working environments were not significant predictors of stress or satisfaction, 80 percent of scientists indicated that unfavorable conditions, such as noise and temperature, reduce their productivity. In order to obtain the highest levels of productivity, regardless of the facility, management should find ways to minimize noise distractions when possible, provide adequate storage of laboratory equipment, and provide breaks to scientists working with particularly noisy equipment or instrumentations in order to provide optimal working conditions for both safety and productivity.

Fifth, laboratory directors and management should promote awareness of negative signs of physical or emotional stress among the scientists in their laboratories. A number of respondents indicated that they experienced some physical symptoms of trauma as a result of their work, such as nightmares, irritability, feelings of alertness, or difficulty sleeping. The presence of these symptoms was correlated with higher levels of job stress, and reduced when individuals report higher levels of work satisfaction. As many of these behaviors can directly reduce the productivity and general well-being of scientists, laboratory managers should encourage clear communication of behavioral changes or concerns about physical health. Such measures could foster trust between co-workers and a more open working environment. Management should also ensure that scientists are aware of the available mental health services, whether counselors or therapists, should they feel the need to speak with a professional to express their concerns. Communicating the value of access to these resources, when necessary,

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may have beneficial impacts on both stress and satisfaction, and improve the overall working environment of the laboratory.

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I. Introduction

A. Statement of the Problem

The tremendous increases in the capability and speed of evidence collection and scientific analysis have changed the way that evidence is both perceived and used by the criminal justice system (National Academy of Sciences, 2009; Peterson, Sommers, Baskin, & Johnson, 2010; Roman, Reid, Reid, Chalfin, & Knight, 2008). Law enforcement and prosecutors have placed increasing importance on the use of forensic evidence in the identification of offenders and support for investigations (Eisenstein & Jacob, 1977; National Academy of Sciences, 2009; Peterson et al., 2010). Despite the expanding role of forensic science in criminal investigation and prosecution, studies indicate that there is a systemic lack of resources across the various disciplines of forensic science, including inconsistent training, preparation of scientists, standard procedures for analysis, and personnel to accommodate the expeditious processing of evidence (Becker & Dale, 2003; National Academy of Sciences, 2009; Peterson et al., 2010). These deficiencies directly affect the ability of scientists to adequately manage the burgeoning volume of evidence collected (Becker & Dale, 2003; Durose, 2008; National Academy of Sciences, 2009; Peterson & Hickman, 2005; Peterson et al., 2010).

It is widely acknowledged that limited resources at the local, state, and federal level hamper the ability of agencies to efficiently hire and train the scientists needed to improve forensic evidence processing (Durose, 2008; National Academy of Sciences, 2009; Peterson et al., 2010). The pressures of this working environment may make it difficult to retain scientists over time in all manner of laboratories (Becker & Dale, 2003; Peterson et al., 2010). As a result, it is imperative that research be conducted to identify ways to rapidly improve the overall

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productivity of laboratory staff based on the personnel currently on hand, as well as defining the factors affecting their overall work experiences (National Academy of Sciences, 2009).

To that end, a substantive body of research has examined how working conditions affect employee productivity and organizational commitment. Results indicate that individuals who experience high levels of work stress—as defined by the disconnect between job demands and employees' available resources and capabilities—report general dissatisfaction with their job, higher levels of physical illness and psychological problems, wasting time or resources, absenteeism, burnout, and generally poor job performance and productivity levels (Anshel, 2000; Band & Manuele, 1987; Brough & Frame, 2004; Brown & Campbell, 1990; Burke, 1993; Cooper & Cartwright, 1994; Donald, Taylor, Johnson, Cooper, Cartwright, & Robertson, 2005; Israel, House, Schurman, Heaney, & Mero, 1989; Jamal & Baba, 1992; Newman & Rucker-Reed, 2004; National Institute for Occupational Safety and Health, 1999; Pflanz & Heidel, 2003; Quick, Quick, Nelson, & Hurrell, 1997; Tang & Hammontree, 1992; Vagg & Spielberger, 1998).

High levels of work stress are also correlated with low levels of job satisfaction, as measured through the extent to which individuals feel fulfilled by or otherwise enjoy their jobs (Castle & Martin, 2006; Lambert, 2004; Tewksbury & Higgins, 2006). Individuals' levels of stress and job dissatisfaction have also been shown to affect the organization they operate within by increasing aggression or negative responses to fellow employees (Morgan, Stewart, D'Arcy, Forbes, & Lawson, 2005; Newman & Rucker-Reed, 2004; Tang & Hammontree, 1992).

Detailed studies of the occupational reactions of stress and satisfaction have directly benefited managers and policy makers by identifying the conditions that increase work stress, and fostering the development of policies and procedures to reduce problematic behaviors through better understanding of the organizational culture and institutional performance of an

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agency (Frone, 1999; Patterson, 1992; Stansfeld, Fuhrer, Shipley, & Marmot, 1999). This body of research has particular salience for criminal justice management and policymakers since high levels of work stress can produce negative interactions with citizens during calls for service that may result in cynical public perceptions and distrust in the agency, and potential lawsuits against individuals or agencies (Newman & Rucker-Reed, 2004; Tang & Hammontree, 1992). The problematic consequences of employee absenteeism, high turnover rates, and low productivity are especially concerning for criminal justice agencies due to the resources required to hire and train new individuals, and then to optimize their effectiveness (Anshel, 2000; Maslach, 2003; Van Yperen & Snijders, 2000).

A substantive literature has emerged examining the work reactions of criminal justice system employees in policing, corrections, and probation (Anshel, 2000; Band & Manuele, 1987; Blevins, Cullen, Frank, Sundt, & Holmes, 2007; Brown & Campbell, 1990; Burke, 1993; Cullen, Lutze, Link, & Wolfe, 1989; Dantzer, 1987; Diskin, Goldstein, & Grencik, 1977; Grossi, Keil, & Vito, 1996; Haisch & Meyers, 2004; Jackson, 1982; Kroes, 1976; Lobel & Dunkel-Schetter, 1990; Patterson, 1992; Reiser, 1974; Robison, Sigman & Wilson, 1997; Westerlink, 1990). These studies have consistently shown that employees often experience high levels of work stress (Abdollahi, 2002; Anshel, Robertson, & Caputi, 1997; Burke & Milkkelsen, 2005; Kirkcaldy, Brown, & Cooper, 1998; Kroes, 1976), and that those with the greatest amount of stress and dissatisfaction report substantial role conflict stemming from competing demands on the individual employee and different or unclear standards for the processing of a specific task (Cullen, Lemming, Link, & Wozniak, 1985; Pogrebin, 1978). Also, a lack of clear guidelines for conduct and work tasks, often referred to as role ambiguity, decreases employee job satisfaction (Hepburn & Albonetti, 1980; Lambert, Reynolds, Paoline, & Watkins, 2004; Van Voorhis,

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Cullen, Link, & Wolfe, 1991). Finally, a deficit in sufficient training, supervisory support for their decisions, and an ability to affect workplace policies or procedures increase job stress overall (Anshel, 2000; Band & Manuele, 1987; Brown & Campbell, 1990; Burke, 1993; Dantzer, 1987; Diskin et al., 1977; Haisch & Meyers, 2004; Jackson, 1982; Kroes, 1976; Lobel & Dunkel-Schetter, 1990; Patterson, 1992; Reiser, 1974; Robison et al., 1997; Westerlink, 1990).

Recently, researchers have begun to call for systematic research examining the working environment of forensic scientists in the criminal justice community, and the conditions that affect their work routines and behaviors (Becker & Dale, 2003, 2007; Burns, Morley, Bradshaw, & Domene, 2008; Holt & Blevins, 2011; Perez, Jones, Engler, & Sachau, 2010; Stevenson, 2007). The unique social and environmental working conditions of forensic scientists have the potential to produce high levels of work stress that could negatively affect productivity as a whole (Becker & Dale, 2003). Specifically, the work tasks of scientists are often extremely complex, requiring a substantial degree of technical training and continuing education (James, Nordby & Bell, 2009; National Academy of Sciences, 2009). Forensic scientists also often operate within unique managerial and administrative structures, including sworn and unsworn personnel with varying backgrounds, education levels, caseloads, and demands (James et al., 2009; National Academy of Sciences, 2009; Peterson et al., 2010). Further, a lack of clear standard procedures for many forensic analyses, particularly for those whose specialty depends more heavily on human interpretation rather than hard scientific data (National Academy of Sciences, 2009), may increase the levels of stress individuals experience.

The types of evidence scientists work with have been shown to increase levels of work stress, as limited research on digital forensic examiners indicates that repeated exposure to noxious images, materials, and scenes has major negative ramifications for their psychological

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and mental health (Burns et al., 2008; Holt & Blevins, 2011; Krause, 2009; Perez et al., 2010; Stambaugh, Beaupre, Icove, Baker, Cassaday, & Williams, 2001; Stevenson, 2007). Likewise, working conditions within laboratories themselves may negatively affect scientists' performance. For instance, individuals who are required to work excessive overtime are more likely to experience high levels of work stress (Becker & Dale, 2003; Fairbrother & Warn, 2003; National Institute for Occupational Safety and Health, 1999). Factors as commonplace as regular exposure to loud noises produced by ventilation systems or laboratory equipment may also increase work stress, as noted in studies of various professions (Fairbrother & Warn, 2003; National Institute for Occupational Safety and Health, 1999).

Taken as a whole, forensic scientists operate within distinctive environments that include multiple prospective sources of stress, but may also generate substantial employee satisfaction as a consequence of their duties. No study to date has, however, attempted to document the occupational reactions of laboratory scientists across the disciplines of the forensic science community (see Becker & Dale, 2003). Thus, this exploratory study is designed to address this gap in the literature through an assessment of forensic scientists (n=899) working in the primary scientific disciplines in local, state, and private laboratories across the United States. The findings consider the levels of work stressors and satisfaction among forensic scientists across the various disciplines, along with any correlates to working conditions, requests from various criminal justice system actors, policies, procedures, and demographic conditions. The use of positive and negative coping strategies by scientists are also measured to assess how individuals working in the field are affected by their job. Finally, the ergonomic and working environment of bench scientists are assessed to consider any influence they might have on their reported levels of stress and satisfaction.

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The findings improve our knowledge of the ways that forensic scientists' activities are affected by role conflicts and ambiguity in processes and procedures, as well as laboratory working conditions and training. In addition, this study considers how managerial requests, along with contacts by external parties such as prosecutors and detectives, influence the processes and work experiences of forensic scientists. The implications of this study for forensic science laboratory directors and managers, the scientific practitioner community, criminal justice system employees, policymakers, and criminal justice researchers are discussed in detail.

B. Literature Review

In light of the unique position and workload of forensic scientists, particularly those who regularly interact with law enforcement and the courts, there is a need to understand the stresses and strains they experience, as well as the ways that they cope with the challenges they face. The limited empirical research in this area has primarily focused on either laboratory directors' perceptions of scientists' stress (Becker & Dale, 2003), or on the experiences of specialized sub-disciplines within the field such as digital forensic investigation (Burns et al., 2008; Holt & Blevins, 2011; Krause, 2009; Perez et al., 2010; Stevenson, 2007). As a consequence, there are few insights into the experiences of the bench scientist working in the larger disciplines of biology, drug chemistry, toxicology, trace evidence, firearms and toolmarks, latent prints, and other fields.

Measuring the occupational experiences of bench scientists, whether sworn or unsworn, is vital to understand the potential triggers for stress and identify policies and procedures that may minimize negative experiences and increase productivity (Abdollahi, 2002; Patterson, 1992). High levels of stress can lead to employee absenteeism, high turnover rates, and inefficiency overall. These issues are especially troubling for criminal justice agencies and

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forensic science laboratories due to the resources required to recruit and train new individuals and optimize their effectiveness (Anshel, 2000; Becker & Dale, 2003; Maslach, 2003; Van Yperen & Snijders, 2000).

Research on stress and satisfaction among criminal justice system employees suggests that high levels of work stress can result in negative interactions with citizens and increase the risk of lawsuits against individuals or the larger agency in which they work, and decrease its perceived legitimacy in the community (Newman & Rucker-Reed, 2004; Tang & Hammontree, 1992). Victims of crime may also report greater dissatisfaction with the criminal justice system due to interactions with disaffected officers (Carlan, 2007; Dantzer, 1987). High levels of work stress are correlated with low levels of job satisfaction, as measured through individual fulfillment or enjoyment (Belknap & Shelly, 1992; Carlan, 2007; Dantzer, 1994; Krimmel & Gormley, 2003). Individual levels of stress and job dissatisfaction have been shown to affect the organization they operate within by increasing aggression or negative responses to fellow employees (Morgan et al., 2005; Newman & Rucker-Reed, 2004; Tang & Hammontree, 1992).

Due to the lack of research on the larger population of forensic scientists across the scientific disciplines, it is unclear what specific factors may influence their occupational experiences on a day-to-day basis. Scientists operate within an environment where some co-workers may be currently sworn law enforcement officers while the larger majority are non-sworn scientists. The variations in experience operating within the quasi-military structure of police-run laboratories may create challenges in managing scientists and relationships to managers. Since all scientists within a laboratory interact with court actors and law enforcement as a part of their job, regardless of being sworn or unsworn, their experiences may be similar to that of traditional criminal justice system employees. Thus, we utilize the existing literature on

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criminal justice system employees to identify prospective correlates affecting the occupational experiences of scientists. For instance, the number of hours an individual works each week may generally be associated with higher levels of stress, particularly those who work multiple overtime hours. There is some evidence that forensic scientists, particularly in state run labs, are more likely to work longer hours with less flexibility in scheduled hours (Becker & Dale, 2003).

The number of years an individual in the criminal justice system has spent on the job may affect reported levels of stress and satisfaction. The influence of experience has been inconsistent in previous studies (see Zhao, Thurman, & He, 1999), with some reporting that more experienced officers have higher work stress and lower job satisfaction than inexperienced officers (Johnson et al., 2005; Zhao et al., 1999). More experienced officers may gain additional job responsibilities over time, or alternatively, grow more cynical about their jobs. In contrast, more experienced officers may have less stress and more satisfaction because they are familiar and comfortable with their jobs (Hunt & McCadden, 1985).

There is also evidence that greater support from supervisors and management helps to reduce levels of stress. The bureaucratic and militarized structure of law enforcement agencies can place a substantial degree of stress on police and correctional officers (Coman & Evans, 1991; Martelli, Waters, & Martelli, 1989). The tight controls placed on officers by management make it difficult to fully exercise discretion in the field (Martelli et al. 1989; Spielberger, Westberry, Grier, & Greenfield, 1981). Officers may feel alienated by an inability to communicate their needs to management in productive ways (Golembiewski & Kim, 1990). This has particular relevance for forensic scientists as they may not be sworn officers yet have to function within an otherwise militarized structure that may otherwise be unknown to those with no prior military or law enforcement experience, leading them to feel isolated from the sworn

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personnel in their agency. In addition, budgetary constraints can make it difficult for scientists to acquire the tools necessary to facilitate their day-to-day activities. This may increase the levels of stress they experience.

Research exploring work stress among law enforcement officers indicates that they report high levels due to substantive role conflicts, measured through competing demands on them and different or unclear standards for completing specific tasks (Cullen et al., 1985; Pogrebin, 1978). This problem may be exacerbated for forensic scientists due to the fact that they regularly interact with internal laboratory managers, prosecutors, police, and other criminal justice system actors regarding different cases (Becker & Dale, 2003, 2007). Each of these groups have their own interests and needs regarding the scientific handling or processing of evidence, which may increase the demands placed on the scientists and raise their overall level of stress (Becker & Dale, 2003, 2007; Gould & Leo, 2010; Saks, Risinger, Rosenthal, & Thompson, 2003).

A lack of clear conduct guidelines for work tasks, often referred to as role ambiguity, decreases employee job satisfaction (Coman & Evans, 1991; He, Zhao, & Archbold, 2002; Symonds, 1970). This has particular salience for forensic scientists as there is often no single, nationally standardized methodology for processing evidence and obtaining results within certain scientific disciplines, (National Academy of Sciences 2009; Stevenson, 2007). As a result, the presence of role ambiguity may substantially increase work stress and decrease job satisfaction.

Overall job stress can be increased through deficient training, supervisory support for decisions, and an inability to affect workplace policies or procedures (Coman & Evans, 1991, He et al., 2002; Symonds, 1970). Support from co-workers has been found to reduce stress among law enforcement as only fellow officers who have experienced the job understand the unique

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nature of policing (Graf, 1986; LaRocco, House, & French 1980; Morash, Haarr, & Kwak, 2006). This could apply to the forensic sciences due to the technical analyses and complications that can emerge that may only be understood by those who work in the same field.

The demographic characteristics of an individual can also influence reported levels of stress and satisfaction among criminal justice employees. For instance, age may be related to occupational experiences, as some studies have found that younger individuals experience more work stress and less job satisfaction (Patterson, 2003; Violanti, 1983) while others have found no significant relationship (Dowler, 2005; Storch & Panzerella, 1996). This variation may result from differences in life experience, individual priorities, and knowledge of working techniques and coping strategies (Patterson, 2003; Violanti, 1983).

There is evidence that men and women experience their jobs differently, as female criminal justice employees report more work stress and lower levels of satisfaction than males (Belknap & Shelly, 1992; Burke & Mikkelsen, 2005; Krimmell & Gormley, 2003; Morash et al., 2006; Zhao et al., 1999). Further, there are some race differences evident in the occupational experiences of forensic scientists, as minorities report greater levels of stress and less satisfaction than whites (Dowler, 2005; Haarr & Morash, 1999, Violanti & Aron, 1995; Zhao et al., 1999). Similarly, marriage appears to reduce reported levels of stress due to the ability to use an existing support network to aid in stress relief (He et al., 2002).

There is mixed evidence of the influence of higher education on occupational reactions (Cullen et al., 1985; Storch & Panzerella, 1996). Cullen and associates (1985) suggested that higher levels of education are related to lower levels of work stress due to better coping mechanisms. The fact that bench scientists in biology, chemistry, and other scientific disciplines increasingly require graduate degrees (National Academy of Sciences, 2009) could obviate any

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relationship between stress and education. Individuals with advanced degrees may, however, report higher job satisfaction because of their interest in the field.

In addition to job stress and satisfaction, research suggests that individuals tend to cope with their work stresses differently within and across occupational categories (see Bowman & Stern, 1995; Israel et al., 1989; Jackson & Maslach, 1982; Sterud, Hem, Ekeberg, & Lau, 2007). Law enforcement officers, correctional officers, and other professions within the criminal justice system use a variety of coping mechanisms to manage their stress, including the use of alcohol or smoking, that allow the individual to stifle or cope with emotional responses to their jobs. However, these coping mechanisms negatively impact individual health (Haarr & Morash, 1999; Lau, Hem, & Berg, 2006; Pienaar, Rothman, & van de Vijver, 2007; Vollrath & Torgersen, 2000; Wearing & Hart, 1996). Psychological counseling or other professional assistance is a requirement at some law enforcement agencies, particularly after a shooting or other incident that may impact the emotional stability of the individuals involved (Anshel, 2000; Lau et al., 2006). There is some evidence that digital forensic examiners are likely to use distraction and suppression techniques to cope with their stress, such as hobbies and working around the house to distract them from the stressors of their work (Holt & Blevins, 2010; Krause, 2009; Perez et al., 2010). Digital forensic examiners also discuss their feelings with spouses, significant others, or friends, but very few utilize professional assistance such as psychologists (Burns et al., 2008; Holt & Blevins, 2010; Perez et al., 2010). These behaviors may not be consistent across all disciplines of forensic science however, and may vary substantially between sworn and unsworn scientists due to differences in their experiences while at work and stressors related to the militarized system of policing agencies generally. Thus, there is a need to explore the coping

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strategies employed to identify how scientists' occupational experiences affect their lives outside of work.

Examinations of various occupations indicate that unpleasant environmental conditions, including constant loud noises, unpleasant smells, exposure to chemicals, poor ergonomic conditions, and excessive overtime increase job stress and diminish overall worker productivity (National Institute for Occupational Safety and Health, 1999). Forensic scientists regularly work with ventilation systems and large analytical equipment that may be quite loud, as well as with potentially dangerous sample types including chemicals, blood, drugs, material evidence, and child pornography in the case of digital forensic analysis (Becker & Dale, 2003; Holt & Blevins, 2010; National Academy of Sciences, 2009). In addition, the space limitations that may be present in some laboratories, whether small and cramped or large labs that are crowded with personnel, may negatively impact the working capacities of forensic scientists. Thus, there is a need to consider how the working environments of forensic scientists influence their occupational experiences.

C. Rationale for Research

Taken as a whole, there are myriad factors that may directly affect the occupational experiences of forensic scientists, across disciplines. For example, scientists in heavily tasked units such as biology or toxicology may report higher levels of work stress due to a seemingly never ending caseload, constant contact with detectives and prosecutors, etc. There has been, however, little research on the stressors and levels of satisfaction reported by forensic scientists across the country (Becker & Dale, 2003; Burns et al., 2008; Holt & Blevins, 2011; Perez et al., 2010; Stevenson, 2007).

This study addresses these issues through a quantitative analysis of survey data collected

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from 899 forensic scientists in public and private laboratories operating at the local, state, and federal level across the United States. The prevalence and incidence of stress and satisfaction were considered, along with the general occupational experiences of scientists, including interactions with prosecutors, police, management, as well as their experiences with various policies and procedures internal to their agency. The influence of these factors for work stress and satisfaction were examined through linear regression models. The use of coping mechanisms by forensic scientists was considered, along with the environmental and ergonomic conditions of their workspace. The implications of these analyses for laboratory management, directors, bench scientists, and the larger criminal justice system were then explored in depth.

II. Methods

A. Data Collection

This study utilized a purposive quantitative research design to understand the factors that affect forensic scientists' work, and the ways that their tasks are affected by various managerial, social, and environmental conditions. In order to develop the questions appropriate to forensic scientists in the field, focus groups were convened with management and bench scientists of the Michigan State Police (MSP) Forensic Science Division in February 2012. Interviews with sworn and unsworn scientists were conducted to identify critical issues and challenges in their day to day activities as well as internal and external factors that influence their work environment and affect their levels of job stress. The focus groups also discussed strengths and weaknesses in the existing survey instrumentation to refine the measures used to assess the occupational environment of forensic scientists.

The recommendations provided by the focus group were used to refine and develop the survey instrument for this study, which was then pre-tested with a sample of sworn and unsworn

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forensic scientists from MSP Forensic Science Division laboratories. The survey was administered via an email sent by MSP management to all forensic scientists across the state. The message included a description of the project, informed consent protections provided by the Institutional Review Boards at Michigan State University and Eastern Kentucky University, and an electronic link to the survey through Surveymonkey. This software allows the survey developer to create, administer, and manage the on-line instrument, and directly collect the data, increasing respondent anonymity and privacy. Pre-test data were collected during April and May 2012, and the responses evaluated for validity and reliability of the survey items.

Once the survey instrument was finalized, nationwide survey administration began in November 2012. The research team coordinated with the Executive Director and management of ASCLD-LAB, responsible for accreditation of forensic laboratories. The Director's office distributed an email to all lab directors in charge of currently accredited laboratories, which included a description of the project, informed consent for the study, and an electronic link to the survey instrument. The first solicitation was delivered on November 2, 2012, with a reminder message sent on December 2, 2012 to increase the overall response rate.

The electronic solicitation method yielded 568 responses, though there is no way to determine the response rate due to the distribution method. There were, however, responses from 31 states and the District of Columbia, suggesting a wide distribution. In addition, responses came from primarily state (N=313), and local police agencies (N=121), as well as 30 federal and 20 private lab scientists. This is somewhat similar to the general distribution of labs currently certified by ASCLD (ASCLD-LAB, 2013).

In order to increase the representative nature of the data, a follow-up paper survey was distributed to 84 agencies in 25 states on May 7, 2013. The states were selected because they

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were under-represented in the electronic survey data due to either low or no responses. A list of the certified laboratories in each of the 25 states was compiled from the information posted on the ASCLD-LAB website. The research team then visited the website for each lab to validate the director contact information, as well as determine an estimated number of scientists that may be working at that facility. A number of labs did not list this information, thus follow-up phone calls and emails were sent to the lab directors of the agencies in order to obtain an estimate. Twenty agencies were excluded from the sample due to missing information and non-responses.

Once the total sample was created, the team constructed a package that was mailed to the laboratory director of each facility along with an introductory letter explaining the reason for the mail and its contents. Packages included individually sealed envelopes to be distributed to each scientist working in the lab, which contained a consent document, paper survey, and self-addressed envelope to return the survey at no cost to the scientist.

A total of 1,569 surveys were mailed, and 331 surveys from 20 states were returned. The response rate for the paper survey distribution was 21.1%, which is in keeping with general responses for such a method (Dillman, 2007). The majority of responses were again from state (N=184) and local (N=52) agencies, while six independent scientists and one federal lab employee responded. This is similar to the distribution of labs currently certified by ASCLD (ASCLD-LAB, 2013).

As a whole, these methods provided 899 responses with representation from most states across the country, and a range of laboratory types. In addition, a variety of scientific disciplines are represented with the majority of respondents working in biology and chemistry. Thus, this sample provides a convenient yet purposive population of scientists and allows for comparisons within and across laboratories based on region of the country identified. Additionally, this

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sample provides a diverse population composed of individuals from laboratories of varying sizes and scientist composition based on sworn and unsworn positions.

B. Measurement and Analysis Techniques

The survey instrument administered to scientists provided myriad measures to assess the occupational experiences of scientists (see Appendix for survey). In order to document the experiences of respondents, this report will first present descriptive statistics generated from the data on the overall prevalence and levels of stress, satisfaction, role conflicts, ambiguity, and organizational dynamics (see Section III, A). Multivariate statistical techniques are then presented to examine the existence and types of relationships between stress, satisfaction, and the various individual and organizational variables measured. Finally, multiple regression models are shown in Section III, B based on scales and indices created from the various measures to demonstrate significant predictors of work stress and job satisfaction (Blevins, Cullen, Frank, Sundt, & Holmes, 2006; Britton, 1997; Cullen, Latessa, Kopache, Lombardo, & Burton, 1993; Robinson, Porporino, & Simourd, 1993) and/or the conditions they face during their work (Blevins et al., 2006; Cullen et al., 1993; Grossi, Keil, & Vito , 1996; Triplett, Mullings, & Scarborough, 1996).

Multiple individual demographic characteristics were included in the instrument, such as age, race, sex, marital status, and education (see Table 1 for demographic detail). About five in eight (62.8%) respondents were female and most were white (90.7%), married (70.7%), and had at least a four year college degree (93.4%). The mean age of respondents was 39.15, and sample members had worked in the field of forensic science for an average of 3.71 years.

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Table 1: Individual Characteristics of Respondents

	N	Valid Percent
Age		
18 to 24	19	2.1
25 to 30	190	21.1
31 to 35	181	20.1
36 to 40	166	18.5
41 to 45	95	10.6
46 to 50	76	8.5
51 to 55	64	7.1
56 or older	108	12.0
Sex		
Male	332	37.2
Female	560	62.8
Race		
White	804	90.7
Black	28	3.2
Hispanic	21	2.4
Asian	21	2.4
Other	12	1.4
Marital Status		
Single/Never Married	201	22.6
Married/Common-Law	630	70.7
Divorced/Separated	57	6.4
Widowed	3	0.3
Education		
High School Diploma or GED	6	0.7
Some College	23	2.6
Two Year Degree	16	1.8
Four Year Degree	378	42.3
Some Graduate Classes	112	12.5
Master's Degree	315	35.2
Ph.D.	30	3.4
Other	14	1.6

Individual work experience was also measured to understand how this is related to stress, satisfaction, and the coping strategies forensic scientists employ (see Table 2). This includes the number of years the individual worked at their current agency, their total number of years working in forensic science, whether they are sworn or unsworn scientists, average number of hours worked each week, number of hours of overtime worked each week, and how many days

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Table 2: Work-related Characteristics of Respondents

	N	Valid Percent
Years at Current Agency		
Less than 1	24	2.7
1 to 5	267	29.7
6 to 10	221	24.6
11 to 15	164	18.2
16 to 20	77	8.6
21 to 25	60	6.7
More than 25	86	9.6
Years worked in forensic science including current and previous positions		
Less than 1	16	1.8
1 to 5	211	24.3
6 to 10	254	29.2
11 to 15	146	16.8
16 to 20	97	11.1
21 to 25	64	7.4
More than 25	82	9.4
Are you sworn or unsworn?		
Sworn	112	12.8
Unsworn	765	87.2
How did you obtain your current position?		
I applied directly for the position	783	89.3
I was voluntary transferred from another position	65	7.4
My supervisor assigned me to this position	29	3.3
On average, how many hours do you work in a given week?		
Less than 20	1	0.1
20 to 30	8	0.9
31 to 39	95	10.6
40	503	56.0
41 to 45	132	14.7
46 to 50	102	11.3
51 to 55	13	1.4
56 to 60	12	1.3
More than 60	33	3.7
How many hours of overtime do you work in a given week?		
0	452	50.3
1 to 5	248	27.6
6 to 10	126	14.0
11 to 15	14	1.6
More than 15	59	6.6
About how much time do you spend in job trainings per year?		
1 to 2 Days	141	16.9
3 to 5 Days	198	23.7
One Week	214	25.7
Two Weeks	170	20.4
Three Weeks	52	6.2
Four or More Weeks	59	7.1

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of training they attend each year. Most respondents (87.2%) held unsworn positions, applied directly for their current positions (89.3%), and had worked at their current agency in some capacity for 3.59 years (see Table 2). Sample members worked an average of 41.8 hours per week, and about half (49.7%) reported some overtime each week. The amount of time spent in annual training varied, though most (59.4%) reported spending at least one week per year in training.

III. Findings

A. Descriptive Statistics

The scientific and occupational responsibilities of this sample of scientists are summarized in Table 3. First, respondents were asked to indicate the number of years they have worked in their current agency and their role as a trainer at their current agency, to examine the influence of work experience on occupational reactions (see Hunt & McCadden, 1985; Johnson et al., 2005; Zhao et al., 1999). Respondents were also asked about the proportion of cases that they work where the victim is a minor, to understand how this might relate to work stress or job satisfaction. The responses were expressed as a percentage, ranging from 0 percent to more than 70 percent. The amount of time scientists spent generating reports each week was also measured as a percentage of time, ranging from 0 to more than 70 percent. Finally, respondents were asked how much time they had to spend engaging in peer reviews of colleagues' reports and analyses, to understand what influence this may have on working behaviors. Responses ranged from 0 hours to more than 40 hours each week (in the case of managers).

Respondents were asked if they serve as crime scene investigators or reconstructors in order to understand what, if any, influence this may have on occupational responses. If an individual does respond to crime scenes, they were asked how many times they did so in the last

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six months to understand how active they are in the field. Responses ranged from 1 to 2 times up to 14 or more times during the six month period. The majority (68.8%) of forensic scientists surveyed did not serve as either a crime scene investigator or reconstructor. Within the sample of scientists who responded to crime scenes, the overwhelming majority (98.9%) had done so one time or less during the previous six months. A substantial proportion of respondents (43.2%) also trained colleagues while at work, suggesting that scientists must handle multiple roles while in the laboratory in addition to their analyses. More than half of all respondents (52.9%) spent 20 percent or less of their time writing or generating reports based on their own analyses each week. In addition, more than half of all respondents (54.1%) spent between one and 10 hours engaging in peer review of their colleagues' reports of scientific analyses. More than two thirds (69.3%) consulted for the prosecutor or court, and 77.2 percent of the sample testified in court during the previous year.

To understand what primary scientific disciplines respondents worked in, they were asked to indicate what proportion of their time was spent in the following areas: 1) biology, 2) digital and multimedia evidence, 3) drug chemistry, 4) firearms/tool marks, 5) latent prints, 6) toxicology, 7) trace evidence, and 8) other scientific tasks. These categories are in keeping with the operationalization of the National Academy of Sciences (2009) report on forensic investigation.

Most scientists performed multiple types of analyses while at work, though there was a good degree of specialization within a discipline. Based on analyses of the time individuals reported to have spent on various tasks, the most common responsibilities were biological analyses, drug chemistry, latent prints, and toxicology. Fewer individuals spent most of their time on digital and multimedia evidence, firearms/toolmarks, trace evidence, and other tasks. A

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majority of respondents did not clearly indicate their primary field of scientific work. In some cases individuals put no response into a category, which may have been because they did not work in that field or simply chose not to respond. In order to ensure that responses were not misinterpreted, these items were treated as missing data and excluded from this category.

Table 3: Work Roles and Responsibilities

Item	N	Valid Percent
Do you respond to crime scenes as an investigator or reconstructor?		
No	596	68.8
Yes	270	31.2
How many times have you had to respond to a scene in the last six months?		
1 to 2 Times	189	69.7
3 to 5 Times	79	29.2
6 to 9 Times	0	0.0
10 to 13 Times	0	0.0
14 or More Times	3	1.1
Are you regularly responsible for training others at work?		
Yes	381	43.2
No	501	56.8
What percentage of your work involves working with cases where minors are victims?		
0 Percent	94	10.5
1 to 10 Percent	291	32.4
11 to 20 Percent	132	14.7
21 to 30 Percent	102	11.3
31 to 40 Percent	26	2.9
41 to 50 Percent	32	3.6
51 to 60 Percent	3	0.3
61 to 70 Percent	5	0.6
More than 70 Percent	214	23.8
On average, what percentage of your time is spent each week generating or writing reports based on your analyses?		
0 Percent	93	10.3
1 to 10 Percent	206	22.9
11 to 20 Percent	177	19.7
21 to 30 Percent	155	17.2
31 to 40 Percent	70	7.8
41 to 50 Percent	80	8.9
51 to 60 Percent	20	2.2
61 to 70 Percent	8	0.9
More than 70 Percent	90	10

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Table 3 (Continued): Work Roles and Responsibilities

Item	N	Valid Percent
On average, how many hours do you spend each week reviewing your colleagues' reports and analyses?		
0 Hours	103	11.5
1 to 10 Hours	484	54.1
11 to 20 Hours	129	14.4
21 to 30 Hours	63	7.0
31 to 40 Hours	10	1.1
More than 40 Hours	105	11.7
How many times have you had to testify concerning scientific analyses in court over the last year?		
0 Times	205	22.8
1 to 5 Times	445	49.5
6 to 10 Times	119	13.2
11 to 15 Times	32	3.6
16 to 20 Times	12	1.3
21 to 25 Times	8	0.9
26 to 30 Times	3	0.3
31 to 35 Times	0	0.0
36 to 40 Times	0	0.0
More than 40 times	75	8.3
On average, what percentage of your time do you spend on the following tasks?		
Biology	136	15.1
Digital and Multimedia Evidence	10	1.1
Drug Chemistry	86	9.6
Firearms/Tool marks	35	3.9
Latent Prints	50	5.6
Toxicology	31	3.4
Trace Evidence	20	2.2
Other	37	4.1
Missing	494	54.9

Table 4 presents information on the experiences of respondents related to court cases during the previous 12 months. The role of court presentation in the daily activities of scientists was assessed by asking respondents: "In the last year, how many times did you experience the following outcome related to a court appearance or case" with five specific outcomes: 1) being subpoenaed, 2) giving testimony in court, 3) the defendant took a plea upon your arrival, 4) being called off while in transit to the court, and 5) serving as a consultant for the prosecutor or court, in an attempt to understand how much of a scientist's time is absorbed in court activities. Responses ranged from 0 to more than 50 times.

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About 90 percent had received at least one subpoena during the last year, and over 80 percent of the scientists in this sample gave court testimony during the previous year. The respondents also indicated that their court appearances did not always lead to testimony. Specifically, 53.7 percent reported to court and observed the defendant take a plea deal, while 44.8 percent were called off by court staff while in transit to a court appearance on at least one occasion.

Table 4: In the last year, how many times did you experience the following outcome related to a court appearance or case?

Item	0 N (Valid %)	1 to 10 N (Valid %)	11 to 20 N (Valid %)	21 to 30 N (Valid %)	31 to 40 N (Valid %)	41 to 50 N (Valid %)	More than 50 N (Valid %)
Subpoena	95 (10.6)	279 (31.0)	124 (13.8)	65 (7.2)	32 (3.6)	54 (6.0)	250 (27.8)
Testimony in court	176 (19.6)	555 (61.7)	43 (4.8)	9 (1.0)	0 (0.0)	1 (0.1)	115 (12.8)
Defendant took plea upon arrival	416 (46.3)	250 (27.8)	15 (1.7)	3 (0.3)	1 (0.1)	1 (0.1)	212 (23.6)
Called off in transit to court	496 (55.2)	199 (22.1)	1 (0.1)	2 (0.2)	0 (0.0)	0 (0.0)	201 (22.4)
Consulted for the prosecutor/court	276 (30.7)	338 (37.6)	43 (4.8)	15 (1.7)	4 (0.4)	10 (1.1)	213 (23.7)

As shown in Table 5, five items were combined to create a scale for work stress. This index was created using statements adapted from scales that have been successfully applied in previous research exploring occupational stress among criminal justice system occupations and those in other occupations and fields (e.g., Blevins et al., 2007; Cullen et al., 1985; Jex, Beehr, & Roberts, 1992; Peters & O'Connors, 1980). Respondents were presented with five statements and asked to indicate their agreement with each, using a six-item Likert scale ranging from strongly agree to strongly disagree. The statements include: 1) "I usually feel that I am under a lot of pressure when I am at work"; 2) "When I am at work, I often feel tense or uptight"; 3) "I am usually calm and at ease when I am working"; 4) "Working with difficult images/scenes/materials all day is a real strain for me"; and 5) "I feel frustrated by my job."

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Each of the items in this scale gauge general feelings of work stress, providing a broad perspective on the amount experienced by scientists.

All scales had possible values of one to six, with higher scores representing higher levels of stress. In general, it appears scientists experience moderate levels of stress while on the job ($\bar{x}$=3.52), though there was less support for the notion that working with difficult images or materials was a strain. In general, the levels of stress reported are similar to those of traditional criminal justice system employees (Eizenberg, 1975; He et al., 2006; Holt & Blevins, 2011; Johnson et al., 2005; Morash et al., 2006; Petrone & Reiser, 1985), as well as workers in helping professions, including ambulance workers (see Sterud et al., 2007), forensic odontologists (see Webb, Sweet, & Pretty, 2002), and therapeutic nurses (see Nathan, Brown, Redhead, Holt, & Hill, 2007). In addition, cross-tabs show no significant differences between levels of stress reported by sworn and unsworn scientists (χ^2=22.824, p=.588) or by disciplines (χ^2=172.572, p=.538).

Table 5: Items Composing Work Stress Scale

Items Composing Work Stress Scale (α=.837, min=1, max=6, $\bar{x}$=3.52)						
Item	Strongly Disagree N (Valid %)	Disagree N (Valid %)	Slightly Disagree N (Valid %)	Slightly Agree N (Valid %)	Agree N (Valid %)	Strongly Agree N (Valid %)
I usually feel that I am under a lot of pressure when I am at work	16 (2.0)	132 (16.6)	104 (13.1)	202 (25.4)	207 (26.0)	135 (17.0)
When I am at work, I often feel tense or uptight	32 (4.0)	170 (21.5)	109 (13.8)	204 (25.8)	164 (20.7)	113 (14.3)
I am usually calm and at ease when I am working	53 (6.8)	102 (13.0)	198 (25.2)	161 (20.5)	228 (29.0)	43 (5.5)
Working with difficult images/scenes/materials all day is a real strain for me	120 (16.1)	285 (38.2)	131 (17.6)	140 (18.8)	55 (7.4)	15 (2.0)
I feel frustrated by my job	56 (7.2)	176 (22.5)	103 (13.2)	198 (25.3)	123 (15.7)	126 (16.1)

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Results for survey items measuring job satisfaction are presented in Table 6. Five measures for job satisfaction with specially designed Likert scale responses were drawn from the *Quality of Employment Survey* (Quinn & Shepard, 1974) that has been successfully used in a wide range of criminal justice research (Blevins et al., 2007; Cullen et al., 1985; Van Voorhis et al., 1991). These measures include: "All in all, how satisfied are you with your job?"; "Knowing what you know now, if you had to decide all over again whether to take the job you now have, what would you decide?"; "In general, how well would you say your job measures up to the sort of job you wanted when you took it"; "If a good friend of yours told you he (or she) was interested in working in a job like yours for your employer, what would you tell them,"; and "If you were free to go into any type of job you wanted, what would your choice be?" This scale is intended to measure general feelings of job satisfaction rather than specific measures of satisfaction concerning items such as particular job duties, relationships with coworkers, and salary (see Quinn & Shepard, 1974). Specifically, 85.6 percent of sample members reported being either somewhat satisfied or very satisfied with their jobs, and 64.1 percent would take the same job again without hesitation. The majority of respondents also indicated that they would keep their current job regardless of other opportunities (48.4%) or strongly recommend the job to their friends (51.7%). Only 9.6 percent of respondents found that their current job was not much like the job they wanted.

Responses to each item were summed into a scale with higher scores indicating greater levels of satisfaction (see Quinn & Shepard, 1974). The average score on the global satisfaction scale was 3.66 for this sample, indicating that these individuals have a moderately high level of satisfaction with their jobs. Again, these findings are consistent with research on criminal justice system employees generally (Eizenberg, 1975; He et al., 2006; Holt & Blevins, 2011; Johnson et

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al., 2005; Morash et al., 2006; Petrone & Reiser, 1985). There were no differences in the levels of satisfaction reported by sworn and unsworn scientists (χ^2=21.499, p=.255) or among the disciplines (χ^2=136.596, p=.057).

Table 6: Job Satisfaction Items

Items Composing Job Satisfaction Scale (α=.824, min=1, max=5, $\bar{x}$=3.66)		
Item	N	Valid Percent
All in all, how satisfied are you with your job?		
Not satisfied at all	42	5.4
Not too satisfied	71	9.0
Somewhat satisfied	359	45.7
Very satisfied	313	39.9
Knowing what you know now, if you had to decide all over again whether to take the job you now have, what would you decide?		
Definitely not to take the same job	47	6.0
Have second thoughts about taking this job	234	29.9
Take the same job without hesitation	502	64.1
In general, how well would you say your job measures up to the sort of job you wanted when you took it?		
Not very much like the job I wanted	75	9.6
Somewhat like the job I wanted	374	47.7
Very much like the job I wanted	335	42.7
If you were able to go into any type of job you wanted, what would your choice be?		
Prefer some other job to the job I have now	230	29.5
Want to retire and not work at all	172	22.1
Keep the job I have now	377	48.4
If a good friend of yours told you he or she was interested in pursuing a career in forensic science, what would you tell him or her?		
Advise my friend against taking the job	37	4.8
Have some doubts about recommending the job	338	43.6
Strongly recommend the job	401	51.7

Table 7 contains summary responses to 13 questions measuring the scientists' perceptions of and relationships with prosecutors and courts. For instance, respondents were asked to rate their agreement with statements such as "Prosecutors doubt my competence,"

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"Prosecutors do not understand why it takes time to complete the analyses they request," "Judges respect me professionally", "Prosecutors do not inform me about the outcomes of the cases on which I work," and "I am regularly pressured by police or prosecutors to rush to produce scientific results." These questions help to capture the relationships between scientists and court staff, as well as explore the impact that these stressors may have on the occupational experiences of scientists (Becker & Dale, 2003).

Although 41.6 percent of respondents at least slightly agreed that they often have to report for court with little notice, 62.6 percent indicated they find it easy to deal with court schedules in their jurisdictions. Very few (4.1%) respondents felt as though prosecutors doubted their competence, and almost 95 percent felt that judges respect them as professionals. At the same time, more than half of the scientists agreed they were regularly pressured by police or prosecutors to rush to produce scientific results (56.7%) and that prosecutors do not understand why it takes time to complete the analyses they request (63.2%). In addition, 78.9% of respondents indicated that prosecutors do not understand that they work very hard on a case even though they end up finding no evidence to support the case against a defendant, and 27.9% agreed that prosecutors try to persuade them to testify to more than just the scientific facts.

Ten of the items presented in Table 7 were combined to create a scale to measure overall relationships with prosecutors and courts. Possible scores on the composite measure ranged from one to six, with higher scores representing more positive relationships. The average score on this scale was 3.67, indicating that, overall, these respondents shared more positive than negative relationships with the prosecutors and courts with which they work.

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Table 7: Experiences with and Perceptions of Relationships with Prosecutors and Courts

Item	Strongly Disagree N (Valid %)	Disagree N (Valid %)	Slightly Disagree N (Valid %)	Slightly Agree N (Valid %)	Agree N (Valid %)	Strongly Agree N (Valid %)
The CSI effect has made my job more difficult, particularly in court testimony	20 (2.6)	60 (7.9)	71 (9.4)	210 (27.7)	249 (32.8)	148 (19.5)
I often have to report for court with little notice	56 (7.4)	226 (29.9)	159 (21.0)	175 (23.1)	91 (12.0)	49 (6.5)
Items Comprising Scale Measuring Relationships with Prosecutors and Courts (α=.738, min=1.9, max=5.5, $\bar{x}$=3.67):						
Item	Strongly Disagree N (Valid %)	Disagree N (Valid %)	Slightly Disagree N (Valid %)	Slightly Agree N (Valid %)	Agree N (Valid %)	Strongly Agree N (Valid %)
Prosecutors doubt my competence	436 (56.4)	278 (36.0)	27 (3.5)	21 (2.7)	7 (0.9)	4 (0.5)
Prosecutors do not understand why it takes time to complete the analyses they request	39 (5.0)	149 (19.3)	97 (12.5)	200 (25.8)	208 (26.9)	81 (10.5)
Prosecutors try to persuade me to testify to more than just the scientific facts	169 (22.2)	276 (36.3)	104 (13.7)	153 (20.1)	50 (6.6)	9 (1.2)
I am not often thanked by prosecutors or police for the work that I do	59 (7.6)	206 (26.7)	141 (18.3)	149 (19.3)	144 (18.7)	73 (9.5)
I find it easy to deal with court schedules across the jurisdiction(s)	52 (6.9)	124 (16.3)	111 (14.6)	151 (19.9)	268 (35.3)	53 (7.0)
Judges respect me professionally	7 (0.9)	13 (1.7)	18 (2.4)	66 (8.7)	473 (62.6)	177 (23.4)
Judges and juries are frequently confused when there is insufficient forensic evidence to support claims made by prosecutors or police	15 (2.1)	93 (13.2)	140 (19.9)	287 (40.8)	143 (20.3)	26 (3.7)
Prosecutors do not inform me about the outcomes of the cases on which I work	6 (0.8)	21 (2.8)	48 (6.4)	126 (16.7)	292 (38.7)	261 (34.6)
Most court decisions are too lenient	7 (1.1)	114 (17.2)	182 (27.5)	227 (34.3)	87 (13.2)	44 (6.7)
Prosecutors do not understand that I sometimes work very hard on a case even though I end up finding no evidence	11 (1.5)	60 (8.1)	85 (11.5)	209 (28.3)	242 (32.7)	132 (17.9)
I am regularly pressured by police or prosecutors to rush to produce scientific results	42 (5.5)	172 (22.7)	115 (15.2)	202 (26.6)	156 (20.6)	72 (9.5)

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The summary findings of the scientists' perceptions of immediate supervisors and management are presented in Table 8. Supervisory support was measured through six work-related variables assessing the willingness of management to support or encourage employees in the course of their jobs, as well as resolve disputes between co-workers (Cullen et al., 1989). They were asked to rate their agreement with the following statements: "The people I work with often have the importance of their jobs stressed to them by their supervisors"; "My supervisor often encourages the people I work with if they do their job well."; and "When my supervisors have a dispute with one of my fellow coworkers they usually try to handle it in a friendly way." High levels of supervisory support are thought to reduce work stress and increase job satisfaction for criminal justice employees (Cullen et al., 1985; Grossi et al., 1996; Liou, 1995; Van Voorhis et al., 1991).

The scientists reported high levels of supervisory support, with 75.9 percent agreeing that their immediate supervisors supported them, gave them clear instructions (76.1%), and had clear expectations of their work (80.2%). More than half of respondents agreed that their supervisors encouraged co-workers if they do their jobs well (59.9%) and handled disputes between coworkers and supervisors in a friendly way (72.5%).

Three measures were used to explore scientists' relationships with top managers. Respondents were asked to rate their agreement with the following items: "The top managers in my agency are responsive to my thoughts and suggestions." "The top managers in my agency are mainly concerned with getting cases out the door.", and "The top managers in my agency are more concerned with looking good to the public than doing a good job". For each measure, items were coded so that higher scores indicate more support, with possible scores ranging from one to six. When asked about top managers in the agency, 55.2 percent at least slightly agreed

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that they are responsive to scientists' thoughts and suggestions. Also, most respondents disagreed that top managers are mainly concerned with getting cases out the door (53.1%) and that they are more concerned with looking good to the public than doing a good job (61.2%). As a result, the mean scores for these items indicate that respondents perceived more support from their supervisors ($\bar{x}$=4.17) than they did from top managers ($\bar{x}$=3.67) in their agencies.

Table 8: Supervisory and Management Support

Items Comprising Scale Measuring Relationships with Top Managers (α=.842, min=1, max=6, $\bar{x}$=3.67):						
Item	Strongly Disagree N (Valid %)	Disagree N (Valid %)	Slightly Disagree N (Valid %)	Slightly Agree N (Valid %)	Agree N (Valid %)	Strongly Agree N (Valid %)
The top managers in my agency are responsive to my thoughts and suggestions	121 (15.2)	134 (16.8)	102 (12.8)	180 (22.6)	194 (24.3)	66 (8.3)
The top managers in my agency are mainly concerned with getting cases out the door	103 (12.9)	192 (24.1)	129 (16.2)	157 (19.7)	110 (13.8)	107 (13.4)
The top managers in my agency are more concerned with looking good to the public than doing a good job	136 (16.9)	238 (29.6)	118 (14.7)	129 (16.1)	86 (10.7)	96 (12.0)
Items Comprising Scale Measuring Supervisory Support (α=.829, min=1.17, max=6, $\bar{x}$=4.17):						
Item	Strongly Disagree N (Valid %)	Disagree N (Valid %)	Slightly Disagree N (Valid %)	Slightly Agree N (Valid %)	Agree N (Valid %)	Strongly Agree N (Valid %)
My immediate supervisor supports me	39 (4.8)	44 (5.4)	32 (4.0)	80 (9.9)	324 (40.1)	289 (35.8)
My immediate supervisor gives me clear instructions	45 (5.6)	71 (8.8)	77 (9.6)	141 (17.5)	289 (35.9)	183 (22.7)
My immediate supervisor has clear expectations of me	34 (4.2)	63 (7.8)	62 (7.7)	118 (14.7)	327 (40.7)	199 (24.8)
The people I work with often have the importance of their jobs stressed to them by their supervisors	34 (4.3)	166 (21.1)	165 (21.0)	208 (26.5)	176 (22.4)	37 (4.7)
My supervisors often encourage the people I work with if they do their jobs well	67 (8.5)	127 (16.1)	122 (15.5)	216 (27.4)	220 (27.9)	36 (4.6)
When my supervisors have a dispute with one of my coworkers they usually try to handle it in a friendly way	39 (5.0)	76 (9.7)	101 (12.9)	169 (21.6)	339 (43.2)	60 (7.7)

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Summary responses to items concerning individuals' personal work roles and reactions, relationships with coworkers, and workplace policies and procedures are presented in Table 9. An additional index of 26 measures was included to understand the way in which laboratory environments operate, and their influence on scientists' behaviors while on the job. These include a number of measures adapted from existing studies of role conflict and ambiguity within the workplace (Churchill et al., 1985; Rizzo et al., 1970) to understand how a lack of clarity in work roles may affect performance. Measures were also included from recent research on digital forensic investigation to understand the impact that exposure to harmful or obscene materials affects the mental health of scientists (see Holt & Blevins, 2010; Krause, 2009; Perez et al., 2010). Several measures were developed based on focus group testing with forensic scientists, including "There are tensions between sworn and unsworn individuals in my workplace."; "I worry that I will make a mistake that might lead to the conviction of an innocent person"; "The standards and practices for analyses are different in my workplace than in other jurisdictions/departments with which I collaborate."; "My plans for the workday are often changed because of new cases/requests that I receive."; and "I worry that I will make a mistake that will ruin my credibility as an expert witness". For each measure, respondents were asked to rate their agreement from one to six, with higher scores indicating greater agreement.

About 60 percent of respondents agreed that they were emotionally drained by their work and 57.1 percent felt frustrated by their jobs. Similarly, 68.4 percent indicated they were under a lot of pressure at work and 60.8 reported that they were tense or uptight at work. Nonetheless, 86.8 percent felt they were positively influencing other people's lives through their work, 92.6 percent felt they have accomplished many worthwhile things in their jobs, and 97.1 percent believed they have contributed to public safety through their work.

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The majority of respondents (75.2%) felt that their colleagues usually agreed on the best way to accomplish something at work, and that their coworkers listened to what they have to say (85.3%). There was, however, some evidence of discord among scientists, as more than one third of the sample (34.4%) agreed that they are held responsible for mistakes made by others, and 58.7 percent reported working with people who did not pull their weight. In addition, 39.6 percent of respondents reported some tensions between sworn and unsworn individuals in the workplace.

Respondents also had varying viewpoints concerning policies, equipment, and manpower at work. For example, more than 70 percent reported that their equipment and resource needs were regularly met at work, yet just over half (51.5%) of respondents felt they did not have adequate IT support. Almost 80 percent of respondents felt their agency's operational guidelines and procedures were clear, though 53.3 percent believed their agency inconsistently applied new rules and policies. Nearly half (48.9%) of all respondents indicated that they received assignments without the manpower to complete them, and the vast majority (86.2%) believed that it took too long to hire replacements when someone left the agency.

Several of the items were combined (Table 9) to create scales to measure role conflict at work (five items) and positive feelings about the work investigators perform (three items). Five measures were used to assess role conflict in laboratories based on measures from Rizzo et al., (1970) and Churchill et al., (1985). These measures identify issues related to a lack of staff or uniform steps to complete a task, an absence of clearly defined work responsibilities, and incompatible work requests. This includes: 1) "I have to do things at work in ways that should otherwise be done differently."; 2) "I do things that are likely to be accepted by one person but not accepted by others."; 3) "At work I receive assignments without the manpower to complete

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them."; 4) "In my job, I receive incompatible requests from two or more people."; and 5) "I do things that are apt to be accepted by one person but not accepted by others". Such issues are likely common in the forensic sciences, and may affect the occupational reactions of scientists in laboratories (National Academy of Sciences, 2009; Stevenson, 2007). Three measures were included to assess the presence of positive feelings scientists hold about their jobs. These include: "I feel I am positively influencing other people's lives through my work."; "I feel exhilarated after working on a case."; and "I have accomplished many worthwhile things in this job".

All scales had possible values of one to six, with higher scores representing greater conflicts or positive feelings overall. With the exception of the one work stress item concerning difficult images or material at work, all of the items in the scales are based on general perceptions and could apply to any occupation. Although respondents experienced moderate amounts of role conflict ($\bar{x}$=3.08), they did have positive feelings about their work ($\bar{x}$=4.392).

Table 9: Respondents' Perceptions Concerning their Occupational Situations

Item	Strongly Disagree N (Valid %)	Disagree N (Valid %)	Slightly Disagree N (Valid %)	Slightly Agree N (Valid %)	Agree N (Valid %)	Strongly Agree N (Valid %)
I spend more time doing peer reviews than casework	171 (22.4)	294 (38.5)	99 (13.0)	73 (9.6)	66 (8.6)	61 (8.0)
It takes too long to hire a replacement when one of my colleagues leaves the agency	14 (1.8)	36 (4.5)	60 (7.5)	124 (15.6)	219 (27.5)	343 (43.1)
I am repeatedly exposed to obscene content in the course of my job	110 (14.2)	212 (27.5)	74 (9.6)	170 (22.0)	154 (19.9)	52 (6.7)
In my job, I have to deal with too much paperwork	10 (1.3)	76 (9.6)	105 (13.2)	207 (26.1)	244 (30.8)	151 (19.0)
My job duties often make me miss regular meals	148 (18.6)	284 (35.7)	118 (14.8)	123 (15.5)	76 (9.5)	47 (5.9)
I do not have adequate IT support at work	65 (8.2)	185 (23.4)	134 (16.9)	148 (18.7)	124 (15.7)	135 (17.1)
My equipment and resource needs are regularly met at work	35 (4.4)	80 (10.1)	120 (15.1)	193 (24.3)	319 (40.2)	47 (5.9)

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Table 9 (Continued): Respondents' Perceptions Concerning their Occupational Situations

Item	Strongly Disagree N (Valid %)	Disagree N (Valid %)	Slightly Disagree N (Valid %)	Slightly Agree N (Valid %)	Agree N (Valid %)	Strongly Agree N (Valid %)
I work with people who do not pull their weight	76 (9.6)	170 (21.4)	82 (10.3)	157 (19.8)	170 (21.4)	139 (17.5)
The agency I work for is inconsistent in the application of new rules and policies	49 (6.2)	185 (23.3)	137 (17.2)	184 (23.1)	140 (17.6)	100 (12.6)
I get held responsible for mistakes made by others	102 (12.9)	286 (36.1)	132 (16.7)	139 (17.6)	90 (11.4)	43 (5.4)
My agency's operational guidelines/procedures are clear	21 (2.6)	58 (7.3)	93 (11.7)	175 (21.9)	365 (45.7)	86 (10.8)
I cannot keep up with the changing technology that is required to do my job	170 (21.4)	356 (44.8)	128 (16.1)	100 (12.6)	31 (3.9)	9 (1.1)
I contribute to public safety through my work	3 (0.4)	9 (1.1)	11 (1.4)	81 (10.3)	366 (46.4)	319 (40.4)
I do not get sufficient cooperation across multiple jurisdictions while at work	43 (5.7)	272 (35.9)	197 (26.0)	151 (19.9)	71 (9.4)	23 (3.0)
There are tensions between sworn and unsworn individuals in my workplace	111 (14.8)	250 (33.4)	92 (12.3)	145 (19.4)	97 (13.0)	54 (7.2)
My plans for the workday are often changed because of new cases/requests that I receive	17 (2.2)	77 (9.8)	68 (8.7)	234 (29.9)	257 (32.8)	130 (16.6)
I worry that I will make a mistake that will ruin my credibility as an expert witness	51 (6.6)	146 (19.0)	70 (9.1)	207 (27.0)	163 (21.2)	131 (17.1)
The standards and practices for analyses are different in my workplace than in other jurisdictions/departments with which I collaborate	55 (7.4)	251 (33.7)	126 (16.9)	144 (19.3)	110 (14.8)	59 (7.9)
My colleagues usually agree on the best way to accomplish something at work	34 (4.3)	51 (6.5)	109 (13.9)	206 (26.2)	326 (41.5)	59 (7.5)
The lack of scientific standards makes it difficult for me to complete my work tasks	210 (27.1)	359 (46.3)	110 (14.2)	55 (7.1)	26 (3.4)	16 (2.1)
I worry that I will make a mistake that might lead to the conviction of an innocent person	121 (15.6)	303 (39.0)	95 (12.2)	142 (18.3)	73 (9.4)	43 (5.5)
My coworkers listen to what I have to say	20 (2.6)	40 (5.1)	55 (7.0)	165 (21.1)	419 (53.6)	83 (10.6)
I have sufficient time to complete a task I am given at work	38 (4.9)	103 (13.2)	119 (15.2)	194 (24.8)	292 (37.3)	37 (4.7)
I have become more callous toward people since I started working in the forensic sciences	69 (8.9)	184 (23.7)	126 (16.2)	205 (26.4)	129 (16.6)	63 (8.1)
I really don't care about the outcome of my cases as long as I know I did the best job possible	20 (2.6)	87 (11.3)	116 (15.1)	178 (23.1)	234 (30.4)	134 (17.4)
I sometimes have an emotional response to the evidence that I handle	141 (18.5)	261 (34.2)	80 (10.5)	190 (24.9)	77 (10.1)	15 (2.0)

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Table 9 (Continued): Respondents' Perceptions Concerning their Occupational Situations

Items Composing Role Conflict Scale (α=.744, min=1, max=6, $\bar{x}$=3.08)						
Item	Strongly Disagree N (Valid %)	Disagree N (Valid %)	Slightly Disagree N (Valid %)	Slightly Agree N (Valid %)	Agree N (Valid %)	Strongly Agree N (Valid %)
I have to do things at work in ways that should otherwise be done differently	67 (8.6)	218 (27.9)	132 (16.9)	200 (25.6)	103 (13.2)	61 (7.8)
I do things that are likely to be accepted by one person but not accepted by others	102 (13.1)	315 (40.4)	120 (15.4)	129 (16.5)	74 (9.5)	40 (5.1)
At work I receive assignments without the manpower to complete them	42 (5.4)	219 (28.0)	139 (17.8)	186 (23.8)	124 (15.8)	73 (9.3)
In my job, I receive incompatible requests from two or more people	57 (7.3)	277 (35.7)	166 (21.4)	185 (23.8)	70 (9.0)	21 (2.7)
I am given too much responsibility with too little control over the outcome	71 (9.2)	353 (45.8)	138 (17.9)	101 (13.1)	73 (9.5)	35 (4.5)
Items Composing Positive Feelings about Job Scale (α=.704, min=1, max=6, $\bar{x}$=4.39)						
Item	Strongly Disagree N (Valid %)	Disagree N (Valid %)	Slightly Disagree N (Valid %)	Slightly Agree N (Valid %)	Agree N (Valid %)	Strongly Agree N (Valid %)
I feel I am positively influencing other people's lives through my work	8 (1.0)	41 (5.3)	53 (6.8)	226 (29.1)	319 (41.1)	129 (16.6)
I feel exhilarated after working on a case	25 (3.3)	113 (14.9)	140 (18.5)	294 (38.8)	151 (19.9)	35 (4.6)
I have accomplished many worthwhile things in this job	4 (0.5)	17 (2.2)	37 (4.7)	139 (17.8)	371 (47.5)	213 (27.3)

Scientists were asked about the extent to which they have experienced a variety of physical and psychological responses, or negative outcomes, associated with stress and their experiences with symptoms of secondary trauma (see Table 10). There is increasing attention being given to the issue of traumatic emotional experiences among law enforcement and criminal justice system employees due to their exposure to episodes such as shootings, accidents, and psychologically harmful events in the field (see MacEachern et al., 2011; Perez et al., 2010). We utilized nine items adapted from surveys of secondary trauma (Bride, 2004): 1) having difficulty falling or staying asleep, 2) irritability or outbursts of anger, 3) difficulty concentrating, 4) a

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constant feeling of alertness, 5) being easily startled, 6) nightmares, 7) feelings of detachment, 8) feelings of mistrust, and 9) physical aches and pain with no apparent cause. A six-item response was provided ranging from never to always. These measures were designed to gauge the prevalence of secondary trauma in the field of forensic science.

The most common responses were difficulty falling or staying asleep (29.8% reported often, very often, or always); a constant feeling of alertness (22.1%); and feelings of detachment or emotional numbness (16.5%). Fewer respondents reported often to always experiencing feelings of mistrust or betrayal (15.5%), difficulty concentrating (15.3%), irritability or outbursts of anger (15.1%), being easily startled (11.8%), physical aches and pains with no apparent cause (10.5%), or nightmares (5.3%).

Table 10: Since beginning your work in forensics, how often have you experienced the following?

Item	Never N (Valid %)	Rarely N (Valid %)	Sometimes N (Valid %)	Often N (Valid %)	Very Often N (Valid %)	Always N (Valid %)
Difficulty falling or staying asleep	118 (15.2)	175 (22.5)	258 (33.2)	159 (20.4)	32 (4.1)	36 (4.6)
Irritability or outbursts of anger	157 (20.2)	241 (31.0)	262 (33.7)	83 (10.7)	23 (3.0)	11 (1.4)
Difficulty concentrating	129 (16.6)	221 (28.4)	308 (39.6)	86 (11.1)	14 (1.8)	19 (2.4)
A constant feeling of alertness	175 (22.6)	236 (30.5)	192 (24.8)	125 (16.1)	15 (1.9)	32 (4.1)
Being easily startled	285 (36.7)	253 (32.6)	147 (18.9)	59 (7.6)	12 (1.5)	21 (2.7)
Nightmares	353 (45.4)	271 (34.9)	111 (14.3)	29 (3.7)	5 (0.6)	8 (1.0)
Feelings of detachment/ emotional numbness	245 (31.5)	206 (26.5)	198 (25.5)	87 (11.2)	17 (2.2)	24 (3.1)
Feelings of mistrust/betrayal	267 (34.4)	208 (26.8)	180 (23.2)	81 (10.4)	15 (1.9)	25 (3.2)
Physical aches and pains with no apparent cause	346 (44.6)	204 (26.3)	144 (18.6)	57 (7.3)	11 (1.4)	14 (1.8)

The correlation matrix presented in Table 11 demonstrates that there is a significant and positive relationship between work stress and each symptom of secondary trauma, and a

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Table 11: Bivariate correlations among job satisfaction, work stress, and negative outcomes.*

	Item	1	2	3	4	5	6	7	8	9	10	11
1	Job Satisfaction	1	-.562	-.314	-.384	-.317	-.082	-.159	-.210	-.274	-.391	-.233
2	Work Stress	-.562	1	.510	.528	.477	.342	.343	.399	.485	.521	.427
3	Difficulty Falling or Staying Asleep	-.314	.510	1	.509	.474	.378	.359	.434	.445	.447	.400
4	Irritability or Outbursts of Anger	-.384	.528	.509	1	.571	.341	.358	.352	.477	.529	.415
5	Difficulty Concentrating	-.317	.477	.474	.571	1	.337	.432	.322	.463	.487	.458
6	A Constant Feeling of "Alertness"	-.082	.342	.378	.341	.337	1	.502	.369	.397	.373	.287
7	Being Easily Startled	-.159	.342	.359	.358	.432	.502	1	.515	.390	.431	.358
8	Nightmares	-.210	.399	.434	.352	.322	.369	.515	1	.466	.377	.381
9	Detachment or Emotional Numbness	-.274	.485	.445	.477	.463	.397	.390	.466	1	.604	.442
10	Feelings of Mistrust or Betrayal	-.391	.521	.447	.529	.487	.373	.431	.377	.604	1	.413
11	Physical Aches and Pains	-.233	.427	.400	.415	.458	.287	.358	.381	.442	.413	1

*All correlations but one were significant at p=.001. The exception was the correlations between job satisfaction and a constant feeling of "alertness," which was significant at p=.023.

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significant, negative relationship to job satisfaction. Those who experience higher levels of stress are more likely to report these various outcomes, while those with higher satisfaction are less likely to experience these events. In addition, there is a significant, positive correlation ($p<.05$) between each symptom of trauma, such that a respondent who experiences nightmares is also likely to report irritability, alertness, and all other symptoms.

Table 12 contains summary responses concerning the frequency in which respondents engaged in a variety of behaviors as a way of coping with work stress when not at work. An extensive body of research suggests that individuals tend to cope with their work stresses differently within and across occupational categories (Bowman & Stern, 1995; Israel et al., 1989; Jackson & Maslach, 1982; Sterud et al., 2007). For instance, law enforcement agents employ a variety of coping mechanisms to manage their stress ranging from drinking and smoking to attending religious services and (Haarr & Morash, 1999; Lau et al., 2006; Pienaar et al., 2007; Vollrath & Torgersen, 2000; Wearing & Hart, 1996). Thus, a 16-item coping scale was used to assess the ways that scientists deal with their stresses when off the job or at home (see Table 12; Jackson & Maslach, 1982). Four items were included considering distraction and suppression strategies, five items were related to drug and alcohol use, and three items considered how likely the respondent was to communicate their feelings or experiences with others. Single items related to prayer or meditation, problem solving through professional help, social withdrawal, and changes in eating habits were also included. Together, these measures have been shown to provide a robust assessment of the dimensions of coping (Burke et al., 1979; Haarr & Morash, 1999; Lau et al. 2006; Pienaar et al., 2007; Vollrath & Torgersen, 2000; Wearing & Hart, 1996). The most frequently reported coping mechanisms can be classified as either positive or neutral, in that they do no specific harm to the individual's physical or emotional well-being. The most

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common forms of coping in which respondents reported at least sometimes engaging were: trying to forget about it (84.9%), finding an activity to take their mind off things (81.3%), talking things over with a spouse or significant other (79.4%), working harder around the house or on the job (68.8%), and talking things over with friends (60.6%). Less than five percent indicated they would take a tranquilizer or some other form of medicine (4.5%) or smoke more often (4.9%), though 44.4 percent said they would at least sometimes have a drink to help them cope. This is in keeping with research that police officers utilize effective emotional coping strategies (see Haarr & Morash, 1999; Kohan & Mazmanian, 2003; Pienaar et al., 2007). Less than 10 percent of respondents reported sometimes or more frequently seeking professional help from counselors or therapists. This rate is in keeping with existing research on the use of counseling services and professional assistance among law enforcement (Haarr & Morash, 1999; Kohan & Mazmanian, 2003; Pienaar et al., 2007).

Bivariate correlations indicate that individuals with higher levels of work stress are more likely than others to engage in various coping mechanisms ($p<.05$). Additionally, respondents tend to cope in either a generally positive or negative manner to their occupational stressors. That is, scientists who report engaging in one negative coping strategy were more likely to report engaging in other negative ways of coping and less likely to report using more positive coping mechanisms. Similarly, respondents who use one type of positive coping strategy were more likely to use other positive coping mechanisms and less like to engage in negative coping strategies overall.

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Table 12: Coping Mechanisms

How frequently do you engage in the following behaviors as a way of coping with work stress when you are not at work?	Never N (Valid %)	Rarely N (Valid %)	Sometimes N (Valid %)	Often N (Valid %)	Very Often N (Valid %)	Always N (Valid %)
I work harder than usual around the house or on the job.	59 (7.6)	183 (23.6)	295 (38.1)	110 (14.2)	101 (13.0)	26 (3.4)
I just try to forget about it.	31 (4.0)	86 (11.1)	223 (28.8)	223 (28.8)	163 (21.0)	49 (6.3)
I have a drink, such as beer, wine, or a cocktail.	232 (29.8)	201 (25.8)	204 (26.2)	82 (10.5)	48 (6.2)	11 (1.4)
I take a tranquilizer or some other form of medicine.	701 (90.2)	41 (5.3)	24 (3.1)	3 (0.4)	3 (0.4)	5 (0.6)
I smoke more often.	716 (92.4)	21 (2.7)	18 (2.3)	10 (1.3)	9 (1.2)	1 (0.1)
I talk things over with my spouse/significant other.	108 (14.0)	87 (11.3)	215 (27.9)	157 (20.4)	136 (17.6)	68 (8.8)
I talk things over with my friends.	107 (13.8)	199 (25.6)	245 (31.6)	122 (15.7)	79 (10.2)	24 (3.1)
I participate in some organized groups or clubs in order to get social support.	392 (50.5)	143 (18.4)	122 (15.7)	62 (8.0)	46 (5.9)	11 (1.4)
I try to get away from everyone.	147 (18.9)	185 (23.8)	288 (37.1)	71 (9.1)	67 (8.6)	18 (2.3)
I engage in some spiritual activity, such as going to church or meditating.	288 (37.2)	146 (18.8)	133 (17.2)	82 (10.6)	73 (9.4)	53 (6.8)
I find some activity to take my mind off things like going to a movie.	54 (6.9)	92 (11.8)	279 (35.8)	206 (26.4)	126 (16.2)	22 (2.8)
I seek professional help such as a counselor or therapist.	598 (77.1)	101 (13.0)	46 (5.9)	16 (2.1)	7 (0.9)	8 (1.0)
I eat more or less than usual.	195 (25.1)	184 (23.7)	244 (31.4)	78 (10.0)	59 (7.6)	17 (2.2)

Respondents were also asked a series of questions assessing the environment and ergonomic conditions of their workplace (Tables 13 and 14). Multiple measures were created through focus group research to assess the influence of environmental conditions on the productivity of forensic scientists. Examinations of various occupations indicate that unpleasant environmental conditions, including constant loud noises, unpleasant smells, chemical exposure, poor ergonomic conditions, and excessive overtime, increase job stress and diminish overall worker productivity (National Institute for Occupational Safety and Health, 1999). Thus, ten

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items were adapted from ergonomic research (Astrand & Rodahl, 1986) to understand the environmental conditions present in forensic science laboratories including "my overall workplace has many noise distractions produced by equipment," and "I am able to control temperature or airflow in my lab space." Additional questions were asked concerning temperature, fresh air, light, equipment, and storage capacity.

Most respondents were satisfied with the cleanliness of their workplaces (76.9%), and felt their lab space contained sufficient lighting and tools to prevent eye strain (77.4%). In addition, many considered their space comfortable enough to work in without getting tired (78.0%), and were satisfied with the privacy in their workspace (59.6%). As for distractions, 44 percent of scientists noted that they had to work with noise distractions produced by equipment, while 63.9 percent felt the same about noise distractions created by people.

More than 86 percent of individuals indicated that they could easily complete their daily tasks due to their overall working environment, and 79.3 percent reported that their lab space had all the necessary equipment to meet typical needs. Most (69.3%) respondents were satisfied or extremely satisfied with the amount of storage and display space in the lab, though only 35.5 percent indicated that their lab space was fairly or completely flexible to adjust, rearrange, or reorganize.

Temperature seemed to be a problem for most respondents. More than 80 percent of scientists indicated that they were unable to control the temperature or airflow in their lab space, and 56.7 percent said the overall temperature in their lab space through the year is somewhat or very uncomfortable. Although only 32.6 percent of scientists said that room temperature in their lab space has a bad effect on their level of productivity, 80 percent reported that unfavorable environmental conditions (noise, temperature, etc.) decreases their productivity.

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Ten of the environmental items were combined into one environmental scale (α=.794) ranging from one to five. Higher scores on this index represent better working environments, and the average score on the measure was 3.55. This mean score indicates that, in general, sample members had relatively positive environments in which to perform their work.

Table 13: Environmental Items

Item	Strongly Disagree N (Valid %)	Disagree N (Valid %)	Slightly Disagree N (Valid %)	Slightly Agree N (Valid %)	Agree N (Valid %)	Strongly Agree N (Valid %)
My lab space is comfortable enough so that I can work without getting tired	32 (4.1)	105 (13.4)	35 (4.5)	48 (6.1)	444 (56.9)	117 (15.0)
I am satisfied with the privacy I am provided by my overall personal workspace	115 (14.7)	161 (20.5)	41 (5.2)	49 (6.3)	312 (39.8)	106 (13.5)
I am satisfied with the cleanliness of my overall workplace	39 (5.0)	107 (13.6)	36 (4.6)	57 (7.3)	422 (53.8)	124 (15.8)
My overall workplace has many noise distractions produced by equipment	71 (9.1)	322 (41.2)	45 (5.8)	90 (11.5)	193 (24.7)	61 (7.8)
My overall workspace has many noise distractions produced by people	41 (5.2)	204 (26.0)	38 (4.8)	91 (11.6)	269 (34.3)	141 (18.0)
I am able to control temperature or airflow in my lab space	368 (46.9)	233 (29.7)	30 (3.8)	27 (3.4)	104 (13.3)	22 (2.8)
My lab space is provided with efficient lighting and tools so that I can work easily without strain on my eyes	36 (4.6)	108 (13.8)	33 (4.2)	51 (6.5)	418 (53.5)	136 (17.4)

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Table 14: Additional Environmental Items

Item		N	Valid Percent
My lab space is flexible to adjust, rearrange, or reorganize to suit my needs.			
	Not at all	150	19.3
	To some extent	306	39.3
	Almost	46	5.9
	Fairly enough	212	27.2
	Completely flexible	65	8.3
To what extent does the room temperature in your lab space affect your normal level of productivity?			
	Bad effect	253	32.6
	No effect	122	15.7
	Normal effect	347	44.7
	Quite good effect	31	4.0
	Positive effect	23	3.0
The overall temperature of my lab space through the year is:			
	Very uncomfortable	82	10.5
	Somewhat uncomfortable	360	46.2
	Somewhat comfortable	268	34.4
	Very Comfortable	70	9.0
The number of windows in my building (inclusive of labs and offices) complete my fresh air and light needs.			
	Not at all	232	34.7
	Did not notice	25	3.7
	To some extent	188	28.1
	Mostly	167	25.0
	Always	56	8.4
My lab space has all the necessary equipment to suit my typical needs (computers, solutions, pipettes, etc.).			
	Not at all	11	1.6
	To some extent	80	12.0
	Often	47	7.0
	Mostly	332	49.6
	Always	199	29.7
I am satisfied with the amount of space in the lab for storage and display of important materials.			
	Extremely dissatisfied	62	9.2
	Dissatisfied	145	21.5
	Satisfied	360	53.5
	Extremely satisfied	106	15.8

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Table 14 (Continued): Additional Environmental Items

Item		N	Valid Percent
Favorable environmental conditions (less noise, suitable temperature, etc.) in the lab space will increase my productivity at work.			
	No effect	256	33.2
	Increase by 20%	289	37.5
	Increase by 30%	140	18.2
	Increase by 40%	35	4.5
	Increase by 50% or more	51	6.6
Unfavorable environmental conditions (less noise, suitable temperature, etc.) in the lab space will decrease my productivity at work.			
	Decrease by 50% or more	66	8.6
	Decrease by 40%	53	6.9
	Decrease by 30%	160	20.8
	Decrease by 20%	336	43.7
	No effect	154	20.0
Can you complete your daily tasks easily due to the overall (office and lab) environment?			
	Not at all	9	1.2
	To some extent	95	12.2
	Often	112	14.4
	Mostly	416	53.5
	Always	146	18.8

In order to more completely understand scientists' feelings about their jobs, two open-ended questions were asked addressing what they thought were the most challenging and satisfying parts of their jobs. These items were open ended to allow respondents to give their thoughts, opinions, and insights in their own words. A content analysis strategy (e.g. Loftland & Loftland, 1995; Silverman, 2004) was employed to identify patterns and trends across the responses, and present them in a concise fashion. The most common challenge identified by respondents involved problems with upper management. There was a general consensus among scientists concerning a lack of trust between upper management and their subordinates and unrealistic expectations concerning the time required to completely process evidence. Some

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scientists suggested that laboratory managers were less concerned with quality work, and focused on policies and procedures that may slow down the processing of evidence.

Respondents cited problems communicating with upper management, and that the militarized chain of command made it difficult to reasonably address staffing concerns, such as the need for more scientists. Some also suggested that upper management did not understand the processes of scientific investigation, making them "out of touch" and more likely to make decisions resulting in poor outcomes for the scientists. For instance, a number of scientists felt that while they were encouraged to attend training courses, their requests to fund their training were consistently denied. There was also some concern over the lack of recognition for good work or professional accomplishment. Many respondents referenced the "broken" promotional system that was unfair to employees, and the presence of nasty office politics that may produce unequal treatment of employees.

A number of scientists indicated concerns over the imbalanced workload in their laboratories. Respondents mentioned that despite the backlog of cases in their lab, they were subjected to additional duties because of a lack of manpower stemming from budget cuts and/or high turnover rates. These conditions make it difficult to efficiently manage their caseloads, which can create conflict with attorneys, court personnel, and police who often already have unrealistic expectations and requests. In addition, some scientists indicated that less productive staff were given reduced caseloads causing an imbalance in case assignments and overloads to certain scientists.

Despite these challenges, respondents reported feeling a great deal of satisfaction in the course of their jobs. In particular, they noted being able to help others including victims, their families, police, prosecutors, and the community. In some instances, scientists even reported

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being able to exonerate individuals who had been falsely accused. Several respondents noted that they enjoyed the changes in their job requiring them to constantly learn new techniques and information. Others indicated that they enjoyed discovering the truth through real evidence. Many respondents said it was extremely satisfying to work with a great staff and that their coworkers appreciate the process of discovering information through difficult analyses. Finally, respondents said they loved using science every day, and that they were able to reveal the truth through unbiased analysis techniques.

B. Sources of Work Stress and Job Satisfaction

In order to better assess the influence of workplace conditions on the occupational experiences of scientists, a series of regression models were created for occupational stress and job satisfaction using the previously described items (Tables 15 and 16). The dependent and independent variables and measures used in these analyses are described below.

1. Dependent Variables

Indicators were derived from existing research on occupational stress and satisfaction from various criminal justice system employees and traditional occupations (Cullen et al., 1985; Jackson & Maslach, 1982; Quinn & Shepard, 1974; Rizzo et al., 1970). These items allow us to directly compare the experiences of forensic scientists to that of the larger body of criminal justice system employees in general to assess any similarities between the distinctive role of forensic scientists and other criminal justice system actors they interact with.

Specifically, occupational stress was measured using a five-item additive index created using statements adapted from scales that have been successfully applied in previous research exploring occupational stress among criminal justice and employees in more general occupations (e.g., Blevins et al., 2007; Cullen et al., 1985; Jex et al., 1992; Peters & O'Connors, 1980).

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Respondents were presented with five statements and asked to indicate their agreement with each, using a six-item Likert scale ranging from strongly agree to strongly disagree. The statements include: 1) "I usually feel that I am under a lot of pressure when I am at work"; 2) "When I am at work, I often feel tense or uptight"; 3) "I am usually calm and at ease when I am working"; 4) "Working with difficult images/scenes/materials all day is a real strain for me"; and 5) "I feel frustrated by my job."[1] Each of the items in this scale gauge general feelings of work stress, providing a broad perspective on the amount experienced by scientists.

The measure for job satisfaction comprised an additive scale of five measures with specially designed Likert scale responses, which were drawn from the *Quality of Employment Survey* (Quinn & Shepard, 1974) that has been successfully used in a wide range of criminal justice research (Blevins et al., 2007; Cullen et al., 1985; Van Voorhis et al., 1991). These measures include: "All in all, how satisfied are you with your job?"; "Knowing what you know now, if you had to decide all over again whether to take the job you now have, what would you decide?"; "In general, how well would you say your job measures up to the sort of job you wanted when you took it"; "If a good friend of yours told you he (or she) was interested in working in a job like yours for your employer, what would you tell them,"; and "If you were free to go into any type of job you wanted, what would your choice be?" This scale is intended to measure general feelings of job satisfaction rather than specific measures of satisfaction concerning items such as particular job duties, relationships with coworkers, and salary.

[1] The measure of occupational stress used here replicates the measures used in most research on criminal justice system employees. Organizational psychology prefers to use only the three measures specifically related to stress rather than including items which may otherwise be conflated with measures of individual burnout. To ensure the validity of the measure used, a factor analysis was conducted using oblique rotation which found that all five items loaded onto a single construct. (results not shown). To further consider the impact of the inclusion of these two items pertaining to burnout, a three item scale was created and used in an OLS regression model replicating those presented in Table 15. The findings (not shown here) are similar to those using a five item measure, with no differences in significant correlations between variables. As a result, we feel the measure used in this analysis for stress is appropriate for use.

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2. Independent Variables

A set of six variables were included to assess the relationship between individual-level factors and occupational responses. The age of respondent is included as a continuous variable, while sex is a binary measure (0 = male; 1 = female). A binary measure was also used for race (0= nonwhite; 1= white) and marital status (0 = no; 1 = yes) due to skewed responses to the broader response categories presented above. Education was measured through an eight-item response (1 = High School diploma; 2 = Some college experience?; 3= Two year degree; 4 = Four year degree; 5 = Some graduate classes; 6 = Masters degree; 7 = Ph. D.; 8 = Other). Finally, the respondent's years spent in forensic science was measured through a seven-item categorical variable based on years in the field (1 = less than 1; 2 = 1-5 years; 3 = 6-10 years; 4 = 11-15 years; 5= 16-20 years; 6 = 21-25 years; 7 = 26 or more years).

An additional set of six variables was created to assess the relationship between working experiences, stress, and satisfaction. First, the average number of working hours each week was measured using a continuous variable for time spent at work. Second, an additive scale was created for the respondent's relationship with prosecutors based on responses to 11 questions: 1) Prosecutors doubt my competence; 2) Prosecutors do not understand why it takes time to complete the analyses they request; 3) Prosecutors try to persuade me to testify to more than just the scientific facts; 4) I am not often thanked by prosecutors or police for the work that I do; 5) I find it easy to deal with court schedules across the jurisdiction(s); 6) Judges respect me professionally; 7) Judges and juries are frequently confused when there is insufficient forensic evidence to support claims made by prosecutors or police; 8) Prosecutors do not inform me about the outcomes of the cases on which I work 9) Most court decisions are too lenient 10) Prosecutors do not understand that I sometimes work very hard on a case even though I end up

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finding no evidence; and 11) I am regularly pressured by police or prosecutors to rush to produce scientific results. Possible scores on the composite measure ranged from one to six, with higher scores representing more positive relationships. These items produced a generally reliable scale (α=.738) with an average score of 3.67, indicating that, overall, these respondents shared more positive than negative relationships with the prosecutors and courts with which they work.

Supervisory support was measured through work-related variables assessing the willingness of management to support or encourage employees in the course of their jobs, as well as resolve disputes between co-workers (α=.829; Cullen et al., 1989). They were asked to rate their agreement with the following statements:1) "My immediate supervisor supports me"; 2) "My immediate supervisor gives me clear instructions"; 3) My immediate supervisory has clear expectations of me"; 4) "The people I work with often have the importance of their jobs stressed to them by their supervisors"; 5) "My supervisor often encourages the people I work with if they do their job well."; and 6) "When my supervisors have a dispute with one of my fellow coworkers they usually try to handle it in a friendly way."[2] High levels of supervisory support are thought to reduce work stress and increase job satisfaction for criminal justice employees (Cullen et al., 1985; Grossi et al., 1996; Liou, 1995; Van Voorhis et al., 1991).

Top managerial support was measured through a three item scale measuring scientists' relationships with top managers in their laboratory. Respondents were asked to rate their agreement with the following items: 1) "The top managers in my agency are responsive to my thoughts and suggestions.";2) "The top managers in my agency are mainly concerned with

[2] A factor analysis was conducted to assess whether these items all load onto a single measure. The results suggest a two factors solution, though the second factor consisted of only one measure: The people I work with often have the importance of their job stressed to them by their supervisors. The findings in the regression models were consistent whether or not this item was used in the supervisory support scale. Ultimately, the item was left in the composite measure because of 1) the stable results and 2) the frequent use of this item in supervisory support scales in the larger literature.

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getting cases out the door.", and 3) "The top managers in my agency are more concerned with looking good to the public than doing a good job." For each measure, items were coded so that higher scores indicate more support, with possible scores ranging from one to six (α=.842).

To assess role conflict in laboratories, a measure for role conflict was created using five measures taken from Rizzo et al., (1970) and Churchill et al., (1985) (α=.744);. These measures identify issues related to a lack of staff or uniform steps to complete a task, an absence of clearly defined work responsibilities, and incompatible work requests. This includes: 1) "I have to do things at work in ways that should otherwise be done differently."; 2) "I do things that are likely to be accepted by one person but not accepted by others."; 3) "At work I receive assignments without the manpower to complete them."; 4) "In my job, I receive incompatible requests from two or more people."; and 5) "I have adequate resources and materials to complete them." Such issues are likely common in the forensic sciences, and may affect the occupational reactions of scientists in laboratories (National Academy of Sciences, 2009; Stevenson, 2007).

An additional item for positive feelings was included in the job satisfaction analysis due to the inconsistent relationships noted between job satisfaction and potential feelings of burnout (Griffin, Hogan, Lambert, Tucker-Gail, & Baker, 2010; Koeske & Koeske, 1993; Myhren, Eheberg, & Stokland, 2013; Sarmiento, Laschinger, & Iwasiw, 2004; Um & Harrison, 1998). Three measures were included to assess the presence of positive feelings scientists hold about their jobs (α=.704). These include: "I feel I am positively influencing other people's lives through my work."; "I feel exhilarated after working on a case."; and "I have accomplished many worthwhile things in this job." Responses ranged from one to six, with higher scores reflecting greater agreement with the statement. All scales had possible values of one to six, with higher scores representing greater conflicts or positive feelings overall. Although respondents

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experienced moderate amounts of role conflict ($\bar{x}$=3.08), they did have positive feelings about their work ($\bar{x}$=4.392).

This item was excluded from the occupational stress models due to potential model misspecification regarding the fact that lower scores on this item could be viewed as an indicator of burnout. While some studies use burnout as a predictor of work stress and some studies use the terms burnout and stress interchangeably, there is compelling evidence that stress is a predictor of burnout (see Garlond, 2004; Maslach, 1982; Nahrgang et al., 2011). In order to avoid issues of temporal ordering and misspecification, this item was excluded from the analyses presented here. It should be noted, however, that including this measure in the model for occupational stress did not change the results. The index itself was not significant, it did not change the direction or significance of the relationships of any of the other predictors, and the explained variation was influenced by about half a percent in both models.

Ten of the environmental items were combined into one environmental scale (α=.794) ranging from one to five. These items include: 1) "My lab space is comfortable enough so that I can work without getting tired"; 2) “I am satisfied with the privacy I am provided by my overall personal workspace”; 3) “I am satisfied with the cleanliness of my overall workplace”; 4) “My overall workplace has many noise distractions produced by equipment”; 5) “My overall workspace has many noise distractions produced by people”; 6) “I am able to control temperature or airflow in my lab space”; 7) “My lab space is provided with efficient lighting and tools so that I can work easily without strain on my eyes”; 8) “My lab space is flexible to adjust, rearrange or reorganize to suit my needs”; 9) “The number of windows in my building (inclusive of labs and offices) complete my fresh air and light needs”; and 10) “Can you complete your daily tasks easily due to the overall (office and lab) environment.” Higher scores on this index

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represent better working environments, and the average score on the measure was 3.55. This mean score indicates that, in general, sample members had relatively positive environments in which to perform their work.

3. Analyses

The two dependent variables were regressed on the same independent variables. Diagnostic analyses revealed no multicollinearity problems with the variables. With one exception, all bivariate correlations were below .70. The exception was the strong correlation between age and years of experience in the forensic sciences (r=.819). This significant positive relationship is common, as many individuals remain in the same career as they age. Still, the variance inflation factors (VIF) for each model for both variables ranged from 1.044 to .3468. With the exception of age and years of experience all reported VIF values were below five, indicating that multicollinearity is not a concern for the variables used in the regression models.

Three models for work stress are presented in Table 15, with each regressing a series of specific independent variables. The first model contains only individual characteristics, while the second contains work-related variables, and the final model includes both sets of variables to understand their overall significance in accounting for stress. The first model is significant, but explains less than three percent of the variation in work stress. Only two variables are significant in this model: being female and having more years of experience were significantly related to higher levels of work stress.

The second model comprising work-related variables was significant, and explained 46 percent of the variation in work stress. The substantial predictive power of this model suggests that the average number of hours worked per week and role conflict shared significant positive relationships with work stress. Those scientists with poor relationships with prosecutors and

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courts, minimal supervisory and top management support, and insufficient working conditions had higher levels of work stress.

Table 15: Work stress regressed on individual and work-related characteristics.

Variable	Work Stress					
	Model 1: Individual Characteristics		Model 2: Work-Related Variables		Model 3: Both Individual and Work-Related Variables	
	Beta	T	Beta	T	Beta	T
Individual Characteristics						
Age	-.108	-1.552	--	--	-.017	-.291
Gender (Female)	.124	3.081**	--	--	.138	3.93 2**
Race (White)	.064	1.711	--	--	-.018	-.557
Married	-.038	-.978	--	--	.019	.562
Education	.012	.324	--	--	-.049	-1.496
Years in Forensic Science	.221	3.305**	--	--	.105	1.807
Work-Related Variables						
Average Hours Worked per Week	--	--	.097	2.971**	.114	3.472**
Relationship with Prosecutors/Courts	--	--	-.178	-4.895**	-.169	-4.601**
Supervisory Support	--	--	-.161	-4.177**	-.167	-4.354**
Top Management Support	--	--	-.113	-2.708**	-.123	-2.936**
Role Conflict	--	--	.366	8.773**	.367	8.508**
Work Environment	--	--	-.077	-2.103*	-.064	-1.737
F	4.519		73.598		40.055	
Significance	.000		.000		.000	
R^2	.037		.467		.498	
Adjusted R^2	.029		.460		.485	

*p<.05, **p<.01

Many of the relationships identified are consistent in the combined model, which accounts for 48.5 percent of the variance in work stress. Sex is the only significant individual characteristic, with females experiencing more work stress than males in line with previous research on occupational responses in the criminal justice system (Belknap & Shelly, 1992; Burke & Mikkelsen, 2005; Krimmell & Gormley, 2003; Lim & Teo, 1998; Morash et al., 2006; Zhao et al., 1999). In addition, scientists who worked more hours per week, had poor relationships with prosecutors and courts, had less supervisory and top management support, and experienced high levels of role conflict, reported greater levels of work stress. These relationships are in line with previous research on stress among law enforcement officers and

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criminal justice system employees generally (Blevins et al., 2007; Coman & Evans, 1991; Cullen et al., 1985; Fairbrother & Warn, 2003; He et al, 1970; Hepburn & Albonetti, 1980; Holt & Blevins, 2011; Holt, Blevins, & Burruss, 2012; Lambert et al., 2004; Pogrebin, 1978; Symonds, 1970).

Table 16 contains three regression models with job satisfaction as the dependent variable: Model 1 includes individual characteristics only, Model 2 includes work-related variables, and Model 3 combines these models together. The model including only individual characteristics is not significant and explains just 0.1 percent of the variation in job satisfaction. The second model including work-related variables accounted for 38 percent of the variation in job satisfaction and is significant. In addition, all variables were significant except the scientists' relationships to the courts and their working environment.

The final combined model has slightly better explanatory power, and shares some similarities to the regressions for work stress overall. Respondents who work fewer hours per week, have high levels of support from supervisors, have good support from top managers, low levels of role conflict, and those who feel good about the work they perform report higher levels of satisfaction[3] (Blevins et al., 2007; Coman & Evans, 1991; Cullen et al., 1985; Fairbrother & Warn, 2003; He et al, 1970; Hepburn & Albonetti, 1980; Holt & Blevins, 2011; Holt et al., 2012; Lambert et al., 2004; Pogrebin, 1978; Symonds, 1970).

[3] The index "Feel Good about Work" emerged as an important predictor of job satisfaction in these models, and it is logical that individuals with higher levels of burnout would have lower levels of job satisfaction. Excluding the index did not affect the other results of other predictors in the final model, but reduced the explained variation in job satisfaction by more than 6.5 percent in Model 2 and 6.8 percent in Model 3.

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Table 16: Job satisfaction regressed on individual and work-related characteristics.

Variable	Job Satisfaction					
	Model 1: Individual Characteristics		Model 2: Work-Related Variables		Model 3: Both Individual and Work-Related Variables	
	Beta	T	Beta	T	Beta	T
Individual Characteristics						
Age	.018	.263	--	--	-.025	-.391
Gender (Female)	.045	1.136	--	--	.045	1.168
Race (White)	-.015	-.408	--	--	.020	.557
Married	.045	1.159	--	--	.012	.314
Education	.018	.479	--	--	.034	.940
Years in Forensic Science	-.091	-1.339	--	--	-.023	-.367
Work-Related Variables						
Average Hours Worked per Week	--	--	-.096	-2.722**	-.092	-2.566*
Relationship with Prosecutors/Courts	--	--	-.012	-.311	.012	.304
Supervisory Support	--	--	.155	3.753**	.172	4.098**
Top Management Support	--	--	.118	2.648**	.120	2.602**
Role Conflict	--	--	-.273	-6.092**	-.250	-5.287**
Feel Good about Work	--	--	.274	7.340**	.278	7.292**
Work Environment	--	--	.043	1.086	.030	.737
F	1.176		45.991		25.052	
Significance	.317		.000		.000	
R^2	.010		.389		.402	
Adjusted R^2	.001		.380		.386	

*p<.05, **p<.01

IV. CONCLUSIONS

A. Discussion of Findings

As forensic scientific investigations play an increasingly prominent role in policing and court processes, the demands on laboratory scientists have grown substantially (Becker & Dale, 2003; Durose, 2008; National Academy of Sciences, 2009; Peterson & Hickman, 2005; Peterson et al, 2010). The decreasing funds in local and state budgets limit the ability of state run laboratories to maintain a sufficient number of scientists who can meet the requests and need of prosecutors and police (Durose, 2008; National Academy of Sciences, 2009; Peterson et al., 2010). As a consequence, these conditions may directly affect the occupational experiences of scientists by increasing stress and decreasing general levels of job satisfaction (Anshel, 2000; Becker & Dale, 2003; Donald et al., 2005; Newman & Rucker-Reed, 2004). There has been

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little research into this issue, thus this study measured the prevalence of stress, satisfaction, and prospective stressors through a survey of 899 forensics scientists across the U.S.

The scientists in this sample reported a moderate level of work stress, and slightly higher levels of satisfaction than those reported by other criminal justice employees (Abolollahi, 2002; Anshel et al., 1997; Blevins et al., 2007; Burke & Milkkelson, 2005; Cullen et al., 1985; Holt & Blevins, 2011; Holt et al., 2012; Kirkcaldy et al., 1998; Patterson, 2003), as well as those working in the helping professions (Nathan, Brown, Redhead, Holt, & Hill, 2007; Sterud et al, 2007;Webb, Sweet, & Pretty, 2002). The most frequently cited self-reported stressors at work included large workloads, extended case backlogs, and difficulties with upper management (see Becker & Dale, 2003; National Academy of Sciences, 2009). Many of the scientists in this sample indicated that they accomplished worthwhile goals and contributed to public safety through their work. They derived a great deal of job satisfaction through helping victims, the community, and the falsely accused by discovering the truth through scientific investigation. In addition, a substantial proportion of respondents felt that they had good working relationships with the court system and had good managerial support within their workplace.

Statistical analysis of the factors associated with greater levels of stress and satisfaction demonstrated that work-related variables have the greatest impact on occupational experiences. Scientists working a greater number of hours (including overtime) each week reported greater levels of stress, as did those who felt less support from their supervisors, management, and court actors. The presence of role conflict increased the likelihood of work stress due to the lack of clear standards for analysis and reporting (see also Coman & Evans, 1991; He et al., 2002; Hepburn & Albonetti, 1980; Symonds, 1970). The opposite relationship was observed regarding job satisfaction, as the absence of stressors generally increase positive associations with one's

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job. All of these relationships are in keeping with previous research on criminal justice system employees and other occupations in general (Becker & Dale, 2003; Blevins et al., 2007; Coman & Evans, 1991; Cullen et al., 1985; Fairbrother & Warn, 2003; He et al, 1970; Hepburn & Albonetti, 1980; Holt & Blevins, 2011; Holt et al., 2012; Lambert et al., 2004; National Institute for Occupational and Safety Health, 1999; Pogrebin, 1978; Symonds, 1970). The only individual characteristic associated with job stress was that females reported higher levels of stress. This finding is consistent with previous research on police officers (Belknap & Shelly, 1992; Burke & Mikkelsen, 2005; Krimmell & Gormley, 2003; Morash et al., 2006, Zhao et al., 1999), but it is not clear why females in this sample reported more stress than males. The relationship identified may stem from the larger proportion of females working in forensic sciences relative to those working in traditional policing roles. As a result, there is a need for additional research exploring the relationship between sex and occupational experiences in the field as a whole.

The scientists who reported high levels of work stress and low job satisfaction were more likely to report negative behavioral and psychological consequences outside of the workplace, in accordance with previous research (Castle & Martin, 2006; Lambert, 2004; Tewksbury & Higgins, 2006). Respondents did not report frequent negative experiences, but those under stress were more likely to experience trouble sleeping, irritability or outbursts of anger, difficulty concentrating, a constant feeling of alertness, and being easily startled. A small proportion also reported physical aches and pains with no apparent cause, or feelings of detachment, mistrust, or betrayal. Thus, this suggests secondary trauma symptoms can manifest in forensic scientists through their exposure to the physical evidence produced by criminal events (Anshel, 2000; Lau et al., 2006).

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The scientists in this sample also reported utilizing a range of coping strategies to deal with work stresses, the majority of which are considered positive for their mental health (Jackson & Maslach, 1982). In particular, respondents reported trying to forget about it, finding an activity to take their mind off things, and talking things over with a spouse or significant other. More than half of respondents indicated they would work harder around the house or on the job or talk things over with friends. Such positive or neutral coping mechanisms are not uncommon ways to deal with stress, including among digital forensic examiners (Holt & Blevins, 2011; Krause, 2009; Perez et al., 2010), law enforcement officers (Haarr & Morash, 1999; Lau et al., 2006; Pienaar et al., 2007; Vollrath & Torgersen, 2000; Wearing & Hart, 1996), and other helping professions such as ambulance drivers (Sterud et al., 2007).

Though forensic scientists reported using generally positive coping mechanisms, just under 10 percent reported consistently utilizing professional counselors or therapists. This level of use is consistent among police officers in the field who may not be required to utilize counseling services unless they are involved in a shooting or serious incident (Haarr & Morash, 1999; Lau et al., 2006; Vollrath & Torgersen, 2000). The scientists in this sample reported infrequent use of negative coping mechanisms such as taking a tranquilizer or some other form of medication or smoking. Almost 45 percent, however, said they would at least sometimes have a drink to help them cope with work experiences which is similar to that of other criminal justice professionals (Haarr & Morash, 1999; Lau et al., 2006; Pienaar et al, 2007; Vollrath & Torgersen, 2000; Wearing & Hart, 1996).

Finally, the majority of respondents in this sample were satisfied with the environmental conditions of their labs, including cleanliness, lighting, comfort, and equipment. They were less satisfied with temperature and distractions, as over half felt that the temperature of their lab was

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uncomfortable and experienced noise distractions created by others in their workspace. Additionally, the vast majority of sample members indicated that unfavorable environmental conditions decrease their productivity, which is congruent with conclusions from the National Institute for Occupational Health and Safety (1999). Thus, further exploration is needed regarding environmental working conditions in order to improve the overall quality of experiences among forensic scientists.

B. Implications for Policy and Practice

As a whole, the analyses presented here suggest that forensic scientists share many common occupational experiences with employees of the larger criminal justice system. The results of the regression analyses for the predictors of stress and satisfaction provide multiple avenues for laboratory managers to develop policies to improve the day-to-day experiences of their employees. The implementation of clear policies that benefit scientists may be able to decrease levels of burnout, absenteeism, poor job performance, turnover, and possibly even physical and mental health problems (Anshel, 2000; Brough & Frame, 2004; Donald et al., 2005; Newman & Rucker-Reed, 2004; Pflanz & Heidel, 2003).

The findings of this study suggest there are several factors that laboratory directors and management should carefully target. First, the number of hours worked per week was significantly related to both work stress and satisfaction. Consistently serving more than 40 hours per week due to overtime has been shown to increase negative work reactions, though it may be necessary to either decrease case backlogs or be mandated by state budgets and small staff sizes (Becker & Dale, 2003; National Institute for Occupational Safety and Health, 1999; Fairbrother & Warn, 2003). Identifying ways to more equitably distribute overtime hours across scientists, or developing flex hours or shifts that are more convenient for scientists working

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extensive overtime could minimize strain form excessive work schedules. In addition, allowing scientists to have greater control over their scheduling during periods of high overtime should enable them to better manage demands from their home and personal lives making them more satisfied and reducing stress.

Second, the relationship between scientists' work reactions and their perceptions of supervisory and top management support indicate the need for well-defined policies and open lines of communication. Establishing clear lines of communication both up and down the chain of command can give scientists direct access to upper management, and foster trust between all parties (Becker & Dale, 2003). The use of open staff meetings where management is present may also help to increase communications between scientists and management, and generally promote support for the scientific staff. In addition, the clear communication of justifications for supporting or denying equipment and training requests would be valuable in demonstrating the reasoning behind managerial decisions and eliminating perceptions of detachment or a lack of concern for scientific productivity.

Third, laboratory management may benefit from carefully revised staffing plans and written policies concerning scientific procedures in order to reduce redundancy and diminish the likelihood of role conflicts. Clear expectations and procedures for employees can lower individual levels of stress and increase job satisfaction by ensuring that individual work roles are understood and achieved on a daily basis. In fact, scientists with negative relationships with prosecutors and courts were significantly more likely to experience job stress. Management may also benefit from workplace policies that are clearly communicated to all partner agencies served by their scientists. Communicating requirements for the time needed to process evidence, appropriate avenues for contact, and demands on scientists' time are necessary to improve the

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occupational experiences of scientists, and help solidify managerial support of scientists in their labs.

Fourth, laboratory directors and management should give careful consideration to the physical environments that their scientists work in on a day-to-day basis. Though working environments were not significant predictors of stress or satisfaction, 80 percent of scientists indicated that unfavorable conditions, such as noise and temperature, reduce their productivity. In fact, many states have a primary laboratory facility with state-of-the-art equipment, with a larger number of satellite laboratories in reclaimed spaces or older buildings that were not designed for scientific analyses (Becker & Dale, 2003; National Academy of Sciences, 2009). In order to obtain the highest levels of productivity, regardless of the facility, managers should encourage scientists to minimize noise distractions, ensure that adequate storage and equipment space is available, and give flexibility to staff to ensure that they are working in optimal conditions for both safety and productivity.

Fifth, laboratory directors and management should promote awareness of signs of emotional stress or secondary trauma among the scientists in their laboratories (Bowman & Stern, 1995; Israel et al., 1989; Jackson & Maslach, 1982; Sterud et al., 2007). A number of respondents indicated that they experienced some physical symptoms of trauma as a result of their work, such as nightmares, irritability, feelings of alertness, or difficulty sleeping. The presence of these symptoms were more likely to be reported with higher levels of job stress, and diminished when individuals reported higher levels of satisfaction. The same is true concerning the use of coping mechanisms to deal with work stress, though very few respondents reported engaging in serious negative strategies.

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Since many of the symptoms of secondary trauma directly reduce the productivity and general well-being of scientists, laboratory directors should encourage scientists to report when they experience these symptoms or any concerns about physical health. Management should also ensure that scientists are aware of the available mental health services, whether counselors or therapists, should they feel the need to speak with a professional to help express their concerns. Less than 10 percent of the scientists in this sample sometimes used professional assistance, in keeping with the rates identified in other studies of criminal justice systems employees (see Burns et al., 2008; Holt & Blevins, 2010; Perez et al., 2010). Ensuring that access to these resources are clearly communicated and encouraged when necessary, may have beneficial impacts on both stress and satisfaction and improve the overall working environment of the laboratory.

C. Implications for Further Research

Though this study provides initial insights into the occupational responses of bench scientists across the various forensic disciplines, there is a need for substantial data collection and research to address the limitations of this work. For instance, no significant differences were noted in the occupational experiences of sworn and non-sworn scientists. Instead, the findings of this study suggest that scientists share a great deal in common with law enforcement officers. This may be due in part to the fact that 12 percent of scientists in this sample were also sworn law enforcement, and that some labs utilize a quasi-military command structure which may equally impact scientists regardless of their status (Becker & Dale, 2003; National Academy of Sciences, 2009). Thus, further research is needed to clarify the ways that differences in the experiences of sworn and unsworn personnel create tensions in laboratory settings or lead to differences in occupational experiences generally.

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The lack of significant differences between the various scientific disciplines regarding stress and satisfaction suggest that scientists experience their occupations in much the same way despite differences in workloads and case backlogs (see also Holt & Blevins, 2010; Perez et al., 2010). This is somewhat surprising given the substantial backlog of rape kits in biology relative to the number of cases regarding evidence from robbery and burglary incidents (Peterson et al., 2010). Further research is needed to assess what, if any, differences can be found in the occupational experiences of scientists on the basis of their discipline-specific tasks. These investigations are vital to understand if there is any need for targeted policies to aid scientists in specific disciplines and increase overall laboratory productivity (Becker & Dale, 2003).

Role conflict also emerged as a substantial predictor of work stress and satisfaction, congruent with previous research on criminal justice system employees (Cullen et al., 1985, 1989; Johnson et al., 2005; Van Voorhis et al., 1991). The scale used in this analysis enables comparison to other occupations, though the large number of variables collected demands further investigation to consider how specific conflicts between co-workers, management, prosecutors, and courts impact scientists. Developing multiple scales from these items will enable a more robust assessment of the sources of stress, whether internal or external, and develop targeted policies to reduce role conflicts.

Additional research is also needed to understand why there are so few demographic factors associated with occupational reactions among forensic scientists. The only significant variable noted was that females had higher levels of stress overall. Though differences have been identified in previous research on policing (Belknap & Shelly, 1992; Burke & Mikkelsen, 2005; Krimmell & Gormley, 2003; Lim & Teo, 1998; Morash et al., 2006; Zhao et al., 1999), the lack of significance for age, race, marital status, and education is a divergence from existing

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research on criminal justice system employees (Folkman, Lazarus, Pimley & Novaceck, 1987; Patterson, 2003; Violanti, 1983). There is no immediate explanation for these findings since it is expected that age and other personal factors would influence the ways that individuals cope with their occupations (Folkman et al., 1987). Further study is needed to identify the ways that the forensic sciences differ from other occupations in generally.

Finally, there is a need for further study exploring the ways that law enforcement and prosecutors perceive the role of forensic science generally. The results of this analysis suggest that the working relationships that scientists have to other criminal justice system employees and the requests they make affect their working experiences. There has been less research considering the ways that these agencies consider their impact and relationship to the forensic sciences, particularly publicly funded state and local laboratories (Peterson et al., 2010). Exploring these relationships could improve our knowledge of the complexities of the interactions between the various components of the criminal justice system and forensic sciences generally.

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VI. Dissemination of Research Findings

There have been no publications or presentations generated from the study at this time.

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VII. Appendix

1. What is your age? _____

2. What is your sex?
   a. Male
   b. Female

3. What is your race?
   a. Black
   b. White
   c. Hispanic
   d. Asian
   e. Other (please specify) _____

4. What is your marital status?
   a. Single
   b. Married/Common-Law
   c. Divorced/Separated
   d. Widowed

5. What is your highest level of education?
   a. High School or GED
   b. Some College
   c. Two Year Degree
   d. Four Year Degree
   e. Some Graduate Classes
   f. Masters Degree
   g. Ph.D.
   h. Other (please specify) _____

6. What is your job title/rank? _____

7. Do you serve as a scientific discipline coordinator or manager?
   a. No (please skip to question 8)
   b. Yes
   If yes, please indicate your agreement with the following statements:

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
I think my level of experience is respected by my colleagues.	1	2	3	4	5	6
My subordinates do not understand the stressors that I have to deal with as a manager.	1	2	3	4	5	6
There are substantial tensions between bench scientists and upper management.	1	2	3	4	5	6
I am able to efficiently communicate lab policies to my coworkers.	1	2	3	4	5	6
I am not able to effectively communicate the needs of my subordinates to upper management to make necessary changes to policies or procedures for my discipline.	1	2	3	4	5	6

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8. How many years have you been with your current agency? _____

9. Are you regularly responsible for training others at work?
a. Yes b. No

10. Are you sworn or unsworn
a. Sworn b. Unsworn

11. How many years have you worked in law enforcement including your current and previous positions (in and out of laboratories)?_____

12. How did you obtain your current position?
a. I applied directly for the position
b. I was voluntarily transferred from another position
c. My supervisor assigned me to this position

13. How many years have you worked in forensic science including your current and previous positions? _____

14. About how many scientists work in your unit within the lab? _____

15. In what state is your laboratory located? _____

16. Please indicate the type of agency where you work:
a. Local Police Agency
b. State Police Agency
c. Federal Agency
d. Private Laboratory
e. Independent (Non-Governmental) Local Agency
f. Independent (Non-Governmental) State Agency
g. Other (please specify) _____

17. On average, how many hours do you work in a given week? _____

18. On average, how many hours of overtime do you work in a given week? _____

19. On average, what proportion of your time do you spend conducting the following forms of scientific analysis techniques each week in the course of your work?

Biology	_____
Digital and Multimedia Evidence	_____
Drug Chemistry	_____
Firearms/Toolmarks	_____
Latent Prints	_____
Toxicology	_____
Trace Evidence	_____
Other	_____

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20. Do you respond to crime scenes as an investigator or reconstructor?

a. Yes b. No

21. If yes, how many times have you had to respond to a scene over the last six months?

a. One or two times
b. Three to five times
c. Six to nine times
d. Ten to 13 times
e. 14 or more times

22. What percentage of your work involves working with cases where minors (anyone under the age of 18) are victims? _____

23. On average, what percentage of your time is spent each week generating or writing reports based on your analyses? _____

24. On average, how many hours do you spend each week reviewing your colleagues' reports and analyses?_____

25. How many times have you had to testify concerning scientific analyses in court over the last year? _____

26. In the last year, how many times did you experience the following outcome related to a court appearance or case?

Subpoena _____
Testimony in court _____
Defendant took plea upon arrival _____
Called off in transit to court _____
Consulted for the prosecutor/court _____

27. About how much time do you spend in job training per year?

a. One to two days
b. Three to five days
c. One week
d. Two weeks
e. Three weeks
f. Four or more weeks

Please move to the next page.

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28. Please indicate the extent to which you agree with the following statements:

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
Prosecutors doubt my competence.	1	2	3	4	5	6
Prosecutors do not understand why it takes time to complete the analyses they request.	1	2	3	4	5	6
Prosecutors try to persuade me to testify to more than just the scientific facts (e.g. telling the jury that someone was "high" instead of stating the marijuana was found in his or her system).	1	2	3	4	5	6
I spend more time doing peer reviews than casework.	1	2	3	4	5	6
I find it easy to deal with court schedules across jurisdiction(s) I service.	1	2	3	4	5	6
Judges respect me professionally.	1	2	3	4	5	6
Judges and juries are frequently confused when there is insufficient forensic evidence to support claims made by prosecutors or police.	1	2	3	4	5	6
The CSI effect has made my job more difficult, particularly in court testimony.	1	2	3	4	5	6
My immediate supervisor supports me.	1	2	3	4	5	6
My immediate supervisor gives me clear instructions.	1	2	3	4	5	6
My immediate supervisor has clear expectations of me.	1	2	3	4	5	6
The top managers in my agency are responsive to my thoughts and suggestions.	1	2	3	4	5	6
The top managers in my agency are mainly concerned with getting cases out the door (i.e. they would rather have quantity than quality).	1	2	3	4	5	6
The top managers in my agency are more concerned with looking good to the public than doing a good job.	1	2	3	4	5	6
It takes too long to hire a replacement when one of my colleagues leaves the agency.	1	2	3	4	5	6
I am not often thanked by prosecutors or police for the work that I do.	1	2	3	4	5	6
I have to do things at work in ways that should otherwise be done differently.	1	2	3	4	5	6
I am respectively exposed to obscene content in the course of my job.	1	2	3	4	5	6

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Please indicate the extent to which you agree with the following statements:

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
I usually feel that I am under a lot of pressure when I am at work.	1	2	3	4	5	6
In my job, I have to deal with too much paperwork.	1	2	3	4	5	6
My job duties often make me miss regular meals.	1	2	3	4	5	6
I often have to report for court with little notice.	1	2	3	4	5	6
I do not have adequate IT support at work.	1	2	3	4	5	6
My equipment and resources are regularly met at work.	1	2	3	4	5	6
I work with people who do not pull their weight.	1	2	3	4	5	6
The agency I work for is inconsistent in the application of new rules and policies.	1	2	3	4	5	6
I get held responsible for mistakes made by others (e.g. secretaries, evidence technicians).	1	2	3	4	5	6
My agency's operational guidelines/procedures are clear.	1	2	3	4	5	6
I cannot keep up with the changing technology that is required to do my job.	1	2	3	4	5	6
The people I work with often have the importance of their jobs stressed to them by their supervisors.	1	2	3	4	5	6
I do things that are likely to be accepted by one person but not accepted by others.	1	2	3	4	5	6
When I am at work, I often feel tense or uptight.	1	2	3	4	5	6
My supervisors often encourage the people I work with if they do their jobs well.	1	2	3	4	5	6
I contribute to public safety through my work.	1	2	3	4	5	6
I do not get sufficient cooperation across multiple jurisdictions while at work.	1	2	3	4	5	6
I am usually calm and at ease when I am working.	1	2	3	4	5	6
At work I receive assignments without the manpower to complete them.	1	2	3	4	5	6
When my supervisors have a dispute with one of my coworkers they usually try to handle it in a friendly way.	1	2	3	4	5	6

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Please indicate the extent to which you agree with the following statements:

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
In my job, I receive incompatible requests from two or more people.	1	2	3	4	5	6
There are tensions between sworn and unsworn individuals in my workplace.	1	2	3	4	5	6
My plans for the workday are often changed because of new cases/requests I receive.	1	2	3	4	5	6
Prosecutors do not inform me about the outcomes of the cases on which I work.	1	2	3	4	5	6
Most court decisions are too lenient.	1	2	3	4	5	6
I worry that I will make a mistake that will ruin my credibility as an expert witness.	1	2	3	4	5	6
The standards and practices for analyses are different in my workplace than in other jurisdictions/departments with which I collaborate.	1	2	3	4	5	6
My colleagues usually agree on the best way to accomplish something at work.	1	2	3	4	5	6
The lack of scientific standards makes it difficult for me to complete my work tasks.	1	2	3	4	5	6
I worry that I will make a mistake that might lead to the conviction of an innocent person.	1	2	3	4	5	6
I am given too much responsibility with too little control over the outcome.	1	2	3	4	5	6
My coworkers listen to what I have to say.	1	2	3	4	5	6
I have sufficient time to complete a task I am given at work.	1	2	3	4	5	6
I feel emotionally drained from my work.	1	2	3	4	5	6
Working with difficult images/scenes/materials all day is a real strain for me.	1	2	3	4	5	6
I feel frustrated by my job.	1	2	3	4	5	6
I feel I am positively influencing other people's lives through my work.	1	2	3	4	5	6
I feel exhilarated after working on a case.	1	2	3	4	5	6

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Please indicate the extent to which you agree with the following statements:

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
Prosecutors do not understand that I sometimes work very hard on a case, even though I end up finding no evidence.	1	2	3	4	5	6
I have accomplished many worthwhile things in this job.	1	2	3	4	5	6
I have become more callous toward people since I started working in the forensic sciences.	1	2	3	4	5	6
I don't really care about the outcome of my cases as long as I know I did the best job possible.	1	2	3	4	5	6
I am regularly pressured by police or prosecutors to rush to produce scientific results.	1	2	3	4	5	6
I sometimes have an emotional response to the evidence that I handle (e.g. bloody clothing, photos, or personal effects).	1	2	3	4	5	6

29. All in all, how satisfied are you with your job?
- a. Not satisfied
- b. Not too satisfied
- c. Somewhat satisfied
- d. Very satisfied

30. Knowing what you know now, if you had to decide all over again whether to take the job you now have, what would you decide?
- a. Definitely not to take the same job
- b. Have second thoughts about taking this job
- c. Without hesitation take the same job

31. In general, how well would you say your job measures up to the sort of job you wanted when you took it?
- a. Not very much like the job I wanted
- b. Somewhat like the job I wanted
- c. Very much like the job I wanted

32. If you were able to go into any type of job you wanted, what would your choice be?
- a. Prefer some other job to the job I have now
- b. Want to retire and not work at all
- c. Keep the job I have now

33. If a good friend of yours told you he or she was interested in pursuing a career in forensic science, what would you tell him or her?
- a. Advise my friend against taking the job
- b. Have some doubts about recommending the job
- c. Strongly recommend the job

34. If you were able to go into any type of job you wanted, what would your choice be?
- a. Prefer some other job to the job I have now
- b. Want to retire and not work at all
- c. Keep the job I have now

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35. How frequently do you engage in the following behaviors as a way of coping with work stress when you are not at work?

	Never	Rarely	Sometimes	Often	Very Often	Always
I work harder than usual around the house or on the job.	1	2	3	4	5	6
I just try to forget about it.	1	2	3	4	5	6
I have a drink, such as beer, wine, or a cocktail.	1	2	3	4	5	6
I take a tranquilizer or some other form of medicine.	1	2	3	4	5	6
I smoke more often.	1	2	3	4	5	6
I talk things over with my spouce/significant other.	1	2	3	4	5	6
I talk things over with my friends.	1	2	3	4	5	6
I participate in some organized groups or clubs in order to get social support.	1	2	3	4	5	6
I try to get away from everyone.	1	2	3	4	5	6
I engage in some spiritual activity, such as going to church or mediating.	1	2	3	4	5	6
I find some activity to take my mind off things like going to a movie.	1	2	3	4	5	6
I seek professional help such as a counselor or therapist.	1	2	3	4	5	6
I eat more or less than usual.	1	2	3	4	5	6

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36. Since beginning your work in forensics, how often have you experienced the following?

	Never	Rarely	Sometimes	Often	Very Often	Always
Difficulty falling or staying asleep	1	2	3	4	5	6
Irritability or outburst of anger	1	2	3	4	5	6
Difficulty concentrating	1	2	3	4	5	6
A constant feeling of "alertness"	1	2	3	4	5	6
Being easily startled	1	2	3	4	5	6
Nightmares	1	2	3	4	5	6
Feelings of detachment/emotional numbness	1	2	3	4	5	6
Feelings of mistrust/betrayal	1	2	3	4	5	6
Physical aches and pains with no apparent cause	1	2	3	4	5	6

37. Please indicate the extent to which you agree with the following statements about your work environment. Please note that lab space refers specifically to your laboratory environment, while workplace or space is inclusive of your entire working environment, including any office and lab space:

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
My lab space is comfortable enough so that I can work without getting tired.	1	2	3	4	5	6
I am satisfied with the privacy I am provided by my overall personal workspace.	1	2	3	4	5	6
I am satisfied with the cleanliness of my overall workplace.	1	2	3	4	5	6
My overall workplace has many noise distractions produced by equipment.	1	2	3	4	5	6
My overall workspace has many noise distractions produced by people.	1	2	3	4	5	6
I am able to control temperature or airflow in my lab space.	1	2	3	4	5	6
My lab space is provided with efficient lighting and tools so that I can work easily without strain on my eyes.	1	2	3	4	5	6

38. My lab space is flexible to adjust, rearrange or reorganize to suit my needs.

a. Not at all
b. To some extent
c. Almost
d. Fairly enough
e. Completely flexible

39. To what extent does the room temperature in your lab space affect your normal level of productivity?

a. No effect
b. Positive effect
c. Normal effect
d. Quite good effect
e. Bad effect

f.

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40. The overall temperature of my lab space through the year is:
   a. Very comfortable
   b. Somewhat comfortable
   c. Somewhat uncomfortable (whether cold or hot)
   d. Very uncomfortable (whether cold or hot)

41. The number of windows in my building (inclusive of labs and offices) complete my fresh air and light needs.
   a. Not at all
   b. To some extent
   c. Did not notice
   d. Mostly
   e. Always

42. My lab space has all the necessary equipment to suit my typical needs (computers, solutions, pipettes, etc).
   a. Not at all
   b. To some extent
   c. Often
   d. Mostly
   e. Always

43. I am satisfied with the amount of space in the lab for storage and display of important materials.
   a. Extremely dissatisfied
   b. Dissatisfied
   c. Satisfied
   d. Extremely satisfied

44. Favorable environmental conditions (less noise, suitable temperature, etc.) in the lab space will increase my productivity at work.
   a. No effect
   b. Increase by 20%
   c. Increase by 30%
   d. Increase by 40%
   e. Increase by 50% or more

45. Unfavorable environmental conditions (noise distractions, unsuitable temperature, etc.) in the lab space will decrease my productivity at work.
   a. No effect
   b. Decrease by 20%
   c. Decrease by 30%
   d. Decrease by 40%
   e. Decrease by 50% or more

46. Can you complete your daily tasks easily due to the overall (office and lab) environment?
   a. Not at all
   b. To some extent
   c. Often
   d. Mostly
   e. Always

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47. Please describe what you find to be the most challenging part of your job:

_____

_____

_____

_____

_____

48. Please describe what you find to be the most satisfying part of your job:

_____

_____

_____

_____

_____

Thank you for your participation in this study. If you have concerns or questions about this study, please contact the researcher Dr. Thomas Holt via email at holtt@msu.edu; postal mail 434 Baker Hall, East Lansing, MI 48823; phone 517-353-9563. Michigan State University wants to ensure that you are treated in a fair and respectful manner. If you have questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the Michigan State University's Human Research Protection Program at 517-355-2180, Fax 517-432-4503, or e-mail irb@msu.edu or regular mail at 207 Olds Hall, MSU, East Lansing, MI 48824.

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