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The official newsletter of the Scientific Committee on Night and Shiftwork of the International Commission on Occupational Health (ICOH) and Working Time Society

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Program and Abstracts of the

XVIth International Symposium on Night and Shiftwork Equity and working time: a challenge to be achieved

17- 21 November 2003, Santos, Brazil

Organization
University of São Paulo, School of Public Health
Oswaldo Cruz Institute, Oswaldo Cruz Foundation (FIOCRUZ)

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Revista Proteção
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UNIFESP (Universidade Federal de São Paulo)
XVth International Symposium on Night and Shiftwork

Useful telephone numbers (in Santos);

Emergency (accidents/ diseases):
192 and 3222-7342

Police:190 and 3219-2305

Intoxication Center: 3222-2878

Tourist information: 0800- 173-887 (English spoken)

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Dear Participants

Quite a long time ago, I had a dream about bringing the International Symposium on Night and Shiftwork to Brazil. My colleagues, Claudia Roberta de Castro Moreno, and Lucia Rotenberg, joined forces to make that dream to come through.

Here we are, all together in Santos, to enjoy each other's company for a few days, in this early summertime 2003-2004. During the next four days, we will exchange experiences, knowledge, and information with each other and with community members (workers, union leaders, governmental representatives, employers, and other organizations).

As a little girl, and in the following years of my childhood and adolescence , I enjoyed the seashore in Santos. I lived 800 km far away, in the countryside, and Santos was a dream for enjoying summer vacations. I still recall those days . At that time, during the 50s' and 60s', Santos was already considered one of the most important resorts visited by hundreds of thousands people every summer. It was and still is, one of the most important harbors in Latin America, extending along 14 km; through which 40 percent of our GDP (Gross Domestic Product) is exported.
Santos has been recently appointed by the United Nations Organization as one of the Brazilian towns showing the highest Index of Human Development. It is considered today a city where many golden age citizens choose to live, due to its enjoyable sites by the sea, its comprehensive health system, thus offering a good quality of life to its citizens and visitors. The educational system also boasts impressive numbers with its 7 universities, cultural centers, libraries, historical sites, and all kinds of well-structured services.

For many years, shiftwork researchers used to convene in remote places to avoid getting distracted by local attractions. This was a rule proposed by late Prof. Joseph Rutenfranz, who was my mentor in shiftwork research . But, when the time to choose the symposium site came, we preferred to organize the meeting in a place which is reached by excellent highways, just 68 km from São Paulo, in a lively area , where my colleagues will have the opportunity to enjoy the Brazilian hospitality and our way of living.
It will also be possible to relax walking by the sea in the beautiful gardens stretching over 5,5 km early in the morning, before the sessions, at lunch time or late in the evening. You will then feel the fresh breeze, the pleasant smell of the flowers, the quietness of the waters on the bay.
I hope we all will enjoy this symposium, as there will be many interesting and interactive sessions.
Thank you for coming to Santos!

Frida Marina Fischer

SCIENTIFIC PROGRAM

Monday, November 17 2003

08:00/17:00 Registration (Hall at floor BR).

08:30 - 17:00h **Pre-Symposium Activity:**
NEW TRENDS OF NIGHT AND SHIFTWORK ORGANIZATION

Lecturers:

Carlos Minayo-Gómez
Insecurity in the labor market in Brazil: challenge for the workers' health field

Frida Marina Fischer
Brazilian and ILO legislation on night and shiftwork

Donald Tepas
History, practice and future of working time in the USA

Peter Knauth
Flexible shift systems

Michael Smolensky
Health issues related to night and shiftwork

Mikko Härmä
Sleep in night and shiftworkers: intervention measures at work settings aiming at reducing sleep problems

Madeleine Estryn-Behar
Participative ergonomics with emphasis on work organization at hospitals

Stephen Popkin
Fatigue and transportation: policy issues, research priorities, and intervention measures

19:30 **OPENING CEREMONY**
Welcome to Brazil
Frida Marina Fischer

Kazutaka Kogi

Brazilian anthem - Choir of the University of São Paulo

20:15 **Opening Lecture:**

Chair: Frida Marina Fischer

Keynote: Simon Folkard

Biological rhythms and human performance: performance parallels temperature, except when it doesn't (with apologies to Professor Peter Colquhoun).

21:00 **Choir of the University of São Paulo**

21:30 **Get-together Party / Show with samba school "Gaviões da Fiel"**

Tuesday, November 18

08:30 **NEW WORK RELATIONS AND HEALTH IMPACT**

Chair: Lee Di-Milia

Keynote: Naércio A. Menezes Filho
The impact of working conditions on health.

Keynote: Peter Smith
Monitoring the impact of shiftwork on employee well being.

Oral presentations:

CO01 *Working hours, work-life conflict and health: A comparison of precarious and "permanent" employment.*
Bohle P.

CO02 *Working overtime: good or bad?*
Jansen B, Koopman M.

CO03 *The AHP, a multicriteria decision making methodology for shiftwork prioritization.*
Garuti C, Sandoval M.

CO04 *Actually, is this a night shift? – Are shiftwork design recommendations becoming meaningless due to fuzzy terms?*
Gärtner J, Åkerstedt T, Folkard S, Nachreiner F, Popkin S.

CO05 *Developing working times in the retail trade in Finland.*
Kandolin I, Järvenpää P.

CO06 *Flexible work hours, health and well being: results of the SALTSA project.*
Costa G, Åkerstedt T, Nachreiner F, Baltieri F, Carvalhais J, Folkard S, Frings Dresen M, Gadbois C, Gärtner J, Grzech-Šukalo H, Härmä M, Kandolin I, Sartori S, Silvério J.

11:00 Coffee Break

11:15 **Guided Poster Session 1A:**
SHIFTWORK DESIGN AND FLEXIBLE WORK HOURS

Chairs: Hiltraud Grzech-Šukalo and Stephen Popkin

P1A01 *Ergonomic design of working hours – integrating workload aspects.*
Schomann, C, Klostermann A, Nickel P, Nachreiner F.

P1A02 *Ergonomic design of working hours – Part1: BASS4 – Development of a software program for the evaluation and design of working hours.*
Schomann C, Stapel W, Eden J, Nachreiner F.

P1A03 *Ergonomic design of working hours – Part 2: e.tide – an internet based planning.*
Hänecke K, Albrecht N, Grzech-Šukalo H.

P1A04 *Always on duty! Designing working times in hospitals – Chances and limitations.*
Hänecke K, Grzech-Šukalo H, Jaeger C, Brüggemann A.

P1A05 *Comparing AHP and ANP shiftwork models: hierarchy simplicity v/s network connectivity.*
Sandoval M, Garuti C.

P1A06 *Shiftwork at high altitude: how choose a good system.*
Sandoval M, Garuti C.

P1A07 *A new approach for evaluating flexible working hours.*
Giebel O, Janssen D, Schomann C, Nachreiner F.

P1A08 *Economic design of working hours – integrating economical aspects.*
Stapel W, Schomann C, Nickel P, Nachreiner F.

P1A09 *Effects of flexible working hours on health and well being – results from a secondary analysis of an European survey.*
Bohnert V, Nachreiner F, Janssen D.

P1A10 *RAS representation & analysis software.*
Leitner W, Wahl S, Popkin S, Gärtner J, Åkerstedt T, Folkard S.

P1A11 *Be our guest – Anytime! Ergonomic working times for hotels and gastronomy*
Grzech-Šukalo H, Albrecht N, Brink C.

Guided Poster Session 1B:
SHIFTWORK DESIGN, TOLERANCE, PARTICIPATIVE PROCESSES AND AUTONOMY AT WORK

Chairs: Ljiljana Kaliterna and Johannes Gärtner

P1B01 *The importance of participation and control processes in considering effects of shift work changes.*
Jeppesen HJ, Smith L.

P1B02 *Exploring the influence of engagement, disengagement and active coping strategies on shift worker psychological and physiological well being.*
Knowles SR, Bull DF.

P1B03 *Review of the standard shiftwork index and its theoretical implications.*
Knowles SR, Bull DF.

P1B04 *Interaction of age with shift-related sleep-wakefulness, sleepiness, performance and social life.*
Bonnefond A, Härmä MB, Hakola T, Sallinen MB, Kandolin IC, Virkkala JB, Pihl SC.

P1B05 *The impact of age and the flexibility of work hours on outcome measures.*
Folkard S.

P1B06 *Individual differences in response to a change of shift order in a very rapidly rotating compressed shift schedule.*
Ingre M, Kecklund G, Åkerstedt T.

P1B07 *New method for screening adaptation to shift work*
Tzischinsky OC, Epstein R, Herer P, Lavie P.

P1B08 *Shift differentials compared.*
van-Limborgh C.

P1B09 *Evaluation of an age adjusted new shift model.*
Karazman R, Kloimüller I, Gärtner J, Lindorfer M, Faux A, Klein-Apfalter U, K-Morawetz I.

P1B10 *Is everything fine if people have a choice? – Reflections on autonomy, on long term decision making and on power.*
Gärtner J, Schürz M.

P1B11 *Reduction of working time: night shifts v/s morning shifts.*
Bourgeois-Bougrine S, Gounelle C, Mollard R, Bouillet A, Gärtner J.

13:15 Lunch

15:00 **DIVERSITY AND EQUITY: DEALING WITH BIOLOGICAL AND SOCIAL DIFFERENCES**

Chair: Arne Lowden

Keynote: Friedhelm Nachreiner
Diversity and equity: dealing with biological and social differences.

Oral presentations:

CO07 *Do nations differ in the impact of the night shift on the well being of workers?*
Tepas DI, Barnes-Farrell JL, Bobko NA, Fischer FM, Iskra-Golec I, Kaliterna L.

CO08 *Shift work, social support and sleep.*
Nordin M, Knutsson A, Sundbom E.

CO09 *Shiftworking families: parents' working time and sleep patterns of adolescents attending school in two shifts.*
Košcec A, Radoševic-Vidacek B.

CO10 *Flexible working hours and their effects on age and gender.*
Grzech-Šukalo H, Albrecht N.

CO11 *Does teamwork benefit night shift vigilance and performance? The alerting effect of social interaction*
Popkin S, Karnali L, Pollard J, Kuchar J, Howarth H.

CO12 *Variability of the circadian time structure in clinically healthy subjects. Interactions between activity patterns and time of food uptake.*
Haus E, Sackett-Lundeen L.

CO13 *Circadian variation in cortisol reactivity to an acute stressor.*
van Eekelen APJ, Kerkhof GA, van Amsterdam JGC, van-der-Holst H.

CO14 *Lifetime accumulated exposure to night-work increases sleep disturbances and reduces subjective health in monozygotic twins.*
Ingre M, Åkerstedt T

CO15 *A light/darkness intervention to improve daytime sleep quality in night shift workers.*
James FO, Chevrier E, Boivin DB.

19:00 Dinner

20:30 **General Discussion:**
METHODOLOGICAL ASPECTS OF SHIFTWORK RESEARCH: COMPREHENSIVENESS AND LIMITATIONS

Chair: Luiz Menna-Barreto

Keynote: Anders Knutsson
Methodological aspects of shiftwork research.

Keynote: Rachel Epstein
(Epstein R, Tzischinsky O, Herer P, Lavie P).
Methodological aspects of shift work research comprehensiveness and limitations: Actigraph and PAT studies.

Keynote: Sonia Hornberger
Intervention studies between scientific claim and business efficiency.

Wednesday, November 19

08:30 **Workshop:**
MANAGEMENT AND SAFETY IN TRANSPORTATION

Chair: Mikko Härmä

Keynote: Göran Kecklund
(Kecklund G, Åkerstedt T)
Truck driving, working hours and fatigue related accidents

Keynote: Mick Spencer
The work and rest of the civil airline pilot.

Keynote: Stephen Popkin
(Popkin S, Coplen M.)
Developing fatigue management resource for the transportation enterprise: US experience towards a non-prescriptive approach.

Oral Presentations:

CO16 *The maintenance of wakefulness test (MWT) and Epworth Sleepiness Scale (ESS) in railway transportation: reference values and connection to dozing-off at work.*
Härmä M, Hublin C, Sallinen M, Virkkala J, Mikola H, Müller K.

CO17 *Sleepiness, napping and driving simulator performance*
Redman JR, Dwyer F, Lenné MG, Rajaratnam SMW.

CO18 *Crew sleep patterns of cockpit napping during transatlantic flights*
Cabon P, Bourgeois-Bougrine S, Mollard R, Speyer JJ.

CO19 *R v Gary Neil Hart: Lessons from the Selby rail disaster*
Rajaratnam SMW, Jones CB.

11:00 Coffee Break

11:15 **Guided Poster Session 2A:**
HEALTH, WELL-BEING, SLEEP AND FATIGUE RELATED TO NIGHT AND SHIFTWORK

Chairs: Acácia Aguirre and Mikael Sallinen

P2A01 *Train drivers work-hours health and safety: a summary of results from the TRAIN-project.*
Ingre M, Kecklund G, Söderström M, Åkerstedt T, Kecklund L.

P2A02 *Factors moderating the impact of long work hours on well-being.*
Tucker P, Rutherford C.

P2A03 *Evaluation of sleep patterns among interstate bus drivers before and after their work shifts.*
Santos EHR, Mello MT, Tufik S.

P2A04 *Total sleep time and sleep latency in bus drivers using MSLT.*
Mello MT, Santos EHR, Tufik S.

P2A05 *The effects of sleep debt and work load on alertness during a 12-hour dayshift*
Sallinen M, Härmä MA, Luukkonen RB, Müller KA, Pihl SA, Virkkala JA.

P2A06 *Relationships between occupational stress, gender and shiftwork in air traffic control.*
Schroeder D, Nesthus T, Cruz C, Boquet B, Thompson D.

P2A07 *Coping with long-range flying: revised recommendations for crew rest and alertness.*
Bourgeois-Bougrine S, Folkard S, Cabon P, Mollard R, Speyer JJ.

P2A08 *Association of sickness absenteeism with poor sleep habits in shift workers.*
Nakata A, Haratani T, Takahashi M, Fukui S, Arito H, Araki S, Kawakami N, Fujioka Y, Kobayashi F.

P2A09 *Sleep complaints among Brazilian offshore workers: a preliminary assessment in the Campos basin, Rio de Janeiro.*
Menezes MCR, Pires MLN, Benedito-Silva AA, Tufik S.

P2A10 *How the night and shiftworkers of an electric bulb manufacturer from São Paulo, Brazil perceive their well-being and health.*
Glina DMR.

P2A11 *Gender and health on extended hours operations.*
Aguirre A, Kerin K, Moore-Ede M.

P2A12 *Extended hours operations: age and workers' health.*
Aguirre A, Kerin K, Moore-Ede M.

P2A13 *Actigraph evaluation of sleep in marine watch keepers.*
Arendt, J; Francis, G.

Guided Poster Session 2B:
HEALTH, WELL-BEING, SLEEP AND FATIGUE RELATED TO NIGHT AND SHIFTWORK

Chairs: Madeleine Estryn-Behar and Kerstin Hänecke

P2B01 *Consequences of 12-hour night work on fatigue and work ability of health care workers.*
Borges FNS, Fischer FM.

P2B02 *Combined stressors faced by health care shiftworkers of a philanthropic hospital of São Paulo, Brazil .*
Bellusci SM, Fischer FM, Barrios SRL, Borges FNS, Teixeira LR.

P2B03 *Methodological considerations with web-base shiftwork data collection.*
Hobbs BB, Farr LA.

P2B04 *Internet data collection with American Indian and White nurse shiftworkers.*
Hobbs BB, Farr LA.

P2B05 *Sleep during the night shift and complaints on sleep and fatigue among nursing personnel at two Brazilian public hospitals.*
Rotenberg L, Portela LF, Soares RES, Gomes-Silva P, Ribeiro-Silva F, Pessanha J, Benedito Silva AA, Carvalho FA.

P2B06 *Referred morbidity, complaints on sleep, fatigue and lack of time and their relation to night work among nursing personnel.*
Portela LF, Rotenberg L, Waissmann W.

P2B07 *The workers' profile and prevalence of diseases among health care night workers at an university hospital*
Chillida MSPC, Cocco MIM.

P2B08 *Night work and health aspects among intensive healthcare unit workers.*
Veloz MNT.

P2B09 *Eating habits and attitudes among shift work nurses in Israel*
Latzer Y, Tzischinsky OC, Epstein R.

P2B10 *Sleep quality of nurses working at night and in shifts.*
Ozola L, Sprudza D.

P2B11 *Work schedules of health care workers in France according to occupational level. Impact of the reduction to 35 hours per week*
Estryn-Behar M, Caillard JF, Le Nezet O, Castell C, Alifax R, Tordjman G, Oginska H, Camerino D, Pokorski J, Hasselhorn HM.

13:15 Lunch

15:00 **MULTIDIMENSIONAL ASPECTS RELATED TO HEALTH AND WELL- BEING**

Chair: Sérgio Tufik

Keynote: Giovanni Costa
Multidimensional aspects related to health and well being.

Oral Presentations:

CO20 *Influence over working hours, overtime and breaks: relation to health.*
Kecklund G, Dahlgren A, Åkerstedt T.

CO21 *Health and psychosocial effects of flexible working hours.*
Janssen D, Nachreiner F.

CO22 *Are reductions in chronic sleep loss offset by an increase in acute sleep loss?*
Di-Milia L.

CO23 *Mortality and shift work/work hours - a prospective study.*
Åkerstedt T, Fredlund P, Gillberg M.

CO24 *Mortality of Swedish shift and day workers in pulp and paper industry between 1952-1998.*
Karlsson B, Knutsson A, Alfredsson L.

CO25 *Postprandial metabolic profiles following meals and snacks eaten during simulated night and day shiftwork.*
Al-Naimi S, Hampton SM, Richard P, Tzung C, Morgan, LM.

CO26 *Laboratory studies of fasting and over-eating-performance, wakefulness and sleep.*
Lowden A, Vestergren P, Lennernäs M, Åkerstedt T.

CO27 *Alcohol consumption and body temperature. A circadian study.*
Touitou Y, Danel T.

CO28 *Coping style is related to psychological and somatic complaints among air traffic controllers.*
Boquet A, Hackworrth C, Cruz C, Nesthus T.

CO29 *The effect of short-duration countermeasures on the night shift.*
Cruz C, Boquet A, Nesthus T, Holcomb K, Shappell S.

18:00 **GENERAL MEETING WTS / ICOH**

19:00 Dinner / **Meeting Executive Board WTS/ICOH**

20:00 **Evening Debate**
CHANGES IN WORK SCHEDULES OR WORKER STRATEGIES: DO THEY GENERATE THE SAME EFFECTS?

Chair: Donald Tepas

Keynote: Peter Knauth
Work schedules Vs. workers' strategies: Do changes generate the same effects?

Keynote: Josephine Arendt
Circadian response to changes in work schedules.

Thursday, November 20

08:30 **Workshop:**
BUILDING A SAFE ENVIRONMENT

Chair: Adam Fletcher

Keynote: Adam Fletcher
Building a safe environment: practical management of worker fatigue.

Keynote: Michael Smolensky
Building a safe environment: circadian rhythms of shift work, industrial hygiene and toxicology.

Keynote: Madeleine Bourdouxhe
Tools for designing and organizing safe work schedules, managing production and fatigue.

Oral Presentations:

CO30 *Flexible working times: consequences on employees' burnout, work-nonwork conflict and performance.*
Demerouti E, Kattenbach R, Nachreiner F.

CO31 *Towards a model based on relative-risk to assess work schedules.*
Folkard S.

CO32 *Does the application of different numbers of teams in the organization of shift work constitute a way for prevention activities?*
Jeppesen HJ, Kleiven M, Boggild H.

CO33 *Temporal patterns of single-vehicle accidents (SVA) specifically due to fatigue of drivers of trucks and passenger cars In Texas.*
Bruno G, Smolensky M, Griffin L.

11:00 Coffee Break

11:15 **Guided Poster Session 3A:**
PHYSIOLOGY AND CHRONOBIOLOGY RELATED TO NIGHT AND SHIFTWORK

Chairs: Erhard Haus and Yvan Touitou

P3A01 *Interactions of lighting regimen and timed feeding as circadian synchronizers in mice.*
Haus E, Lakatua D, Sackett-Lundeen L.

P3A02 *Biological rhythms and occupational risk assessment: lung function tests in a tire factory.*
Fabri G, Marini Bettolo P, Paoletti A.

P3A03 *Nutritional status and eating habits of shiftworkers: a chronobiological approach.*
Pasqua IC, Moreno CR de C.

P3A04 *Ultradian rhythms in speed of memory processes and cerebral hemispheres.*
Iskra-Golec I.

P3A05 *The 24-hour pattern of recognition accuracy.*
Iskra-Golec I.

P3A06 *An animal model of shift work: Impact on sleep and circadian rhythms.*
Reid K, Woods BC, Losee MV, Turek FW.

P3A07 *Comparison of the prevalence of premature beats with twenty-four hour holter electrocardiography in shift workers in a manufacturing company.*
Tai T, Iwasaki K, Sasaki T.

P3A08 *Effects of nightwork on imunne function among nurses.*
Morikawa Y, Kitaoka-Higashiguchi K, Tanimoto C, Hayashi M, Oketani R, Miura K, Nishijo M, Nakagawa H.

P3A09 *Measuring mental effort via peripheral arterial vasoconstriction: a new, non-invasive and objective method.*
Nave R, Tzischinsky OC, Epstein R, Herer P, Lavie P.

P3A10 *Night shift work and breast cancer risk: comparing additional artificial lighting and increasing natural day light.*
Cohen P.

P3A11 *Seasonality and seasons out of time – the effects of illumination pollution.*
Haim A.

P3A12 *Effects of acutely displaced sleep on testosterone.*
Axelsson J, Åkerstedt T, Ekstedt M, Holmbäck U.

Guided Poster Session 3B:
PERFORMANCE, FATIGUE AND SAFETY ASPECTS OF NIGHT AND SHIFTWORK

Chairs: Arne Lowden and Mick Spencer

P3B01 *Effects of length and timing of nighttime naps on task performance and physiological functions.*
Takeyama H, Matsumoto S, Murata K, Ebara T, Kubo T, Tachi N, Itani T.

P3B02 *Frequency and incidence rates of accidents in tunnel diggers.*
Capanni C, Sartori S, Carpentieri G, Costa G.

P3B03 *Working and driving hours in public and fright transport operations.*
Pankonin C, Nachreiner F.

P3B04 *Association between the risk of obstructive sleep apnea and accidents in a truck driver population.*
Moreno CR de C, Carvalho FA, Matuzaki LS, Prezotti S, Bighetti P, Lorenzi-Filho G.

P3B05 *Shiftwork and performance in aircraft maintenance: developing programs to reduce human errors.*
Assis MR, Lacerda ET, Paulich C, Ribeiro SLO.

P3B06 *Occurrence of work injuries among non-diurnal workers from São Carlos county, SP, Brazil in 2000.*
Monteiro MS, Almeida IM, Wada M, Kawakami L, Nagliate P.

P3B07 *Fatigue monitoring devices: the quest for grail continues.*
Pollard J, Popkin S, Oudonesom V.

P3B08 *The effect of one hour nap and bright light on university students, performances of multiple-reaction task, an occupational suitability test, and addition test after night shift work.*
Kozu H, Ogawa I.

P3B09 *Outcome in sleep problems and accidents/incidents according to work hours. A representative sample.*
Lowden A, Åkerstedt T.

P3B10 *Sleep-wake rhythm in irregular shift systems.*
Sallinen M, Härmä MA, Mutanen PB, Ranta RB, Virkkala JÁ, Müller KA.

P3B11 *Effect of fatigue on cardiovascular system activity under 12-hour shifts and predominantly mental work*
Bobko N.

12:45 Lunch

13:30 **MULTIDIMENSIONAL ASPECTS RELATED TO HEALTH AND WELL BEING**

Chair: Kazutaka Kogi

Keynote: Ennio Vivaldi
Actimetry assessment of sleep distribution through a shiftwork rotation with intermittent altitude exposure.

Oral Presentations:

CO34 *Acute mountain sickness in shiftwork at high altitude.*
Sandoval M, Silva J, Villarroel F, Berrios H, Lara D.

CO35 *Working hours in the nursing and care sector.*
Koopman M, Jansen B, van der Weerd E, Messchendorp H.

CO36 *Do shifts make workers unhappy? The quality of life, life satisfaction and happiness of shift- and non-shiftworkers.*
Kaliterna L, Prizmic LZ, Zganec N.

CO37 *Elevated daytime sleepiness in day and shift workers experiencing stress at work.*
Takahashi M, Nakata A, Haratani T, Fukasawa K, Ogawa Y, Fukui S, Fujioka Y, Nagai C, Tachibana N.

CO38 *The "Healthy Shift Worker Effect" in the relationship between shift work and longitudinal change in blood pressure.*
Yadegarfar G, McNamme R.

CO39 *The relationship of working hours and work intensity with sleep disturbance among 12-hour shift workers in the automobile factory in Korea.*
Son M, Park W, An J, Kang S, Sung J, Cho H, Härmä M.

16:00 Sightseeing Tour- Schooner tour

19:00 Symposium Dinner on Porchat Island

Friday, November 21

08:30 **Students meeting**
Chair: Adam Fletcher

09:15 **Guided Poster Session 4A:**
HEALTH, WELL-BEING, SLEEP AND FATIGUE RELATED TO NIGHT AND SHIFTWORK

Chairs: Donald Tepas and Lee Di Millia

P4A01 *Correlations between night work and tiredness in self employed, home based IT workers with preschool children.*
Sasaki T, Matsumoto S.

P4A02 *Effect of shift work on subjective symptoms among female workers in Korea.*
Lee K, Hwang JH, Han SH, Ahn YS, Kim JJ.

P4A03 *Nutritional status among cell center operators working in three-shift fixed schedule.*
Cristofoletti MF, Rocha LE, Moreno CR de C.

P4A04 *Assessment of the nutritional habits and perceptions of shiftworking police officers.*
Knowles SR, Bull DF.

P4A05 *Sleep disturbances are common in radio – and television – personnel working in an irregular shift work.*
Savolainen A, Ahlberg J, Lindholm H, Hirvonen A, Hirvonen K, Hublin C, Partinen M.

P4A06 *Sleep deprivation and work shifts: the importance of the morning shift.*
Matuzaki L, Pasqua I, Moreno CR de C..

P4A07 *A controlled intervention study of a quickly forward rotating shift system among young and elderly maintenance workers.*
Härmä M, Hakola T, Kandolin I, Sallinen M, Virkkala J, Bonnefond A.

P4A08 *Work demands, working times and sleep among information technology professionals.*
Härmä M, Kivistö M, Kalimo R, Sallinen M.

P4A09 *Sleep and mood evaluations of medical residents working day and night shifts*
Gaspar S, Menna-Barreto L.

P4A10 *Acute effects of long work hours*
Dahlgren A, Kecklund G, Åkerstedt T.

P4A11 *Effects of one week of moderate overtime work*
Dahlgren A, Kecklund G, Åkerstedt T.

P4A12 *Non-scheduled overtime and sleep*
Ekstedt M, Söderström M, Axelsson J, Nilsson J, Åkerstedt T.

Guided Poster Session 4B:
SLEEP, STRESS AND BURNOUT; ADOLESCENT SCHEDULE RELATED TO SCHOOL AND/OR WORK ACTIVITIES

Chairs*:* Giovanni Costa and Ennio Vivaldi

P4B01 *Hours of work for aircraft maintenance engineers in Canada.*
Rhodes W, Booth-Bourdeau J.

P4B02 *Aircraft maintenance personnel's stress and sleep disturbance: a case of night shift workers.*
Paulich C, Assis MR, Lacerda ET, Cruz C, Ribeiro SLO.

P4B03 *A study of the architecture of sleep and the sleep-wake cycle characteristics in nurses on different shift.*
Martino MMF.

P4B04 *A light/darkness intervention to realign the cortisol rhythm to night shift work.*
James FO, Chevrier E, Boivin DB.

P4B05 *Effect of light/dark regimen on sleep spindle distribution in a simulated eastward flight.*
Santo JB, James FO, Chevrier E, Boivin DB.

P4B06 *Sleep disturbances mediate the association between burnout and increased HbA1C among women.*
Grossi G, Perski A, Evengård B, Blomkvist V, Orth-Gómer K.

P4B07 *Professional burnout within violating work rhythms.*
Kaskisaari M.

P4B08 *Knowledge-intensive work, working time and well being.*
Nätti J, Anttila T, Kandolin I, Härmä M.

P4B09 *School schedule transition and adolescent's biological rhythms.*
Attan I, Menna-Barreto L.

P4B10 *Teen at work: the burden of a double journey on sleep-wake cycles.*
Teixeira LR, Fischer FM, Andrade MMM, Louzada FM, Nagai R.

P4B11 *Sleep patterns of adolescents attending classes in two shifts.*
Radoševic-Vidacek B, Košcec A.

11:15 Coffee Break

11:30 **WORKING TIME AND HEALTH PROMOTION: THE ROLE OF EDUCATION**

Chair: Philip Bohle

Keynote: Kazutaka Kogi
Linking better shiftwork arrangements with safety and health management systems.

Keynote: Alexander Wedderburn
What is the best way of educating shiftworkers? Reflections on a career.

12:30 **WHAT DO WE BRING HOME?**

Claudia Roberta de Castro Moreno
Lúcia Rotenberg

Closing Ceremony:

Frida Marina Fischer

13:00 Lunch – Barbecue

ABSTRACTS

XVIth International Symposium on Night and Shiftwork
Equity and working time: a challenge to be achieved

Gender and health on extended hours operations

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Extended hours operations (environments where irregular schedules, nightshifts or extended hours are worked) are becoming common in most work environments and industries. It has been suggested that biological factors might make women more vulnerable to these work schedules, however there is general agreement that the main determinant is social demands (i.e., the higher domestic workload). Nachreiner et al (1) reported that women show an earlier development of a specific structure of health complaints than men, which the authors relate to their socially determined role-specific behavior.

This study analyzes the relationship between gender and health on extended hours operations, based on Circadian's employee survey database, which contains over 10,000 surveys from workers working a wide variety of schedules in different industries, mainly manufacturing and utilities. Average age was 39 years. Seventy-seven percent of employees were male and 23% female. Almost half (45%) of employees have worked shifts for ten years or more. Moonlighting was more frequent among men (30% vs 23%). Seventy-three percent of men and 56% of women were married.

Gender was related to lifestyle: men smoked more and consumed more alcohol than women, although they also reported exercising regularly more often (χ^2, $p<.05$).

Seventy-two percent of women reported needing 8 hours of sleep compared to 67% of men (χ^2, $p<.0001$). Sleep duration and quality was similar in both groups for morning and evening shifts. However, there were significant differences for the night shift: 48% of women sleep six hours or less compared to 41% of men and 28% of women reported "poor" sleep on the night shift, compared to 20% of men (χ^2, $p<.0001$). Women also reported suffering insomnia more frequently than male shiftworkers (χ^2, $p<.0001$).

The average Epworth sleepiness score was similar for men and women. Reports of feeling tired, nodding off and making mistakes while working do not differ significantly between men and women.

Women reported more gastrointestinal disorders (GI index 14.5 vs 13.4) and more musculoskeletal disorders than men (χ^2, $p<.0001$). However, the prevalence of hypertension was similar in both groups. Women reported a higher use of antacids and pain killers than men (χ^2, $p<.0001$). The use of depressants was about double for women (χ^2, $p<.0001$). However, there were no differences between men and women for the use of stimulants.

In conclusion, women suffered more health problems than men, and reported a higher use of medication.

1. Nachreiner F, Lubeck-Ploger H, Grzech-Sukalo H. Changes in the structure of health complaints as related to shiftwork exposure. **Work Stress** 1995; 9(2/3): 227-234.

Extended hours operations: age and workers' health

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Extended hours operations (environments where irregular schedules, nightshifts or extended hours are worked) are becoming common in most work environments and industries. Intolerance to these schedules seems to increase with age. Aging is related to increased instability of circadian rhythms, a tendency toward morningness, less deep sleep and increased awakenings. Some studies have also indicated that middle-aged workers adjust more slowly to shiftwork than younger ones (1). On the other hand, older workers often have better housing conditions than younger workers, and usually they do not have small children at home, which would allow them to get better sleep and thus recover better from their work.

This study analyzes the relationship between age and health on extended hours, based on Circadian's employee survey database, which contains over 10,000 surveys from workers working a wide variety of schedules in different industries, mainly manufacturing and utilities. Average age was 39 years. Seventy-seven percent of employees were male and 23% female. Almost half (45%) of employees have worked shifts for ten years or more.

Overall, young workers (18-24 years) and workers aged 55 or older reported getting more sleep than other age groups. They also had the lowest frequency of insomnia (χ^2, $p<.05$). The average Epworth sleepiness score was similar for all age groups, but it was somewhat higher for workers with 10-15 years of shiftwork experience. Sleepiness while working (feeling fatigued, nodding-off and making mistakes) is lowest for workers with less than one year or more than 15 years of experience (χ^2, $p<.001$). Overall, workers aged 25-34 seem to have the most problems (χ^2, $p<.01$).

The prevalence of gastrointestinal problems is lowest for workers aged 18-24 and for those 55 or older (χ^2, $p<.01$). On the other hand, workers with 5 to 15 years of experience have more digestive problems (χ^2, $p<.01$). The prevalence of hypertension increased with age (χ^2, $p<.0001$). Obesity also increased with experience and age (χ^2, $p<.0001$); workers aged 18-24 were the only group with a healthy average weight.

Use of medication such as antacids and pain killers increased with age (χ^2, $p<.0001$). Use of stimulants was double for workers aged 25-34 (χ^2, $p<.0001$) than for other age groups, and was also higher for workers with one to ten years of shiftwork experience than for the other groups. However, there was no relationship between age or shiftwork experience and use of depressants.

Overall, adjustment to their work schedule seems to be better in younger workers, with low exposure to extended hours, as well as in older workers with more experience. This could be related to the "healthy worker effect," that is, workers who cannot tolerate shiftwork eventually quit and those remaining learn how to cope with it.

1. Harma M. Individual differences in tolerance to shiftwork: a review. **Ergonomics** 1993; 36(1-3): 101-109.

Mortality and shift work / work hours – a prospective study

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There is very little long-term prospective data on the role of shift work and overtime work in the prediction of mortality. The present study sought to provide such data and to control for other work related factors. The design used was an open cohort study with repeated national cross-sectional surveys, focusing on living conditions. These cross-sectional surveys utilized data obtained from the National Survey of Living Conditions (ULF), conducted annually by Statistics Sweden. The study base comprises all gainfully employed males and females in Sweden. Altogether, 45.747 responders participated (>80% response rate) - all employees. The surveys were subsequently linked with the Swedish Cause-of-Death register and followed-up for 25 years. 2029 deaths were obtained. Exposure to shift work was classified as: day work, shift work without nights (evening work, two-shift work, morning work), shift work with nights (night work, 3-6shift work), mixed roster work (either day or night work). Exposure to work hours was classified as: part-time work (<33h/week), short hours (34-38), normal hours (39-41h), low overtime (41-50h), high overtime (50+). Additional predictors were: sex, age (16-29, 30-49, 50+), socio-economic status - SES (unskilled and skilled manual workers, low, intermediate and high level non-manual workers), physically strenuous work, hectic work, disease at outset (presence of any serious disease (cardiovascular, diabetes, tumour, psychiatric, joint/muscle, etc). Survival analyses were performed by Cox proportional hazards regression. The first model was adjusted for age and gender,. Model 2 was adjusted for the above plus disease at outset and socioeconomic group, "physically strenuous work" and "hectic work". The duration of the follow-up was 9 years on the average. The total number of man years was 516851. The results show that there was no clear relation between shift work and mortality. This agrees with previous work. Work hours, however, showed a significantly increased risk for part-time work and there was a tendency towards a reduced risk for high overtime work. No previous work is available, but the increased risk for part-time work probably reflects selection even if selection for disease at the start should have eliminated many health influences. Still, there may be a selection of individuals with a weak constitution into part-time work. The lack of effect for high overtime may also reflect selection since overtime work occurs to a higher extent in more privileged groups. Even if variables such as socioeconomic group, hectic work, etc should have controlled for such effects it may be the case that within higher white collar groups overtime is still something that occurs more for those with a high degree of interest in and commitment to work – and this could not be controlled for.

	1. Hazard Ratio & Ci	**2. Hazard Ratio & Ci**
Day	**1**	**1**
Shift Day	1.24 (1.05-1.46)*	1.19 (1.01-1.10)*
Shift Night	1.09 (0.82-1.46)	1.06 (0.79-1.42)
Other/mixed	1.02 (0.85-1.23)	1.04 (0.86-1.26)
Part-time	**1.27 (1.13-1.44)*** **	**1.21 (1.07-1.37)** **
Short hours	0.93 (0.78-1.10)	0.94 (0.79-1.11)
Full time	1	1
Low overtime	1.00 (0.84-1.18)	1.09 (0.92-1.30)
High overtime	0.64 (0.43-0.96)*	0.72 (0.48-1.07)

***=p<.001; **=p<.01; *=p<.05; #=p<.10

Conclusion: Part-time work and possibly night oriented shift work increases the risk of mortality. The former probably reflects selection.

Postprandial metabolic profiles following meals and snacks eaten during during simulated night and day shiftwork.

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Shiftworkers are known to have an increased risk of developing cardiovascular disease (CVD) compared with dayworkers. Whilst causes are likely to be multifactorial, an important factor could be the increased incidence of postprandial metabolic risk factors for CVD amongst shift workers, as a consequence of the maladaptation of endogenous circadian rhythms to abrupt changes in shift times. We have previously shown that both simulated and real shiftworkers[1,2] show relatively impaired glucose and lipid tolerance if a single test meal is consumed between 0000-0200h (night shift), compared with 1200-1400h (day shift). The objective of the present study was to extend these observations to compare the cumulative metabolic effect of consecutive snacks/meals, as might normally be consumed throughout a period of night or day shiftwork.. In a randomised crossover study, 8 healthy non-obese men (20-33yrs, BMI 20-25kg/m^2) consumed a combination of 2 meals and a snack totally 1740kcal (39% fat, 51% carbohydrate, 10% protein) on two occasions following a standardised pre-meal, simulating night and day shift working. Meals were consumed at 0100/1300h and 0700/1900h, and the snack at 0400/1600h. Blood was taken after an overnight fast, and for 8h following the first meal on each occasion, for the measurement of glucose, triacylglycerol (TAG) and non-esterified fatty acids (NEFA).
RM-ANOVA (factors time, shift) showed significantly raised plasma TAG on simulated night shift compared to day (p=0.04) and a trend towards raised plasma glucose (p=0.08)

(mmol/l.h)	Total AUC (0-8h)		AUC 1st meal (0-3h)		AUC snack (3-6h)		AUC 2nd meal (6-8h)	
	Night	Day	Night	Day	Night	Day	Night	Day
TAG	12.2	10.5	4.8	4.5	4.4	3.5	2.9	2.5
Mean (sem)	(0.9)	(0.6)	(0.5)	(0.4)	(0.4)	(0.3)	(0.1)	(0.1)
Glucose	44.5	41.7	17.2	15.3	16.5	15.5	10.8	10.9
Mean (sem)	(1.8)	(1.4)	(0.6)	(0.6)	(0.8)	(0.4)	(0.5)	(0.5)
NEFA	2.8	3.1	1.2	1.3	0.9	1.1	0.7	0.7
Mean (sem)	(0.2)	(0.2)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)

Inspection of the area under the plasma response curve (AUC) following each meal and snack revealed that the differences in lipid tolerance occurred throughout the study, with greatest differences occurring following the mid-shift snack. In contrast, glucose tolerance was relatively most impaired following the first night-time meal, with no differences observed following the second meal. NEFA responses were not affected by type of shift. These findings confirm our previous observations of raised postprandial TAG and glucose at night, and show that sequential meal ingestion has a more pronounced effect on subsequent lipid than carbohydrate tolerance.

Ribeiro D, Hampton SM, Morgan LM, Deacon S, Arendt J. Altered postprandial hormone and metabolic responses in a simulated shiftwork environment, **Journal of Endocrinology** 1998; 158:305-310.
Lund J, Arendt J, Hampton SM, English J, Morgan LM. Postprandial hormone and metabolic responses amongst shift workers in Antarctica. **Journal of Endocrinology** 2001; 171:557-564.

Circadian temporal system, feeding pattern and health risk in nightshift workers

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Introduction: The paradigm of biological clock with expression of endogenously generated biological rhythms concerns the internal temporal structure and circadian system of the organism. The food intake is a synchronizer of the circadian rhythms and affects the mechanisms of metabolic adaptation. The inversion of the light phase and of sleep/wakefulness cycle in night shift is a risk factor for desynchronization of circadian system, disruption of sleep and food intake pattern. **Aim:** To investigate the influence of circadian desynchronization related to night shift on metabolic, functional and psychological parameters in workers from transport and telephone communications. **Methods:** A cross-sectional epidemiological study of 141 male subjects 25-60 years of age - traffic controllers and control group of employees in transport management, as well as 146 female subjects 27-58 years of age - telephone operators and control group of telephone communication controllers, working on day/night shift schedule versus regular working time for control groups, has been performed. Food intake pattern is evaluated for three consecutive working cycles (12-h day shift / 12-h night shift / 2 days rest) according to dietary records. Blood pressure and pulse rate are determined five times during the night shift and five times during the day shift for three nonconsecutive shifts. Stress perception is evaluated by self-assessment rating scales, and attention and memory function are measured by psychometric tests. Plasma lipoprotein profiles - total cholesterol, LDL-cholesterol, VLDL-cholesterol, HDL-cholesterol and triacylglycerol concentrations have been determined in the beginning of the day shift and relative risk (RR) of prevalence of dyslipidaemia is evaluated. **Results:** Blood pressure is higher during the night shifts with mean systolic blood pressure levels SBP = 127.8 ± 8.8 mm Hg and mean diastolic blood pressure DBP = 87.5 ± 5.9 mm Hg when compared to the levels during the day shifts, respectively - mean systolic blood pressure value SBP = 125.1 ± 9.6 mm Hg ($P>0.05$) and mean diastolic blood pressure DBP = 81.6 ± 8.5 mm Hg ($P<0.05$). Stress perception, attention and memory functions show phase of minimal levels at 0400 - 0500 during the night shifts. Prevalence of dyslipidaemia, associated to the night shift working schedule is higher - 64.9 % versus 49.2 % in control group; the evaluation of relative risk shows the magnitude RR= 1.914 ($P < 0.05$) suggesting that night shift work is related to increased risk for developing of disturbances in lipoprotein metabolism. Determination of plasma lipoprotein profile reveals unfavorable changes in the levels of all plasma lipid parameters for night shift workers. **Conclusion:** Circadian desynchronization and sleep deprivation with dietary pattern disruption in night shift workers is related to potential health risk for the parameters of metabolic, functional and psychological factors - plasma lipoprotein profiles, blood pressure, stress perception, attention and memory function.

Circadian Response to Changes in Work Schedules

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The requirement to work at night means that in most circumstances subjects are working at the nadir of their performance and alertness rhythms and their maximum sleepiness. Unadapted night shift workers show metabolic abnormalities after a night shift meal compared to the response to an identical day shift meal (1). The internal circadian clock adapts slowly to abrupt changes of time cues and full adaptation to the imposed schedule is rare. Exceptions to this are found in isolated situations such as on oil rigs and in Antarctica. We have used the melatonin metabolite 6-sulphatoxymelatonin (aMT6s) in sequential urine samples as a marker of circadian phase in order to investigate the physiological response to different shift schedules. aMT6s is suitable for measuring phase shifts in field studies in that it is robust and reflects remarkably well the characteristics of the melatonin rhythm itself using 3-4 hourly collection intervals (8h oversleep). In some schedules worked by the offshore petrochemical industry full circadian adaptation to night shift is seen. On North Sea installations, for a 14-day 12-hour night shift (1800-0600h), subjects do adapt but are out of phase for at least the first 4-5 days of the night shift (2). For a 14 day tour starting with 7 day shifts (1200-2400h) then switching to night shift (2400-1200h) the majority of crew do not adapt to night shift with some effects of season being evident (3). Most recently we have shown, at 61^{o}N, that for a 14 day tour of 7 night shifts (1800-0600h), then 7 day shifts (0600-1800h), most subjects adapt to nights, but a very individual response was evident on return to days (4). The evidence suggests that readaptation to days may be more difficult than to nights in these conditions. This is consistent with observations on an Antarctic base where, particularly in winter, with no natural sunlight, delayed return to normal dayshift phase is seen. In addition to sleep problems and decrements in performance and alertness, strategies to shift rapidly and reliably the circadian clock to hasten adaptation are desirable in some circumstances. Much research demonstrates unequivocally that timed exposure to bright light is an effective means of manipulating the circadian timing system. Questions such as optimal intensity, spectral composition, duration and timing of light exposure, individual differences in response to light and age effects must be addressed. Similarly, timed melatonin can enhance adaptation to simulated and real night shifts and can improve sleep. Melatonin and light may act in concert to maintain endogenous circadian synchronisation. Their combined use should provide optimum phase shifting strategies.

1. Lund J, Arendt J, Hampton SM, English J, Morgan LM. Postprandial hormone and metabolic responses amongst shift workers in Antarctica. **J Endocrinol** 2001; 171: 557-564

2. Barnes RG, Deacon SJ, Forbes MJ, Arendt J. Adaptation of the 6-sulphatoxymelatonin rhythm in shiftworkers on offshore oil installations during a 2 week 12-h night shift. **Neuroscience Letters** 1998; 241: 9-12

3. Barnes RG, Forbes MJ, Arendt J. Shift type and season affect adaptation of the 6-sulphatoxymelatonin rhythm in offshore oil rig workers. **Neuroscience Letters** 1998; 252:179-182.

4. Gibbs M, Hampton S, Morgan L, Arendt J. Adaptation of the circadian rhythm of 6-sulphatoxymelatonin to a shift schedule of seven nights followed by seven days in offshore oil installation workers. **Neurosci Lett** 2002; 325: 91-94

Actigraph evaluation of sleep in marine watch keepers

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Introduction: Ships provide an opportunity to evaluate factors influencing the health, safety and performance of shift workers using the watch-keeping and non-watch keeping crew. This project has evaluated sleep by actigraphy and diaries in ships crew working different watches (4h on, 8h off, 0800-1200h, 1200-1600h, 1600-2000h, fixed schedule or changing/rotating once weekly) or 'normal' hours. In addition sequential urines were collected over 48h at weekly intervals for measurement of of the melatonin metabolite 6-sulphatoxymelatonin (aMT6s) as an index of circadian phase. **Methods:** Volunteers wore Actiwatch-L (Cambridge Neurotechnology Ltd) wrist worn activity and light monitors continuously except when showering. Data were downloaded approximately weekly and sleep parameters were derived from recorded movement (30 sec epochs) using the manufacturers software. The volunteers kept daily sleep diaries of bedtime, trying to sleep start time, actual sleep start time, wake up and get up, rated sleep quality and alertness 30 min after wake up on a visual analogue scale. For 48h at weekly intervals the volunteers collected sequential urine samples in 4h 'bins' (8h during sleep when appropriate), volumes were measured and recorded. Aliquots were frozen for measurement of aMT6s at the University of Surrey. Recording and collections were initiated on the RRS Ernest Shackleton, October 2002 and continued until January 2003 during a voyage from Immingham (UK) to Halley Bay (Antarctica, 75°S), with a crew change in Montevideo, finishing during the return journey to the Falkland Islands. Twenty two crew (8 rotating watch keepers, 6 fixed watchkeepers, 8 dayworkers) and 4 supernumeraries (dayworkers) took part. Nine weeks of activity recording and sample collections, 3 weeks on the Immingham-Montevideo leg and 6 on the Falklands-Halley-Falklands leg are available for analysis. Shifts were modified during periods of cargo discharge and loading, and this data was excluded from the analysis leaving 7 weeks of recording. **Results:** Compliance was good with 93% (range 81-100), dayworkers, 89% (71-97) rotaters and 92% (82-100) fixed watches, of the maximum possible data present and usable. All individuals working 12-4h and 4-8h watches had two sleeps per day which were analysed separately and then combined for calculation of overall averages. Initial results indicate that the rotating watch keepers have significantly less 'efficient' sleep than fixed watchkeepers and dayworkers, and longer total sleep time per 24 hours than the fixed watchkeepers ($p<0.01$ & 0.05 respectively, ANOVA, single factor: watch type, using individual averages, post hoc Students t-tests). The average overall sleep efficiency of dayworkers was 80%, fixed watches 82% and rotating watches 74%. There was no overall difference in sleep efficiency between the fixed watch-keepers and the dayworkers. Moreover there was little difference in sleep efficiency between the main (longest) sleep and the second sleep in fixed watch keepers (83.0±4.3, 78.9±4.1%, mean +-SD), whereas for rotating watchkeepers these figures were 80.5±5.1 & 70.4±4.2%. However these differences were both significant ($p<0.0001$ & $p<0.05$ respectively, paired Student's t-test). Urine analysis is ongoing together with the possible influence of ambient light. We conclude that fixed watches favour adaptation to a split sleep schedule.

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Shiftwork and performance in aircraft maintenance: Developing programs to reduce human error

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The worldwide hull loss aircraft accident rate declined greatly from the beginning of the jet age through 1975; however, the rate has stayed approximately the same since 1975 - around 1.5 hull loss accidents per million departures. Current projections are that the number of departures will almost double between now and the year of 2015 and so will the number of accidents. Thus, there will be about one major hull loss accident every week (Boeing 2001). Human factors research now encompasses not just failures of the flight crew to reduce human error, but all aspects of aviation in which a human may be involved, among them, aircraft maintenance. Maintenance technicians perform an essential and crucial role during 24 hours of the day and night. Their work is organized in fixed or rotating shifts. According to Airbus (2002), aircraft maintenance personnel and inspection are responsible for 12% of accidents worldwide. The Australian Safety Bureau's (2001) survey showed that most of 340 occurrences of error in the maintenance operations of high capacity airlines (airlines that operate aircraft with more than 38 passenger seats) occur during the early morning. In fact, the survey is consistent with other studies that have found that the early morning is a "high risk period" for human error. Folkard (2001) points out that the available evidence indicates that is a fairly substantial increase in risk across at least the first three successive night shifts. Thus, the aim of this paper is to make a review on what the aviation industry say about the effects of shiftwork on the performance of maintenance technicians and what they have done in order to mitigate human error. A maintenance error is an action or inaction within the maintenance organization that leads to an aircraft problem. Airbus (2001), Boeing (2002) and Tam Airline's (2002) data showed that shiftwork may lead to fatigue, insomnia, emotional stress, sleep disturbance affecting performance in various ways causing judgment error, inability to concentrate, slow reaction time, excessive time spent on one task, communication errors among others. Therefore aviation safety specialists from air carriers, regulatory agencies, research community have spent more than ten years developing maintenance resources management (MRM) or maintenance error decision aid (MEDA) programs to reduce human error in aircraft inspection, repair and overhaul. According to McKenna (2002), MRM is an effort to improve the capability of an aviation maintenance operation to identify and mitigate risks to safe and efficient activities by recognizing and addressing physiological and psychological limitations of the people conducting those activities. Boeing (2001) developed MEDA, a program that helps airline maintenance organizations reduce errors by giving them a tool to identify factors that contribute to failures. Another program called GRM (maintenance resource management) has been implemented by TAM Airlines since 2002 and the objective is to reduce error, increase situational awareness and communication and to build a safety culture within the maintenance personnel.

1 Folkard S. Improving safety at night. **Proceedings of XV International Symposium on Night and Shiftwork**, Hayama, Japan, 2001.
2. McKenna J. Maintenance resource management programs provide tools for reducing human error. **USA: Flight Safety Foundation,** 2002**.**

School schedule transition and adolescent's biological rhythms

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In former studies we reported partial sleep deprivation due to afternoon-morning school schedule transition occurring at a younger age (fourth to fifth grade). In this study we show the effects of a similar school schedule transition at an older age (fifth to sixth grade). Our hypothesis was that the afternoon-mroning transition at an older age would shown a stronger impact on biological rhythms, due to the phenomenom of sleep phase delay characteristic of adolescence, making the cost of the transition higher for the students.
We followed a group of 26 students aged 12-13 years old (13 boys and 13 girls) on two occasions, in May 1999 when they were attending school in the afternoon (13:00 thru 17:00h) and in September 2000 when they had shifted to the morning schedule (07:20 thru 12:30h). Biological rhythmicity was assessed with actimeters and the students kept a sleep diary for 14 consecutive days. A Brazilian version of the Horne & Östberg Morningness-Eveningness Questionnaire was applied and salivary melatonin was collected on one occasion at the end of the study.
We confirmed our hypothesis of a stronger impact on biological rhythms of the transition for older children, comparing sleep deprivations seen in this study (fifth to sixth graders) with our previous results (fourth to fifth graders).
Eveningness detected by the H&Ö questionnaire and confirmed by melatonin onset was associated with more important sleep deprivation.

Support: FAPESP

Effects of acutely displaced sleep on testosterone

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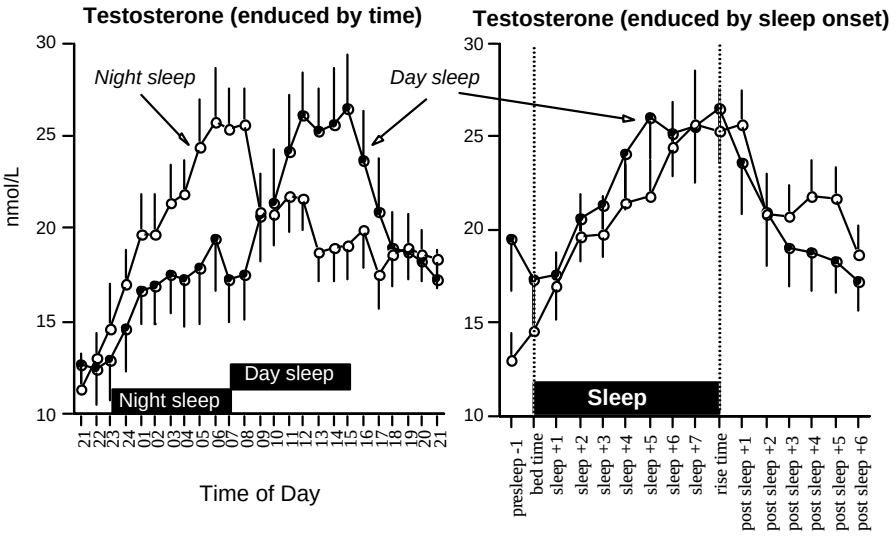
Objective There is little knowledge of how acute changes of sleep affect our physiology. The aim of the present study was to evaluate how circulating testosterone is affected by an acute change of sleep to the day-time.
Methods: Seven healthy, non-shift working, males participated in the study protocol (mean age 25±1SE years), which, besides an adaptation night, included a night sleep (sleep = 23-07h) and a day sleep condition (07-15h), in a balanced order. A venous catheter was inserted at 18:00 and blood was drawn hourly from 21:00 to 21:00 the following evening. Serum was analysed with respect to testosterone.
Results: The total amount of circulating testosterone did not differ between condition (p=.41), but there was a clear effect of time (p<.0005) and a significant interaction between condition and time (p<.005).



The eduction of testosterone at sleep onset, showed that testosterone increases during sleep (p<.0001) and decreases the hours after awakening (p<.001 for time), independent of time of day (during sleep: p=.07 for condition and p=.34 for interaction; during time awake: p=.20 for condition and p=.06 for interaction).
Conclusions: Diurnal changes of testosterone seems to be mainly sleep dependent and the released amount across a 24hour period will, hence, not be affected by an acute phase shift of sleep, at least when length or quality is unaffected. However, we do not yet know whether the anabolic effects of testosterone, *per se*, are the same during a day sleep as during night sleep, which makes assumptions about the recuperative value of day sleeps in shift workers uncertain. Another concern, particularly for the measurements of testosterone, is that morning levels are more dependent on time awake than on time of day.

Combined stressors faced by healthcare shiftworkers of a philanthropic hospital, of São Paulo, Brazil.

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Health care shiftworkers face a variety of stressors at work. A study was carried out in a philanthropic hospital in São Paulo, 400 beds, during the year 1999 (Fischer & Bellusci, 2000). The aim of this study was the evaluation of workers' perception of stressors at work. The studied population (total: 559 workers) consisted of 155 registered nurses and 404 nurse aids, with the following demographic characteristics: 408 (73.0%) females, and 151 (27.0%) males; age brackets 18|–30y 148 (26.5%), 30|–45y 324 (58.0%) and 45 |– and +, 87 (15.6%); time on the job as shiftworkers: 0|–10y 387 (69.2%), 10y and plus 172 (30.8%); college education 170 (30,4%), high school 389 (69.6%). Mean working time was 40hours per week. Shiftwork schedules were: 12h night shifts (19:00-7:00h), 8 or 6h day shifts, (7:00-13:00h, 13:00-19:00h or 7:00-15:00h). An open- ended question: "what strain you at work? " was answered by 502 persons, and mentioned 911 items. These items referred to several types of stressors. The stressors were classified in categories. The most frequently mentioned stressor was difficulty to perform tasks (52,7%) consisting in: excessive workload, difficulty to deal with the patients and their families, apprehension to commit errors, fear of death, fear of being laid off, multiple demands regarding the way tasks are performed, psychological pressure, work objects, high physical and cognitive demands, unexpected changes in tasks, bureaucratic procedures. The organizational climate was mentioned by 23.0% as source of stress: poor interpersonal relations, lack of cooperation, conflicts and competitiveness among coworkers and excessive demands by the administration.The most mentioned stressors related to working organization (12.9%) were: long working hours, night work, shift schedule, non-sufficient breaks during work, low wages, unpaid overtime, extended working time. Working environment (4.9%) stressors were: non- sufficient room, excessive noise, frequent renovation work, unsafe work environments, service elevators not readily available. Other stressors (3.8%)associated to work conditions were: long commuting time, bad transportation to and from work- home, excessive number of activities at work, and back home. Only 2.7% of the respondents answered there wasn't strressors at work. Previous and recent studies conducted among forensic workers, and healthcare workers of São Paulo, showed that these stressors are not unique of this occupational health group. Inspite shiftwork was not mentioned as one of the most important stressors, additional difficulties are expected due to continuous shiftwork. A comprehensive approach to improve working and living conditions, are necessary for this group of shiftworkers. It is important to improve the organizational and psychosocial climate, in order to maintain a healthy work environment.

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Effect of fatigue on cardiovascular system activity under 12-hour shifts and predominantly mental work

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Changes within the body's physiology caused by the work done under round-the-clock industry interact on the circadian changes in functional activities. Shiftwork, long working hours as well as mental work – each of these characteristics is known as a risk factor for cardiovascular disease. The purpose was to reveal the fatigue effect on cardiovascular system (CVS) activity in shiftworkers at the prevalence of mental work under 12-hour shifts in round-the-clock industry. Electricity distribution network controllers working 12-hour shifts under a 2-day rotation were observed (altogether 913 subject-shifts). Protracted concentrated observation against the background of hypodynamia characterises their work. Heart rate (HR) and both systolic and diastolic blood pressure (BPS and BPD) were measured at the beginning and end of the shifts for each subject. Eight haemodynamic parameters were calculated for each observation. A 5-point scale was used to estimate the perceived level of fatigue experienced by the controllers. Interactive changes in CVS activity were found to be coupled with increased feelings of fatigue (Pillai's test, $p<0.01$). Increased perceived fatigue was also related to increased HR, BPS and BPD ($p<0.02$). While HR at the end of the shift was lower than at the beginning of the shift, BPS and BPD showed the opposite changes ($p<0.01$). Increase in perceived fatigue was found to be related with the greater extent of shift-end increase in BPS and also lesser extent of shift-end decrease in HR ($p<0.02$), providing evidence for shift-end activation in CVS activity. Interactive changes in CVS efforts at the end of the day shifts (Pillai's test, $p<0.03$) as well as the changes in 3 parameters ($p<0.05$) were found to correspond to increased perceived fatigue. No interactive changes were found at the end of the night shifts. One of the CVS activity parameters at the end of every night shift depended significantly on the level of perceived fatigue ($p<0.02$). Interactive over-shift changes in CVS efforts, coupled with increased feelings of fatigue, were found to be the most pronounced in the 2nd consecutive day shift (Pillai's test, $p<0.03$). This probably reflects the mutual strengthening of the fatigue effect – on the one hand, and changes in functional activities from morning towards evening within the circadian cycle – on the other hand. No interactive over-shift changes in CVS activity were found in the 2nd consecutive night shift evidencing apparently the masking effect of morning activation in a body's physiology. Over-shift changes in 5-6 parameters depended on the level of perceived fatigue in every night and first day shift ($p<0.04$). Thus, pronounced interactive changes found at the day shifts in CVS activity coupled with level of perceived fatigue probably manifest the active central mechanisms in the body's adjustment to the work conditions at the day time. In the opposite, at night, the peripheral mechanisms in CVS activity regulation appear to be more pronounced. The nature of changes in CVS efforts with respect to fatigue, apparently, is similar to this one from morning to evening, and, in the opposite, is contrary to the nature of changes from evening to morning. The revealed increases in BP and HR with increases in perceived fatigue can reflect an increase in physiological cost of the work done.

Working hours, work-life conflict and health: a comparison of precarious and "permanent" employment.

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Recently, precarious employment (including casual, temporary, sub-contract and other forms of insecure work) has expanded dramatically in industrialised countries and is strongly associated with negative health and safety effects (1). Although many shiftworkers are precarious employees, shiftwork research has focussed predominantly on full-time workers in continuing employment. This paper examines differences between precarious and "permanent" employees working in the same workplaces, focusing on working hours, work-life conflict, and health and safety outcomes. Data were collected using convergent interviews followed by questionnaire surveys and structured interviews. A total sample of approximately 1500 workers was drawn from workers employed in road transport, call centres, and five-star hotels. This paper reports on data collected from 48 convergent interviews completed in two hotels. Convergent interviewing (see 2) is a structured process within which a series of non-directive, in-depth interviews is conducted and interpreted. The process iterates between data collection and interpretation and enables researchers to refine research questions and interpretations across a series of interviews.
The results highlighted numerous differences in work organisation and health and safety between precarious and permanent employees. For example, precariously employed shiftworkers were more likely to work highly irregular hours over which they had very limited control. Daily and weekly working hours could range from very long to very short according to organisational requirements. Longer working hours, combined with low predictability and control, produced more negative effects on work-life balance for precarious employees. In many cases, these problems were exacerbated by uncoordinated hours worked across multiple jobs (or paid employment and tertiary study). Other issues identified concerned factors such as stress and fatigue associated with work overload and unpredictable hours, inadequate health and safety training, inadequate knowledge of rights and entitlements in relation to health and safety, exposures to physical hazards and the use of personal protective equipment.
Further research is required to establish the generalisability of the effects identified, to determine the causal processes leading to these effects and to identify effective management responses.

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Effects of flexible working hours on health and well being – results from a secondary analysis of a European survey

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Problem: Flexible working hours seem to be at the core of strategies for improving economic efficiency and a requirement for any economy to survive according to the arguments from economists and employers. Flexible working hours on the other side seem to be a chance for unions and employees to recover autonomy over one's own working conditions, at least with respect to time. Flexible working hours, so the argument, allow workers to adapt their working hours to their specific preferences, e.g. relating to family and social life. Reviewing the literature, however, shows that little is known about the effects of flexible working hours. Empirical evidence for the arguments raised is usually simply missing. In the context of the SALTSA project on flexible work hours and in conjunction with a national project (see Janssen & Nachreiner, this volume) a study has been conducted on the effects of flexible work hours on health and well being.
Method : A secondary statistical analysis of a the data from a survey conducted in 2000 in all of the 15 member stated of the EU by the European Foundation for the improvement of working and living conditions was performed, using factor analyses over those questions related to working hours to categorize flexible working arrangements into orthogonal groups in order to separate different aspects of flexibility and to test for their separate or combined effects on health and well being. Dependent variables were health complaints, which were analyzed separately and after factorization, as well as reported psychosocial impairments. For the analysis only employed people were selected, since autonomy available to the self employed by definition. In total, about 10.000 respondents have been included in the analyses.
Results: The results of the factor analyses allowed to separate variability effects from those of night and shift work, since variability resulted in a separate factor apart from the one covering night and shift work. The third factor could be interpreted as autonomy or discretion in regulating one's working hours. ANOVAs showed that shift work, variability and autonomy all affect health and well being separately, but also in interaction. Shift work and variability of working hours in general lead to impairing effects, whereas influence shows a positive effect. Employees with variable working hours and no influence on the arrangement of their working hours clearly show the strongest impairments in family and social life, in particular if this coincides with shift work, representing an significant interaction effect, e.g. for sleep or satisfaction. It would seem that discretion reduces, but cannot compensate the impairing effects of variability or shift work, and especially not their combined effects.
Conclusions : The results of this study are in full agreement with results from our national study. If flexibility of working hours includes variability, and this is nearly implied by definition, impairing effects on health and well being seem to be an important problem, comparable to shift work effects, which have to be observed in the design of flexible working hours.

Interaction of age with shift-related sleep-wakefulness, sleepiness, performance and social life

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The objective of the present study was to analyse the shift-related interaction of age with sleep, social life, subjective sleepiness and objective performance among the shiftworkers.
A field study with a developed Pocket PC diary and actigraph recordings (ActiWatch) was carried out for 49 male technicians shiftworkers of an aircraft technical maintenance unit and with the same regularly rotating schedule (MMM — NNN — EEE —). They were divided in 3 age group (young : 25-34 years, n = 13 ; middle : 35-49 years, n = 17 ; senior : 50-58, n = 19). During one cycle of 15 days, sleep variables actigraphy and diaries were collected as well as social life ratings. Subjective rating of sleepiness (Karolinska Sleepiness Scale, KSS) and objective performance (with the PVT, a 10-minute visual Psychomotor Vigilance Task) were rated at the start and at the end of each shift. The effects of shift, age and time on the shift (KSS and PVT) and their interactions were studied by the analysis of variance with repeated measures.
Most variables were strongly shift-dependent, night shifts being related to the shortest sleep latency and shortest actual sleep length, lowest subjective alertness and poorest performance and social life. Age had significant main effects only on the time in bed and the actual sleep time showing a shortening of the main sleep period of the older age groups after the night shifts. Young subjects reported more insufficient sleep after the morning shifts and the oldest group after the night shifts, as indicated by a significant interaction between the shift and age ($p=.046$). According to the median reaction time and the percentage of lapses in the PVT, the performance of the middle-aged and older group impaired more than that of the young group towards the end of the night shift, as indicated by a significant interaction between the shift, age and time of the shift ($p<.001$ for the response times and $p=.11$ for the lapses). According to subjective sleepiness, results indicate the same triple interaction : the increase of subjective sleepiness was greater in the young group than in the older groups towards the end of the night shift ($p<.001$).
Although the shift type influenced the sleep significantly, subjective sleepiness, objective performance and social life of the male technicians, age was distinctly related only to the amount of sleep and psychomotor vigilance. Night shifts were related to shorter sleep, decreased objective performance and increased sleepiness. The increase of performance lapses during the night shift was about 2-3 fold among the 35-49 year and 40-58 year old workers compared to the youngest group.

Coping style is related to psychological and somatic complaints among air traffic controllers.

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Introduction. Two different styles of coping, engagement and disengagement, were investigated to assess their relationship to reported psychological, digestive, and cardiac symptoms among shiftworking air traffic control specialists (ATCSs) in the United States. Engagement represents a more active, task oriented coping style utilized to manage stress. This coping style may be more costly (to the individual) initially, but more effective in the long run. Disengagement, on the other hand is characterized as an emotion-focused strategy in which the individual avoids the stressor, which may save the individual effort in the short-term, but produce more negative consequences in the long-term. **Method**. A modified version of the Standard Shiftwork Index (SSI) was distributed to all Federal Aviation Administration employees designated as 2152s (ATCSs). Of those, 6,753 (28.74%) completed the survey. Two subscales from the Coping Strategies Inventory (CSI) were used to assess the degree to which an individual actively (engagement) and passively (disengagement) coped with problems. Only those individuals currently working shiftwork were included in the analyses (n = 5,879). A tertile split, collapsed individuals into high (n = 2,051) or low (n = 1,608) engagement and high (n = 1,896) or low (n = 1,763) disengagement groups. Gender also served as a factor in the analyses (male = 3,042; female = 617). Dependent measures included the General Health Questionnaire (GHQ), cardiovascular health (CV), and gastrointestinal health (GI). **Results**. All analyses consisted of a 2 (high/low engagement) X 2 (high/low disengagement) X 2 (male/female) between-subjects ANOVA, controlling for age and number of years working their current shift system. For the GHQ, there was a significant three-way interaction, F (1, 3649) = 5.8, $p < .05$. Post-hoc analyses revealed that the interaction resulted from higher GHQ scores among the females who scored high in disengagement and low in engagement. For both GI and CV, there were significant main effects for gender, GI: F (1, 3658) = 7.6, $p < .05$; CV: F (1, 3650) = 11.5, $p < .05$, with females reporting significantly higher symptomatology than males. The analyses of GI and CV also revealed a significant main effect for disengagement, GI: F (1, 3658) = 151.7, $p < .05$; CV: F (1, 3650) = 128.7, $p < .05$, with individuals scoring higher in disengagement reporting more symptomatology. **Discussion**. In general, individuals who scored high in disengagement reported higher (worse) GHQ scores, as well as more GI and CV symptoms. Our findings suggest that women may employ disengagement more than men. These findings are consistent with others who have found that for most people, engagement may be used to manage problems on a day-to-day basis with disengagement reflecting an emotional coping strategy used when problems become too frequent or too severe. In conclusion, the finding that high disengagement is associated with higher GI and CV scores may reflect the physical expression of this relationship. Further research is needed to ascertain if those individuals who scored high in engagement maintain low GI and CV scores.

Consequences of 12-hour nightwork on fatigue and work ability of health care workers.

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Introduction: Concepts as fatigue, tiredness and also sleepiness have been used to describe the same status, without a clear definition. Fatigue was defined, psychologically, by Brown et al., 1984, as a performance´s decrease. There are several causes for fatigue such as circadian factors, sleep deficit and time on the job acting separate or together. As hospitals must work round a clock, the work schedules should be based on continuous shifts. This can cause fatigue and decrease on work ability. In Brazil, an adopted traditional shift work schedule in hospitals is 12-hour shifts (day or night) followed by 36 hour off.
Objectives: To evaluate the impact of 12-hour night work followed by 36-hour off on perception of fatigue and work ability of health care workers.
Methodology: A cross-sectional study was carried out in the Orthopedic Institute of the University hospital of the Medical School of the University of São Paulo, São Paulo, Brazil. Work Ability Index (Tuomi et al, 1994) and fatigue (Yoshitake, 1975) questionnaires, were filled out by the workers.
Results: Thirty four shiftworkers (31 women and 3 men), with mean age of 37.5 (sd + 10.8) years, mean working time on shifts at hospital of 89.1 (sd + 74.2) months accepted to participate on this study. More than 20% of the studied population showed higher scores for fatigue (higher than 75 points in a total score of 150). Fatigue was negatively correlated to age (r= -0.52; p=0.006): younger workers (less than 40 years) showed higher scores than older workers. An important percentage of the studied population (61.7%) showed a reduced "work ability index" (WAI) than expected, including younger workers. Those with lower WAI perceived also higher perception of body fatigue (r= -0.89; p=0.000).
Discussion and Conclusion: The results are possibly influenced by the healthy worker effect. The studied population showed some decrease of workability as well as higher fatigue scores in younger workers. A decreased duration of day time sleep was observed among these healthcare workers (Borges & Fischer, 2003). Twelve- hour night shifts is a negative stressor to nursing personnel, and in combination with other stressors can compromise work ability and well-being of the workers. These findings support recommendations to discuss the organization of 12-hour shifts for healthcare workers in Brazil.

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Tools for designing and organizing safe work schedules, managing production and fatigue

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With the increased demand for flexibility in the production of goods and services, work schedules are becoming diversified and the tools for designing and managing them are increasing in number. From examples of research carried out in Québec Province, Canada, three complementary types of tools for designing and organizing work schedules and for managing fatigue will be described. Their advantages and disadvantages will be discussed, as well as the methodological and ethical limitations of research and ergonomic intervention in this area.

1. Organization of work schedules based on ergonomic criteria. Field studies carried out in activity sectors where the shifts are particularly long have shown the harmful consequences of these schedules on the health of workers and the safety of operations, during the day as well as the night. A tool for organizing work schedules in relation to the production requirements and the operators' needs has been developed. However, the experimental study on the design and evaluation of ergonomic schedules in the petrochemical industry, in airplane equipment manufacturing and in the motion picture industry could not be continued because this schedule design tool requires a high degree of maturity in labour relations as well as a high capacity by workers to make compromises among themselves.
2. Computer-assisted design and management of work schedules. A recent study in the home care sector has shown that workers perform a large variety of tasks, many of which the managers are unaware of. The software used to plan routes and work schedules rarely take this "hidden" work into account, nor the major differences between the prescribed work and the real work. For this reason, success in implementing this type of software depends to a great extent on work organization in the care services in question.
3. Fatigue management programs. A current experimental investigation is attempting to test the benefits of a fatigue management program on police officers working on rotating shifts. The program integrates a judicious sleep/darkness and light exposure schedule. Sleep, performance, adjustment of the biological clock and satisfaction are evaluated before and after 7 consecutive night shifts. This study is attracting controversy because, besides the unknown long-term effects of phototherapy, it asks the question: "Should people be adapted to the work, or the opposite?" For this reason, a concurrent pilot project is exploring the benefits and feasibility of an alternative work schedule: the police officers are undergoing an ambulatory study for 3 months on their normal schedule, and for 3 months on a modified schedule.

Reduction of working time: night shifts versus morning shifts

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Objective: A company aware of the negative effects of night work on sleep, biological rhythms and social life decide to reduce to 32 hours per week the night working time. Now, work schedules include also Morning and Afternoon shifts. This study concerns the evaluation of the feeling of workers as well as their wishes toward work schedules in order to propose the best compromise that respects this new internal law and workers expectations. **Method**: the approach setting up includes 2 successive parts. First: evaluation by questionnaires and interviews of the feeling of workers and their wishes regarding to work schedules. 29 workers on 30 participated to this survey. Second: Shift Assistant Plan (SPA) software was used in working group to elaborate new work schedules with respect of the law and the results of the first part of the study. **Sample and work schedules**: 65% of workers are male, 76% are married and 48% with children. Average age is 32 years (range from 24 to 56 years). Shift work system rotates weekly between morning (M: 5h-13h), night (N: 21h-5h) and afternoon shifts (A: 13h-21h). There are 4 to 5 shifts per week, and an off period between Saturday at 12h and Monday at 4h. The 27 weeks of the cycle include 40 N shifts, 41 M shifts and 36A shifts. **Results:** Regarding to sleep and fatigue, workers complain more from morning shifts than from the 2 other shifts (N and A). The early starting time and the high number of consecutive M shifts induce sleep deprivation and an increase of fatigue after 2 or 3 M shifts. The difficulties of N shift are related to the day off including during N weeks. Workers like N shifts but they complain from the sleep disturbances caused by one day off between 2 N shifts. While day off between 2 M shifts is appreciated because of its recuperative value. The workers expectations regarding to work schedule are associated with this feeling. Some of them prefer to be at work on fixed N shifts (10 workers), 2 workers on fixed M shifts. The others prefer first to extend the duration of N shift to 9 hours in order to start the morning shift at 6h, second to avoid one day off between 2 N shifts and third to have more days off during M weeks. Of course, the administration doesn't agree with these propositions that are contrary to the new law that aims to reduce the night working time. Using SPA software, it appears rapidly that the only introduction of the new law will induce an increase of number of N shifts weeks with one day off between 2 N shifts and that it's impossible to change from weekly rotation to rapid rotation because of the variation of the need of workers over the week and between the shifts. But, the software proposes a new work schedule that respects 32 hours per week for N and also for M shifts. In fact A shift duration was increased from 8 to 9 hours (13h to 22h), 8 hours for N shift and 7 hours for M shift. The days off between 2 N shifts were also suppressed. **Conclusion:** The administration was surprised by the fact that workers complain more from morning shifts than from night shifts. The workers ask to implement the reduction of working time to morning shift instead of night shift arguing that a part of morning shift occurs during the night. The shift-rotas elaborated by SPA is under discussion between the administration and workers.

Coping with long-range flying: revised recommendations for crew rest and alertness

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This paper is concerned with a revision of our earlier recommendations booklet for crew rest and alertness on long-range flights. The original recommendations (Cabon et al, 1995, Mollard et al 1995) were based on extensive research by a number of international groups, and were validated in a number of studies using physiological recordings on 156 flights (Cabon, et al, 1993). They were issued in French by the DGAC and an English version was issued by Airbus. The English version was distributed by Airbus to more than 5000 samples and was adapted by both British Airways and Varig to local long-haul aircrews rotations. The initial version of the recommendations took account of the most frequent situations that aircrews encounter in term of flight schedules and time zones. It comprised 20 different cards that the pilots have to choose from to fit their flight characteristics and destination. Separate recommendations were made for the "pre-flight and in-flight" periods, and for the "post-flight layover" rest. The pre-flight and in-flight recommendations took account of the timing of the flight and the type of crew. The recommendations for layover rest took account of the direction of the flight, the number of time zones crossed and the duration of the layover. We have updated the recommendations to take account of advances in the field, to extend these recommendations to all long-haul flight schedules (around the clock) with all time zones (+12) and to simplify their use. For example, we now take account of the time at which the crew member has to leave their home or hotel, as opposed to the timing of the flight, since it is this that will determine when they have to terminate their sleep and when they are able to nap. In addition, the layover recommendations took account of the number of local nights instead of its duration in hours. We also aim to simplify their use and reduce the total number of cards by regrouping in the same card pre-flight, in-flight and layover recommendations. Finally, we plan to develop software based on the various algorithms with a view to implementing the recommendations on a laptop. This would enable the crewmember to simply enter their flight details in order to obtain a detailed set of recommendations that could to tailored to take account of any known individual differences such as morningness-eveningness, their sleep quantity and quality before and during the flight, and the pattern of rest during layover.

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Temporal patterns of single-vehicle accidents (SVA) specifically due to fatigue of drivers of trucks and passenger cars in Texas

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The object of the study was to assess the State of Texas (USA) motor vehicle accident database for temporal patterns in SVA caused by driver fatigue, as documented by the investigating highway patrolman. The investigation focused on SVA involving light (weight <10,000 lbs. and 2 axles) and heavy (weight >10,000 lbs. and >2 axles) trucks and passenger cars resulting from driver fatigue (primarily falling asleep while driving). A total of 83,309 fatigued-induced SVA occurred between 1975 and 1994; however, the records of only 79,227 SVA were complete and useable for analyses. A total of 28,976 (36.6%) SVA involved drivers of light (N=24,125) and heavy (N=4,851) trucks. The remaining 50,251 (63.4%) SVA involved drivers of passenger cars. SVA involving recreational and sport utility vehicles, vans and station wagons, which were relatively small in number, were excluded from the analyses. The drivers of the three types of vehicles were assumed to have been adhering to a usual routine of diurnal activity alternating with nocturnal sleep. $\div^2$ analysis of the hour of day, day of week and month of year data validated 24h, 7-day and annual patterns in light truck, heavy truck and passenger car fatigue-triggered SVA ($P<0.0001$). The 24h variation was the most dramatic temporal pattern, with a robust major peak in SVA in the early morning hours and a secondary, yet substantial, peak ~12h later in the afternoon. Preliminary findings of single cosinor analyses[1] applied to the 20-yr aggregated SVA confirmed prominent high-amplitude 24h patterning of accidents caused by fatigue with the major peak varying from between 03:00h and 04:16h in the drivers of both light and heavy trucks as well as passenger cars ($P<0.001$). These findings are consistent with the results of other studies typically involving data of a shorter time span and a lesser sample size. Additional cosinor analyses of the aggregated 20-yr data, however, failed to reveal 7-day or annual patterns in SVA ($P>0.05$).

1. Nelson et al., Methods for cosinor rhythmometry. **Chronobiologia** 1979; 6:305-323)

Crew sleep patterns of cockpit napping during transatlantic flights

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Since the initial study of Rosekind et al (1994) who showed the positive effects of cockpit napping on alertness and performance in 3-man crews, cockpit napping in non-augmented crew during long-haul flights raises numerous issues regarding flight safety because of the negative effects of sleep inertia on performance. These effects are known to be maximum when awakening occurs during a deep sleep stage (Naitoh, 1981). In order to study the in-flight sleep patterns, cockpit napping of 20 pilots were recorded using physiological data (EEG, EOG and EKG) during 10 round trips Brussels-New York (i.e. 20 flights). The flight schedules (in GMT) were 1900 to 0200 for the outward flights and 0400 to 1030 for the return flights with a 1 day layover in New York. During these flights, crews were encouraged to take short naps during limited periods of 45 minutes. Based on previous studies, it was assumed that this duration should avoid the occurrence of deep sleep stages. Results show that out of the 20 flights studied, 12 rests includes at least one sleep period during the outward flights and 18 during the return flights. Mean sleep duration is significantly longer during the return flights (30.1 mn) than during the outward flights (13.3 mn). The sleep latency is significantly lower during the return flights (5.2 mn) than during the outward flights (12.1 mn). The sleep stages differ also significantly between the outward and the return flights. During the outward flights, only one stage 3 and 4 is observed while 5 are noticed during the return flights. Furthermore, during the return flights, the mean stage 3 and 4 latency is shorter than expected (21.9 and 21.2 mn, respectively). These results suggest that sleep inertia due to deep sleep is likely to occur after cockpit napping even when the rest period has been limited to 45 minutes as it is widely recommended by several airlines. The deep sleep during the return flights can be explained by both the effects of the time of the day and the cumulative sleep loss. From these results it should be recommended that pre-planned cockpit napping should take into account theses factors to modulate the rest period and that sufficient time should be provided after the nap to allow the dissipation of sleep inertia. Technological systems should also be considered as an help for avoiding drowsiness of the pilot flying while the other is napping (Cabon et al, in press).

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Frequency and incidence rates of accidents in tunnel diggers

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Aim of the study. To analyse the temporal distribution of the accidents occurred in a 3 and a half year period among workers (740 workers per year on average) engaged in tunnel digging for a new high speed railway network.
Methods. All the accidents, occurred during the period 1.1.1999 - 30.03.2002, were recorded. Both "light" (without absence) and more "severe" accidents (1-3, 4-30, >30 day absence) were considered. They were stratified according to time of occurrence (year, month, day of the week, day of the duty period, hour of the day, hour of the duty period) and duty schedule (day work, 2 day-shifts, semi-continuous 3-shift system, continuous 3-shift system).
Results. One thousand nine hundred and fifty one accidents were recorded in total: 54.5% with no absence, 5.6% with 1-3 day absence, 25.6% with 4-30 day absence, and 14.4% with more than 30 day absence.
The frequency rates, in relation to the annual worked hours, were quite constant in general during the seven semesters and the months of the year, showing a slightly higher incidence in summertime and slightly lower in wintertime, and a trend to a decreasing of the most severe cases in the last two semesters (following the adoption of improved preventive measures).
Significant differences in terms of temporal distribution were recorded as concerns:

- day of the week: higher frequencies on week-days (less on Friday) and lower on week-ends, due to the different presence of the work-force in relation to the duty schedules.
- day of the duty period: higher frequencies on the 1st and 3rd day of the 5-6 day period in general; higher frequencies on the 5th day in 3-shift workers than in day and 2-shift workers.
- hour of the day: there were four peaks in the incidence rates: at 1-2am, at 10-11am, at 4-5pm and 8-9pm; that was evident both during week-days and on week-end (when mainly continuous shift workers were at work) with the difference that the peak at 4-5pm was far more higher during the week-days, and probably due to the contribution of overtime of day workers.
- hour of the duty period: higher frequencies at the central hours (particularly at the 4th and 5th hour) in general, but high frequencies at the 7th and 8th hour in 3-shift workers than in day and 2-shift workers.

The workers' profile and prevalence of diseases among health care night workers at an university hospital

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Objectives: to evaluate the Work Ability Index and reported health symptoms and diseases, among nursing personnel.
Methods: The study was conducted at an University hospital of the countryside of the State of São Paulo. The questionnaire "Work Ability Index" (Tuomi et al, 1997) complemented with demographic data and living conditions, including life style questions, were answered by nursing personnel (registered nurses and practical nurses) who worked night shifts.
Results: Response rate was 73%: 312 out of 425 health care shiftworkers participated in the study. All of them worked 12-hour fixed night shifts, 12h-on X 60 h-off (mean work duration per week was 31 hours, approximately 10 night shifts per month), from 19:00 to 07:00h. 83.7% were women and 16.3% were men, age range of 24-59 years old (mean age of registered nurses: 38.3 years old(SD 6.7) and 40.3 years old(SD 7.6). Their educational level varied quite significantly: 0.96% had only four years at school, 11.86% up to eight years, 38.5% had at least eleven years and 34.29% attended College.
69.9% worked as practical nurses and 30.13% as registered nurses. Mean time as night workers: 10.7 years (SD 4.99) and 8.3 years (SD 6.1) for registered nurses and practical nurses, respectively. Registered nurses received a monthly payment of US $ 700.00- 1,400, according to their seniority. And practical nurses, 350.00 US dollars, approximately. Smoking habits and regular use of alcoholic beverages were reported by 20.8% and 34.9% respectively; 28.5% of our participants held a second job during their off-nights of the university hospital.
The scores of work ability index were: poor (2.6%), moderate (25.6%), good (47.4%), and excellent (39.4%). Registered nurses showed mean work ability index of 40.1, and practical nurses of 39.2 (non-significant differences). Logistic regression analyses showed 27.7% decrease of work ability as age (5 years inteval) increased (p= .02). Similar results were obtained associated to time on the job: every 5 years are associated to a decrease in the work ability index in 40.7% of the subjects (p= .04).
The most reported medical conditions were: arterial hypertension, lesion in the arm and hands, obesity, lesion in the legs and feet and minor mental disturbances. 67.9% reported, at least, one medical condition. Injuries leading to back pain (28.9%); disorders of lower back (17.0%), sciatica (11.9%), minor mental diseases (23.7%), obesity (13.5%), gastritis or duodenal irritation (6.4%), skin allergic reactions (8.3%), repeated infections of the respiratory tract (6.4%).
Although this is a relatively young population, important medical conditions were reported, with an impact in the workability. Recent changes in the Social Security System obliging workers to remain longer in their jobs will have an impact in these workers. They might be leaving their jobs earlier, due to compulsory retirement, if urgent improvements in the working conditions and life styles are not implemented.

Night shift work and breast cancer risk: comparing additional artificial lighting and increasing natural day light

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Enhanced breast cancer risk in women working in night shifts has been attributed to additional lighting at night (1). In a study on annual variations of breast cancer in Israeli patients seasonality was found by month of self-detection of the first symptom (2). Here a comparative study between the putative effect of artificial lighting and annually varying natural lighting is conducted. Self-detection was reported in 1944 (66%) out of 2948 patients diagnosed during 1960 through 1966. Equating increasing day length with extended lighting at night a division was made between patients who detected the symptom during increasing day length (after winter solstice) and those who detected the sign during decreasing day length (after summer solstice).

Table 1. Distribution of self-detected breast cancer symptoms by season

Environmental factor	Increasing day length	Decreasing day length
	No of cases (%)	No of cases (%)
Seasonally affected	575 (29.6%) in spring	429 (22.1%) in autumn
Seasonally non-affected	464 (23.9%) in summer	476 (24.5%) in winter

The sharp increase began in the month after the spring equinox, rising from 163 cases in March to 195, 190 and 190 cases in the following three consecutive months. While in summer and winter the percentages are more or less equal and do not deviate from the expected 25%, spring and autumn differ significantly: Odds Ratio (OR)=1.37 (95% CI=1.15 -1.64 P<0.005). For subgroups (data in reference 2, p. 893), patients <55 years of age OR=1.34, CI=1.07-1.68 P<0.05); patients 55+ OR=1.25, CI=0.94 to 1.67. When there was another first symptom (5.1%) mostly pain, OR=5.58, CI= 2.13-14.62. In the diagnostic groups the ORs were smaller (All ages: OR= 1.07; CI= 0.93-1.24). Interestingly, a similar distribution of self-detection of the first breast cancer symptom by month in the Southern Hemisphere (3) showed also significant annual cycling with a peak in November (spring) and a trough in May (fall). The seasonal patterns of breast cancer incidence and of conception rates appear to be similar. As can be deduced from birth seasonality: a sudden rise in conceptions occurs after the spring equinox, and continues under photoperiodic regulation till the summer solstice. The significant differences between peak and trough seasons might imply that by diminishing conceptions during spring and increasing conceptions during fall breast cancer incidence can be decreased considerably. **Conclusion** Our findings supports the presumed effect of light on human conceptions and suggests that the same factor underlies seasonal occurrence in breast cancer .

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Shiftwork accidentability pattern in 7,007 Chilean companies

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Objective.
The main objective of this investigation was to make a retrospective statistical study of the accidents gravity in a wide sample of Chilean companies.
Method.
2.1 Companies selection:
Using the data base registries of work accidents of the national health network of the Chilean Safety Association (ACHS), were selected 7,707 companies that had reported at least one night accident within 23:00 - 07:00, at the period 1996-2001.
2.2 Statistical analysis:
On the totality of the accidents reported by these companies (n=427,859), gravity statistics were studied, according to hour of occurrence, size of company, economic sector and geographic region. It was used a normality test (Kolmogorov-Smirnov) and a parametric test to analyse averages differences (T-Student).
Results: The results indicate that night shifts accidents (23:00-07:00), have greater severity than occurred during diurnal shifts (07:00-15:00 and 15:00-23:00; $p<0.05$). The severity peak occurs between 5:00 and 7:00. In any size of companies (small, medium or large), the night accidents, have greater severity than occurred during diurnal shifts ($p<0.05$). The accidents occurred in the mining sector have greater severity than in rest of economic activities, in any schedule ($p<0.05$). The accidents occurred in the manufacturing sector, during the morning, are more serious than occur in the commerce, construction, electricity and service sectors ($p<0.05$). The accidents registered in companies located at south of Chile are more serious than occurred in companies located in the center of the country (Santiago), in any schedule ($p<0.05$). The accidents registered during the day (07:00-23:00) in companies located at the north of Chile, are more serious than located in the center of the country ($p<0.05$). There are not significant differences in the accidents severity within companies located at center and south of Chile, in any schedule ($p<0.05$).
Conclusions: These results show the importance of developing specific risks prevention strategies according the economic sector, size and geographic region of companies in Chile. The severity of shiftwork accidents is dependent of a complex network of variables. The studied ones in this investigation have importance, but it is necessary to develop field investigations to evaluate the causality of work accidents.

Flexible work hours, health and well being: results of the SALTSA project

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The project brought together researchers from 9 EU-Countries; the main findings are:
a) There is an urgent need of defining the concept of flexible work hours, since it has been used in many different and even counterintuitive ways. There are large variations in the conceptualization and approaches to FWH according to different cultures, history, socio-economic conditions, work sectors, and industrial relations. The most obvious distinction was where the influence over the work hours lies, that is between the *"Company-based flexibility"* and the *"Individual-oriented flexibility"*. b) The review of the Legislation in force in the 15 European countries shows that the regulation of working times is quite extensive and covers (also with reference to the Council Directive 93/104/EC) almost all the various arrangements of working hours (part-time, overtime, shift and night work, etc.), but fails to provide for flexibility. c) The literature review was able to list more than 1000 references, but it was striking that most of these documents were mainly argumentative with very little empirical data, and of low quality. Thus, from a scientific perspective one may conclude that there is a large scale intervention going on in our societies with completely unknown and uncontrolled effects, especially concerning long-term effects on safety, health and well being of the workers. d) According to the 3rd EU Survey on Working Conditions (EURF 2000), the prevalence of flexible work hours as defined by being able to influence one's work hours (i.e. individual flexibility) was 38.3 and 37.0% for men and women, respectively. Longer and "irregular" working hours are in general associated with lower levels of health and well-being. Moreover, low (individual) flexibility and high variability of work hours (that is company based flexibility) were consistently associated with poor health and well-being, while low variability combined with high autonomy were associated with positive effects. e) Several studies from different countries showed that: the majority of the workers in the European Union have some forms of individual or company-based flexibility in work hours; flexibility varies according to country, economic sector, social status and gender; overtime is the most frequent form of company-based flexibility; agriculture, transportation, information technology, education and health are the sectors with the highest flexibility in work hours. Overtime and weekend work have negative effects on stress, sleep, social and mental well being. Individual flexibility alleviates the negative effects of the company-based flexibility in work hours on subjective health, safety and social well-being. However, individual flexibility is not associated with the subjectively reported sickness absence or the opinion to remain in the work force until the retirement age.

The project (Contract no. Dnr. 2000-1141/1998-0327, V-kod 24982011) was funded by the Joint Programme for Working Life Research in Europe (SALTSA), driven by the Swedish National Institute for Working Life and the Swedish Confederation of Trade Unions (LO), Professional Associations (SACO) and Professional Employees (TCO).

Multidimensional aspects related to health and well-being

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The impact of shift and night work on health and well-being is a complex and multifaceted problem. It shows a high inter- and intra-individual variability, both in terms of kind of troubles and temporal occurrence, related to various combinations among several aspects dealing with different domains: individual characteristics, personal behaviours, work demands, company organisation, family relations and social conditions.

Such factors can have different effects according to the circumstances and ways of interaction, and the consequent result depends not only on the specific load of each factor, but mainly on how much and how long they interact and interfere with each other in relation to the peculiar conditions of each individual or group of shiftworkers. Moreover, they may have significant implications also on productivity, company strategies, family life and social organisation, which in turn influence individual health and well-being. Circadian desynchronisation, psycho-physical fitness, performance efficiency, mental and physical health, work satisfaction and social integration are the main indicators by which we try to evaluate this impact.

While effects on family and social well-being might manifest in the short-term, significant health troubles are more likely to occur after a long-term exposure and to have a chronic-degenerative trend with increasing age and work seniority; these factors are generally strictly connected, but their interactions are not always clearly interpretable. On one hand, aging is associated to greater rhythm disturbances, sleep troubles, psychic depression and reduction of physical fitness; on the other hand, it also means a progressive learning of better coping strategies, particularly in terms of work commitment, regular life regimen, more satisfactory job positions, better housing conditions, and fewer domestic constraints.

It has also to be considered that the health troubles are typical psychosomatic disorders, that are quite common in the general population, as they recognise a multifactorial origin due to the influence of several risk factors related to genetics, personality, life style, social conditions and intervening illnesses. They can be also modulated by other factors affecting their historical prevalence and epidemiological relevance, which are strongly influenced by living conditions and therapeutic aids, able to modify and support the work ability of the persons. In this context, shiftwork can act as a further stress factor or a trigger, as it matches conflicts between endogenous rhythms and social synchronizers with demanding working conditions and interferences within family and social life.

Consequently, it seems rather arbitrary and unjustified to focus the problem of tolerance only on specific aspects, in particular as concerns individual characteristics as predictors for selection of 'more tolerant' shift workers; but, the most appropriate (although more difficult) way to address the question appears to be a systemic approach, able to match as many variables as possible, aimed at defining which factors are the most relevant for *those* individuals, among *those* groups, and in *those* specific work and social contexts.

This can support a more effective and profitable (both for individuals and companies, as well as for the society) adoption of preventive and compensative measures, that have been proved to be able to mitigate adverse effects on health and well-being.

Nutritional status among call center operators working in three shift fixed schedule

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Aim: The aim of this research was to identify nutritional status of call center operators working in 3-shift fixed schedule.
Methods: 218 workers (Morning workers [6-12h; 7-13h] = 72; Afternoon workers [12-18h; 13-19h] = 97, and Evening workers [18 –24h; 19-1h] = 49) that had been working in two call centers were studied (A dealing with managed care services and B selling with air tickets reservation)

For anthropometrics assessment was used weight, height and waist circumference (WC). The operators filled self-applicable questionnaire about food frequency (FFQ) about snacks and stimulants consumption. Interviews were taken about dietary intake (24 hours recall in 2 workday and 1 off day). Body mass index (BMI) and WC was classified by World Health Organization's (WHO) patterns. The nutritional values were calculated by Virtual Nutri software. The statistics testes were: ANOVA, Kruss-Wallis, Exact Fisher test and Pearson's chi-square. **Results**: Out of the 218 workers, 24,8% were men and 74,2% women, average age 28,9 years (Stand dev = 7,6 years). 72,4% had university level and 12,4% were students. Call center operators worked 6 hours a day, and remained in the sitting position, typing and answering phone calls, for 95% of the working time, with 15 minutes for meals. Among night workers 12,7% was obesity, 10,6% were men and 2,1% women. In men there were not significantly differences among the shiftworks, BMI and WC. In women there were significantly differences among the shiftworks and BMI. WC did not showed significantly differences among women and shiftworks. Obesity was more prevalent among men night workers than in PNSN in all ages. Waist circumference indicator showed that among night workers 55,5% of the men and 9,0% of the women held substantially high risk for chronic diseases. The food frequency questionnaire showed that night-shift workers drank significantly less juice fruit and more coffee than morning and afternoon workers. Men working at night ate more energy, percentage of total energy intake from lipids and protein, less fiber and insatured lipids, although there were not significantly differences. Among night female workers, the percentage of total energy intake from lipids was higher and the intake of energy, protein, insaturated lipids, cholesterol, fiber were lower when compared with others shifts, although there were not significantly differences.
Conclusions: Study findings suggest that diets were inadequate, BMI and abdominal obesity was high in call center operators, especially in men that work at night.

The effect of short-duration countermeasures on the night shift

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Introduction. A number of studies regarding shiftwork in air traffic control have identified the need for countermeasures to sleepiness and fatigue on the night shift. The purpose of this study was to examine the effectiveness of two short-duration countermeasures on performance during the night shift: two 20-minute naps and two 20-minute periods of mild activity (i.e., pedaling a stationary bike at 20% of Vo_2 max). **Methodology**. Two experiments were conducted (Experiment 1, n=11; Experiment 2, n=12). Both protocols included two training days followed by three rapid rotations from early morning (0600-1400) to midnight shifts (2200-0600 in Experiment 1; 2200-0700 in Experiment 2) with 48 hours off between rotations. Participants were not allowed to sleep between the morning and midnight shift, resulting in approximately 17.5 hours of prior wakefulness at the beginning of the midnight shift. Each treatment (nap, activity, and control) was administered twice during the night shift, and each participant served in all three, randomly ordered treatment conditions. In Experiment 1 performance was measured immediately following each treatment, while in Experiment 2 performance was measured 40 minutes after each treatment. Performance was assessed using the Bakan Vigilance Task. Subjective and physiological measures were also collected. **Results**. Results of the experiments revealed potential benefit for napping, but not for mild activity, when vigilance was measured 40 minutes after the nap to control for sleep inertia. While no significant differences in vigilance were noted in Experiment 1, vigilance in Experiment 2 was significantly better in the napping condition compared to the control condition following the first nap, $t\,(11) = 5.0$, $p < .025$ and at the end of the shift, $t\,(11) = 2.5$, $p < .05$ (Fig. 1). **Discussion.** These data represent a "worst-case scenario" where a controller works a rapidly rotating shift schedule with no opportunity for rest prior to the midnight shift. Nevertheless, two 20-minute naps appear to have been somewhat beneficial in mitigating vigilance decrements on the night shift.

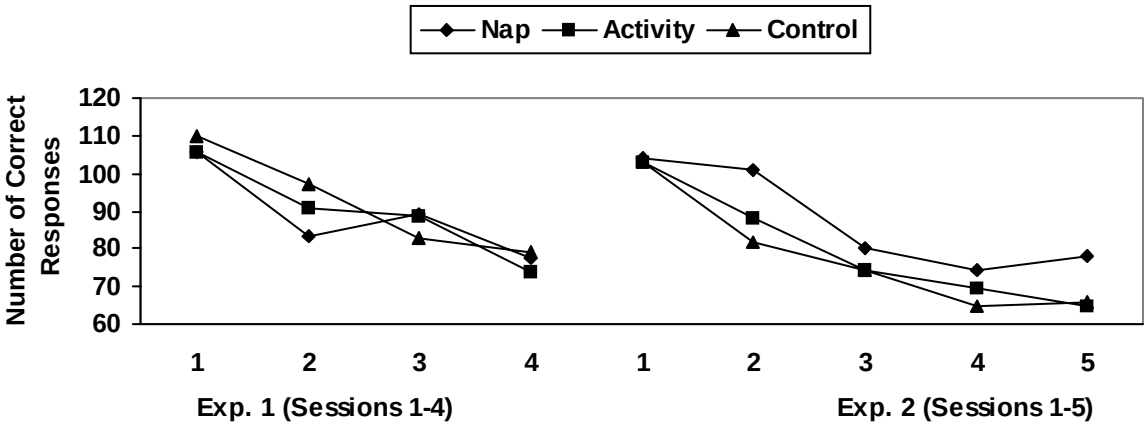

Figure 1. Bakan Vigilance Task Performance by Treatment and Session for Experiments 1 and 2

Acute effects of long work hours

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Objectives: This study aimed at investigating the relation of work hours and workload, stress sleep and health using a within subjects design. The purpose was to explore the acute effects of a long workday using a group of white collar workers who had full control over their work hours.
Methods: Thirty-one white-collar workers (20 women and 11 men, mean age 45±10 years) with flexible work hours participated in the study. For two weeks subjects wore actiwatches, filled out a sleep diary and made sleepiness (Karolinska Sleepiness Scale, 1-very alert, 9-very sleepy, fighting sleep/effort to stay awake) and stress (1=no stress, 9=extreme stress) ratings throughout the day. For each subject the workday with longest working hours (L=13,3±0,3) was compared with that with the shortest hours (S=7,6±0,2).
Results: Results showed that the long workday was characterized by more (1=to a large extent, 5=not at all) time pressure (L=3,0±0,2, S=3,6±0,2; $p<0.05$) and higher stress levels at the end off the day. This was expressed as higher ratings of stress at 7 pm (L=4,9±0,3, S=4,0±0,3; $p<0.05$) and 22 pm (L=4,4±0,4, S=3,4±0,2; $p<0.05$). There were no differences in reported sleepiness or fatigue. However, subjects reported more slow-thinking ($p<0.05$) and insufficient recovery (1=not sufficient, 5=sufficient) during the long workday (L=2,4±0,2, S=3,3±0,1; $p<0.01$). No differences were demonstrated with respect to health at the end of the day. At bedtime subjects reported more stress/restlessness (L=3,7±0,2, S=4,2±0,2; $p<0.05$) and they expected their sleep to be worse on the day with long work hours. Results from actigraphy recordings showed that after the long workday subjects fell asleep later (L=24:12±00:12, S=23:13±00:11; $p<0.001$) and had a shorter sleep duration (05:48±00:12, S=6,28±00:12; $p<0.05$). However, there were no signs of an altered sleep quality from either actigraphy or diary ratings.
To further examine the relation between working time, stress, sleepiness and health an intra-individual correlation (based on pooled data and elimination of inter individual variation) was performed for all workdays. Due to loss of data one subject was excluded. Results showed that health was significant correlated with sleepiness (r=0,33; $p<0.05$) and stress (r=0,23; $p<0.05$) whereas working hours did not show any significant correlation (r=-0,05).
Conclusions: The results indicate that a long working day is related to workload/stress and to sleepiness, delayed bedtime and reduced sleep length. The differences between the long and short day are probably not due to the working time per se but rather a work situation with higher demands and stress. Since these subjects have considerable possibilities to influence their work time they probably work long hours because their work situation demands it. The day-to-day variation in reported health showed no relation with work hours. Instead sleepiness and stress levels explained the variations in health

Effects of one week of moderate overtime work

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Objectives: Overtime work is quite common in most professions although there are few experimental studies on this subject. This study aimed to examine a week with overtime work and the effects on stress, sleepiness and health using a within subject design and exploiting the fact that the subjects were free to decide how much, and when, to work.
Methods Eighteen white-collar workers with flexible work hours (12 women and 6 men, mean age 48±11 years) participated in the study under two work weeks. One of them included overtime (O) work (mean:10,5±0,3 h/day) and one was a normal (N) week (mean: 8,9±0,3 h/day). The mean of the total working time per week was 53,5±1,7 hours for the overtime week and 43,4±1,5 hours for the normal week. The subjects wore actiwatches, filled out a sleep diary, rated their sleepiness (Karolinska Sleepiness Scale, 1 - 9-very sleepy, fighting sleep/effort to stay awake) and stress (1 – 9-extreme stress), and gave repeated saliva samples (for cortisol) during one workday.
Results: Results showed that subjects reported more stress during the overtime week (O=4,6±0,2, N=4,2±0,2; $p<0.01$). Stress levels were highest in beginning off the workweek and then they levelled off ($p<0.01$). The overtime week was characterised by a higher (1 – 5-very high) workload (O=4,1±0,1, N=3,5±0,2; $p<0.01$), more (1- 5-not at all) time pressure (O=2,9±0,2, N=3,4±0,2; $p<0.01$) and less rest and relaxation ($p<0.001$). At the end off the workday subjects felt more worn out but there were no differences in ratings of health status. There were no differences in sleepiness between the two weeks (O=4,5±0,2, N=4,5±0,1; $p>0.05$), however there was a trend towards higher mean levels off sleepiness at the end of the workweek ($p<0.06$). Neither ratings from the sleep diary nor atigraphy data did show any differences in sleep length or sleep efficiency. Analyses of the cortisol data did not show any significant differences on paired t-tests. Due to data loss and the rather small number of subjects it was not possible to carry out an ANOVA for repeated measures.
Conclusions: The results suggest that increased workload caused the participants to extend their working week, but this did not seem to affect sleep or cortisol, probably because of a rather moderate load. It is likely that a week with more extreme overtime would have shown stronger effects.

Flexible working times: consequences on employees' burnout, work-nonwork conflict and performance

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Problem

This study is based on the idea that flexibility of working times can be based on the discretion of employees, employers or both, and on the job demands-resources model (Demerouti et al., 2001). According to our hypothesis, we expected that employee based flexibility would be positively related to performance and negatively related to burnout and work-nonwork conflict. On the contrary, we expected that employer based flexibility would influence performance, burnout and work-nonwork conflict in an unfavorable way.

Methods

A study was conducted among 164 German employees (61% response rate) from 17 different units. The majority of the participants worked with people (58%), information (23%) or both (12%) and only 7% with objects. Results of an exploratory factor analysis of the flexibility items confirmed the expected two factors structure of flexibility including the factor 'employee autonomy' and 'employer restrictions'. The effects of these two dimensions of flexibility on our dependent measures was examined by means of regression analyses using perceived job demands (work pressure, bureaucracy, dependency from colleagues) and job resources (job control, collegiality, social support by supervisors) as control variables.

Results: After controlling for job demands, 'employee autonomy' was negatively related to both work-nonwork conflict and the exhaustion component of burnout, while the 'employer restrictions' factor was positively related to both outcomes. None of the flexibility dimensions was associ-ated with the second, attitudinal component of burnout, disengagement from work, after con-trolling for job resources. In a similar vein, none of the flexibility dimensions was related to self reported in-role or extra-role performance (measured as altruism and initiative). However, we found that 'employee autonomy' had a negative and significant relationship to altruism as rated by a colleague of the focal person (others rating) even after controlling for the impact of job resources. Finally, among the two flexibility dimensions only 'employer restrictions' were significantly and negative related to job satisfaction, again after controlling for job resources.

Conclusions: These findings argue for a differential understanding of flexible working times. Accordingly, the degree to which employees have decision authority in the design of their working hours can be seen as a job resource that helped employees to avoid negative effects of their work not only on their health but also on their nonwork domain, as well as to exhibit positive behavior towards their colleagues. On the other hand, the degree to which employers restrict the design of the working times functions as a job demand that lead to health impairment and conflict between the work and nonwork domain.

Changes in the reaction of the cardiovascular system and suprarenal activity in conditions of overheating microclimate

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Aim: Assessment of the intensity of heat loading of the workers, working in a glass industry, and occupationally exposed to overheating.
Methods: The studied group consisted of 20 men /mean age 38 ± 7.5 yrs/, working in conditions of overheating during a regular shift (07.00 – 13.00h) at constant temperature in the workplace over 35°C. The excretion of catecholamines (adrenalin and noradrenalin) and cortisol were analysed. The dynamics of pulse rate was monitored telemetrically and the cardiovascular risk of the individuals exposed to overheating was assessed. The data was compared to a corresponding control group.
Results: Statistically significant elevated level of catecholamine and cortisol excretion were observed compared to the control group – first half of the work shift - 07.00 – 10.00 –($F = 7.3$, $p = 0.013$); and in the second half 10.00 – 13.00h these differences were yet more marked ($F = 23.5$, $p = 0.0002$).
The pulse rate during the second half-time of the work shift was also significantly elevated compared to the control group ($F = 14.7$, $p = 0.0009$). An interesting finding was the significantly lower levels of arterial blood pressure in exposed persons compared to controls - 130/84 mm/Hg vs. 145/90 mm/Hg ($p<0.01$) for systolic and ($p=0.05$) for diastolic blood pressure. The circadian variations of parameters were not observed.
Conclusion: The results showed a tension in the simpatico-adrenal system in workers exposed to overheating, especially in the second half during regular shift.
A modification of the work and leisure schedule was proposed aiming to reduce the health risk for exposed workers from the industry.

Are reductions in chronic sleep loss offset by an increase in acute sleep loss?

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Faster rotating shift systems have been argued to have a number of benefits for shiftworkers (1). In terms of sleep loss, the Sleep Deprivation Model (2) would suggest that faster rotation would be associated with a reduction in chronic sleep loss due to the fewer number of consecutive night shifts worked. Faster rotations however, also require more transitions to night shift and typically, the first night shift is associated with the greatest amount of sleep loss (3) giving rise to acute sleep loss. The possibility exists that whilst faster rotations assist in reducing chronic sleep loss, this is at the expense of increasing acute sleep loss. The objective of this study was to examine this proposition.

Method:

A group of shiftworkers moving from a weekly continuous 8-h shift to a faster rotating 12-h shift were studied using a repeated measures longitudinal design. Seven shiftworkers provided complete paper based sleep diaries over a 15 month period. During this time, sleep was sampled on five occasions.

Results:

There were no main effects for changes in sleep duration between 8-h and 12-h shifts and arguably, this is an expected finding given the low power of the study. However, significant reductions in total sleep time (TST) for night shift and a significant increase in TST on days off were found on 12-h shifts. To examine the relationship between chronic and acute sleep loss, the mean TST for 8-h and 12-h shifts was calculated for each shiftworker across the shift cycle. TST for each day was plotted as a deviation from the shift cycle mean and in a cumulative manner. The results showed that the number of shifts worked when mean TST was below the shift cycle mean actually increased on the faster rotation (12-h shifts). However, the total number of days across the shift cycle when mean TST was below the shift cycle mean decreased. This suggested a strategy of using days off to recoup the sleep debt. The cumulative sleep gain/loss plots illustrated the effect of the faster rotation on acute sleep loss.

Conclusions:

This study concluded that whilst there was no significant change in TST, a faster rotation was associated with an increase in acute sleep loss. In terms of shift design, strategies that seek to reduce the impact of acute sleep loss need to be carefully examined. It is also suggested that repackaging the total number of night shifts into smaller blocks does not reduce the overall night shift exposure.

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Non-scheduled overtime and sleep

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Objective: Modern working life is often characterized by a high production pressure, unlimited working hours and overlapping projects. This paper aimed to evaluate the relationship between non-scheduled overtime and work, stress and sleep characteristics.

Method: 24 individuals (14 women/10 men), in an IT company were recruited based on high (>2.75) and low mean scores (<1.5) on a revised Melamed Burnout Questionnaire, MBQ, (min=1, max=4). The subjects completed a questionnaire on work conditions, stress and various sociodemographics, and were recorded for a two-week period using daily ratings of work, sleep and performance, polysomnography (EEG) at home, and a morning blood sample.

Results: 49,3% of the employees perceived their work as extremely stressful. When the individuals were analysed with respect to non-compensated overtime (expressed in; 'work at home'; high =every-several days/week, vs low=never-a few days /months) the group with high amount of overtime perceived higher demands, more conflicting roles, that work interfered with their leisure time and they had also more difficulties to unwind at weekends. They had a lower sleep quality and showed more sleepiness, stress, anxiety and burnout symptoms.

Table 1. Differences in sleep, stress and work characteristics between individuals with high end low frequency of overtime; mean±se from ANOVA.

	Overtime		
	low n=15	high n=8	F-value
Age (yrs)	30±1	32±1	.619
Total sleep time, TST (min)	395±7	399±21	.053
Sleep latency (min)	15.3±2	22.4±9	.89
Sleep efficiency (%)	90±.01	86±.02	2.0
SWS (min)	33±8	28±5	.198
ARO/h (number)	8.7±1	14±2	4.9*
S-Cortisol (nmol/l)	430±33	518±59	2.0
Stress	3.7±.3	4.9±.2	5.7*
Work Demands	2.1±.1	3.0±.2	20.3***
Control	2.8±.2	2.7±.2	.284
Social support	3.4±.2	3.3±.1	.218
Conflicting roles	3.0±.2	2.1±.2	8.1**
Work interfere with leisure	2.9±.4	1.5±.2	7.3*
Thoughts about work evenings	4.3±.2	3.5±.4	5.9*
Thoughts about work weekends	4.6±.1	2.8±.4	21.1***
SQI (1-5 high)	3.9±.2	2.8±.3	13.1**
Alertness (5-1 high)	4.2±.1	3.3±.2	33.3***
MBQ (1-7 high)	3.0±.3	4.9±.4	10.6**
Tension (1-5=high)	4.1±.2	2.9±.2	12.6**
HAD-D	3.3±1	8.5±1	10.1**
HAD-A	5.1±1.5	13.4±1.5	12.0**

*p<.05, ** p<.01, *** p<.001, SWS=Slow Wave Sleep, SQI, Sleep Quality Index, Melamed Burnout Questionnaire, MBQ, HAD = Hospital Anxiety & Depression scale (clinical level >11)
Ratings; work variables; 5-1=high/to a great extend, stress; 1-9=extremely high

The only differences among the polysomnographic sleep variables were a higher frequency of arousals (table 1). To understand the relation between sleep parameters (and to control for their interrelations) and overtime a stepwise multiple regression analysis (controlled for gender, age, children, position and civil status) was carried out. It yielded frequency of arousals as the only sleep predictor explaining 25% of the variance for overtime (β= -.528, F=8.1**). In a second analysis of work variables 'demands' explained most variance (26,5%, β= .603, F=3.1*). In a third analysis of state/trait 'HAD-A' (β= -.656 F=3.7*), tension (β=.645, F=3.4*) and sleepiness (β=.627, F=3.9*) were significant with 25-29% explained variance.

Conclusions: Overtime showed a relatively strong association with frequent arousals from sleep indicating sleep fragmentation. Overtime was also associated with high work demands, difficulties to relax during free time, sleepiness and tension. Sleep disturbances may indicate a vulnerability to high work demands, which in the long run may have negative consequences on health and safety.

Methodological aspects of shift work research-comprehensiveness and limitation: Actigraphic and PAT studies

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Shift work is becoming increasingly common, due to the increased demand for service provision around the clock. In England, 16% of all employees work in shifts, in the United States, about 20% of the workers were reported as shift workers in 1999, and that number is growing by 3% each year. In Canada, in 1998, the prevalence of shift work was around 30% of the labor force. Consequently, tolerance and adaptability to shift work is an issue of growing importance in our modern industrialized society. Shift workers' ability to adjust to changing sleep-wake schedules is the key to successful adaptation. Some of our recent studies have accumulated evidence showing that shift workers suffering from sleep disturbances are more prone to cardiovascular diseases. Therefore, to evaluate adaptation to shifts, workers' sleep quality should be objectively measured. There are three evaluation methods: questionnaires, laboratory recording (polysomnography) and ambulatory monitoring (Actigraphy, Peripheral Arterial Tonometry - PAT). Questionnaires are the most frequently used method: they can be distributed quickly among large populations and may include questions about work conditions, work satisfaction, general health, adaptation to the shift system, personality traits and sleep habits. However, participants' responses are subjective. Laboratory recordings (polysomnography) are most accurate, but are cumbersome, limited to few participants and few nights, and expensive. The actigraph is a small solid-state computerized movement detector (Ambulatory Monitoring, Inc.). Actigraphic data provide objective measures of sleep-wake schedules and sleep quality for prolonged periods of time. Actigraphic measurements are stable and reliable: actigraphic monitoring of sleep-wake cycles of 78 medical residents repeated 5 times during the 2 years of residency showed no statistically significant differences in any actigraphic parameters between the 5 monitoring periods (1). Based on our vast experience, we have developed and validated a new method using questionnaires and actigraphs, for predicting the suitability of candidates for rotating shift work. This method has enabled us to screen more than 300 candidates for shift work in the Israeli Electric Company (2). The PAT (Itamar Medical Ltd.), is a novel non-invasive and objective device, which provides information on many physiological variables including sleep and wake, obstructive sleep apnea, and stress, based on changes in the autonomic nervous system (3). The PAT signal has been used to discriminate between different levels of mental effort imposed by tasks, and has demonstrated the relationship between an overloaded sympathetic nervous system and increased cardiovascular morbidity. We conclude that both the actigraph and the PAT are reliable and objective methods to evaluate shift work adaptation, based on sleep-wake schedules, sleep quality and mental load.

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Work schedules of health care workers in France, according to occupational level. Impact of the reduction to 35 hours per week.

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In Europe, most nurses leave nursing long before retirement age. Much is speculated and little is known about the underlying reasons. Within the coming decades the mean age of the working population will rise substantially. In addition, the growing number of aged patients will require increased care. To assure health care (HC) for the population, future attention has to be paid to the ageing workforce in HC. We investigate occupational factors associated with 'intent to leave HC' among nurses in the NEXT-Study (www.next-study.net). **Objectives:** The role of work schedules in work satisfaction, burn out and intent to stay or leave HC is studied. The design of shift systems in France in 1991 and 1998 was compared among national samples of HCWs (1). It was demonstrated that knowledge on how to reduce difficulties linked to shift work (2) was seldom put into practice. The French part of the NEXT sample allows the development since the reduction to 35 hours per week (35h/w) in 2002 to be analysed. **Methods :** 5376 postal questionnaires were filled out and sent back by the HCWs working in 55 HC institutions in France (41% response rate) The analyses were made using SPSS software. **Results :** .Since the introduction of 35h/w the quality of private life is considered to be the same as before the reduction by 61.4% of HCWs, easier by 31.1% and more difficult by 7.5%. But professional satisfaction is less for 24.8%, especially for registered nurses and head nurses. The wish to continue a HC career is identical for 78.4%, more important for 7.2% and less important for 14.4%. The wish to continue is more often less important for nursing aids (17,5%) and for registered nurses (17.5%). Working conditions are considered identical by 51.4%, better by 9.8% and worse by 38.8%. Registered nurses (44%) considered their working conditions to have worsened since the 35h/w. Having to work supplementary hours without payment or compensation, working fixed afternoon shift or alternating shifts are linked with decreased professional satisfaction since the 35h/w. Working fixed morning or afternoon shifts and having to work supplementary hours without payment or compensation are linked with a higher percentage of respondents saying that their working conditions are worse. This study showed that the 35h work per week has often been implemented by reducing the time for communication between two shifts. The insatisfaction with that reduction is associated with a doubling of professional insatisfaction (32.5% instead of 16.7% $p<0.001$). The necessity to change working days with short notice is also associated with twice as much professional insatisfaction (36.9% instead of 19.3% $p<0.001$). **Conclusions.** The importance of satisfaction with work schedules among HCWs must be taken into account more seriously if we want to keep a satisfactory HC system and rather satisfied nursing profession in France.

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Biological rhythms and occupational risk assessment: lung function tests in a tyre factory

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Objectives. During the tyre vulcanisation, fumes are emitted in moulding areas, and workers can be exposed to irritant substances, both in the corpuscular and gaseous phase, including SO_2. Annual pathological decreases in FEV_1 and an above-average incidence of symptoms of chronic airways irritation have been reported in vulcanisers, as well as acute exposure effects during shifts. We decided to ascertain variation in respiratory parameters after the work shift in a group of healthy vulcanisers (24 subjects). We compared them with a control group (17 employees), taking into account the biological rhythm of lung function.
Methods. The first lung function test on workers was carried out during the first 30 minutes while the second test was performed during the last 30 minutes of the morning shift (lasting from 6 a.m. to 2 p.m.); employees underwent the first test from 7.45 a.m. to 8.30 a.m. and the second test from 1.30 p.m. to 2.15 p.m.. Each subject was examined twice, on two different Mondays. The lung function indices taken into consideration were FVC, FEV_1, $FEF_{50\%}$ and $FEF_{25\%}$. We used a pneumotachograph (Godart Co.), to obtain volumes and flows by the transducer (Watanabe recorder). Statistical analysis was performed using paired samples t test based on paired differences (t_{pd}). **Results**. In employees, statistically significant increases were found between the two tests performed at the beginning and end of the work shift in FVC (+6.18%), FEV_1 (+4.37%), $FEF_{50\%}$ (+6.78%), and not on $FEF_{25\%}$ (+0.73%). No significant increases were found in vulcanisers during the work shift with regard to FVC (+1.58%), FEV_1 (+1.09%), and $FEF_{25\%}$ (+3.04%), whereas mean values of $FEF_{50\%}$ regressed (-1.14%). The largest difference in percentage variations was recorded for the $FEF_{50\%}$ parameter, in behalf of employees compared to vulcanisers (+6.78 versus –1.14). **Discussion.** After the classic reports of exposure to cotton dusts, the search for acute occupational effects on respiratory capacity that could be detected during a work shift was extended to various occupational situations. This sometimes led to results that were conflicting or difficult to interpret. This may have been due to the fact that circadian rhythm, which typically characterises biological functions such as breathing, was often overlooked in the past, and consequently only the most evident effects were taken into consideration. Even studies on circadian variations in lung function are sometimes conflicting due to the presence of variability factors. The respiratory parameters usually taken into consideration (FVC, FEV_1, FEFs) can be influenced not only by smoking or by medical conditions, including bronchitis, but also by socio-ecological synchronisers such as the work shift, which plays a very important role. They can also have rhythms that differ in acrophase and amplitude. We should remember that in healthy shift workers, reports showed an average increase of +4.1% in FVC during the morning shift and a mean reduction of –1.8% during the afternoon shift, whereas no significant differences occurred during the night shift. Our data show a significant increase in FVC and FEV_1 at the end of the work shift in controls, while the increases in exposed workers are much smaller, and not significant. Instant flows follow a similar pattern: there is a significant increase in $FEF_{50\%}$ in controls and a slight reduction in exposed subjects, thus confirming that $FEF_{50\%}$ is extremely sensitive in assessing acute effects related to exposure to pollutants. It would therefore seem that, under the aforementioned factory conditions, exposure to vulcanising fumes can have an effect on respiratory function since normal circadian rhythm, which should have produced a significant increase in the examined parameters during the morning shift, was altered.

Characteristics and organization of work in the offshore oil industry with emphasis on shift work

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When we talk about the offshore oil industry in Brazil, it is recognized that despite its dramatic technological development, the predominant scenario in terms of safety and working conditions still needs a lot of improvement, as the numerous serious or fatal accidents involving workers from this sector can confirm.
We will try to describe four of the main conditions prevailing in oil refineries and maritime terminals: the risks, the complexity, continuous production, and the collective dimensions. In our opinion, such conditions also prevail in offshore platforms.
In the offshore platforms, a peculiar fifth condition could be added: shift work coupled with confinement and isolation. Confinement, because they stay fourteen consecutive days working twelve hours per shift, before they can return home. Workers are submitted to risks 24 hours a day, that is, throughout the period they remain on board. And isolation, as the platforms are installed on the high seas, making it difficult for people to leave the place in case accidents, problems that call for land support, or even abandoning the platform when a serious or long-lasting accident occurs. The ANCHOVA case, a platform that burned in 1984, another platform, the P-36 in 2001 (11 casualties), and the P-34, in 2002 (when 25 people plunged into the sea) are examples of these situations.
No doubt, the factors mentioned above, coupled with confinement and isolation, contributes to aggravate the risks that are inherent to the activity.
We consider that shift work in offshore platforms has peculiarities that make it harder and more stressing as compared to the work in oil refineries and maritime terminals. We recognize that it is impossible to completely eliminate the effects of the adverse health conditions prevailing in offshore platforms. However, we believe that a consistent effort should be made by the companies operating in this segment to identify such effects and try to minimize them, as offshore workers should be considered a risk population.
We think that in order to deal with this issue it would be necessary to analyze it under an interdisciplinary perspective, incorporating valuable ergonomic material, contributions from other disciplines such as, the physical dynamics of the work. It would also be necessary that oil workers in the Northern Region of the State of Rio de Janeiro (Sindipetro NF) joined efforts towards this initiative.

Building a safe environment: practical management of worker fatigue

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Worker fatigue is acknowledged as a significant occupational health and safety risk across numerous industries within many countries in the world. With this acknowledgement, organisations are being held more accountable for the management of fatigue. However, there are growing concerns over how worker fatigue is being managed by organisations and regulated by governments.

Fatigue is usually managed and regulated by placing prescriptive totals on how many hours an individual can work per day, week and/or month. Such totals are not strongly supported by research and can restrict organisational or worker flexibility without necessarily benefiting safety. Furthermore, such systems ignore many additional components of fatigue management that can contribute to lower fatigue risk.

Example components of a practical fatigue risk management system (FRMS) are:

- Organisational fatigue policy;
- Mathematical models to predict work-related fatigue;
- Risk management frameworks; and
- Communication strategies including training and education.

It could be argued that the development of a fatigue policy is a primary requirement of any organisational FRMS. At a specific level, the policy can share the responsibility and accountability of fatigue between the organisation and its workers. Furthermore, the policy can operationalise specific rules to each site, job and environment based on scientific evidence.

Another component of FRMSs that is supported by evidence is mathematical models that assess hours of work or sleep. Numerous models now exist that use processes such as sleep regulation to give predictions of sleepiness, impairment and/or fatigue. From a scientific perspective, additional validation of these models is desirable. However, from a fatigue management perspective these models have merit if used in specific contexts.

The use of risk management frameworks is increasingly being seen by organisations to assist in managing fatigue risk. Such frameworks, which can apply to any risk including fatigue, can ensure that fatigue risk management is approached in a systematic and consistent manner. It could be argued that there is little scientific evidence supporting the use of risk management, communication strategies or training and education as a method for improving safety. However, as a process to clearly communicate the responsibilities of the organisation and its workers as well as to provide practical information on reducing fatigue risks there is value in including them as example components.

Taken together, it is clear that there are many options available to reduce risks associated with worker fatigue. Most of these are supported by scientific evidence and could be incorporated into management and regulatory models superior to those currently in use. Future workplace-based validations should further clarify those components that best contribute to reduced fatigue risk.

Towards a model based on Relative-Risk to assess work schedules

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In most shiftworking situations safety is one of the primary concerns of both the employees and their employers. This is particularly true in situations such as transport or the nuclear power industry where there may be a high "public" or "environmental" risk. This concern with safety underlies the development of most, if not all, the recent models that have been developed to predict alertness, sleepiness, tiredness and/or performance on different work schedules. However, they all appear to make the tacit assumption that if they can account for the trend in these measures, they will be successful in predicting risk. The fact that this may not necessarily be true is evidenced by the fact that the 24-hour curve in sleep propensity accounts for only about 54% of that in the risk of single vehicle accidents (1).

The present paper will review the available on shiftwork safety in which real measures of injuries and/or accidents can be related both to the time of day and to the point within the shift system that they occurred. Unfortunately, many published studies of accident risk have failed to ensure that the *a priori* risk is constant. Nevertheless, there are a few studies that allow the relative risk of accidents and/or injuries associated with specific features of shift systems to be calculated. These include the type of shift, the length of the shift, and the number of successive shifts. In addition, a single recent study (2) provides evidence on the influence of rest breaks. Since all these trends can be expressed in terms of relative risk, it is possible to combine their effects in a simple additive or multiplicative manner to estimate the relative risk over any given span of shifts, and hence for an entire shift system. This allows a comparison of the estimated risk on different shift systems.

This paper will illustrate some of the somewhat surprising predictions made by such a relative risk model. It will conclude that we desperately need further, well-controlled, epidemiological studies of accident and injury rates to allow us to estimate the relative risk associated with other features of shift systems such as the number of successive rest days and the influence of early starts.

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Biological rhythms and human performance: performance parallels temperature, except when it doesn't (with apologies to Professor W. Peter Colquhoun)!

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In the late 1960's and early 1970's Peter Colquhoun propounded the theory that variations in performance over the 24-hour day reflected on an underlying rhythm in basal arousal. Further, although these variations were clearly not seen as directly caused by similar changes in temperature, Colquhoun claimed that, with the exception of a "post-lunch dip", they did parallel the rhythm in body temperature.

This paper will review the evidence that has subsequently been produced for and against Colquhoun's claims. On the one hand, abnormal day length and constant routine studies have tended to show a fair degree of parallelism between performance on a variety of different tasks and body temperature. On the other hand, studies of the adjustment of performance rhythms to changes in the timing of the sleep/wake cycle, such as those occasioned by shiftwork, have consistently found that some performance measures adjust rather quicker than others. More specifically, those with a high working memory load appear to adjust particularly quickly, and it has been suggested that they might be controlled by a separate oscillator with an intrinsic period of about 21-hours (1). Whatever the underlying cause of these differences in the rate of adjustment, they are difficult to reconcile with any unitary theory, such as that of arousal. Further, a recent study provided evidence from a range of subjective and objective psychological measures that even under normal sleep/wake conditions they failed to closely parallel temperature (2).

A reanalysis of the data reported in that study provides an insight into the possible reasons for these discrepancies. More specifically, it suggests that, relative to body temperature, performance tends to decrease over most of the day, presumably reflecting on a homeostatic "time since waking" process. Further, there were marked deviations from this parallelism in the first few hours after awaking and in the last few hours before sleep. These variations are hypothesised to reflect on very different effects of "sleep inertia" and "sleep anticipation" on the various measures. If these arguments are accepted, then it seems reasonable to conclude that Colquhoun was, at least partially, right. It would seem that the endogenous, body clock, component of rhythms in performance and subjective measures may indeed closely parallel that in body temperature and reflect an underlying rhythm in basal arousal.

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The impact of age and the flexibility of work hours on outcome measures

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This paper is concerned with a reanalysis of an existing data set to determine the impact of the available measures of flexibility and age on the various outcome measures, including health, obtained in the survey. The survey was a cross-sectional study of over 2000, predominantly male, aircraft maintenance engineers and included measures of the number of day's notice given of the shift schedules, and ratings of the extent to which the individuals concerned were able to exercise control over the specific shifts that they worked and the start and finish times of their shifts. The survey also included items relating to health, interference of the shift schedule with other activities, and alertness, the likelihood of making mistakes, and the confidence with which they could drive home safely following each of the three main types of shift.
Flexibility in the form of control over both the specific shifts worked and their start and finish times had a substantial beneficial influence on ratings obtained for all the outcome measures included in the survey. Increased control was associated with lower levels of poor health and interference as well as reduced perceived risk on all three shifts. In addition, increased numbers of day's notice of the shift schedule was associated with substantially reduced interference and with a slight, but significant reduction in perceived risk on the night shift.
Main effects of age were confined to the poor health outcome measure where, overall, older workers reported greater levels of ill health. There was no reliable effect of age on the interference measure, or on perceived risk on any of the shifts. However, the effects of age on poor health were moderated by the individual's ratings of control over the start and finish times of their shifts. Those who claimed to have a least "a fair amount of control" showed no obvious effects of age at all, while the adverse effect of age on health in those claiming to have "not very much" control were delayed by about 10 years relative to those claiming to have no control at all.
Taken at face value these results suggest that the adverse effects of age on health may, at least partially, be mitigated by increasing the workers' control over their shift system, and specifically over the start and finish times of their shifts. However, it should be born in mind that these findings are all based on self-ratings obtained in a cross-sectional study, and may reflect biases in reporting level of control, dependent on health problems, rather than vice versa. Nevertheless, the present findings would appear sufficiently important to warrant further study, ideally using a longitudinal design in which flexibility or control could be directly, and objectively, manipulated.

Actually, is this a night shift? – Are shiftwork design-recommendations becoming meaningless due to fuzzy terms?

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Objective: Many recommendations in the field of night and shiftwork refer to terms such as Night, Evening, Morning shifts, Early Morning Shift, and Irregular Work Schedule. The definitions of these terms are driven by context, actors, and at times by law. For example, shifts going from 10pm to 6am are probably considered to be night shifts by most night workers, and would fall into the legal EU definition of a night shift. However, specific definitions for scheduling concepts begin to fall apart when considering the wide variety of work rotas used within the service sector at large and in the transportation enterprise in particular. This variety leads to a broad range of start- and end-times of work, of shorter and longer breaks, making definitions and concepts less clear in several respects. For example, it becomes unclear whether a specific shift is to be considered as a night-shift or as an evening shift (e.g. a shift going from 10pm to 3am) and correspondingly which ergonomic recommendations should be considered. Another problem is that several short work periods may blur the difference between a situation where there are two shifts or one long shift with a long break. A final consideration is whether the commonly accepted nomenclature is still relevant or useful when discussing more non-traditional shift work systems. **Method**: A two-step method was applied in this study. In the first step definitions of central concepts and terms used in recommendations regarding night- and shiftwork were collected by asking shiftwork researchers and schedulers to provide the definitions they consider to be most appropriate for these terms. The survey was done via the Internet with the possibility to provide one's own definition or select a definition from a list of candidates found within the literature. Researchers and schedulers from different countries and scientific backgrounds participated. In step 2, the definitions collected were then applied to actual rotas, i.e. very tra-ditional rotas in heavy industry, rotas for nurses and actual working times of train-drivers. **Results:** The provided definitions for each term varied substantially from each other and were differentially applicable to the actual rotas. In several instances, these differences in definitions lead to contradicting recommendations with regard to the BEST scheduling guidelines. **Conclusion:** If the field is to continue with its core set of scheduling terms, the definitions for these terms need to be reconsidered and rooted more deeply in empirical research and scheduling practices. This may lead to context-dependent definitions of these terms, one that addresses the scheduling practices within a particular industry or different definitions for health, safety, etc. Over time it may become apparent that an increasing number of term-dependent recommendations for improving a work schedule become meaningless and references to other features of shiftwork (e.g. disturbance of sleep, time slots) become a more appropriate approach.

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Is everything fine if people have a choice? Reflections on autonomy, on long term decision making and on power

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Objective: Participation of employees in decisions concerning their living and working conditions was and is an important issue. Persons typically want to influence their conditions, participation often leads to better results, and research has shown the importance of participation on health and well-being of those concerned.
However, participation brings up difficult questions: If people concerned chose a working time model considered to be problematical (by most or all researchers) with respect to health or safety, is this ok? In what cases, under what conditions is it ok?
From a research perspective, a first issue is whether the choice really is in conflict with the research results, or whether the conclusions drawn from the underlying study are going too far, or whether there are exceptional circumstances, etc. From an ethical point of view, advisors face the risks of not warning strongly enough (in spite of their knowledge) or warning too strongly and thereby causing a worse model for those concerned.
There is third issue and this is the focus point of this article: What do we know about decision making of individuals with respect to long term health and safety?
Method: The question of personal autonomy and "bad choices" touches many issues. Practically all societies – in rather different ways and to different degrees - limit decision making of persons with respect to health in some areas (e.g. smoking, alcohol) or if long-term consequences are not assessable (e.g. toxic substances). We address the complex question of autonomy and "bad choices" from two perspectives. First, we aim for a better understanding of long-term decision making of individuals under uncertainty where health and safety issues are involved. Saving for pensions is the specific topic that we selected as an example to discuss this question. Different institutional 'pension-solutions' developed by societies in the course of time, discussed as case studies are used to illuminate approaches taken to deal with such long-term decision making.The second perspective deals with the legal framework of decision making at the wok place. In most countries there are limits imposed by the law to make it more difficult for employers to shape the decision arena too strongly to their advantage. However, the approaches taken differ strongly (e.g. how to deal with injuries at the work place; whether to focus on outcomes [the breaks have to have 11h] or procedures [employers and employees have to agree on the break]) and often reflect more general approaches to the role of law and how to solve interest conflicts. Again case studies are applied. **Results**: The two perspectives pursued here brought up variety of approaches regarding the question of autonomous decision versus health & safety. The approaches discussed were embedded in specific social contexts of laws, rules, norms, conventions. However, they have a common denominator and strongly indicate the need for institutions and legal limits in order to make "bad choices" more difficult or even impossible in severe cases. Given that increasing flexibility allows for but also calls for more decision making of those involved, it is necessary to re-evaluate the experiences made in the field of working time and autonomy as well as in other fields of similar decision making to discuss these limits of autonomy.

The AHP, a multicriteria decision making methodology for shiftwork prioritization

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The objective of this presentation, is to show a very powerful methodology for making- decision process, specifically in the shiftwork area, where the huge numbers of variables and knowledge to be structured, integrated and synthesized, forces the need for a system analysis process, able to deal with such complexity.
The Analytic Hierarchy Process (AHP) for decision-making uses objective mathematics to process the inescapably subjective and personal preferences of an individual or a group in making a decision. With the AHP, we can construct hierarchies composed in the first level by strategic or politic criteria, and then open each one of these levels in more specific subcriteria until reaching the lower or technical level, also known as terminal criteria or behavior indicators. Later, makes judgments or performs measurements on pairs of elements with respect to a controlling element (using eigenvectors and eigenvalues theory), to derive ratio scales (metric) that are then synthesized throughout the structure, to prioritize the set of alternatives and select the best one, embedding the decision-making process in a structured and holistic view.
The results of this systemic approach is the "Shiftwork Asset" software, a generic tool for shiftwork prioritization ranking, able to deal with the holistic nature of this problem, constructed by means of dividing into smaller subject-matter connected areas, within which different groups of experts determine how each area affects the total problem, along with the constructions of metric scales able to measure each alternative (shift) over each terminal criterion of the hierarchy.
Also, this methodology give an "extra bonus" (due to the metric construction system), which is the possibility to mathematically define thresholds such as, the limit of tolerance shift, the limit of healthy shift and the ideal shift.
The system can be customized (via software), to adequate it for the specific problem or situation to be dealt with.
As a final conclusion, we have to remember that everybody makes decisions all the time, young and old, educated or uneducated, with ease or with great difficulty. Making a decision is not just a matter of selecting the best alternative. Often one needs to prioritize all the alternatives, or to combine the strengths of preferences of individuals to form the collective preference.
Decision-making is the most central and pervasive human activity, intrinsic in our biology and done both consciously and unconsciously. We (as humanity) need the decision-making process to survive, so to improve that kind of process and thinking is where we have to do our best effort.

Sleep and mood evaluations of medical residents working day and night shifts

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This study is part of an investigation on individual differences in subjective states of shiftworkers. Our goal in this longitudinal study was to evaluate the effects of a work schedule change of medical residents from fixed day shift to one night of work (twelve hours) every five days. Self-perceived subjective states and wake/sleep patterns were analysed in both work schedules. Data were collected for fifteen consecutive days, five times a day, in each of the two schedules. Each data collection consisted of filling four visual analog scales for self-evaluation of sleepiness, disposition, depression and irritability. Activity logs with records of sleep and work episodes were filled by subjects during the same fifteen days. A questionnaire was applied to investigate aspects of sleep, anxiety, use of psychoactive drugs and psychiatric complaints. In the beginning and in the end of data collection we applied a clinical inventory (Beck) for diagnosis of depression. The results showed changes in the perception of depression (in a lesser extent, irritability) associated to the schedule including night work. Sleep duration and self-perception of sleepiness and diposition showed no change associated to work schedule.Circadian rhythms detected for sleepiness and disposition in the first schedule showed attenuation when the residents changed to the second schedule. Those results seem not attibutable to sleep deprivation since sleep duration did not differ in the two schedules. One night of work every five days seems thus able to produce a relative disruption of rhythmicity which is associated to increased values of self-perceived depression.

A new approach for evaluating flexible working hours

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Problem: For the evaluation of shift rotas an established set of ergonomic criteria is available. For an ergonomic evaluation of flexible working hours, however, this is not the case, although this seems urgently needed, since some kinds of flexible working hours seem to be associated with impairing effects on health and well being (see Janssen & Nachreiner; Bohnert et al., this conference). It has been shown there that the variability of working hours seems to play an important role. Shift work research [1] has shown that periodicity of rotas is able to predict some of the impairments, based on assumptions of synchronisation / desynchronisation with social and/ or biological rhythms. If variable flexible working hours, on the other hand, tend to produce impairments comparable to those produced by shift work, e.g. sleep disorders, it can be hypothesized that this might also be due to problems of disturbed periodicity. For completely irregular systems, e.g. work on demand, this might results in a suppression of the periodicity of work /non-work rhythms towards "noise". Combining efforts from two ongoing research projects an attempt has been made in a pilot study to see whether this hypothesis merits any support.
Methods: Data on actual working hours from a survey on flexible work hours have been converted into time series (at/off work) and analyzed using spectral analysis. This yielded typical spectra for each participant, with more or less similarity to normal day work or certain shift rotas. Schedules have then been grouped according to these spectra by methods of cluster analysis, which led to groups with similar spectral characteristics of their working hours, some of them approaching a profile like noise, while others have a distinguished periodicity.
Data on health and psychosocial effects from the same survey have been used to combine these effect variables with the spectral characteristics, both on group and individual levels.
Results: Results on the group level show that those arrangements of flexible work hours which lead to a suppressed periodicity show the largest impairments, e.g. for sleep, whereas those systems with an near to "normal" periodicity (e.g. clear 24 and 168h periodicity, including harmonics thereof) show the least impairments. Ongoing research on the individual level lends support to these results.
Conclusions: Analyzing the spectral characteristic of the time series of work/non work seems to be a promising approach for the evaluation of potential impairment by flexible work hours. A next step in the analysis is to try to differentiate according to impairments with temporal relatedness, e.g. sleep and digestion against those with less strict coupling to temporal patterns in order to see whether differential predictions will be possible.

How the night and shiftworkers of an electric bulb manufacturer, from São Paulo, Brazil, perceive their well being and health

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Objective: To evaluate workers´ perception on night and rotating shiftwork and health effects.
Method: The research was carried out in a multinational company, located in the city of São Paulo, Brazil, during the year 1992. The manufacturer used metallic mercury in the productive process of some types of bulbs. There were 1850 employees in 1992, and 230 of them worked in the sections where mercury was used.
The studied population consisted of two-hundred fifteen shiftworkers, submitted to neuropsychological evaluations. A survey on working and health conditions was performed together with neuropsychological tests to evaluate memory, concentrated attention, cognitive efficiency, fine motor coordination, hand dexterity. A content analysis of all the questionnaires was performed.
Results. Most of the employees worked in two rotating shifts (69,8%), one week from 5:00 am to 1:00 pm (day-off on Sundays) and in the second week from 1:00 pm to 10:30 pm (days-off during Saturday and Sunday). 11,6% of the workers worked in night shift (from 10:30 pm to 5:00 am). 7,4% worked in three rotating shifts, being two months in the night shift and three months alternating mornings and afternoons. 7,9% worked from 7:00 am to 5:00 pm, and two were allowed to work in a fixed shift, either morning or afternoon.
Approximately 50% of the workers perceived the work schedule as affecting their rest. The workers of the night shift perceived the quality of their sleep being worse during the day than at night. Workers in two rotating shifts claimed that they didn't get used to sleep late (after 11:00 am) when they were in the afternoon shift, and to wake up early (at 4:00 am) when they were in the morning shift. Since they were afraid to miss the wake up time, they got used to stay awaken during the whole night in order to watch the clock.
If the workers would have the free choice to work in fixed the shifts, there would be the same amount of people interested in working in the morning as in the afternoon. It was also reported having difficulties to find schools which had suitable timetables for people who work in rotating shifts. That is one of the reasons why many workers stopped to study, according to ten of the workers.
The interviews revealed health problems, like fatigue, sleepiness, digestive problems, and difficulties in adapting to the day and night rotating shifts.
Conclusions. Taking into account the discomfort and health problems caused by shiftwork, the non existence of a reason for the rotating shifts from the production view point and the workers' preference for fixed shifts, the enterprise should review their work organization concerning morning and afternoon rotating shifts.

Sleep disturbances mediate the association between burnout and increased HbA1C among women

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Objectives: The purpose of this study was to investigate the extent to which the sleep disturbances observed in burnout may be related to glycated hemoglobin (HbA1C), an integrated estimate of glucose during the preceding 6-12 weeks.
Methods: Sixty-three female participants (mean age 48±6 years) were allocated to a low (n = 20) and a high burnout group (n = 43) based on median splits of their scores for the Shirom-Melamed Burnout Questionnaire (SMBQ). They were compared in terms of Hba1C in whole blood, and in terms of sleep disturbances by means of the Karolinska Sleep Questionnaire (KSQ).
Results: Participants with high burnout manifested higher levels of HbA1C ($p<.0001$), and higher scores for the KSQ-indices Sleep Quality ($p<.001$), Awakening ($p<.001$), and Fatigue ($p<.001$). In multivariate analyses controlling for age, BMI, smoking and sedentary life-style, Sleep Quality was positively related to HbA1C (Std. Beta =.302, std. err. =.064, $p<.05$) .
Conclusions: The results indicate that a poor quality of sleep mediate the associations between burnout and increased HbA1C among women.

Flexible working hours and their effects on age and gender

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Models of flexible working time systems are frequently sought after in our counselling practise. Due to the fact that market's and customer's demands change rapidly either seasonally, monthly, weekly or even daily, companies try to meet these short-term and almost unpredictable requests by in- or decreasing the number of production or service hours accordingly. Flexible working times of any kind may have a crucial impact on the employees because they have to deal with the demands and benefits of flexibility in their job as well as in private life. It can be assumed, that there are age-related effects in coping with changed working time arrangements, with the impact on family life as well as with impact on leisure time.
In the context of a more than 3-year long project in the Federal State of North Rhine-Westphalia, Germany, named "Modern Working Times"[1], AWiS-consult supported the implementation of flexible working time arrangements in two companies: a service company, where flexible day work and working time accounts could be accomplished and an industrial production company where a flexible shift system as well as working time accounts were introduced. In both companies the employees' satisfaction with the new flexible working time arrangement were reviewed by a questionnaire study.
The study differentiated between Group A (98 new employees) who only worked under the condition of the new flexible shift system and Group B (136 long serving employees) who could compare the former (discontinuous) shift system with the new flexible arrangement which included a continuous variant in case of a high production demand.
The results showed interactive effects for groups, gender and age regarding satisfaction with the new shift system. In Group A younger females are more dissatisfied in comparison to older females and younger males, whereas older males are generally more content than younger males and older females. In Group B younger females are less satisfied than older females, but more satisfied than younger males.
For younger women the double burden of family and job has negative effects. Especially when changing from discontinuous to a predominating continuous shift system (Group A), younger women had difficulties to cope with this change, which causes considerable impairment on the organisation of job and family life. Considering the different groups, it is very important whether employees are new in the company (Group B, probably unemployed before) and therefore working voluntarily in the flexible shift system. In this case, younger women, for example, could cope better with this situation than their younger male colleagues, but still not as good as older women.
According to these results, flexible shift work systems should be orientated to the age and gender pattern of the employees.

[1] Supported by the Federal State of North Rhine Westphalia, Germany, and the European Social Fund

Be our guest - anytime! Ergonomic working times for hotels and gastronomy

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In the hotel and gastronomy business, service and therefore also the working times of the staff have always been oriented towards the customer's demands. Consequently, many employees in this branch often work in the evenings or during the night as well as on week-ends and holidays. Furthermore, there are – especially in certain regions like for instance the holiday islands – seasonal fluctuations of customer demand. These specific attributes of the trade often make it difficult to plan and organize the working times of the staff according to the German Law of Working Time and according to ergonomic standards. The actual working time arrangements are mostly not only no longer acceptable from the moral point of view, they are also not beneficial anymore, as many young people turn their backs to these conditions and prefer to learn other trades. In the project "Working Times of Hotels and Gastronomy"[2], the business consultancy AWiS-consult was one of the project partners who offered support to small and middle enterprises in the federal state of North Rhine Westphalia, Germany. The consulting service took part on different levels: While some businesses only asked for some advice other businesses sought for extensive support service. This consisted of three basic steps. First of all, the actual situation of the business was carefully analysed. Even though our main focus was on the working times of the employees, the general economic condition of the business was taken into account as well. A thorough data analysis was carried out and the introduced results helped the businesses to develop and evaluate their own profile. In workshops and consultations the results were discussed and strengths as well as weak points of the organization carefully assessed. In regard to ergonomic working times the data (for instance working schedules) sometimes revealed quite negative results. For example, employees often had too short breaks or even no breaks at all, frequently worked long hours and sometimes had not enough time for recreation between shifts. But then we often found that many businesses were not even aware of the regulations and restrictions they had to heed. Within the second step of our support service we offered the businesses more information and tried to mutually find alternative working time designs which were conform to the German Law of Working Time and to ergonomic standards. On the one hand, the owners/managers of the businesses had to find satisfactory solutions – meaning in this case competitive advantages. On the other hand, the employees were supposed to get better working conditions.
In the last step of the consultation process it was ascertained that the staff planning and the work load were of a good relation. This process was supported by the use of different planning methods and by structured meetings. The businesses were then encouraged to establish different working schedules for a trial period. One business, for example, changed the working times of the afternoon shifts; others were interested in the employment of more part-time employees. As working times are mostly closely connected with other operational aspects of a business the hotel and gastronomy businesses were sometimes inspired to also alter other aspects of their work organization in order to safe time and work more effectively. For the other hotel and gastronomy businesses in the region who did take part in the extensive consultation process, the project partners and our firm developed a comprehensive manual to enable these businesses to establish ergonomic working times.

[1] Supported by the Federal State of North Rhine Westphalia and the European Social Fund

Seasonality and seasons out of time- the effects of illumination pollution

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For most organisms the movement of our planet around the sun is the cause for seasonality. During the winter we are exposed to a long scotophase, while during summer, to a long photophase. Therefore, in many species, studies to date seasonality acclimatization of physiological systems such as reproductive and thermoregulatory as well as the immune system is primarily through changes in photoperiod. Bearing in mind that due to artificial illumination, over two thirds of the USA population and over a half of the EU population are not exposed to night darkness, a following question should be asked.
Do these artificial illumination conditions affect winter acclimatization or immune or physiological systems of various organisms?
In an experiment carried out in enclosures under natural conditions, a group of social voles *Microtus socialis* were exposed to light (450 lux) interference during winter. As voles breed under long scotophase, it was assumed that such interference would inhibit reproduction. Indeed, breeding was inhibited in such voles, but furthermore, the voles also died, while the control group of voles reproduced and tripled their numbers in a period of seven months.
Under laboratory conditions, interference with illumination during the dark period, long scotophase acclimatized voles increased food and energy consumption, and when exposed to low ambient temperatures, increased heat production, but could not maintain their body temperature. These results suggest that thermal conductance or insulation were also affected.
Although they were acclimatized animals (long scotophase), they behaved as if they were under long photophase acclimatized conditions. Similar physiological results were obtained for multimammet mice *Mastomys cocha.*
In voles acclimatized to long scotophase periods and which received light interference, only a third of IgG was detected, when compared to the control group. A significant difference in the daily rhythms of body temperature and melatonin were noted.
These results suggest that under long scotophase acclimatization, light interference avoids seasonal acclimatization or seasonality, by causing an effect of "seasons out of time". So, as for human beings, when we are exposed to artificial illumination do we still experience seasonality? What could be the implications of such a situation?

Ergonomic design of working hours part 2: e-tide – an internet based training

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E-tide is short for *ergonomic time design* and describes a cooperative project between AWiS-consult and the University of Oldenburg[3]. While the University is responsible for the further development of a computer program for ergonomic working time design (BASS 4.0), AWiS-consult has developed and implemented an internet based training concept for employees as well as for other interested parties. With the help of the internet based training the key employees of the companies get a good basic knowledge – the condition for an adequate and efficient decision making.
The internet based training allows the participants to organise their own learning pace and structure. The participants can learn to assess their existing working times; if the occasion should arise they will also be able to optimize their working times according to legal standards and to standards of preventive health care.
The training consists of seven courses, which covers basic topics on working time design, night- and shift work, flexible working times, part-time etc. Each course includes an intro, in which the aims and main aspects are described, course units, in which the participant can learn the respective contents, a summary, comprehensive exercises to evaluate the present knowledge and an index of links and publications, which indicates relevant references. The structure of the course units is similar. The courses start with a practical and illustrated case study followed by the actual contents. At the end of a course unit the participants have the opportunity to test their knowledge in form of multiple choice questions. A direct feedback of the results will be given. The edited exercises, however, will be sent by e-mail to a mentor who will review the answers and comments and correct them if necessary. A feedback will also be given via e-mail. Further questions can be exchanged by telephone. Furthermore, the training will be evaluated to enable quick direct improvements.
In addition to the internet based learning two seminar phases are offered, in which the computer program BASS 4.0 will be introduced. The participants will learn to design working time systems with the support of this program which will finally be handed over to them.
The first course has started in November 2002. All in all, the participants have so far given us a good feedback. Especially the case studies are found helpful because they are regarded as practical and realistic and are last but not least also a nice diversion. Another positive aspect often mentioned is the fact that the topics are of practical relevance and the contents easy to understand. Therefore e-tide is an effective way to transport the idea of work and health safety into the companies and to give them more competence in effective working time design.
The training concept, the contents and the method will be presented.

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Always on duty! Designing working times in hospitals - chances and limitations[4]

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Working times of hospital doctors get more and more in the centre of attention because it is obvious that they by no means fulfil the standards of the German law and are therefore also not conform to the ergonomic principles. Especially the demand during on-call duty, the violation of maximal working hours but also the irregular breaks have to be mentioned in this context. In many cases, local authorities for health and safety get aware of the disquieting situation by anonymous complaints from hospital doctors who – in these circumstances – can't stand the stress any longer and find themselves unable to guarantee for their patient's safety. This negative development is intensified by the fact that there is a growing shortage of hospital doctors in Germany. In addition to that, a European law which defines on-call duty as full working time could – if adapted to German law – worsen this alarming situation even further.
Taking these circumstances into account, with their requests the hospitals often want to make "the impossible possible": They frequently hold the false hope that through a new working time system they will be able to solve all their problems like minimizing their violations against the law as well as relieving themselves from serious and complex organisational deficits. The approach of our business consultancy basically takes organizational, personnel and time aspects into account.

1. In a first step, the actual situation gets closely analysed: In view of legal regulations, labour agreements and ergonomic health standards, the duty rota of the doctors is examined. Additionally, we take complex aspects of co-operation with other professional groups (e.g. the nurses) and units into consideration, as working time can't be separated from the working tasks and the different processes in the organisation.
2. In a next step, we create – with the help of an especially formed project group – a scenario of a better working time system. This project group normally consists of representatives of the management, of the doctors and of the works committee. The main objective of this group is to discuss the results and to find solutions with a focus not only on working time alternatives but also on other improvements in regard to personnel and organisation.
3. Finally possible variants of duty rotas which are not only based on legal and tariff regulations but are also in agreement with ergonomic health and safety standards are developed, presented and discussed. If it is wished by the customer, one of these alternative duty rotas also takes the new European law on on-call duty into account.

In regard to working time, the aim is to present a sensible approach for the consultation process. In this context, the main focus lies on the results of real counselling projects with detailed documentation of working times, working tasks and individual solutions for the units of the hospitals. But there are also obvious limitations which result from the complex netting of the legal and tariff regulations, the consequences of the German Health Reform as well as the development of the educational training of doctors.

The maintenance of wakefulness test (MWT) and Epworth Sleepiness Scale (ESS) in railway transportation: reference values and connection to dozing-off at work

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The MWT and ESS are used widely to measure excessive daytime sleepiness (EDS) and especially the ability to maintain wakefulness in soporific circumstances. Our objective was to define the distribution of MWT and ESS values in a random sample of workers with irregular shifts and to study the connection of MWT and ESS values to dozing-off at work.
275 randomly selected train drivers and traffic controllers with irregular work hours participated in a combined sleep laboratory and sleep diary study. The subjects filled in a sleep diary for 21 consecutive days prior to laboratory testing. Nodding-off, sleep and working hours were reported. After at least two days with no night shifts, a polysomnography and MWT the following day were performed according to Doghramji et al. (1). The subjects were asked to fill in ESS for the last 3 weeks.
The mean sleep onset latency (SUSMWT40) was 35.9 ± 7.2 min. If the trial duration of 20 minutes would have been used, the mean S1 latency (MWT20) would have been 19.0 ± 3.0 min. Based on a definition of normality of 2SDs lower than the mean, the normal limits for the SUSMWT40 and MWT20 were 21.5 and 13.0 min, respectively. The mean ESS score was 5.5 ± 3.1 for the last 3 weeks. To exclude major sleep disorders, a subgroup of 159 subjects was formed based on the polysomnography with the following criteria: TST > 6 hours, AHI < 10 /hour and no signs of periodic leg movements in sleep. The mean MWT sleep latencies of the subgroup did not differ from the whole group and TST and sleep efficiency correlated negatively with sleep latencies in both groups. Workers with a mean latency in the SUSMWT40 of at least 1SD below average dozed off more often (16.7%) during the day shifts than the rest of the group (5.7%) while there were no significant differences during the other shifts. Similarly, the ESS scores were associated with dozing-off during the evening and night shifts and especially during the days off. The MWT sleep latencies were not related to age or the number of preceding work shifts.
The results show that the MWT and ESS are valid and feasible methods for the estimation of the ability to maintain wakefulness among shiftworkers. The lower reference limits for MWT became higher than in the data of Doghramji et al. (1) even though our sample included habitual nappers. One explanation is that high requirements for maintaining wakefulness at work can be associated with longer sleep latencies in the MWT. Although ESS is a subjective measure, it seems to predict self-reports of dozing-off at work better than the MWT.

1. Doghramji K, Mitler M, Sangal RB et al: Normative study of the maintenance of Wakefulness Test (MWT). Electroencephalogr **Clin Neurophysiol** 1997;103:554-62.

A controlled intervention study of a quickly forward rotating shift system among young and elderly maintenance workers

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Objectives: Shift work is related to a higher risk of sleep and other medical complaints. According to age, the problems with day sleep after the night shifts tend to increase. The curtailement of day sleep may be related with age-dependent increase in morningness, slower circadian adjustment to consecutive night shifts and, at the end, increased

sleepiness together with the cumulative sleep deprivation. In order to develope more ergonomic shift schedules for ageing workers, we studied the effects of a very rapidly forward rotating shift system on sleep, health and well-being among young (45-) and elderly (45+) maintenance workers.

Methods: A controlled intervention study was carried out in a line maintenance unit of a large airline company. In the beginning, all workers had a continuous backward rotating three-shift system with the shift order of EEE—MMM—NNN—. (E=evening shift, M=morning shift, N=night shift, -=free day). The shift changing times were mostly at 07:00, 15:00 and 23:00. A new quickly forward rotating shift system (MEN—) was developed with the morning shift from 06:00 to 16:00, the evening shift from 15:00 to 01:00 and night shift from 21:00-06:00. Based on the ergonomic ideas and the needs of the employer and employees, the new schedule had only a single consecutive night shifts, more time for recovery between the individual shifts and an earlier starting and ending time for the night shift. The two shift systems were compared by a questionnaire (n= 273 before and n=116 after) and by field studies (n= 53 before and n=40 afrer) and by the registration of sleep (actigraphy), subjective sleepiness (KSS) and objective performance (PVT) during The old system and 6 months after the testing of the new schedule.

Results: Based on a linear mixed model for repeated measurents, the the new shift schedule had significant positive effects on the perceived effects of the current shift schedule on general health, sleep, well-being at work and social and family life compared to the control group. Napping before the first night shift (and after the late evening shift) increased especially among the older age group (45+) and alertness during and after the night shift (recovery days) improved. Sleep length seemed to increase during the free days. Subjective complaints of sleep decreased in all shifts. Performance in the PVT showed some improvement, but the changes took place in both age groups in the new schedule. At the and of the study, all subjects voted for the new shift system. **Conclusions:** It concluded that although the new shift system increased the number of night work hours, the rapidly forward rotating shift system had wide positive effects on sleep and well-being. Especially the recovery period after the single night shifts and perceived alertness improved.Although the older age group was self-selected, the positive effects of the new shift schedule were detectable in both groups and also partly by objective methods. The positive changes in sleepiness and social life were probably related with the changes in sleep behavior before the night shift and the faster physiological recovery.

Work demands, working times and sleep among information technology professionals

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The frequency of long working hours and shortened or disturbed sleep was studied among information and communication technology (ICT) professionals. Secondly, we wanted to analyse which specific work demands and individual characteristics were related with long working hours and their consequences for shortened sleep and insomnia.
A questionnaire was sent to a sample of the members of the Finnish Information Processing Association in 2001. 2355 subjects (50.7 %) replied. Factors related with total working hours, sleep length and insomnia were investigated with linear and logistic regression models, in which the explaining factors consisted of age, gender, individual and work-related demands and resources. Average weekly working hours (total hours) were about 44 hours among the ICT professionals. 88% worked overtime and 27 % had at least 50 hours per week. A sleep debt of at least one-hour was found in 37 % of the subjects. The most important individual factors explaining the total working time were the perceived importance of work, demands for management and the knowledge intensiveness of work. Possibilities to influence one's work were, however, linked with shorter weekly working hours. Working time was the most important factor influencing sleep length, but it was not related to insomnia. The risk of sleep debt was about four times as high among those who suffered from insomnia and twice as high among women, evening-types and those who worked 50 hours a week or more compared to others.
The results indicate that long working hours and short sleep, but not insomnia or daytime fatigue, are common among ICT professionals. Total working time is an important factor influencing sleep length, but it is not related with insomnia. Although it is not possible to make conclusions on causal relationships, the results still encourage to suggest that long working hours among ICT professionals could be controlled by proportioning the greatly varying work demands better to individual resources and by increasing job control.

Variability of the circadian time structure in clinically healthy subjects. Interactions between activity and patterns and time of food uptake

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The human circadian time structure is subject to a great degree of variability in clinically healthy subjects. This variability may in part explain differences in the response to environmental agents including drugs used in clinical medicine and in the response to phase alterations as experienced during night and shiftwork and/or after transmeridian flights.
The circadian time stucture of 13 hormonal variables was explored by 20' sampling for cortisol and prolactin and by 90' sampling for aldosterone, DHEA-S, estradiol, estriol, estrone, insulin, LH, 17OH-progesterone, Total T_4, Total T_3, and TSH in 85-24 hour profiles in 26 American women of different ages. Twelve hematologic variables were studied by 4-hourly samples over a 24 hour span in 150 American (Caucasian) subjects and up to 55 endocrine and biochemical variables by 4-hourly sampling in 194 children (11±1.5 years of age), 46 young adults (21±1.5 years of age) and in over 300 elderly subjects (75±8 years of age) of both sexes. All subjects were clinically healthy and followed a diurnal activity pattern with rest at night (from approximately 23:00 to 07:00), and eat 3 meals during daytime. To explore the effect of timing of food uptake on circadian synchronization 17 subjects (22±9 years of age) were studied living on a diurnal activity pattern as above but consuming all their caleries as a single meal either as breakfast (~08:30) or as dinner (~18:30) for 3 weeks prior to study in a crossover design. Thirty hematologic, biochemical and endocrine variables were studied by 4-hourly samplin over a 24 hour span at the end of each dieting regimen.
Rhythm description by single cosinor analysis indicated a deviation from the group mean (population mean cosinor) of (among others):

Variable	Age/ Sex*	Samples / 24 hrs	Phase Advance (hrs)	Phase Delay (hrs)	Variable	Age/ Sex	Samples / 24 hrs	Phase Advance (hrs)
Cortisol	A - F	72	3	3	Prolactin	A - F	72	4
	E - M,F	6	4	5.5		C - M,F	6	3
	C - M,F	6	4	4		A - M,F	6	5
*C=Children, A=Adult, E=Elderly; M=Males, F=Females					Lymph	A - M,F	6	6

In the subjects eating a single meal/day the acrophase of plasma insulin, serum iron and blood urea introgen concentration followed the time of food uptake inrespective of the activity pattern. In contrast, the timing of the circadian rhythm in growth hormone, plasma cortisol and total leutocyte count shifted only slightly while the rhythm in lymphocytes remained syrchronised to the day/night (activity-rest and light-dark) pattern.
Conclusion: Clinically healthy subjects of different ages show a substantial degree of variability in their time structure. The relationship of the activity rhythm to the timing of food uptake may entrain some circadian rhythms but not others and thus may change the internal circadian time organization.

Interactions of lighting regimen and timed feeding as circadian synchronizers in mice

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In light-dark synchronized animal models with food and water available *ad libitum*, the lighting regimen entrains via a non-visual function of the retina, the "master clock" in the suprachiasmatic nuclei (SCN) of the hypothalamus which in turn controls the timing of peripheral oscillators in numerous organs and tissues. If the availability of food is limited to a 4-hour span/24 hours, the SCN looses operative control of some but apparently not all peripheral oscillators some of which tend to follow the timing of food availability as dominant synchronizer.
Swiss-Webster female mice (6-8.5 weeks of age) were studied under a lighting regimen of LD 12:12 with water available *ad libitum*. The animals were subdivided into four groups of 516 animals each, and fed either Purina mouse chow or 68% carbohydrate, 64% protein, or 23% lipid fortified diets. Within each diet group, subgroups of mice had either access to food *ad libitum* or were restricted to a 4 hour feeding span placed at six different circadian system phases along the 24-hour scale: Hours After Light On (HALO) 0-4, 4-8, 8-12, 12-16, 16-20, 20-24. The animals were sacrificed after 25 days on this regimen at 4 hour intervals over a 48 hour time span. The following biochemical and hormonal rhythms were studied: serum glucose, insulin, thyroxin (T_4), corticosterone and liver glycogen. A complete blood count and differential count were done.
The data were analyzed by the single cosinor procedure and differences between the groups were verified by T-test, ANOVA, and/or Bingham test. The exposure to "competing synchronizers" of light and time limited feeding shows: (1) body temperature and serum insulin followed the feeding schedule. (2) Liver glycogen, serum T_4, and glucose show phase alterations with liver glycogen and T_4 predominantly following the feeding schedule. (3) The number of circulating white blood cells and serum corticosterone, followed predominantly the lighting schedule. (4) Synchronization by timed feeding was similar in animals with carbohydrate, protein, fat enriched or mixed diet. The time of feeding rather than the food composition determined the circadian synchronization.
In human shift-work, the times of food uptake are often out of phase with the work-rest schedule of the subjects. Animal models with independent variation of the light-dark schedule and feeding time may be suitable to study the effects of changes in the circadian internal time structure upon the mammalian organism.

Indicators to assess the strain input on video terminal operators

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Aim: to evaluate the human body reactivity and the value of some indicators for assessing the strain and its effects, in order to optimize working conditions.
Methods: This study was carried out with 200 female operators, with the use of a video display terminal (VDT), technical data entry, program projection and technical editing,
The research methods included: analysis of the equipment used at work; characterization of the work environment conditions; dynamic assessment (before work and during it) of some indicators; ocular accommodation and convergence distances, blinking frequency; critical fusion frequency (CFF), visual acuity of performance (time and mistakes in optotype reading); visual perception speed; eye movements, exactness/accuracy of the Weston test, heart beat rate, urinary excretion of catecholamines; subjective symptomatology; data processing through a special computer program.
The evaluations were carried out in morning and afternoon workshifts, at the beginning and at the end of the workshifts (7:00-14:00 and 14:00-21:00 shifts).
The VDT tests were run in rooms provided with windows and air conditioning. The microclimate was comfortable. The electromagnetic waves were under TLV; sometimes the noise level exceeded the TLV by 1-5 dB(A). The three work planes (cathodic screen, keyboard, written material – documents, manuscripts) had different characteristics in terms of light and distance towards the operator's eyes.
Results: The screen brightness, light and luminescence between the work planes varied. The strain upon the human body is something quite complex. The vision workload predominates, as many visual functions were involved in this work.
The hands, acting on the keyboard, produce tactile and psychomotor strain. The sitting position without any variation produces postural strain. The attention, memory and thinking required causes mental strain. The performance of the neuropsychic indicators decreased in most or all subjects showing fatigue. The heart beat rate and urinary excretion of catecholamines decreased, showing a deactivating status, thus reflecting fatigue. The decrease was higher in the afternoon shift and when lighting was deficient. The functions investigated were strained under work with VDT. The major decrease was observed in CFF and visual acuity (all subjects registered $p<0.05$-0.001), since such functions appear to be the most sensitive ones. The heart beat rate and urinary excretion of catecholamines are also important to indicate the body's general strain and fatigue. All subjects presented fatigue complaints. The highest level of strain was found among subjects dealing with calculation and technical data entry. Strain among VDT operators depends on: content/level of satisfaction with the work; the way the information is displayed; working environment, particularly in terms of lighting; location of the work plane; equipment (table, chair, etc); type of documents (handwritten or typed), work organization (time/schedule/load, etc), operator's visual conditions; professional training and experience. Deficiencies concerning any of these aspects contribute to increase the strain and fatigue. Technical, organizational, medical and social interventions/initiatives would be necessary to prevent the body from being submitted to excess strain and fatigue.

Methodological considerations with web-base shiftwork data collection

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Internet and world wide connections offer new data gathering methods. A two phase study, examining time and sleep disturbances using a web-based survey and Actiwatch™ data collection methods was designed. In phase one, American Indian (N150) and White non Hispanic (N150) nurses are to complete a web-based shiftwork survey. The purpose of this paper is to discuss the methodological considerations in planning and carrying out web-based data collection. Investigators identified four steps (planning, going-live, valuation and response) in the process of on-line data collection. (1) Planning: Recognized shiftwork and temporal survey measures that reflected the study's aims were selected. Team members (webmaster and database staff) were selected. Meetings (on site, teleconference, and email) were used to plan the on-line survey development, and discuss remuneration, access controls, pilot testing, test duration, and recruitment strategies. Time lines were developed for pilot testing the survey, webpage links, and revisions. For each database item, a survey item was created. Drop-down boxes were used for multiple choice items such as "age" by group. Likert-type items had "option buttons" that matched scale items. An index webpage describing the study, aims, an invitation to participate, and remuneration was developed. Web links to the consent form, inclusion/exclusion criteria and the survey were created. Web pages describing the Actiwatch™ and diary completion were also linked to the main web page. In consideration of variable download speeds, limited graphics were used. Subjects had to give a user ID and password to access the survey. The survey was accessible for 24 hours and allowed subjects to reenter the survey if disconnected. To prevent lost data, data was saved periodically and cued by the word "continue." For confidentially, the database and survey was password protected and located on a secure server. Access was limited to team members only. After the survey was completed, the team received an email message with personal information and survey completion. (2) Going-live: Recruitment was stared after the survey was Internet accessible. Marketing included printed advertisements, published articles, email, and nursing organization chat rooms and discussion groups. A serious error occurred from posting the webpage at a recognized search engine. A "pay-for-survey" website posted the survey and remuneration link from study web site, eliminating purposes and inclusion criteria. Payment offered for survey completion (a $10.00 gift card) resulted in 150+ invalid surveys. Tighter control links were added to ensure subject and system reliability. (3) Validation: Each day, completed survey emails were reviewed. A data base listing a subject's number, completion code, identification information, ethnicity, licensure type and state were reviewed for discrepancies. Personal data was validated before remuneration was mailed. (4) Response: A personalized thank you letter, gift card and webpage advertisement were sent after survey completion and subject validation. **Conclusions**: Data collection using the Internet offers many challenges. Researcher must be vigilant throughout the process. Team work and frequent communication are needed for quick revisions, setting controls, and problem solving. Strategies to prevent "survey fortune-hunters" need to be in placed.

Internet data collection with American Indian and White nurse shiftworkers

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Sleep-loss and sleepiness are frequent complaints of nurse shiftworkers. However, sleep problems among nurses of different socio-cultural groups are not known. Based on projected demographic changes, a greater number of ethnic minorities are expected to enter the United States workforce. This includes American Indian/Alaskan Native (AI/AN) nurses. More minority nurses are needed to give culturally congruent care; however, AI/AN nurses represent less than .05% of nurses. Shiftwork studies report similar sleep disturbances and sleepiness; however, a cross-cultural assessment has not been reported. Socio-cultural influences on sleep disturbances and sleepiness are not known. Therefore, a two-phase study comparing temporal factors (time awareness, morningness and polychronic time use), shiftwork-related sleep disturbances, and shiftwork-tolerance in AI/AN and White, non Hispanic (WNH) nurses is underway. In phase one, AI/AN and WNH (150/group) nurses complete an on-line survey. For phase two, objective activity/rest data (ActiWatch™ and activity diary data) is collected over five (24-hour) days. During the five day period, the nurse works at least two (2) 12-hour night shifts. **Objective:** To obtain a sufficient cross section of each group, (N150/group) a web-based Internet survey was developed. **Method**: The on-line survey was based on recognized shiftwork-related instruments. Items about schedules, sleep (quality, quantity), naps, family support, socio-cultural choices, time awareness, polychronicity, morningness/eveningness, ethnic identity and demographic questions is asked. The survey is linked to a series of web pages. These pages describe the study purpose, inclusion and exclusion criteria, consent form, web survey, ActiWatch™ methods, and diary completion. The survey was pilot tested for error codes, item confusion, test length and time to complete. Access control codes were added asking for a user name and password before accessing the survey. Nurses could access the survey for 24 hours. The users name and password were used to log in when a subject's internet connection was lost. Data was saved periodically and cued by the word "continue." The web page inviting participation and survey were posted to http://learn.sdstate.edu/hobbsb/survey. Subjects were recruited using published articles and printed advertisements, hospital email systems, national nursing organization websites (minoritynurse.com; NANAINA.org), nursing website discussion groups, snow-balling, and word of mouth. **Findings**: To date, the on-line survey has been completed by 100 WNH and 11 AI/AN nurses with 54 and 105 survey's pending validation respectfully. Subjects with incomplete information are contacted by letter to clarify their licensure and ethnicity before a thank you letter and remuneration ($10.00 gift card) can be mailed. More than 100 unlicensed subjects attempted to or completed the survey. This data will be removed before analysis. Phase two, 30 people have volunteered to complete activity data collection. Currently, activity data records have been completed for 16 WNH and 2 AI/AN subjects with 2 more pending. **Conclusion**: It is possible to recruit nurse shiftworkers and collect data through the Internet; however, the researcher must remain vigilant throughout the process.

Intervention studies between scientific claim and business efficiency

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Intervention studies in general deal with the design and implementation of measures as well as with the consideration of their effects and consequences, thus including both intervention as well as evaluation tasks. In the shiftwork research a great variety of types of intervention can be found: engineering (e.g. bright light), behavioural (e.g. stress management training) as well as administrative interventions (e.g. shift scheduling). The paper focuses specially on intervention studies provided in the field, i.e. in organisations running shifts. The open and dynamic character of organisations, their interaction with the environment as well as their rigorous orientation to efficiency on the one hand, and the claim of the researchers to provide scientifically profound evaluation and to deliver reliable results on the other hand, build an area of conflict challenging both sides. As seen from the researcher's point of view it actually concerns all methodological issues: *Intervention characteristics*: How long the intervention should last, how much time should pass between the pretest and posttest measurements and a reasonable amount of exposure of the subjects to the intervention are amongst the most controversially discussed topics between researchers and practitioners as for the validity of results and the efficiency of intervention. *Study design*: Who is measured (truly experimental, quasi-experimental and non-experimental design) and when (pretest and posttest, posttest only, time series). In field studies merely quasi-experimental or even only non-experimental designs are possible due to given organization structures. Longitudinal studies including pre- and posttest are reasonable, however due to limited time and costs in many studies single posttests have to be sufficient. Time series are extremely seldom in field studies. *Timing and placing:* In order to measure the pure effect of an intervention, neither other interventions nor changes in the intervention environment should occur during the testing period. However, this is hardly possible due to the dynamics of the action field in business. *Subject selection and number:* In quasi-experimental field studies there is often quasi-voluntary participation. Mostly groups as a whole are selected and their size is predetermined. A check can be made regarding the comparability of the experimental and control groups, but researchers hardly have any influence on making any improvements. *Data collecting methods:* Objective or subjective measurements, qualitative or quantitative approach. From a researchers' point of view a multimethodological approach should be used in data collection in order to increase the quality of the evaluation results. However, "hard", quantitative data are regarded as being stronger and more demonstrative by practitioners, even if qualitative and subjective data might help identify underlying factors. The access of evaluation research in intervention studies must consider the basic phenomena of the practice as a field of application, in order to make realistic claims and to deliver useful information for both the scientific and practical purposes. The following implications should be considered:

- The purpose of the intervention evaluation is rather to increase the probability of a correct decision than to give an absolutely robust statement regarding the effects.
- The employees affected by the intervention are the primary source of information for the evaluation. Their participation is indispensable.
- Pilot projects are an advisable field of learning and experience in the implementation and a useful instrument for evaluation.
- Besides the analysis of the effectiveness of an intervention, with regard to the achievement of objectives, its efficiency in terms of input/output analysis should be evaluated, e.g. by means of integrated analysis assessments.

Lifetime accumulated exposure to night-work increases sleep disturbances and reduces subjective health in monozygotic twins

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The effect of night-work on sleep and health is a debated issue. Almost no lifetime follow-up has been carried out and when attempted, selection may have biased the results because of insufficient control over individual factors. The most powerful design available to control for individual factors is the comparison of monozygotic twins. The present study sought to investigate the effect of exposure to night work over the life span in monozygotic twins discordant on the exposure to night-work. The Swedish twin registry collects questionnaire data from all twins that are born in Sweden. Because the focus of this study was exposure over the working life span, only twins 65 years or older (the normal age of retirement in Sweden) was analyzed. A total of 720 monozygotic twin pairs were available and 200 were discordant on night work exposure - one twin had no exposure and the other at least one year (mean exposure to night work = 13 years). The latter 200 pairs (101 men, 99 women, mean age 69 years) were used to analyze differences within pairs on subjective questionnaire data. Variables describe habitual bedtime, rise time and time in bed, as well as items (1-5 with 5 as the most positive outcome - less frequent complaints) describing disturbed sleep, early awakening, well rested and self rated health. Diurnal type was scored 1-5 with 5 as extreme eveningness. One control variable was available describing the number of years of formal education. The effect of exposure to night work was analyzed using ANOVA for dependent measures between paired twins. The results showed that here were no differences between paired twins on habitual bedtime, rise time, time in bed, early awakening, well rested, diurnal type or the number of years of formal education. There was however, a significant difference for disturbed sleep (p=.002) and self rated health (p=.021). Twins exposed to night-work reported more frequent complaints of disturbed sleep (4.2/pm.08 vs 4.5/pm.07 mean±sem) and poorer self rated health (3.6/pm.08 vs 3.8/pm.07). In a second analysis, twins were matched according to their formal education in fours groups corresponding to elementary school, high school, college and university degree. A total of 109 twin-pairs were left with equal level of formal education and the effect of night-work was tested with ANOVA. The results confirm the prior analyses. Disturbed sleep was more pronounced (p=.002) and self rated health poorer (p=.016) in twins exposed to night-work. The effect of gender was also investigated by introducing gender as a between groups factor. No significant interaction was found between gender and exposure to night-work on any of the studied variables.The results suggests that lifetime accumulated exposure to night-work has negative effects on subjective sleep and health in monozygotic twins. The effect seems to be independent of gender and the level of formal education.
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Individual differences in response to a change of shift order in a very rapidly rotating compressed shift schedule

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Objective: The main objective of this study was to evaluate the effects of a change in shift order within a compressed shift schedule at a paper mill and if possible evaluate individual differences in health and well being among the shift workers. **Method:** The original shift schedule was very rapidly rotating (N-A-M-X repeated 7 times + 8 days off) and shift orders was changed so that the morning shift was moved from the end to the beginning of the shift sequence (MN-A-X-X). Rest time between shifts was 8 hours.Four years before, and one year after the shift change, a questionnaire was completed by 278 shift workers (192 men & 86 women, mean age 41 years) and 65 day workers (47 men & 18 women, mean age 42 years). The questionnaire included questions of sleep, fatigue, psychosomatic complaints, psychosocial factors at work, satisfaction and background factors. Prevalence of insomnia was assessed with a combination of questions in the questionnaire (complaints at least a few times every week with: falling asleep OR repeated awakening OR premature awakening OR disturbed sleep AND complaints of sleepiness). **Result:** The effect of the changed shift schedule was analyzed with a two factor ANOVA for repeated measures with the interaction between time (before/after) and group (day/shift) as the main term of interest. There were no effects ($p<.05$) on any of the variables describing health or well-being for the shift workers as a group. However, satisfaction with work hours was decreased for 38% and increased for 33% of the shift workers. A total of 34% of the shift workers wanted to change back to the old schedule and 59% wanted to keep the new schedule. A separate series of ANOVA on the two groups (positive/negative) showed individual differences in almost all variables studied ($p<.001$). Sleep quality (1-5 very good) decreased in the negative group ($3.8\pm.07$ - $2.7\pm.08$) but showed a slight improvement in positive group ($3.60\pm.06$ - $3.70\pm.06$). The same pattern was observed for various complaints of sleep, fatigue, health and time for social activities. However, before the shift change, the negative group actually showed *less* complaints and *higher* satisfaction than the positive group. A multiple regression analysis showed that the negative group had (after the change): more difficulties with the nap between the M- and N-shift ($\beta=.39$), insufficient time for social activities ($\beta=.18$), longer exposure to shift work ($\beta=.13$) and more frequent repeated awakenings ($\beta=.18$) with 37% of explained variance ($p<.001$). The prevalence of insomnia increased from 11% to 20%. However, most insomniacs (83%) before the shift change were normalized over time and most insomniacs (69%) after the shift change were new cases. This was also validated against shift specific sleep complaints. Only a fraction (3%) where chronic insomniacs and for this group sleep complaints were worsened over time. **Conclusion:** Despite a rather small change in the shift schedule, strong differential effects on sleep, health and well-being was found but no "overall" effect. Negative effects were found in a well adapted and more experienced group but positive effects were found in others. The result raises questions of individual differences in tolerance of shift work: Does one size fit all? Or are there several different shift worker types suited for several different schedules?

Train drivers work-hours, health and safety: a summary of results from the TRAIN-project

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Objective: This paper summarizes results from the TRAIN-project (TRAffic safety and INformation environment for train drivers). The project was financed by the National Swedish Rail Administration. **Method:** The studied population was all train drivers of commuter and long distance passenger trains active in the Stockholm area (n=402). Four separate studies will be presented. **1)** All active shift-schedules were subjected to a descriptive work-hour analysis. **2)** 290 (72%) train drivers completed a questionnaire. **3)** 46 train-drivers were followed with a sleep/wake diary and actigraph watch during 14 days. **4)** 18 train-drivers participated in a within group field experiment on an 11h round trip (Stockholm-Malmö-Stockholm) with three conditions: early- (06:18-17:41), day- (08:18-19:41) and evening shift (10:18-21:41). Variables presented include scales and single items from the questionnaire (study 2) and diaries (3,4), bedtimes from actigraphy (3) and sleep diary (4), subjective sleepiness (KSS: 1=very alert, 9=very sleepy, fighting sleep, difficult to stay awake) from the wake diary (3,4) sometimes expressed as the peak since the last stop (4). Prevalence of insomnia was assessed with questionnaire data (difficulty falling asleep OR maintaining sleep OR waking too early AND complaints of daytime sleepiness at least a few times every week) as was self-reported incidents (signal passed at danger, overseen vital information and aspects of handling the safety system - Automatic Train Control (ATC))
Results: Study **1)** Work-hours were extremely irregular with shifts beginning and ending at all hours. Early morning shifts (beginning 03:00 to 06:00) accounted for 28% and night shifts (beginning <01:00 OR ending >03:00) for 14% of all shifts and 28% of the shifts had a prior rest time of d”12 hours (9%d”8h). **2)** A total of 55 subjects (19%) were classified as insomniacs and sleep disturbances (as indicated by short TST) for insomniacs were pronounced before early shifts (5.5h±.16 vs 6.1h±.07; $p<0.001$). Insomniacs were also over represented (p=,032) in the groups that reported 3-5 and 1-2 incidents (28% and 20%) compared to the no-incidents group (11%). Multiple regression analysis suggest sleepiness (β=.22), depressive symptoms (β=.16) and lack of motivation (β=.18) as main predictors of incidents (adj R^2=.17; $p<.001$). **3)** Total sleep time was extremely short before the early morning shifts (4.5h±.14) especially compared to days off (7.7h±.26; $p<.001$). Mean sleepiness over the work shift was also as high during the early shift as during the night shift (KSS=5.7±1 vs. 5.4±1, n.s) despite the fact that the nigh shift had peak at 02:00 with very high levels (KSS=7.6). **4)** A three factor ANOVA showed an effect of shift (p=.011) and time (p=.026) but no effect of direction (p=.144). Sleepiness was most pronounced during the early shifts, especially when the drive between stops was long and suppressed when there were short drives between stops (p=.017). 86 % of the drivers reported severe sleepiness (KSSe”7) at least once during driving.
Conclusion: Work-hours were extremely irregular with short rest times and contributed to high levels of sleepiness and likely to the high prevalence (19%) of insomnia. Almost all (86% in study 4) drivers reported severe sleepiness during driving. Sleepiness and insomnia was also related to self-reported incidents. Early morning shifts seems to bee a major concern due to very short sleep (4.5h), pronounced sleep disturbances and a high level of sleepiness throughout the shift. Improved work-hour ergonomics would most likely improve safety.

Ultradian rhythms in speed of memory processes and cerebral hemispheres

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Search for ultradian rhythms in psychological variables revealed variety of periodicities suggesting a mulitioscillatory controlling system (1). The aim of this study was to find out oscillations in speed of encoding (shallow and semantic) and recognition of words and pictures laterally exposed during 24-hour constant routine. The subjects were 30 right-handed students (10 female and 20 male) aged between 21-25 years. During encoding parallel sets of words and pictures (6 to each visual field) were exposed for 200ms at a random order in either the left or the right visual field on the computer screen by purposely-designed software program. The sets to be analysed semantically were preceded by a question concerning stimuli meaning. The subjects were to press one of two buttons reacting to picture or word appearing on the screen (shallow encoding) or answering the question concerning the appearing stimuli meaning (semantic encoding). During recognition following each encoding the subjects were to press the appropriate buttons reacting to the already seen or the new stimuli. Performance was measured 8 times every 3 hours starting from 06.30 with 30-minute break between shallow and semantic conditions. The speed of memory processing was analysed using non-linear last-squares technique (2) for each subject separately. Two significant ultradian components with shorter and longer periods were found for 24 subjects' complete data. Dominant periods were analysed using four factorial ANOVA to find out factors determining period length. The factors were level of processing (LP), memory process (EC), visual field (VF), and stimulus (S). For the purpose of this paper the significant interactions LPxERxVF ($F(1,23)=9,213$, $p=.006$) and LPxERxS ($F=(1,23)=6.868$, $p=.015$) were taken for further consideration. Distributions of periods lengths of speed of shallow encoding of pictures independently of the visual field and of both stimuli in the left visual field showed 2 peaks allowing to distinguish two groups with average periods lengths of around 8- and 12 hours, respectively. Distribution of period lengths of the recognition speed of semantically encoded words independently of visual field and of both stimuli in the right visual field showed one peak in each and the average periods were around 8 hours. According to hemispheric lateralization theories and the recent findings of brain imaging studies (3), certain structures in the left hemisphere are more engaged than those of the right one in more complex cognitive processes like semantically encoded words recognition and the reverse pattern occurs in case of pictures shallow encoding. These may imply that under applied experimental design it was possible to show that efficiency of the right hemisphere structures involved in the less complex spatial memory tasks fluctuates with periods of around 8 and 12 hours. And efficiency of the left hemisphere structures involved in more complex memory verbal tasks oscillates with a period of around 8 hours.

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The 24-hour pattern of recognition accuracy

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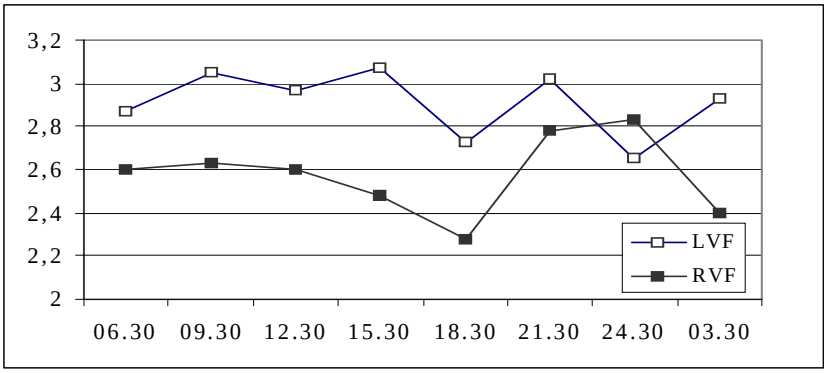
The studies demonstrated time of day effect on immediate memory what was suggested to reflect lessening in left hemisphere dominance from morning to evening (1). The aim of this study was to find out the 24-hour pattern of errors in recognition words and pictures encoded on the basis of their physical appearance.



The data from 24-hour constant routine study of a larger experiment were analysed for the purpose of this presentation. The materials were parallel sets consisting of words and pictures exposed by purposely-designed computer software. During encoding the stimuli were exposed for 200 ms on a computer screen at a random order to the left or to the right from the fixation point and the subjects were to press one of two buttons reacting to picture or to a word. During recognition following immediately each encoding the same stimuli plus the same amount of the others appeared in the middle of the screen and the subjects were to press the appropriate buttons reacting to already seen and to the new stimuli. The subjects were 30 right-handed students (10 female, 20 male) aged 21-25 years. Performance was measured 8 times every 3 hours starting from 06.30. Three factorial ANOVA was performed on the data. The factors were visual field (VF), stimulus (S), and measurement time (MT). Significant interaction VF x MT ($F(26,182)=2.169$, $p=.039$) appeared. Number of errors in recognition of stimuli encoded in the left visual field oscillated insignificantly during the day. While the number of errors in recognition of stimuli addressed during encoding to the left hemisphere was significantly higher at night at 21.30 and at 24.30 hours than at 18.30 ($t=-2.096$, $df=29$, $p=.045$; $t=-2.375$, $df=30$, $p=.024$ respectively) and at 24.30 also higher than at 03.30 ($t=2.196$, $df=29$, $p=.036$). The stimuli addressed to the left hemisphere were recognised significantly more accurately than those addressed to the right hemisphere at 15.30, 18.30 and 03.30 hours.

Figure 1. Daily trends in a number of errors in recognition of stimuli encoded in the right (RVF) and the left (LVF) visual fields.

The decreased accuracy of the right visual field performance at night hours when compared to afternoon hours may imply lower efficiency of the left hemisphere functioning at that time of day what may partly support earlier hypothesis.

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A light/darkness intervention to realign the cortisol rhythm to night shift work

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Introduction: Many night shift workers experience a persistent circadian misalignment to their shifted rest/activity schedule despite years of experience (1). Based on the importance of judicious schedules of light and darkness exposure in circadian readaptatation to shifted sleep-wake schedules (2), we tested the efficacy of a light/darkness intervention in a group of nurses working permanent night shifts.
Methods: We recruited 11 nurses working full-time night shifts for this combined field and laboratory study. Following a period of e" 10 vacation days during which they maintained day-oriented schedules, nurses were admitted to the laboratory for an assessment of endogenous circadian phase via a 36-hour constant routine technique. Following the circadian assessment, nurses returned to their habitual schedule for ~12 night shifts worked in a ~20-day period. During this period, they were observed under one of two experimental conditions. Nurses in the treatment group (n=6; mean age ± SD: 37.1 ± 8.1 years) received an intermittent exposure to bright light (~2,000 lux) in the first 6 hours of each night shift, and were shielded from morning light during the commute with darkened sunglasses. Control group nurses (n=5; mean age: 41.15 ± 9.9 years) were observed in their habitual environments. All nurses kept regular sleep-wake schedules. At the end of the night work period, nurses were readmitted to the laboratory for a final 36-hour constant routine. From data collected during constant routines, circadian phase was assessed as the time of fitted minima and maxima of salivary cortisol concentration. Bedtimes during the vacation period preceding the study, as well as times in bed following night shifts, were recorded in sleep-wake logs.
Results: At the time of the first constant routine, the cortisol rhythm was well adapted to a day-oriented schedule and comparable between groups (Mann-Whitney, fitted minimum: P=0.3, fitted maximum P=0.1). Following the period of night work, the treatment group displayed delays of 11:26 ± 1:26 and 11:04 ± 1:26 in the fitted minima and maxima of cortsiol, respectively. These phase shifts differed significantly from the phase delays observed in the control group for the fitted minimum (3:41 ± 2:09, P=0.006) and the fitted maximum (12:31 ± 0:20, P=0.02) of the cortisol rhythm.
Discussion: The significant phase shifts observed in the treatment group suggest an appropriate alignment of the circadian pacemaker with the shifted sleep-wake schedule. This suggests that a judicious pattern of light/darkness can significantly promote circadian readaptation to night shift work.
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A light/darkness intervention to improve daytime sleep quality in night shift workers

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Introduction: Shift work, and night shift work in particular, are often associated with sleep complaints (1) as daytime sleep following night shifts may be abbreviated by 1-3 hours (2). Where the quality of sleep is in part governed by circadian phase, we implemented an intervention designed to improve circadian reentrainment and increase the length of daytime sleep in night shift workers. **Methods:** Following a vacation period including ≥ 10 days on a regular daytime schedule, 15 nurses returned to their regular schedule of full-time night shifts for ≥ 12.1 ± 0.7 shifts. Ten nurses (mean age ± SD: 41.7 ± 8.8 years) observed under the treatment condition were given an intervention regimen consisting of a 6-hour exposure to bright light (~2000 lux) at the beginning of their shifts and shielding from morning sunlight with tinted goggles. Nine nurses (41.98 ± 7.2 years) were observed under the control condition in their habitual lighting environments. Both groups maintained regular sleep schedules that were limited to a single daily 8-hour sleep/darkness period during which they attempted to sleep. The sleep period was scheduled two hours after the end of night shifts. Diurnal sleep was objectively measured by portable polysomnography or the NightCap device where total sleep time and sleep efficiency were significantly correlated between recording methods ($r=0.623$, $p<0.001$ and $r=0.681$, $p<0.001$, respectively). Nurses recorded their times in bed following night shifts and on days off in sleep wake logs. Circadian phase of the core body temperature rhythms was assessed in the laboratory via constant routines before and after the series of night shifts worked. **Results:** The average length of diurnal sleep episodes in the treatment group of workers was (± S.E.M.) 7:19 ± 0:17 with a measured sleep efficiency of 92.1 ±1.1 %. Mean sleep length in the control group was 6:36 ± 0:12 with a sleep efficiency of 87.9 ± 3.2%. The significant between-group difference in sleep length was significant ($p =0.04$), whereas differences in sleep efficiency did not reach statistical significance ($p=0.2$). Reported times in bed following night shifts ($p=0.2$) and on days off ($p=0.1$) were comparable between groups. Only in the treatment group did circadian phase regain an appropriate alignment to the sleep-wake schedule, comparable to that in the baseline observation ($F_{(1,15)}=0.002$, $p=0.9$).
Conclusions: The light/darkness intervention resulted in significant adaptive phase shifts in the treatment group. The appropriate alignment of the circadian pacemaker with the shifted sleep-wake schedule resulted in an improvement in daytime sleep quality. These results support the feasibility of promoting circadian adaptation in permanent night shift workers as a practical means of improving sleep duration in night shift workers.

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Working overtime: good or bad?

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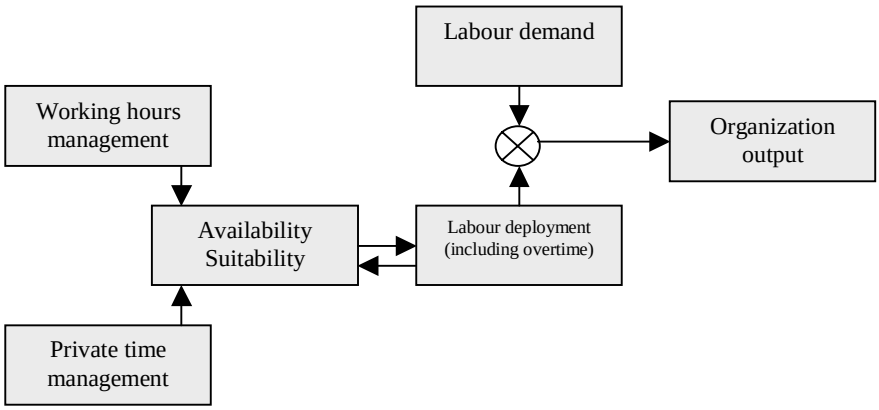
In many places working overtime is a controversial issue. In the Netherlands, for instance, a total ban on working overtime was suggested in trade union circles, a horrifying prospect to many employers.
There are various potential pros and cons to working overtime on a micro, intermediate and macro level. An example: overtime provides flexibility in the conduct of business and is therefore highly commended by employers. For groups of employees working overtime is a means to increase their income.
The application of working overtime differs per country and per organization. In this context it is important to distinguish between formal/paid overtime and informal/unpaid overtime.
This contribution provides an overview or review of overtime studies. The Labour Deployment Model shown below is used to look into the causes and consequences of working overtime. The guidelines for 'good' overtime are sketched in the final section of this contribution.



The contribution includes some empirical findings of recent studies of overtime in the Dutch security business.

Health and psychosocial effects of flexible working hours

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Problem: Innovative working time arrangements are currently regarded as some of the most important elements in the organisation of work. However, until now such 'modern, flexible solutions for the design of working hours' have not been sufficiently examined with regard to their effects on health and psychosocial well-being . There are indications that besides the advantages, which these kinds of working time models may have for both companies and employees, flexible working time arrangements may also have negative effects on health and/or social lives of the employees. A study was therefore conducted to examine whether such negative effects on health and social lives can be found, and whether this is related to specific characteristics of flexible working hours arrangements.

Methods

1. Questionnaire survey on employees working under some 'typical' flexible working time arrangements in different companies and different occupational fields (health care, manufacturing, retail, administration, call centres; n = 660)
2. Internet survey, mixed sample (questionnaire in German, still in progress)

Results Results of the questionnaire study show that the level of variability of working hours and the influence, which employees have on their working hours clearly affect their health and social behaviour. For example sleep problems are much more prevalent under flexible, variable working hours than under regular working hours, and this is especially true for employees without influence on their working hours. The same pattern of impairment has been found with regard to participation in social live: Employees with variable working hours and no influence on the arrangement of their working hours show clearly stronger impairments in family and social life. As a result such effects can also be found in satisfaction with working hours: those employees; who have more self determined, regular working hours are more satisfied and see more positive effects on their social lives and leisure time than those who have company based high flexibility. Since it was not possible to get the co-operation of companies with pure company based flexibility the questionnaire has been prepared for an internet survey. The intention was to find other kinds of flexible working hours, e.g. highly variable, company controlled working hours, which were not represented in the first survey. First results of this survey with a broader range of flexibility of working hours clearly support the results of the paper based survey. High company based variability is again associated with the highest impairments. Results from both surveys will be presented and compared.

Conclusions High variability of working hours, especially if company based, clearly increases impairments in health and well being. Flexible working hours thus have to be considered against such detrimental effects, even if on the other hand there are some positive effects, as can be expected from gaining more autonomy over one's working conditions

The impact of a 'functional energy drink' on performance and subsequent recovery sleep following a night of wakefulness

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Objectives: The popularity of 'Functional Energy Drinks' (FEDs) has increased over the past few years. Generally, FEDs are promoted as ideal for improving the alertness and performance of fatigued individuals. While recent research supports the performance-enhancing effects of FEDs in driving simulators (1), little is known about their potential impact on sleep. Given that FEDs contain several active ingredients, including caffeine, it is possible that FEDs may alter the quality and/or quantity of subsequent sleep periods. The aim of this study was to determine the suitability of the maximum recommended daily dosage (2x250ml cans) of a particular FED for night workers. Ideally, the FED should improve performance during a night of wakefulness, without significantly impacting on subsequent recovery sleep.
Methods: 16 healthy adults participated in a randomized cross-over design with two conditions: (1) No Treatment (NT), and (2) Functional Energy Drink (FED). Each condition involved a baseline night sleep (2300-0700hr), immediately followed by a night of wakefulness and an 8-hour recovery sleep (0730hr-1530hr). Performance was tested 2 hourly using a 10-minute Psychomotor Vigilance Task (PVT). During the FED condition, a commercially available FED was administered at 0130hr and 0530hr. Sleep data was collected during all of the sleep periods using a standard polysomnographic EEG montage.
Results: Preliminary analysis (n=6) indicates that mean reaction times (RT) and lapses (RT>500ms) both significantly ($p<.05$) increased with increased wakefulness in the NT condition. General trends indicate that the FEDs were able to suppress the degree of performance impairment (i.e. for the final 2 tests). No significant differences in the subsequent 8-hour "recovery" sleep period in the two conditions were noted (Table 1).

Table 1 – Comparison of Means (SD) for Recovery Sleep Variables for NT and FED conditions

Condition	Total Sleep Time (mins)	Sleep onset latency (mins)	Slow Wave Sleep (mins)
NT	443.2 (15.6)	2.7 (2.3)	98.9 (44.4)
FED	441.8 (34.7)	4.3 (4.4)	99.3 (56.6)

Conclusions: Preliminary analysis of this data indicates that if the 2 can/day maximum for this particular FED is adhered to, then impairments to performance during a period of acute sleep deprivation can be reduced. In turn, the residual effects of the active ingredients contained in the FED do not significantly impact on the quality and quantity of subsequent recovery sleep.

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Does the application of different numbers of teams in the organization of shift work constitute a way for prevention activities?

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Prevention activities towards the adverse social and health effects from shift work can take place at different levels and with different measures. They can involve secondary prevention dealing with shift workers coping strategies, sleep conditions etc or primary prevention activities aiming at changing the nature of exposure through for example the design of shift work, reduced working hours, or distribution of work tasks. Altering work organization through the use of an increased number of teams seems to hold such opportunities via a reduced number of evening, night and weekend shifts for the single shift worker. This study exams in what way and on what conditions an increased number of teams improve the conditions of the shift workers.
The material for this study derives from a European cross national study about employee influence in the organization of shift work. It was accomplished within a multinational company (Hydro) which implied that the participating companies belonged to the same division and thus shared a common culture but acted independently. The plants were all producing fertilizers, about the same size, similar technology and product organisation. Companies in Italy, Germany, the Netherlands, Sweden and Norway participated. Information consisted of data based on documentary material and questionnaires. All the companies used continuous shift work but with a different number of teams. Only operators with continuous shift work participated which gives an estimated reply rate of 40-59% across the companies corresponding to the general rate for shift workers. The distribution of participants according to number of used teams was 36 working a four team, 144 a five team, and 80 a six team system.
The analyses demonstrated that with more teams in the system the employees had proportionally more irregular working time schedules consisting of more extra hours and changes in schedules. Regardless of national variations and local participatory practices all three groups wanted the employees as a group to have most influence on the design of schedules. Shift workers in systems with four teams experienced having the least influence, but they were also the most satisfied with their working hours. Regarding the interplay between work and social time shift workers with four and five teams stated a slightly greater need for taking special initiatives to ensure the quality of social activities. Fewer employees in systems with six teams wanted to change to day work. No differences were found between the groups concerning sleep and well-being.
The apparent mixture of results indicate that a shift work system composed of six teams have the potential of enlarging the social conditions for shift workers compared to those with four or five teams, but the actualisation of this depends on the organizational structure and to what degree the six team system is used as part of an increased company favoured flexibility.

The importance of participation and control processes in considering effects of shift work changes

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Changing the design of a shift system is often the intervention of choice used to alleviate problems for shift workers and to address the economic and organizational requirements of employers. A range of information on factors to consider when designing shift rotas is available with notification of circadian influences, methods to evaluate shift patterns and ergonomic principles in the design of shift rotas, based on the extant research evidence (Knauth, 1993). Employee participation in the process of designing and implementing shift rotas is mentioned to varying degrees. However, participation is an expression of control at many levels and given the importance of control in helping to minimize the consequences of shift work conditions (Smith & Barton, 1994), it might be expected that participative processes, also highlighted by Kogi (1998) would be evident in the research literature.
The aim of this review was to examine how reported effects attributed to changes in shift rota features considered the participative processes involved. Over 30 papers citing changes to shift rotas were reviewed subject to a number of criteria in relation to explicit evidence given for the level of participation of the workforce and the nature of the participative process involved. Despite the majority reporting positive consequences of shift rota change, a majority also failed to report on the level or nature of participation of the workforces involved. For example, only 39% of studies implied the provision of information to shiftworkers but details were not reported. An even lower proportion (18%) reported that the involved shiftworkers could decide (usually through voting) whether or not a rota should be implemented. In addition, only 6% of papers reviewed offered more substantive information regarding introducing, implementing and evaluating the process of change engaged in. Human control at different levels of analysis is fundamental to tolerance of stressful working conditions. Intervention studies in designing shiftwork schedules have indicated the significance of involving the employees and distributing control at individual and group level as part of the intervention process (Jeppessen & Bøggild 2000). This paper expands on these issues and suggests that reported rota-change effects need to clarify the vital contribution of the subtle participative dynamic embodied in the change process.

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Do shifts make workers unhappy? The quality of life, life satisfaction and happiness of shift- and non-shiftworkers

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The disruptive effects of shiftwork on social and domestic life of workers are well documented. Still there are specific domains in which shiftworkers may be particularly affected by their work hours. The aim of this study was to investigate differences in several aspects of quality of life, life satisfaction and happiness between shift- and non-shiftworkers.
Subjects were professionals in social care settings (e.g., nursing homes, retirement homes) from 75 cities around Croatia. Three groups were examined: shiftworkers working in schedules with the night shift (N=311), day-shiftworkers (N=207) and non-shiftworkers (N=1210). The survey consisted of several questionnaires measuring different aspects of workers life and subjective well-being. The Quality of Life Profile measures the *importance*, *satisfaction*, *control* and *opportunities* in the nine domains of life: physical, psychological and spiritual being, physical, social and community belonging, practical, leisure and growth becoming. Subjects also reported their overall happiness, percentage of being generally happy, unhappy and in neutral mood, and global life satisfaction. Demands of work were assessed in terms of subjects' reports of effort required by the work and tiredness resulting from their work.
While both groups of shiftworkers, compared to non-shiftworkers, needed more physical effort to complete their work and reported being more physically tired, no differences were found in reports of overall happiness, life satisfaction and total quality of life score. Though, night-shiftworkers reported greater percentage of time unhappy than other two groups of workers. In analyses of nine specific domains of life, importance and feeling in control were the same across the groups. However, night-shiftworkers were less satisfied with domains of spiritual being (e.g., personal values, beliefs), physical (e.g., connections with one's home, community) and community belonging (e.g., connections with services, events) than day-shiftworkers and non-shiftworkers. They also reported having fewer opportunities to improve their physical being (e.g. health, exercise), leisure (e.g. fun activities) and personal growth (e.g. knowledge, skills) than the other two groups. Even though quality of life scores for specific domains (i.e., combination of importance and satisfaction scores) are in range of acceptable to adequate, the domain of spiritual being was rated worse for night-shiftworkers than other groups of workers.
In general, results suggest that shifts, particularly night shifts, play a role in workers' quality of life assessments and that specific domains are more affected than others. This suggests intervention may be best targeted on specific domains.

Developing working times in the retail trade in Finland

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The service hours in retail trade have been greatly extended during the past decade. The working hours have become more irregular: e.g. weekend work, also Sunday work, and late evening work are very common, and employees are required to be more flexible to comply with the needs of their companies. The aim of the study was to develop and evaluate new, innovative working time arrangements comprising also individual flexibility. Joint seminars were arranged to allow employers and employees to engage together in participatory planning to develop innovative working time arrangements for the work unit. These arrangements were tested in two companies over a period of six months. The use of a working time bank, based on voluntary choice, was tested in both companies, and regular meetings held to plan shift schedules in one company.

During the intervention, information on the implementation practices was gathered with a questionnaire in three phases: initial, intermediate and final. The questionnaire focused on the needs to develop working hours, on psychosocial characteristics of the work and work organization, on well-being at work, and on the integration of work and leisure time. Response rates varied between 63% and 72%. The data were analyzed by using logistic regression analysis with repeated measures (n=88). In addition, employees, representatives of the employers as well as representatives of labour market organizations were interviewed.

The use of a working time bank made more autonomous responsibility of work tasks possible concurrently with a decreased amount of overtime work without compensation ($p<0.001$). The accumulated hours were often taken off as longer continuous free time, perceived to be motivating. Also the level of mental stress was significantly lower at the end of the intervention among those using the working time bank ($p<0.001$). Altogether 89% of them were willing to continue with the system, and 42% of those who had not yet used it, were willing to start using the bank. Almost all (95%) who had participated in the regular meetings for shift scheduling wanted to keep up the practice.

An essential requirement in the implementation of the working time bank was to define exactly its rules. For example, the maximum number of bank hours should be limited to prevent overload. It is important to acknowledge that the compensation of overtime work is different when requested by the employer (+50% by labour contract in Finland) as compared to a situation when suggested by the employee (hour per hour). Information about the practices of the bank should be disseminated effectively in the beginning of the process and should also be available continuously, preferably in regular meetings for work shift planning.

Evaluation of an age adjusted new shift model

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Objective: The percentage of persons quiting shift work before retirement is high in many industries, and often due to health reasons. This is not only bad for these persons. With aging population this becomes more and more difficult for the companies involved as well as for the society as a whole. In a project in a large chemical company we introduced a number of measures to improve the health situation in the short and long term perspective in the perspective of developing age-adjusted shift-systems in two plants. As it is a large company that used a similar roster in many other plants of the company and a homogeneous company with respect to workforce, it was possible to analyze the effects in detail. **Method:** Before the programme started, the shift schedule was a 4-crew shift schedule with 38.0 hours per week and a rotation of MMAANN— with several standby shifts per year. In order to reach the agreed weekly working hours (i.e., 38.0 hours), one person out of seven had to be on standby. Every worker was scheduled for such shifts. The new shift system uses a 5-groups schedule with basic weekly working hours: 34.4 h/week in a main rhythm where 5 work days alternate with 3 days off. Two out of five weekends are free. One day each month is reserved for training. The costs for additional personal were to some degree covered by slower increase of salaries in the future. Furthermore a number of additional measures aim on improving health (extra wellness days). The development of the new shift system took place in a participatory design process with strong involvement of employees in working groups, discussions and surveys.

The changes in both plants were compared to a matched control group (same company, same area, same shift schedule, similar age, work, years of shift work, and health stats). No significant differences were found at t0. The evaluation was performed after 6 and 12 months. The methods applied were: Human Work Index (Work Ability Index/Work Interest Scale), Shift Work Index, Work-Life-Survey, workplace evaluation (culture, organisation), OSQ, Health stats including standard health examination by occupation physicians.

Results: Improvements could be found in many areas, e.g.

- improved sleep and regeneration (especially between shifts)
- improved life quality and meaningfulness in private life with optimism
- improved Human Work Index/Work ability index for 2,5 points
- improved commitment to working life and increased interest in work Human Work Index/ Work interest scale) and satisfaction with working times improved from 3,1 to 1,5 (on a scale with 1 = best, 5 =worst)

Conclusion: The effects of the changes were strong and already remained for 12 month after the change. The combination of substantial improvement in working time and the schedule (including less night work), the participatory design approach, and the measures supporting a different way of dealing with health issues combined were a feasible approach to age-adjusted shift work.

Mortality of Swedish shift and day workers in pulp and paper industry between 1952-1998

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Objectives: To investigate whether shift work has an effect on total mortality among workers with different shift exposure time.
Methods: A male population of blue collar workers in two paper and pulp manufacturing plants who had been employed at least six month between January 1, 1910 until December 31, 1998 was monitored. Two thousand three hundred and ninety-one shift workers, and 3,160 day workers were enrolled in the study.
Information about job titles was obtained from company files and groups of exposed individuals have been categorised on years of shift work. Different shift schedules are described since the beginning of 1940's until 1990's.
The mortality of the cohort was monitored from January 1, 1952 until December 31, 1998, according to five consecutively ICD-classifications.
The data is directly age-adjusted and carried out by the Mantel Haenszel method.
Results:

SRR for total mortality among day and shift workers

Years of shiftwork	No of exp. cases	Rates*	CI**
Shift< 5 years	35	1.79	0.57-5.63
Shift>=5 -<10	36	0.97	0.68-1.38
Shift>=10 - <20	86	0.89	0.70-1.11
Shift>=20 - <30	145	1.05	0.88-1.25
Shift>=30	363	1.02	0.91-1.15
All shift vs day	665	1.03	0.93-1.14

` * All rates are age adjusted
** Confidence intervals

Conclusions:
In this study there is no significant effect on longevity for shift workers compared to day workers. These results are coherent with the findings in two earlier studies (1) and (2).

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Professional burnout within violating work rhythms

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The aim of the larger study is to construct an adequate theoretical approach to violating work rhythms within post-industrial working life. Violating rhythms are approached empirically by analysing age and gender in the context of professional burn out and well being at work, where as "work time" is a generational concept understood in a context of lifespan. Not only are work communities and working life domains of common values, but also places of hidden injuries (1) and violations (2). The discursive practices of workplaces, such as, the ethos of 'toiling', gendered values or emotional attitude towards aging are always potentially violating.
In Finland, there has been a large research and action programme during 2001-2003 called "Well-Being at Work" initiated by Ministry of Employment in 2001. It has largely collected material on professional burnout and means to prevent it, for example several case studies in organisations, individual experiences and local government initiatives. The aim of this paper is to reveal the main results of the program in relation to work time, special focus on 'violating' features of work rhythms and its consequences to professional bun out pertaining age and gender.
There is all reason to ask in what ways burnout relates to gender. Well being at work and work rhythms are gender related issues especially among young workers. While men have recovered well from the economic depression in the early 1990s in Finland there has been no or very little improvement of women's job related exhaustion since 1993 (3). As a result of analysis of how aspects of well being and job exhaustion are age, gender and work rhythms related in organisational, individual and societal level, there has been found different power imbalances among men and women. Especially young women and old women are those who are most likely to experience violation and emotional injury at work. They are most likely to be unemployed or work under unsteady work rhythms. On the other hand, persons experiencing an injury may become personally reserved and begin to secure the competence of their own lives. On the other hand, an experience of injury may lead to emotional estrangement, isolation form working life, fatigue, and burn out. In conclusion, there is reason to look at how gender operates at the concrete, organisational level. There are also some preventive methods introduced in "Well-Being at Work" –program that are critically analysed here. This study is funded by The Finnish Work Environment Fund.

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Influence over working hours, overtime and breaks: relation to health

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Introduction: The effects of non-shift (daytime) working hours on self-rated health are not well known. The aim of this study was to investigate the relation between five variables related to working hours and self-rated health among white-collar workers. **Method:** The working hour variables were (1) possibility to influence working hours, (2) frequently occurring long working week (>50h), (3) frequently occurring long working day (>12 hours), (4) frequently occurring working at home and (5) insufficient breaks. The sample included 540 full-time workers (63% females, mean age=47 years, SD=10) belonging to two unions. A questionnaire was distributed and the response rate was 82%. Three health instruments were used in the present analysis; insomnia, pain/musculoskeletal complaints, and burnout (developed by Melamed, cut-off score=5). Finally, a question related to insufficient recovery between working days was also used. A multiple logistic regression with working hour variables as predictors was used. In the first step the analysis was adjusted for age, gender, position, psychosocial work stress (demand-control model) and workload during free time. In the next step "unable to stop thinking about work during free time" was added as a predictor.**Results**: Table 1 shows the odds ratios (95%CI) for each working hours variable (tested one by one). Poor influence over working hours predicted all of the health problems. Insufficient breaks showed an association with insufficient recovery between working days. Long (>12h) working day predicted insomnia and insufficient recovery whereas long working week (>50h) showed no association with health and recovery. Frequent working at home showed an association with burnout and insufficient recovery. When "thinking about work" entered the regression only "poor influence over working hours" remained significant (burnout: OR=4.1, 95%CI=1.9-8.8; insufficient recovery: OR=2.5, 95% CI=1.3-4.8). When all working hours variables were tested in the same analysis "poor influence of working hours" was significant for burnout and insufficient recovery (after adjustment for confounders). However, the strongest predictor of poor health was "unable to stop thinking about work during free time".

Table 1. Odds ratios (and 95% CI) after adjustment (see below)

	Insomnia	Pain	Burnout	Insufficient recovery
Poor influence (work hours)	2.3 (1.1-4.7)*	2.0 (1.0-3.9)*	4.4 (2.2-9.0)*	2.7 [1.5-5.0)*
Working week, >50h	2.2 (0.9-5.3)	2.0 (0.9-4.8)	1.0 (0.3-3.2)	2.1 (0.9-4.3)
Working day, >12h	3.5 (1.4-8.9)*	1.8 (0.7-4.8)	1.4 (0.4-4.5)	3.1 (1.4-7.1)*
Frequent working at home	1.2 (0.6-2.4)	0.8 (0.5-1.5)	2.3 (1.1-4.9)*	1.8 (1.1-3.0)*
Insufficient breaks	1.9 (0.9-3.8)	0.9 (0.5-1.7)	1.9 (0.9-4.0)	1.8 (1.0-3.1)*

Adjustment for age, gender, position, demand, control and workload (free time), * significant p-value (<0.05)

Conclusion: Influence over working hours showed a clear association with the health complaints and insufficient recovery between working days even when psychosocial work stress and workload during free time was controlled for. Indicators of overtime work, such as long working week and long working day, showed rather moderate associations with poor health, which disappeared after control for "thinking about work during free time".

Truck driving, working hours and fatigue related accidents

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Fatigue is regarded as one of the most important contributing factors for transportation accidents, in particular for truck driving. It is, however, difficult to estimate the proportion of truck accidents that is related to fatigue. According to official statistics only a few percent of the accidents are fatigue related, but these figures are not reliable since causal factors, like fatigue or stress, are usually not recorded. National Transportation and Safety Board (NTSB) in the USA has made in-depth studies of fatal truck driver accidents and comes to the conclusion that up to 30% of the accidents are fatigue related. NTSB has also shown that fatigue occurs in more than 50% of the single vehicle accidents for truck drivers.

Several studies show that driver fatigue is prevalent among truck drivers. During night driving physiological signs of sleepiness, such as micro sleep and dozing-off episodes, has been recorded. Many simulator studies have been able to demonstrate the negative impact of fatigue on driver performance and in particular lane drifting increases when the driver is impaired of fatigue.

The major determinant to severe driver fatigue is probably the highly irregular working hours, which involves 24h operation. Recent data from our group suggest that the risk for severe (fatal and severe injury) single vehicle accidents for truck drivers is 3 times higher during late night hours than during daytime when we control for differences in traffic intensity. Work hour regulations usually permit both long work shifts and extended working hours per week. Thus, it is not uncommon for truck drivers' to work (both driving and loading) for up to 80 hours (or more) per week. In some studies, long work shifts, together with night driving and sleep loss, has shown a strong association with driver fatigue. However, it has been difficult to quantify the accident risk in relation to length of work shift (or driving time). In most studies the effects of length of work shift is mixed with other fatigue determinants such as time of day, length of time awake and prior lack of sleep. A recent study has shown that also short-haul drivers can suffer from severe fatigue. An American study estimated that 20% of driver incidents (near-accidents) were fatigue related for short-haul drivers. The fatigue incidents were mainly related to sleep loss and poor sleep quality. Interestingly, a small group of drivers was involved in a majority of the fatigue incidents. The latter suggests that certain individuals are more sensitive to driver fatigue. Another contributing factor is sleep loss. Several studies have shown that truck drivers suffer from chronic sleep loss and seldom get more than 4 or 5 hours of sleep, which can cause accumulated fatigue. Insufficient rest periods between work shifts and sleeping in the truck are probably the major cause for the severe sleep loss.

The major strategies to reduce fatigue accidents is improvement of work hour regulation (incorporate scientific principles of sleep/wake regulation), implement work-rest scheduling principles that minimize driver fatigue, improve awareness of fatigue as a safety critical factor, and to introduce devices that monitor driver fatigue and gives feedback of driver impairment.

Work schedules vs. workers' strategies: do changes generate the same effects?

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Several studies have shown improvements in some problems of shiftworkers (e.g. sleep deficits, fatigue, accidents) after a change from traditional to **new shift systems corresponding to ergonomic recommendations**. However, the effects of work schedules appear to be interrelated with the effects of other factors relating both to work and to the private sphere of the worker. For this reason, it makes sense to analyse the problems of each group of shift workers and combine some of the preventive and compensatory measures listed in Figure 1.

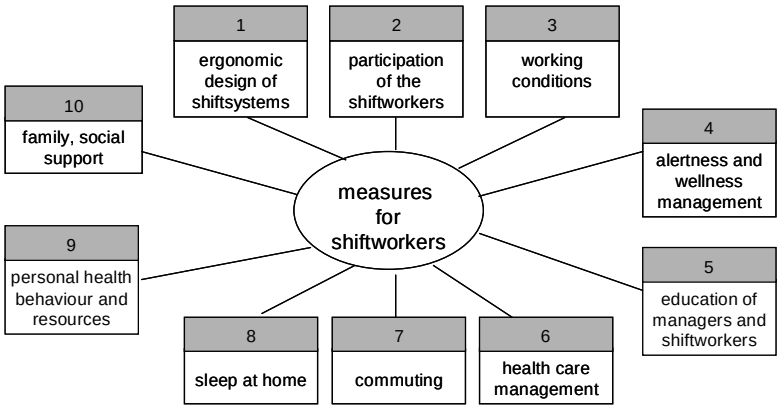

Fig.1 Preventive and compensatory measures for shiftworkers

1. As the working time preferences and needs of shift workers may vary considerably, **their participation** in the design or selection of shift systems has had a very positive effect on their satisfaction with the shift system ultimately adopted.
2. A combination of high **workloads** or inadequate **staffing levels** with shift work may enhance the negative effects of shift work on health, alertness, and performance.
3. A variety of measures, such as **on-duty naps**, **exercises, adequate lighting, and breaks** may help to enhance alertness during night shifts.
4. As the psychological and physical health of shift workers may be influenced by supervisor support, some authors have recommended educating managers (**shift work awareness program**).
5. **Regular medical surveillance** of shift workers helps to identify health problems at an early stage.
6. Various **measures** have found useful to reduce tiredness in shift workers **driving home** after a night shift.
7. Improving the sleeping **environment** and following a '**sleep hygiene chart'** may alleviate sleeping problems after night shifts.
8. **Healthy food**, improved **physical fitness** and active coping strategies **reduce problems with sleeping, appetite and stress.**

The question in the title of this paper cannot be answered with a clear 'yes' or 'no' because many factors are interrelated. Therefore, an adequate combination of countermeasures will have the greatest effect.

Exploring the influence of engagement, disengagement and active coping strategies on shiftworker psychological and physiological wellbeing.

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The aim of this study was to utilise an exploratory analysis (stepwise and standard multivariate regressions) to assess the impact of 18 specific individual coping strategies (4 disengagement, 4 engagement, and 10 active coping) on shiftworker psychological (psychological distress, cognitive and somatic anxiety) and physiological (chronic fatigue, digestive and cardiovascular symptoms) wellbeing and levels of sleep disturbance. The 4 disengagement and 4 engagement coping styles were taken from the Coping Strategies Inventory (CSI) included in the Standard Shiftwork Index (SSI). Each of the disengagement and engagement coping styles were based on the summation of 4 5-point Likert scale questions. The 10 active coping strategies were taken from the Active Coping Questionnaire (ACQ) created by the primary author. The ACQ assessed 10 specific coping styles (eg avoiding tea/coffee before sleeping, using napping strategies, using sleep hygiene strategies, exercising, etc) each using a single 5-point Likert scale. The 10 active coping strategies used in the ACQ were based on recommendations published within the shiftwork literature. One hundred and thirty-five subjects from two Police Local Area Commands completed a modified version of the SSI that included the ACQ. Two disengagement and one active coping strategy were found to have the greatest impact on subjective symptoms. The two extracted disengagement based coping styles were 'I criticise myself for what's happening' and 'I spend more time alone', while the extracted active coping strategy was 'How well do you think you successfully adapt to shiftwork?'. The two disengagement coping strategies were found to have an adverse relationship with various psychological and physiological symptoms, including digestive problems and cognitive anxiety. In contrast, the extracted active coping strategy was found to have a beneficial relationship with individual psychological and physiological symptoms, including chronic fatigue and somatic anxiety. This exploratory study provides evidence that shiftworkers utilise a constellation of different coping strategies, and that each of these coping strategies may mediate specific aspects of psychological and/or physiological wellbeing.

Keywords: police, shiftwork, coping strategies, standard shiftwork index, psychological and physiological wellbeing.

Review of the standard shiftwork index and its theoretical implications

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The aim of this paper is to review critically the shiftwork research using the Standard Shiftwork Index (SSI) and discusses its relevance to the proposed SSI theoretical model by Barton, Spelten, Totterdell, Smith, Folkard, & Costa (1995). To date, the SSI is one of the most comprehensive questionnaire-based research tools used to assess psychological and physiological impact of shiftwork, and the various mediating factors (eg personality and coping strategies). The SSI is based on a theoretical model developed by Barton, Spelten, Totterdell, Smith, Folkard, & Costa (1995) and proposes health is influenced by several factors including the shift system, individual and situational differences, biological rhythms, and coping strategies. Several studies using the SSI have provided support for the theoretical model including the impact of the shift system on individual wellbeing (Aguirre, Heitmann, Imrie, Sirois, & Moore-Ede, 2000; Barton & Folkard, 1993; Barton, Smith, Totterdell, Spelten & Folkard, 1993; Tucker, Smith, Macdonald, & Folkard, 1999); the impact of individual differences such as age on individual wellbeing (Costa, Schallenberg, Ferracin, & Gaffuri, 1995; Ognianova & Dalbokova, 1998; Prescott, 1995; Smith, Robie, Folkard, Barton, Macdonald, Smith, Spelten, Totterdell, & Costa, 2000); the impact of shiftwork on social and domestic roles (Lushington, Lushington, & Dawson, 1997; Totterdell, Spelten, Barton, Smith, & Folkard, 1995); and finally, the impact of various coping strategies on individual wellbeing (Barton, Spelten, Totterdell, Smith, Folkard, & Costa, 1995; Smith, Robie, Folkard, Barton, Macdonald, Smith, Spelten, Totterdell, & Costa, 1999; Spelten, Smith, Totterdell, Barton, Folkard, & Bohle,1993). This review also discusses the methodological aspects of the SSI, specifically with regard to its advantages (eg holistic approach, etc) and disadvantages (eg time to complete, etc) in the applied research field of shiftwork. This review concludes that to date, the SSI provides the researcher with a methodologically valid and holistic research tool to investigate the impact (and mediating factors) of shiftwork on individual psychological and physiological wellbeing.

Keywords: review, shiftwork, standard shiftwork index, psychological and physiological wellbeing.

Assessment of the nutritional habits and perceptions of shiftworking Police Officers

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The aim of this study was to assess the nutritional status of police officers in comparison to the recommendations by the Australian Department of Health & Ageing (ADHA, 1998). Sixty-seven subjects completed the Nutritional Status Questionnaire (NSQ) that investigates dietary habits (average number of healthy meals, average servings of vegetables, average servings of dairy products, average servings of meat products; average servings of fruits, and average servings of cereals and/or grains) and perceptions (perceived nutritional status, perceived nutritional status in comparison to workmates and immediate family). Supporting the hypothesis was the finding that subjects reported lower than the recommended average daily intake of five servings of vegetables; two servings of dairy products; two servings of fruit; and four servings of cereal or grains. Not supporting the hypothesis was the finding that subjects tended to report eating more than recommended one serving of meat products per day. Pearson's correlation coefficients provided evidence of a significant positive relationship between dietary perceptions (nutritional status in comparison to workmates and immediate family) and average number of meals consumed each day, and average diet scores. Other findings from this study were that 44% of subjects reported not consuming any tea; 27.8% of subjects reported not consuming any coffee; 91% subjects reported not consuming any hot chocolate; 42% of subjects reported not consuming any alcohol on after work; 41.8% subjects in reported not consuming any alcohol on days away from work. Sixty-nine percent of subjects in this study did not smoke. The findings from this study provide evidence towards the possible adverse impact of shiftwork on an individual's dietary habits and perceptions.

Keywords: diet, nutrition, nutritional habits, nutritional perceptions, police, shiftwork,

Methodological aspects of shiftwork research

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Shift work research is interdisciplinary in nature, combining basic biological understanding of the mechanisms by which the circadian rhythms are generated and propagated in the body with studies of pathological, psychological, and sociological consequences for shift workers. A major issue has been to understand the possible ways in which shift work can impact on performance and health. One problem to be considered in assessing the research is how the exposure factor "shift work" is defined. Obviously, the term shift work has been used in different ways in the scientific literature. A narrow definition of shift work is a work schedule in which a worker replaces another on the same job within a 24 hour period. However, usually shift work covers a wide variety of working time arrangements, including all work hours that are outside normal day-time work. Due to this fact, it is often difficult to compare results from different studies. Another issue has been to identify the deleterious component of shift work.Shift work research is closely related to chronobiology, which is a branch of science that studies biological rhythms. Nearly all body functions, from the cellular level to those of the entire body, have certain predictable rhythms. In chronobiology, the experimental animal study has been the dominating research design. In studies of shiftworkers, experimental and quasi-experimental studies have also been used, especially for studying short-term effects. For studies of long-term health effects epidemiological designs, for example cohort studies and case-control studies, have been used. Many studies on health effects in relation to shift work have used cross-sectional designs. Cross-sectional studies, however, are not feasible when studying causal relationships.The healthy worker effect is a common problem in studies on populations of shift workers. The selection of healthy workers commences already when the shift workers are employed. In the pre-employment health examination, workers are asked for history of gastrointestinal disorders, sleep problems, cardiovascular disease, and other diseases, and only people with a healthy record are selected for shift work. Thereafter, a continuous selection process takes place, because shift workers with health problems will be transferred to day work. This selection tends to lead to an underestimation of the potential association between the exposure factor shift work and health outcome, especially in cross-sectional studies. Fatigue and sleep are important outcome variables in shift work research. Fatigue is not only a matter of well-being, it is also linked to deterioration of performance and an increased risk of accidents among shift workers. A great number of test batteries have been constructed and evaluated for studying performance. Electroencephalography is the gold standard for measuring sleep. Fatigue, however, is difficult to measure, and no gold standard exists. We must trust on self-assessments, with limited possibility to external validation. The concept of fatigue is also weak and undefined. What do we mean with fatigue and what is the difference between fatigue and sleepiness? The variables we measure, either physiological or self-assessed, mirror dynamic processes, which often are difficult to capture in field studies of shift workers. Different rhythms are superimposed on each other. For example cortisol has a pulsatile secretion, which is superimposed on the circadian pattern of secretion. In field studies of shiftworkers it is difficult to manage this big variability.

Linking better shiftwork arrangements with safety and health management systems

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Aim: Recent experiences in promoting joint change approaches toward improving both shiftworking arrangements and safety and health management systems are reviewed. These approaches are gaining importance as occupational safety and health management systems for enterprise-level risk management are spreading. Necessary support measures for the participatory change processes are discussed based on our experiences.
Materials: Experiences in providing support for management-worker consultations and for participatory workplace improvement projects are summarized. Such support was given in two ways, by assisting the consultation processes through providing factual data and advice based on field studies and by supporting the participatory improvements in both working time and workplace conditions. Examples included management- worker consultations in process industries and hospitals as well as risk assessment and reduction in plant maintenance and transport. The results of questionnaire surveys, field intervention studies, checklist applications and near accident studies were examined to know the types of support that were effective in assisting the joint change processes.
Results and discussion: The reported experiences demonstrated the importance of attempts to change both working time arrangements and other workplace conditions together. On the one hand, changes toward more flexible shiftwork systems were often associated with the need for re-organizing workload or certain environmental conditions. On the other hand, risk assessment including the analysis of near-accidental incidents was facilitated by taking into account the effects of changes in working time arrangements. These experiences thus pointed to the need for participatory steps and appropriate group work tools for assessing existing risks and finding practicable solutions in multiple areas. The growing awareness about participatory risk management obviously helped promote these joint change activities. Working conditions assessment tools, such as action checklists, questionnaires and incident report forms, were found important in promoting effective participatory steps. It was particularly useful to present multifaceted action guidelines in the form of illustrated checkpoints combined with action checklists. Presentation of practicable options in these multiple areas seemed to facilitate group action of managers and workers covering both working time and other workplace conditions.
Conclusions: These experiences confirm the need to address multiple job-related aspects of night and shift work. The joint change approaches studied could be fruitful when both shiftworking arrangements and other workplace conditions were taken into account in the same job assessment processes. Group work tools such as multifaceted checkpoints and action checklists should be developed to facilitate participatory joint change processes. The increasing trends toward comprehensive safety and health management systems seem to offer valuable opportunities to improve working time and job content together at shop-floor level.

Working hours in the nursing and care sector

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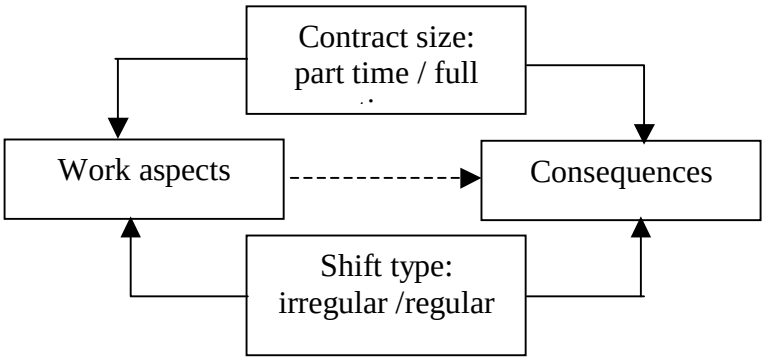
The employers' and employees' organizations in the Netherlands ordered a large-scale study of labour perception in the Dutch nursing and care sector, with the objective to gain some insight into the status of policy themes mentioned in the collective labour agreement, the experienced quality of the work situation and the employees' labour perception.
1,462 nursing and rest homes took part in the study. Of the 198,399 questionnaires sent 86,158 were returned (43.4%). The respondents are sufficiently representative so as to render a reliable picture for all nursing and rest homes in the Netherlands.
The study provides information on many work aspects and also offers some insight into the possible consequences, such as work satisfaction, satisfaction with the organization and health.
Two subjects from the study are focused on in the presentation: contract size and shift type. Contract size (part time or full time contract) and shift type (irregular or regular shift) appear to have a major impact on the perception of various work aspects and the consequences. Full time workers, for instance, are more positive about independence and less positive about the work pressure than employees with a small part time contract. Employees in regular shifts are more positive about the physical burden and independence than employees who work in irregular shifts.



Shiftworking families: parents' working time and sleep patterns of adolescents attending school in two shifts

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In Croatia both elementary and high school students attend classes in two shifts. They generally go to school one week from 08:00 to 13:00 and the next from 14:00 to 19:00. Therefore, if the parents are working shifts too, all members of the family are "shiftworkers".
In this study we compared the sleep characteristics of three groups of adolescents that attended school in two-shift system: first group with both parents working only day shifts, second group with one parent on day shift and the other one working evening, night or rotating shifts and third group with both parents working evening, night or rotating shifts. Our hypothesis was that the adolescents whose parents were working shifts would have more irregular sleep patterns and would consequently be more sleep deprived than the adolescents whose both parents were day workers.
During October and November 2001 and 2002 a total of 2365 students from 24 elementary and high schools in Zagreb completed the Croatian version of School Sleep Habits Survey (1). In this study the results of 1141 students ($n_{elementary}$ = 656, n_{high} = 485) of both genders, who lived with both parents and whose both parents were employed full-time, were analyzed. The average age of elementary school students was 12.2 years (S.D.=1.2) and of high school students 16 years (S.D.=1.2).
Elementary and high school adolescents, whose both parents work shifts, go to bed significantly later on the morning shift week than the adolescents whose both parents work only day shifts or only one parent works unusual hours. For the other sleep variables the parents' working time had more impact on sleep patterns of high school students than of elementary school students. High school students, whose both parents work shifts, wake up earlier in the morning shift week than the other two groups. Since they also go to bed later their total sleep time on morning shift is the shortest of all three groups. On weekends high school adolescents whose both parents work shifts go to bed later. They also show greater irregularity in their sleep patterns than adolescents whose both parents work dayshift or only one of them works unusual hours. The differences between their bedtime on weekends and both school weeks are greater than in other groups.
The parental control over the adolescents' bedtime is weakest on weekends and strongest on the morning shift week. However, that control is generally rare. Thus on the morning shift week only 11.2% of elementary school and 3.6% high school adolescents report their bedtime has been set by the parents.
Biological factors aside, as adolescents get older their sleep habits are shaped by various psychosocial influences. The results of this study imply irregular sleep and wake time of parents to be a behavioral model related to adolescents sleep patterns.

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The effect of a one-hour nap and bright light on university students' performances of a multiple-reaction task, an occupational suitability test, and an addition test after night shift work

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Introduction

The effect of a nap and bright light has been reported in order to improve human performances in night shift work in the literature. In recent years, the number of part-time night shift workers, particularly university students, has increased in Japan. Part-time night shift workers are faced with challenges greater than those faced by professional night shift workers. One of the reasons is that part time night shift workers, particularly university students, cannot sleep after night shift work because they must attend class during the day. The purpose of this study was to investigate whether taking a one-hour nap (11:00-12:00) and having been exposed to bright light (BL;12:00-15:00) after night shift work would impact on human performances such as a multiple-reaction task, an occupational suitability test, and an addition test.

Method

Subjects: Six healthy male university students working in night shifts (22:00^ÿ6:00) at a convenient store two or three times a week for more than one year participated in this experiment. The types of the circadian rhythm of the six subjects were classified through the Japanese Morningness-Eveningness test and were 1 subject (moderately morning), 3 subjects (neither), and 2 subjects (moderately evening).

Performance measure: Human performances were measured and evaluated by the reaction time in a multiple-reaction task, the number of correct answers in an occupational suitability test, and the number of correct answers in an addition test.

Experimental conditions and procedures: Four days were required to complete the experiments, as the experiments were applied under four different conditions (no-nap & no-BL, nap & no-BL, no-nap & BL, and nap & BL). The four conditions were carried out at random. An adjusting period was allowed between each of the conditions. The performance was evaluated every hour along the period ranging from 10:00 to 15:00.

Results

The average reaction time for the multiple-reaction task was the lowest under the "no-nap & BL" condition. There was a significant reduction at 13:15 and 14:15. The average number of correct answers for the occupational suitability test under "nap & BL" condition showed the highest increase. The number of correct answers increased at 12:30 under both "nap & no-BL" and "nap & BL" conditions, and at 13:30 and 14:30 under the "no-nap & BL" and "nap & BL" conditions. The number of correct answers for the addition test did not show any noticeable change.

Assessing performance in the field: alternatives to the 10-minute PVT

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In laboratory studies assessing the functional consequences of fatigue, the 10-minute Psychomotor Vigilance Task (PVT) is a widely accepted measure of neurobehavioural performance. Moreover, the simplicity, size and short learning curve of the PVT make it an extremely popular tool. In field studies however, it may be impractical for participants to perform a test of this length. The aim of this series of studies was to identify a performance measure that is sensitive to the effects of fatigue, portable and easy to use, but not overly disruptive in terms of task length. Specifically, performance on a 10-min PVT was used as a standard with which to compare the effects of fatigue on several shorter tests, including a 90-second PVT, a 5-minute PVT (Study 1), and a 5-min Palm-PVT (Study 2). If the level of agreement between the shorter tests and the 10-minute PVT is sufficiently high, this will confirm that they may be used as alternative performance measures in field studies. In each study, 16 healthy participants aged between 18 and 30 years arrived at the laboratory at 1800hr for a short training session. Following a night of sleep (2300-0800hr), participants remained awake for 28 hours. During every second hour of wakefulness, participants completed the performance tests (each study included the 10-min PVT), presented in random order. Fatigue-related impairment was observed for all three PVT lengths (10-min, 5-min and 90-sec). Specifically, mean reaction times (see Figure 1) and percentage of lapses significantly increased with increasing hours of wakefulness. A significant interaction of hours-of-wakefulness by task length indicated however, that performance on the 90-sec and 10-min PVT was differentially affected by fatigue. In contrast, no interaction effect was observed for the 5-min and 10-min PVT. These initial findings indicate that the 5-minute PVT may be a valid fatigue assessment tool for operational environments'. Further analysis of the data will determine whether this is also the case for a 5-min Palm-PVT.

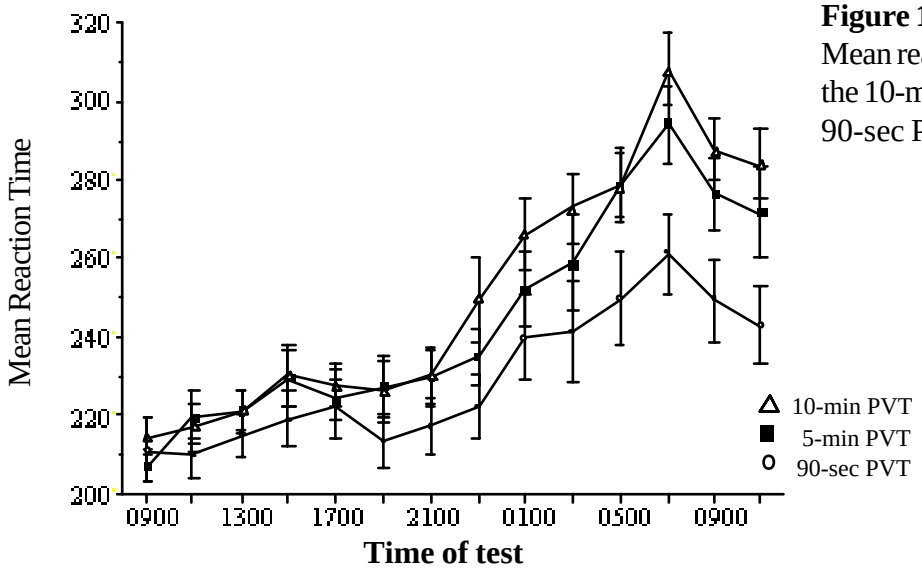

Figure 1.
Mean reaction times for the 10-min, 5-min, and 90-sec PVT.

Eating habits and attitudes among shift-work nurses in Israel

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Shift work has been reported to predict health problems and may lead to poor health habits, thereby increasing a person's vulnerability to illness. Several health problems appear to be associated with nurses working rotating shifts. These problems include sleep disturbances, cardiovascular and gastrointestinal diseases, and disordered eating habits and attitudes. There are some indications that temporal distribution of food intake, qualitative and quantitative food intake, may affect health. This evidence is compatible with the possibility that nurses working rotating shifts are more likely to be overweight and to have eating disorders. Thus the goals of the present study were:

1. To identify demographic and clinical characteristics of shift-work nurses.
2. To identify eating habits, characteristics, and disordered eating attitudes of shift-work nurses.

Method: Subjects: 141 female nurses working rotating shifts at Rambam Medical Center in Israel. Mean age 39±10 years, mean BMI 25.6±4.3.
Questionnaires: Self-administered Demographic, Eating Habits, and Attitudes Questionnaires. Eating Habits Questionnaire reflects food consumption for the individual across a work cycle (morning, evening, and nightshift), and Eating Disorders Questionnaire (EAT-26).
Results: Results indicate that nurses consumed more carbohydrate food products during than after their shifts. The highest percentage of carbohydrate consumption was during evening and night shifts, while during vacation the nutritional proportion was balanced.
EAT-26 questionnaire indicated that 10% of the nurses were EAT-positive (score>20), and 7% of the nurses indicated waking-up during the night to eat.
Discussion: The current results are preliminary, and the process of collecting more data is underway. Our current findings show that nurses during shift work, in particular during evening and night shifts, suffered from unbalanced nutritional intake. In addition, EAT-26 questionnaire showed higher percentage of disordered eating as compared to the literature. To our knowledge this study will be the first to describe the eating habits and eating attitudes among shiftwork nurses.

Effect of shift work on subjective symptoms among female workers in Korea

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In order to estimate the effect of shift work on subjective symptoms in female workers, a questionnaire survey of the demographic variables, working conditions and subjective symptoms was carried out among 1875 Korean female workers in 2002.
One thousand eight hundred seventy five (1875) subjects were randomly selected among female workers by cluster sampling in Korea and interviewed by well- trained interviewer, who filled out a structured questionnaire. The valid response rate was 94%, and 1002 office workers (53.4%) and 873 blue-collar workers (46.6%) were included and 1449 shift workers and 426 non-shift workers were analyzed.
Many items such as smoking, drinking, marital status, job type and other work conditions showed significant differences between shift workers and non-shift workers. The prevalence rates for subjective symptoms related to gastrointestinal, respiratory, cardiovascular, skin and fatigue among female shift workers were significantly higher than those of non-shift workers. In multivariate analysis that adjusted the differences of demographic and occupational variables, the scores for gastrointestinal, cardiovascular and eye symptoms were significantly higher among female shift workers than those of non-shift workers.
In conclusion, we suggest that the shift work has significant effects on some subjective symptoms among female workers in workplace and the effects are also influenced by several other personal and working conditions. In order to cope with the health problems of shift workers, it is recommended to consider proper preventive program for women engaged in shift work when planning and implementing shift work system at the workplace.

Key Words: shift work, subjective symptoms, female workers

RAS representation & analysis software

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Objective: Actual working hours of employees in the service industry, and particularly within the transportation sector often vary strongly from day to day and week to week. These shifts may be highly irregular, utilize split shifts and extended work hours. Given the complexity of these systems, it is often very difficult to analyse and compare relevant features of such schedules. The intended user groups who could benefit from a work schedule analysis tool include both shiftwork and sleep researchers along with the scheduling practitioner. All these stakeholder groups could use information from such a tool to visually interpret and understand the amount of drift (variability) contained within a particular schedule along with other relevant work-schedule features (e.g., night hours, timing and duration of off time, etc.). Such information aims to facilitate the reading and interpretation of work-schedules, foster the identification of safety critical parts of that schedule, and help to develop alternatives to it. Ideally, this soft-ware would be used in conjunction with the users' existing scheduling package or practice.
Method: The software RAS was developed using a series of anticipated use scenarios that considered a wide rage of possible applications. These scenarios and first software prototypes were discussed with potential future users in several design meetings. Design sketches were also on the last Symposium on Night- and Shiftwork in Japan. Separately, the software was applied to actual working hours collected from field research.
This software allows users to enter or import work-schedule and associated time-stamped (e.g., sleep) data. It analyses these data qualitatively, using a range of graphical devices, and quantitatively, using a range of statistical techniques. Software use is facilitated by extensive help dialogs that are integrated into the package and teaching material.
To account for highly irregular shifts, a technique for schedule comparison and evaluation was developed that make applicable the recommendations regarding the design of shift systems to various length' of shifts. **Results:** The software as a first version is in use and allows for the analysis of flexible and irregular working hours. Several graphical visualizations aid the analysis and comparison of the underlying complex data structures.
Further developments will focus on

- easing the entering of data
- allowing automated comparisons of larger number of schedules
- becoming even more flexible in analysing the data
- building interfaces to software packages that focus on estimation, scheduling or other specific tasks, RAS serving as a general analysis and management tool.

The goal of the presentation of RAS at the symposium is to collect feedback from experts in field of shiftwork and to evaluate the tool so it can be improved upon, E.g. is the user interface usable? Do the various graphical representations make sense or do users need a lot of time to understand them? Is the analysis tool flexible enough and does it cover the most important questions? Is something missing?

Laboratory studies of fasting and over-eating – Performance, wakefulness and sleep

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Introduction: The role of food intake in relation to fatigue and the effects on sleep are relatively unknown. But it is obvious that displaced work hours often disrupt the normal pattern of nutritional intake. In two laboratory studies we decided to follow the effects of a day fast and a double daily nutritional intake on sleepiness and performance.
Aim: The research questions centred on if there are any times during the day when deviation from a normal dietary intake may be deleterious to performance. If so, what mental functions are most affected – psychomotor performance, learning or problem solving? Are there any effects on the following sleep?
Methods: Both studies included 12 subjects, half of them female. They were studied in a crossover design. The protocol included one night of sleep in the laboratory (23:30-07:00) followed by one day of performance testing during the day (at 08:00, 11:00, 13:00, 16:00, 18:00 and 21:00). Subjects were served meals adjusted to weight, age and calculated energy expenditure (at 07:30, 12:30, 17:00 and 22:30). In the fasting study no food was served in one condition. In the over-eating study meals were at 12:30 and 22:30 h. The experimental day was followed by a second laboratory EEG sleep period. Cortisol and testosterone was measured in saliva every second hour during daytime.
Results: The results showed that fasting reduced alertness and performance. A loss of energy was perceived during late afternoon. Cognitive vigilance seemed to be most sensitive to food deprivation and as well as sleepiness. In the over-eating condition no effects on sleepiness and performance were observed. In both studies EEG parameters were very little affected. Hormone levels of cortisol and testosterone were not significantly affected during any of the experimental conditions.
Conclusion: Fasting elevates sleepiness and reduces performance while over-eating does not affect wakefulness.

Outcome in sleep problems and accidents/incidents according to work hours. A representative sample

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Introduction: Shiftwork is an important predictor of sleep disturbance (1) and it has been demonstrated that self-reported disturbed sleep is a predictor of accidental death at work in addition of night work (2). **Aim:** The aim of the study was to predict sleep problems from work hours and also to predict self-reported accidents and incidents. **Methods:** A sample of 1300 cases was telephone interviewed in January 2003. The sample was randomly selected but stratified to represent 13 regions in Sweden. The questionnaire included items on sleep problems and sleep habits, work and work hours, accidents and incidents during the past year and background factors. About half the sample (51%) was actively working (n=668) in four types of workhours (n in parentheses); day work (530), shiftwork - day (34), shiftwork – including night (51), varied work hours (53). Using a logistic regression model, controlling for age and gender, work hours was used to predict sleep problems and accident outcome. **Results:** The results showed that 18.1% of all participants received too little sleep and 19.3 % complained of having disturbed sleep at least once a week. During wake time 18.7% had prolonged periods of tiredness at least once a week. In connection with day work, the sleep length reached 6.78±0.04 hours. This gave a deficit of sleep amounting to 90.4±0.05% (ratio of sleep obtained/sleep need). Almost one out of 6 workers (15,7%) had experienced an accident or near-accident during the past year at work or during leisure time. Logistic regressions controlling for age and gender demonstrated that the OR of having a disturbed sleep was significantly elevated by shiftwork – day (p=0.028; OR=1.96; 95%CI=1.96-3.55) but not for shiftwork - including night. Too little sleep was almost significantly predicted by shiftwork - day (p=0.079; OR=1.73; 95%CI=0.94-3.18) and again non-significant in shiftwork - including night.A different pattern was observed for accidents and incidents during the past year where shiftwork – including night, became highly significant (p=0.001, OR=2.92, 95%CI=1.65-5.15) but was non-significant for shiftwork - day. When controlling also for socioeconomic status, disturbed sleep could not be predicted by work hours but too little sleep became significant for shiftwork – day (p=0.05, OR=1.95, 95%CI=0.99-3.82). There was no change in accident outcome. One likely explanation for some differences obtained could be the occurrence of short rest periods in day shiftworkers resulting in sleep problems and long periods of wakefulness in connection to night work affecting accident risk.
Conclusion: Night oriented shiftwork is associated with increased accident risk but not with sleep problems.

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Health and hazard issues among nightshift work in the Philippines

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The Philippines has established many export zones as a response to the Structural Adjustment Programs of the World Bank in order to stabilize its economy. The study aimed at looking into the problems caused by night/shift work.
Method: This study was conducted in an export zone in the Philippines involving 31 industries and an interview with 613 women workers. The study showed that the industries had nightshift work due to the 24-hour production. There were usually three shifts of eight hours each, or two shifts of twelve hours each. For some work factors, the night/ shiftworkers reported the following: 30.6% said that their salary was sufficient to meet their daily needs and 43.2% said that they experienced conflict between work and home. On the content of the job, the women workers reported that the work requires many skills (93.5%), much concentration (82.7%), and that strict visual inspection (59.5%). This again is characteristic of work in electronics and garment factories where information technology has been incorporated and used in the production process. Stress and burnout were also reported in the interview due to the need to work at a faster rate in extended time. In this study, workers were not asked voluntarily about their consent for overtime work. Burnout is the extreme manifestation of stress, which may eventually lead to rapid deterioration of both physical and mental health of the person. Stress and burnout manifested among the workers as psycho-physiological manifestations such as diarrhea problems, skin allergies, and headaches, sleep disturbances and cardiac pains. Other affective and mood signs would include progressive detachment, loss of self- confidence, lowered self-esteem, depression, mood swings, inability to concentrate or to pay attention, increased cynicism and pessimism, anger and frustration, irritability and general sense of futility. The controversial study of Karoshi where he showed the relationship between overwork and death signifies the importance of regulating workload (Sutherland,et.al.,2000:73).
There was also a report of persistent chronic sleep debt . Among the night/ shift workers this is characterized by persistent sleepiness and the lack of supervisors who could assist them when problems arise. For companies that have three work shifts, women complained of inability to adjust readily to the next work shift because the change in schedule occurs every week. The body could not adjust to their circadian rhythm. Physiologically, the absence of the regulation of the circadian rhythm leads to increase or slowing down of heart beat, stress, and digestive disorders. The study proposed for a massive review of the existing regulations for night/ shift work, including the extended overtime and the provision of safe facilities to prevent accidents at night.

A study of the architecture of sleep and the sleep-wake cycle characteristics in nurses on different shifts

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Objective. The purpose of this study was to evaluate the architecture of diurnal sleep and the characteristics of the sleep-wake cycle in nurses.
Method This study was conducted at the University Hospital of Ribeirão Preto, School of Medicine of the University of São Paulo (HC/FMRP-USP).
A questionnaire elaborated by Multidisciplinary Group of Biological Rhythms, Institute of Biomedical Sciences USP, was used to assess the data. The sleep-wake cycle was registered in sleep diaries by 36 subjects. Mean age was 30 years old. Nurses worked on morning / afternoon shifts: 7 am to 1 pm or 2 pm or 1pm to 7 pm (six hours per shift), and 12-h night shifts (from 7 pm. to 7 am), depending of the week. When working during the day, their work schedule was of 6 days X 1 day off. In the night shifts, 12 h X 36 h off.
The polysomnographic recordings were conducted at Sleep Laboratory HC/FMRP-USP. Six nurses volunteered to participate in the polisomnographic evaluations. They slept in a sleep lab after the working shift (after a day and a night shift).
Results. It was observed a progressive sleep deprivation in the day sleep in all subjects. Frequent awakenings and short naps during day sleep were also reported in the sleep dairies, as well as during the polisomnographic evaluations.
Sleep efficiency evaluated by the use of polisomnography showed lower values during day sleep than at night sleep. REM sleep was shorter during day sleep periods.
Nurses reported poorer day sleep, probably perceived by the frequent awakenings and reduced duration of day sleep. They also, complained of frequent irritability, headaches, and appetite disorders.
As rotating shift workers, having long working times at night, and different hours for sleeping, waking up and resting, nurses have difficulties to cope, due to their shift work organization affecting their sleep and well-being.

Sleep deprivation and work shifts: the importance of the morning shift

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Work organization has a significant influence upon adaptation to shift work. Working in shifts may reduce the worker performance, increase the risk of accidents and expose him/her to harmful agents, which may cause premature functional disability. In most interventions, however, only the night shift is taken into consideration, and the sleep deficit caused by reduction in the night sleep preceding the morning journey when it begins too early is ignored. In addition, not always is the damage suffered by those working under a fixed morning schedule evaluated. Within this context, the present study aims at comparing three fixed shifts, that is, morning, evening and night shifts with regard to workers sleepiness, sleep duration and quality.
The study was carried out with male individuals working at the Maintenance Department of a transportation company in São Paulo, Brazil. Such workers used to work in fixed shifts which might go from 07:00am to 03:30pm (morning shift); from 03:30pm to 11:15pm (evening shift); or from 11:00pm to 07:30am (night shift). The company's allocates around 65 workers to the morning shift, 62 to the evening shift and 62 to the night shift – all male individuals. Thirty two workers out of this total agreed on participating in the study: 8 from the morning shift, 12 from the evening shift, and 12 from the night shift.
Sleep duration was assessed during a period of 10 consecutive days with the use of actigraphs and sleep questionnaires. Also data on sleepiness and sleep quality were collected by means of questionnaires filled out by the workers themselves.
The average of total sleep duration from morning workers was shorter than the one registered for night workers (343 minutes and 380 minutes, respectively). The result of Kruskal-Walis analysis as to sleep quality was statistically significant ($p<0,01$); the quality of sleep experienced by the morning shift workers was considered the best, followed by that of the evening shift workers and, in third place, that of the night shift workers. The averages concerning sleepiness self-evaluation were higher among the morning shift workers, and the lowest ones were found among the evening shift workers. The Tukey test confirmed the differences among the shifts with regard to sleepiness obtained through ANOVA ($p<0,05$). Sleepiness levels were lower at 12 noon, 03:00pm and 06:00pm and, according to the Tukey test, in statistic terms they are different from the other ones ($p<0,0002$).
The results obtained point to the need of evaluating the morning shifts, particularly with regard to sleepiness deriving from partial sleep deprivation. Social pressures to keep awake associated with biological rhythms make it difficult to fall asleep earlier, thus generating sleep deprivation. The earlier the work journey starts, the greater the deprivation, and this causes damage to workers, sometimes similar, sometimes worse than those suffered by night shift workers.
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Total sleep time and sleep latency in bus drivers using MSLT

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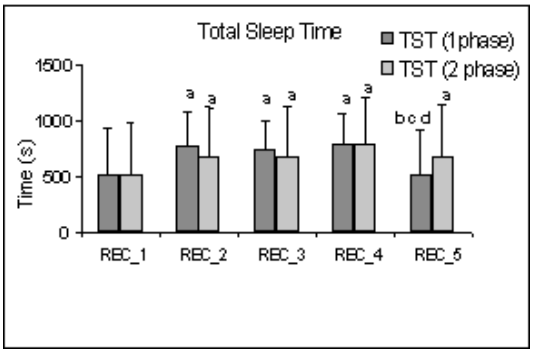
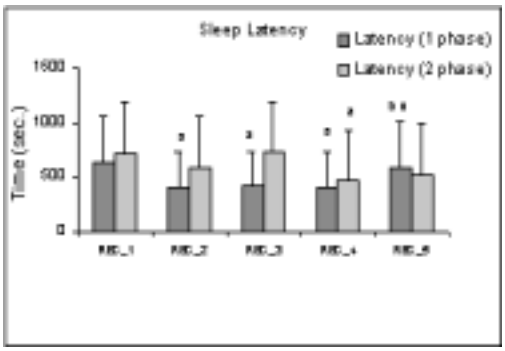
Objective: The aim of the study was to analyze variations in sleep latency at different times of the day and night before and after work, using a specific test for the diagnosis of sleepiness (MSLT)[(1)].
Methodology: The volunteers were professional bus drivers working for a single interstate passengers transport company. Testing took place at the Psychobiology Department sleep laboratory at UNIFESP. MSLT tests were carried out for two different phases. The first phase was before work, after a night's sleep (and after a period of 28 hours without work) and testing (MSLT) in this phase was during the day, after 8 hours sleep. The second phase was 16 hours after work and 8 hours after a sleep period, with the test being applied during the night period.
Results: There were statistical differences for sleep latency in the first phase of the study, in the second, third and fourth MSLT recordings compared with the first recording period. In relation to total sleeping time in the first phase, there were statistical differences in the second, third and fourth recordings compared with the first recording period. In the second phase statistical differences were found for sleep latency only in the fourth recording compared with the first, although in relation to total sleeping time there were statistical differences for the second, third, fourth and fifth recordings compared with the first MSLT recording. These results point to greater propensity to sleep (sleepiness) during the day (10.00 – 16.00 h) when sleep latency is substantially shortened and total sleeping time longer for recordings at these times. In the night period there was greater propensity to sleep (sleepiness) from 03.00 to 04.30, with shorter latency in this period, and longer total sleeping time at night period for all the other recordings compared with the first. In conclusion, more attention should be paid to preventive action at these times, such as rest stops or changing drivers, in order to reduce the risk of accidents.
Note: a = diffence from REC_1; b = diffence from REC_2; c = diffence from REC_3; d = diffence from REC_4





Keywords: Sleepiness, Sleep latency, Bus driver, MSLT
Acknowledgments: CEPID/SONO/FAPESP, AFIP, Nacional Expresso

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Sleep complaints among Brazilian offshore workers: a preliminary assessment in the Campos Basin, Rio de Janeiro

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Shift work has potentially adverse effects for health, particularly on sleep. The purpose of the present study was to assess sleep complaints among personnel working in oil and gas offshore installations in the Campos Basin, Rio de Janeiro, Brazil. One hundred and seventy nine subjects were asked to complete a sleep questionnaire with multiple choice answers. Offshore workers were divided in two groups according to their work schedule: (1) fixed daytime workers (n=86; age: 35.8±9.6 y) and (2) shift (n=87) or nightime (n=6) workers (total n=93; age: 37.7±9.7 y). Most of them (70%) had a work schedule of 14 days on (12-h) and 14 days off. Results are shown in the table below. A significant proportion of shift/night workers rated their sleep as poor. They also reported more difficulty of falling asleep, interrupted sleep and non-restorative sleep than the fixed daytime workers. Furthermore, many of them have short sleep episodes and irregular bedtimes. The frequencies of most symptoms suggestive of parassonias were comparable between the two groups, but habitual snoring was twice more often in shift/night workers than in daytime workers. However, few workers had sought for medical help for their sleep problems. In addition, a great number of shift/night workers reported feelings of sadness. These findings point to the fact that sleep problems in offshore workers are of considerable importance. Further investigations and development of strategies to minimize the negative impact of shift work are clearly needed.

	Daytime (n=86), %	*Shift/Night (n=93), %*	*Z test; p value*
Sleep problems			
Poor or very poor quality of sleep	1.2	20.4	4.09; *P*<0.01
Difficulty initiating sleep (frequently or always)	4.7	15.1	2.31; *P*<0.01
Latency to sleep > 30 minutes	7.0	28.0	3.66; *P*<0.01
Two or more awakenings during sleep	16.3	45.2	4.16; *P*<0.01
Wake and cannot get back to sleep	4.7	5.7	NS
Waking up feeling tired (frequently or always)	3.5	15.1	2.64; *P*<0.01
Sleep duration of 6 hours or less	16.3	44.1	4.03; *P*<0.01
Irregular bedtime (frequently or always)	12.8	29.0	2.66; *P*<0.01
Parassonias (occasionally or more frequently)			
Unpleasant feelings in the legs	9.3	14.0	NS
Pauses in breathing	0	3.2	NS
Loud snoring	10.5	23.7	2.33, *P*<0.01
Nightmares	9.3	10.8	NS
Consulted a physician for sleep problems in the last month	1.2	3.2	NS
Sadness feelings (occasionally or more frequent)	9.3	26.9	3.03, *P*<0.01

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The impact of working conditions on health

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The aim of this paper is to examine the impact of working conditions on health in Brazil. In the first part of the paper we investigate the changes in employment relationships over time in Brazil. We notice that the percentage of workers with a formal relationship with their firms has declined between 1984 and 2000, with a corresponding rise in the share of workers in the informal sector, self-employed and unemployed, especially among males. Moreover, child labor and average hours worked have declined over the same period. In the second part of the paper we use the 1998 PNAD (*Pesquisa Nacional de Amostra Domiciliares- National Survey of Household Sampling*) survey, conducted by the Brazilian Census Bureau (IBGE) to investigate the impact of working conditions on health. We use as our main dependent variable a question where the respondent is asked to evaluate her own health conditions, and try to relate this answer to a series of labor market indicators. We apply an econometric technique known as the ordered logit model to the data and find several interesting results. Firstly, as expected, health conditions improve with education and income and decline with age for the whole sample. Heads of the family also tend to be healthier than spouses and children. Health conditions are also better for those in the labor force, either working or looking for a job. Among those in the labor force, we find that health deteriorates with unemployment. Among the employed, health conditions are better for those who work as employers, as opposed to employees, domestic servants and self-employed and for those that work longer hours per week. However, those that have more than one job are generally unhealthier. Finally, among the employees, those in formal relationships tend to be healthier and, more importantly, those that work during part of the day and part of the night tend to have worse health conditions than those working only during the day or only during the night.

Occurrence of work injuries among non-diurnal workers from São Carlos county, SP, Brazil in 2000

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The objective of this study was to describe the characteristics of the registered work injuries that occurred among non-diurnal workers, in São Carlos County, in all economics branches, during the year 2000.

Methods.

Data bank was the "Work Accidents Communication" registered at the National Institute of Social Security, in the branch of São Carlos, State of São Paulo, Brazil, during the year of 2000. Only accidents occurred before 8 AM and after 6 PM are here reported, totalizing 814 registers. The data classification was based on Economic Activity National Classification, Brazilian Occupation Classification, and some chapters based in the International Disease Classification (IDC -10), the codification of the agent involved in the injury causation and codification of the injury according to body localization. The studied variables referred to the workers are: age, sex and occupation; accident variables included: the nature of the injury, the external causes, the injury causes, the nature and the localization of the injury, the time of the injury occurrence and the probable sick leave duration. The data bank has been constructed using EPI-Info version 6.04d.

Results.

All registers concerning the primary sector (n=40), the secondary sector (n=387) and part of the third sector (n=206) had been analysed in a total of 633 registers(77.7% of all registers). The preliminary results showed that work accidents occurred among non-diurnal workers in 20.0% of the primary sector registers, 28.1% of the secondary sector and 20.5% of the third sector. 17.9% of the registered work accidents involved females, but comparing by the time of the injury occurrence, 38.1% of the accidents occurred among females and 26.3% in males. The distribution of the registers according to age group was 27.5% from 15 to 24 years, 20% from 25 to 34 years, 35.1% from 35 to 44 years, 23.5% from 45 to 54 years and 11.1% 55 years old and plus. The official work injury register stating the probable duration of the sick leave due to the work accidents among shiftworkers was 78.8% until 15 days, 7.3% from 16 to 44 days and 13.9% 45 days and over, while among the other workers the duration of the sick leave due to the work accidents lasting 45 days and over was 5.5%, suggesting that these accidents produce more serious injuries

Association between the risk of Obstructive Sleep Apnea and accidents in a truck driver population.

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Obstructive Sleep Apnea (OSA) is characterized by loud snoring, repetitive obstructive respiratory events and sleep fragmentation with consequent hypersomnolence during the day. OSA is a public health problem due to its high prevalence. The prevalence of OSA is thought to be particularly high among professional drivers because several risk factors for OSA such as gender (male) and obesity are common. OSA increases the risk of truck drivers to fall sleep while driving due to excessive sleepness, a leading factor to highway accidents. Other factors contribute to increase the risk of accidents, including variations in glycemic levels, the use of stimulants and inadequate diet associated with irregular work schedule.

The aim of this study was to investigate the association between episodes of drowsiness and accidents and the presence of OSA symptoms as well as the factors mentioned above. The study sample consisted of 10,464 truck drivers who participated in a campaign promoted by a highway company in the State of São Paulo. This campaign offered truck drivers who used the highway a medical and laboratorial evaluation. The Berlim questionnaire was used to evaluate the risk of OSA. Personal details were also recorded.

Among 10,464 drivers included in the study, 2,707 (26%) were classified as having a high risk for OSA while 7,757 (74%) were considered as low risk for OSA. The expect proportion for the two groups (high risk for OSA and low risk for OSA) were tested using the chi-square test. 15.4% of all drivers admitted that they had, at least once, slept while driving (9.8% of the high risk for OSA group and 5.6% of the low risk) (chi-square, $p<0,001$). 15% of all drivers admitted using drugs (5% of the high risk for OSA and 10% of the low risk for OSA group) (chi-square, $p<0,0001$). The consumption of alcohol was mentioned by 33.1% of all drivers (9.7% of the high risk for OSA and 23.4% of the low risk for OSA group) (chi-square, $p<0,0001$). 32% of all drivers reported involvement in an accident (10% of the high risk for OSA and 22% of the low risk for OSA group). The chi-square test confirmed the difference between the expect proportion for the two groups ($p<0,0001$). Glycemic levels were evaluated among 5000 drivers included in the study. 26% of drivers had raised levels of glucose (9.4% of the high risk for OSA and 16% of the low risk for OSA).

Our results suggest that the prevalence of OSA is high among Brazilian's truck drivers and that the risk for OSA is associated with high somnolence.

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Effects of night work on the immune function among nurses

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Objectives: The effects of night work on the immune function, particularly natural immune function, were investigated among nurses.

Materials and methods: 105 nurses – 28 males and 77 females – aged 23-59 working at a public hospital for mental diseases. Among them, 89 subjects were shift workers (three different schedules) and the others were day workers with a fixed scheduled. Blood samples were collected from each subject on two consecutive mornings. In the case of the shift workers, the first day for sampling started on the daytime shift, and the second day, at the end of the night shift. Twelve-hour sleep diaries before sampling and also questionnaires on fatigue were used. Lymphocyte subsets and Natural Killer cell activity were measured by BML Inc (Tokyo, Japan). The data collected on these two days among shift workers and day workers were compared.

Results:

The sleeping hour period before a night shift was shorter among the younger group than that of the older group. Among female shift workers, Natural Killer cell activity and Natural Killer cell subset ($CD16^{+}56^{+}$) shortly after a night shift decreased significantly as compared to the values of the day shift. On the other hand, T-cell subsets, such as CD3 and CD4, increased significantly. Male shift workers also showed a trend similar to that of the female shift workers. When the subjects were divided into three groups according to age, the Natural Killer cell activity and Natural Killer cell subset ($CD16^{+}56^{+}$) among the younger group showed a decrease greater than that of the older groups. The day workers did not show any significant change along the two days. The changes occurred between two days on lymphocyte subsets and Natural Killer cell activity concerning the female shift workers and the female day workers were compared. The decrease in $CD16^{+}56^{+}$ was significantly larger on shift workers than on day workers. The sleeping hours before a night shift, that is, taking a nap during the night shift, as well as the scores on fatigue were not related to the changes in the immune function observed in the morning subsequent to the night shift.

Conclusion:

It is suggested that sleep deprivation affects night workers immune function, as is the case of nurses. The effects were more evidenced among the younger group.

Diversity and equity: dealing with biological and social differences

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Comparing working hours across different groups, aggregations, or categories of people very fast leads to the result that working hours show a diversity that is dependant on individual and social characteristics. It can easily be shown that women in general have less favorable working hours than men. Women furthermore usually have a second, unpaid job, i.e. domestic responsibilities, which make adaptation to certain kind of working hours, e.g. shift work even more difficult than it would be for people without these responsibilities, e.g males. So the same shift system will differ in its effects upon the worker, depending on gender, which has been well documented in the literature on shift work

Besides such obvious differences in the distribution of working hours, which will be demonstrated using data on flexible working hours from a recent European survey on working conditions, it can be shown that working hours, their extent, distribution and their control differ between countries, depending on economic conditions as well as cultural backgrounds. Again these differences do lead to different effects in people working under such conditions, besides or in surplus of some generalizable effects.

In this line of arguments one of the remarkable effects of globalization is the diversity of working hours between developed and developing countries – and the development within and between these countries. Again this diversity in working hours is accompanied by diversity in a number of other working and living conditions, leading to different effects of working hours on workers.

The economic competition between countries leads to remarkable developments in working hours. While developing countries try to compete via social dumping, induced in part by economic pressures to survive, trends can also be observed in developed countries to reduce established standards on the design of working hours, e.g. by increasing agreed working hours, postponing retirement age, deregulation of health and safety constraints, or by making working hours more 'flexible'. Here also the argument is that this has to be done to become competitive, e.g. competitive with developing countries. It is remarkable – at least in some developed countries – that ergonomic considerations seem to be of absolutely no relevance in this argumentation. Researchers in the field of working hours should thus not only produce results based on sound research, but also try to get them implemented.

In general then, specific and well adapted regulations of working hours, based on specific consideration of the diversity to be observed, based on research which takes this diversity into account – instead of simply overgeneralizing results from specific (developed) countries or specific populations –, may become an increasingly important aspect of health and safety policy. As diversity in working and living conditions is a fact, diversity of regulations and the design of working hours might be a mean to achieve some kind of equity in the quality of work and social life.

Association of sickness absenteeism with poor sleep habits in shift workers

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Sickness absence from work is an expensive and increasing problem for industrialized countries. However, few studies have shown whether workers with sleep problems or poor sleep habits would relate to sickness absenteeism directly. The aim of this study was to clarify the relationships between sleep habits and sickness absenteeism in male shift workers.

Methods: A self-administered questionnaire concerning sleep, and sickness absence was submitted to a sample of 540 shift workers (aged 18 to 59, mean 27 years) in an electric equipment manufacturing company. Participants worked under a weekly rotating 3-shift system in a counterclockwise direction. Sickness absence was assessed by total sick leave days in the past year. The questionnaire of sleep comprises seven questions, i.e., time to fall asleep (TFA), awakening during sleep (ADS), early morning awakening (EMA), sleeping well at night, sufficiency of sleep, dozing or napping while commuting time or during lunch break, and excessive daytime sleepiness (EDS) at work. Each answer was rated on a four or five point scale. To determine the relationship between sleep habits and sick leave, we dichotomized responses to the sleep habit questions by a criterion response as described in the Results section; the presence of insomnia was defined when at least one of 1) TFA more than 30 minutes, 2) ADS almost every day, and 3) EMA almost every day. Sick leave days were dichotomized at four days or less and five days or more in the past year. To examine the associations of sleep habits and sickness absenteeism, prevalence rate ratios (PRR) were calculated.

Results: In this study, 53.9% of workers experienced sickness absence at least a day during the previous year, and 16.3% reported 5 days or more. Increased risk of sickness absenteeism was observed for workers who reported insomnia (PRR 1.3 95% Confidence Interval [CI] 1.0-1.7), ADS almost every day (PRR 1.6 95% CI 1.1-2.6), sleeping poorly at night (PRR 1.7, 95% CI 1.2-2.4), and insufficieny of sleep (PRR 1.3, 95% CI 1.0-1.6).

Discussion: In the present study, significant and positive associations were found between poor sleep habits and incidence of sickness absenteeism among shift workers. Among sleep habits, workers who reported sleeping poorly at night showed a stongest association with sickness absence. The results were quite similar to the findings in daytime workers in our previous study (APA-NIOSH conference, 2003). Improvement of sleep habits in workers with poor sleep quality seems to be important to decrease sickness absenteeism.

Knowledge-intensive work, working time and well-being

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In the working time discussion, the coming of the information society and knowledge-intensive work is often predicted to break the industrial divisions between work and non-work (home, leisure) and their defined sites. Especially those in dynamic sectors - as in information and communication technology sector - and in a good labour market position – experts, managers and others with large autonomy, high productivity and good career prospects – are assumed to work long hours. Demanding knowledge work appears to require a marginalisation of private life and concentration on work.
The aim of the paper is to examine the relationships between working time and well-being in knowledge-intensive work. Empirical analyses are based on a representative survey among third level educated Finns between 24 and 64 years of age, conducted by Statistics Finland in the spring 2001 (n=1643, response rate was 63%). We separate three dimensions of working time (duration, tempo and autonomy) and well-being (physical, psychological and social). Duration of working time is defined as usual number of working hours per week including overtime work (Mean=41.3, SD=8.2): 45% of the respondents worked 41 or more hours per week. Working time tempo is defined as perceived time pressure at work (four items, rel=.79); e.g., 71% of the respondents agreed that their work include tight schedules. Working time autonomy is defined as possibility to influence one's working time (three items, rel=.66): e.g., 49 % of the respondents could decide when to begin and end working day. Physical well-being is defined as sleep debt, which was measured as time difference between perceived need of sleep during workdays and actual sleep time: 31% of the respondents reported at least one hour daily sleep debt. Psychological well-being is defined as difficulties to detach from work (five items, rel=.86): e.g., 41% of the respondents said that they often think about work issues during free time. Social well-being is defined as compromises one's own time and family time because of demands of work and career (eight items, rel=.84): e.g., 30% of the respondents had often or regularly compromised or given up personal friends and hobbies because of work. The relationships between working time dimensions (antecedents) and well-being (consequences) among women and men are analysed by using three linear regression analyses. Besides working time dimensions, the models include six sets (industry, occupation, age, family situation and children, social support at work) of explanatory variables.
According to the results, tempo of working time is the best antecedent of well-being both among women and men after controlling various background factors: high time pressure at work decreases well-being. Duration of working time also predicts problems with psychological and social well-being, but not with physical well-being. Working time autonomy is linked only to physical well-being: higher autonomy decrease sleep debt among men, but not among women.

Measuring mental effort via peripheral arterial vasoconstriction: a new, non-invasive and objective method.

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Introduction: In recent years, increased interest has been shown in mental load and physiological markers. The basic assumption is related to the idea that exertion of mental effort is associated with an increase in the activity of the sympathetic nervous system (SNS). Since overloading the SNS is associated with increased cardiovascular morbidity, efforts have been made to investigate whether mental effort is associated with increased sympathetic activity. Several studies have found that shift workers are most likely to suffer from cardiovascular morbidity, therefore investigating this phenomenon is of particular importance to them. Until now, heart rate, heart rate variability, blood pressure, EEG, blood hormone levels have been the most applicable physiological measurement methods to study this phenomenon. We used innovative plethysmographic technology to measure Peripheral Arterial Tone (PAT) in order to investigate the relationship between SNS activation and mental effort. The PAT is essentially a plethysmograph that allows non-invasive monitoring of pulsating blood flow from the finger pad (Schnall et al., 1999). As the finger is densely enervated with alpha-adrenergic-mediated vasoconstrictor efferents, it an eminently suitable site. The PAT measures pressure changes accompanying the blood volume pulse. An increase in this value compared to baseline indicates vasodilatation, while a decrease indicates vasoconstriction. We hypothesized that if peripheral arterial tone reflects the amount of mental effort invested in task performance, then the measure should discriminate between different levels of demand for mental effort imposed by a task.
Purpose of the study: To investigate PAT's sensitivity to varying exertion of mental load.
Method: Sixteen consenting subjects (aged 22-29 yrs.) participated, and were paid according to their performance. The research consisted of two 24-h experimental periods, separated by at least one 7-day rest period: one started at 07:00, the other at 19:00. Subjects were asked to perform a short memory task (4 and 7 memory sets), each set requiring differing levels of mental effort, according to instructions: no instruction (NE) - referred to baseline while "Your performance in this session will be included in your bonus" referred to the "Effort" (E) performance level. The experimental procedure was Latin square design. Subjects performed the 4 series every 4 hours from 07:00-07:00. Each session included 5-min baseline recording of the PAT's amplitude.
Statistical Analysis: Sympathetic activity was measured by the difference between the values of the PAT's amplitude during performance and during rest. The more negative the value the higher was the increase in SNS activity.**Results:** SNS activity level was significantly higher during the tasks performance period compared to baseline in all sessions and for all subjects (BL:1069.55±344.66. Mean Performance level: -181.89, $p<0.0001$). In addition, sympathetic activity measured via the PAT showed significant statistical differences between E and NE conditions. E had significantly lower amplitude compared with NE. **Conclusion:** We found PAT amplitude to be sensitive to different mental loads: sympathetic activity increased when mental load increased. This device could be an important non-invasive easy to use tool, reflecting pure sympathetic activity.

Monitoring of 6-OHMS in exposure to eletromagnetic fields

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Objective: This study focus on the increasing number of professionals exposed to electromagnetic fields, as well as on the diversity of results and scientific opinions.
We tried to point out the modifications that may occur in the melatonine circadian rhythm by carrying out successive determination/measurements of 6-OHMS metabolites on subjects working at electric power stations with electromagnetic fields at a 50 Hz frequency.
The second parameter addressed in this study is the serum antioxidant capacity; the same subjects were submitted to chemiluminescence reaction tests.
Method: a 72-hour monitoring was performed through successive measurements of 6-OHMS. Such measurements were taken at every miction of the 27 subjects.
The monitoring was carried out in two phases with a six-month interval; the subjects were selected from three similar electric power stations/plants. They usually worked in 12-hour on x 24-hour off, the light intensity during night shifts was lower than 200 lux.
It was used kits assembled by IBL – Immuno Biological Laboratories, for neuro-hormones metabolite determination. These are also used to check ELISA reaction.
The determination of the serum antioxidant capacity was performed through chemi luminescence tests. The system used was based on luminol. It was also determined the quenching factor (Q%) and the level of lipidic peroxides.
Results and Discussion: It was found that out of all subjects studied, 80% showed a decrease in the maximum values during the periods of exposure. The rhythm of melatonine synthesis and secretion was regular, but with a maximum value in advance or in delay, depending on the program span.
The reference levels were based on the values recorded on the same subjects during non-exposure periods. The results of the chemiluminescence tests are as follows: the quenching factor (Q%) decreased significantly: from 97.15 (control) to 94.71 concerning station I, and to 92.99 concerning station III. As for station II, a significant reduction could be observed in the quenching factor: it dropped from 97.15 (control) to 91.34.
Determination of lipidic peroxides, performed in parallel, emphasizes the need of complementary studies.

Shift work, social support and sleep

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Nakata et. al. (1) showed that insomnia in shift workers was improved by social support from co-workers. The objective of this paper was to further explore this topic. Can shift workers' sleeping problems be eased by the help of social support? Are shift workers more susceptible to social support than daytime workers when it comes to sleeping problems?
The study population comprised 1,054 persons. Out of these, 349 were shift workers and 705 were daytime workers. Social support was measured by the instruments Availability of Social Integration (AVSI), and Availability of Attachment (AVAT). These instruments measure central concepts in social support such as emotional support (AVAT) and social network, appraisal support and instrumental support (AVSI). Shift work was defined as working according to shift schedule and working varying hours. Statistical analyses were performed using Pearson's Chi-square analysis. SPSS version 10.0 was used.
The results showed that social support indeed was associated with sleep. However, there were no differences between shift workers and daytime workers. When analyzing the whole population stratified on gender, the sexes differed significantly with respect to the associations between social support and sleep. A higher proportion of women, perceiving lack of social support, reported poor sleep. When further stratifying the data on working hours, the gender differences remained for the daytime workers but not for the shift workers with regard to the concept of social integration. Forty-two per cent of the daytime working women compared to 16% of the men, who perceived low social integration, reported sleeping problems ($p < 0.01$). Corresponding figures for the shift working women were 35% compared to 22% of the men ($p = 0.11$).
Social support was associated with sleep. The finding apply to both shift workers and daytime workers. However, shift workers were not more susceptible to social support affecting sleeping. In the total population a higher proportion of women who perceived lack of social support, suffered from sleeping problems compared to the proportion of men. However, this gender difference was not as prevalent for the shift workers. The explanation for this finding can be found in previous research about social consequences of shift work (2). Neither shift working women nor shift working men have the same opportunity as daytime workers to engage in or maintain a social network.

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Some parameters of functional status of organism in the population of locomotive drivers

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Locomotive drivers, during their working process, are affected by a number of factors which can change functional status of organism. Usually locomotive drivers are a healthy worker population, in good physical conditions. Their reactions are mild and nonspecific, such as fatigue and decrease of working abillity. However, in longer terms, health disorders can follow.
Method: In our research some of the parameters of the functional status of the organism are examined, such as Combine Reaction Time (CRT), blood preasure, quality of sleeping, presence of headache. These parameters were related to some of the health risks of the profession of locomotive drivers. This study included 62 people, locomotive drivers employed in Novi Sad railway, who drive locomotives with electric and diesel engines.
Results: Locomotive drivers had significantly slower combine reactions after working process. Increase in blood preasure was also noticed, especially in electrical-engine locomotive drivers. The diagnosis of hipertension was confirmed in several cases.
Headache was present in 40% of examined persons, especially among workers involved with extraordinary events. Sleeping quality data pointed out the negative effects of fatigue and shiftwork organisation. Some of the disorders (sleeping, headache) were associated with the poor economical aspects people faced, as well as sidejobs and low wages.

Sleep quality of nurses working at night and in shifts.

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Introduction Difficulty of falling asleep and depression are more observed among night shift nurses than day nurses.[1] In Latvia there is a great number of people working at hospitals in night shifts as medical aid must be guaranteed 24 hours running.
Aim To investigate sleep habits of nurses working at night and in shifts
Methods The investigation was carried out at wards in Clinical Hospital in Latvia December, 2002 – March, 2003. To obtain the needed results anonymous questionnaires was applied. The participation in the investigation was of free choice of female nurses numbering 120, 58 of them work in the day shift and 62 work in the night shift, the average age of the participants is 39, from 21 to 70. The questionnaire consists of two parts. The 1st part contains general information (sex, age and family status). The 2nd part includes questions characterizing the quality of sleep (difficulty of falling asleep, application of sleeping draughts, fatigue after a working day). The questionnaire was carried out personally. After the questionnaire 30 nurses from the night and 30 nurses from the day shift were selected who had to perform psycho - physiological tests at the end of the working day (Correctures and Ravens). The 1st of them proves the abilities of work at the end of the working day. The 2nd test checks the logical thinking at the end of the working day.
Results 25% of nurses at the age of 28 – 37 working at night often experience difficulty of falling asleep. At all the tested nurses 58% those working at night usually fall asleep in the course of 10 to 15 minutes; 60% need 15 to 20 minutes, 48% need - > 20 minutes. In the course of resting (watching TV, reading etc) 32% of nurses often fall into a slumber, 21% of them are from the night shift, 28% of all the nurses sometimes fall into a slumber, 11% of them are from the night shift (p=0,03). *Correcture test:* The age of the participants is 22 – 56 years of age. They are divided into four age groups. In the third group (32 – 42) statistically credible differences in the number of mistakes may be observed among the day and night nurses (p=0, 03). Night nurses have admitted fewer mistakes on the average compared with day nurses. In the other age groups no statically credible numbers of mistakes among day and night nurses have been found. *Ravens test:* In order to obtain the results of Ravens test a scale from 1 – 9 has been applied. The difference of marks among day and night nurses shows that the obtained number of marks among day and night nurses is not similar (p=0,04). The best result (7 marks) has been obtained by 70% of night nurses (95% the interval of credibility 60,4 – 78,1) - day nurses is 47% (95% the interval of credibility 37,5 – 56,7%)
Conclusion: The experiment proves that work in the night shift causes difficulties of falling asleep. Psycho - physiological test shows, that night nurses have better attention and power of concentration than day shift nurses. It means that night shift should not be systematically arranged according to legislative acts.

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Work and driving hours in public and fright transport operations

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Introduction

Working and driving hours in public and fright transport operations are regulated by European and national laws as well as by collective agreements. Yet complaints are heard about high competition followed by wage and social dumping as well as poor working conditions such as extended working hours, insufficient rest, and impairing shift schedules. At the same time violations of the relevant norms have been reported repeatedly. Therefore the Federal Institute for Occupational Safety and Health (FIOSH) has initiated an investigation on the prevalence of different working hours in transport operations in Germany and the effects of these working hours on health and safety.

Methods

First European and national regulations as well as selected collective agreements have been reviewed and evaluated for both public and fright transport operations. In a second step systems of working hours for selected transport companies were evaluated against relevant legal and ergonomic criteria. This evaluation included comparing different kinds of transportation services in public and fright transport as well as the comparison of companies operating in rural or urban environments. Furthermore truck drivers have been interviewed about their actual driving hours during police regulated traffic controls. For urban public transport operations companies with different strategies of arranging working hours have been selected in order to see whether these different strategies will lead to differential effects on health and safety. For this purpose besides data on working hours health and safety relevant data (absenteeism, accidents) have been collected from those companies.

Results

German national regulations differ from European legislation, with collective agreements often stretching relevant laws to their limits or sometimes even violating them. The results of the analyses of the statutory provisions clearly show that within transport operations less restrictive regulations with regard to health and safety are employed, e.g. extended working hours per day/ week or shortened rest periods.

First results from police regulated traffic controls show that working reality of truck drivers often does not even meet these decreased requirements, with a substantial number of the drivers extending the allowed driving hours, e.g. driving up to 37 consecutive hours.

Analysing shift schedules in public transport operations yielded serious violations of ergonomic requirements, e.g. short backward rotation, and in practice even violated legal and agreed provisions.

Analyses of health and safety effects are still in progress. First results indicate that those companies which make full use of the legally provided possibilities have higher rates of absenteeism and early retirement than those companies / departments that observe ergonomic criteria in the design of their shift schedules.

Nutritional status and eating habits of shiftworkers: a chronobiological approach.

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Objectives: The eating habits of workers may vary according to the season of the year and the corresponding work schedule. A study aiming at verifying the dietary variations in summer and in winter, as well as the nutritional status of those who work in fixed shifts was carried out. The 24-hour distribution of the amount of calories and macronutrients ingested and the circadian rhythmicity of the calories contained in their diet was also analyzed.
Methodology: The study was carried out with 28 workers subjected to three fixed work shifts (morning, afternoon, and night) at a transport company in São Paulo. Food consumption was meaured with a 3-day dietary record, and nutritional status was evaluated through the body mass index, both in winter and in summer. Parametric and non-parametric tests were performed to compare the different groups of workers and the seasons. The Cosinor method was utilized to verify the circadian rhythmicity of the calories included in their diet.
Results: In winter, the workers typical diet contained a larger amount of calories ($p=0,00$), carbohydrates ($p=0,00$) and lipids ($p=0,03$). Their body mass index, on the other hand, did not show any variation from one season to another. The comparison carried out among the groups of workers did not show differences between the seasons for the ingested amount of calories ($p=0,44$), proteins ($p=0,78$), carbohydrates ($p=0,59$) and lipids ($p=0,24$), and no differences as to the body mass index were observed, that is, the same index ($p=0,35$) was registered both in summer and winter. On both seasons a circadian rhythmicity of the calories was found in the workers belonging to the morning shift ($p<0,05$) and those belonging to the afternoon shift ($p<0,05$).
Conclusion: The eating habits of workers subjected to fixed shifts varied from one season to another, but the variation was not reflected by body mass index. In view of this, we might conclude that the work schedule (morning, afternoon, or night) do not seem to be related to the seasonal changes observed. Nevertheless, a 24-hour distribution of food intake may reflect type of shift.
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Aircraft maintenance personnel's stress and sleep disturbances: a case of night shift workers

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According to Harma (1999) night and shift work is characterized by the necessity to continuously change the individual sleep-wake cycle according to new work shifts. In the aviation context, the aeronauts have to develop their professional activities at different hours of the day and night with the same accuracy, improving safety. Folkard (2001) mentioned that the investigation of some recent disasters have concluded that they were, at least partially, attributable to fatigue and/or human error. Indeed, according to Airbus (2002), aircraft maintenance personnel and inspection are responsible for 12% of accidents worldwilde.Therefore, air industry researchers gathered important data about some contributing factors that may cause maintenance deficiencies, among them some individual factors such as stress and sleep disturbances were listed. Some examples of failures in maintenance that may be a result of these two factors are: judgement errors, inadequate vigilance, slow task performance or not completing a task or missing steps in a multiple step task. Therefore, the aim of this study was to investigate the presence of stress and the symptoms of sleep disturbance in a group of 33 Brazilian airline's maintenance technicians working night shifts. For data collection two questionnaires were used: Adults Stress Symptoms Inventory (Lipp,1998) and Standard Shiftwork Index (SSI; Barton, Spelten, Totterdell, Smith, Folkard, & Costa, 1995) -modified by researchers at CAMI. The results showed that 54% of the technicians were stressed and they related some relevant symptoms of sleep disturbances. They were: difficulty of falling asleep before a night shift (45%), difficulty of falling asleep after a night shift (42%), spontaneous awakening earlier than necessary (64%) frequently awakening during the night (42%), tiredness after awakening (52%), changes in humor due to sleep loss (61%) and trouble sleeping because of shiftwork (52%). It is interesting to observe that these two factors seem to be strongly related and both affect performance negatively jeopardizing flight safety standards. To conclude, due to the results it is possible to assume that some immediate steps in order to prevent the risk in the maintenance environment concerning must be taken. Therefore, some suggestions are made in order to highlight the system barriers and to mitigate the incidence of errors due to sleep disturbances and stress. In the organizational level, a better shift distribution, a more effective prioritization of tasks, distribution of workload and time management and , emphasis on training in technical and human factors skills. In the individual level, an engagement in educational programs on health habits including nutrition hints, physical activity and information about the hazards of alcoholic intake and the use of medicine without medical prescription.

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The effects of fatigue on perceptual processes in situation awareness: the first stage of 'naturalistic' decision making

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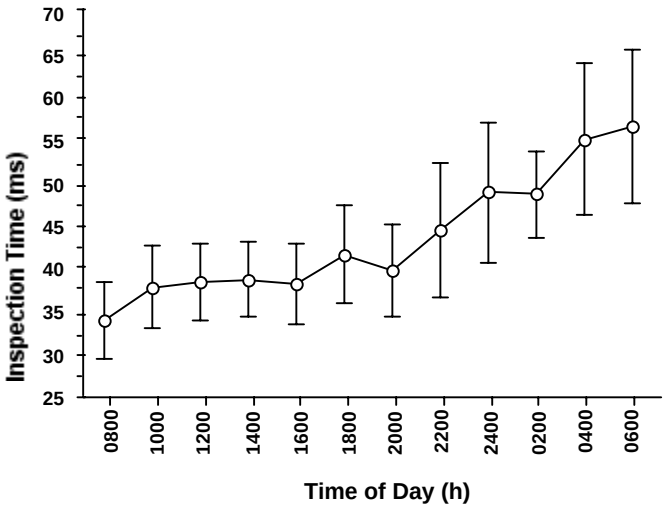
Previous research indicates that human fatigue, induced by sleep loss, time on task, or time of day impairs decision making ability. However, the locus of fatigue-related impairment within the decision making process remains undefined. Theoretical models of decision making in the work-place (generally referred to as 'naturalistic' decision making) have been developed that consist of an initial stage of *situation awareness*. This involves the *perception* of elements in the environment, *comprehension* of their meaning, and *projection* of their status in the near future [1]. The aim of the current study was to examine the effects of fatigue on perception, the first stage of situation awareness. Specifically, the proposed study investigated the effects of fatigue on both lower-level and higher-level visual perceptual processes. Eighteen healthy individuals (mean age 21.2 ± 2.1 years) who were recruited from the general community, attended a pretreatment training session and baseline night prior to 24-hours of sustained wakefulness (07:00h- 07:00h). Perception and performance were assessed at 2-hourly intervals, commencing at 08:00 on day 1 until 06:00h on day 2, using a 30-minute battery. The battery consisted of (i) an Inspection Time (IT) task, a simple stimulus discriminatory measure that probed lower-level processes, (ii) a visually presented Traveling Salesperson Task (TSP), a measure that requires perceptual optimization skill that probed higher-level perceptual processes, (iii) a 10-minute Psychomotor Vigilance Task (PVT), a well-validated measure of basic reaction (RT) that was used as a baseline measure to compare IT and TSP performance, and (iv) a Visual Analogue Scale (VAS) to examine subject's subjective ratings of alertness. Fatigue significantly affected performance on the IT (see figure) and PVT tasks as well as subjective ratings of alertness ($p < 0.05$). However, no significant effects of fatigue on TSP performance were found. Overall these findings suggest that when individuals are suffering from fatigue, erroneous decision making may be due, at least in part to performance deficits at the initial stage of situation awareness, specifically during the stage of lower-level perceptual processing.



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Fatigue monitoring devices: the quest for the grail continues

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Objective: The search for a method to quickly and accurately assess a person's level of alertness, and therefore their ability to perform work safely and effectively, is nothing new. Current economic and demographic conditions within the US are causing people to work longer hours and later in life than they have in recent memory. Despite this shift, work-scheduling practices have remained fairly constant, especially within rail freight. This particular industry continues to utilize highly variable and unpredictable work schedules that maximize worker utilization and pay within the framework Federal hours of service (HOS) law. The present HOS law does not take time of day or days off into account. Performance and safety decrements resulting from fatigue and falling asleep at the controls is therefore a concern. Initially this concern was addressed through the application of an alerter device that required the train driver to press a switch at regular intervals to prevent the train from automatically braking. However, over time the train drivers developed an automatic response to this device, and therefore continued to reset the alerter device though asleep at the controls. Even if the train driver does not fall asleep, a high level of fatigue may impair their ability to perform safely and effectively, and as such are still a safety risk. Railway companies are therefore interested in new ways to measure and maintain the alertness of a train driver. Labor relations issues aside, this presents a serious technical challenge given the multidimensional nature of fatigue. Nonetheless, a host of companies continue to develop new technologies to be used by organizations such as the railroads, either as a fitness for duty screener or as an alerter to inform the driver that they may need to take action to stave off fatigue impairment. The problem is that most of these devices are not validated or are unimplementable in their current form. The current study attempts to develop a framework to evaluate the merit and utility of these different devices for use by railroads.**Method:** A market survey was conducted to identify the current and upcoming fatigue monitoring and alerting devices. Manufacturer and scientific literature was then collected on each device. This information was then sort developed into a device technology-based taxonomy. Where possible, copies of the products were purchased and tested as part of a one-night sleep-deprivation protocol. As it is unlikely that a US train driver would go much beyond 30 hours without sleep and as no device reported working with chronic, partially sleep deprived individuals, an acute sleep deprivation protocol was considered adequate for testing purposes. The participants drove a simulated train and periodically performed a battery of cognitive tests from 10pm-6am. The taxonomy was instantiated with the collected information and simulator study results. **Results:** The taxonomy is comprised of **s**even main branches and seventeen sub-branches. None of these devices have been validated for use in the railroad industry. Most require the driver to be severely, acutely sleep deprived to work properly, or require back-end data analyses and therefore cannot provide useful information in real time. The taxonomy will be presented and distributed. **Conclusions**: The quest for the grail goes on as all the current and known in-development devices have operating constraints that severely limit their usefulness both to industry and to research.

Does teamwork benefit night shift vigilance and performance? - The alerting effect of social interaction

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Objective: There were 2,983 train accidents that occurred in the USA in 2000, 38.5% of which were found to have a direct human error component. While little hard evidence exists that these accidents were the result of sleepiness or fatigue, there is a wealth of anecdotal information that points to fatigue as a real issue among US railroad workers. This may be especially true for the train driver who is often working a highly variable and unpredictable schedules. Until recently, American intercity and freight trains had at least two people in the locomotive cab, especially during nighttime operations. Given current economic constraints, this practice is giving way to single-person operations; the driver may be the only person in the locomotive cab during night runs that do not intersect 0:00 to 06:00 by more than 4 hours. The present study tested the extent to which a second person affects the alertness and performance of a worker at night under mild, acute sleep deprivation. Social Cybernetic theory postulates that the feedback loop established between two people working towards a common goal has an arousing effect on both individuals. It is unclear, however, whether 1) this effect is strong enough to overcome the effects of time of day and time since waking, and 2) the increase in arousal, should it exist, translates into improved job performance. **Method:** Participants include 13 volunteers who are, to the extent possible, demographically similar to the existing population of US train engineers. Males between the ages of 35 and 65 were recruited and then screened to ensure that they were not suffering from health issues that would be dangerous, prohibitive, or confounding to the goal of the experiment (e.g., sleep disorders). An additional requirement was that participants reported a diurnal sleep pattern. A background survey, including scales to measure morningness-eveningness and introversion/ extroversion, was provided prior to participation. Actigraph data were collected for one week prior to the experimental sessions. Alertness-altering ingestibles were controlled. Participants were first trained on the operation of the fixed-based locomotive simulator, and were exposed to other aspects of the experimental protocol. The experiment took place over two sessions per participant, counterbalanced across the study. Sessions occurred overnight, starting at 22:00 and lasted about eight hours. In one session, a second person – a confederate – was present to provide interaction with the participant if the participant chose to engage in conversation. The other session included only the participant. In both conditions, the participant drove the simulator. There were four, 1.5 hour train runs per session. Regardless of condition, the confederate was continuously monitored for percent eye closure (PERCLOS) and heart rate change. Between runs the participant was administered a battery of cognitive vigilance (PVT) tests. The participant was well trained on the simulation tasks, which included an auditory vigilance test, a memory test and a train handling performance test. There was a monetary reward associated with good performance. **Results:** Preliminary results indicate that social facilitation, when used by the participants had a mild alerting effect upon them. There seems to be an association with personality type but not with circadian phasing. Full results will be presented at the symposium.
Conclusions: Whether or not social facilitation improves alertness and performance, the role of distraction needs to be studied as a possible offset to any improvement observed gains.

Developing fatigue management resources for the transportation enterprise: US experience towards a non-prescriptive approach

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This presentation provides details on the US Department of Transportation (DOT) exploration of non-prescriptive approaches to fatigue mitigation, and our successes and lessons learned to date. There will be an explanation of the tools currently developed by the US DOT to address fatigue and a discussion on the next steps to both evaluate our progress and our next steps with this effort. Shift work is now fully embedded into our society. Compared to day workers, numerous studies have documented shift workers as having higher medical costs, more serious accidents, higher absenteeism, more sick time, and a lower degree of job satisfaction. Shift work as a biological, cultural and safety problem, affects more than 20 million working Americans and their families.[5] The US DOT Human Factors Coordinating Committee (HFCC) has identified shift work and employee fatigue as a pervasive problem, one that costs American companies an estimated $70 billion annually in accidents, injury claims and lost productivity.[6] All modes of transportation are engaged in 24/7 operations using work-scheduling regimes of various degrees of irregularity and predictability. Each transportation mode has documented disasters associated with worker fatigue; the US National Transportation Safety Board continues to view fatigue as a top-ten safety issue. Recognizing the safety, health and economic importance of mitigating fatigue, the US DOT has historically relied on a regulatory approach to control fatigue by limiting duty hours. However, to date the US Hours of Service regulations and laws are not based upon circadian science in part due to its perceived impact on bottom line operational costs and wages. This lack of scientific underpinnings with the present regulatory approach has precluded ergonomic scheduling solutions, sometimes exacerbating the problem. Several attempts have been made in recent years within the various transportation modes to rewrite these regulations so they reflect current scientific understanding of work scheduling and fatigue. Most of these attempts, though, have failed due to the compromises required between the various stakeholders and the difficulties of addressing complex technical considerations in a rigid regulatory framework. The US DOT HFCC has begun a program to explore alternate, non-prescriptive approaches to the fatigue management of transportation personnel, reducing reliance on regulation as the sole strategy. This four-fold approach to addressing human fatigue includes 1) the development of better data collection tools and surveillance systems so as to obtain more accurate rate and cost information, 2) the development of a suite of fatigue management tools tailored for non-prescriptive fatigue management within the US transportation enterprise, 3) the testing and validation of fatigue countermeasures that are either commercially available or under development, and 4) the evaluation of fatigue management tools, programs and processes in both a functioning prescriptive (i.e., US) and non-prescriptive management-based approach (i.e., Australia). This is a methodical, long-term effort to change human behavior, corporate and government practice, and cultural norms to improve safety and reducing worker fatigue. Each of the components listed above fulfills a necessary role in developing a non-prescriptive fatigue management approach. For this approach to work, though, it is necessary to gain a high degree of stakeholder acceptance of fatigue management, including willingness to change to work scheduling practices and to make available and utilize appropriate countermeasures. If properly implemented, a tailored non-prescriptive fatigue management approach should provide quicker, more sustainable and substantial progress towards improving fatigue-related safety and health concerns than through regulation alone.

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Referred morbidity, complaints on sleep, fatigue and lack of time and their relation to night work among nursing personnel

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This text describes an exploratory cross-sectional research among nursing personnel, aiming at analyzing whether referred morbidity, and complaints on sleep, fatigue and time management are associated to work time schedule.
The study was carried out at two hospitals, through a structured questionnaire. The study was planned to make univariate analysis of night work as a risk factor for the reporting of diseases and symptoms, and complaints on sleep, fatigue and lack of time for taking care of children, of her/himself, to rest and leisure, and to accomplish domestic duties. People who worked at night in at least one job were considered as night workers. Associations between independent and dependent variables were assessed through the estimation of prevalence ratios with a 95% confidence interval. Additional analysis considered work hours in the past, as well as the experience on night work and the number of working nights as risk factors.
A total of 280 workers took part in the study (260 women) with mean age of 37.1 y; most of them are married or live with a partner; half the sample has children under 10 y. old. Mean time on occupation was 12.6 y. Shifts that included night work were: Night shift: work from 7:00 pm to 7:00 am, followed by two days off (n=46) and 24-hour shift: work from 7:00 am to 7:00 am, followed by five days off (n=96). The report of migraine was less prevalent among night workers. Both current and ex-night workers were less likely to refer to mild depression (complaints on nervousness, anxiety or insomnia), as compared to those who have never worked at night. Working more than 4 nights in the last fortnight was suggested as a risk factor for complaints on lack of time for children and for rest and leisure. High cholesterol was more prevalent among those who work at night for more than 10 y. No significant difference was observed as to the prevalence of complaints on sleep and fatigue between day and night workers.
A possible explanation for the lower prevalence of migraine among night workers is that day workers may be submitted to stress factors that overcome adverse effects of night work (stress is a precipitating factor for migraine). The healthy worker effect does not seem to be a sufficient explanation for this, at least for persistent health effects caused by night work, as judged by results concerning ex-night workers. The absence of difference between day and night workers as to sleep and fatigue complaints may be related to the permission to sleep during the night shift (see Rotenberg et al, this issue) and/or to the night shift adopted in the studied hospitals, that includes two days off after the night work. The high prevalence of reports on high cholesterol among those who have worked at night for more than 10 years may be related to the adverse effects of night work to the digestive system. Complaints on lack of time for children, and for rest and leisure are likely to reveal the social value of evening hours for the family and for the workers themselves. Data deserve further analysis on a larger sample, taking ergonomic and psychosocial aspects of night and day work into account.

Irregular working schedules and health: results of an epidemiological study

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If we have a lot of good informations about the impacts of the classical forms of shiftwork on the quality of life, on the other hand little is known about the effects of flexible working hours which are today increasingly used through all countries and all occupational sectors. A contribution to a better knowledge of this topic is given by a secondary analysis of the data collected by a French epidemiologic survey on health, work and ageing (1). The study included 21378 employees randomly selected from exhaustive lists of workers followed by 380 occupational physicians. They were men and women born in the years 1938, 1943, 1948, and 1953. They were surveyed in 1990 and 1995. The data were collected by means of standardized questionnaires - including data on past and present work and self-evaluation of health based on the Nottingham Health Profile : NHP (2) - and a medical examination.
The collected information enables to compare 4 groups of people with different working schedules:
a) wage earners on normal regular daywork systems, (n=11393)
b) wage earners on alternating shiftwork (n=2897)
c) wage earners on fixed shiftwork systems (n=945)
d) wage earners on irregular working schedules (n=1631)
The comparison of these 4 groups shows that irregular working schedules have a negative impact (with some differences by gender) on five dimensions evaluated with the NHP : Physical mobility, Sleep, Energy, Pain, Emotional reactions. The importance of these effects are evaluated by logistic regression analyses which highlight a particularly salient effect on Emotional reactions. In most cases the frequency of health problems among people with irregular working times is at the middle between those of people on normal day work and people on alternating shift systems, and it appears worse than those of people on fixed shift systems on some points.

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Sleep patterns of adolescents attending classes in two shifts

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In comparison to the children, the adolescent sleep patterns remarkably change due to combined influences of biological and psychosocial factors. As they get older, the adolescents tend to go to sleep later in the evenings, sleep longer in the mornings and the difference between their weekday and weekend sleep patterns increases (1). Since on weekdays their wake time is still being determined by the early school start time, many adolescents worldwide tend to sleep less than minimally recommended 8.5 hours.
The majority of students in Croatia, both in elementary and high schools, attend classes in two shifts. They usually go to school one week from 08:00 to 13:00 and the next from 14:00 to 19:00. In this study we wanted to examine the effects of two-shift schedule of school time on the sleep characteristics of the adolescents.
During October and November 2001 and 2002 students from 5th to 8th grades of elementary school and from 1st to 4th grades of high school were examined in Zagreb. A total of 2365 students from 24 schools completed the Croatian version of School Sleep Habits Survey (2). In this study the results of 1921 students of both genders were analyzed. Their median age ranged from 11 years in the 5th grade of elementary school to 18 years in the 4th grade of high school.
ANOVA showed the effect of grade to be statistically significant for all sleep variables. As adolescents progress from the 5th grade of elementary school to the 4th grade of secondary school they go to bed later on morning shift week ($F_{7/1806}$=77.2), afternoon shift week ($F_{7/1806}$=48.6) and on weekends ($F_{7/1806}$=121). Although the school start time in Croatia does not change with transition to high school, older adolescents tend to wake up somewhat earlier on the morning shift week ($F_{7/1806}$=52.9), since they travel longer to school. On the other hand, older adolescents wake up later than younger ones on the afternoon shift week ($F_{7/1806}$=2.2) and on weekends ($F_{7/1806}$=31.2). The sleep length curtails in older adolescents on the morning shift week ($F_{7/1806}$=126), afternoon shift week ($F_{7/1806}$= 33.4) as well as on weekends ($F_{7/1806}$=37.7). Transition to higher grades also results in more pronounced differences in sleep length and bedtime between morning- and afternoon shift weeks on the one hand, and weekends, on the other.
Regarding sleep characteristics the adolescents from Zagreb experience beneficial effects of two-shift school schedules. During the afternoon shift and on weekends they generally manage to get enough sleep. They are partially sleep deprived only during five days of the morning shift. Future laboratory and field studies will explore the effects of two-shift school schedules on adolescents' daytime functioning and sleepiness.

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R v Gary Neil Hart: Lessons from the Selby rail disaster

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On 14 April 2003, the English Court of Appeal refused Gary Hart leave to appeal against his five-year jail sentence and 10 convictions for causing death by dangerous driving. At just after 6am on 28 February 2001, Hart allegedly fell asleep while driving his Land Rover vehicle, having remained awake the previous night. The vehicle went off the road, down an embankment and into the path of a Newcastle-London express train. The train was derailed and collided with a goods train traveling in the opposite direction. Six train passengers and four train staff died in the accident, and more than 70 passengers were injured. The trial judge, Mr Justice Mackay, described the crash as "perhaps the worst driving-related incident in the UK in recent years", and stated that driving without sleep was morally equivalent to drink driving. The case received substantial publicity in the UK and worldwide, and has increased community awareness of the perils of sleep deprivation. It is reported that the disaster will result in the largest motor insurance claim in history. The aim of the present research was to analyze the main legal arguments in the high profile case of *R v Gary Neil Hart* (in particular those relating to whether the driver was asleep or not) and to identify issues that remain to be addressed in research. Other similar cases will also be discussed.

Among the key facts in issue in the *Hart* case was whether the defendant had fallen asleep while driving and whether before this happened, the defendant knew (or ought to have known) that he was at risk of falling asleep but nevertheless continued to drive. These matters were particularly controversial as the defendant (who elected to give evidence) consistently denied having fallen asleep. An expert witness for the prosecution testified that subjective feelings of sleepiness would be expected to precede sleep, and that after a sleep episode one may not recall such subjective feelings. Details of the evidence given by this expert will be discussed. The fact that this evidence was admitted by the trial judge indicates that such knowledge is deemed to be within the expert domain.

An essential ingredient of the offence charged, as described by the trial judge, is that the defendant knew or could be expected to have known from his subjective feelings of sleepiness that he was at risk of falling asleep. This is an important aspect from a legal perspective, as it imputes culpability or responsibility on the defendant. The process of falling asleep, including subjective experiences of sleepiness, should be the subject of future research. In addition, the question of whether an individual's capacity to self-assess driving competence is significantly impaired by sleepiness warrants further investigation. With the recognition that sleepiness is a substantial cause of accidents in all modes of transportation, issues pertaining to knowledge of sleepiness are likely to be the mooted in future cases.

Sleepiness, napping and driving simulator performance

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Sleep deprivation adversely affects many aspects of mood and performance, including driving performance. One counter measure frequently recommended for fatigued drivers is to take a road-side nap. Sometimes drivers may have to take this nap in less than ideal circumstances which may limit the nap's effectiveness. This study examined the effects of no nap, a non-disrupted nap (in silence in a bed) and a disrupted nap (in a chair with a tape of traffic noise playing) on simulator driving performance, a secondary reaction time task, and subjective assessments of sleepiness and mood in sleep-deprived (26.5hours) drivers. We have previously reported that performance on this driving simulator is impaired by sleep deprivation (1) and is modulated by time of day (2) In this study drivers were sleep-deprived for 26.5 hours overnight then one-hour naps were allowed next morning with testing occurring around noon. Preliminary results indicate no clear nap condition effects but performance on straight segments of driving track is generally more adversely affected by sleep loss than curved segments, and driving performance varies throughout the 60 minute driving sessions suggesting a time on task effect. Sleepiness ratings indicate sleep inertia following the nap in both nap conditions, but also that subjects felt less sleepy

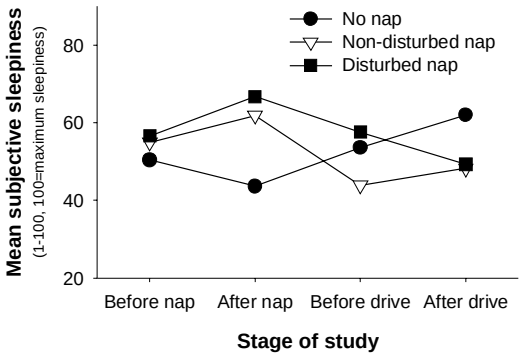

Figure 1: Mean (± SEM) subjective sleepiness ratings in the three nap conditions during each stage of the study.

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An animal model of shift work: Impact on sleep and circadian rhythms

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Objectives
The objective of this study was to develop an animal model of shiftwork. The goal of this model is to determine the impact of 12 hours of imposed activity [work] at different circadian times on sleep and circadian rhythms in mice.
Methods
Young adult male C57BL6/J mice (N=20) were sleep deprived for either 12 hours in the light or dark period of their 12:12 light:dark (LD) cycle. To impose these periods of wakefulness animals entrained to a 12:12 LD cycle were placed in a slowly rotating wheel for 12 hours a day either during their normal active phase (dark N=10) or during their normal rest phase (light N=10) for a period of 10 consecutive days. Core body temperature and sleep were recorded prior to (baseline) and during the imposed wakefulness protocol, this was followed by 14 days of recovery recording.
Results
Preliminary results from animals (N=4) forced to be active during the light phase indicate a significant increase in wakefulness across the 24 hour day compared to baseline and recovery periods. During imposed wakefulness, a mouse never obtained REM sleep and between 20-50% of NREM was achieved. Upon release from imposed wakefulness, mice responded with significantly increased REM sleep during the dark period when they would normally spend the majority of their time awake. We did not observe any alterations in the circadian rhythm of temperature from baseline to recovery periods regardless of sleep deprivation protocol.
Conclusions
We report findings in this animal model similar to those reported in human studies of chronic partial sleep restriction. This animal model will be a useful tool for investigating how the circadian and sleep systems are affected by the desynchrony associated with shiftwork and how this temporal disorganization influences sleep and neurobehavioural capabilities. This novel animal model could also prove important in the development of effective countermeasures to the adverse effects associated with circadian disruption and sleep loss.

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Hours of work for aircraft maintenance engineers in Canada

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Purpose In 1996 the Safety of Air Taxi Operations (SATOPS) task force recommended that Transport Canada "*...initiate a Canadian Aviation Regulation Advisory Council (CARAC) review to determine if AME (Aircraft Maintenance Engineer) duty times should be regulated, and if so, determine appropriate limitations*". The study of hours of work was commissioned as an initial step in addressing the issue of hours of work in the aircraft maintenance environment. The present research set out to determine how many hours aircraft maintenance engineers in Canada work and rest; and at what time of day and under what conditions these hours occur. This presentation will focus on the work/rest cycle.
Method A nation-wide survey was sent to fifty percent of the licensed AMEs working in all parts of Canada. The survey was based on the FAA survey administered in the U.S. in 2000, and modified for the Canadian AME work environment. Phone interviews were conducted with several AMEs representing all operational maintenance environments.
Results Twenty-five percent of the questionnaires were completed and returned. The study sample was representative of geography, facility type, responsibility (AME category) and operational environment. The results showed that AMEs in Canada work an average of over 50 hours per week, with 16 percent working over 60 hours per week, and almost 30 percent of those in helicopter operations working over 75 hours per week. More than half (66 percent) of the AMEs work overtime. Over 50 percent work night shifts. Night shifts can extend to over 21 hours at least once a month for between 60 and 80 percent of the AMEs working nights. Thirty-six percent of the sample indicated they worked at additional jobs outside their responsibility as an AME. A six percent subset of the sample, which included AMEs from all facility types, reported averages of between 60 and 80 hours of work per seven-day period.
Conclusions Like many professions AMEs in Canada work more hours per cycle than the standard 40 hours. At least 15 percent of AMEs in Canada work hours that leave little time for adequate rest and recovery. The industry would benefit from a deeper understanding of the implications of the impact of scheduling and work-rest cycles.

Sleep during the night shift and complaints on sleep and fatigue among nursing personnel at two Brazilian public hospitals

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The allowance to sleep on the job during the night shift was suggested in data derived from a structured questionnaire data on 280 nurses and nurses aids. The present study aims to describe the occurrence of spontaneous sleep during the night shift and to verify whether the length of those sleep episodes is related to complaints on sleep and fatigue in the same population.

The study was carried out at two public hospitals in Rio de Janeiro, Brazil. Data collection were based on a structured questionnaire, sleep diaries and actigraphic records. The description of sleep episodes during working nights was based on diary (2 to 22 days) and actigraph data (3 to 18 days). Both the work at studied hospitals and at any other job was considered, as moonlighting is common among healthcare workers in Brazil. The study of the association between sleep length and sleep complaints was based on questionnaire data corresponding to those who work at night (n=158). In this case, two groups of workers were compared (chi square test) as to sleep and fatigue complaints: those who usually sleep up to 2 hours and those who usually sleep more than this.

Two shift systems included night work at those hospitals: Night shift: work from 7:00 pm to 7:00 am, followed by two days off and 24-hour shift: work from 7:00 am to 7:00 am, followed by five days off. Diary data concerning 167 night shifts showed that sleep occurred in 76% of the working nights; only 2 workers did not take any sleep when working at night. Also, no sleep occurred on the consecutive diurnal period in most cases (53%); generally, the absence of sleep was not because of work on the following day. Actigraph records on night sleep on the job revealed sleep length varying from 35 to 290 minutes for sleep episodes occurring during the 12-h night shift, and from 94 to 273 minutes for those occurring during 24-h shifts. Most episodes (59%) began between 11 pm and 2 am. Those who usually sleep for less than 2 h (according to questionnaire data) significantly showed more complaints on bad sleep and on difficulty to fall asleep, as compared to those who sleep more than this.

Given the opportunity and allowance, practically all workers sleep at work during the night shift. Special places for workers to sleep or rest are available in each sector. Here, a possible interference on sleep on the subsequent day is suggested. The relation between a shorter sleep length and sleep/fatigue complaints suggest a possible role of sleep during the night shift on workers tolerance as to night work hours.

Effect of caffeine intake on cognitive work performance at night-part-3

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Introduction: The present study dealt with the effects of caffeine, one of the popular countermeasures against the decrement of alertness level during night work. The purpose of this study was to clarify the relationships between psycho-physiological indices and to construct a caffeine-effect model on performance at night that may improve alertness management in operational settings and to prevent accidents.
Methods: Six male students (23.2±1.2) participated in this experiments that included three conditions, a non-caffeine condition and two caffeine ingestion conditions (100mg and 200mg). Measurements were made every 40 min in the period of 0:00 to 8:00 in the morning except during the rest period. Caffeine was taken at 2:00. Each subject was asked to perform three performance tests. The tests presented to the subjects consisted of a cognitive work test, similar to the Grammatical Reasoning Test (GR), a Color-Word Test (CW) and a Simple Reaction Test (SR). Self-administered psychological measures were given on five questionnaires, such as KSS and VAS1 (sleepiness), VAS2 (fatigue), VAS3 (stressful) and Vigor in POMS. The CFF Test was also made for measuring arousal level.
Results 1) Caffeine-effect on alertness increased in all questionnaires except for VAS2. The improvement effect by the quantity of caffeine was observed in the tests of CFF, VAS1 and Vigor in mood states.
2) As to the relation between performance and psycho-physiological indices; CFF and VAS1 representing arousal level and sleepiness were associated with performance, but not associated with any doses of caffeine.
3) A caffeine-effect model was constructed by referring to the alertness model developed by Akerstedt, 1995. Prediction of performance was successful with significant coefficients of the determinants by using psycho-physiological indices.

The effects of sleep debt and workload on alertness during a 12-h dayshift

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Objective: Fatigue is known to be common with extended workdays. Our aim was to studythe effects of partial sleep debt and workload on an operator's alertness during a single 12-h dayshift.
Material & methods: Twelve male process operators (aged 36-56 years) completed four experimental conditions including a night sleep and a 12-h dayshift (7:10 a.m.- 7:10 p.m.) in the laboratory. A simulated distillation process served as a work task. The conditions were a monotonous workday after normal (mean TST 7.4 h) and restricted sleep (mean TST 3.6 h) and an active workday after normal (mean TST 7.1 h) and restricted sleep (mean TST 3.7 h). All workdays included morning (7:30 a.m.), noon (10:50 a.m.), mid-afternoon (1:50 p.m.) and late afternoon (5:20 p.m.) work sessions of 1,5 h and cognitive tests. Objective sleepiness was measured with continuous EEG/EOG recordings during the work sessions and with a sleep latency test of 20 min. In the EEG/EOG epochs of 20 sec, sleepiness was indicated by slow eye movements or theta activity. Subjective sleepiness was measured with the Karolinska Sleepiness Scale.
Results: Fourteen percent of the EEG/EOG epochs showed the signs of sleepiness at work during the monotonous workday after sleep debt. The corresponding values were 12% for the monotonous workday after normal sleep, 11% for the active workday after sleep debt, and 5% for the active workday after normal sleep. EEG/EOG defined sleepiness increased with sleep debt ($p=.006$) and monotonous work ($p=.001$). Also the time of day effect was clear ($p=.006$). Sleepiness peaked in mid-afternoon. Subjective sleepiness at work also increased by sleep debt ($p<.001$), but not so clearly by monotonous work. The effects of sleep, work pace, and time of day interacted in the sleep latency test ($p=.003$). The fatiguing effect of sleep debt was clearly greater during the busy workdays than during the monotonous ones in morning and mid-afternoon, but not in late afternoon.
Conclusions: The results suggest that the amount of objective sleepiness at monitoring work is doubled by both one night paritial sleep debt and a monotonous task as compared to normal sleep and an active workday. The peak of sleepiness during a single 12-hr dayshift is reached in mid-afternoon, 7-8 hours since the beginning of the shift.

Sleep-wake rhythm in irregular shift systems

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Objective. Sleep in shift work has been studied extensively in regular shift systems but to a lesser degree in widely used irregular shifts. Our main aim was to examine the sleep-wake rhythm in shift combinations ending with the night or the morning shift in two irregular shift systems.
Material and methods. Three weeks' sleep / work shift diary data, collected from 126 randomly selected train drivers (mean age 42 years, range 33-55 years, all men) and 104 traffic controllers (mean age 44 years, range 26-61 years, all men), were used in statistical analyses including a linear mixed model and a generalised linear model for repeated measurements. We used the length of the main sleep period, the occurrence of napping before the shift and the occurrence of dozing off during the shift as dependent variables. In all statistical tests, the effect of various shift combinations on the sleep-wake rhythm was adjusted to age, number of children at home, subjective sleep need, occupation, and the starting time of the shift.
Results. The sleep-wake rhythm was significantly affected by the shift combinations. The main sleep period before the first night shift shortened by about two hours when the morning shift immediately preceded the night shift as compared with the combination containing at least 36 h of free time before the night shift (reference combination). The main sleep period before the night shift was most curtailed between two night shifts, on average by 2.9 and 3.5 h among the drivers and the controllers, respectively, as compared with the reference combination. Afternoon napping increased when the morning or the day shift immediately preceded the night shift, the odds being 4.35-4.84 in comparison to the reference combination. The main sleep period before the morning shift became 0.5 h shorter when the evening shift preceded the morning shift in comparison to the sleep period after a free day. The risk for dozing off during the shift was associated only with the shift length, increasing by 17% and 35% for each working hour in the morning and the night shift, respectively.
Conclusions. The results demonstrate advantageous and disadvantageous shift combinations in relation to sleep and make it possible to improve the ergonomy of irregular shift systems. Particularly, early shifts immediately before the night shift and evening shifts immediately before the morning shift should be avoided.

Acute mountain sickness in shiftwork at high altitude

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Classical acute mountain sickness (AMS) is described in sportsmen who practices mountaineers, over 5000 meters, but in Chile we have workers over 3000 until 5050 meters and we don't know how is AMS in them. In the altiplanic (north of Chile), thousand of miners working at high altitude in several schedules of permanence in the place of work. Some of these schedules are 4 days on high and 4 days at sea level, 7 days on high and 7 days off, 4 days on and 3 days off, etc. All of them AMS sickness as a consequence of hypoxia.
Method: during a year we followed for one week the ascents to the workplace miners with a questionnaire about symptoms and signs workers have at final place, 6, 12, 24, 48, 72 and 96 hours of permanence. We started the questionnaire in a random way taking the buses who ascent to the miners, explain the study and giving them the questionnaire. During 4 days they answer the questionnaire at the beginning of the day and we supervised this asking them. We followed other group of miners who work at sea level to compare only the effects of altitude. **Results**: We compared only the first 4 days for all schedules. AMS are present in 70% of miners in first day, 48% at second, 27% at third and only 16% at 4th day. The principal symptom was insomnia and was present in workers that must sleep during the day (78%) respect to the others who sleep at night (74%). At high altitude quantity and quality of sleep are altered (decreasing both). The second place in frequency of symptoms was headache (day shift: 22 %, night shift: 11%). The others frequencies symptoms in mountaineers appears in low frequency in workers (fatigue: 20%; decrease appetite: 20% and dizziness: 2%). **Conclusions**: the symptoms of AMS in miners at high altitude, miners at sea level and sportsmen are different. The most important symptom at altitude is insomnia and represent by itself the symptom that can be distinguish AMS at altitude because the others are not different respect to sea level. By this reason we can use a typical questionnaire for AMS in workers to identify problems at high altitude.

Questionnaire: 1450	Miners High Altitude	Miners Sea Level	Sportsmen
Insomnia	78	32	70
Headache	30	33	96
Fatigue	20	20	35
Decrease Appetite	20	20	38
Dizziness	2	20	27

Comparing AHP and ANP shiftwork models: hierarchy simplicity v/s network connectivity.

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The objective of this presentation is to show a comparison of models and results between two different but complementary methods applied to the real shiftwork problem.
The Analytic Hierarchy Process (AHP) for decision-making uses objective mathematics to process the inescapably subjective and personal preferences of an individual or a group in making a decision. With the AHP, we can construct hierarchies composed in the first level by strategic or politic criteria, then open each one of these levels in more specific sub-criteria until reaching the lower or technical level, also known as terminal criteria or behavior indicators.
The method called Analytic Network Process (ANP), is a mathematical extension of the AHP method, where the feedback process is allowed, moreover, you can connect any criteria with another one (even with himself) in different ways. These new groups, called clusters, may have a set of criteria or alternatives (now called nodes) inside. Once the model is built, we continue by entering the judgments or pair wise comparisons of elements with respect to each of the influenced element. Then, by means of eigenvectors, we derive ratio scales (metric) that are internally located in one stochastic super matrix (matrix of matrices). Finally, to prioritize in a form that reflects all the different interactions between clusters, nodes and alternatives, this process hangs from an even higher level strategic hierarchy that control all the benefits, costs, risks and opportunities that the specific shiftwork problem has.
The results of this network modeling process are then compared with the AHP ranking results obtained for the same problem and both decision metrics are compared to evaluate how compatible the final results are. The following table show this metric comparison for a set of 4 different shiftwork alternatives:

Shifts (alternatives)	AHP (rating)	ANP (rating)
7x7	**1**	**1**
4x4	0,953	0,970
7 weeks	0,591	0,565
9x3	0,562	0,707

The incompatibility index between AHP and ANP turns out, for this case, to be just 1.1%, calculated with the Hadamard formula (metric compatibility index for 2 different vectors). Which means that this two vectors solution are 98.9% compatible. This is a very high level of compatibility, considering that in the decision making process, good practices allows values of 10 or even 11% of incompatibility to represent 2 compatible decision metrics.
Conclusion: the ANP modelling process, replaces a big amount of criteria by the proper network relations (connectivity) between elements and clusters, so the problem is represented in a very compacted way. We can see that almost "equally good results" can be obtained considering that, the AHP model was built avoiding the feedback process that appears in real life problems; this good results was reached mainly due to the modelling effort done, which is reflected in the over 400 criteria that have the AHP general model (The Shiftwork Asset Software).

Shiftwork at high altitude: how to choose a good system

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During several decades people who design shiftwork systems to other people who must to work at high altitude have use only some criteria not recognized for experts, in this way in few years or months the mining operations have face problems and they need again to make a change in his shiftwork scheduling. At high altitude one of the most important criteria is acclimatization, this criterion acquire a very relevant position for each variable since modulated all the remaining criteria.

Objective: meet knowledge, created standard scales based in researches of difference field (medicine, biology, psychology, anthropology, operations work, economy, etc.) and integrated all of them information to take a decision.

Method: Using the Analytic Hierarchy Process (AHP), 22 professionals with their experiences (hard data and softdata), identify the variables that influence shiftwork at high altitude, developing cardinal scales for each one using different researches, after that, each professional in their field used a double enter matrix gotten the eigenvector with the weights of each variable.

Results: we obtained an asset software that can be customized to the specific reality of one enterprise at high altitude, reaching the priorization that represent the cardinal level of impact of one set of shiftwork; in health, productivity, family relations, public relations, etc. and identifying the differences between them. Since we have created cardinal measurements in absolute scales, we can introduce a new shift alternative and evaluated only this and get what is the relative position among the others. Another important element that we can obtain with this kind of models are the theoretical limits (thresholds of impact) like: shift limit, is when a shift meet conditions that are very bad for us; healthy limit shift, is the level when the damage in health start to be unacceptable, and ideal shift, a non real shift, but very useful as a point of reference.

Conclusions: the model allow us take a better decision to work in this environment and identify the most sensible variables for correcting conducts. We also may know the thresholds for our biology in different workplaces. Finally, this manner to face the shiftwork issue is useful in other fields of continuous work systems.

Alternative	Total
Limit Shift (theorical)	,4009
☑ D4/H12/E12	,3508
☑ D12/H12/E8/12x12	,3094
☑ D7/H12/E12/L	,3025
☑ D10/H12/E8/10x10	,2948
Healthy Limit Shift	,2889
☑ D4/H12/E8	,2829
☑ D7/H12/E12/Mi	,2606
☑ D7/H12/E8/L	,2378
☑ D7/H12/E8/Mi	,2325
Ideal Shift	,1217

Effect of the light/dark regimen on sleep spindle distribution in a simulated eastward flight

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Introduction: Simulated jetlag protocols in healthy individuals have indicated that changes in the sleep-wake schedule have various effects on EEG sleep recordings (1). Recent evidence indicates that spindle frequency activity (SFA) displays a circadian pattern (2). Different schedules of light administration have been shown to have varying effects on the adjustment of the circadian pacemaker (3). The temporal distribution of SFA should thus be sensitive to the circadian phase at which sleep is scheduled. The study aims to test the effect of a 5-hour phase advance on sleep EEG in young healthy individuals and assess the effect of different schedules of light administration. **Methods:** Seventeen healthy drug-free participants (age = 25.20 ± 3.29, 13 males) maintained a regular sleep schedule for 3 weeks prior to admission into a time-free environment. After 3 baseline days, they underwent a 35-hour constant routine to unmask the expression of their endogenous circadian pacemaker. They then lived for one week on a schedule that was advanced by 5 hours relative to baseline. They were assigned to two groups of light exposure using a daily 6-hour light stimulus of 380-lux. Circadian phase was reassessed by a final 45-hour constant routine. In the **late light** group (n=7), phototherapy was planned prior to bedtime to impair circadian adaptation. In the **early light** group (n=10), phototherapy was started at the original wake time and advanced by one hour daily (**early light** group; n=10). This was designed to improve circadian adaptation to the new schedule. Sleep of the last baseline day and of the last shifted day was analyzed. Spectral analysis of frequency ranges were performed using low (12.25–13.00 Hz) sigma activity. **Results:** A phase advance of +5.32 + 0.76 hours and +1.38 + 2.64 hours was observed in the early light and late light groups, respectively. This shift was significantly different between both groups (Two-factor ANOVA: $F_{1,26} = 26.49$, $p < 0.0001$). A circadian misalignment thus persisted in the late light group in that subjects were going to bed at a circadian phase that was about 3.5-hours earlier than on their original schedule. In this group only, the peak of low SFA occurred significantly later compared to baseline conditions (p=0.033). **Conclusions:** The present study indicates that a 5-hour advance in the sleep-wake schedule has significant effects on low SFA. As in previous reports, the low range sigma activity was the most sensitive to circadian phase (2). Moreover, different schedules of light administration had significant effects in modulating the ability of the circadian pacemaker to adjust to an abrupt change in schedule.

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Evaluation of sleep patterns among interstate bus drivers before and after their work shifts

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Objective: The present study sought to evaluate, by means of polysomnography (PSG) the sleep pattern and somnolence (MSLT), of professional interstate bus drivers from a commercial company.

Methods: The study was carried out in two phases, distributed as follows: In the first evaluation, the driver spent a first night of adaptation to the exam (PSG)(1), followed by a whole PSG recording night and a multiple sleep latency test (MSLT)(2) two hours after waking up. In the second evaluation, the driver underwent the PSG recording immediately after a nocturnal working journey and, two hours after waking up, the driver was submitted to the MSLT. Were evaluated 32 bus drives.

Conclusion: It is possible to conclude that the drivers exhibited high levels of excessive somnolence, AHI and PLM either on the first or on the second phase. Although the total sleep time was undistinguishable between the phases, a lower sleep efficiency was observed on the 2nd phase, due, mainly to the longer waking time. This fact shows that drivers may be sleep deprived and shift-work may be causing sleep disturbances, since sleep was not refreshing on the second phase of the study, thus becoming a risk factor for accidents.

Table 1. Sleep pattern parameters evaluated by PSG. (n=32)

VARIABLE	Phase 1	Phase 2	p(#)
Sleep latency (minutes)	16 ± 1	3.9±3	0.01
REM sleep latency (minutes)	89± 5	77.4±4	0.01
Total sleeping time (minutes)	393 ± 93	361± 95	0.07
Time awake (minutes)	50 ± 3	76 ± 5	0.04
Sleep efficiency (%)	84 ± 9	76 ± 17	0.02
Periodic Leg movements (PLM)	18%**	28%**	0.005
Apnea/hypopnea (AHI)	38%***	38%***	Ns
Snoring	35%	50%	0.02
Somnolence (MSLT)	51%	51%	Ns

** % drivers who presented PLM/h above 5 (5 paroxisms ≥3 contractions/hour of sleep) in the respective phases.

*** % drivers who presented AHI above 5 /h.

data were analyzed statistically by the Student t-test paired, except for PLM and AHI and Somnolence, which were analyzed by the Mcnemar- chi-square test.

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Correlations between night work and tiredness in self-employed, home-based IT workers with preschool children

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The objective of this study is to evaluate the material circumstances of night, self-employed home-based IT work and its possible deleterious effects. Such work has increased in the past five years in Japan, due to recent advances in small, lightweight computer terminals with high data storage capacities and the spread of high-speed networks, among other factors. The participants in this study consisted of 15 home-based IT workers (mean age and standard deviation; 34.6 +/- 3.9 years) with preschool children aged less than seven years. The study consisted of a time budget study, a study of tiredness, and measurement of the amount of motion activity, all conducted over a period of one month. In the time budget study, a special format was used, with entry spaces for thirteen kinds of activities in a 16-row list. Each row was divided into 96 sections per day, each section corresponding to a 15 min period. The thirteen items included sleep, having a meal, commuting and travelling, work at computer-based work, non-computer based work (e.g., meetings), learning, childcare and nursing care, and taking a bath. Since these workers were all fully computer literate, the time budget study was prepared in computer file format. In addition, we had them record their tiredness upon waking and when going to sleep. We instructed them to send this time budget study file to the researchers by e-mail on a daily basis. We used the amount of motion activity as an index of sleep quality, using wrist activity monitor (Actiwatch 64) attached to the non-dominant arm for one month. We analyzed time budget data covering an aggregate total of 300 weekdays and 150 weekends and holidays. Our results indicated increases in tiredness among those working 4 hours or less and among those working 6-8 hours. On days when the workers worked for 8 hours or more, however, their degrees of tiredness resembled those of days off. We then analyzed daily work times in tandem with the working hours.
The results of this analysis clearly showed that a more correlation exists between night work and level of tiredness; when work was done in the night hours, degrees of tiredness increased. In addition, the distribution of work times on holidays resembled that of weekdays, the median of working hours was between 2100 and 2300 (Fig.1). These results clearly showed that the work of self-employed, home-based IT workers with preschool children tends to extend into the night hours, blurring the boundary between weekdays and holidays. More importantly, this tendency has a deleterious effect on this group of workers, notably increasing their levels of tiredness.

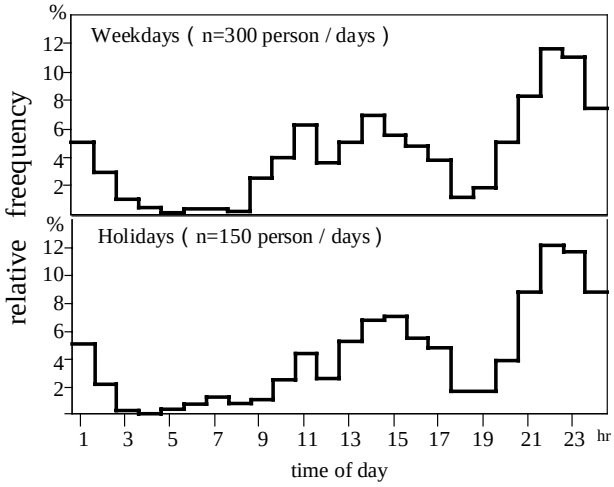

Fig. 1. Distribution of computer-based work on weekdays and holidays

Sleep disturbances are common in readio and television personnel working in a irregular shift work

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Regular shift work is related to several acute and chronic health problems, most of them being related to the circadian rhythmicity of humans. At least one-fifth of the 4500 employees in the Finnish Broadcasting Company work non-standard schedules (Morning-TV, 24-hour news, broadcasting monitoring personnel, text-TV etc.). The aim of this study was to analyse the differences in the perceived health of employees with or without irregular shift work.
A standardised questionnaire was mailed to 1550 employees working either in an irregular shift work or in a regular 8 hours daytime work. The work duties of the media personnel included journalism, broadcasting, program production, technical support and administration. The questionnaire covered demographic items, employment details, general health experience, physical status, psychosomatic symptoms, psychosocial status, work satisfaction and performance, and health care use. The questionnaire also included the assessment of sleep habits, insomnia symptomatology, associated and sleep/mental disorders and daytime consequences.
The overall response rate was 56% (53% men). The response rate was 75% (56% men) in shift work group and 34.5% (46% men) in daytime workers. The mean age for males in shift work was 45±10.6 years and for females 41±10.7 years ($p<0.001$). The respective figures for daytime workers were 48±9.5 and 45±10 years ($p=0.088$). Shift workers reported difficulties in falling asleep often or continually (27.1%) significantly ($p=0.031$) more often than daytime workers (21.3%). They also reported frequent nightmares (8% vs. 4.7%, $p<0.001$) as well as tiredness after normal sleep (27.4% vs. 20.3%, $p<0.001$) significantly more often than daytime workers. Moderate or severe lethargy (19.9% vs. 11.4%, $p=0,034$), irritability (18.4% vs. 8.8%, $p=0.011$) and tiredness and weakness (24.8% vs. 15.8%, $p=0.022$) were all significantly more often reported by shift workers. Shift workers also reported having dyspepsia often or continually significantly more often than daytime workers (12.9% vs. 7.4%, $p<0,05$).
Thus, it is concluded that sleep disturbances such as early insomnia, nightmares and tiredness after normal sleep are common in radio and television personnel working irregular shifts. Apart from regular shift work also irregular shift work seems to affect circadian rhythmicity through autonomous nervous system and cause noticeable discomfort to workers and affect their well-being and satisfaction in their daily life.

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Ergonomic design of working hours - integrating workload aspects

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Problem - The ergonomic design of working hours has a long tradition as one of the preventive strate-gies to avoid impairing effects (e.g. fatigue) from work. Since the intensity and the duration of the workload influence the resulting effects – multiplicatively combined – in an exponential function, shift length, rest periods and the sequence of shifts should be adjusted to the inten-sity of the physical and mental workload. However, this problem has usually been neglected for the time being. This has most probably been due to reasons of the complexity of the prob-lems involved and the problems of measuring and specifying criterion functions with regard to workload. In a project supported by the Federal Ministry for Education and Research under the program 'Innovative work design' an attempt has been made to address this problem in the context of computer aided scheduling of working hours.
Methods - First an applicable and suitable method (called EBA) has been developed to assess the intensity of physical (6 items), emotional (4 items) and mental (5 items) workload components and their temporal patterns. The EBA is intended to allow for an objective assessment and analysis of workload (or work stress) by people at the shop floor. Evaluations with potential users, e.g. designer of working hours or safety practitioners, have been carried out in a manufacturing company at different workstations with different tasks (e.g. assembly, inspection) to test the applicability of the instrument for the intended user population. Each worker on five se-lected workplaces has been observed for at least 20 minutes before assessing the workload at this workstation by ergonomic experts and practitioners. Multifactor analyses of variance have been applied to assess the inter-rater-reliability among and between ergonomics experts (n=3) and non-experts (n=3) and to investigate, whether the method is suitable to differentiate different kinds of workplaces with different kinds and amounts of workload. Based on these workload assessments and the functions described in the ergonomics literature, criterion functions have been specified and tested in the evaluation and generation of shifts with regard to shift duration and shift sequence.
Results -The Results show a significant main effect between the two groups (ergonomics experts vs. non-experts), but no significant effect for raters within groups. In general there is a tendency for the non experts to use higher workload levels, which is most probably due to the fact that practitioners make use of their experience with these jobs beyond the observation periods and then assess rather conservatively. Lack of interaction effects for group x user x item indicates a comparable understanding of the concepts to be assessed. Results further show a significant interaction effect for workplace x item, but no significant main effect for workplaces, indicating that EBA differentiates different kinds of workload, without being subjected to halo-effects. The resulting criterion functions seem to allow already for an implementation into workload oriented shift design, but will be improved and tested in a stepwise procedure, using observational and psychophysiological workload assessments across whole shifts.
Conclusions - EBA is an applicable and suitable prototype of a method to assess the intensity and temporal pattern of workload components. The specified criterion functions seem to be appropriate to evaluate and design working hours with regard to the intensity of workload.

Ergonomic design of working hours - Part 1: BASS 4 - Development of a software program for the evaluation and design of working hours

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Problem: Computer aided evaluation and scheduling of working hours according to ergonomic criteria has shown to be both effective and efficient, since in participatory approaches to shift schedule design advantages and disadvantages of individual solutions can be demonstrated clearly and rapidly to the parties involved, allowing them to make informed decisions. However, some problems have usually been neglected, e.g. taking workload and economical aspects into account design and evaluation of working hours and in trying to evaluate and to support the design of flexible working hours arrangements.
Methods: An attempt has been made to solve these problems and to extend and redesign our existing computer program for the evaluation and design of shift schedules [BASS 3.0 (1)]. First an applicable and suitable method has been developed to assess the intensity of physical, mental and emotional workload components and their temporal patterns. Based on the available literature, criterion functions have been specified and tested for the evaluation and generation of shifts with regard to their duration and sequence, which have been implemented into the revised system. Furthermore economic criteria have been identified and specified, allowing for an evaluation and joint optimization of working time systems (see contributions by Schomann et al and Stapel et al, this conference).
For the evaluation and design of flexible working hours the applicability of the existing approaches, criteria and procedures have been tested. One of the problems is that the evaluation and the design of such work schedules will most probably have to be based on an individual level (as opposed to a group level in shift scheduling). At least for the evaluation of past schedules this seems to be possible and most probably this should also be possible for an (at least limited) time perspective in the design of individual future work schedules.
Results: First results from tests with different prototypes seem to support this. Since the project will be finished in April 2004 the then actual prototype of the computer program BASS 4 will be demonstrated. The current version includes the main module for the design and evaluation of shift schedules with a new user interface and the workload and economics modules. Results concerning the evaluations of flexible working hours module will be demonstrated on site.

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Relationships between occupational stress, gender, and shiftwork in air traffic control

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A survey was developed to assess shiftwork and fatigue among the U.S. air traffic control workforce in 1999. Using data from the survey, this presentation will focus on self-reported occupational stress, gender, and fatigue associated with working a rotating shift schedule, individual differences, and selected health outcomes. **Method.** Among the instruments used in the survey was a modified version of the Standard Shiftwork Index (SSI - Barton, Folkard, Smith, Spelten, & Totterdell, 1990), adapted for the air traffic control workforce. The modified SSI was used because it addresses numerous measures that have been traditionally viewed as outcome variables. Of direct relevance for this study was the inclusion of a single item designed to assess work stress: "In general, how stressed do you feel at work?" Responses were provided on a five-point scale, from "Not at All" to "Extremely" (The Marlin Company, 2000). A number of biographical items were also included within the survey. In total, the 24-page, scannable questionnaire contained 161 items and required around 50 minutes to complete. **Results.** The response rate (28%) was lower than that generally found in mailed surveys within the FAA; however, the overall sample (n= 6,753) was representative of the controller population. Analyses focused on the respondents who were Certified Professional Controllers (CPCs) and involved those in active control of air traffic, along with a second group of air traffic control specialists (Flight Service Station - FSS) who were primarily involved in providing weather and other advisory information to pilots. The CPC sample was comprised of 588 women (15.3%) and 3,251 men. The FSS sample was similarly comprised of 169 women (19.3%) and 705 men. A majority of the CPCs fell within the 36-45 age group (58.6%), whereas the majority of FSSs (58.7%) were over age 45. Overall, responses to the single-item measure of occupational stress were similar to those of the normative group, with 20% CPCs and 16% FSSs reporting that they felt "quite a bit" to "extremely" stressed at work compared with 24% in the 1999 U.S. national sample. Bivariate analyses indicated no statistically significant gender differences in self-reported occupational stress. Regression analyses suggested a fair amount of overlap in the factors associated with occupational stress in both CPCs and FSSs; gender differences in both groups were not significant. Gender differences were evident in several of the traditional SSI outcome measures. For instance, female controllers reported significantly higher levels of chronic fatigue, somatic anxiety, neuroticism, and poorer general well being. **Discussion.** The findings regarding stress were in line with prior research, which found ATCSs reported levels of stress similar to that of individuals in other professional organizations. Regression analyses suggested that similar factors predicted job stress in male and female employees. The stability of gender differences for several of these psychological measures complicates interpretation of any interactive effects of gender and rotating shift schedules.

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Monitoring the impact of shiftwork on employee well being

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Safe design (Christensen and Manuele, 1999) underpins OHS and therefore has been the focus of recommendations for shift work practice (Knauth, 1993). Traditionally well designed rosters have been endangered by unplanned and excessive working of overtime hours. Today this concern is given added emphasis by increased reliance on labour flexibility to meet market driven production (Smith and Wedderburn, 1998) as much as to address work-life balance (Tausig and Fenwick, 2001), to support shift worker participation in the design of shift rosters ((Kogi and Martino, 1995), and to encompass the greater diversity of contractual arrangements for employment (Martens, et. al., 1999). The need for flexibility to meet both work and life demands highlights the importance of fatigue management (Smith and Cross, 2001) with a fatigue management plan that brings together roster design, work hours policy, support arrangements, and the ongoing monitoring of the impact of shiftwork on employee well being (Queensland Government, Natural Resources and Mines, 2001).
This paper will outline and discuss the potential and practical utility of monitoring the impact of shiftwork on employee well being using shift worker surveys, human resource management data and production data.

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Building a safe environment: circadian rhythms, shift work, industrial hygiene and toxicology

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Human biological functions are organized in time in terms of growth, development and aging and as biological rhythms of discrete frequencies. Under routine conditions, human circadian rhythms are staged during diurnal activity to support and fuel optimal efficiency and to neutralize encountered potentially noxious chemical, physical and other agents and during nocturnal sleep to support the rest and repair of the diurnally "stressed" tissues and organs. The chronobiology of shiftwork has been the subject of numerous laboratory and field investigations and international conference the past 35 years or so. Shift workers in many industries are routinely exposed to potentially harmful substances during every 8h, 12h or extended shift; however, little attention has been given to the circadian time structure in the development and testing of industrial exposure standards designed to protect workers from harm. The setting of industrial exposure standards is based on many criteria (e.g., body burden, metabolic and clearance kinetics and epidemiologic studies). Most such studies have failed to take into account the potential role of the circadian time of exposure on worker tolerance and subsequent disease. This may be because industrial hygienists, occupational health physicians, toxicologists and epidemiologists who conduct these studies assume the biological time of exposure is irrelevant. Numerous laboratory experiments on rodents prove the circadian time of exposure is a major determinant of the effect, even survival, of a large variety of substances, including ones commonly found in the work environment. Moreover, the pharmacokinetics and/or the desired and side effects of most classes of medications are now known to differ, sometimes radically, according to the circadian time of their dosing. Together, the findings of animal and human circadian rhythm studies suggest the tolerance of workers to industrial contaminants and medications can be affected by shiftwork schedules. This presentation will review the evidence of circadian rhythms in the susceptibility-resistance of human beings and laboratory animals to potentially harmful substances and to medications with reference to the concerns of industrial hygienists, toxicologists and occupational health physicians.

The relationship of working hours and work intensity with sleep disturbance among 12-hour shift workers in the automobile factory in Korea

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Backgrounds: While most workers in the automobile factories in Korea have been working with 12-hour shift, worker's worrying about the health on shift work has been emerging. However, a few studies related to the shift work and health have been undertaken in Korea. The objective of this study is to explore the relationship of working hours and work intensity with sleep disturbance among 12-hour shift workers in the automobile factory in Korea.
Methods: Among 300 workers, who were randomly selected in the 10,000 workers in one car factory, 262 workers filled out the questionnaire and sleep diary. A cross-sectional questionnaire and a sleep diary during 14 consecutive days were distributed and collected by workers' representatives, who were trained for the participatory action research in this study. Logistic regression analysis was modeled using the prevalence of severe sleepiness at work (i.e. Karonlinska Sleepiness Scale 7 or higher) as dependent variable and working hours, sleep pattern, work intensity, health behaviours as independent variables.
Results: The prevalence of severe sleepiness at work was more than 60% after finishing night shift in the automobile factory. The main risk factors related to the severe sleepiness at work were long working hours, night shift, poor quality of sleep, sleeping hours and intensified work. Especially, the odds ratios showed that the risk for severe sleepiness was 6.51 times higher in the workers with the long working hours more than 10 hours compared to the workers with 8 hours or less work. As for the work intensity, risk for severe sleepiness was 2 times higher in the decreasing tendency of resting time in a day compared to the increasing decreasing tendency of resting time in a day.
Discussion: It is suggested that long working hours, intensified work and short duration as well as quality of sleep were main risk factors for the severe sleepiness among the 12-hour shift workers in the automobile factory in Korea.

The work and rest of the civil airline pilot

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An important consideration in the management of civil air operations is the disruptive effect of duty schedules on the sleep and circadian rhythms of aircrew. Unlike the shift worker, aircrew are rarely able to establish a regular pattern of work. The timing of flights varies from day to day, as does the frequency of the alternation between daytime and night flights. In addition, as a result of the time-zone changes associated with transmeridian flights, the circadian rhythms of aircrew may be out of synchrony with the local environment. Problems are often exacerbated by flight delays and other operational changes, so that there are large variations between the hours rostered and those actually worked. All these factors make it difficult for aircrew to establish an acceptable pattern of sleep.

Short-haul operations are characterized by early starts, late finishes and, in many cases, by night flights, although frequent night flying is a feature of cargo rather than passenger operations. The main problem with early start times is the difficulty in obtaining adequate sleep prior to departure. Sleep is truncated because the onset of sleep does not advance sufficiently to compensate for the early start, and approximately 30 minutes of sleep is loss for every hour that the report time advances between 09:00h and 05:00h. Early starts, together with multiple flight legs, are associated with increased levels of fatigue. This has led to the recommendation that restrictions be placed on the number of consecutive early starts and on the number of individual flight legs on the most demanding rosters (1).

In the past few years, a considerable number of studies have been carried out of the sleep, circadian rhythms and alertness of aircrew on long-haul routes. Frequent time-zone transitions have a major effect on the timing, duration and quality of the sleep of aircrew, and the most significant disruption tends to occur after a long eastward flight (2). Levels of alertness during the flights are influenced by a variety of factors including circadian rhythms, time since sleep and the duration of the flight, and large increases in fatigue have been observed towards the end of long overnight flights (3). On longer flights, additional crew members are carried and sleeping facilities are provided on the aircraft. Aircraft that will shortly be coming into service will be capable of even longer non-stop flights than current aircraft, and a major challenge will be to ensure that the in-flight rest will be sufficient to ensure that acceptable levels of alertness can be sustain throughout the flight.

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Economic design of working hours - integrating economical aspects

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Problem: Many computer programs for the evaluation and design of working hours or shift schedules merely contain some legal and sometimes even ergonomic criteria but economic aspects are usually neglected. In the framework of the development of a new computer program for the evaluation and design of shift schedules (BASS 4) economical aspects and functions have thus been integrated in addition to ergonomic and legal criteria. Against this background and based on the relevant economic literature economic criteria and functions have been identified, specified and tested, allowing for an evaluation, generation and joint optimization of working hours systems. It is thus now possible to compare different systems of working hours with regard to the economical effects as well.

Methods/Procedure: The relevant criteria from an economic point of view are the costs of working hours arrangements or. shift schedules. Based on the available economic literature primarily the following types of costs have to be considered:

1) labour costs (depending among others on different occupational qualifications)
2) surcharges (additional labour costs, i.e. costs for a certain time, e.g.: overtime premia, for night work, costs for work on Saturday, Sunday)
3) (extra) allowance (i.e. costs over the entire labour time, e.g.: productivity supplements, bonus for shift-work)
4) structural costs (e.g.: maintenance, repair, service).

These types of costs have been applied in the economic evaluation of systems of working hours by specifying appropriate functions, which at the same time can be used for the generation and optimization of working hours, using a “linear programming” approach.

Results: First applications with taking these types of costs into account show that it is possible to differentiate different solutions of working hours or shift schedules with regard to their economical effects and to optimize these solutions for economic criteria: For example following options (i.e. variations) may be used for such an optimization of working hours systems:

1) adjustment of shifts (e.g.: from Sunday to Friday, concerning night hours)
2) addition of shifts (with additional personnel requirements)
3) elimination of shifts (with additional surcharges for the remaining operators)
4) variation of working hours.

The results further show that systems can be effectively improved (e.g. as compared to the initial system) and so to find those working hour systems, which jointly optimize systems for economic, ergonomic and legal criteria.

The electrical stability of the rat myocardium in conditions of hypoventilation and reoxygenation. Chronophysiological study

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Objectives: At the present time it is known that practically all functions of cardiovascular system fluctuate in the circadian dependence. From this reason, the aspect of circadian variability would considered in the studies of factors with direct or indirect impacts on cardiovascular parameters or on relationships between them. Although it is generally accepted that some disorders of pulmonary ventilation belong to the group of proarrhythmogenic factors, it was not studied in the circadian dependence. The goal of our study was to determine the dependence of the changes in the electrical stability of the heart on the light - dark cycle at the disorders of pulmonary ventilation. **Methods:** The ventricular arrhythmia threshold (VAT) was measured in female Wistar rats (adaptation on the light regime 12 : 12 h, ketamine/xylazine anesthesia 100mg/15mg/kg, i.m., open chest experiments). The conditions of the normal artificial ventilation and reoxygenation V_T = 1ml/100g, respiratory rate 40 breaths/min, hypoventilation V_T = 0.5ml/100g, respiratory rate 20 breaths/min. The animals, after tracheotomy, thoracotomy and five minute stabilization, were subjected to 20 minute hypoventilation followed by 20 minute reoxygenation (n = 11, light group; n = 19, dark group). The control VATs were given by electrical stimulation of the right ventricle base after surgical interventions and five minute period of stabilization at the normal ventilation. In the course of hypoventilation and reoxygenation, VATs were measured after 5., 10., 15. and 20. minute of respective ventilation. **Results:** The differences in the control VAT values were not found between the light (1.90 ± 0.84 mA) and dark (1.88 ± 0.87 mA) part of day. Hypoventilation changed the electrical stability of the rat heart in the dependence on the light - dark cycle. Although the VAT decreased parallelly in both light parts of day during 20 minute hypoventilation, the higher VATs were found in the dark part of day (2.35 ± 0.95; 2.12 ± 1.02; 2.20 ± 1.25; 1.93 ± 0.99 mA) a compared to values from the light part of day (1.68 ± 0.43; 1.20 ± 0.45; 1.28 ± 0.67; 0.86 ± 0.44 mA). Reoxygenation partly rectified the VAT to prehypoventilatory values in the both light parts of day (1.74 ± 0.72 mA reoxy light vs. 1.90 ± 0.84 mA control light; 1.99 ± 0.92 mA reoxy dark vs. 1.88 ± 0.87 mA control dark). The problem remains that the VAT was increased only in the light and not also in the dark part of day against hypoventilatory values. **Conclusion:** It is concluded that the myocardial vulnerability, measured by ventricular arrhythmia threshold, fluctuates in the dependence on the light - dark cycle at the disorders of pulmonary ventilation in rat model. Important and still unanswered question remains, what is primarily. Mobilization of mechanisms responsible for the changed electrical stability of the heart by hypoventilation, with the additive effect of the light - dark cycle, or by others factors oscillating in the circadian dependence, with the additive effect of hypoventilation. The recovery of VAT is probably more effective during light than dark part of day. The dark VAT decrease signalizes the increased vulnerability of myocardium or larger extent of the reoxygenation injury of myocardium in active part of day.

Comparison of the prevalence of premature beats with 24-hour Holter electrocardiography in shift workers in a manufacturing company

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Objective
The objective is to assess whether there are differences in the prevalence of premature beats between normotensive and hypertensive shift workers and between dayshift and night shift with the use of 24-hour Holter ECGs.
Methods
First, 9 hypertensive and 11 normotensive shift workers were fitted with 24-hour Holter ECG monitors and comparisons were made between the prevalence and types of premature beats encountered among 20 shift workers.
Second, it was investigated differences in the prevalence of premature beats between day and night shifts for 7 among 20 shift workers.
Results
The prevalence of isolated supraventricular premature beats (SVPB) and SVPB runs were higher in the hypertensive shift workers than in the normotensive shift workers, but without statistical significance.
Among 7 shift workers, one had more ventricular premature beats in night shift than that in dayshift.
Conclusion
This study was a preliminary investigation in shift workers to clarify the differences in the prevalence of premature beats with the use of 24-hour Holter ECGs.
The results suggested the necessity of a larger scale study to clarify an association between shiftwork and the prevalence of premature beats.

Elevated daytime sleepiness in day and shift workers experiencing stress at work

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For working populations, daytime sleepiness is unfavorable. However, it can be seen as a sign of how workers cope with their working conditions. Mounting evidence indicates that job stressors may cause health problems. We know that working shifts affects the level of sleepiness considerably. Yet, what remains unclear is the role of job stress in daytime sleepiness. This study investigated whether daytime sleepiness would be varied as a function of stress at work for day and shift workers.

Participants included 828 day workers (male 386, mean age 43±13 years; female 442, 35±9 years) and 205 male shift workers (mean age 39±13 years). They worked in various industries, and 44% of the day workers had professional jobs and 47% of the shift workers had technical ones. Participants completed a self-administered questionnaire asking job stress (quantitative workload, variance in workload, job control, social support from supervisors, coworkers, and family/friends), stress responses (job satisfaction and depressive symptoms [CES-D]), sleep habits, daytime sleepiness (Epworth Sleepiness Scale, ESS), and lifestyle (exercise, smoking, and drinking). The scales of job stress and stress responses were derived from the Japanese version of the US NIOSH generic job stress questionnaire. The scale scores for job stress and stress responses were divided into four groups with quartile points. Differences in ESS scores between these four groups were tested by analysis of covariance (ANCOVA) with age and sex (only for day workers' data) as covariates. Subsequently, ANCOVA was made with age, sex, and other factors (lifestyle, comorbidity, insomnia, sleep duration, work hours) as covariates. Insomnia was defined if one had at least one of the following three symptoms: over 30 minutes in falling asleep, difficulty in maintaining sleep or early morning awakenings 3 times or more a week. Prevalence of insomnia was 18% and 25% for male and female day workers, respectively, and 32% for shift workers. The ESS scores were 6.2±3.5 and 7.3±3.5 for male and female day workers, respectively, and 5.5±3.3 for shift workers. ANCOVA showed significantly higher ESS scores of day workers by greater quantitative workload, greater variance in workload, higher job dissatisfaction, and more depressive symptoms. For shift workers, significantly higher ESS scores were found with higher job dissatisfaction and more depressive symptoms.

The results indicate the build-up of daytime sleepiness among day workers who experience high workload, its large variance, job dissatisfaction, and depressive symptoms. Also, daytime sleepiness may be elevated among shift workers when they have job dissatisfaction and depressive symptoms. Our findings suggest that those occupational factors should be addressed in managing workers' sleepiness.

Effects of length and timing of nighttime naps on task performance and physiological functions

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To examine the effects of the length and timing of nighttime naps on task performance and physiological functions, an experimental study was carried out under simulated night shift schedules. Six healthy male students were recruited for this study. The study was composed of 5 experiments. Each experiment involved 3 consecutive days with one night shift (22:00-8:00) followed by daytime sleep (11:30-17:00) and night sleep (0:00-7:00). The naps had in different length and timing in the 5 experiments: between 0:00 and 1:00 (E60), 0:00 and 2:00 (E120), 4:00 and 5:00 (L60), 4:00 and 6:00 (L120), and with no nap taken. All subjects underwent the 5 experiments in a counterbalanced order. The intervals between experiments were at least 5 days. During the night shifts, the subjects typed documents from paper sheets into a computer for 30 minutes and underwent computerized performance tests; choice reaction time test (RT), logical reasoning test (LT), and vigilance test (VT). A questionnaire for subjective fatigue feelings and a critical flicker fusion frequency (CFF) test were administered after the performance tests. Heart rates, R-R intervals, and rectum temperature were recorded continuously during the experiments. The R-R interval data were transferred into a computer after the measurement, and a frequency analysis was performed. An electroencephalogram, electromyogram, electrooculogram, and electrocardiogram were also recorded during the nighttime nap, daytime sleep, and night sleep to analyze sleep stages.

Sleep latency was shorter and sleep efficiency was higher during the L60 and L120 naps than in the E60 and E120 naps. Slow wave sleep and REM sleep during the E120 and L120 naps were longer than in the E60 and L60 naps. The high frequency power component of the R-R intervals during later timing naps tended to be higher than during earlier timing naps, although the difference was not significant. Performances under the no nap condition deteriorated with the progress of night work. The mean lengths of VT response time were suppressed after E60 and E120 naps. The CFF values tented to increase after the E60 and E120 naps. However, the results of the RT and CFF tests after L60 naps were deteriorated due to sleep inertia. The change of the rectum temperature after the E120 nap tended to be higher than that in other experiments. The complain rates of subjective fatigue feelings significantly increased with the progress of night work under all the conditions, but there were no significant changes associated with nap conditions.

In summary, earlier naps counteract the decrement in task performance and physiological functions during night shifts. On the other hand, performances were somewhat improved by taking a 2-hour nap with later timing, but deteriorated after taking a one-hour nap due to sleep inertia.

Teens at work: the burden of a double journey on sleep-wake cycles

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Changes in biological components of the sleep-wake cycle occur during puberty years. Additionally, changes might also be associated to several factors, such as school hours, duration and type of activities during free time and working hours. A former research conducted among students who work and don't work of a small town of São Paulo State, showed different patterns of sleep-wake cycle between the two groups [(1)]. **Aim**: The aim of this study was to evaluate sleep-wake patterns between working and non-working students, either in paid and unpaid jobs, living in the Metropolitan area of São Paulo, Brazil.
Methods: A field study was carried out among high school students, attending evening classes (19:00-22:30h), of a public school. Twenty-seven students, ages 14-18 years old participated. Students groups were: working students (8 males and 8 females), non-working students (5 males and 6 females). Mean weekly working hours were 46,6 (SD= 7.4h). A comprehensive questionnaire about working and living conditions, as well as reported health symptoms and diseases, was answered. Activity- rest measurements were continuously recorded with Actigraph (Ambulatory Monitoring, USA). Activities and sleep diaries during 15 consecutive days were reported. Main variables were tested using two factors ANOVA and t-Student tests. **Results:** A) The duration of night sleep was shorter among working students [$F_{(1,23)}$=16,7; p=0,00], and males [$F_{(1,23)}$=10,8; p=0,00] than non-working students. B) The male working students showed a shorter nap duration during the working week [$F_{(1,23)}$=5,6; p=0,03]compared to females and non-working students. C) Working students took naps approximately in 45% of the recorded time, while non-working students nap 16% of the recorded time [$T_{(1,25)}$=5,5; p=0,03]. Compared to non-working students, working students nap twice to three times a day [$T_{(1,25)}$=20,2; p<0,01] and during classes [$T_{(1,25)}$=7,3; p=0,01]. Reported sleep complaints such as "difficulties waking up in the morning" [$F_{(1,23)}$=6,5; p=0,02] were higher among working students. Regarding self-evaluation of complaints related to night sleep, it was observed a "work effect" of "easiness to wake up" [$F_{(1,23)}$=6,5; p=0,02] and worse night sleep quality during Monday-Friday [$F_{(1,23)}$=6,2; p=0,02] among working students. **Conclusions:** Work caused negative sleep consequences among these adolescents, with possible build up of a chronic sleep debt. The burden of a double journey (study and work in full-time jobs) significantly affects sleep quality and duration. It can also have negative effects in their quality of life, and schooling development.

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Do nations differ in the impact of the night shift on the well-being of workers?

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A Survey of Health Care Professionals was designed, translated and back-translated by the authors into five languages. The survey was then completed by 876 health care workers from Brazil, Croatia, Poland, Ukraine and the USA.[1] Only health care workers were studied in a rough effort to equate for occupational differences in work design and work demands. In a previous report, the Croatian data from this survey found that shiftworkers reported being more physically tired at the end of their workday than non-shiftworkers.[2] Although this finding is intuitively compatible with expectations, it does not address the issue of whether this impact varies from country to country. The present report examines whether nations differ in the impact of the night shift on perceived well-being.

The respondents from each country were sorted into night worker and non-night worker groups on the basis of individual responses to the question "Do you usually work at night?" Reported physical fatigue at the end of the workday was the dependent variable for an analysis using a 2 X 5 ANCOVA model, with work schedule (night, non-night workers) and nation (Brazil, Croatia, Poland, Ukraine and USA) as independent variables. Number of work hours per week and rotating/non-rotating shift were included as covariates. With physical fatigue as the dependent variable, the results showed significant differences for work schedule, nation, and the interaction of work schedule and nation. Additional ANCOVAs were calculated using other measures of worker well-being and quality of life from the survey. These included reported mental fatigue, tenseness, work ability, and several composite variables developed in previous analyses of this data base[1]. For every dependent variable examined, there is a significant effect for nation, but the impact of the work schedule and/or the interaction test are not always significant.

The results of this study consistently support the general proposal that nations differ significantly in their perceptions of well-being. The data also suggest that the manner and/or degree to which night shift work impacts the work force in a given nation varies. For some variables, the impact of night work on worker-reported well-being and quality-of-life may be minimal. With other variables, the impact of night work is significant and must be taken into account in the organization of working time. The interaction of these variables is complex, and more research on nation differences is needed.

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Sleep strategies during watchkeeping at sea : consequences on subjective alertness

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Introduction: A common work/rest schedules at sea, based on the watchkeeping, is the 4-on/8-off. In this system it is difficult to sleep for 7 or 8 hour at convenient times because of work scheduling and socializing (1). Thus, sleep disruption, associated with critically low levels of alertness at some time during the watch, is a serious problem among watchkeepers (2). A countermeasure to improve alertness is taking a short sleep episode whenever is possible. Also, we propose to analyze the effects of different sleep strategies on subjective alertness of crewmembers aboard an oceanographic research vessel. **Method:** A total of 21 watchkeepers and day workers participated during at least 11 consecutive days. Watchkeepers worked on a 4-on/8-off pattern: 0-4/12-16; 4-8/16-20; 8-12/20-24, i.e. twice 4-h shift a day, and day shift. A 10-cm Visual Analogue Scale (VAS) was used to evaluate subjective alertness every 4 hours. Sleep/wake rhythm was assessed by sleep diary and actigraphy for 10 watchkeepers in different shifts. ANOVA for repeated measures was performed.
Results: Sleep was fragmented into a main sleep episode and one (rarely two) second sleep episodes (>15min and shorter than main sleep). Three different strategies were observed in the watchkeeper groups and two in the dayworker group. Each strategy had one or two sleep episodes at various time of day (table 1).

Table 1 – Sleep strategies according to different shift. M/morning ; N/night ;A/afternoon ; E/evening ; EN/ early night/ 0/no second sleep episode.

Shift	Main sleep episode	Second sleep episode	Sleep strategy
« 0-4 »	M	0	M+0
	M	A	M+A
	M	E	M+E
« 4-8 »	M	0	M+0
	EN	M	EN+M
	M	E	M+E
« 8-12 »	N	0	N+0
	N	<16:00	$N+16^-$
	N	>16:00	$N+16^+$
« day shift »	N	0	N+0
	N	A	N+A

For all types of shift, the time of day effect on alertness was significant (« 0-4 »: F=7,2 ;*p=.0001/* « 4-8 »: F=23,7 ; *p<.0001/* « 8-12 »: F=25; *p<.0001/* « day »: F=38,2; *p<.0001*). In the « 0-4 » and the « 8-12 » shift, sleep strategy tended to have a significant effect (strategy*time of day: « 0-4 »: F=2,5 ; *p=.08*; « 8-12 »: F=3,0; *p=.19*) but no effect in the other two shifts. In the "0-4" shift group, those who adopted the M+A strategy showed a decrease in alertness at 16:00 (p<.0001) and those who adopted the M+E strategy at 20:00 (p<.0001). In the "8-12" shift group, a significant difference in alertness was found at 16:00 between the N, $N+16^+$ strategies (p<.005) and N, $N+16^-$ (p<.05). **Conclusions:** The present results suggest that the timing of the second sleep episode is determinant in alertness level, particularly to maintain alertness in an appropriate level before the late shift. Nevertheless, the decrease in subjective alertness in the "0-4" shift group may be due to the sleep inertia more than the sleep strategy. References: Tirilly, G. **Social factors strength in sleep/wake adjustment and alertness aboard an oceanographic boat.** Paper presented at the 16th Congress of the European Sleep Research Society, 2002, Reykjavik.Sanquist T, Raby M, Forsythe A, Carvalhais A. Work hours, sleep patterns and fatigue among merchant marine personnel. **J. Sleep Res**., 1997; *6*, 245-251.

Alcohol consumption and body temperature. A circadian study.

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Only a few controlled studies deal with the effect of alcohol on core body temperature and they examine single doses of ethanol. No published studies report the effects of a 24-h consumption period, of the type found in heavy drinkers. We therefore conducted a trial based on a 26-h alcohol consumption period with 9 (23.3 ± 2.9 yr) healthy and synchronized volunteers during a single-blind, randomized, crossover study comparing a 26-h alcohol session and a 26-h placebo session. In the alcohol session, 256 g of ethanol were administered between 1000 the first day and 1200 on the second day to obtain blood alcohol concentrations between 0.5 and 0.7 g/l throughout the session. To obtain a significant blood alcohol concentration (BAC) at the beginning of the data collection (1200), 20 g of ethanol were administered orally at 1000, 1100, and 1200; then 10 g/h were administered from 1300 to 2100 and from 0700 to 1100 on the second day. The alcohol administered was mixed with fruit juice. In the placebo session, only fruit juice was administered. To enable subjects to sleep while simultaneously maintaining a sufficient BAC, 7 g/h of alcohol (Curethyl*) in saline solution were administered intravenously during the night (between 2200 and 0600) in the alcohol session and saline solution only in the control session. A rectal probe for recording core temperature was inserted at 1200 and left in place throughout the monitoring period. Rectal temperature was recorded every 20 min throughout the 26-h experimental period. For each subject, the two sessions were separated by 2 to 5 wk. During observation, subjects were in bed; they ate standardized meals at 0800, 1200, and 1900 on the first day and at 0800 and 1200 on the second day. Lights were off between 2200 and 0600. Ambient temperature ranged from 20 to 22°C. Blood samples were collected every 6 h (1200, 1800, 2400, 0600, and 1200 h) for blood alcohol determination. We found that alcohol consumption led to a decrease in core body temperature at the beginning of the trial, in the daytime (between 1240 and 1400), a finding consistent with the standard hypothermic effect of alcohol reported in the literature. The principal finding of our study, however, is that alcohol consumption increased nocturnal core body temperature by inducing its nocturnal increase (average increase of 0.36°C); this resulted in an H" 43% decrease in the amplitude of the circadian temperature rhythm. Our data, obtained on a circadian basis, strongly suggest that the effect of alcohol on core body temperature is time dependent and ultimately reduces the amplitude of the rhythm.

Factors moderating the impact of long work hours on well-being

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Results are presented from a large scale questionnaire survey of train drivers in the United Kingdom. The research explores the relationship between the number of hours worked per week and a range of physical and psychological health outcomes, and also fatigue. While previous research suggests that prolonged work hours tend to negatively impact upon workers' health and well-being, the overall picture remains unclear, with several inconsistencies within research findings. It has thus become evident that the precise nature and level of the impact will depend upon a range of moderating factors. The current study examined the role of a range of such potential moderators. The first category of moderators to be examined were the various motivations that underlie an individual's decision to work overtime. Three types of motivation were identified within the current sample, namely: 'extrinsic / financial' (workload pressure, instruction from supervisor, desire to earn money); 'commitment' (to organisation, customers, job goals, supervisor / colleagues); and maintenance of job security and good working relations. Overtime worked as a result of extrinsic / financial pressure moderated the relationship between hours worked and cardio-vascular symptom frequency. The results suggest that working overtime in response to extrinsic demands and / or financial pressure is likely to be especially harmful. Secondly, respondents who reported having relatively little control over how much overtime they worked, or when they worked it, were more likely to show a significant positive association between hours worked and cold / flu symptom frequency. This is interpreted in terms of the beneficial effects of schedule flexibility and choice in working-time arrangements. Thirdly, amongst those reporting a deficit in social support from colleagues and / or friends, there were significant associations between the number of hours worked per week and cardio-vascular and cold / flu symptom frequency. This is interpreted as providing partial support for the social buffering hypothesis. Fourthly, respondents reporting high levels of interference between hours worked and life outside work (e.g. performing household duties, non-domestic chores, leisure activities, maintaining close relationships, exercising, eating healthily and sleeping adequately) showed significant positive associations between number of hours worked and cold / flu symptom frequency, as well as between hours worked and psychological well-being. Moreover, those reporting lower levels of interference reported negative associations. These findings are interpreted in terms of the fit between domestic / non-work circumstances and work schedule characteristics. Finally, additional comments made by the respondents suggested that, even though many of them worked very long hours (30% worked more than 50 hours per week), the way in which their hours were arranged may have been at least as salient as the overall quantity of those hours. In the light of the complex picture that emerges from an examination of the relationship between long work hours and health and well-being, doubt is cast upon the utility of a single blanket limitation of weekly work hours, as specified in the European Working Time Directive. We conclude by considering the possibility of specifying work hours limits, based upon an assessment of individual circumstances and / or working conditions.

New method for screening adaptation to shift work

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Objectives: Tolerance to shift work, adaptation to shifting schedules and special personality traits characterizing habituation to rotating shifts are issues of increasing importance for the worker's health, life quality, and social and family life. Data on specific screening shift work candidates are scarce. Therefore the goal of our study was to develop a new method for predicting suitable candidates for rotating shift work. Here we describe the construction of a novel test battery to screen shift worker candidates.
Method: The study included 2 populations: 224 candidates for shift work, and 274 shift workers. A special battery of tests was developed comprising self-administered sleep questionnaires on potential sleep disorders and sleep habits in addition to personality and traits questionnaires. In the first stage the candidates for shift work (mean age 28.8 ± 6.3 years) were examined with the new battery. Then the data obtained for each worker were subjected to factor analysis technique to identify clusters of characteristics. The results of the factor analysis suggested 2 factors. In the second phase of the study, the extracted factors were compared between adapting and non-adapting shift workers. Non adapting shift worker was defined as worker who complained of the combination of "difficulty falling asleep after any of the shifts" and "frequent mid sleep awakenings after night shift".
Results: Based on factors analysis, candidates could be classified into 2 types: 1. The sleep disturbances personality: multiple complaints regarding sleep, fatigue and falling asleep in disconcerting situations. 2. The blinkered personality: has rigid habits, rigid day schedule, needs quiet while asleep, and is a member of voluntary organizations. Based on our new method, 196 candidates were found suitable for shift work and were recommended to start working, while twenty-eight were rejected. There was a statistically significant difference between the accepted and rejected candidates for factors 1,and 2 ($z=1.81$, one-tailed $p<03$, $Z=2.13$, one-tailed, $p<.02$). The same battery of questionnaires was administered to shift workers from the Israeli Electricity Company. 274 shift workers participated in this part of the study (age 42.08±9.08 years, seniority 15.169±9.76 years). 186 workers were defined as adapting (age 40.86 ±9.18, seniority 13.65 ± 9.34), while 66 were defined as non-adapting (age 43.22 ± 8.33, seniority 17.13 ± 9.79). Comparing the scores of the 2 factors between the adapting and non-adapting workers with the Wilcoxon Rank Test, revealed that non-adapting workers had significantly different scores on the 2 factors. There was a statistically significant difference between the adapting and non-adapting workers for factors 1 and 2 ($z=5.15$, one tailed $p<0001$, $Z=2.38$, one tailed, $p<.009$). In the first factor, the sleep disturbances personality; all non-adapted workers scored higher than 14.2 ($z= 5.0$, $p<0.0001$). In addition, 72.9% of the adapted workers also had factor 1 greater than 14.2. The blinkered personality factor did not differentiate between the adapting and non-adapting shift workers. With the increasing technological complexity of the jobs that shift workers are called upon to perform, and the consequences for the health of others, early screening of candidates to shift work becomes an issue of crucial importance.
Conclusion: Therefore our new method of predicting potential adaptation to shift work may have practical implications for screening shift work candidates.

Circadian variation in cortisol reactivity to an acute stressor

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The objective of the present study was to investigate the role of the circadian pacemaker in cortisol reactivity to an acute stressor, i.e., a cold pressor test. A constant routine protocol was used to control for time-related changes in the masking effects of sleep, posture and physical activity by requiring subjects to remain awake in a semi-recumbent position for 26 h. To estimate the potential impact of sleep deprivation, the subjects were randomly divided into an early-start (09:00 h), group 1 and a late-start (21:00 h), group 2. After 2 h of lab adaptation, a cold pressor test was presented every 3 h. The cortisol response was assessed by means of saliva samples that were taken shortly before and after the test. The pre-test samples were considered to be base-rate measures. Cortisol reactivity measures were estimated by subtracting the base-rate values from the post-test values. Figure 1 shows similar 24 h patterns for both group 1 and 2. Base-rate cortisol declined during the day with the nadir in the first hours of the night, followed by a robust increase towards the end of the night, with the circadian peak attained at approximately 08:00 h. Figure 2 shows that cortisol reactivity scores were increased at 06:00 h, whereas at other times the scores remained close to base-rate values. A repeated-measures ANOVA with between-subjects factor Group and within-subjects factor Time-of-day was performed. For both measurements, the Time-of-day factor proved significant (respectively: $F_{7,168} = 16.92$, $p < .001$, $\varepsilon = .383$; and $F_{7,175} = 8.01$, $p < .001$, $\varepsilon = .523$) and no effects were found for the Group factor. Apparently, the baseline values as well as the reactivity responses varied in a circadian pattern, which was not significantly affected by sleep deprivation. Thus, in conclusion, the present study shows that not only the static level but also the dynamic properties of the HPA regulatory system are controlled by the circadian system.

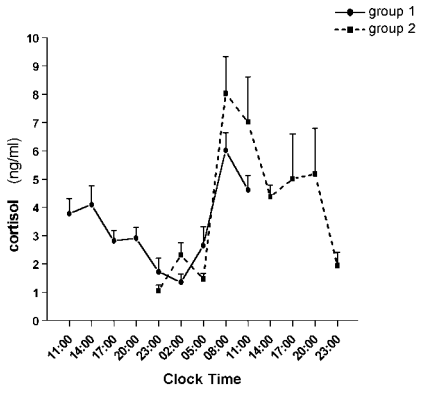

Figure 1: chronological representation of base-rate cortisol values for Group 1 (N=15) and Group 2 (N=11). Bars represent standard error of mean.

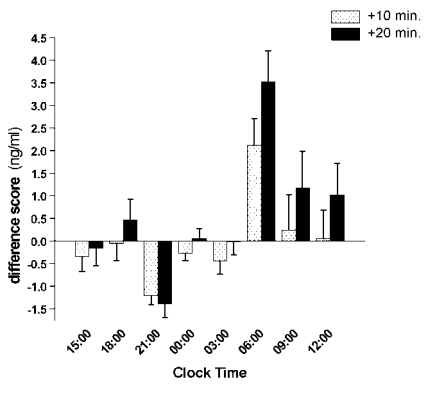

Figure 2: cortisol reactivity values; 10 min and 20 min post-test values minus base- rate value (N=26). Bars represent standard error of mean.

Shift differentials compared

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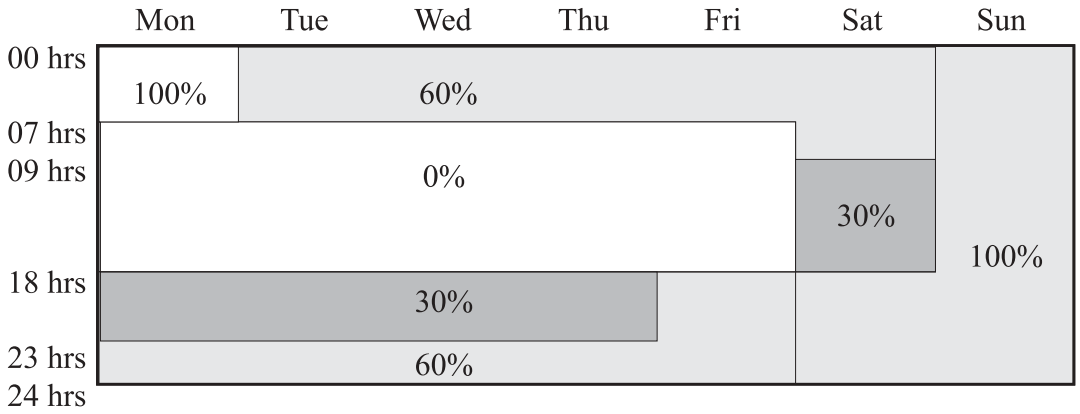
Traditionally in Dutch industry shift workers get paid shift allowances based on fixed percentages of their income for working in a stable shift schedule. As flexibility is increasing in all sectors of industry, employers and unions look for the development of shift differential systems that can cope with more flexible shift systems. An example of such a system is the so-called matrix inconvenience scheme (see below), where the percentages implicitly indicate the inconvenience of the different time zones and (explicitly) the allowance to be paid on the hourly wage.



These matrix inconvenience schemes are custom-made, most likely because of the need for support among the shift workers. Matrix inconvenient schemes from different collective labour agreements show noticeable similarities in the resulting allowance percentages for standard shift schedules.
The development of a new system for compensating the inconveniences of shift work urges to make explicit statements about what is considered fair and what is not. For instance, should the shift differentials be fixed or percentage payments, should they be based on the planned shift schedule or on the actual hours worked, should the compensation be built in the salary or not, should the system concentrate on counter weight or rather on counter value compensation. What are pros and cons of these parameters?
Eight groups - working in different shift schedules - from different ground departments of an airline company have participated in a study to develop a fair, well-fitting compensation system within the organizational conditions. The groups show a striking conformity in their judgements of inconvenience-time-zones and the degree of inconvenience related to these hours.
An attempt will be made to compare the Dutch 'normal workers-results' to compensation practices in non-western countries, including such conditions of employment variables as average working hours, annual leave, etc.

Cardiovascular risk in operators under 24-hour shiftwork and radiofrequency electromagnetic radiation

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The technical stuff in the broadcasting and TV stations is working under high stress, monotony, extended shifts and radiofrequency electromagnetic radiation (EMR). The long term effect of some of these stressors is known to contribute to cardiovascular disease. The aim of the study was to assess the cardiovascular risk in operators working under 24-hour shiftwork and different levels of radiofrequency EMR.

The cardiovascular risk was assessed in 120 operators, divided in two groups of 60 persons from broadcasting and TV stations and compared with 120 operators from radiorelay stations, matched by sex and age, with the same job characteristics except for the radiofrequency EMR. A dosimetric evaluation of the latter in the studied stations was carried. The cardiovascular risk was assessed on the base of arterial pressure, lipid profile, body mass index, tight/hip ratio, smoking, family history for cardiovascular disease and stress during work. Lipid profile included the following indices: total cholesterol (TC), high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), triglycerides and HDL-C/TC ratio. Stress was assessed following the excretion rates of cortisol, adrenaline and noradrenaline in 36 operators: three groups of 12 subjects from a broadcasting, TV and radioreley station on four hours during the 24-hour shifts. Cortisol was assessed using RIA, the catecholamines were measured by spectrofluorimetric method. The data were calculated with variation (one-way ANOVA), tests of between-subjects effects (SPSS), correlation and regression analysis.

The dosimetric data show high level radiofrequency EMR exposure with the broadcasting station operators and low level with the TV station ones. High incidence of hypertension was found in the broadcasting and TV station operators and it reached 60% of the investigated. The systolic and diastolic blood pressure, TC, LDL-C and HDL-C/TC ratio were significantly higher in both broadcasting and TV station operators in comparison to radiorelay station ones. Also TC and LDL-C were significantly higher in the broadcasting station operators than in the TV station ones. The effect of high level EMR exposure was significant on cortisol ($F_{(1,143)}$=12.724, $p<0.001$), adrenaline ($F_{(1,143)}$=4.941, $p=0.028$) and noradrenaline ($F_{(1,143)}$=20.980, $p<0.001$) excretion rates and was manifested with very high values during the first four hours of the shift and high ones during the second four hour period. The increase in the excretion of stress hormones under low level exposure did not reach significance, but the effect on cortisol excretion was in the frame of trend.

Summing up, our data indicate very high cardiovascular risk in broadcasting station operators working 24-hour shifts under high level radiofrequency EMR and high in TV operators exposed to low level EMR. Multifactorial preventive strategy for coping with hypertension, improving the lipid profile and lowering stress at work, factor increasing cardiovascular risk and moderating the cardiovascular risk factors was implemented.

Night work and health aspects among intensive healthcare unit workers

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Objective: A cross sectional study was conducted to evaluate night work effects on health personnel in intensive care units.
Methods:
A prospective-descriptive study was conducted taking a universe of 102 medical and paramedical workers out of the total 108 (81 paramedical workers-nurses- and 21 doctors).
Data was collected during year 2002 at "Abel Santamaria General- Teaching Hospital", Pinar del Río, Cuba.
Age, sex, working time, psychological manifestations, stress, libido, hypertension, cardiac rate disorders and sleep disorders were collected using a questionnaire. The study participants were sampled according to their job positions.
Results: Average age of the group: medical doctors 35 years (14 were interviewed- 66.6%), registered and nurses aid 30 years (52 interviewed- 64.1%). Males prevailed in the group of doctors (15- 71.4%) and in the nurses, females (56- 69.1%); doctors worked 44 hours/week and rested 60 hours; nurses worked 50 hours/week and rested 48 hours, working in alternative shifts. Female workers in the age bracket of 30-40 years old showed the majority of the reported disorders. Most of them were registered nurses, and nurse assistants. They reported the greatest number of weekly working hours (62.3%), compared to physicians. Sleeplessness and emotional disturbances (anxiety symptoms) were the most reported manifestations (89% and 52,6% respectively); it was followed by stress symptoms (67,2%), and decrease of libido (8,9%). Hypertension and tachicardia represented (43,5%) of the cardiovascular referred symptoms.
These results showed that night workers of the Intensive Care Unit in this hospital environment have a great number of reported sleep and psychic disturbances. These findings point to the need to implement a program of health promotion. This would prevent an aggravation of these health symptoms, and further decrease of work ability.

Actimetry assessment of sleep distribution through a shiftwork rotation with intermittent altitude exposure

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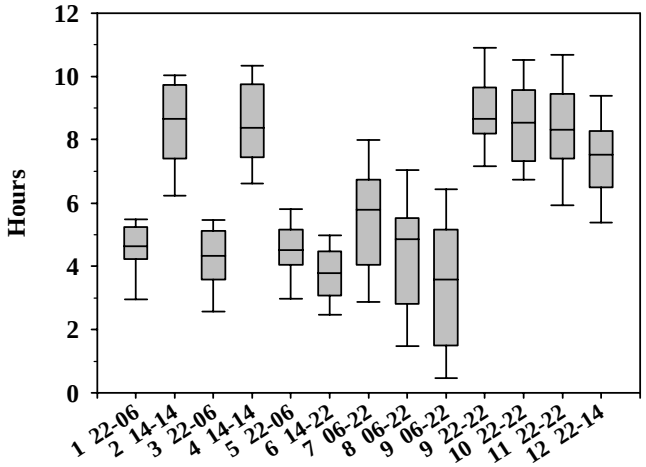
Sleep transition and maintenance are active physiologic processes under homeostatic and circadian regulation. A major issue in evaluating and improving a shiftwork schedule should be the assessment of the actual behavior of workers in the time spans allocated for work, social life, rest and sleep. Actimetry allows long-term monitoring of sleep wake distribution in real-life settings. We conducted a study for 24 days in 36 workers of a high altitude (3,400 m, 2-hour travel time) copper mine. Data on labor accidents, seasonal effects, sleep while traveling and workers tasks were also considered. Data was also collected on cognitive tests and the Standard Shiftwork Index. Workers were under a 12-days rotating schedule: EMEMEMNNNFFF (E = 1400-2200, M = 0600-1400, N = 2200-0600, F = free). Time of day and place allocated for sleep changed throughout the rotation, with the miners staying in dormitories on location in the eight hours between the three E-M sequences and between the M-N sequence, and going home in the other intervals. Sleep behavior was assessed in terms of total amount, distribution, latency and quality. The results on total amounts of sleep per interval are presented in the Figure. Problems related to circadian and homeostatic disregulation and family and social disturbances are inherent to shiftworking. High-altitude mining activity adds the further burdens of intermittent exposition to altitude, long transportation times and isolated environments. Reliable knowledge of actual sleep-wake cycle of workers through rotations is a necessary point of departure for assessing and improving alternative schedules.

Daily amount of sleep throughout the 12-day schedule



What is the best way of educating shiftworkers? Reflections on a career

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Objective: To reflect on a career in shiftwork research, in order to improve the one talk I am giving all year as President, which ends up as a Presidential Address to the BPS in April 2004.
Method: My work started as *observation,* with naked experience of watch-keeping in the Royal Navy on my National Service, preceded and followed by a night shift on one day a week to meet academic deadlines at school and at university. At University, this was combined with being a sleep-deprived subject for Ian Oswald (1), which taught me about some of the artificialities of sleep measurement, and reading Kleitman (2), which taught me about isolation in caves (where there are seldom many shiftworkers.) Observation continued for four years in the steel industry, where I worked a weekly rotating shift system. *Serendipity* contributed a large *survey* of shiftworkers on the 2-2-3 rapidly rotating system in my first research job, which was planned to be about trade union problems.
A further series of body temperature studies, including tidal shiftworkers (who moved sleep according to their domestic circumstances), day and night sleep of two shiftworkers in a sleep lab., and three more surveys of shiftworkers. On reflection, these are simply extended forms of observation. Lastly, two field experiments tested the effectiveness of three hours of one-to-one counselling, using an experimental and delayed group, and then measured the effectiveness of a booklet of written educational information, with a similar design of experimental and delayed groups.
Results: One-to-one counselling was significantly effective; providing written materials was not.
Conclusions: The results are ironic, considering that most of my work has been in writing, both in journals and in BEST (Wedderburn 1992). Reflecting on it all makes me aware of the limitations of writing, in a practical working world, and of scientific interventions, compared with observation and luck. Replication is necessary, and perhaps an extension to counselling by trained fellow shiftworkers or occupational nurses and doctors.

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The "Healthy Shift Worker Effect' in the relationship between shift work and longitudinal change in blood pressure and body mass index

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Objective: To investigate whether there are healthy shift worker effects, ie selection-in and selection-out bias in a longitudinal study of BP, BMI and shift work. **Methods:** The study was based on information collected retrospectively from records of two sites of a single company in the North-West of England. The 1567 subjects were a subset of a larger group of industrial workers chosen for a nested case-referent study of death from ischaemic heart disease (IHD).To be eligible for the study, subjects had to have at least one BP (BMI) measurement made during a single period of employment at the company. **Main Outcome Measure**: The outcome variable was BP (BMI) measured annually from workers who attended an annual medical examination. The number of BP (BMI) measurements varied between 1 to 36 measurements. In total, 12757 BP (BMI) extracted from medical records were included in the final analysis. **Shift work:** Historical personnel records, containing pay codes which differed for day work and shift work, were used to define the duration of employment and work status of each worker. Work status (shift work or day work) and duration of shift work were based on employment between the first and last BP (BMI). **Confounding Variables:** Values of BMI made at the time as BP measurements (for BP analysis only), and smoking status at first and last BP were extracted from medical records. In addition to BMI and smoking status, place of work (site A or B) was regarded as another potential confounders; and year at birth to control for possible birth cohort effect. **Analysis Method**: The dependence of blood pressure-systolic (SBP) or diastolic (DBP)- on age controlling for BMI, smoking, site and year at birth was analysed by a hierarchical regression method. The regression coefficients (age, BMI and the intercept) were allowed to vary randomly from one subject to another. Interest then focused on whether shift work (shift vs days) and duration of shift (shift-dose response) might explain some of the variation in the regression coefficient for age. **Selection-in** bias was addressed by comparing intercepts centred at the mean age of starting work between shift workers & non-shift workers. Selection-out bias was considered by examining the differences in intercepts for groups with different length of duration of shift work. **Results:** Overall, 69% of subjects had done shift at least one month. The median length of employment, median duration of shift and median number of BP (BMI) measurements were 14.7 years, 0.5 year, and 6.0 respectively. **Evidence for the HWHE:** Shift workers at hire were younger, taller, with lower percentage of high BP, with lower percentage of overweight than day workers but with higher percentage of smokers which the effects may be partly cancelled out. Overall, adjusted SBP mean at age 37 (mean age at hire) was 0.89 mmHg (SE=0.89) lower for shift workers. **Evidence for the HWSE:** At site A, those who were longer in shift work were 'healthier' to begin with than those with less time in shift work. For example, shift workers with one year experience in shift had a SBP mean of 127.9mmHg at age 37 while shift workers with at least 20 years in shift had SBP mean of 125.0 mmHg at age 37. However, relative to day workers some might have been less healthy. Similar results were seen for DBP and different results for BMI and in the site B data. **Conclusion:** Evidence of both health-related selection into and out of shift work was also found from repeated measures analysis in terms of SBP mean at age 37, the mean age at the time of recruitment and decreasing these means for shift workers who experienced at least 20 years of shift work. The mean change in SBP per year of age was higher for shift workers than day workers at site A, but not at site B. A lack of strong evidence in change in SBP between day and shift workers could be due to the time of measurement of BP in relation to the circadian rhythms.

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