

SHIFTWORK INTERNATIONAL NEWSLETTER

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EDITORIAL

Web-site for shiftwork research and practice is now available. Please visit us !
Johannes Gaertner and Michael Kundi developed the new version of the Web-Site for SIN. Not only the contents of regular SIN issues, but also pieces of information by SIN readers and other information sources are included. The address of the web site of the SIN is: [Http://128.130.176.47/](http://128.130.176.47/)

Call for more inputs

The editors of SIN intend to deliver any information concerning shift and night work and changes in shiftwork conditions from various parts of the world. The editors would like to ask for kind contribution from the SIN readers including reports of innovative experiences for improving shift and night work. Short articles describing

new developments, new methods, newly organized meetings and recent topics are most welcome. Your submission should be sent to the following editors:

- Hardcopy issues of the Shiftwork International Newsletter:
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Subscription of the SIN

The Shiftwork International Newsletter (SIN) may be subscribed in either of the two ways:

- (1) the participants of each of the International Symposium on Night and Shiftwork paying the full registration fees become SIN subscribers for two years as the subscription fees are included in the symposium registration. (Therefore, the participants of the 14th International Symposium in Wiesensteig automatically get this copy);
- (2) SIN may also be subscribed by transferring US \$35 (for two years) directly to the editors' account (direct transfer is necessary because bank drafts of a small amount of \$35 cannot be accepted by the bank: see below !):

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You may request a free membership if you have financial hardship or difficulty in obtaining foreign currency.

Unfortunately we have problems in cashing a check of small amount, such as US\$35, due to commission paid to the bank, direct submission of the subscription fee during the next International Symposium on Night and Shiftwork in Tokyo, in 2001 would be, in fact, most appreciated.

We apologize for your inconvenience. Of course, all account in Japan have surely been registered and kept in our mailing list without paying any additional charge.

ILO New publication:**Working time – Its impact on safety and health –**

ISBN 89-950050-1-7-92330

This new publication (2003) by Dr. Anne Spurgeon of the University of Birmingham (UK) Institute of Occupational Health provides a comprehensive review on the current trends, problems and intervention strategies in working time issues. Special attention is paid to safety and health in diversifying working time arrangements. In particular, safety and health of workers engaged in shift work, night work, “compressed” workweeks, and other “non-standard” working time arrangements are highlighted.

Chapter 1, “Background and scope” gives a brief history of working time arrangements as a core issue in the working conditions. Two objectives of this book are mentioned. The first objective is to describe the information about both positive and negative impacts on the well-being of workers by different types of work patterns. Second objective is to examine how available information can offer people working time arrangements towards healthier and more productive lives.

Chapter 2, “Current trends” reviews the recent research papers to provide a clear-cut summary on numbers of work hours, patterns of hours including shift work, and legislation. Comparison of working hours by countries and occupations is provided. Legislative measures taken by countries are briefly summarized. Special attention is paid to roles of ILO’s Night Work Convention (No. 171) and European Council Directive 93/104/EC.

Chapter 3 discusses methodological issues in working time, especially shift work research such as complexity of working time perspectives, healthy worker effects, or definition of exposure to shift work.

Chapter 4, working time and health,

The following points are the key findings regarding shift work and health are as follows:

- sleep disorders are widely reported;
- there is strong evidence of cardiovascular disorders;
- there is strong evidence of gastrointestinal disorders;
- in most cases, night work increases the risk of health disorders;
- except for sleep disorders, the underlying cause of any association is not fully understood.

Chapter 5 deals with working time and safety, discussing the effect of long hours, overtime, and shift work. Circadian rhythms and performance are examined from the task-related, situation-related, and individual-related viewpoints. The effect of shift work and safety was concluded as follows:

- The data relating to both shift work in general, and night work in particular, are inconsistent and inconclusive;

- Despite the lack of consistent and conclusive evidence, it should not be concluded that shift work is safe. There are numerous possible explanations for the varying effects of shift work on safety;
 - The data or its interpretation may be biased by the nature of the accident reporting system, or the particular organizations which were studied, and
 - The occurrence or not of more accidents is likely to depend on a number of characteristics of the individual, the job and the workplace.

Chapter 6 examines individual differences such as gender, age, individual circumstance, personality attitudes and behaviour patterns, physiological and health status, and job types. It summarizes that shift work is not advisable for workers with the following characteristics:

- over 50 years old;
- morningness/sleep rigidity;
- history of sleep disorders;
- history of psychiatric disorders;
- history of gastrointestinal problems;
- history of cardiovascular disease;
- history of drug and alcohol abuse;
- neurotic introversion;
- epileptic;
- diabetic;
- regular long-term medication;
- heavy domestic responsibilities;
- low family support;
- high stress job;
- high fatigue job.

Chapter 7 on intervention strategies provides a summary of options for intervention as follows:

1. Work schedule organisation
 - Forward shift rotation
 - Optimal speed of shift rotation*
 - Optimal shift start and stop times*
 - Optimal rest breaks*
 - Limitation of overtime
 - Limitation of night work

(*Take into account individual characteristics and job demands)
2. Environment modification
 - Bright light introduction
 - Attention to temperature
 - Where possible reduce physical workload at night
 - Optimize workplace facilities
3. Individual help
 - Sleep management
 - Health promotion (diet, exercise)
 - Counseling and stress management
 - Training and education

Chapter 8 handles the management of working time: practical recommendations. General principles to assist in schedule design based on current scientific evidence is summarized.

- Night work is best avoided or limited where possible
- Unpredictable, irregular hours, particularly where these are beyond the worker's control, should be avoided if possible, or limited
- Working weeks in excess of 48 hours on a routine basis should be avoided. Reduction of weekly hours to below 40 is preferred
- Overtime should be limited, distributed between workers, and not routine
- Where shifts rotate, forward rotation is preferable
- Weekly rotation is undesirable
- Slow rotation (2-3 weeks) is likely to produce phase adjustment
- Fast rotation (1-2 days) maintains workers on a normal circadian cycle
- Phase adjustment is preferred for workers whose jobs are largely routine and therefore particularly susceptible to fatigue effects
- Jobs which are mentally stimulating are less susceptible to fatigue effects and probably more suited to schedules where phase adjustment does not occur
- Traditional starting times for shifts, notably 6 a.m. for the morning shift, may not be optimal. Later starts (7-8 a.m.) should be considered
- Shift changeover times are vulnerable points in terms of errors and accidents
- Where work is extended beyond an 8-hour period a re-assessment of other occupational risks (chemical, ergonomic, noise etc) should be carried out
- In all cases the participation of workforce representatives in schedule design is highly recommended -

In Chapter 9, the author discussed the future research needs. Five broad areas of inquiry are identified as research needs. They were: (1) situations that have been under-investigated (e.g. irregular and unpredictable hours); (2) effects which have been under-investigated (e.g. family and social effects); (3) potential effect modifiers (e.g. the possible influence of attitudinal variables on effects); (4) the effectiveness of various potential interventions; and (5) issues related to systems of health monitoring.

The book is published jointly by the International Labour Organization and Occupational Safety and Health Research Institute, Korea Occupational Safety and Health Agency.

**Working Time Research Abstracts from the 15th International
Symposium on Night and Shiftwork, Hayama, Japan,
10-13 September 2001**

- First part of the two parts -

(From Journal of Human Ergology, Vol.30, Nos. 1/2)

P R E F A C E

There are diversifying forms of work associated with rapid technological, economic and social changes. A clear trend is seen towards flexible working time arrangements in responding to various business needs and workers' preferences. Managing shiftwork systems thus requires a comprehensive approach looking into the interactions of phase-shifted work schedules with business performance and with safety, health and well-being of workers. Shiftwork is considered today as one of the most important work-related stress factors. It is therefore necessary to explore practical measures to improve the management of shiftwork learning from positive advances.

"Innovative strategies in managing shiftwork" was the main theme of the 15th International Symposium on Night and Shiftwork held in Hayama, Japan, from 10-13 September 2001. The symposium was one of the international symposia serially organized since 1969 under the auspices of the Scientific Committee on Shiftwork of the International Commission on Occupational Health. About 180 participants from 28 countries attended the Hayama symposium.

This special issue of the Journal of Human Ergology contains a selection of papers presented at this symposium. A group of reviewers from the Scientific Committee undertook the task of reviewing these papers. The papers covered the seven themes of the symposium: (1) innovative shiftwork management; (2) risk management at shiftwork; (3) sleep/wake rhythm adjustment and health; (4) shiftwork and industrial development; (5) shiftwork and well-being; (6) shiftwork of health care workers; and (7) support for shift scheduling.

In the meeting, the strategies in managing shiftwork were discussed based on recent experiences in different countries. Innovative measures in work scheduling and in improving work life conditions of shiftworkers were a focus of the discussion. Many examples of these innovative measures were presented during the sessions. The management of safety and health risks associated with shiftwork was examined in detail, and the need for improving not only the work schedules but also the job content and the working environment of shiftworkers was stressed throughout the symposium sessions.

The discussion about the themes centered around the support for managers and shiftworkers in managing these risks and enhancing the quality of life for shiftworkers. As discussed in the symposium, such support seemed particularly useful for workers in high-risk jobs, elderly shiftworkers, women working nightshifts as well as workers in health care and other services working irregular shifts. The need for providing guidelines about workable solutions was suggested with respect to safety and health risks and management procedures including participatory steps.

The support through interactive computer-aided shift scheduling seemed promising along with these guidelines.

A particular attention was paid to the conditions of shiftworkers in industrially developing countries. These workers are working in difficult conditions and there are gaps in improving their conditions of work. The need for improving both work schedules and general workplace conditions in the process of industrial development was pointed out. Concrete support for enterprise-level measures and for participatory programs was emphasized.

The papers in this special issue highlighted the recent progress in orienting these various support measures towards improving conditions of shiftwork in different industries and countries on a more equitable basis. Many of the papers pointed to the existing gaps in achieving the necessary improvements. These papers also indicated the need to address these gaps as part of effective strategies for managing shiftwork.

During the symposium, the participants agreed to inaugurate the Working Time Society as a new international scientific body for promoting the study on working time arrangements and measures to improve them. The society will work in close collaboration with the Scientific Committee on Shiftwork. It is hoped that the new society will advance the international exchange of study results and the development of guidelines for solving working time issues including shiftwork issues discussed during this symposium.

The organizing committee of the symposium and the editors of this special issue would like to thank the authors for their papers. We hope this special issue will serve as a useful basis for future discussion concerning workable strategies for improving conditions of shiftwork.

Editors

K. Kogi and T. Sasaki

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HEALTHY SHIFTWORK, HEALTHY SHIFTWORKS

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Reflecting diversifying shift systems, extensive effort is put into managing shiftwork and reducing safety and health risks. It is accepted that shiftworkers are exposed to particular risks inherent in their irregular work schedules. This raises the question of how and to what extent we can ensure healthy work life for shiftworkers. In answering the question, we need to identify effective measures to improve both shiftworking conditions and the health of shiftworkers. Based on recent experiences in managing shiftwork, we note three directions of such measures: (a) comprehensive action to avoid risk-enhancing conditions based on general guidelines, (b) risk control as to workload, worksite ergonomics and risk reduction, and (c) support for flexible and restful working life. International standards are obviously relevant to these three aspects. Our own experiences in applying a set of ergonomic checkpoints to plant maintenance shiftwork demonstrate the usefulness of focusing on flexible work schedules and on multiple job-related factors such as night workload, ergonomic environment, resting conditions and training. There is a strong need for participatory planning and implementation of multi-area improvements as well as for relying on flexible schedules and autonomic teamwork. We may conclude that healthy shiftwork and healthy shiftworkers are compatible with each other only when certain conditions are met. In achieving this end, we need to combine (a) comprehensive measures to improve work schedules and job life, (b) strict risk management and (c) locally adjusted participatory steps for continual improvement.

STRATEGIES FOR THE IMPLEMENTATION OF NEW SHIFT SYSTEMS

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Implementation barriers may be caused by deficiencies in the knowledge, skills, motivation, or support of those involved in the process of implementation of a new shift system. There is no 'one and only' way of planning and implementing a new shift system. However, if the following factors of success are taken into consideration there is a better chance that workers will accept a new shift system: worker participation, information, communication, training, promoter commitment, professional project management, tailor-made solutions and an adequate organizational framework. These factors are particularly relevant in addressing barriers to the implementation of new shift systems. The most important measures to cope with resistance to change of shift systems are: worker participation, information, communication, training, promoter commitment, professional project management, tailor-made solutions and an adequate organizational framework.

THE 24-HOUR SOCIETY BETWEEN MYTH AND REALITY

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The 24-hour society appears to be an ineluctable process towards a social organisation where time constraints are no more “restricting” the human life. But, what kind of 24-hour society do we need? At what costs? Are they acceptable/sustainable? Shift work, night work, irregular and flexible working hours, together with new technologies, are the milestone of this epochal passage, of which shift workers are builders and victims at the same time. The borders between working and social times are no more fixed and rigidly determined: not only the link between work place and working hours is broken, but also the value of working time changes according to the different economic/productive/social effects it can make. What are the advantages and disadvantages for the individual, the companies, and the society? What is the cost/benefit ratio in terms of physical health; psychological well-being, family and social life? The research on irregular working hours and health shows us what can be the negative consequences of non-human-centered working times organisations. Coping properly with this process means avoiding a passive acceptance of it with consequent maladjustments at both individual and social level, but adopting effective preventive and compensative strategies aimed at building a more sustainable society, at acceptable costs and with the highest possible benefits.

INTERACTIVE COMPUTER AIDED SHIFT SCHEDULING

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This paper starts with a discussion of computer aided shift scheduling. After a brief review of earlier approaches, two conceptualizations of this field are introduced: First, shift scheduling as a field that ranges from extremely stable rosters at one pole to rather market-like approaches on the other pole. Unfortunately, already small alterations of a scheduling problem (e.g., the number of groups, the number of shifts) may call for rather different approaches and tools. Second, their environment shapes scheduling problems and scheduling has to be done within idiosyncratic organizational settings. This calls for the amalgamation of scheduling with other tasks (e.g., accounting) and for reflections whether better solutions might become possible by changes in the problem definition (e.g., other service levels, organizational changes). Therefore shift scheduling should be understood as a highly connected problem. Building upon these two conceptualizations, a few examples of software that ease scheduling in some areas of this field are given and future research questions are outlined.

FLEXIBLE WORK HOURS, HEALTH AND WELL-BEING IN THE EUROPEAN UNION: PRELIMINARY DATA FROM A SALTSA PROJECT

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Demand for flexible work hours (FWH) is increasing in Europe aimed at increasing the number of production hours on one hand, and, on the other, reducing individual working hours and/or increasing autonomy and control on them. In view of the lack of knowledge of the effects of FWH on health and safety, we started a pilot project, funded by the Joint Programme for Working Life Research in Europe (SALTSA), aimed at: a) comparing the most relevant national legislation and how the EU Directive 93/104 "concerning certain aspects of working time" has been implemented in the member States; b) reporting prevalence and trend of FWH in Europe according to the three EU Surveys on Working Conditions carried out in the last decade; c) collecting practical examples of innovative FWH; d) evaluating their impact on health and safety in relation to work sectors, job demands, social life, aging and gender. Consequent actions are going to include information and consultancy for pertinent authorities and social parties involved, as well as training programmes for Union officials and similar groups concerning the organisation of FWH according to ergonomic principles.

FLEXIBLE WORKING HOURS AND WELL-BEING IN FINLAND

Irja KANDOLIN, Mikko HÄRMÄ, and Minna TOIVANEN
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Flexibility of working hours became more prevalent in the 1990s in Finland. According to a representative survey on Finnish wage and salary earners (n=1790) at the beginning of 2000, a great majority of male (76%) and female (65%) employees regularly worked overtime and/or had irregular working hours every month. These employees were flexible in meeting the needs of their companies/employers. Individual flexibility of working hours was far less common, only one third of male and female employees were able to regulate their working hours. A better balance between company-controlled and individual flexibility would, however, improve the well-being of employees. Employees working overtime without being allowed to regulate their working hours felt more symptoms of distress and had more conflicts in combining workplace and family roles than those who could individually determine their working hours flexibly. An investment in individually determined flexibility, for example by means of participatory planning, would improve the well-being of employees, and thus also improve the productivity of the organization.

THE FRENCH 35-HOUR WORKWEEK: A WIDE-RANGING SOCIAL CHANGE

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The reduction of the legal working week to 35 hours in France has generated wide-ranging social change. We examine the resulting changes in working-time patterns as well as their repercussions on the use of the time gained and on the quality of life and health. To compensate the reduction in the length of the working week, companies have modified the working-time patterns, by extending operation time (shiftwork, atypical schedules) and by matching the on-site workforce to production requirements (flexible working hours). They have sought to make more efficient use of working time: job intensification or job compression. The effects on the off-the-job life and health are linked to the shiftwork and atypical schedules designed to increase the company's operating time, and adjustments to the company's need for flexibilization impose working time/free time patterns that are at odds with biological rhythms and social life patterns. Changes to working-time patterns have unexpected consequences for work organization: heightened difficulties for the individual and the crew. These changes may generate a range of health problems related to overwork and stress. The way some companies have adapted may call into question the usefulness of work done by employees, thus damaging their social identity and mental well-being.

FLEXIBLE WORKING TIME SYSTEMS - THE PROCESS OF DESIGN AND IMPLEMENTATION -

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Examples of the design and implementation processes of flexible working time systems are derived from a counselling project in North Rhine-Westphalia, Germany. The practical cases shown represent a diversity of variable or flexible working time systems according to different branches and different anticipated aims to reach with flexibility. For companies flexibility should improve or at least consolidate their economic situation, and for employees flexibility should result in a beneficial effect on health, family and social life. Three examples of counselling practice are reported in this paper, each case representing a different approach to flexibility in working time. To avoid overtime an industrial production plant expanded the weekly operating time without increasing the employees working time. For this purpose shifts off had to be planned. To provide a continuous service one department of a service company changed from duty on call to regular shifts on weekends. Responsibility in handling the new working times was assigned to the team. In an old people's home working times were designed according to the irregular demands throughout the day, in combining full and part-time jobs adequately.

THE EFFECTS OF DOUBLE-SHIFTS (15.5 HOURS) ON SLEEP, FATIGUE AND HEALTH

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The aim of the present study was to investigate how “double-shifts” (15.5 hours) affects sleep, fatigue and self-rated health. The study was carried out on male construction workers of which 80% were long-distance commuters. The schedule involved two work periods and each work period involved two double shifts in a row. The subjects filled in a sleep/wake diary at 8 times across a year and a questionnaire at 3 times. They also wore an actigraph during one shift cycle. The results showed that sleepiness, and to a certain extent, mental fatigue increased during double shifts and accumulated across days. The short rest time (8.5 hours) between days caused insufficient sleep and approximately 5.5 hours of sleep was obtained between double shifts. Questionnaire data showed that complaints of insufficient sleep, exhaustion on awakening and pain symptoms increased across the year. It was concluded that a shift system involving double shifts has a negative effect on fatigue, recovery and health-related well-being.

PREDICTING SHIFTWORK-RELATED OUTCOMES: SHIFTWORK LOCUS OF CONTROL AND CIRCADIAN TYPE

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This research discusses the use and viability of the shiftwork locus of control construct alongside circadian type measures as a potential predictor of shiftwork-related outcomes. The shiftwork locus of control (SHLOC) scale, measures of circadian type and shiftwork-related outcome measures were completed by 100 shiftworkers on two occasions separated by seven months. The SHLOC scale measures shiftworkers' generalised beliefs about the levels of personal control they perceive in relation to four major functional domains commonly associated with shiftwork-related disruption. These domains include: sleep, social, health and work problems. The results of multivariate regression analysis showed the SHLOC scale to be predictive of the experience of shiftwork-related sleep and social-life problems while the circadian type measures were predictive of alertness at 7 months. The results suggest that a constellation of personality factors may be an important influence on an individual's tolerance to shiftwork.

THE EFFECTS OF A ROSTER SCHEDULE CHANGE FROM 8- TO 12-HOUR SHIFTS ON HEALTH AND SAFETY IN A MINING OPERATION

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The current study examined the impact on employee health and safety of changes to the roster system of an Australian coal mine. Absenteeism and incident frequency rate data were collected over a 33-month period that covered three different roster schedules, an 8-hour system, a 12-hour system and a 12-hour system incorporating unregulated overtime. The first change was implemented after consultation with the employee population, whereas the second was not. There were no significant negative effects of the 12-hour pattern, when compared to the 8-hour system. However, when unregulated and excessive overtime was introduced as part of the second round of changes, absenteeism rates were increased in one sector of the mine. The maintenance sector was subject to a significant increase in absenteeism rates, which may have been attributable to the excessive overtime required of the workers in that area. It is important that overtime be strictly monitored and that the employee population are involved in the process of roster change.

A STUDY OF NURSE SCHEDULING IN JAPAN

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Scheduling nurses to staff shifts is a major problem in hospitals. The necessity of maintaining a certain level of service and skill in the makeup of every shift, while balancing the workload among the nurses involved, is incredibly difficult. It is often impossible to develop a schedule which satisfies all the requirements despite the time and resources spent in the effort. This paper summarizes all our published research on nurse scheduling to date. The difficulties realized by our two investigations in Japan are shown first, together with a resulting scheduling problem. The nurse scheduling model based on the results is then described. In this model, all constraints are divided into two essentially different types; that which maintains a certain level of skill for each shift ('shift constraints') and that which concerns the workload for each nurse ('nurse constraints'). By classifying the constraints in this manner, we can determine what is affected by a specific constraint when the constraint is not satisfied. We developed efficient algorithms while taking advantage of the structure of this model. Finally, it is shown that our algorithm can solve this problem for a 2-shift system efficiently.

BALANCING FLEXIBILITY FOR THE EMPLOYER AND THE EMPLOYEE: A CASE STUDY OF THE DEVELOPMENT OF ANNUALIZED HOURS EMPLOYMENT CONTRACTS

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As with many forms of flexible working, Annualized Hours (AH) systems offer potential benefits to both the employer and the employee. However, the flexibility requirements of employers and employees often conflict. Therefore, when a large food manufacturing organization decided to redesign its AH system, it employed an independent consultancy to act as neutral third party. The consultancy provided technical expertise and assistance in developing an AH system that optimised productivity and was acceptable to the workforce. Data are presented, obtained from focus groups conducted throughout the organization, describing some of the potential difficulties of implementing an AH system. Drawing upon these data, a number of new AH systems were proposed and modelled using specialist software tools. The design process is described, together with the advantages and difficulties associated with use of the software tools. It is concluded that the key elements in the process of designing AH systems are centred around issues of trust and communication; the involvement of a broad range of interested parties, through a process of carefully managed group facilitation; and the need for adequate technical support in the development and evaluation of AH systems.

REDUCING NIGHT SHIFT EXPOSURE: A PILOT STUDY OF ROTA, NIGHT SHIFT AND AGE EFFECTS ON SLEEPINESS AND FATIGUE

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The reduction of exposure to longer runs of successive night duties is often one of the aims of 'best practice' intervention.. The objective of this pilot study was to examine the effects of a change in rota upon sleepiness and fatigue, and potential age-related issues in relation to the change. Participants were 102 police officers, mean age 33.60 (sd 6.11), mean shiftwork experience = 10.56 years (sd 6.84). Testing occurred at least one month before the change from the existing 'Ottawa' system to a new rota that split a run of 7 consecutive night shifts into blocks of 3 and 4 within the rota cycle, and 6 months after the change. Measures of critical flicker fusion, subjective fatigue and sleepiness, and stimulant intake were taken in relation to selected night shifts on both rotas. Older officers tended to report higher fatigue and sleepiness, and higher caffeine intake than the younger shiftworkers irrespective of rota or shift. The findings tend to suggest that the change of rota had little effect but that age may play a substantial role in responses to night work.

CAN WE PREDICT PERCEIVED RISK?

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This paper examines the possibility that we may be able to use subjective measures of perceived risk in order to assess the relative safety of different shift systems. A large-scale survey of safety-critical engineers included three items relating to risk on each shift, namely alertness, likelihood of making a mistake and confidence in driving home after it. These three measures were found to load on a separate factor for each shift. Hierarchical regression analyses indicated that perceived night shift risk could be predicted on the basis of circadian type, the extent to which the engineers could control their work schedule, and a number of features of the scheduled shift system. In most cases the relationships observed were reasonably consistent with established trends in either performance capability or accident and injury frequency. However, there were exceptions to this indicating that results based on measures of perceived risk should be interpreted with the utmost caution.

TIME ON TASK EFFECTS ON SAFETY

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Reviewing the literature on time on task effects on safety shows contradictory evidence, especially with regard to 12h shifts. It is argued that this might depend on methodological problems associated with the analysis of accident data, e.g. selectivity of samples, validity of data bases and study designs, especially for analyses at the company level. Analyses of aggregated data seem to indicate an exponential increase of accident risk with time on task beyond the normal working day. This is supported by some recent studies based on data from the Federal Republic of Germany.

PREVENTION OF ACCIDENTS BY TRANSPORTATION SHIFTWORKERS

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For commercial transportation operations, around-the-clock operations are not a recent development. Despite the tenure of these practices, many accidents related to hours worked continue to be a problem. Although efforts by shiftwork experts to solve these problems are often mode specific, the transportation field does suggest several alternative approaches, which may be relevant to general shiftwork problems outside the transportation area. Four contemporary approaches to transportation shiftwork are discussed: environmental design, equipment design, organizational design, and information access systems. Examples are presented within each of these approaches.

LEGAL ISSUES IN ACCIDENTS CAUSED BY SLEEPINESS

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The impact of shift-work on sleep, performance and general health appears to be substantial. The most immediate consequence of night shiftwork is sleep loss. The aim of the present paper is to describe legal cases involving accidents attributed to sleepiness or fatigue, mainly as a consequence of shift-work or prolonged work hours, in the UK, USA and Australia. The paper will describe how legal systems are dealing with such incidents and how this may change in the future. Accidents related to sleepiness may result in criminal prosecution, for example charges of culpable driving. For acts performed while a person is sleeping (e.g. motor vehicle accidents), the legal question of voluntariness may be raised. The issue of employers' liability in such cases is contentious. Special liability regimes are in place to cover employers' liability. Employers may be deemed liable for injuries of third parties caused by wrongful acts of employees committed in the course of their employment. In the future, it is likely that employers will need to take greater precautions to reduce sleepiness and fatigue in the workplace, especially where the risk to public and environmental safety, health and productivity are significant.

HEALTH AND SAFETY AMONG FILM TECHNICIANS WORKING EXTENDED SHIFTS

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This paper presents selected results from a pilot research. The study of film technicians' work schedules and occupational hazards was based on a questionnaire administered to all 2200 film technicians (650 valid replies; response rate = 30%), interviews with producers and technicians on film-shooting organization and scheduling, courses in film technique, individual interviews with workers in trade at high risk, and review of the literature on freelancers, on the effects of intermittent work, and on risk factors for musculoskeletal injuries. Work schedules showed a tendency to extremely long work shifts (14 hours per day on average, and up to 19 hours in some trades). Occupational constraints and work schedules were found to relate to an increased risk of work-related injuries. Technicians identified fatigue associated with work schedules as the principal risk of accidents and one of the factors responsible for causing or aggravating their many musculoskeletal injuries. Work schedules were not the only cause of these injuries: stress - due to time constraints, work responsibilities and job insecurity - was also an important risk factor, consistent with the literature on musculoskeletal disorders. Physical workload was also problematic, particularly when demanding tasks had to be performed under severe time constraints.

BENEFICIAL EFFECTS ON EMPLOYMENT AND PREVENTIVE HEALTH CARE: THE CONCEPT AND RESULTS OF COUNSELLING PROCESSES FROM A GERMAN PROJECT

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Since December 1998 a project of working time counselling named "Design of Modern Working Times" is supported by the federal state of North Rhine-Westphalia in Germany and the European Union; AWiS-consult is entrusted to carry out this project. The service offered to all companies, institutions, work committees, and employees interested covers information, assessment of existing working time schedules, development of alternative or new working time schedules, and accompanying implementation processes. Up to June 2001 nearly 300 inquiries were worked on, most of them from industry, service companies, and from the field of care and hospitals. Working time design in this project aims not only at work safety and health care but also at beneficial effects on employment. In a special campaign from May 2000 to May 2001, 61 companies were supported by AWiS-consult, with the result of more than 400 new employees and 16 companies with employment secured, so the combination of preventive health care and beneficial effects on employment by working time design can be assessed as successful.

COMPARING THE EFFECTS OF FATIGUE AND ALCOHOL CONSUMPTION ON LOCOMOTIVE ENGINEERS' PERFORMANCE IN A RAIL SIMULATOR

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Laboratory studies have established that the performance impairments due to fatigue and alcohol consumption are quantitatively similar. However, the generalisability of this phenomenon is not clear because comparisons have not been made in realistic work settings with experienced shiftworkers. The aim of the current study was to quantify the effects of fatigue on performance in a simulated work environment (i.e. rail simulator) and compare them with the effects of alcohol consumption. It was hypothesised that fatigue would significantly impair driving performance, and that this impairment would be quantitatively similar to that associated with moderate levels of alcohol consumption. Twenty locomotive engineers participated in the study with a randomised cross-over design and three conditions: baseline, fatigue, and alcohol. During each 8-hour condition, participants completed four driving sessions in the rail simulator. The results indicate that fatigue caused participants to disengage from operating the simulator such that safety was traded off, not necessarily deliberately, against efficiency. The impairment in safety due to fatigue was in a range similar to the impairment associated with moderate levels of alcohol consumption. In summary, the study demonstrated that the effects of fatigue in a simulated work environment can be quantified and may be considerable.

THE EFFECT OF SHIFTWORK ON DRIVING TO AND FROM WORK

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A questionnaire study was conducted to obtain information from shiftworkers on the levels of tiredness experienced on the drive to and from work at different times of the day. The results demonstrated that, compared to non-shiftworkers, shiftworkers were more tired on the drive between their home and the workplace and more at risk of falling asleep behind the wheel. The main factors contributing to this increased level of sleepiness and associated driving impairment were the length of the sleep period prior to work, the type of shift and the travelling time. There was some evidence to suggest that on working days shiftworkers were more likely to be involved in an accident than non-shiftworkers. However, there were insufficient data to determine whether accidents were correlated with driver sleepiness.

PERFORMANCE, SLEEP AND CIRCADIAN PHASE DURING A WEEK OF SIMULATED NIGHT WORK

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The current study investigated changes in night-time performance, daytime sleep, and circadian phase during a week of simulated shift work. Fifteen young subjects participated in an adaptation and baseline night sleep, directly followed by seven night shifts. Subjects slept from approximately 0800hr until they naturally awoke. Polysomnographic data was collected for each sleep period. Saliva samples were collected at half hourly intervals, from 2000 hr to bedtime. Each night, performance was tested at hourly intervals. Analysis indicated that there was a significant increase in mean performance across the week. In general, sleep was not negatively affected. Rather, sleep quality appeared to improve across the week. However, total sleep time (TST) for each day sleep was slightly reduced from baseline, resulting in a small cumulative sleep debt of 3.53 (SD = 5.62) hours. Finally, the melatonin profile shifted across the week, resulting in a mean phase delay of 5.5 hours. These findings indicate that when sleep loss is minimized and a circadian phase shift occurs, adaptation of performance can occur during several consecutive night shifts.

SLEEPINESS AND RECOVERY IN SCHEDULE CHANGE AND THE EIGHTY-FOUR HOUR WORKWEEK

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The aims were to evaluate sleepiness and recovery during a schedule change, and during an 84-hours workweek. The control group (16 men) stayed on a six-week schedule, whereas the intervention group (12 men) transferred to a seven-week schedule. Sleepiness was estimated, using the KSS-scale, four times during the first and the third night in the fifth or sixth shift week. Recovery was assessed through four estimations on days one, three and five during the week off. Statistical testing was carried out using repeated measurement ANOVA. Sleepiness at night was affected by night ($F=4.90$, $p<0.05$) and hour ($F=33.64$, $p<0.001$) in both groups. The intervention group was sleepier during the first recovery day compared to the control group ($F=4.02$, $p<0.05$). Analysis of the 84-hour-week showed an effect of night ($F=8.98$, $p<0.05$) and hour ($F=71.60$, $p<0.001$) on night work, and day ($F=22.49$, $p<0.01$) and hour ($F=6.66$, $p<0.05$) on recovery. Sleepiness was more pronounced on the first recovery day ($F=23.08$, $p<0.01$). The seven-week schedule showed no effect that differed from that of the control group on sleepiness during the night shift. After the 84-hour workweek the workers recovered in about three days. The new schedules may affect the first recovery day negatively.

CROSS-SECTIONAL SURVEY ON RISK FACTORS FOR INSOMNIA IN JAPANESE FEMALE HOSPITAL NURSES WORKING RAPIDLY ROTATING SHIFT SYSTEMS

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A cross-sectional survey was carried out for the purpose of examining the association of work stress with insomnia among nurses working rotating shift systems. A self-administered questionnaire on sleep and mental health was distributed to 875 nurses at five hospitals in Japan. Out of the data from 785 (89.7%) respondents, those from 555 women engaged in rapidly and irregularly rotating shift systems as full-time nurses were examined. The prevalence of insomnia (29.2%) was three to four times higher than that in the general population. Among the insomniacs, 23% were current users of medically prescribed hypnotics. Multiple logistic analysis revealed that being 24 or less years old, working three or less night shifts per month, having six or less non-working days per month, receiving less support from colleagues and superiors, and taking care of severely ill patients were independent risk factors for insomnia. The number of hours of a night shift was found not associated with insomnia, taking the above variables into account. These results suggest that at least three factors, i.e., 1) young nurses not adapted to shiftwork, 2) the nurses requiring to remedy

sleep deficits on non-working days, and 3) the work stress partly characteristic of nurses, have an adverse influence on their sleep.

SHIFTWORKERS IN DEVELOPING COUNTRIES: HEALTH AND WELL-BEING AND SUPPORTING MEASURES

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Developing countries currently represent approximately 79% of the world population. Living and working conditions in middle and low income countries are harder and worse than for workers in industrialized countries. In developing countries, workers usually face more dangerous workplaces and unhealthy environmental and occupational conditions than those of industrial countries. Shiftworkers can face even more difficulties, due to constraints caused by their working time and consequences on health. Occupational health actions oriented by health policies were implemented during the 1990s in several Asian countries and in Brazil. These actions are important to promote workers' health. The general aims of this report are: a) to discuss topics related to equity and health; b) to present the main items of international and Brazilian legislation for shiftworkers; and c) to review general and specific measures of occupational health for shiftworkers in developing countries. In order to have equity on health and well-being, supporting measures should encompass micro and macro improvements at local, regional and national levels. Governmental and non-governmental organizations, professional bodies, labor unions, research institutes, universities, technical schools and syndicates, would play important roles to achieve these goals.

SHIFTWORK IN THE HOT ENVIRONMENT

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The study examined the risks of heat induced workplace accidents (textile industry, N=4125) and the heat tolerability of the rotating day (morning and afternoon, N=16) and permanent night shift workers (N=13) in hot-dry and hot-humid environment (34 to 49°C, 50-80% RH; 31 to 42°C ET, Basic). Accident prevalence was significantly high in the summer months (May-June) when the ambient temperature ranged between 42 and 48°C (hot-dry). The influence of hot climate in accident causation was evident from the shift-wise variations in the occurrence of accidents. The longitudinal study showed that the night workers were more vulnerable and less tolerant to heat, the tolerance time being less by about 15% (31°C ET) to 40% (39°C ET), compared to the rotating day workers. The relationship of the segmental and compartmental temperatures (segmental triggering response) played a critical role in heat dissipation/accumulation mechanism, and reflected in the heat tolerability of the day and night workers.

SHIFT WORK AT A MODERN OFFSHORE DRILLING RIG

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The oil and gas exploration and production offshore units are classified as hazardous installations. Work in these facilities is complex, confined and associated with a wide range of risks. The continuous operation is secured by various shift work patterns. The objective of this study was to evaluate how offshore drilling workers perceived shift work at high seas and its impacts on their life and working conditions. The main features of the studied offshore shift work schedules are: long time on board (14 to 28 days), extended shifts (12 hours or more per day), slow rotation (7 to 14 days in the same shift), long sequence of days on the night shift (7 to 14 days in a row) and the extra-long extended journey (18 hours) on shift change and landing days. Interviews revealed a wide range of stressors caused by the offshore shift work, as well as difficulties to conciliate work with family life. It was observed that changes of the family model, leading to role conflicts and social isolation, work in a hazardous environment, perceiving poor sleep when working at night shifts and the imbalance between the expected and actual rewards are the major stressors for the offshore drilling workers.

HOW A SMALL ENTERPRISE IMPROVED THE CONDITIONS OF NIGHT AND SHIFT WORK USING LOCAL RESOURCES

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A small oxygen factory in Cantho Province located in the Mekong Delta Area in the southern part of Vietnam was studied to provide practical support measures to improve night and shift work. A direct observation study and a fatigue symptom survey during the work were conducted. The factory applied discontinuous two-shift systems in two teams. Depending on customers' demands, they frequently prolonged oxygen production until midnight. The study results showed work-related risks such as carrying heavy oxygen cylinders, workers' sleepiness during the night work, and increased fatigue feelings among production operators. Based on the study results, better strategies for night and shift work schedules such as regular work hours minimizing overtime and night work were discussed with the managers and workers. A follow-up visit three months later confirmed many improvements undertaken in the factory. Better work arrangements for night and shift workers were made including local lighting, resting corners, filling the height gaps on the work floors, and clear work instructions. Prolonged mid-night shift was stopped. It was concluded that local small enterprises in Vietnam have much potential to improve their conditions of shift and night work once practical support measures based on their local practice is given.

INTEGRATED ERGONOMICS APPROACH TOWARD DESIGNING NIGHT AND SHIFT WORK IN DEVELOPING COUNTRIES BASED ON EXPERIENCES IN BALI, INDONESIA

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Recently, the effort in carrying out an integrated ergonomics approach known as "SHIP" (systemic, holistic, interdisciplinary and participatory) approach has been intensively undertaken in Bali with the aim of sustaining improvements being done. The People's Consultative Assembly of the Republic of Indonesia issued for the 1999-2004 period a "SHIP" Act on the Macro Guidelines of Tourism Development in which ergonomics and other factors must be considered comprehensively to attain sustainable development in tourism. Therefore the night and shift work that is recently increasingly applied in the tourism industry must also be designed and organized through this approach. In fact, however, economic factors have still been the predominant reason for workers to accept any type of night and shift work decided by the management, without taking into account possible impacts and consequences. For example, rapid forward rotation schemes seem more adapted to the hotel industry instead of traditional 6-6-6 rotation. Further, inter-city bus drivers are approved to work a 24-hour shift followed by one day off. These drivers often work an additional risky night shift after two consecutive night shifts so as to meet needed expenses for the family. Cultural or religious activities still presented constraints for workers as they carried out subsequently the night work. Therefore, proactive steps should be taken in a timely manner through the integrated SHIP approach in designing night and shift work so as to achieve work schedules compatible with both social life of shiftworkers and business concerns.

SUPPORT MEASURES TO IMPROVE NIGHT AND SHIFT WORK CONDITIONS IN THAILAND: A CASE STUDY IN A GLASS FACTORY

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The present study aimed to examine the working conditions of shift workers in a multinational enterprise in Thailand and to identify practical support measures for improvements. A multinational, glass-manufacturing factory employing 1,500 workers was selected as the research site. Three shift systems in three teams were adopted. A direct observation study and a fatigue feeling monitoring study were carried out to compare the differences between different shifts. A 10-day time-budget study was conducted for 30 shift workers to know their work and sleep patterns. The direct observation study identified safety and health risks during the night work periods. The risks included insufficient lighting, height gaps on the floor, excessive exposure to heat, inappropriate workstations, and sleepiness and fatigue feelings among shift workers. Working consecutive double shifts and overtime work was often seen. An advisory meeting was held based on the study findings to assist managers and

workers in improving their working conditions. A follow-up visit six months later confirmed that the glass factory implemented several improvements to help night and shift workers. It was concluded that the direct observation methods associated with the time-budget study were helpful for identifying practical action points and strengthening workplace initiatives.

MEASUREMENT PROPERTIES OF THE SHIFTWORK SURVEY AND STANDARD SHIFTWORK INDEX

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The Shiftwork Survey (SS) was introduced, along with the Standard Shiftwork Index (SSI), to provide a set of standardized self-report measures to be used in shiftwork research. However, beyond the initial assessment, no attempt has been made to examine the measurement properties of these scales in an independent sample of shiftworkers. Our goal, therefore, was to examine the measurement properties of these scales in an industrial sample of primarily male shiftworkers (N=370). We found that all scales had acceptable reliabilities (alphas). The confirmatory factor analyses revealed that the chronic fatigue, coping, job satisfaction, and sleep scales are the weakest psychometrically, and the anxiety, personality (extraversion, neuroticism), general health, and physical health scales are the strongest psychometrically. Using item response theory analyses, we found that the scales overall are generally adequate measures of their underlying constructs, although many items should be altered or omitted. Our results, however, are limited by reliance on a single sample.

A 6-HOUR WORKING DAY - EFFECTS ON HEALTH AND WELL-BEING

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The effect of the total amount of work hours and the benefits of a shortening is frequently debated, but very little data is available. The present study compared a group (N=41) that obtained a 9h reduction of the working week (to a 6h day) with a comparison group (N=22) that retained normal work hours. Both groups were constituted of mainly female health care and day care nursery personnel. The experimental group retained full pay and extra personnel were employed to compensate for loss of hours. Questionnaire data were obtained before and 1 year after the change. The data were analyzed using a two-factor ANOVA with the interaction term year*group as the main focus. The results showed a significant

interaction of year*group for social factors, sleep quality, mental fatigue, and heart/respiratory complaints, and attitude to work hours. In all cases the experimental group improved whereas the control group did not change. It was concluded that shortened work hours have clear social effects and moderate effects on well-being.

JOB STRESS, SOCIAL SUPPORT AT WORK, AND INSOMNIA IN JAPANESE SHIFT WORKERS

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A cross-sectional study was conducted to clarify the contribution of psychological job stress to insomnia in shift workers. A self-administered questionnaire concerning job stress, sleep, depressive symptoms and lifestyle factors was submitted to a sample of 530 rotating shift workers of age 18-59 years (mean age 27) in an electric equipment manufacturing company. Perceived job stress, i.e., job demands, job control and social support at work, was assessed using the Japanese version of the Job Content Questionnaire. Insomnia was regarded as prevalent if the workers had at least one of the following symptoms in the last year; less than 30 minutes to fall asleep, difficulty in maintaining sleep, or early morning awakening almost everyday. Overall prevalence was 37.8%. Logistic regression analyses while adjusting relevant factors showed that lower social support at work was significantly associated with a greater risk of insomnia than the higher social support (adjusted OR 2.5). Higher job strain with lower social support at work increased the risk, compared to lower strain with higher support at work (crude OR 1.8; adjusted OR 1.5). Our findings suggest the low social support at work independently associated with insomnia in shift workers.