

Editorial

International consensus statements on non-standard working time arrangements and occupational health and safety

Introduction

Workplaces have changed profoundly in the last century, especially in the developed world. In many places, the workforce has gone from being relatively homogenous—predominantly male employees in full-time employment living within traditional family groupings—to quite diverse—greater cultural diversity, greater participation rates for women, increased use of automation and technology, increased work intensity, significant casualization, and a significant increase in “on-call” working time arrangements^{1–6}). Importantly, working times have increasingly shifted into the night, and workplaces have increasingly become “24/7” (24 h per day, 7 d per week), leading to a substantial increase in productivity, availability of goods and services around the clock, and economic growth^{7–9}).

While there is little doubt about the benefits associated with the provision of goods and services around the clock as enabled by the 24/7 economy, this does not come without consequences since it requires many individuals to be subjected to shiftwork schedules and other non-traditional working time arrangements. In developed countries, around 20–25% of workers have non-standard working times^{10–12}), although what constitutes “non-standard hours” is subject to interpretation and change.

Work schedules outside the stereotypical Monday–Friday “9-to-5” timeframe—or rather, working more than 8 h per day, more than 40 h per week, and/or between 9pm and 9am—have long been associated with deleterious effects on the safety, health, and well-being of workers and their families and communities^{13–18}). The reasons for these effects include insufficient time for sleep, misalignment of the biological clock, and a multitude of other factors that are only partially understood¹⁹). Regardless, the costs of these adverse consequences of non-standard work schedules to workers, industries, governments and society are significant. In developed countries these costs are estimated to be in the hundreds of billions of dollars annually in terms of lost productivity²⁰)—in addition to loss of social capital owing to reduced cultural, social and

psychological well-being. In developing countries, where workplace conditions may be relatively hazardous and associated risks may be exacerbated by non-standard work hours, the relative economic and social costs may be even greater²¹).

Not surprisingly, there is a growing interest among regulators, employers, and employees in the adverse effects of non-standard work hours for productivity, safety, health, and well-being, and in mitigating these effects. However, the effects of shiftwork on workers, organizations and communities are complex, and the extant literature does not provide clear, unequivocal advice regarding the design and regulation of working time arrangements. Much of the available research is opportunistic and limited by the circumstances of the data collection, and some of it is biased by pre-conceived perspectives. Overall, the literature on working time arrangements is sporadic and mixed, inadvertently enabling stakeholders to draw selective findings from the literature in support of opposing views.

To address these issues, the Scientific Committee on Shiftwork and Working Time of the International Commission on Occupational Health (ICOH) commissioned a series of papers from the Working Time Society (WTS) to provide a broad and international perspective on the current state of research, identify working time-related health and safety risks, recommend guidance for effective interventions to mitigate adverse outcomes from non-standard working hours, and suggest future directions. In that context, the goal of this special issue of *Industrial Health* is to provide succinct and clear information—in the form of consensus statements—on key issues in the field of shiftwork and working time arrangements.

Working Time Society Papers and Consensus Statements

In response to the request from ICOH’s Scientific Committee on Shiftwork and Working Time, an Editorial Board was formed consisting of Drs. Imelda Wong and Drew

Dawson, with assistance from Dr. Hans Van Dongen. A series of papers were proposed by the Editorial Board to address a broad spectrum of topics related to the health and safety outcomes associated with non-standard working time arrangements. It was determined that the goal of these papers would be to provide guidance statements for an international audience of researchers, industry members, workers, labor representatives, and policy makers, on managing fatigue associated with non-standard working hours and ensuring worker health and safety.

For each paper, the writing process was overseen by a member of the WTS Board of Directors or another subject matter expert appointed by the Board, who formed an authorship team. Each team worked for approximately 6 months to prepare a draft version of their paper, to be presented for discussion at the 24th International Symposium on Shiftwork and Working Time in Uluru, Australia, held in June 2017. Author teams were asked to include with their papers a number of proposed consensus statements to capture the scope of scientific agreement. Prior to the 2017 International Symposium, draft versions of each of the papers underwent internal review by the Editorial Board and were posted on the web site of the WTS for review by the WTS membership.

Comments were solicited online—and through dedicated discussion forums during the 2017 International Symposium, which was attended by close to 100 attendees hailing from 21 different countries (Austria, Australia, Brazil, Canada, Denmark, France, Finland, Germany, Greece, India, Italy, Japan, Korea, Nepal, Netherlands, Norway, Philippines, Peru, Sweden, UK, USA) and representing a multitude of different backgrounds from academia, industry, labor, and government agencies. Further comments were solicited through e-mail messages to the WTS membership, for those who could not attend the International Symposium in person. Subsequently, author teams revised their manuscripts based on the feedback they received from the WTS members. Each paper also underwent an external review by 2 topic experts.

The consensus statements from each paper underwent an extensive discussion among a panel of 3 experts—which included a member of the WTS Board of Directors and two topic experts with no conflicts of interests related to the topic of the paper (and not having served as external reviewer of the paper)—to ensure the messages provided are accurate and congruent with the available science.

A total of 9 papers resulting from this effort are presented in this special issue of *Industrial Health*. In sequential order, these papers address the following topics:

- *Evidence-based effects on shift work on physical and mental health.* Moreno and colleagues²²⁾ provide a broad overview of the adverse health effects associated with shiftwork. They describe and evaluate the current evidence for chronic diseases such as cardiovascular and cancer, other physical effects such as metabolic syndrome, reproductive disorders and gastrointestinal illnesses, and mental health effects such as depression.

- *Circadian time structure impacts vulnerability to xenobiotics—Relevance to industrial toxicology and nonstandard work schedules.* Smolensky and colleagues²³⁾ consider human circadian rhythms and raise the question that if workplace threshold limits and biological monitoring methods for toxic exposures are based on studies of daytime workers, should they be revisited and adjusted for those working at night? Recommendations from the authors include considerations in improving measurements of circadian timing and its association with acute and chronic adverse health effects to inform workplace threshold limits.

- *Psychosocial stressors relevant to the health and well-being of night and shift workers.* Fischer and colleagues²⁴⁾ approach the psychosocial health and well-being challenges of shiftwork using two well-known psychosocial models: the Job Strain Model and the Effort-Reward Imbalance Model. Suggested solutions to addressing psychosocial stressors stemming from shift work include multidisciplinary approaches to the recognition, assessment and implementation of control measures such as work scheduling and provision of workplace violence reduction programs.

- *Evidence-based effects of shift work and non-standard working hours on workers, family and community.* Arlinghaus and colleagues²⁵⁾ discuss stress related to shiftwork from the perspective of social impacts, and raise the issue that the effects of shiftwork are not confined to the worker. The authors review the current evidence regarding conflicts between working time arrangements and various social and family variables and provide recommended strategies to reduce these adverse effects and improve work-life balance and social well-being.

- *Individual differences in shift work tolerance and recommendations for research and practice.* Ritonja and colleagues²⁶⁾ discuss individual differences in tolerance and adaption to shiftwork, which can be attributed to a range of individual and workplace factors. While acknowledging that the understanding of shiftwork tolerance is limited in the current body of evidence, the authors offer a number of practical solutions for employers and employees to

mitigate the harmful effects of shiftwork at the level of individuals.

- *Evidence based interventions using light to improve circadian adaptation to working hours.* Lowden and colleagues²⁷⁾ discuss the significant role that light plays in entraining circadian rhythms and how exposure to light at night, as is common among shift workers, can have adverse health and safety implications. The authors review human and animal laboratory studies to highlight effective use of lighting strategies, including timing and intensity, to adapt and realign circadian rhythms.

- *A multi-level approach to managing occupational sleep-related fatigue.* Wong and colleagues²⁸⁾ discuss a hypothesized sequence of events that may occur prior to a fatigue-related incident and suggest a layered approach to reducing the risk for fatigue-related incidents by offering suggestions for each level of the fatigue-risk trajectory. Aspects discussed include providing adequate opportunities to obtain sufficient, quality sleep; strategies for recognizing and alerting fatigue-related behaviors and errors; and a brief introduction to fatigue-risk management as a long-term sustainable strategy.

- *Regulatory approaches to reducing the risk associated with shift work: a global perspective.* Gärtner and colleagues²⁹⁾ describe international approaches across Europe, Asia, Australia and North America to reduce the adverse health and safety risks associated with shiftwork. Recognizing cultural differences across countries, lessons can be learned from commonalities among some regulatory approaches and recommendations to keep shiftworkers healthy and safe.

- *Prescriptive rule sets and risk management-based approaches for the management of fatigue-related risk in working time arrangements.* Honn and colleagues³⁰⁾ compare traditional, prescriptive approaches to work scheduling with modern, more holistic approaches based on fatigue risk management. They argue that in around-the-clock operations, the relationship between regulatory compliance with prescriptive rule sets and safety outcomes tends to break down, and risk management-based strategies designed to regulate the procedures associated with managing fatigue-related risk provide a viable alternative.

Collectively, these papers and their consensus statements represent the efforts and reflect the knowledge base of the members of the WTS, presented here in an open access format through *Industrial Health* so that the information is accessible to a broad audience. It is our hope that these papers inform discussion on the issues associated with non-standard work schedules, provide guidance on

available resources and potential solutions, and encourage efforts—ranging from the international to organizational level—to reduce the adverse consequences faced by workers in non-standard working time arrangements.

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