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Preface

Long Working Hours, Occupational Health and the Changing Nature of Work Organization

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Background *The impact of long working hours on health has been of major concern since the late 19th Century. Working hours are again increasing in the US.*
Methods *An overview of historical, sociological, and health-related research presented at an international conference on long working hours is discussed as an introduction to a special section in this issue.*
Results *Research indicates that long working hours are polarizing along class lines with professionals working regular though longer hours and less well-educated workers having fewer though more irregular hours. Extended and irregular hours are associated with acute reactions such as stress and fatigue, adverse health behavior such as smoking, and chronic outcomes such as cardiovascular and musculoskeletal disorders.*
Conclusions *Improved methodologies are needed to track exposure to long working hours and irregular shifts longitudinally. Research should focus on the adverse impact that sleep-deprived and stressed workers may have on the health of the public they serve. A variety of protective efforts should be undertaken and evaluated.* Am. J. Ind. Med. 49:921–929, 2006.

KEY WORDS: work organization; overtime; work hours; work schedule; shift work; sleep; work schedule tolerance; workload; occupational diseases; occupational exposure; occupational injuries; occupational research agenda; fatigue; stress; sociology of work; history of work

We want to feel the sunshine and we want to smell the flowers
We are sure that God has willed it and we mean to have eight hours;
Eight hours for work, eight hours for rest,
Eight hours for what we will.
From "Eight Hours"
by I.G. Blanchard, the most popular labor song of the late 19th Century in Foner, 1975.

Long work hours have been and continue to be of enormous concern for the health and well-being of working people [Bosch, 1999]. One hundred years ago 16-hr work days, 6 days a week were relatively common [Foner, 1947]. At that time the campaign for reduced working hours galvanized the labor movement in the United States and in Europe to demand the 8-hr day [Hunnicutt, 1984]. This movement for shorter working hours was one of the first widespread and coordinated efforts mounted to change the

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conditions of work. Throughout the 1870s workers mobilized around the issue of the shorter day, and in 1886, on May 1st, the Federation of Organized Trades and Labor Unions (which was later to become the AFL), organized a nationwide strike of over 1 million workers for the 8-hr day [Foner, 1947; Hunnicutt, 1984; LeGrande, 2004]. In light of current discussion of the 'overworked American' it is interesting to recall that this earlier debate revolved around reducing the number of hours worked in order to provide the conditions by which workers could develop their full human capacities in line with the slogan: 'eight hours for work, eight hours for rest, eight hours for what we will' [Foner, 1975]. This movement was largely successful and since the later part of the 19th century working hours for most workers gradually declined, at least until quite recently [Bosch, 1999]. Although they are continuing to decline in Japan and in most of Europe, they have been increasing in the US which now has the longest working hours of any of the wealthy industrialized countries [ILO, 2001]. Workers in the US work 200–400 more hours per year (5–10 more weeks each year), than workers in Germany, France, Norway, Sweden, or Denmark [OECD, 2002].

Time at work is one of the most basic components of occupational exposure. As Bosch [1999, page 131] notes: ''Time and pay are the two elements in every wage employment relationship that can be measured in quantitative terms.'' In addition to being a critical aspect of any work exposure's duration, there is increasing epidemiological evidence that indicates that long work hours are an important risk factor for a number of acute and chronic health outcomes [Caruso et al., 2004, 2006]. Time at work structures all other aspects of daily life. The way in which the work day, the work week, the work month, and the work year is organized has profound significance for the life of the worker both on and off the job. The late Marie Jahoda (1907–2001), a social psychologist and founder of the Research Center for Human Relations, was one of the first to point out that how time was spent at work was one of the most fundamental patterns organizing daily life in modern society (1982). This became apparent to her as she studied the impact of unemployment during the 1930s and thereafter. Those who were unemployed often seemed at a loss as to how to use their time, and rather than feeling liberated by their lack of time structure, they suffered from alienation and social exclusion [Jahoda, 1982]. Although the loss of temporal structuring can be harmful for the unemployed, there is increasing evidence that too many working hours can be detrimental to those who are ''over-employed'' [see Caruso et al., 2006, in this issue].

Working hours, in both their length and their structure, are one of the clearest and most important aspects of an entire class of occupational exposures involving the work process itself—the way in which work is structured and organized at the level of the worksite, the firm, and even the labor market. Increasingly referred to as 'work organization,' other aspects of the organization of work (OOW) include: payment systems (e.g., piece-rate), task-level work content (e.g., repetitive, short-cycle operations), management practices (e.g., lean production methods), as well as the broader psychosocial work environment including job demands, work control, social support, and effort/reward imbalance [Landsbergis, 2003]. Once somewhat marginal, these types of exposure variables have become more central to the field of occupational health over the past decade for a number of reasons. Work organization exposures affect all workers, including both industrial and service sector workers. Also, the field of occupational health historically has focused on manufacturing industries and exposures to chemical and physical hazards rather than the health effects of work organization variables. Perhaps even more importantly, there has been a growing awareness in many disciplines that the nature of work has undergone a profound transformation in recent decades, not the least of which has included a move from the production of goods to a largely service-based workforce. Much of what we have assumed to be true about working life requires reconsideration in the light of these revolutionary changes [Johnson, 1997; Landsbergis, 2003].

In the mid 1990s the National Institute of Occupational Safety and Health (NIOSH) began to evaluate the scope and the content of these changes in the nature of work organization as part of its National Occupational Research Agenda setting process (NORA). The NORA initiative mobilized NIOSH and many of its primary partners in the business, labor, and academic communities to critically evaluate the state of the art in occupational health, in order to determine where there were gaps and to propose a road map for future research. A significant outgrowth of this process was the formation of 21 priority areas and working groups that included the NIOSH Organization of Work (OOW) Work Group. In 2002 the OOW Work Group published its report entitled: *The Changing Organization of Work and the Safety and Health of Working People* [NIOSH, 2002]. The report discussed the fundamental changes that are occurring in the nature of work organization: Organizational restructuring has occurred in many industries with the subsequent downsizing of the core, permanent work force and the emergence of an increasingly temporary and contingent group of workers. At the same time, new systems of work organization, such as lean production and ''high performance'' work organizations are altering the most basic components of the work process including supervision, work content, social environment, and the terms of employment. The report goes on to emphasize that occupational health research has not kept pace with these dramatic historical changes: ''. . .the revolutionary changes occurring in today's workplace have far outpaced our understanding of their implications for worklife quality, safety and health on the job

[NIOSH, 2002, page 1].'' The authors of the report point out that although there is wide-spread concern in the occupational health research community that these changes have resulted in an increase in stressful and hazardous exposures, there continues to be a lack of research examining these changes on health and safety. For example, although the data indicate long working hours have increased in the US over the past two decades ''the body of research literature on the safety and health effects of long working hours is surprisingly small,'' furthermore, ''little is known about the interaction of long work hours with demanding schedules (nightwork, shiftwork, etc.), with different jobs with different job characteristics, and exposures, with the intensification of work, and with mandatory and unplanned overtime'' [NIOSH, 2002, page 12]. The OOW Work Group recommended that, ''researchers need to develop improved methods for measurement of working hours, give much more attention to safety outcomes, and focus on populations most likely to work long hours'' [NIOSH, 2002, page 12]. Finally, the OOW Work Group suggested that future research on working hours should carefully examine:

- The effects of modest increases in working hours.
- How the effects of long work hours might be modified by alternative work schedules and work-rest regimens, and varying domestic demands.
- The task-specific effects of long work hours (e.g., effects of long work hours for physically demanding tasks and other hazardous exposures).
- The effects of unplanned and mandatory overtime.

Following the publication of the OOW report in 2002, NIOSH initiated the next stage of the NORA process involving the formation of focused sub-groups assembled to further refine and in some instances to begin implementing the recommendations put forward in the report. The first such group to be organized was the NORA Long Working Hours Team (afterwards referred to as the LWH Team). Beginning work in 2003, the LWH Team organized an international conference sponsored by the Work and Health Research Center of the University of Maryland School of Nursing in Baltimore in the spring of 2004. The conference brought together 175 scientists, policy makers, and practitioners from a variety of relevant disciplines, representing the academic, government, business, and labor communities. A number of research papers and reports were either commissioned for the conference or grew out of a synthesis of the insights generated at the conference. Five of these papers are published in this issue of the Journal. The papers, presentations, and discussions offered at the conference focused on four major themes concerning working hours: societal trends, health effects, ameliorative efforts, and research needs. A discussion of some of the most critical issues raised at this conference follows.

WHAT IS HAPPENING AT A SOCIETAL LEVEL IN TERMS OF LONG WORKING HOURS?

Long Hours Are Increasing But Not in the Way That We Once Thought

The importance of Juliet Schor's [1991], *The Overworked American* in which she argues that the average amount of working hours per week were increasing after having fallen for nearly a century were acknowledged by Dr. Jerry Jacobs. Her findings were the subject of considerable debate during the 1990s with other researchers, using time diary data, arguing that average working hours were actually decreasing [Schor, 2000]. He discussed these seemingly contradictory findings and stated that Schor had basically gotten it right—that Americans are indeed feeling more overworked and squeezed for time, but not for the reasons that Schor had originally suggested (i.e., that they were on average working more hours). A detailed analysis of trends in working time was presented which showed that time pressure, although real, is not due to the lengthening of the average work week, which has actually changed very little, but because of a bifurcation in working time with some jobs requiring very long weeks and others very short weeks [Jacobs and Gerson, 2000, 2004]. He refers to this as a ''time divide'' which mirrors the social class divide—long working hours are increasingly being concentrated among managerial and professional workers while shorter working hours occur among lower level production and service employees with more modest educational training.

Another important societal trend has contributed to the feeling of time pressure. According to Jacobs, although individual workers may not be working that much more, the family is being squeezed for time because both partners are working. This substantial increase in dual-earner couples means that the combined working time of households has increased markedly. An analogous trend is the rise of single-parent households where one worker experiences the combined burden of employment and domestic responsibilities [Jacobs and Gerson, 2004]. It is the emergence of these trends, and their combined effects that explain why Americans are actually more pressed for time. He suggests that the intensity of job demands for productivity and performance have also increased.

The 24/7 Economy Is Creating a Greater Demand for Jobs With Non-Standard Working Hours

Harriet Presser [2003, 2004] argued that it was important to look not so much at the average number of working hours but at which hours are being worked. Demand for non-standard, irregular hours has been driven by macro-level

social factors such as the decline in manufacturing and the rise in the service economy. Two-fifths of all employed Americans work mostly during evenings, nights, weekends, or on rotating shifts outside the traditional 9-to-5 work day. There is increasingly a complex time structure which particularly affects the working poor. This includes primarily low wage occupations such as cashiers, truck drivers, sales workers, waitresses, cooks, janitors, food service workers, and nurse's aides. There is generally little pay advantage to working these kinds of long working hours. These kinds of working hours often have an adverse impact on the family and are associated with poor overall health and higher levels of marital dissatisfaction and marital instability.

Women and Those in Working Class Jobs Have Much Less Control Over Working Hours

Not all jobs are created equal. As Juliet Schor [1999, page 1] has suggested ''hours tend to be inflexible downwards.'' For example, control over working hours tends to be much higher for those in managerial and professional jobs, according to Jacobs and Gerson [2004]. This kind of flexibility is generally not available to those who are in the greatest need of it, which often includes mothers or single parents of either sex. Rarely do those working non-standard hours actually choose to work in these kinds of jobs, according to Presser [2004]. The absence of widely available day care in our society exacerbates the impact of long working hours on all parents. In addition, it increases the class disparities associated with long working hours, with those who can privately employ others to perform their domestic labor being at an increased advantage relative to those families who cannot usually afford that kind of paid support. According to Presser [2004]: ''As with many other social problems, the burden of these schedules disproportionately affects the working poor, reflecting their lack of options in the workplace and adding to their disadvantage.''

Social class differences in long working hours are also examined in the paper by Grosch et al. [2006, this issue] in this special section. Grosch et al. present original data from the 2002 General Social Survey quality of work life module that addresses the question ''Who is working long work hours?'' These findings lend support to the conclusions that were presented by Jacobs and Presser at the LWH Conference: those who work overtime hours are more likely to have higher levels of education and income, to be male, white collar, and to have higher levels of decision making and the opportunities to develop their special abilities; those with fewer working hours reported less flexibility concerning their start times than the higher working hours group; women represented 65.6% of part-time workers; whites represented 84.2% of the ''highest work hours'' category; overtime hours are also associated with higher levels of stress and overwork.

Grosch et al.'s [2006] findings not only concur with Jacobs' observations, but extend them significantly. The patterns that seem to be emerging from these data are of a relatively privileged, male group of professionals who work long hours and are intensely involved in their work, have high levels of job satisfaction, yet are also likely to suffer from exhaustion, greater job-family problems, as well as, poor general and physical health. Part time workers are less stressed and report less job-family conflict, but also indicate lower levels of job satisfaction. The study by Grosch et al. [2006] is one of the first national population studies that examine long working hours in combination with the psychosocial work environment. Their findings are remarkably consistent with Juliet Schor's [1999, page 2] earlier conceptual formulation:

> . . . there is a positive correlation between hours and ''career success''/occupational prestige. More lucrative and remunerative occupations, on average, require longer hours. Similarly, within particular occupations, career advancement typically requires longer hours. Indeed, success depends on ''primary commitment to work and career'' and in some cases, participating in the ''face time'' culture. This commitment (often euphemized as an issue of ''employee loyalty'') is both overtly articulated and subtly communicated, as a growing literature on workplace culture and temporal norms describes. Employees who appear to place their families first put themselves at risk for career immobility.

WHAT ARE THE SAFETY AND HEALTH EFFECTS OF LONG WORKING HOURS?

There is a growing body of scientific literature demonstrating the effects of long and non-standard working hours on a variety of health outcomes including both acute reactions such as stress, fatigue, sleep disorders; adverse health behavior such as smoking and sedentary life style, as well as more long-term effects such as cardiovascular disease, gastrointestinal disorders, musculoskeletal disorders (MSDs), and mental illness [Caruso et al., 2004, 2006]. The five articles published focus on understanding and measuring the health effects of long working hours in a variety of ways and in a diversity of populations. It is immediately apparent that examining the association between working hours and health is a lot more difficult and complex a task than one would at first anticipate. The papers suggest to the reader that worker health may be affected not so much by the quantity of time per se, but rather by a combination of the patterning of that time, the intensity of work within that time, the potential for rest embedded within the time, as well as the control the worker is able to exercise over the time. One take-home message is that work time cannot be separated from the content of work itself. The quantity of hours spent in poorly

paid, monotonous, and repetitive work are unlikely to be comparable in terms of their health effects to those spent in more rewarding and highly remunerated professional activities.

The article by Folkard and Lombardi [2006, this issue] represents a major re-evaluation of our understanding of the impact of shift work on safety and health. The authors have summarized much of the available literature and have pooled relative risk estimates across studies to provide an overall estimate of relative risk associated with different lengths of the work week, different types of shifts, and lengths of shifts. Their review focuses on acute accidents and injuries that have a clear time of onset, and which can be connected to a specific feature, or features of working hours and shift type. The authors suggest that fatigue is the most meaningful gauge of the impact of working hours and shift schedules on the human organism and on human functioning. A Risk Index model is presented that evaluates the combined effects of the impact of the complex patterning of shifts, hours, and the length and timing of recovery periods on human fatigue. The authors walk through each component of their model and investigate whether the research literature demonstrates evidence for significant trends in risk. They report on the pooled results across a variety of studies which suggest linear dose/response effects across a number of types of shift and working hour arrangements, including:

- Increasing risk across morning, afternoon, and evening shifts;
- increasing risk with each additional night shift worked across a span of four consecutive nights;
- a non-significant trend in risk across successive work-days;
- a significant trend in increasing risk with each additional hour on duty;
- an increasing trend in risk as the time since the last rest break increases.

Based on these results, Folkard and Lombardi [2006] create a combined effects, or ''Risk Index'' model, that is an additive linear combination of each of the components of shifts and hours noted above: type of shift, shift length, the number of successive shifts, and the interval between breaks. They conclude that it is ''necessary to consider the various features of the schedule in combination with one another, rather than in isolation from one another.''

Trinkoff et al. [2006, this issue] also use a combined effects model in their longitudinal study of the impact of work hours, mandatory overtime and being on-call on MSDs in nurses. However, these authors examine a wider variety of time-related variables and use a principal components factor analysis to identify the underlying patterns in 15 work schedule variables. The investigators identified five distinct factors:

- Work day (hours/day, working 13+ hr, non-day shifts, weekends, and working with less than 10 hr off);
- work week (hours/week, full vs. part time);
- overtime (required on-call, mandatory overtime);
- days worked in a row (number of jobs, most days worked in row);
- working on time off (breaks/day, work while sick, on vacation, or day off).

The authors report that the workday factor and the working on time off factor were independently associated with elevated risk of neck, back, and shoulder disorders, even after adjusting for psychological job demands. Mandatory overtime was associated with shoulder MSDs. After adjusting for the effects of physical job demands, however, the only significant association that remained was the effect of the workday factor on back MSDs. Although the authors do not discuss this, this may indicate that the impact of long working hours and irregular shift schedules is in some way mediated by the intensity of exposure to physical job demands which would certainly be consistent with a fatigue-related mechanism.

Nurses are a particularly important population to study because the effects of their exhaustion and fatigue are also likely to have an adverse impact on the health and safety of their patients. Nurses working more hours report a greater likelihood of errors in patient care [Rogers et al., 2004]. Police officers are in a similar position in relation to the communities they serve according to Vila [2006, this issue]: ''Many of their most difficult and complex decisions are made in fluid, ambiguous, and emotionally charged situations where lives, property, and liberty can be lost in a split second.'' Only recently, however, has there been a concerted attempt to regulate or enforce limits to working hours in this occupational group, Vila reports. Even when regulated, however, the limits are so high (for example, 96 hr per week for the Boston Police Department) that they are unlikely to be protective. The demands on law enforcement and health care workers are very similar: the pressure to work long hours is enormous therefore there is a clear need to provide protection for workers, their patients, and the general public through strong regulatory mechanisms [Trinkoff, 2006, this issue; Vila, 2006, this issue]. One impediment to creating such a protective regulatory framework is the lack of a strong body of rigorous research linking long work hours and shift schedules, to decrements in stress, fatigue, and performance. Vila's paper describes a long-term and ongoing research program that involves the National Institute for Justice, the National Institute for Mental Health, the Centers for Disease Control, and NIOSH, as well as, a number of academic researchers and local police departments. This set of research studies has been designed to ''help understand how long work hours, inadequate sleep and stress interact to interfere with officer performance,

health, and safety—-and to help police and other first responders better manage the long and often erratic hours they work'' [Vila, 2006, this issue]. The longitudinal studies Vila describes in his paper are designed to unravel the causal sequencing of how specific work hour and schedule components give rise to stress and fatigue, and how these in turn influence health and performance. Hopefully, knowledge obtained in highly visible and client sensitive occupations such as law enforcement and nursing may eventually lead to generalization to other occupational groups as well.

WHAT ARE THE ORGANIZATIONAL RESPONSES THAT ARE EMERGING TO AMELIORATE THE POTENTIALLY ADVERSE EFFECTS OF LONG WORKING HOURS?

A major theme in the Long Working Hours Conference concerned what organizations and institutions should be doing to either reduce long working hours or to ameliorate their impact on human health. Bill Kojola [2004] representing the AFL-CIO emphasized that overtime hours are often mandatory—worker's simply can't say no. In addition, there are often no limits to the hours workers are forced to work which in some cases can escalate to 168 hr of work per week [Kojola, 2004]. He argued that though we need to continue to do additional research, there is sufficient evidence of a dose/response relationship at this time to recognize that excessive hours at these levels represent a genuine workplace hazard. Therefore, he urges the passage of protective legislation and the introduction of other safeguards without further delay. According to Kojola labor unions are already using collective bargaining, contract language, and strikes to limit the authority of employers to mandate long overtime hours. This has been most successful among nurses in hospitals, where overtime has become a widespread safety concern, not only for the nurse, but for their patients. By emphasizing the relationship between long working hours, fatigue, and patient safety, nurses and their unions have been successful in passing legislation limiting the use of mandatory overtime in six states [Kojola, 2004]. He also emphasized how important it is to see long hours in the broader context of how work is organized: intensity, load, pace, staffing levels, and rest breaks are all important to consider as they interact with long working hours.

David LeGrande [2004] representing the Communications Workers of America emphasized the importance of utilizing education and training materials to increase the awareness of the adverse health effects of long working hours both among the leadership and among the membership of the union. Their union has also been active in promoting additional research as part of ''institutionalizing the topic of work organization and the field of ergonomics within the U.S. and the international labor movement'' [LeGrande, 2004]. Both LeGrande [2004] and Kojola [2004] emphasize the importance of understanding the significance of long work hours from a public policy perspective, for the erosion of the 40-hr week as the acceptable cultural and legal norm may have a detrimental effect on all workers rights.

At the LWH conference, the presentation by Dawson et al. [2004] of Circadian Technologies, Inc., suggested that in the real world of business an emphasis on the financial bottom line is one of the main operational drivers used to justify an extension of working hours. For example, overtime is often justified as a way for employers to save the costs of recruiting and training new hires. Dawson et al. [2004] argue, however, that the costs associated with excessive overtime hours often severely compromise productivity, as well as, health and safety. Therefore, the true costs for overtime employees are often much more than is usually realized. Dawson et al. [2004] suggest that: ''These indirect costs relate, for example, to an increased risk of heart attacks, diabetes, high blood pressure and mental illness; a greater risk of retirement disability; increased safety risks due to human error; lowered productivity and presenteeism; increased chance of turnover and absenteeism; and costs of liability issues and law suits.'' For example, data from 18 manufacturing industries in the US show that a 10% increase in overtime was associated with a 2.4% loss in productivity [Shepard and Clifton, 2000]. Dawson et al. [2004] suggested that the management of overtime should become an integral part of sound company policy.

WHAT ARE THE MOST CRITICAL RESEARCH NEEDS IN THE FIELD OF LONG WORK HOURS?

The NORA LWH Team article [Caruso et al., 2006, this issue], provides a major new synthesis and integration that directly addresses future research needs. The LWH Team authors have integrated the research literature, as well as, many of the discussions that occurred in the conference and have developed a broad conceptual model that identifies the determinants, outcomes, and moderating factors of long work hours and their relationship to health. This paper addresses many of the conceptual and methodological challenges in the field of work hours and health research. Their discussion sheds light on research on other types of work organization exposures as well. Some of the LWH Team's key points include:

- The varying exposure methodologies combined with the complexity of mitigating factors have made it very difficult to establish safe exposure limits.
- Studies of work schedules must provide clear and complete details of the actual patterns of work hours.

- Clear tracking metrics are needed for future research—total hours for all paid work, start end times, consecutive work days and rest days, etc.
- Studies are needed that model the relationship between progressive work duty time and specific outcomes such as fatigue, performance and safety.
- Total work hour measurement should include extra jobs, overtime (and, one might add, hours spent in domestic work).
- Longitudinal prospective studies that examine the impact of carefully measured hours worked over many years are needed.
- Combined effects models such as the joint influence of long work hours and various directions and speeds of rotation should be examined.
- Research on the health effects of workers' ability to predict and control their work schedules is needed.
- The moderating effects of age, sex, health status as well as the job and organizational context on the relationship between long work hours and health outcomes should be examined.
- Researchers should begin to study the process by which immediate biological effects such as stress and fatigue lead to more long-term health outcomes such as cardiovascular disease, MSDs, and mental illness.
- The impact of long working hours on family well-being needs to be investigated.
- Research on the effects of long work hours on worker performance, for example public safety and/or patient safety outcomes is very important.
- A variety of interventions should be tested to examine the effects of both workplace and broader societal strategies directed at work hours and job content.

CONCLUSIONS AND POLICY IMPLICATIONS

Although substantial challenges to causal inference remain, the papers published in this special section indicate that there is a growing acknowledgement within the scientific community that long working hours, especially in combination with other adverse aspects of work organization such as irregular working hours and intense performance demands are strongly associated with fatigue, stress, decrements in performance, adverse health behaviors, and both acute and chronic physical disorders [Caruso et al., 2006, this issue]. Longitudinal studies are now being undertaken to further examine the temporal process by which exposure to irregular and long work hours may lead to acute and then chronic health outcomes [Vila, 2006, this issue]. In occupations where the consequences of the exhaustion and fatigue related to long work hours may adversely impact the public there have already been efforts to regulate extreme working hours. For example, rules governing hours of work were established for truck drivers by the Interstate Commerce Commission as early as 1938 which limited driving time to 10 hr in a 24-hr period and required at least 8 consecutive off duty hours within each 24-hr period [Wylie, 2005]. In 2003 the Department of Transportation further increased this to 10 consecutive off duty hours within a 24-hr period [Wylie, 2005]. Today, health care workers often work shifts that are far longer than this: Until very recently medical residents regularly worked 32-hr shifts with 2- to 3-hr of sleep [Barger et al., 2005]. Nurses also frequently work extended shifts of up to 16 hr [Scott et al., 2006]. In 2003 new regulations limiting medical residents to 30-hr shifts and 80-hr work weeks were introduced by the Accreditation Council for Graduate Medical Education, the licensing body for resident training programs. The contrast in the working hour limits for truck drivers established in 1938 and physicians-in-training in 2003 is quite striking. It is also interesting to note that residents working extended shifts are 2.3 times more likely to report a motor vehicle crash and 5.9 times more likely to report a near-miss incident compared to when they are working a non-extended shift [Barger et al., 2005]. In New York the law limits residents to 24-hr shifts, as does the law passed recently in Puerto Rico. Similar legislation has been introduced in the US House and Senate and in the states of Delaware, Pennsylvania, New Jersey and Massachusetts [AMSA, 2006]. Regulatory efforts have been received with considerable controversy and debate at a national level and within the medical profession, and the absence of strong research that specifically links fatigue in health care workers with medical errors is cited as an important reason to continue to postpone the regulation of work hours through legislation. [Gaba and Howard, 2002; Brennan and Zinner, 2003]. However, more recently, Wylie [2005] has argued that medical residents and truck drivers have basically similar sources of fatigue and are likely to react the same way because of sleep debt and disturbed circadian rhythms. He argues that the fundamental determinants of fatigue are not new but were identified in one of the first studies of working hours and fatigue, performed among drivers over 60 years ago [Jones et al., 1941]:

- Performance of a skilled operation requiring a high degree of alertness and attention. . .;
- Nervous strain due to driving under adverse conditions. Fear of accidents and feeling of responsibility for cargo play a part in causing strain.. . .;
- Muscular exertion. . .;
- General irregularity of habits, particularly in respect to sleep, food, recreation, and exercise;
- Failure to obtain satisfactory rest or sleep during rest periods at work or when off duty. [Wylie, 2005, page 197]

Although the 80-hr resident work week was met with considerable controversy in the US, it is substantially less

protective than what has existed in the European Union countries since the early 1990s. In the EU restrictions on the weekly working hours of doctors in training are being decreased in stages: 58 hr from 1 August 2004 to 31 July 2007; 56 hr from 1 August 2007 to 31 July 2009; 48 hr from 1 August 2009 [BBC, 2006]. The European Union's Working Time Directive provides a legal framework that governs working hours in 25 member states of the EU. It protects all workers, not just those with duties that may have an impact on the public. The basic mandate of the Directive is that no employee must work more than 48 hr per week. Recently the European Court of Justice has ruled that on-call time must also count as working hours [BBC, 2006]. There is currently an 'opt-out' feature that allows workers to work more than 48 hr if they wish, though the EU Parliament is reportedly considering closing this loophole.

The remarkable difference between US and EU standards and policies regarding working hours underscores the political and historical nature of the protective efforts in this field. From a historical perspective even the 48-hr limits of the EU are substantially less protective than the standards fought for and largely won in the US by the end of the 1920s. The 8-hr day had become almost universal in the United States by the early 1920s, and the focus of the working hour movement had begun to shift to the establishment of the 5-day week. Meeting in October 1926 in New Orleans, the AFL once again committed itself to working for this further reduction in working hours in words that continue to have relevance today [Hunnicutt, 1984, page 375]:

> Whereas if compelled to work for long hours under modern processes of production, the vitality, the health, and the very life of workers is put in serious jeopardy.

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