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Harrynauth Persaud  
*CUNY York College*

Shawn Williams  
*CUNY York College*

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## Mini Review

# Long Working Hours and Occupational Stress-related Illness and Injury: Mini Review

Persaud H and Williams S\*

Department of Health Professions, School of Health Sciences and Professional Programs, City University of New York - York College, USA

### Abstract

Workplace injuries and illnesses have been associated with long working hours. In the United States, working overtime has been on the rise. It is estimated that American workers spend an extra 1.5 hours per week at their job, and for those working in manufacturing-overtime has increased by 25% when compared to 10 years ago. Data suggests that working greater than 12 hours in a single day was associated with a 37% (95% CI=1.16–1.59) increase in hazard rate (HR), while working greater than 60 hour per week was associated with a 23% (95% CI=1.05–1.45) increase in HR. For those working overtime, there was a 61% (95% CI=1.43–1.79) increase in HR when compared to jobs without overtime. Long working hours carries a risk of 80% in developing Coronary Heart disease (CHD) (95% CI=1.42–2.29) after adjusting for age, sex and socioeconomic status. More stringent restrictions found a risk for CHD to be 59% (95% CI=1.23–2.07). There is little known on the effectiveness of strategies to address the association between long working hours and occupational stress-related injuries and illnesses. Prevention strategies should address all levels in the hierarchy including individual, organizational and policy levels. There is an urgency to support efforts that attempt to bring individuals, workplace and legislative policies together to understand the adverse effects of working long hours and collaboratively work towards a solution.

**Keywords:** Working hours; Stress; Illness; Injuries

### Introduction

For decades, there have been concerns about long working hours and the associated increased risk of injuries and illnesses. Long hours can be defined as exceeding eight hours per day at work or greater than a 40 hour work week. Thousands of workers spend a significant amount of time at their place of occupation exposing themselves to potentially numerous workplace hazards. It is understood that in today's economy many people have to work multiple full time jobs to "earn a living", many of who do not know how these working habits affect their health. According to the National Institute for Occupational Safety and Health (NIOSH), the number of annual hours worked in the United States has been on a steady rise [1]. The US News and World Report found that the majority of people between the ages of 22 and 65 spend more than 40% of their time at work [3]. Since 1980, American workers have been working additional hours, spending an additional 1.5 hours per week at their place(s) of occupation. It was estimated that hourly manufacturing workers are working 25% more overtime when compared to 10 years ago [2]. It was also estimated that work-related injuries and illness cost the United States about \$250 billion annually [3].

Multiple studies [4-7] have shown a strong association between long working hours and the development of various illnesses and injuries including, but not limited to, hypertension, diabetes, cardiovascular disease, musculoskeletal disorders, stress, fatigue, chronic infections, and substance abuse. In addition, people working overtime are subjected to a greater risk of adverse work-related outcomes [5].

During the year 2007, it was estimated that deaths due to occupational injuries and illnesses was higher than deaths due to breast cancer, motor vehicle accidents or prostate cancer [3]. This highlights the collective social need to reduce occupational injuries and illnesses.

Long working hours is related to a myriad of adverse health outcomes and injuries; however, the current surveillance system does not fully capture every single adverse work-related outcome, thus leading to an underestimation of the true effects. For example, Rosenman et al. [8], sought to enumerate the amount of work-related injuries and illnesses that were missed by the national surveillance system. Their findings suggest that up to 68% of work-related injuries and illnesses were missed by the current national surveillance system [8] begging the question: If this information was more publically available and/or accessible, would employers and employee make a preventative effort to adjust work schedule(s)? This is an area yet to be explored and a question that is very difficult to answer due to the multitude and complexity of factors involved.

### Literature Review

Dembe et al. assessed the impact of extended work hours and overtime on illnesses and injuries via National Longitudinal Survey of Youth (NLSY) [5]. A nationally representative sample consisting of 10,793 working Americans was used in the study between 1987 and 2000.

Multivariate analysis was performed adjusting for age, gender, occupation, industry and region. Dembe et al. [5] found that working greater than 12 hours in a single day was associated with a 37% (95% CI=1.16–1.59) increase in hazard rate (HR), while working greater than 60 hours per week was associated with a 23% (95% CI=1.05–1.45) increase in HR. For those working overtime, there was a 61% (95% CI=1.43–1.79) increase in HR when compared to jobs without overtime. Overtime or long hours of any type was found to have a HR of 38% (95% CI=1.25–1.51). In addition, a strong dose-response relationship was found between injury rates and long hours [5]. The top 5 injuries and illnesses in this study across all job types were musculoskeletal disorders, cuts and bruises, other traumatic injuries, other occupational diseases, and fractures respectively. It must also be noted that an increased risk of injury or illness does not necessarily mean that a particular occupation is more risky. It is hypothesized that the resulting affects merely stems from the stress and fatigue subdued by the workers [5].

A study conducted by NIOSH in 2015 found that first year medical residents who work continuously more than 24 hours are two times more likely to be in a car crash driving after their work shift, and five times more likely to be in a near-miss accident when compared to medical residents who work shorter shifts [9]. Based on these findings, it is clear that long hours are not only limited to injuries and illness within the workplace, but also beyond.

Virtanen et al. conducted a systematic review and meta-analysis using published studies and unpublished data from individual participants to explore the association between long working hours and alcohol use [7]. They found statistically significant results between alcohol use and long working hours with increased odds of 11% and 12% for cross-sectional analysis and prospective studies, respectively. When compared to those working standard weekly hours (35-40 hours), individuals who worked 49-54 hours and >55 hours had an increased odds of alcohol use at 13% and 12% respectively, both statistically significant at 95% alpha level. No differences were found between gender, socioeconomic status, geographic location, sample type or tendency for risky alcohol use [7]. These findings suggest that individuals who work long hours are more likely to drink alcohol resulting in poor health outcomes versus those working shorter hours.

Another systematic review conducted by [4], exploring the correlation between long working hours and health outcomes also found statistically significant association with long working hours and adverse health effects. These include, but not limited to, diabetes, metabolic syndrome, circulatory disease, anxiety and other psychological disorders, decreased cognitive function, poor sleep and behavioral disorders [4].

Apart from working long hours, other factors such as, time of day also play an important role in determining exposure to work related illnesses and injuries. For example, de Castro et al. [10] found that when nurses were exposed to non-day shifts, their odds of sustaining a work related injury and illnesses were 54% (95% CI=1.07–2.24) and 48% (95% CI=1.02–2.16) respectively, after controlling for the number

of hours worked, the length of the shift and demographic factors [10]. Consistent with other findings, there were statistically significant results of 22% and 19% increased odds of work related illnesses and injuries respectively, for nurses working overtime [10].

A study conducted by Wirtz et al. [11] sought to assess the relationship between gender, long working hours and injuries and illnesses. Seven years of pooled data was obtained from a nationally US representative sample (the US National Health Interview Survey) and analysed. The results showed that injuries were higher among men. However, before any adjustments, it was found that, as working hours increased, there was a direct correlation with injuries for both men and women. After adjustments with logistic regression, the results indicated that women who worked 41-50 hours per week and >50 hours per week had statistically significant odds of 51% and 69%, respectively, of being injured on the job, when compared to those working 31-40 hours. These trends were not observed for their male counterparts [11].

In addition to all the illnesses and work related injuries mentioned above, it is important to note the relationship between working long hours and heart disease. Coronary heart disease (CHD), as we recall, is one of the leading causes of death [6], including Karoshi (sudden death due to overwork) [4]. Multiple studies have demonstrated a strong association with CHD and working long hours. For example, one report from the *Annals of Internal Medicine* showed that when compared to a normal 8-hour day-shift, those working >11 hours per day have a significant increased risk of heart disease, which could be as much as 67%. This population also has a >50% risk of a recurrent MI [12]

A systematic review and meta-analysis was conducted by Virtanen et al. [6], using data sources through Medline from 1966 to 2011, and Web of Science through March 2011. The focus was to assess the link between long working hours and CHD. Relative Risk, Odds Ratio and Hazard Ratio were calculated for any studies that did not contain statistical measures. Pooled analyses were also performed using adjusted risk estimates and their associated standard errors. In addition, to determine whether or not there were variations between different study designs, sub-group analyses were performed. A total of 12 eligible studies (totalling 22,518 participants comprising of 53% males and 43% females) from across the world, were found to meet inclusion criteria, of which 7 were case-controlled, 4 were prospective cohort and one was a cross-sectional [6]. After minimal adjustments (adjusting for age, sex and socioeconomic status), it was found that working long hours carries a risk of 80% of developing CHD (95% CI=1.42–2.29). For studies utilizing maximum restrictions using multivariate analyses, the risk of CHD decreased to 59% (95% CI=1.23–2.07). When analysed separately, the 7 case-controlled studies carried a risk of 143% whereas; the 4 prospective cohort studies carried a risk of only 39%, both statistically significant at 95% alpha level. To avoid confounding from shift work, studies were restricted to only daytime work, of which the relative risk was calculated to be 51%. Despite the vast difference in relative risks

between the two studies, statistically significant results were obtained. Since prospective cohort studies are more robust and can show causality, we can with 95% certainty say that, individuals working long hours have at least a 39% risk of developing CHD. However, due to the fact that the data (when combined together) were obtained from observational studies, we cannot with 100% certainty attribute causality. The authors [6] noted very little evidence of publication bias between the studies. Regardless of some limitations (as stated in the original article), this systematic review and meta-analysis produced an accurate estimate between working long hours and the risk for coronary heart disease [6].

### Intervention and prevention

A collective effort is required to prevent workplace injuries and illnesses—changes need to be made at all levels in the hierarchy. Policy implications are one such measure, which should be implemented at the national level. Regulatory organizations such as OSHA have already made some impacts. Given the significant correlation between HR and overtime work, policies targeting jobs with frequent overtime, may help reduce the incidence of work-related illnesses and injuries. Some professions such as nursing have made some progress limiting the number of hours nurses can work. For example, in New York, a proposed bill (A.2025/S.1380) states that “no hospital will permit or require a registered nurse or licensed practical nurse to remain on duty for longer than 16 hours except in an emergency, nor be permitted or required to be on duty for more than 60 hours in a seven-day period” [2]. The Fair Labor Standards Act of 1938 (FLSA) is the organization responsible for regulating overtime. Currently, there is no restriction on the amount of overtime worked [2]. Given the premium pay of at least 1.5 times base salary, a most people would opt for optional overtime to boost their salary. Regulation, to restrict the amount of overtime worked in a day or week could be a way of limiting long working hours.

At the workplace or organization level, some strategies may include rest breaks, re-organization of work schedules to avoid frequent overtime, employ more staff to decrease job strain, active participation of unions, providing ergonomic equipment, health promotion programs funded by employers and frequent medical evaluation for employees in high-risk jobs [5]. Although all of these will help alleviate the problem, it is not always possible, as we know from history most employers are concerned about production and their bottom-line. It has been a challenge to change organizational practices, which may continue if regulatory agencies do not actively intervene.

Despite changes at policy or organizational levels, individuals can also make some changes on their own to preserve their well-being. Some of these practices include but not limited to, eating a healthy diet, regular exercise, avoid illicit drugs, tobacco and alcohol, get enough sleep (at least 8 hours per day) and close follow-ups with their primary care provider to utilizing measures of preventative care [5].

Another area that ought to be explored is to recognize working hours as a medical problem and incorporating questions regarding this topic during medical visits. Primary care physicians can screen patients at risk and implement preventative strategies early to counteract the adverse effects [12].

### Conclusion

The literature provides a wide range of information on the negative consequences of long working hours. This expansive body of knowledge can serve as a catalyst for change and alter the prevalence and incidence of occupational stress-related illness and injury that are the result of long working hours. What is yet to be understood is how to bring individuals, workplace and legislative policies together to understand the adverse effects of working long hours and collaboratively work towards a solution. Yet, based on the evidence provided, it is clear that working long hours on the job is directly related to injuries and illnesses and overall adverse health outcomes. Clearly, there is a lot that needs to be done. However, despite hurdles and challenges, with increased advocacy and awareness we can make some impact towards eliminating this problem.

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**\*Corresponding author:** Shawn Williams, DC, PhD, Department of Health Professions, School of Health Sciences and Professional Programs, City University of New York - York College, SCI 115B, USA, Tel: 718-262-2907; Email: [swilliams2@york.cuny.edu](mailto:swilliams2@york.cuny.edu)

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