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through safety and health research



NIOSH Research Rounds

NIOSH Research Rounds is a monthly bulletin of selected research at the National Institute for Occupational Safety and Health.

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Job Stress

Job stress refers to the harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources, or needs of the worker. Job stress can lead to poor health and even injury.

The concept of job stress is often confused with challenge, but these concepts are not the same. Challenge is an important ingredient for healthy and productive work. It energizes us psychologically and physically, and it motivates us to learn new skills and master our jobs. When we face a challenge and handle it well, we feel relaxed and satisfied. The importance of challenge in our work lives is probably what people are referring to colloquially when they say, “a little bit of stress is good for you.” In reality, while challenge can be good for personal growth, stress is never good by any measure. One form of stress under investigation at the National Institute for Occupational Safety and Health (NIOSH) is job strain, which occurs when high job demands combine with low job control.



As part of its commitment to ensuring a safe and healthy work environment for all workers, NIOSH studies job stress to understand its causes and association with health effects. Most importantly, NIOSH studies how to prevent job stress and related health effects from occurring in the first place. In this issue of *NIOSH Research Rounds*, we feature five recent research projects on this complex and costly issue for today's workers and workplaces.

Job Control in Many Occupations Linked to Decreased Risk of High Blood Pressure

Does your job provide a variety of tasks? Do you have the opportunity to develop your own special abilities? Are you able to make work-related decisions on your own? Do you have the freedom to decide how you do your work? If so,

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you may have a job that gives you a high level of control. This kind of control correlates with a decreased risk of high blood pressure in many occupations, according to a study by NIOSH with university partners.

In this study, workers with the highest level of job control were less likely to have high blood pressure than were workers with the lowest level of job control. This association occurred in many different job areas, including management/professional, sales/office, and production. However, in the case of healthcare support workers (for example, home health aides, nursing assistants, dental assistants, medical transcriptionists, pharmacy aides, and phlebotomists), the pattern reversed; high job control correlated with a greater risk for high blood pressure. Although overall a greater proportion of men than women had high blood pressure, more women in healthcare support and two blue-collar job areas (production; and installation, repair and maintenance) had high blood pressure. The results were similar across racial/ethnic groups.

Investigators examined the association between occupational information on 2,517 voluntary participants and blood pressure data collected by the Multi-Ethnic Study of Atherosclerosis (MESA), funded by the National Heart, Lung, and Blood Institute. MESA recruited study participants from six communities, in Forsyth County, North Carolina; Manhattan and Bronx, New York; Baltimore, Maryland; St. Paul, Minnesota; Chicago, Illinois; and Los Angeles, California. The study oversampled racial/ethnic minorities to ensure sample diversity: 38% were white, 28% were black, 23% were Hispanic, and 11% were Chinese-American. Their average age was 57 years, and all worked at least 20 hours per week at the time of the study, from 2002 to 2004. Overall, the findings from this study suggest that increasing job control could help decrease the prevalence and incidence of high blood pressure among workers. Further research could help clarify why women in some occupations are more likely than are men to have high blood pressure and why health care support workers did not have lower blood pressure when their levels of job control were higher.

For more information, click the titles below:

- [*Job Strain, Occupational Category, Systolic Blood Pressure, and Hypertension Prevalence: the Multi-Ethnic Study of Atherosclerosis \(Full article available after November 1, 2016\)*](#)
- [*Organization of Work: Measurement Tools for Research and Practice*](#)

Nightshift Work and Job Strain Associated with Weight Gain

When her children started school, Susan* felt fortunate to land a job as a nightshift nurse, a job that would enable her to be there for her children when they came home in the afternoon. Even though the work was demanding, a year into her new job she felt confident about understanding her job duties and mastering necessary skills. However, what she did not understand was why her new work uniform no longer fit comfortably, and she was concerned about the health effects of gaining weight.

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Workers who work outside of regular daytime schedules—night shift workers—may experience greater levels of job strain. Few studies, however, have examined shift work and job strain together in connection with weight gain. Now a study in progress by NIOSH investigators and their university partners is looking at the joint effect of shift work and job strain on women's weight gain over 4 years. The investigators plan to control for other factors that could affect weight gain, including age, race and ethnicity, pregnancy history, job types, change in family situations, and health behavior.

Investigators analyzed data from 52,622 women who enrolled in the nationwide Nurses' Health Study II in 1989. At the time of enrollment, the average age was 39 years. Since shift work is an inherent part of nursing, studies like this one are important to clarify the health effects of shift work and to develop interventions to protect nurses' health. Two important areas for interventions are reducing job strain and supporting night shift workers, according to the NIOSH study.

For more information and training resources, click the title below:

- [*Work Schedules: Shift Work and Long Hours*](#)

*Susan is a fictional person.

Job Strain Linked to Greater Weight Gain among Already Overweight Women

Job strain correlated with greater weight gain among already overweight women than among women who weighed less initially, a study by NIOSH and university partners has found. These findings underscore the importance of identifying and addressing occupational factors to prevent obesity, rather than focusing on behavioral or individual factors in isolation. This approach is consistent with NIOSH recommendations in its [Total Worker Health®](#) Program.

Although obesity is a recognized risk factor for a host of serious diseases—including heart disease, cancer, stroke, diabetes, and kidney disease—its relationship to job strain has remained unclear. Previous NIOSH-supported research found that women who reported five job stressors on a regular basis had a four-fold greater risk of obesity than women who reported no job stressors. In the current study, investigators specifically examined the relationship between job strain and change in the height-to-weight measurement known as body-mass index (BMI). They found that women reporting high job strain at least once had a greater increase in BMI over 4 years than did women reporting no job strain. Voluntary study participants included 52,656 adults in the ongoing Nurses' Health Study II of health and behavior among nurses and student nurses in the United States and Canada. Participants' average age was 38.5 years, and most were white.

Even after controlling for factors that could influence weight gain, such as age, race and ethnicity, pregnancy history, change in job types, and health behavior, investigators found that the difference in BMI changes remained. One reason for the difference, according to investigators, may be that chronic stress, including job strain, results in hormonal disruptions that are associated with greater BMI and abdominal weight gain. Some previous studies suggest that overweight and obese women are more vulnerable to stress-induced hormonal disruptions. Health promotion practitioners in the workplace should be aware of the different vulnerability to stress by weight. While reducing stress and preventing obesity are important for all, this study suggests that additional resources are warranted for those who are already overweight and exposed to stress.

For more information, click the titles below:

- [*Job Strain and Changes in the Body Mass Index among Working Women: A Prospective Study*](#)
- [*Total Worker Health*](#)

Relationship between Job Strain and Stress Hormone Explored

Increasingly, medical research links stress, including work-related forms such as job strain, to a range of serious health effects, such as obesity, diabetes, certain types of cancers, and heart disease. One of the main hormones released in response to stress is cortisol. Occupational health researchers study this hormone as a biomarker to measure the possible health effects of job strain and, ultimately, to develop better interventions to prevent job strain. Previous research, however, found inconsistent results in the relationship between cortisol and job strain. One reason for this inconsistency may have been failure of those studies to account for day-to-day variability in cortisol.

Investigators at NIOSH, along with university partners, designed a new study to account for this variability and to address other possible limitations in earlier investigations comparing daily cortisol levels with high-strain versus low-strain jobs. Accounting for day-to-day variability is important because an individual's cortisol levels are highly variable within and between days, the investigators said. Cortisol levels typically rise sharply at the time of waking and then decline throughout the day, so the investigators compared hormone levels in salivary samples from voluntary participants at six different times daily for 3 days. In addition to comparing overall cortisol profiles, the investigators compared two commonly used cortisol summary measures. The first measure is the “cortisol awakening response,” which is the increase in cortisol levels from awakening to 30 minutes later that likely shows the body's ability to respond to stress. The second measure is the total cortisol released from awakening to 16 hours later, known as the “area under the cortisol curve.” A growing body of data suggests that chronic stress and associated health conditions may impair the release of cortisol, what the investigators call a “blunted cortisol diurnal profile.”

After controlling for other influences, the investigators found that job strain correlated with lower total daily cortisol but did not affect the cortisol awakening response. The findings differ from those of several previous studies and could be explained by work-related burnout or fatigue. The differences could also be due to limitations in the statistical analyses of previous studies, including failure to account for variability in estimating the cortisol summary measures and failure to adequately control for confounding—both of which the present study addresses.

Investigators obtained the study data from MESA, which collected the data between 2002 and 2006 from 1,002 employed adults enrolled in the study in New York and Los Angeles. Participants' average age was 58 years; 58% were Hispanic, 27% were black, and 15% were white. This study sample of middle- to older-aged, racially and ethnically diverse adults in two U.S. urban areas differed from those of earlier studies, which comprised younger, mostly European, white populations. Further research is necessary to understand how demographic factors such as career stage and socioeconomic level may moderate the association.

For more information, click the title below:

- [*Job Strain and the Cortisol Diurnal Cycle in MESA: Accounting for Between- and Within-Day Variability*](#)

Next Steps

Identifying how job stress contributes to early signs of disease will provide critical information for effective prevention. In a first step in this direction, NIOSH and university partners studied how occupational characteristics predict blood vessel changes that signify early heart disease. Due to methodological difficulties, investigators were not able to identify a clear link between job characteristics and these signs of early heart disease. Nevertheless, this study clarified the importance of more detailed and accurate assessment of occupational characteristics and exposure history.

For the study, investigators analyzed data from MESA. Using noninvasive ultrasound imaging, MESA investigators measured the lining of the main artery in the neck—the carotid artery—and the amount of plaque, or fatty substances, built up within the artery. Both carotid thickening and plaque formation are early signs of developing heart disease. Voluntary study participants included 3,109 adults from six communities in North Carolina, New York, Maryland, Minnesota, Illinois, and California. Their average age was 60 years; half were women, and all were free of heart disease when the study began. Study participants underwent ultrasound imaging of the carotid artery once at the beginning of the study and at least once more over the following 9 years. To obtain participants' occupational information, investigators asked their current or pre-retirement job title and retrieved job characteristics from the U.S. Department of Labor database (Occupational Resource Network, O*NET) that describes each job.

Although this study was the most methodologically rigorous at the time, some crucial information was not available, which limited the study's ability to clarify the link between job characteristics and early signs of heart disease. The unavailable information included the complete work history across lifetime and data from people who developed heart disease at a young age (before age 45). Learning from this experience, investigators are collecting the information in their current projects to gain a better understanding of the contribution of occupation to the development of heart disease.

For more information, click the titles below:

- [*Occupational Characteristics and the Progression of Carotid Artery Intima-media Thickness and Plaque over 9 years: the Multi-Ethnic Study of Atherosclerosis \(MESA\)*](#)
- [*Stress at Work*](#)

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