PROGRAM AND ABSTRACTS

17th International Symposium on Shiftwork and Working Time
18-22 September 2005, Hoofddorp, The Netherlands

Balancing Interests

Edited by:
Ben Jansen
Gerard Kerkhof
Monique Koopman
Arianne Witmond
Cover and art design: Arno Geels
Grafische en ruimtelijke vormgeving, BNO

Orders: shiftwork2005@atos.nl
National Organizing Committee

Ben Jansen
Coen van Limborgh
Monique Koopman
Arianne Witmond
Gerard Kerkhof
Ludovic van Amelsvoort

Board Committee of the XVIIIth International symposium on Night and Shiftwork
(in alphabetical order)

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Alexander Wedderburn (UK)
Ben Jansen (The Netherlands)
Claudia Moreno (Brazil)
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Giovanni Costa (Italy)
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Friedhelm Nachreiner (Germany)
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Johannes Gaertner (Austria)
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Mikko Härmä (Finland)
Natalia Bobko (Ukraine)
Peter Knauth (Germany)
Phil Bohle (Australia)
Simon Folkard (UK)
Sonia Hornberger (Germany)
Stephan Popkin (USA)
Torbjorn Akerstedt (Sweden)
Dear participants, welcome friends,

In the meanwhile this symposium has a tradition of 40 years. It concerns a long period in which scientific knowledge on working times and its confrontation with the practical situation forms the ‘meeting place’ of an ambitious group of scientists and experts. This time this group settled in the Netherlands. That is the first time in the history of the International Symposium on Shift- and Nightwork, or rather, the International Symposium on Shiftwork and Working Time, which is the most recent name of the symposium.

As customary, a symposium in these series has a theme. This time this theme is ‘balancing interests’. On the one hand this choice reflects the multidimensional and multidisciplinary nature of the subject of ‘working times’. After all, there are few subjects that are as multifaceted as the time regime of human and organisational behaviour. On the other hand this title refers to the political field of influence in which working times and/or time regimes will be ultimately designed and realised. It is also in this last context that working times in general have a high topical value.

The 17th International Symposium on Shiftwork and Working Time is organised as a kind of ‘scientific event’. It is an authoritative, interesting but also lively event in which we will not hesitate to show and discuss controversial issues. Not only to shock, but to give time and room to development. For example, we will make use of parallel sessions for the first time in the history of this symposium. And columns will be delivered in order to stimulate the senses.

The burden of the organisation of this symposium is borne by many shoulders. Many of these shoulders belong to ATOS Research & Consultancy, the organisation that must be mentioned as the main contractor and main sponsor of this symposium. Like the symposium, this organisation recently changed its name, just before the realisation of the symposium. They are called the Déhora Consultancy Group now!
A project organisation at the Déhora Consultancy Group has been responsible for the preparations of the practical work for this symposium for over 2 years. And we think that they have been successful.
We wish you a fantastic and much-discussed ‘scientific event’!

The National Organizing Committee,
Ben Jansen (chair)
Coen van Limborgh (secretary)
Monique Koopman
Arianne Witmond
Gerard Kerkhof
Ludovic van Amelsvoort
With many thanks

Working groups

**Finance & Insurance**
Chair: Elvira Smit
Ben Jansen
Arianne Witmond

**Social Programme**
Chair: Derk Bothe
Emiel Reuling
Onno Wansink
Manon Kuys

**Technology**
Chair: Edwin Barendse
Alex Klein
Milan Saleh

**Young Researchers**
Chair: Monique Koopman
Christine Baaijens
Ludovic van Amelsvoort
Nicole Jansen

**Sponsoring**
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Carlo Verleun
Hennie Havenaar

**Sponsor book**
Chair: Christine Baaijens
Ben Jansen
Heidi v.d. Holst

**Accommodation/ Food & Beverages**
Chair: Ben Jansen
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**Sponsors**
Akzo Nobel
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Ministerie van Sociale Zaken en Werkgelegenheid
Shell
Déhora Consultancy Group
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# 1. SYMPOSIUM PROGRAM AND PRESENTATION OVERVIEW

## SUNDAY 18 SEPTEMBER

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<tr>
<td>13.30-17.00</td>
<td>Mini Symposium</td>
<td>The Ballroom</td>
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<td>16.30-20.00</td>
<td>Registration</td>
<td>Paparazzi café</td>
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<td>18.00-20.00</td>
<td>Buffet</td>
<td>Spiegelsalon</td>
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<tr>
<td>20.00-22.00</td>
<td>Opening’s Ceremony</td>
<td>The Ballroom</td>
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Speeches by Dr. Ing. B. Jansen, Chair of the National Organizing Committee and Prof. G. Costa, Chair of the Shiftwork Committee and music entertainment

## MONDAY 19 SEPTEMBER

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<tr>
<td>08.45-09.30</td>
<td>Keynote</td>
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<tr>
<td>09.30-09.55</td>
<td>Introduction Session 1. Working Time Autonomy</td>
<td>The Ballroom</td>
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<tr>
<td>10.10-10.35</td>
<td>Introduction Session 2. Sleep/Wake Behaviour</td>
<td>The Ballroom</td>
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<tr>
<td>10.45-12.30</td>
<td>Session 1. Working Time Autonomy</td>
<td>Greenhouse</td>
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<tr>
<td>10.45-12.30</td>
<td>Session 2. Sleep/Wake Behaviour</td>
<td>The Ballroom</td>
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### Session 1. Working Time Autonomy

- **10.45-11.45**: Working time autonomy at health care.  
  T. Hakola, M. Koivumäki  
  Choosing their schedules: a preventive strategy for private homecare agency.  
  M. Bourdouxhe, E. Cloutier, E. Ledoux, A. Marchand, H. David, I. Gagnon, F. Ouellet  
  Reliability and predictability of flexible working hours – effects on health and well-being.  
  D. Janssen, F. Nachreiner  
  Optional Working Time Model  
  D. Karl, P. Knauth, S. Hornberger, G. Scheuermann

### Session 2. Sleep/Wake Behaviour

- **12.00-12.30**: Dimensions of working time and well-being.  
  J. Näätä, T. Anttila, M. Välsänen  
  Participatory planning of irregular three-shift work and well-being.  
  I. Kandolin, M. Härmä, R. Pösö, T. Hakola
### Session 2. Sleep/Wake Behaviour

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<tr>
<th>Time</th>
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<tr>
<td></td>
<td>Shift scheduling in irregular train transportation shift systems.</td>
<td>M. Härmä, M. Sallinen</td>
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<tr>
<td>12.00-12.30</td>
<td>Objective sleep disturbance measures in ethnic nurse shift workers.</td>
<td>B.B. Hobbs</td>
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<td></td>
<td>Fatigue at the end of shift: an example from long-haul aviation.</td>
<td>T.L. Sletten, G. Roach, D. Darwent, D. Dawson</td>
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### MONDAY 19 SEPTEMBER – CONTINUED

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<tr>
<th>Time</th>
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<tr>
<td>12.30-13.30</td>
<td>Lunch</td>
<td>Spiegelsalon</td>
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<td>13.30-14.00</td>
<td>Session A. One-Slide Poster Presentations</td>
<td>The Ballroom</td>
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<tr>
<td>10.15-10.45</td>
<td>Session A. One-Slide Poster Presentations</td>
<td>The Ballroom</td>
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<td></td>
<td>Profiles of sleepiness and melatonin during day and night shifts.</td>
<td>A.H. Garde, A.M. Hansen, J. Hansen</td>
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<td></td>
<td>Night-time work and melatonin among Danish nurses.</td>
<td>A.M. Hansen, A.H. Garde, J. Hansen</td>
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<td>Ethnic shiftworkers’ chronotype, time and sleep disturbances.</td>
<td>B.B. Hobbs</td>
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<td>Ultradian and asymmetric rhythms of laterally exposed stimuli processing.</td>
<td>I. Iskra-Golec</td>
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<td>24-hour oscillations in recognition accuracy of laterally exposed stimuli.</td>
<td>I. Iskra-Golec</td>
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<td></td>
<td>Role of the nonvisual photoreceptors in the regulation of diurnal biological periods.</td>
<td>M.J. Manzano e Silva, B. Vight, C. David, A. Magyar, A. Szel</td>
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<td></td>
<td>Irregular working hours stimulate cortisol awakening response during work days.</td>
<td>A. Savolainen, H. Lindholm, A. Jahkola, A. Hirvonen, M. Partinen, Ch. Hublin, J. Ahlberg</td>
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<td></td>
<td>The vulnerability of the rat myocardium to acute hypoxia depends on the light – dark cycle.</td>
<td>P. Svorc, I. Bracoková, E. Svorcová</td>
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<td></td>
<td>Patterns of sleepiness among high schoolers who work and don't work.</td>
<td>L.R. Teixeira, F.M. Fischer, R. Nagai, L.C. Souza, S.L. Turte, R. Repullo-Jr., A. Lowden</td>
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<td></td>
<td>Variations of melatonin and stress hormones under fast-rotating extended shifts.</td>
<td>K. Vangelova, M. Israeli, D. Veikova, M. Vatkov</td>
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<tr>
<td>14:15-14:40</td>
<td>Introduction Session 3. Circadian Rhythmicity</td>
<td>The Ballroom</td>
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<td>T. Akerstedt</td>
<td>T. Akerstedt</td>
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<tr>
<td>15.00-16.30</td>
<td>Session 3. Circadian Rhythmicity</td>
<td>The Ballroom</td>
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</table>
Session 3. Circadian Rhythmicity

15.00-15.45
The circadian rhythm in subjective sleepiness and shiftwork tolerance.
M. Ingre, G. Kecklund, T. Akerstedt

Individual differences in adaptation to changes in sleep-wake timing?
N.L. Rogers, G. Maislin, J. Starzyk, H.P.A. van Dongen, D.F. Dinges

Circadian variation of heart rate variability modified by severe sleepiness and work intensity in a weekly rotating 12-hour shift system.
M. Son, M. Yum, J. Kong, S. Ko, U. Jin, M. Härmä

16.00-16.30
Light behaviour of shift workers in connection to day sleep.
A. Lowden, T. Akerstedt

Predicting the Timing and Duration of Sleep in an Optional Setting using social factors.

MONDAY 19 SEPTEMBER – CONTINUED

16.45-17.35
Session B. One-Slide Poster Presentations

Sleep quality and quantity: the assessment of shiftwork on a high risk worker cohort using the Standard Shiftwork Index and a Daily Sleep Diary.
D.F. Bull, S.R. Knowles

One-Page Sleep/Activity Diary for Persons on Irregular Schedules.
C.C. Caruso, R.R. Rosa, S.J. Lee

Recovery from cumulative sleep restriction involves a complex multi-factor “reservoir”.
A. Fletcher, M.L. Johnson, T.J. Balkin

The effects of partial sleep deprivation and work pace on subjective stress, catecholamines and heart rate during a 12-hour work shift among professional process operators.
M. Härmä, M. Sallinen, A. Holm, R. Akila, H. Mikola, J. Virkkala

Individual differences in adjustment at an early stage of shiftwork experience.
H.M. van der Holst, G.A. Kerkhof

Subjective assessment of performance during total sleep deprivation.

Profile of early riser workers in de morning shift at Wholesales Food Market.
I. Monteiro, H.R. Rodrigues Corrêa Filho, M.M. Figueiredo de Martino

Fatigue and mood correlates of sleep length in three age groups.
H. Oginska

Fatigue and daytime sleepiness among construction workers.
R. Persson, A.H. Garde, A.M. Hansen

Sleep quality, health perception, burnout and work ability in Polish nurses.

Effects on nap opportunities on sleep architecture during the simulated two consecutive night shifts.
T. Sasaki, S. Matsumoto, Y. Matsukuma, K. Suzuki

Morningness-Eveningness as preferred sleep and wake time: Relationship to choice of fixed shifts, stress, health and social disruption.
L. Smith, H.J. Jeppesen, H. Boggild

Napping on night shifts: Is more better?
L. Smith, S. Smeaton, I. Umbers

Sleep quality and subjective health parameters in shiftworkers.
R.J. Verpraet, P. Kiss, I. Mahy, I. Gevaert, I. Vergrote, L. Braeckman
## MONDAY 19 SEPTEMBER – CONTINUED

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<tbody>
<tr>
<td>17.35-18.30</td>
<td>Posters Visits (unguided)</td>
<td>The Ballroom, balcony</td>
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<tr>
<td>19.00-20.30</td>
<td>Dinner and Column Hk. Thierry</td>
<td>Spiegelsalon</td>
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<tr>
<td>20.30-22:00</td>
<td>Board Meeting</td>
<td>Marriott</td>
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<tr>
<td>20.30-21.30</td>
<td>Meeting Young Researchers</td>
<td>Marriott</td>
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<tr>
<td>21.30-22.30</td>
<td>Bowling Young Researchers</td>
<td>Bowling</td>
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## TUESDAY 20 SEPTEMBER

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<th>Time</th>
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<tbody>
<tr>
<td>06.00-09.30</td>
<td>Visit to Flower Auction</td>
<td>Aalsmeer</td>
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<td>Tour to the famous Flower Auction in Aalsmeer. Leaving the Bloemenveiling Aalsmeer Visitors Centre, you cross a gallery at a height of 6 metres above the working floor. In this way you can see for yourself the auction process at work in the world’s largest flower auction.</td>
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<tr>
<td>10.00-10.45</td>
<td>Keynote</td>
<td>The Ballroom</td>
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<td></td>
<td>G. Bosch</td>
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<tr>
<td>11.00-11.30</td>
<td>Introduction Workshop Scheduling Concepts &amp; Software</td>
<td>The Ballroom</td>
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<td></td>
<td>B. Bos</td>
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<tr>
<td>11.40-12.10</td>
<td>Introduction Session 4. Interface Roster/Individual</td>
<td>The Ballroom</td>
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<td></td>
<td>F. Nachreiner</td>
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<tr>
<td>12.15-13.15</td>
<td>Workshop Scheduling Concepts &amp; Software</td>
<td>Greenhouse</td>
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<tr>
<td></td>
<td>Chairs: B. Bos and O. Giebel</td>
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<tr>
<td>12.15-13.15</td>
<td>Session 4. Interface Roster/Individual</td>
<td>The Ballroom</td>
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<td></td>
<td>Chairs: F. Nachreiner and F.M. Fischer</td>
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</tbody>
</table>
### Workshop: Scheduling Concepts & Software
Presentations by: J. Gärtner, A. Kreicbergs and F. Dufour

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<th>Time</th>
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<th>Presenters</th>
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### Session 4. Interface Roster/Individual

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<tr>
<th>Time</th>
<th>Title</th>
<th>Presenters</th>
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<tr>
<td>12.15-13.10</td>
<td>Between preferred and actual working time schedules: The case of Dutch employees.</td>
<td>C. Baaijens</td>
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<td>12.15-13.10</td>
<td>The role of supportive work environments in reducing work life conflicts.</td>
<td>A. Pisarski, C. Gallois, B. Watson, P. Bohle</td>
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<tr>
<td>12.15-13.10</td>
<td>Influence of flexibility and variability of working hours on health.</td>
<td>G. Costa, S. Sartori</td>
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<td>13.15-14.15</td>
<td>Lunch and Column W. Rietveld</td>
<td>Spiegelsalon</td>
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<tr>
<td>15.00-16.00</td>
<td>General Assembly</td>
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<td>17.00-18.15</td>
<td>Session 4. Interface Roster/Individual – Continued</td>
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<tr>
<td>17.00-18.15</td>
<td>Session 5. Extended Work Periods</td>
<td>The Ballroom</td>
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<td>Chairs: P. Knauth and A. Fletcher</td>
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### Session 4. Interface Roster/Individual – Continued

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<th>Time</th>
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<tr>
<td>17.00-18.15</td>
<td>Predicting tolerance to shift work-sleep dominates.</td>
<td>J.P. Nilsson, T. Akerstedt, G. Kecklund, J. Axelsson</td>
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<tr>
<td>17.00-18.15</td>
<td>Shiftwork and work autonomy – clocking out of work organization?</td>
<td>H.J. Jeppesen, P. Smith</td>
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<tr>
<td>17.00-18.15</td>
<td>The employees perception of labour and the effects of deployed policies in nursing and care institutions.</td>
<td>A.J. Blok, M.I. Koopman</td>
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<td>17.00-18.15</td>
<td>The relationship between shiftwork and the work ability: results from a Brazilian pharmaceutical company.</td>
<td>E. Hodge, I. Monteiro</td>
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<tr>
<td>17.00-18.15</td>
<td>Accidents in bus and tram drivers – length of duty and time of day effects.</td>
<td>M. Kundi, J. Sprenger, J. Gärtner</td>
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</tbody>
</table>
Session 5. Extended Work Periods

17.00-18.15

Long work hours; effects on sleep, sleepiness, cortisol and blood pressure.
A. Dahlgren, T. Akerstedt

Effects on extended working hours on health and well-being – results from a secondary analysis of a European survey.
B. Rädiker, D. Janssen, C. Schomann, F. Nachreiner

Conflicting interests at a Brazilian hospital: controversial 24-hour shifts for nurses.
R.E.S. Soares, L. Rotenberg, L.F. Portela

Alertness of aircrew during ultra-long-range flights.
K.A. Robertson, M.B. Spencer

Effect of the working patterns of UK train drivers on fatigue – a diary study.
C. Turner, M.B. Spencer, B.M. Stone

TUESDAY 20 SEPTEMBER – CONTINUED

18.30-19.00  Session C. One-Slide Poster Presentations  The Ballroom

18.30-19.00  Session C. One-Slide Poster Presentations

Smoking among shift workers: more than a confounding factor.
L.G.P.M. Amelvoort, N. Jansen, I.J. Kant

Health, stress and coping of Correctional workers: a comparison of shift and day workers.
B.G. Buckby, S.R. Knowles

Work ability in aging shift and day workers.
G. Costa, S. Santori

A checklist for assessing accumulated fatigue due to overwork.
K. Iwasaki, T. Sasaki, I. Mori, N. Hisanaga, E. Shibata

Validation of Heat Stress Indices in Mobarake Steel Complex.
A. Kalantari (Ph.D), M.R. Sadeghi (MSc)

Investigating the nutritional perceptions of day vs. shift Correctional workers over a period of seven days.
S.R. Knowles

Six hour day – effects on health and gender equality?
I. Larsson, A. Falkenberg, C. Bildt

Job satisfaction and work ability among educators.
E.C. Marques, C.R.C. Moreno

TUESDAY 20 SEPTEMBER – CONTINUED

20.00-22.00  Dinner Event “Twilight Zone”  Spiegelsalon

A Surprise Presentation will be held during dinner

WEDNESDAY 21 SEPTEMBER

08.45-09.25  Session D. One-Slide Poster Presentations  The Ballroom
### WEDNESDAY 21 SEPTEMBER

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<td>08.45-09.25</td>
<td>Session D. One-Slide Poster Presentations</td>
<td>The Ballroom</td>
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<td></td>
<td>Subjective sleepiness on a 6th on – 6th off sea-watch system – effects on time on watch.</td>
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<td>M. Gillberg, C.A. Eriksen, P. Vestergren</td>
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<td>A field study of sleep, fatigue and performance in regular rotating 12-hour shifts.</td>
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<td>S.D. Baulk, K.J. Kandelaars, A. Fletcher, G.D. Roach, D. Dawson</td>
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<td>Long work hours and moonlighting among Brazilian nurses. A time use study.</td>
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<td>F. Ribeiro-Silva, L. Rotenberg, R.E.S. Soares, J. Pessanha, F.L.C. Ferreira, P.F. Oliveira, A. Silva, A.A. Benedito-Silva</td>
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<td>Longer-term 12-hour rota effects on mood, sleep and fatigue.</td>
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<td>L. Smith, S. Smeaton, I. Umbers</td>
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<td>Working Time Reduction and Health: a literature review.</td>
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<td>C. Bildt</td>
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<td>Medical Surveillance of Shift Workers in a large chemical Company.</td>
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<td>R.J. Pluto, M. Nasterlack, P. Messerer, A. Zober</td>
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<td>The Effect of Long Working Hours on Health and Safety of Women Workers in Diverse Manufacturing Industries</td>
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<td>J. Lu</td>
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<td>Safety issues in the workplace confronting those in extended shiftwork</td>
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<td>J. Lu</td>
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<td>G. Costa</td>
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<td>Sleepiness and two or three pilot crews on intercontinental flights.</td>
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<td>C.A. Eriksen, T. Akerstedt</td>
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<td>The impact of international flights on the sleep, neurobehavioural performance and subjective alertness of commercial aviation pilots.</td>
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<td>R.M. Petrilli, G.D. Roach, D. Dawson, N. Lamond</td>
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<td>Short trips, long days : Precarious employment, working hours and health in short-haul trucking.</td>
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<td>P. Bohle, A. Williamson, M. Quinlan, D. Kennedy</td>
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<td>The effects of day and night work on fatigue and performance in heavy truck drivers.</td>
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<td>A. Williamson, R. Friswell</td>
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<td>12.00-12.30</td>
<td>Quality of shift schedules and absenteeism in public transport operations.</td>
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<td>F. Nachreiner</td>
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<td>Trends in the incident risk of train drivers.</td>
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</table>
**Session 7. Health and Well-Being**

**10.45-11.45**

- Alterations of biomarkers of heart disease across a shift cycle in women
  J. Axelsson, G. Kecklund, T. Akerstedt

- "Metabolic 5 years follow-up" among male day and rotating three-shift workers.
  B. Karlsson, A. Knutsson, L. Alfredsson, B. Lindahl, J. Hermansson

- Shiftwork and Aviation: focusing on maintenance technicians’ health.
  C.L. Paulich, M.R. Assis, E.T. Lacerda, A. Palma

- Shift work, death from ischaemic heart disease, social class and healthy shift worker effect.
  G. Yadegarfar, R. McNamee

**12.00-12.30**

- Risks associated with irregular hours of work by hospital anesthesiologists.
  K. Kogi, K. Sakai, S. Matsumoto, T. Itani

- Mental illness and depression among shift and day workers
  L.G.P.M. van Amelsvoort, N. Jansen, I.J. Kant

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**WEDNESDAY 21 SEPTEMBER – CONTINUED**

**12.30-13.30**

- Lunch and Column I. Sabelis
  Spiegelsalon

**13.30-14.00**

- Session E. One-Slide Poster Presentations
  The Ballroom

**13.30-14.00**

- **Session E. One-Slide Poster Presentations**

  - The impact of shiftwork in the aviation environment: a review of some Brazilian studies.
    M.R. Assis, C.L. Paulich, E.T. Lacerda

  - Working time of tramway drivers and traffic control operators.
    J. Carvalhais, A. Simoes, P. Ferreira, J. Correira, M. Lourenço

  - Ergonomic Evaluation of Musculoskeletal discomfort among Public busses drivers days.
    E. Habibi, M. Mirlohi, A. Hajazee, A. Babaei

  - Train Drivers’ Sleep Quality & Quantity During Extended Relay Operations.
    S.M. Jay, N. Lamond

  - Employee attitudes towards a fatigue risk management system.
    K. McCulloch, A. Fletcher, D. Dawson

  - Working patterns of UK train drivers – a questionnaire study.
    A.L. McGuffog

  - Effects of Fatigue on Flight Crews’ Non-technical Performance.
    R.M. Pettrilli, G.D. Roach, D. Dawson, M.J.W. Thomas

  - Regulatory approaches to the management of fatigue in transportation: A comparative analysis.
    S.M.W. Rajaratnam, C.B. Jones, D. Dawson, J. Gärtner

  - Health and well-being in pilot-rosters developed by workers themselves.
    H. de Ree, A. Kock

  - Relationships between chronological age and various health-related outcomes in air traffic controllers.
    D.J. Schroeder, C. Cruz, T.E. Nesthus, C. Hackworth
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<td>15.00-15.45</td>
<td><strong>Session 7, Health and Well-Being - Continued</strong></td>
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<td>15.00-15.45</td>
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<td>15.00-15.45</td>
<td><strong>Session 7. Health and Well-Being – Continued</strong></td>
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<td><em>Effect of sleep patterns on Body Mass Index in a truck driver population.</em></td>
<td>C.R.C. Moreno, F.M. Louzada, F.A. Carvalho, L.S. Matuzaki, S. Prezotti, P. Bighetti, G. Lorenzi-Filho</td>
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<td><em>Assessment of working times in German Restaurants.</em></td>
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<td><em>Studying the interplay between working time arrangements and work family conflict: the need for cross-national comparisons.</em></td>
<td>N. W.H. Jansen, I.J. Kant, L.G.P.M. van Amelsvoort</td>
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<td><em>Time pressure and the 24 hour economy.</em></td>
<td>K. Breedveld</td>
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<td><em>Working time and workers’ needs and preferences in industrialized countries: Finding the balance.</em></td>
<td>J.C. Messenger</td>
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<td>Time</td>
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<tr>
<td>16.45-17.15</td>
<td>Social corporate responsibility management and workers perceptions of fatigue and workability. R.J. Metzner, F.M. Fischer</td>
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**Impact of shift work on cardiovascular risk factors.**
Y. Morikawa, M. Ishizaki, K. Miura, Y. Soyama, T. Kido, Y. Naruse, H. Nakagawa

**Impact of shift, type of activity and life style upon the work ability of workers from the extrusion segment.**
A.O.K. Schiefler, C.R.C. Moreno

**Phychosocial work factors predicting daytime sleepiness in day and shift workers.**
M. Takahashi, A. Nakata, T. Haratani, Y. Ohtsuka, K. Kaida, K. Fukasawa

**Impaired alertness and performance driving home from the night shift – a driving simulator study.**
T. Akerstedt, B. Peters, A. Anund, G. Kecklund

**Fatigue management in health care: development of practical tools and strategies to manage fatigue-related risk to patient safety.**
S.A. Ferguson, J. Dorrian, D. Dawson

**Job characteristics and stressors faced by call center operators of an international bank, located in Rio de Janeiro, Brazil.**
F.M. Fischer, D.M. Raab Glina, L.E. Rocha

**Observations of Age-related Differences in Sleep, Performance and Alertness at an Australian Lead Smelter.**
K.J. Kandelaars, S.D. Baulk, A. Fletcher, G.D. Roach, D. Dawson

**Can a shorter PVT be used as a reasonable substitute for the 10-minute PVT?**
G.D. Roach, D. Dawson, N. Lamond

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<td>20.30-24.00</td>
<td>Conference Dinner</td>
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Conference dinner at The Duif in Amsterdam city centre. The Duif is a former church, build in 1857. The dinner is accompanied by the ensemble; Three Acoustics and Three to boogie.

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Chair: S. Folkard

10.45-12.30  Session 10. Rosters/Interventions  The Ballroom
Chairs: J. Gärtner

**Session 9. Performance & Risk**
10.45-11.45

- **Does subjective sleepiness predict performance?**
  T. Akerstedt, B. Peters, A. Anund, G. Kecklund

- **Work hours, sleep and medical errors in Australian nurses.**
  J. Dorrian, N. Lamond, C. van de Heuvel, J. Pincombe, D. Dawson

- **Estimating the circadian rhythm in the risk of errors resulting in injuries.**
  S. Folkard, D.A. Lombardi, M.B. Spencer

- **Work schedules and driver sleepiness.**
  L. Di Milia, D. Tepas

**Session 10. Rosters/Interventions**
10.45-11.45

- **BASS 4 – a software to assess the quality of working hours in relation to risks for safety, health and well-being.**
  O. Giebel, C. Schomann, D. Janssen, F. Nachreiner

- **A mathematical model for home help staff scheduling based on questionnaire survey results.**
  A. Ikegami, Y. Ogata, S. Morita, M. Ohkura

- **Smart shifts: the trade-off between productivity and flexibility.**
  A. Goudswaard, J. de Leede, G. van Rhijn, J. van Schie

- **Optimal work rest schemes and working hours in manufacturing environments.**
  M.P. de Looze, J.W. van Rhijn, T. Bosch, M.P. van der Grinten, N. Schoenmaker

12.00-12.30

- **Sleep, health and well-being among police officers: effects of shift scheduling.**
  G. Kecklund, C.A. Eriksen, T. Akerstedt

- **Characteristics of companies using new working time schedules.**
  D.J. Klein Hesselink, R.J.C. Nelemans

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12.30-13.30  Lunch  Spiegelsalon

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<td>C.A. Erikson, G. Kecklund, T. Akerstedt</td>
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<td><em>Six hour day – effects on health and gender equality.</em></td>
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<td><em>Operating Hours Assistant – A software for shift design.</em></td>
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<td><em>Time Intelligence – Software for analyzing large time-related data sets.</em></td>
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<td>J. Gärtner, S. Wahl, J. Siglär</td>
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<td><em>Measuring the impact of work hours redesign on the employee: the Working Time Change Impact Scale (WTCIS).</em></td>
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<td>C. Garret, P. Smith</td>
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<td><em>Does the light condition during night shift work affect daytime tracking task and self-evaluated sleepiness?</em></td>
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<td>H. Kozu, I. Ogawa</td>
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<td><em>Do short layovers allow pilots sufficient opportunity to recover?</em></td>
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<td>N. Lamond, R.M. Petrilli, D. Dawson, G.D. Roach</td>
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<td><em>Changes of working schedules through the life’s course.</em></td>
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<td>14.30-15.30</td>
<td><em>Flight crew shift patterns, performances and fatigue.</em></td>
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<td><em>A framework for an integrated fatigue risk management system:</em></td>
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<td><em>Considerations for designing shiftwork schedules in 24-hour operations.</em></td>
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<td>A. Fletcher, R. Yates, S. Ferguson, D. Dawson</td>
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<td><em>Rest break schedules and accident risk.</em></td>
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<td>P. Tucker, L. Smith, S. Folkard</td>
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<td><em>Does Shiftwork-Research Research Shiftwork?</em></td>
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<td>Speech by Dr. ing. B. Jansen, Chair of the National Organizing Committee</td>
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<td>17.30-19.00</td>
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<td><strong>Spiegelsalon</strong></td>
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<td>Informal gathering in conclusion of the symposium</td>
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Impaired alertness and performance driving home from the night shift – a driving simulator study
Åkerstedt T., Peters B., Anund A., Kecklund G.

Institute for Psychosocial Medicine
Karolinska institutet, Stockholm, Sweden
Swedish Road and Transport Research Institute, Linköping, Sweden
Email: torbjorn.akerstedt@ipm.ki.se

Keywords: sleepiness, driving, night work, accidents

Driving in the early morning is associated with increased accident risk affecting not only professional drivers but also those who commute to work. The present study used a moving base driving simulator to investigate the effects of driving home from a night shift. 10 shift workers participated after a normal night shift and after a normal night’s sleep. Analysis of variance for repeated measures showed significant effects of time and condition (No night sleep /Baseline (night sleep) for all variables (fig1). Driving home from the night shift was associated with an increased number of incidents (2 wheels outside the lane marking, from 2.4 to 7.6 times), decreased time to first accident (4 wheels outside the lane marking), increased lateral deviation (from 18 to 43cm), increased eye closure duration (0.102 to 0.143sec), and increased subjective sleepiness. The results indicate severe post-night shift effects on sleepiness and driving performance.

Figure 1. Meanse for sleepiness, eye closure duration, and standard deviation of lateral position, as well as sum of incidents for the drive after the night shift (N) and after baseline (B, full sleep).
Does subjective sleepiness predict performance?

Åkerstedt T., Peters B., Anund A., Kecklund G.

Institute for Psychosocial Medicine, Swedish Institute for Transportation Research, Karolinska
institutet, Stockholm, Sweden

E-mail: torbjorn.akerstedt@ipm.ki.se

Keywords: night work, driving, accidents

Subjective sleepiness is often used in studies of shift work or sleep pathology. Often high levels of rated sleepiness are used to infer accident risk or performance impairment. It is not clear to what extent this inference is warranted. Apart from individual differences and the shape of the putative relation (linear, curvilinear), the context of the measurement may affect prediction. For example, a rating is often carried out in an uncontrolled situation which may mask latent sleepiness, whereas a subsequent performance task is carried out under low external interference and is likely to induce task dependent fatigue or sleepiness. The present analysis was carried out to reveal some of these connections.

The analysis made use of data from a high fidelity, moving, driving simulator experiment in which 10 subjects drove for 2 hours during the morning after a night shift or after a night of normal sleep. Among other parameters incidents (2 wheels crossing a lane marking) and accidents (4 wheels crossing a lane marking) were recorded. Data were analyzed in 5-minute segments. Every 5 minutes sleepiness was rated using the Karolinska Sleepiness scale (given orally after a prompt on the windscreen) and referring to sleepiness during the last 5 minutes (scale = 1-9; very alert – very sleepy, fighting sleep, an effort to remain awake).

Data in 5-minute epochs were put into bins of levels of sleepiness. Friedman non-parametric analyses of variance showed no relation to performance at low and moderate levels. At levels 7+8 performance was significantly impaired and at level 9 the risk of an accident (4 wheels outside the lane marking) was 17% (and 0 before that) and the risk of an incident (2 wheels outside the lane marking) was 49% (10% at levels 3+4 and 5+6). The standard deviation of lateral position (Sdlat) was 43 cm at level 9 and 24-25cm on the two lowest levels. Eye closure duration was 0.15 sec on level 9 with 0.113-119 sec on the two lowest levels.

Correlations were computed between the proportion of ratings of 9 on the KSS scale and the other parameters. The correlation with accidents was r=0.65 (p<.05), with incidents r=0.74 (p<.05), with Sdlat r=0.81 (p<.01) and with blink duration r=0.72 (p<.05). Mean levels of KSS did not show any significant correlations with the dependent variables (r<0.30, ns) and for KSS at the start of the sleep loss condition the correlation coefficients were r= 0.46, r=0.43, and r=0.56 and r=56 respectively, all non-significant.

The results suggest that sleepiness before a task is not a good predictor of performance during the task, but that the frequency of ratings of severe sleepiness during a task is good predictor. The lack of correlation for mean sleepiness during a task suggests that only the highest levels of sleepiness are important for the link with performance. The results also suggest that pre-performance sleepiness ratings may improve their predictive power if they are carried out in a well-controlled situation similar to the performance situation.
Mental illness and depression among shift and day workers

Amelsvoort L.G.P.M. van, Jansen N., Kant I.J.

Occupational Health Epidemiology, Maastricht University, Maastricht, The Netherlands

Email: LGPM.vanamelsvoort@epid.unimaas.nl

Keywords: Shift work, depression, health and well being

So far, most studies dealing with psychological health problems among shift workers addressed sleep problems and fatigue (1, 2). However, one might assume that working in shifts, which is related to disturbances of the circadian physiological rhythms and exposure to sunlight, is also related to an increased risk on mental illnesses in general and depressive symptoms in particular.

Objectives

(1) To study whether the shift workers also working nights report more mental illnesses and report more depressive symptoms, as compared to day workers; (2) To study whether this risk is different in workers who quit working in shifts.

Methods

Data from 8482 subjects participating in the Maastricht Cohort Study was used to assess the longitudinal relationship between working in shifts including nights and the incidence of mental illness. Subjects who reported having a mental illness at baseline were excluded from the analysis, as were those individuals who dropped out of the study. 29 % of the subjects worked in shifts at baseline. After two years of follow up, 16.7 % of shift workers quit working in shifts. Additionally, after three years of follow up, 6829 of the participants completed the Hospital Anxiety and Depression Scale (HADS) (3). The HADS was used to determine the number of depressed cases in shift and daytime workers.

Results

In the subjects who worked in shifts involving night work, the, for age, gender and educational level adjusted Odds ratio to report a mental illness was found to be 1.36 (95 % C.I.: 0.97 -1.92) as compared to day workers. In workers who left their shift work job to work in day time this risk was much higher (OR 1.85 (1.1 – 3.1). When looking at the results of the HADS questionnaire after three years of follow up, shift workers were found to have, on average, a 10 % higher score on the HADS depression scale, which corresponds with an odds ratio of being a depressed case of 1.33 (1.02 – 1.73).

Conclusions

Working in shifts, including nights was found to be associated with a higher depression score and an increased risk of reporting a mental illness. This risk was found to be highest in those individuals leaving shift work indicating a strong healthy worker selection.

Smoking among shift workers: more than a confounding factor

Amelsvoort L.G.P.M. van, Jansen N., Kant I.J.

Occupational Health Epidemiology, Maastricht University, Maastricht, The Netherlands

E-mail: LGPM.vanamelsvoort@epid.unimaas.nl

Keywords: Shift work, smoking, methodology, health and well being, cardiovascular disease

Rationale:
So far, in studies on the cardiovascular disease risk among shift workers, smoking is considered to be a confounding factor. However, in a study among 239 shift and 157 daytime workers we found that shift work was prospectively related to an increased cigarette consumption (1) indicating that smoking might be in the causative pathway. However, the number of study subjects was too low to warrant sound conclusions. Therefore we used data from the Maastricht Cohort study to investigate the longitudinal relation between smoking and shift work in a much larger population. In this study, a total of 12,140 employees were followed for two years by means of self-administered questionnaires. We compared workers normally worked during daytime hours only (74 %) with workers who worked in shifts (26%). Logistic regression analyses was performed, with adjustment for demographic factors (age, gender and educational level) to evaluate the risk of start smoking (n= 225) in the group of non-smoking workers and the risk of quitting (n=318) in the group of smoking workers.

Table: Odds ratios for the risk to start smoking in non-smoking workers.

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<th>Odds ratio (95 % confidence interval)</th>
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<tr>
<td>male (as compared to female)</td>
<td>0.82 (0.60 – 1.11)</td>
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<tr>
<td>age ([per year])</td>
<td>0.99 (0.98 – 1.01)</td>
</tr>
<tr>
<td>shift work</td>
<td>1.42 (1.02 – 1.97)</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
</tr>
<tr>
<td>low (reference)</td>
<td>1</td>
</tr>
<tr>
<td>intermediate</td>
<td>1.00 (0.70 – 1.41)</td>
</tr>
<tr>
<td>high</td>
<td>0.70 (0.48 – 1.03)</td>
</tr>
</tbody>
</table>

Logistic regression analysis showed a significant association between shift work and taking up smoking during two years of follow-up (Odds ratio: 1.42, p: 0.03). The risk to stop smoking was somewhat lower in the shift workers (Odds ratio: 0.91) but not statistically significant (p = 0.5). To conclude, this study showed that, independently from educational level, shift workers are more prone to start smoking. This not only has implications for studies on the cardiovascular disease risk among

The impact of shiftwork in the aviation environment: a review of some Brazilian studies

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Keywords: shiftwork, aviation personnel, sleeping habits, circadian rhythmicity, working conditions

The introduction of ultra long-haul aircrafts in recent years has highlighted the need for researches on how to manage rest and sleep with long-haul crews. According to Costa (1996) shiftwork can have a negative impact on health and well-being of workers as it can cause: a) disturbances of the normal circadian rhythm of the psycho-physiological functions, beginning with the sleep-wake cycle; b) interferences of work performance leading to human error; c) difficulties in maintaining family and social relations; and d) deterioration of health. Brazilian aviation shiftworkers have been long investigated by the Psychology Lab of the Physical Activity Science Institute (ICAF) since 1994. This Institute has gathered important data on health and work performance in aviation. Thus, the aim of this study was to make a review about the impact of shiftwork in Brazilian aviation workers using as its main reference the investigations developed by the ICAF group. This review encompasses the sleeping habits and circadian rhythmicity of captains, flight attendants, air traffic controllers and maintenance personnel from 3 Brazilian airlines and Brazilian Air Force. The analysis showed that all groups suffer from several difficulties caused by shiftwork as mentioned above. Captains and flight attendants are submitted to long haul flights as well as short ones with 5 landings, jet lag syndrome, family distance, bad flight schedule distribution and lack of appropriate time and conditions for rest. Air Traffic Controllers deal with high complex tasks with inadequate working conditions, including insufficient personnel, duplicity of tasks among others. Although maintenance personnel work in fixed shifts their work takes place under unhealthy conditions such as excessive noise, heat, lack of luminosity, dust and toxicological gases. They also suffer from time pressure, workload and absence of specific periods and place for rest. In fact, shiftwork effects not only vary from one individual to another but also within different occupations in the aviation context; therefore any countermeasure regarding shiftwork must take into consideration the specific characteristics of the task.

Alterations of biomarkers of heart disease across a shift cycle in women

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Keywords: Cardiovascular disease, cholesterol, tolerance, lipoprotein, gender

It is well known that shift work increases the risk for developing cardiovascular disease (CVD). However, there is little knowledge of how risk factors for CVD change across a shift sequence and how a week off affects them. The main aims of the present study was to evaluate how biomarkers of heart disease change across a shift cycle and whether tolerant women differ from vulnerable ones.

We followed 18 female shift workers working in a paper and pulp factory with an extremely rapidly rotating shift schedule. The women were divided into a tolerant group (10 women with a mean age of 38±3SE yrs and a BMI of 23±1m/l²) and a vulnerable group (8 women, 45±4yrs, BMI=24±1) depending on their ratings of satisfaction with their working hours. Morning blood samples and health examinations were carried out during the first and last morning shift in the shift cycle. Resting blood pressure was taken and serum was analyzed with respect to cortisol, prolactin, total cholesterol, low-density lipoprotein (LDL)-cholesterol and high-density lipoprotein (HDL)-cholesterol.

Several biomarkers of CVD changed significantly across the shift cycle. Total cholesterol, LDL, total/HDL-cholesterol ratio as well as diastolic blood pressure was lower at the end of the shift cycle compared to after a week off. The only variable that differed significantly with respect to satisfaction was a higher total/HDL-cholesterol ratio in dissatisfied shift workers. No interaction was significant.

| Table 1. Means, standard error and results from the analysis of variance (ANOVA) for hormones, lipoproteins and blood pressure in women |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
|                                 | after a week off | end of shift sequence |
|                                 | tolerant | vulnerable | tolerant | vulnerable | time | tolerance |
| Cortisol (nmol/l)               | 402±63 | 271±49 | 409±59 | 251±30 | †     |
| Prolactine (µg/l)               | 7 9.3±9 | 5 11.4±2.1 |
| Sytolic BP (mm Hg)              | 118±4 | 129±6 | 119±6 | 132±6 | *     |
| Diastolic BP (mm Hg)            | 81±3 | 89±6 | 77±3 | 82±4 | *     |
| Total cholesterol (mmol/l)      | 5.3±2 | 6.3±6 | 5.2±2 | 5.9±5 | **    |
| LDL-cholesterol (mmol/l)        | 3.1±2 | 4.1±6 | 2.9±2 | 3.7±5 | **    |
| HDL-cholesterol (mmol/l)        | 1.8±1 | 1.5±1 | 1.8±1 | 1.6±1 | †     |
| Total/HDL-ratio (nmol/l)        | 1.9±2 | 2.7±3 | 1.8±2 | 2.4±3 | *     |

Df=1/17. Significance levels are set as *=p<.05 & **=p<.01, trends as †=p<.10.

In conclusion, several biomarkers of CVD changed across the shift cycle in women - diastolic blood pressure decreased, as did total-cholesterol, LDL and the total/HDL-cholesterol ratio. One implication of our findings is the importance of the timing of measurements of risk factors. There was also support for dissatisfied shift workers to have worse cholesterol values than satisfied ones. In women, it seems that a week off is related to increased levels of risk factors for CVD. Possibly lifestyle is more lax during days off.
Between preferred and actual working time schedules: The case of Dutch employees
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Keywords: preferences; work/life balance

Introduction
Owing to the risen female labour force participation and the growing share of single person households, an increasing number of Dutch persons has to combine paid work with household and caring tasks. In addition, a large share of employees combines paid work with other activities, such as volunteer work, participation in club life, or a study. One’s working time schedule can interfere with the combination of paid work and these other activities.

Aim of the study
To assess Dutch employees’ preferred and actual timing of the workweek and to determine whether there exists a discrepancy.

Methods
During 2000/2001, a cross-national study was carried out at Utrecht University among employees working in 28 different organisations (organisations in the public sector, the service sector and industrial organisations). In each organisation a questionnaire was sent to a sample of employees. A total of 1,319 employees replied (53%). The preferred timing of the working week is obtained by asking employees to indicate for each day of the week whether they would like to work or not and, if so, what their preferred starting and ending time would be. The actual timing of the working week is obtained by asking employees to report the for the last two weeks on what days and what times of the day (starting and ending times) they had worked. Due to insufficient numbers of respondents, employees working in shift work were excluded from the analysis. The results therefore refer to employees with regular working hours.

Results
Based upon the fact that humans are biological beings, the fact that humans are social beings and restrictions that stem from the household context and job characteristics, a framework for the preferred timing of the working week is derived. The results show that employees in general indeed prefer to work on days and hours within this framework. In general employees prefer to work on Mondays to Fridays. Insofar employees would like to work less than five days a week, the Friday is the most wanted day off, followed by the Wednesday (especially wanted by women with young children). Furthermore, there is a general preference to start working between 7 a.m. and 9 a.m. and to end the working day between 4 a.m. and 5.30 p.m. Actual working times schedules are closely in line with preferred working time schedules.

Discussion
The empirical results indicate that most employees are working according to ‘traditional’ times’ and also show a preference for these working times. All in all, this seems to indicate that The Netherlands are still a ‘nine-to-five’ society. Furthermore, in light of the above results, it is not expected that any changes to a 24-hours society will arise from employees.
A field study of sleep, fatigue and performance in regular rotating 12-hour shifts

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Keywords: Sleep; Fatigue; Performance; 12-hour shifts

Objectives
Twelve-hour shift systems are an important part of working practices in many industries. Increasingly, companies are moving away from traditional 8-hour shifts, towards systems which compress the working week. Many employees favour these systems due to the prolonged periods of time away from work, and therefore increased opportunity for social and domestic interactions [1]. However, the effects of 12-hour systems have been found to be complex and contradictory, with various advantages and disadvantages reported for fatigue, safety, physiological health, psychosocial factors and absenteeism [1-3]. This study aimed to explore the potential for effects on sleep, fatigue and performance, in a regular rotating 12-hour shift system, consisting of two days, two nights, and 4 days off (DDNNOOOO) at an Australian Smelter.

Methods
Sleep behaviour and subjective fatigue ratings were recorded using 20 male employees (mean age 40.89y, SD 9.63y) at a South Australian smelting plant, using wrist actigraphy, and sleep/wake diaries. Neurobehavioural performance was also recorded using 5-minute psychomotor vigilance tasks (PVT), at the start, mid-point and end of each shift. The study ran for a 14-day period, during which time all participants continued their regular, rostered work schedule.

Results
Sleep data showed clear differences between day and night shifts, with the first night shift causing some sleep disruption. Wakefulness at the end of shift reached 18-20 hours for some individuals. Similarly, subjective fatigue was higher during the night shifts (p<0.001), with the first of these causing the greatest increase from start to end of shift. Importantly, performance data supported these findings, with reaction times increasing significantly across the night shifts, most markedly during the first night shift (p<0.001).

Conclusions
Although fatigue levels and performance data were not cause for immediate concern in terms of occupational health and safety, these findings demonstrate that 12-hour shift systems do require adequate management of fatigue issues, particularly in the case of continuous hours of work policies and the regulation of overtime. In addition, this study highlights the importance of the management of fatigue issues during the first night shift, which has greatest potential for fatigue-related problems.

Health concern has not been most important in the discussion about working time reduction (Isidorson). In Sweden, the only time a decision on working time reduction has been made based on health arguments was in 1919. In the Swedish debate, discussions have been going on about a reduction of the eight-hour working day ever since the legislation on reducing the working week to 40 hours was passed in 1974. Since then, four large public commissions have dealt with the issue of a possible working time reduction. On the whole, there is nothing that points to that the working time reductions that have been carried out so far have improved medical health. The reason for this is probably partly that no changes in people's actual health have been noted, and partly that the experiment periods have been too short. Another aspect of the matter is that the subject working time reduction in research contexts often is discussed as a phenomenon only from an economic perspective. Regarding discussions on the subject from a health perspective, there has been no debate or research until recent years, and these are strictly limited to evaluating medical health. Few research approaches are made, for example, to measure psychosocial stress and its possible physical consequences (Ohlsson). In France, where they have a statutory working time reduction, health effects that the working time reduction could have contributed to are seldom discussed. The discussions are rather about the national economic effects that this has involved. In this literature review, really only one article from France was found on health effect (Gadbois). Overall, based on what can be seen from the publications that we have studied in this review, there is a lack of a broader understanding of working time and its effects on health. There is a lack of a more integrated research that takes more theories and more disciplines into consideration. Particularly, a study design that are comprising medicine, sociology and economy is required.

Isidorsson Tommy. Reduction of Working Hours in Western Europe - Part one: The present Situation, ETUI (Brussels 1979-1980).
The employees perception of labour and the effects of deployed policies in nursing and care institutions

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Keywords: nursing and care sector, labour perception, time-study, deployed policy

The employers’ and employees’ organizations in the Netherlands agreed to perform a study of the labour perception by the employees in nursing homes and rest homes every two year. The first measurement has taken place in 2002, the second measurement in 2004. The main objective of the study is to gain insight into the status of policy themes mentioned in the collective labour agreement, the experienced quality of the working conditions and the employees’ labour perception on the moment of the measurement. By comparing the results of the two measurements it is possible to gain insight in changes that has taken place in the perception labour by the employees, i.e as result of deployed policies.

In this presentation the focus will be on the comparison of the measurements in 2002 and 2004. Not only the changes in the experienced working conditions and the employees’ labour perception, also the effect of the deployed policies by the management of the institutions is taken into account.

The subject of the study is the group of nursing homes and rest homes which participated in 2002 and also in 2004. It concerns a total of 502 institutions, with 35,260 participants in 2002 and 30,131 in 2004. The two groups are comparable on background variables.

Changes

<table>
<thead>
<tr>
<th>Work aspects</th>
<th>2002</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal and job characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applied policy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>consequences</td>
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</table>

The results show that no large changes have taken place in the cause of the years. Only for two work aspects, namely work pressure and physical load, a positive change has been identified. Taking into account background differences of employees clear differences can be found. Young employees (younger than 25 years), employees with small part time contracts and employees working in irregular shifts are in 2002 as well as in 2004 the least positive about the working conditions, even though the results have improved slightly in the cause of the years.

The differences between the measurements in 2002 and 2004 are used to determine 2 groups of institutions: those with mainly improved results (changes with a difference >.20*sd) and institutions with mainly deteriorated results (changes with a difference <-.20*sd). Next these groups have been compared with respect to the effects of the deployed policies (type and number).

The result of this comparison is that the institutions with improved results did implement less actions in the area of employee development and more actions in the area of organisation of work and participation of the employees. More research is necessary to determine the specific relation between type and number of deployed actions and their effects on the employees’ labour perception.
Effects of mental work tension on cardiovascular system activity under round-the-clock industry

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Keywords: cardiovascular system, mental work tension, control room shiftworkers, 12-hour shifts

Shiftwork is known as a risk factor of health problems development. High mental tension in its turn could lead to cardiovascular system (CVS) pathology. The purpose was to reveal the effects of mental work tension on CVS activity in control room shiftworkers under round-the-clock industry. Electricity distribution network controllers were observed at their work places over the 3-week periods under 2-day rotation of 12-hour shifts. Heart rate (HR), systolic (S) and diastolic (D) blood pressures (BP) were registered each 2 hours during working shifts (n=17 subjects, N=1224 subject-observations). Eight haemodynamic parameters were calculated for each observation. A 5-anchor scale was used to estimate the perceived level of work tension experienced by the controllers. Pronounced interactive changes in CVS activity were found to be coupled with the increased feeling in work tension (Pillai’s test, p<.0001) as well as the changes in every studied parameter of CVS activity (p<.021). Similar results were revealed at the day shifts. At the night shifts, interactive changes in CVS efforts were found in 8 calculated haemodynamic parameters and were not found in 3 registered parameters. At the 2nd consecutive night shifts, also changes in 3 calculated haemodynamic parameters were revealed to be related to the increased perceived tension (p<.03).

At the 1st day shifts, the increase in feeling of tension was coupled with the U-appeared dependency in BP changes (max BP scores - at the middle tension) and decrease in HR. Majority of calculated haemodynamic parameters also showed U-appeared dependency. At the 2nd consecutive day shifts, rather increase in 3 registered parameters was found to correspond to the increase in perceived tension. In this, scores “lower than middle” and “higher than middle” looked as the “turning” points. Unfavourable, typical for the day shifts, vascular type of bloodcirculation self-regulation was found under “middle” tension during the 1st day shifts and under “lower than middle” tension - during the 2nd day shifts. Unfavourable, typical for the night shifts, cardiac type of bloodcirculation self-regulation was found under “middle” tension during the 1st night shifts and under “lower than middle” and “middle” tension - during the 2nd night shifts. Under further increase in tension, probably, other mechanisms are being involved to maintain workability. In air traffic controllers under excessive tension at night the unfavourable lipid type of metabolism was found [1].

So, in electricity distribution network controllers, pronounced interactive and unilateral changes in CVS activity parameters were found to be coupled with perceived tension at the day shifts, very poor – at night. This could evidence the weakened CVS possibility to maintain mental work tension at night and requires special attention to provide qualitative rest after night working. At the 2nd 12-hour shifts the “turning” points in bloodcirculation self-regulation take place at the lower level of perceived tension compared to the first shifts that could be caused with deficient restoration between the consecutive shifts. Special attention has to be paid to provide sufficient recovery of a control room worker in case perceived work tension was higher than “middle” (if 1st shift is over) or “lower than middle” (after 2nd consecutive shift).

Effects of space related parameters onto the frequency of daytime and night accidents caused by human operators

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Keywords: human-operator reliability, space weather, time of day

Space related parameters influence the body functioning including professional performance and human caused accident rate [1]. In this, space exposure is different at day and night time. It is shown also that outdoor workers manifest worse adjustment to night/shift work compared to indoor workers [2]. The purpose was to reveal the effects of space related parameters on human caused accident (HCA) number during the daytime (when the Sun is above the horizon) and at night (while the Sun under the horizon).

Fluctuations in the frequency of 165 human (operative and management personnel) caused accident situations in energetics of Ukraine occurred during 14 months were compared to fluctuations in the everyday (published) data of solar activity (S), neutron component of the cosmic rays (NC), geomagnetic activity (K-index), horizontal component of geomagnetic field tension (H), air temperature (T), atmospheric pressure (Patm) and precipitation sum (APS). The data were averaged for every 12-13 days (n=35) and cross-correlated at a p-value of 0.05.

Irregular dissemination of HCAs during the observation period was found. 79% of the daytime periods and 88% of night periods were revealed to be HCAs free. 17% of the days and 11% of the nights were noted with 1 HCA, 3.5% and 0.2% - with 2 HCAs, 0.5% and 0.2% - with 3 HCAs per day or night correspondingly. Decrease in HCA number at the nights could be connected with the decrease in energy output by power stations owing to the decrease in energy consumption by society.

Number of HCAs per day was found to be coupled with changes in S (p<.03) and T (p<.002), at the level of tendency – with P and APS (p<.07). In this, the accident rate increased with the increase in solar activity that goes right with literature data. No correlations were found for the night accidents.

For the slow (multiday) fluctuations in the daytime HCAs, the correlations between HCA number and two weather parameters were revealed: APS (r=0.40) and also T (r=0.38). At nights, the slow fluctuations in space related parameters (including weather indices) showed the precedence of the HCA number ones: H – for 74 (r=.41) and 150 (r=.49) days, NC – for 98 days (r=.44), APS – for 110 days (r=.48), T – for 13 (r=-.34) and 110-134 (r=.38 ... .46) days.

Possibly, human body absorbs the night time space influences carrying them on up to some months. At the daytime, the sun rays activate human body increasing its resistance – on one hand, and repulsing other space influences to some extent – on the other hand. At the same time, pronounced changes in solar activity and weather conditions could affect human reliability.

Therefore, human reliability depends on space related parameters differently at the day and night times. The number of accidents occurred during daytime changed mainly synchronously with solar activity and some meteorological conditions. Night accident number fluctuations came after the fluctuations in some space related parameters including weather indices lagging up to 2.5-5 months.

Such the delay in the night body reaction would allow to certain extent to prognosticate the human-operator reliability at night time using monitoring of space related parameters – to undertake the preventive measures in time aiming to maintain the sufficient human professional performance.

Short trips, long days: Precarious employment, working hours and health in short-haul trucking

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Keywords: working hours, precarious employment, road transport, health, safety

There has recently been a rapid expansion of precarious employment in OECD countries which has been associated with a wide range of negative effects on occupational health and safety (OHS) (Quinlan & Bohle, 2003). To date, there has been little research on the effects of precarious employment in short-haul trucking. This paper, based on a survey of 217 short-haul truck drivers, compares the working hours and OHS of permanent employees, casual employees and owner-drivers. The three groups had similar demographic and experience profiles. Most had extensive experience; 25% had 25 years or more. All groups had very long weekly working hours and reported spending similar time driving (40 - 45 hours) and loading (14-15 hours). However, owner-drivers reported spending twice as much time as employees on maintenance. Owner-drivers drove the highest mean kilometres each week while casuals drove the lowest. Most permanents and owner-drivers worked permanent shifts, but less than half of casuals did. Conversely, most casuals had non-standard shift schedules but less than a third of owner-drivers did. Start and finish times differed as well. Owner-drivers were more likely to report starting between 06.00 and 12.00. No owner-drivers started between 00.00 and 03.00 but some employees did (5.4% of permanents, 8.3% of casuals). Employees were also more likely to start in the afternoon than owner-drivers. Finish times reflected start times. Most owner-drivers finished between 18.00 and 21.00 but most employees finished in the afternoon. Most permanents and owner-drivers did no weekend work or only worked on Saturdays, but over a quarter of casuals worked both weekend days. More employees reported work-related accidents than owner-drivers, but there was no difference in work-related crashes. Injuries most often occurred during loading and unloading and were most often musculoskeletal, especially involving the back and knee. There were no differences in psychological well-being (GHQ-12) but permanents and owner-drivers reported chronic work-related illness more often than casuals. Permanents were more likely than casuals to have claimed compensation in the last five years. Owner-drivers were unlikely to have claimed, most often reporting that they could not afford the time off. When casuals failed to claim, it was most often because they were unaware of their entitlement. These results indicate that all three groups worked very long hours, but there were differences in the distribution of daily and weekly hours. There were significant difference in work-related illness and injury between the groups but these differences were confounded to some extent by factors that inhibited reporting.

Choosing their schedules: a preventive strategy for private homecare agency


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Keywords: private agency nurses, choice of work schedules, homecare services, preventive strategies

Objectives
In a study on the employment, work, and health and safety conditions of private homecare agency nurses, an in-depth study of their work schedules was carried out in order to compare them to those of previously studied public sector nurses (1). The flexibility and variability of work schedules were studied, as well as their atypical aspects (frequency of night work, weekend work, “broken” schedules, overtime) and the workload that they represent. The ultimate objective was to determine whether private agency nurses have temporal margins of manoeuvre that allow them to maintain their health and the quality of care services.

Method
The daily, weekly, monthly and seasonal variations in schedules, routes and clienteles served were measured from the time sheets and agendas of six nurses over a six-month period. In this case of repeated measurements for days and weeks, multilevel analysis was used to measure the variability in schedules and work situations (2). Analyses were done using MLwiN software on the following variables: numbers of institutions, programs, clients and different locations visited per day; number of hours worked per day; in cases of broken schedules: amplitude of the work days and number of hours not worked between the blocks of hours worked; overtime; work shift (day/evening/night); number of consecutive days worked; number of consecutive days off; frequency of weekend work. In-depth interviews coded with Atlas software were used to describe what the nurses consider as their ideal schedule and which availability they announce when they are hired by the agency.

Results
The choice of schedules is a basic component of the nurses’ motivation to work for private agencies rather than in the public sector. However, multilevel time analyses show noticeable differences between the idealized flexibility of the interviewees’ statements and the flexibility actually measured on their time sheets. For each nurse, the results show a great stability of her number of hours actually worked per week (variance = 0.05). On the other hand, it has been calculated that all of them undergo very great variations from one day to another with regard to the number of hours worked (variance = 2.8; p< 0.001), the total amplitude of the working day (variance = 6.4; p< 0.001), and the number of hours worked in overtime (variance = 0.8; p< 0.001). Meanwhile, despite the nurses’ statements that vaunt the advantages of the diversity of schedules and tasks that they find in private agencies, quantitative analyses of their time sheets show that they tend to favour stability – same institutions, same programs, same clients, same type of schedule – in order to construct as rapidly as possible their knowledge about the cases cared for, which is an important component of any effective preventive strategy.

Conclusion
Uncertain about their future, the nurses tend to accept a greater workload (in terms of schedule constraints) than their announced availability. The results also confirm that chosen work schedules, even when they are demanding, are preferable for health to imposed schedules.

Time pressure and the 24 hour economy

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Keywords: hours of work, time pressure, opening times, 24 hour economy, social rhythms

In the 1990s, many politicians as well as scientists proclaimed the advent of a ‘24 hour economy’, in which concepts like weekdays, office hours and working from 9 tot 5 would lose their value, and shops and services would remain open for the full 24/7 period.

However, data from so called time use surveys suggest that the 24/7 economy is still a myth rather than a reality. Relying on the outcomes of Dutch time use surveys, we know that in 2000, over 85% of paid work is still being performed from Monday to Friday, during the day time (see www.tijdsbesteding.nl, in English). Generally, shops and services have not prolonged their opening hours to the degree that was often expected. In 2002, over 80% of commercial shops and services still closed at 6 pm (in the Netherlands). Changes in this respect have been slow, generally far less than predicted.

This paper explores the reasons why change in the timing of work have not been as great as has often been predicted. As such, it explores the social and economic advantages of social rhythms (while not neglecting its disadvantages), the logic behind their social reproduction over time, and by consequence the continuing ‘oddness’ of odd working hours.

This being said, it can not be neglected that there are social forces at work that stimulate the advent of a 24 hour economy, in this case implying prolonged opening hours of services. In the paper we will explore these forces. We hypothesize that the demand for prolonged opening hours is, among others, influenced by the possibility to frequent such services during the day time. This possibility is in itself influenced by working time factors such as length of working time, control over working time and the degree of work at ‘odd hours’. Using cross-sectional time use-data, we will perform multi-variate analyses to analyze the relative importance of these factors in the demand for a 24 hour economy.
Health, stress, and coping of Correctional workers: a comparison of shift and day workers.

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Keywords: Sense of coherence, coping, psychological and physiological well-being

The aim of this study was to investigate the impact of work type (day vs. shift work) while controlling for Sense of coherence (SOC) on physiological (cardiovascular and digestive symptoms) and psychological (psychological distress, perceived stress, cognitive and somatic anxiety) well-being. Ninety-nine workers (age \( M=47 \)) from two correctional centres participated in this study. Participants completed a modified version of the Standard Shiftwork Index (SSI) that also included measures to assess Sense of coherence and perceived stress. A MANCOVA (covariate: SOC) indicated that Dayworkers had significantly more cardiovascular symptoms in comparison to Shiftworkers. No other well-being measures were found to be significantly different across work type. Workers’self-reports showed a high frequency of prisoner interactions as a primary source of stress, and non-prisoner contact work as the least stressful aspect of work. A second MANCOVA (covariates: Length of service and SOC) accounting for prisoner contact (high-demand vs low-demand) indicated that High-demand contact workers had significantly more digestive symptoms than Low-demand workers and that Length of service in High-demand prisoner contact increased risk of cardiovascular symptoms. Significant proportions of all well-being measures including general sleep disturbance were found to be explained by SOC. High-demand workers also reported more diagnosed health conditions than Low-demand workers; no significant difference was shown between Shiftworkers and Dayworkers. Strong SOC workers adopted an engaged coping style (i.e. talked more to colleagues, problem solved, used positive comparisons, reacted assertively in conflicts, etc). Strong SOC Shiftworkers were also found to report taking more time to engage in leisure and sport activities and spending more time socializing with other shiftworkers. The findings from this study provide evidence that SOC is an important individual characteristic that influences individual well-being and preference towards coping style. Specifically, individuals with a strong SOC are more likely to report greater well-being and a greater preference towards positive, engagement type coping styles. This study also provided evidence that high stress prison work environments appear to exacerbate health risks to Dayworkers in comparison with Shiftworkers due to the increased daytime contact with prisoners. Implications for these findings in relation to the previous research are discussed.
Sleep quality and quantity: the assessment of shiftwork on a high risk worker cohort using the Standard Shiftwork Index and a Daily Sleep Diary.

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Keywords: Sleep quality and quantity, sleep disturbance

It is well established that shiftworkers are more likely to suffer from both psychological and physiological symptoms in comparison to permanent day workers. If the shiftworkers are also in the high risk worker cohort (e.g. police, etc) the additional burden may intensify those symptoms. To date, the Standard Shiftwork Index (SSI) has been a benchmark in a variety of shiftwork related studies to assess the impact of shiftwork on a variety of health related measures including psychological and psychological well-being. One of the most commonly reported measures from the SSI has been the sleep disturbance questionnaire. This questionnaire provides researchers with an indicator relating to the impact of shift patterns on a shiftworkers sleep-health status. The aim of this study was to investigate the relationship between scores on the SSI sleep disturbance questionnaire and actual daily reports of sleep quality (1 poor < 3 average < excellent 5) and quantity (minutes) over 28 days. A further aim of this study was to assess the possible interactional process between levels of sleep disturbance and its affect across Shift type (PM shift, AM shift, and Days off). It was hypothesised that in contrast to low sleep disturbance participants, high sleep disturbance participants would report significantly less sleep and poorer sleep quality across Shift type. Twenty-nine Police Officers (22 male, 7 female) with an average age of 33.06 (SD = 8.0) completed a modified version of sleep disturbance questionnaire taken from the Standard Shiftwork Index and then asked to complete a 28-day diary assessing perceived quality and quantity of sleep. Based on a median split of sleep disturbance scores, participants were defined into two groups, high sleep disturbance (HSD), and low sleep disturbance (LSD). A multiple analysis of variance was conducted using high/low sleep disturbance and shift type on sleep quality and quantity. The results indicated that HSD participants reported significantly less sleep and poorer sleep quality in comparison to LSD participants (for quantity HSD group \( M = 402.07 \), LSD group \( M = 466.05 \); for quality, HSD \( M = 2.90 \), and LSD \( M = 3.54 \)). The results also indicated that there were significant differences in sleep quality and quantity across Shift type: for quantity, PM shifts HSD \( M = 332.03 \), LSD \( M = 397.83 \); AM shifts HSD \( M = 402.89 \), LSD \( M = 465.72 \); and Days off HSD \( M = 431.72 \), LSD \( M = 495.47 \). For quality, PM shifts HSD \( M = 2.48 \), LSD \( M = 3.17 \); AM shifts HSD \( M = 2.87 \), LSD \( M = 3.53 \); and Days off HSD \( M = 3.11 \), LSD \( M = 3.70 \). No significant interactions were found. The findings from this study provide further evidence towards validating the Sleep disturbance questionnaire to indicate differences in the sleep-health states of shiftworkers.
Objective
A one-page sleep/activity diary was developed to capture detailed data about the ways workers time their sleep and other daily events when working demanding schedules. The diary is useful to document potentially risky patterns such as sleepiness at the end of the work period and very long work shifts so that future studies can design interventions to reduce risks.

Methods
Development of the diary included consultation with seven shift work scientists. The consultants verified the usefulness of the new diary and suggested improvements. After incorporating changes, the diary was pilot tested with research staff. After further improvements, the diary was pilot tested with nurse shift workers.

Result
The diary records daily events for one 24-hour period on an 8.5 inch by 14 inch page. (See figure below.) The diary is designed for scanning using Cardiff Teleform software to facilitate collecting data from large numbers of subjects. The format includes eight horizontal bars to mark time starting on the left at midnight and ending on the right at 11:59 pm. Each bar is divided into 15 minute segments and records times for one of eight events or feelings: 1) sleeping and naps; 2) working; 3) eating; 4) caffeine; 5) nicotine; 6) alcohol; 7) sleepiness; and 8) exercise. Two questions rate the quality of sleep during the longest sleep episode. A space records medications and unusual occurrences.

Conclusion
The new scannable diary efficiently collected data in a large study of work schedules in nurses. The Teleform diary file and instructions are available for use in other studies.
Working time of tramway drivers and traffic control operators

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Keywords: tramway drivers, tramway traffic control operators, shiftwork, ergonomic study

This study was developed in a company operating a tramway network in Portugal over the 24 hour’s period and it was focused on two different working contexts with shiftwork: the tramway drivers and the operators of the traffic control centre. The aim of the study was to provide health and safety guidelines for both working situations, based on an ergonomics thorough analysis of the exposure to stress and fatigue factors. Particular attention was devoted to the work schedules. Despite of certain adjustments to the specificity of each of the working contexts, the same methodology was used. The first analysis step consisted on the development and application of a questionnaire for the subjective assessment of working conditions. The total population of tramway drivers (54 subjects) and traffic controllers (12 subjects) were interviewed. After having a consistent characterisation of all workload related aspects, a job analysis was carried out, by means of video recording. For this procedure, each of the working contexts had different requirements. Thus, specific protocols for video sampling and analysis were defined. Regarding tramway drivers, the sampling of routes and drivers aimed to obtain an accurate representation of all different driving environments and schedules. As for traffic controllers, the considerable variability of tasks performed, required the collection of continuous video records throughout a whole working shift. A total of 6 drivers were filmed and three different shifts for traffic control. For both groups of subjects a chart was prepared to support a self-confronting interview, based on relevant issues gathered during video observation. Basically, these interviews consisted on the interpretation of different observed behaviours, in order to understand the unobserved aspects required by task performance.

On both contexts each shift has a 9 hours duration including one hour for meal. The tasks can be classified as complex task in a dynamic environment with high continuous cognitive demands of attention and decision making [1] [2].

Most of the control operators (67%) were not satisfied with their rotation system. The main reasons for this are the insufficient time interval for rest between shifts, overtime and irregularity on time for meals and pauses which depends of the amount of work sometimes leading to a high consecutive number of working hours without pauses.

The tramway drivers that were not satisfied with their rotation system (52%) report the irregularity of rotation as the main factor. The insufficient duration of pauses and the irregularity on time for meals are also referred.

Both groups report the existence of stress, fatigue and insufficient sleep duration on the morning shifts that start around 04:00 hours. The consequences are errors that could have an impact on safety. Recommendations regarding the working time and shiftwork organization were made based on available literature [3].

Influence of flexibility and variability of working hours on health

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Keywords: Working time arrangements, flexibility, variability.

In a previous analysis of the 3rd EU Survey on working conditions (1) we tried to evaluate possible relations between different “flexible” working hours with health outcomes. We defined as: a) “variability” an index of arrangement of working hours more subjected to company control and decision, and based on having or not to work the same number of hours every day and/or the same number of days every week and/or at fixed starting and finishing times”; b) “flexibility” an index of arrangement of working hours more related to individual discretion and autonomy, based on possibility of taking a break at one’s wish and/or being free to decide when to take holidays or days off, and/or able to influence one’s working hours. In general, the individually-oriented flexibility was associated to better health conditions than the company-based one. The aim of this study was to better analyse the relation between these two dimensions and health and well-being, considering the interaction with some background variables related to demographics, social and working conditions.

Methods
We used the dataset of the 3rd European Survey on Working Conditions, involving 21505 people, including 3595 self-employed and 17910 employed workers, 11815 men and 9690 women, standardised by age and work sectors. We tested the influence of “flexibility” and “variability” on the most relevant outcomes concerning 20 health disorders and 4 psycho-social conditions, by means of a multiple logistic regression analysis (STATA 8.0 package), in which the mutually adjusted Odd Ratios were calculated for age, gender, marital status, no of children, occupation, mode of employment, shift work, night work, time pressure, mental and physical work load, job satisfaction, involvement in work organisation.

Results
Among the 15 factors taken into consideration, “flexibility” appeared to have a positive influence on almost all the outcomes, while “variability” showed some influence only on few of them. In particular, lack of flexibility proved to be the most significant factor associated to “job dis-satisfaction (OR=2.82), “working hours fitting in not well with family and social commitments” (OR=2.33) and irritability (OR=1.87); it was the second most important factor associated to “overall fatigue” (OR=1.88), the “feeling of not being able to do the same job when 60 year old” (OR=1.77) and headache (OR=1.61), and the third most important factor associated to stomach ache (OR=1.80) and anxiety (OR=1.65); it was also a significant risk factor for heart diseases (OR=1.68), stress (OR=1.55), sleeping problems (OR=1.55) and the feeling that health or safety are not at risk (OR=.63). On the other hand, as concerns “variability”, less variable arrangements of working hours were significantly associated with better integration with family and social commitments (OR=.43), less heart disorders (OR=.50), and being able to do the same job when 60 years old (OR=.79).

Work ability in aging shift and day workers

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Keywords: work ability index, shiftwork, daywork, hospital workers, manual workers

Aging workers often show a reduced tolerance to shift and night work in relation to chronobiological factors, psycho-physical fitness, social and working conditions. We used the Work Ability Index [1] as a complementary tool for periodical health surveillance in order to better evaluate their functional working capacity, and to plan more appropriate preventive and compensatory measures.

Subjects and Methods:
1449 workers of both sexes (873 men and 576 women) were examined, aged between 21 and 67 years, and with a working experience varying from 0.5 to 48 years. They were engaged in three work sectors: 877 in hospitals; 186 in a chemical plant; 386 in construction works. According to their task and work load they were divided into five groups: office workers (14%), nurses (50.7%), physicians and biologists (18.5%), light manual workers (13.7%), heavy manual workers (17.1%). According to working hours, 647 (385 men, 262 women) were day workers, 676 (445 men, 231 women) were shift workers, both on semi-continuous and continuous 3-shift systems, and 86 were former shift workers. During their annual health check at work site they were submitted to a complete medical examination, including health history and blood and urine analysis, and the Work Ability Index (WAI).

Results:
WAI was “excellent” in 29.6%, “good” in 47.6%, “moderate” in 19.5% and “poor” in 3.2% of all subjects. WAI progressively decreased with increasing age, passing from 41.2 on average in people under 26yrs to 37.8 in those over 55yrs; people with “poor/moderate” WAI were 13.4% in the youngest group and 34.5% in the oldest one; on the contrary, 33.8% of the youngest had an “excellent” WAI, but 17.8% of the oldest. A higher decreasing trend was recorded among women than men in nurses, but not among physicians and clerks. In men, the max decreasing trend of WAI over the years was recorded in heavy manual workers and nurses, while it was evident only in the oldest group among light manual workers, and was almost unaffected in clerks, physicians and biologists. In general, men shift workers showed a significantly lower WAI than day workers after 45 years of age, while women shift workers showed a lower WAI than day workers starting from 35 years of age. Considering the same job, among hospital workers, women (but not men) shift-workers showed a more pronounced decrease of WAI in all age groups as compared with their day workers colleagues. In men construction workers, WAI proved to be worse in shift workers than day workers, but less in semi-continuous than in continuous 3-shift workers. The 3-way ANOVA showed, besides age, a more significant influence of shift schedule than job on WAI, and more interaction between job and shift schedule than job and age. There was also a clear difference in WAI scores between day and shift workers suffering from cardiovascular and digestive disorders, above all in men.

Long work hours; effects on sleep, sleepiness, cortisol and blood pressure

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Objectives
There are inconclusive results from previous studies of overtime work and 12h workdays and their effects on stress, sleep and health. This may be partly due to methodological problems such as the use of between group designs, or before-after reorganizations. In addition, stress is usually a confounder- overtime work is likely to coincide with stressful work situations. The present study examined the effects of working 8 or 12 hour during a 5 day workweek (40h or 60h per week) using a within subject design and without any external stress. The additional work hours were simply an extension of the normal working day.

Methods
In an experimental field study16 white-collar workers (10 women and 6 men, mean age 44.7±15 years) undertook one workweek with normal work hours (8h) and one week of 12h days. Subjects wore actigraphs, rated their workload (1-5 very low), how exhausted and slow thinking they felt (1-5 not at all) and if they had had enough recuperation (1-5 definitely enough). At 8 times per day they rated sleepiness (Karolinska Sleepiness Scale, 1-very alert, 9-very sleepy) and stress (1=no stress, 9=extreme stress). They also reported what they did after work each day. Eight samples of saliva for cortisol analysis were collected on Mondays and Thursdays. On these days also ambulatory heart rate and blood pressure were measured for 24h in a 1h intervals during the day and 2h intervals during the night.

Results
Subjects reported no differences in workload or stress between the 8h and 12h workweek. However results showed significant differences in exhaustion, slow thinking, and recuperation. During the 12h workweek subjects felt more exhausted (8h=4.8±0.1, 12h=4.6±0.1; p<0.01), more slow-thinking (8h=4.7±0.1, 12h=4.3±0.2; p<0.05) and had less sufficient recuperation (8h=3.7±0.1, 12h=3.4±0.1; p<0.01). Analysis of sleepiness showed a significant interaction (p<0.05) between conditions, with higher levels at the end of the workweek in the 12h condition. Data from actigraphy showed that subjects woke up later at the end of the 8h workweek but there were no differences in objective or subjective measures of sleep quality. However during the following weekend sleep efficiency (actigraphy) increased after the 12h workweek (8h=90.3±1.0%, 12h=93.2±0.7%; p<0.05). There were also differences in time spent on different activities. During the 12h workweek subjects spent less time on household work and on “personal time”. There were some differences in objective measures of arousal showing a higher systolic blood pressure during the Monday in the 12h workweek. Analysis of cortisol showed a significant effect of time of day and reduced amplitude on the Thursday during the 8h week, though this might be an effect of the later wake up times.

Conclusions
A 12h workweek was associated with greater exhaustion and increased sleepiness by the end of the week. The current participants had low work/family conflict and groups with greater commitments outside work may possibly be more negatively effected by longer work hours.
Work schedules and driver sleepiness

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Objectives of the study
There is increasing recognition that shiftworker safety extends beyond the work place. In particular, driving to and from work is an additional risk factor faced by workers. There are few direct studies in this area and they have tended to focus on rotating shiftworkers working extended shifts (1). In general, these studies concluded that driving after night shift is linked with the highest levels of sleepiness. There do not appear to be studies that have compared sleepiness between shiftworkers and day-workers and in particular, day-workers whose shift length also varies. The objective of this study is to examine the relationship between work schedules, shift timing and shift length on driver sleepiness.

Approach and methods
Three driver groups were examined. Each group varied in terms of work schedule, shift timing and shift length. Rotating shiftworkers (SW, n=217) were employed mostly on 12.5h shifts (82%) and the balance worked 10-12h shifts. Long day workers (LDW, n=72) worked 10-12.5h shifts (87%) per day. Day shift start times for SW and LDW were approximately 06:30. The standard day work (SDW, n=75) group worked mostly an 8h shift (89%) that commenced at approximately 08:30. The groups were matched for driving distance to work (mean 45km). Respondents completed a survey that contained items concerning work/travel times, sleepiness ratings (KSS), driving impairment and accident involvement.

Results
Significant differences (<0.01) in sleepiness were found for sleepiness levels between the three groups when driving to commence day shift. The SDW group reported the lowest levels of sleepiness and the longest sleep duration (7.7h). Sleepiness when driving home from day shift was highest in the LDW group. Sleepiness ratings for SW when driving to commence night shift were similar to the end of day shift and significantly increased (<0.01) when driving home after night shift. There were no significant differences in ‘falling asleep at the wheel’ for day work but the frequencies were higher in the SW and LDW groups. Thirteen per-cent of SW reported falling asleep when driving to night shift compared with 43% falling asleep when driving following night shift. Falling asleep resulted in a number of lane drift incidents including running off the road. These incidents were more common in the LDW group.

Conclusions
The earlier driving time to commence day shift was associated with increased levels of sleepiness. For all groups, sleepiness ratings were higher when driving after completing the day shift; the greatest change was in the LDW group. Driving home following night shift was linked with the highest levels of sleepiness and frequencies of falling asleep at the wheel. The findings suggest that sleepiness was greatest in SW driving after completing night shift followed by the LDW. Workers on standard working arrangements reported the least sleepiness.

Work hours, sleep and medical errors in Australian nurses

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Keywords: nursing, sleep, fatigue, work hours, errors

Background and Objectives
The frequency and severity of adverse events in Australian healthcare has recently come under increasing scrutiny. A state government report for New South Wales (2003/4) identified 31 events involving “death or serious [patient] harm” and 452 “very high risk” incidents [1]. Australia-wide, a previous study identified 2324 adverse medical events (AME) in a single year [2]. Over half of these events were considered preventable.

Despite the recognised link between fatigue and error in other industries, to date, few studies of medical errors have assessed the fatigue level of the healthcare professionals involved. Nurses work extended and unpredictable hours with a lack of regular breaks and are therefore likely to experience elevated fatigue [3]. Currently, there is very little available information on Australian nurses’ sleep or fatigue levels. Nor is there any information about whether this affects their performance. This study therefore aims to examine work hours, sleep, fatigue and error occurrence in Australian nurses.

Methods
Using anonymous logbooks, 50 full-time nurses in an Australian metropolitan hospital completed daily recordings over a 1-month period of their scheduled and actual work hours, sleep length and quality, sleepiness and fatigue levels. Frequency and type of nursing errors, near errors, and observed errors (made by others) were recorded, and nurses wrote a short narrative describing the circumstances surrounding each error.

Results
Preliminary analyses (n=23) indicated that nurses reported struggling to remain awake during 36% of shifts. Moderate to high levels of stress, physical exhaustion and mental exhaustion were reported on 23%, 40% and 36% of shifts respectively. Extreme drowsiness during the commute home was reported on 45 occasions (11.5%), with 3 reports of near accidents when driving or cycling home. Overall, 20 errors, 13 near errors and 22 observed errors were reported. The perceived potential consequences for the majority of errors were minor. However, 11 errors were associated with moderate and 4 with potentially severe consequences.

Conclusions
This suggests that Australian nurses experience sleepiness and related physical symptoms at work and during their trip home. Further, a measurable number of errors occur of various types and severity. Ongoing analyses will directly examine the relationship between sleep, fatigue and errors, specifically investigating the connection between fatigue, error type and severity.

Assessment of Working Times in German Restaurants

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Keywords: Working time, shift work, gastronomy, rota risk profile

Working times of gastronomy staff vary considerably over days, weeks, and seasons. In German restaurant kitchens and service areas, a study has been carried out to answer the following questions:

1. What working times are common in this service sector?
2. What do employees think about the effects of these working times?
3. How can working times be judged on the basis of ergonomic criteria?

132 employees completed a form for time-budget studies (working time, leisure time, days off) over a period of 28 days. Another 147 questionnaires were completed that were based on the Standard Shift Work Index (SSI) adapted to the situation in the restaurants and Bruggemann's (1974) analysis of job satisfaction. We plan to assess working times using the Rota Risk Profile Analysis (Scheffmann and Jansen, 2001), which is based on 9 rota-risk criteria. The innovative approach of this analysis lies in its coherent assessment of the physical and social risks of different working times.

The first question revealed wide differences between the working times of restaurants in the Berlin region with constant opening hours over the year and restaurants in a touristy region (Lake Constance) with considerable variations and peak months from April to October. The average daily working time was 9.7 hours (8.7 hours in kitchens in Berlin, 10.8 hours in kitchens on Lake Constance). In the touristy region, 73.5 percent of the employees in the kitchens had to work split shifts. About half of the employees in the service areas had to work evening shifts.

The evaluation of the SSI showed that 77 percent of employees would prefer to work only in day shifts. Most sleep problems were reported in connection with split shifts. Most complaints about tiredness had to do with morning shifts and split shifts. 23 percent often or nearly always suffered from gastro-intestinal problems. About 60 percent were not satisfied with the amount of time available for leisure at weekends and excursions with the family.

As a result of these enquiries, we plan to assess working times using the Rota Risk Profile Analysis which yields reliable predictions. Furthermore, we will calculate correlations between profiles and complaints.


Scheffmann, M. and Jansen, B.Rota-Risk-Profile-Analysis (RRPA), Shift work International Newsletter, Vorl. 18, No. 1, p. 33 (2001)
Shift schedule interventions: the effect of workers’ participation

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Objectives of the study
The aim of the present study was to investigate a shift system intervention at two work sites and study the effects of sleep, health and well-being. The intervention was based on a change from a rapidly rotating three-shift system with short rest (8 and 9 hours) between shifts to a shift system based on slower rotation and longer rest times between shifts. However, at one of the sites the workers’ had participated in the development of the new schedule, whereas the new schedule was forced on the employees at the other work site.

Methods
The study was conducted on police officers. The design included control groups at both sites and pre- and post-change measurement. However, one of the control groups could not participate in the post-change measurement. The sample was approximately 30 subjects at each work site, in addition to the controls. However, in the post-change measurement the number of subjects was reduced to 26 and 17, respectively, for each of the sites. The measurement involved a questionnaire and saliva samples for determination of the stress hormone cortisol. The present analysis will only deal with the subjective data.

Results
80% was positive and 10% was negative to the intervention at the work site where the workers’ participated (site A) in the development of a new schedule. At the other work site (forced intervention, site B), 28% was positive and 66% was negative to the shift change. The satisfaction with the possibilities to influence the intervention was higher at site A (60% vs. 8% for site B, p<0.001). At site A the frequency of subjects reporting insufficient sleep decreased from 41% to 15% (control group: approximately 30% at both measurements). The prevalence of sufficient recovery between work shifts also improved at site A (pre: 41%, post 80%; control group: pre: 41%, post: 55%). Sleepiness decreased after the intervention, however, the control group also showed improvement for the post measurement. The effects on health and social life were mainly non-significant, although 60% reported that health had slightly improved after the change. At site B, the prevalence of insufficient sleep increased from 31% to 52% after the intervention (p<0.05). Also insomnia increased (pre: 2.5, post: 3.6, 1 no problems – 6 problems every day, p<0.01). In particular, fatigue during days off increased after the intervention (69% reported increased complaints). Some health complaints, e.g. burnout, increased after the intervention. No significant effects were found for questions related to the social life situation. At site A, 80% wanted to keep the new schedule, whereas at site B 31% wanted to keep the new schedule.

Conclusions
Workers’ participation in the development of a new shift schedule had a large impact on the intervention. Forcing a new schedule on the staff increased problems with sleep and recovery and decreased satisfaction with work hours, whereas high influence on the intervention improved sleep and well-being. It is likely that forcing a new schedule on the employees caused increased stress and decreased work motivation. This highlights the importance of involving the workers in the intervention process when new shift systems are introduced.
Sleepiness and two or three pilot crews on intercontinental flights

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Keywords: sleepiness, pilots, crew size, sleep, jet lag

Intercontinental flights usually involve sleep loss and sleepiness. The number of pilots (2 or 3) may have a bearing on this. We therefore carried out an experiment with 20 pilots who were scheduled to one flight as a member of a 2 pilot crew and another flight as a member of a 3-pilot crew. With 2 pilots sleep was restricted to the chair of the pilot in the cockpit. With 3 pilots a crew bunk could be used. The flights involved the route Stockholm-Chicago starting at 1015 from Stockholm and 1615 (EST) from Chicago. Data were collected from two days before the flight to two days after the flight, with a 28h layover (4,5 days). A wrist-worn actigraph was used for objective sleep scoring; the Karolinska Sleep Diary was used for subjective sleep data and the Karolinska Sleepiness Scale was used for ratings of sleepiness - on rising, 2-3h later, at blocks off (*start*), Top of Climb, 2 hours after ToC, 4 hours after ToC, Top of Descent, and Blocks off (standstill after landing). The data were analyzed with t-test to compare conditions for amount of sleep on board and similar variables. Sleepiness and sleep was analyzed using a two-factor (time*crew size) analysis of variance for repeated measures. The results showed that sleep varied very little between the 5 “days”. The amount of sleep on board differed significantly 0.18±.06 vs 0.76±.12 h, p<.001) on the outbound and on the homebound (0.75±.15 vs 1.03±.17h ns ) flights. Sleepiness showed a highly significant variation across time and the interaction term was marginally significant (see fig). Essentially sleepiness increased towards the end of the flight. Similar results were obtained for subjective performance. the homebound flight showed less differences but increased sleepiness late in the flight. It was concluded that the 2-pilot condition involves less sleep and higher sleepiness.
Six our day – effects on health and gender equality

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Keywords: Work environment, home environment, health, experiment, measurement

National Institute for Working Life got a mission from the Government according to research the relation between the quantitative work time and the employee’s health. The mission’s purpose is to be made in a perspective of gender. The experiment involves employees reducing 25 per cent working time every day due to the Swedish normal full time is eight hour a day down to six hour a day. The project pays the absence of salary. It is 450 employees in the study group and the same number in the control group spread on 28 places of work. The control group is not reducing their time.

Tools used in the experiment are questionnaire for describing the work environment, the home environment and the quality of the sleep. The 900 employees do also a visit at the doctor and get measured length, wideness and weight. The condition and blood pressure is tested and fat and sugar in the blood is also measured. All the tools are used three times in two years.

Since 1997 has the absence due to sickness accelerate on the Swedish labour market and most of all in the public sector. There are also huge differences between the Counties the further north the more sickness. The differences in sickness between women and men are also notable, women 36 per cent and men 64 per cent.

In our just finished first measurement we found that woman has worse health in general, they have overweight, to high cholesterol and exercise in short extent. On the other hand women’s work time is way longer than men’s if you put paid and unpaid work together. A time own your own is an unknown idea for the woman while men has time of their own in larger extent. Different forms of psychological problems seems to be an increasing problem specially among young women during the last couple of years. The three diagrams below shows the so-called un-health number that in a measure on paid days for employee’s illness from the government. In Sweden the employees get 80 per cent of their salary from the employer the first 14 days of the period of illness. These 14 days are not in the diagram. Demands at work has increased in the last ninetieth, and the security has reduced, as a result there are long terms effects on the health in general and because of that increased reporting sick for periods more than three weeks. The reported unhealthy has grown among the younger employee’s for example with more psychosomatic problems like problems with the sleeping. It is not only growing demands at work that is responsible for the increasing sickness, it is a complex of problems there the free time and that social net are at least as much sense as work. After the next period of measurement we are able to introduce a bases of knowledge with more profound analysis with more facts taken in consideration for example work environments influence and factors like family, level of educational attainment, organization and structural factors.

In the order in which they appear: Riksförsäkringsverket “Social Insurance book 2004” Stockholm (www.rfv.se)
Fatigue management in health care: development of practical tools and strategies to manage fatigue-related risk to patient safety.

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Keywords: Sleep, Patient safety, Fatigue, Risk management

Fatigue has been recognised as a major risk factor for health and safety in a number of industries. Aviation, road and rail transport and mining organisations worldwide have begun to implement fatigue risk management systems aimed at reducing the number and severity of fatigue-related accidents in the workplace. Individuals working in the health care setting are often exposed to long/irregular hours that impact on sleep and therefore fatigue levels. The purpose of the project was to develop practical tools and strategies that will enable health workers in Australia to recognise, prevent and mitigate fatigue.

A consultation phase addressed the following key issues with respect to fatigue risk management: perceptions about the causes of fatigue; frequency, typology and consequences of errors and incidents; types of errors that others make; identifying successful informal practice; training and education; culture and implementation issues; fatigue management system framework. Information was collected using focus groups, semi-structured interviews and questionnaires nationally. Consultation in this type of project is critical to ensure that the fatigue management tools and strategies are practical, relevant and suitable for implementation within the Australian healthcare environment. Particular focus was given to the manner in which teams or work units manage fatigue risk. Other topics covered in the consultation included current rostering practices, continuity of care, hours of work and implications for training of junior staff, potential barriers to fatigue management and human factors issues.

Research and applied experience shows that individuals exposed to fatigue-related risk in their employment often adopt formal risk mitigation strategies, based directly on the degree of fatigue experienced, the types of errors that occur and the nuances of the job that dictate appropriate responses. The consultation phase drew on this collective experience and knowledge to define informal strategies that are used by individuals and work teams and from that, develop formal procedures for managing fatigue-related risk.

The project provides a unique perspective on current views and attitudes of health workers towards fatigue and fatigue management. Further, the results from the consultation indicate specific areas that need to be targeted in the management of fatigue-related risks. The tools and strategies developed from this project will also be trialled and evaluated.
Operating Hours Assistant – A software for shift design

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Keywords: shift design, operating hours, qualifications, annual planning, staffing level

Objective
In some sectors, e.g. transport or health services, typically strong variations in demand occur. E.g., a demand profile can vary strongly over the day as well as over the week. If one would use traditional 8h shifts to cover that demand over- and understaffing would occur. To deal better with such circumstances a specialised software tool was developed. Based on operating hours – the number of employees that should be available at a definite time – the Operating-Hours-Assistant should automatically search for optimal shifts. This optimisation process is influenced by several conditions, e.g. the minimal or maximal length, reasonable starting and ending times, and – in case there is no optimal solution – how under- and overstaffing should be weighted. Additionally for any shift system found the number of employees needed can be calculated considering absenteeism like holidays, sickness, etc.

Method
Based on several prototype projects where shift design was done with the aid of excel-sheets we identified crucial issues for such a software and developed a first version. After working a lot with the first version in consulting it got obvious that the software should be extended to facilitate the planning with different qualifications as well as varying annual demand.

Results
The current version 2.0 supports professional shift-designers in three core areas. The main task is to find optimal coverage. At the one hand excessive overtime or idle time can lead to high costs and therefore employers try to avoid them. At the other hand employees should be provided with sufficient numbers of days off.

A second purpose of the Operating-Hours-Assistant is to enhance the calculations with the qualifications of the staff. For example in a hospital it can be verified if there are sufficient physicians or nurses to comply with the shifts found.

The third task is the calculation of varying operating hours during one year. Given an company different shift systems may be needed to be able to react to varying volume of work. Choosing a calendar with a specific starting point the designer can calculate the average weekly working hours for an employee during one year assuming that some weeks exhibit a higher workload than others. In addition the amount of production reached within that specific year can be computed.

Conclusion
Spending time with shift design pays off because the main costs of a shift system as well as the working conditions for the employees are influenced significantly. The Operating-Hours-Assistant supports design tasks providing clear graphical illustrations and the most important key figures of the initial requirements as well as the solutions found. Moreover the ergonomic quality of a shift rota can be evaluated.

The next version of the Operating-Hours-Assistant will provide a considerably improved algorithm for finding optimal shift systems.

The presentation will demonstrate how to find shifts for a hospital ward and check whether the shifts found will lead to an ergonomic shift schedule.
Work ability of healthcare shiftworkers: what matters?


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Keywords: healthcare shiftworkers, work ability, work control, life styles

Objective
The aim of this study was to evaluate variables associated with work ability, well-being and health of healthcare shiftworkers.

Methodology
A cross-sectional study about working and living conditions and consequences on health and well-being is being carried out in a University Hospital of São Paulo, Brazil. This study is part of a larger research study aiming to evaluate tolerance to 12-hour day and night work. It is being conducted in a general hospital with 977 beds. Nursing staff, mostly females, includes registered nurses and nurse aides. They total 904 workers. All participants signed consent forms. Data collection began in October 2004. So far, 173 workers (only 22 are men) answered a comprehensive questionnaire about living conditions and working conditions (including incivility at work, work demands, work control and support), mental and physical health symptoms (fatigue, sleep disturbances), and early aging. Several scales are included in this questionnaire: SF-36- (Ware, Snow & Kosinski, 1993), validated in Brazil by Ciconelli et al (1999), SQR-20 (Harding et al, 1980) – a validated Brazilian version (Mari & Williams, 1986), Work Ability Index (Tuomi et al, 1991) - an adapted Brazilian version (Tuomi et al, 1997), Job stress scale (Alves et al, 2004) - a modified adapted version of Job Content Questionnaire (Karasek & Theorell, 1990). The studied population work in one of the following shift schedules: 12-hour nights followed by 36- hours off; 12-hour day followed by 36- hours off; 8-hour or 6-hour day shifts. At this stage, only results for women are presented here (n=151). Mean age of the respondents is 36.9 years (s.d. 11.2), mean time on the job is 10.9 years (s.d. 8.9). Statistical analysis using a multiple logistic regression model was performed to evaluate the factors associated to inadequate (moderate and low) Work Ability Index (WAI).

Results
Factors associated with inadequate WAI are: time on the job as a registered nurse or nurse aide up to 10 years- as a protection factor (OR 0.23, p=0.013), lack of exercise (OR=2.76, p=0.018), low work control (OR= 3.17, p=0.039). Adding to the model all domains of SF-36, and SQR-20, results are slightly different: pain and general health state domains present in SF-36 and SQR-20 (presence of minor psychic symptoms) are statistically significant and lack of exercise lost statistical significance. However, time as a nurse or nurse aide- up to 10 years, as a protection factor (OR=0.16, p=0.028) and low work control (OR=3.84, p= 0.076) remained in the model. Results on the non-association between some work factors (e.g. shift schedules) and WAI may change after the accomplishment of the study, with an increased sample size.

Nowadays, early aging is a matter of concern. A former study among healthcare workers eight years ago, in another University hospital of São Paulo showed inadequate Work Ability Index among nursing personnel in their late thirties. In spite of the small number of participants, and the limitations of the study design, results indicate that nursing is a profession usually associated with bad working conditions leading to health problems. Intervention measures, such as exercise practice, are very necessary to prevent a decrease in work ability, even in this quite young working population.

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Job characteristics and stressors faced by call center operators of an international bank, located in Rio de Janeiro, Brazil

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Keywords: shift work; call center; job demands, ergonomics work analysis.

Aim
To describe job characteristics and stressors of call center operators during day and night shifts, working week and weekends.

Method
A case- study was carried out in a call center of an international bank located in Rio de Janeiro, Brazil. Ergonomic work analysis included systematic observations of 6 call center operators (3 males and 3 females), in their twenties, working during morning and afternoon shifts, including video-recording, and call electronic monitoring. Additional interviews were conducted among day and night operators and totalized 91 workers. Fixed shifts were of 6-hour duration, with 30 minutes break. This call center worked 24 hours round a clock, and 7 days a week. During weekends and holidays there were a special schedule to cover the 24- hour operations. Total number of weekly working time were 36 hours. Mean wages were 250,0 US dollars a month. Mean working time were 30 months. Data collection were conducted in 1999 and 2000.

Results
The studied workplace was a call center of recepive attendance and crossed sales. The complexity of the tasks resulted from the diversity of customers and services requested. These required workers to gather information in different manuals as well as asking colleagues and supervisors when attempting to solve clients’ demands. Prescribed work aimed that operators should take care of at least 80 percent of incoming calls, selling bank products whenever was possible. Clients shouldn’t wait longer than 15 seconds. Operators had to maintain a pattern established by the bank of 90 to 140 calls daily and an average length of time of one and a half minutes per call. Ninety attendance operators, 6 supervisors and 1 manager took care of an average of 8,000 daily calls which reached 11,000 during peak times. These were in the beginning and end of each month, before and after holidays. Busier working hours were from 10:00 to 14:00 hours, from 15:00 to 16:00 hours, and from 01:00 to 03:00h. During these times, it was quite common a queue of dozens of callers. During night shift (after 19:00 hours), weekends and holidays, calls from the whole country were transferred to this call center. Call center operators faced high physical and cognitive demands. It is worth of notice the static postures for long periods (95% of the time the workers remained in a sitting posture) and insufficient rest time within the shift. Also, a significant number of psychosocial stressors were prevalent in the workplace, such as, few opportunities of career; injustices concerning wages, rumors about closing the call center; high turnover and absenteeism leading to overload of operators who were present, discrimination of call center operators by other employees of the bank. Bad environmental conditions were noise, indoor pollution, and thermal discomfort due to air conditioner, insufficient illumination and screen glare, improper furniture and equipment, dirty floors with fleas. Night workers and those scheduled to work during weekends, holidays (either during the day or night) reported: worse quality of connections, lack of supervision, difficult clients calling during these times, restricted access to proper information, impossibility to release credit cards, internet was not working during part of night shift, calls’ queue, insufficient number of workers, and last minute recruitment to work during weekends and holidays. There was a rivalry between clients and operators, when incoming calls were from São Paulo and operators were from Rio de Janeiro.

Conclusion
There were common job demands for call center operators working in different shifts. However, working conditions during night shifts, weekends and holidays were worse and demanded different skills and coping strategies from the operators, compared to day shift workers.
A framework for an integrated fatigue risk management system: considerations for designing shiftwork schedules in 24-hour operations

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Keywords: fatigue, schedule, risk, management, system

\textbf{Introduction & Objective}

A growing body of research has led to an increasing understanding of the risks associated with sleepiness and fatigue on the roads and within workplaces\textsuperscript{1-3}. In addition, specific laws now communicate a clear responsibility to businesses, for the management of fatigue risks, in numerous jurisdictions\textsuperscript{4}. One of the major influences that a business can have, to manage work-related fatigue, is the work schedule. Therefore, the development of safe and effective schedules is of growing interest to industry and governments alike. The general objective of this study was to review the potential components of fatigue management initiatives, including work scheduling. The specific objective of the study was to develop a framework for an integrated fatigue risk management system with a major focus on critical factors for 24-hour work schedules.

\textbf{Approach & Methods}

Over a six-month period two parallel processes were completed. One process involved both formal interviews and informal discussions with a sample of employees and managers within a large (>30,000 employees) 24-hour per day business. The second process involved the collation and review of published strategic and tactical fatigue countermeasures in order to develop a framework for an integrated fatigue risk management system that included schedule design criteria.

\textbf{Results}

Two groupings of processes emerged from the study. One grouping related to technical, procedural and administrative processes and controls. The specific requirements within this grouping included scientifically supported hours of work rules, audit systems to assess compliance with hours of work rules as well as clear accountabilities for managing non-compliance and incident/accident situations where fatigue may have contributed. The second grouping of processes related to fatigue risk management training for numerous levels of employees as well as periodic review and adjustment of system rules based on changing business and/or employee preferences.

\textbf{Conclusions}

By creating scientifically valid hours of work rules that are applied and supported by technical, procedural and administrative systems, businesses can better meet both operational and human requirements. This is especially true when work schedules fit within an integrated fatigue risk management system since a more consistent and auditable framework exists to allow compliance audits from within the business or from a government office. Furthermore, the costs of fatigue-related incidents and accidents and the operation of the actual work hours can be more objectively be determined. Although compliance by itself is an acceptable benefit of such systems for businesses there is an essential demand for ongoing evaluations to objectively determine any benefits to safety.

Recovery from cumulative sleep restriction involves a complex, multi-factor ‘reservoir’

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Keywords: sleep restriction, recovery, model, performance

Introduction & Objective
Cumulative sleep restriction, as opposed to total sleep deprivation, most closely resembles the sleep/wake patterns of groups such as shift workers, engaged military personnel and emergency response operators. The amount of available data of individuals subjected to cumulative sleep restriction however is minimal. From existing data it is apparent that recovery from cumulative sleep restriction is not a comparable process to recovery from total sleep deprivation. This implies a more complex, multi-factor ‘reservoir’ of capacity to withstand sleep deprivation as indicated by laboratory performance tests. In order to assess what factors may modulate recovery from cumulative sleep restriction, datasets from the Walter Reed Army Institute of Research was assessed.

Approach & Methods
Given that previous assessments of cumulative sleep restriction recovery indicated an increasing recovery time based on greater sleep restriction, numerous potential factors were considered. These included the quantity of recovery sleep and the level of sleep saturation prior to sleep restriction. The standard deviation weighted least-squares parameter estimations were performed by a damped Gauss-Newton procedure.

Results
These findings are consistent with previous results showing that a multi-factor recovery function improves the proportion of variance accounted for by predictions of recovery. In addition, there is an indication that the period of time generally used for the collection of baseline sleep data prior to experimental conditions is insufficient for the provision of an absolutely accurate performance baseline.

Conclusions
These results suggest that recovery from cumulative sleep restriction is likely to involve a number of factors including degree of sleep restriction, degree of sleep saturation over the period prior to sleep restriction and differences between individuals. This implies that sleep data should be collected for significantly longer periods than traditional protocols require so that recovery profiles of cumulative sleep restriction can be more accurately predicted.

2 Van Dongen HPA, Maislin MS, Mullington JM, Dinges DF. Sleep 2003; 26(2):117-126.
Estimating the circadian rhythm in the risk of errors resulting in injuries

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Keywords: Accidents, injuries, safety, work schedules, mathematical models

We recently proposed a prototypic Risk Index (RI) to estimate the risk of critical errors associated with shift systems (Folkard & Lombardi 2004). The RI is based on published trends in the relative risk of injuries and accidents associated with (i) 3 different (8h) shifts, (ii) successive day or night shifts, (iii) the length of the shift, and (iv) the interval between successive rest breaks during the course of a shift. A simple additive model based on these trends (and linear extrapolation where necessary) is used to estimate the risk for any given shift system. In principle, the RI is similar to the various models of fatigue that have been proposed and to the UK HSE’s Fatigue Index (FI). It shares with them the distinct advantage that it considers features of shift systems in combination with one another. This contrasts with work hour limitations or regulations (e.g. the European Union’s Working Time Directive) that typically consider shift system features independently from one another. Further, the RI has two distinct advantages over the other “combined-feature” models, namely that (i) it is based directly on trends in the risk of injuries and “accidents” and thus has a high face validity, and (ii) the output is an estimate of the relative risk associated with the shift system, rather than an arbitrary fatigue value, and thus allows informed decisions to be made as to the shift system’s acceptability.

The prototypic version of the RI can be used to provide risk estimates for most types of shift system, and the derived estimates are typically positively correlated with the fatigue values derived from the FI. However, in its current form it cannot be used for the type of irregular work schedules that are commonly found in transport and other operations since it is based on “normal” shift start times (e.g. 06:00, 14:00 and 22:00). To extend it to irregular work schedules requires an estimation of the shape and size of the circadian rhythm in risk. This paper will review three independent sources of data that allow such estimations to be made, namely (i) the risk across the 3 different (8h) shifts, (ii) the trend in risk over the course of the night shift, and (iii) the trend in the risk of occupational injuries over the 24-hour day. Phase estimates derived from these three data sets showed considerable agreement with one another. However, the amplitude estimates exhibited greater variation, with that based on the 3 shift data being substantially smaller than the other two. We consider various confounders that may account for these differences in amplitude estimates, such as lighting conditions, time on task, and differences in occupational exposure. We conclude that the best estimate of amplitude is probably that based on the 3 shift data. Finally, we consider the fact that the phase estimate of the circadian rhythm in risk is much earlier than that which would be predicted from considerations of alertness, fatigue, or performance and offer possible explanations for this discrepancy.

Does Shiftwork-Research Research Shiftwork?

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Keywords: Shiftwork in service industries, gender aspects of shiftwork, economical aspects of shiftwork

Objective
The specific forms of shiftwork working conditions vary strongly between different occupations (e.g., cleaners often work very early morning shifts that are short and often early evening shifts, while industrial workers often work in 8h Morning-, Evening-, Night-Shifts). The objective of this paper is to review how well shiftwork research considers different occupations and different arrangements of shiftwork.

Methods
We conducted a search in Entrez - a service of the National Library of Medicine - that includes over 15 million citations for biomedical articles back to the 1950's from MEDLINE and additional life science journals - http://www.ncbi.nlm.nih.gov/entrez/query.fcgi. Given the diversity of journals that publish shiftwork research, this library probably contains many but not all research papers in this field. The search was done for key words like shiftwork, night shift, morning shift, working time, etc. in order to apply a very broad definition of shift work (i.e., it includes evening work, very early morning work). Abstracts from other research areas (e.g. working time of elastic impression materials) were excluded and the remaining 4424 references of research papers were analyzed.

Results
In 3373 cases we could obtain the abstracts of the research work and 2958 gave some information on the persons involved. However only 640 abstracts dealt specifically with working time/shiftwork and allowed for a classification regarding the occupation along the International Standard Classification of Occupations (ISCO-88) that led to 772 classifications(565 single, 75 multiple classifications that led to further 207 entries).

There is a striking discrepancy between the number of research papers dealing with employees from specific occupations and actual distribution of shiftwork.

- In primarily male occupations most research papers dealt with plant and machine operators and assemblers 117 (plus 32 as one of several occupations) or police officers 17(3).
- In primarily female occupations studies on nurses dominated completely 174(42).
- Some smaller, high profile, occupational groups were covered quite well too, e.g., air traffic controller 19(0).
- Other occupations were left out in shiftwork research. Most strikingly is that the coverage for some but not all large (primarily female and economically weaker) groups is disproportional low. E.g. housekeeping and restaurant service workers 1(3); domestic and related helpers, cleaners and launderers 1(4). The same holds true for home services, an industry that grew strongly in the last years.

Discussion
The lack of research dealing with these occupations is a shame.
Time Intelligence – Software for analyzing large time-related data sets

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Keywords: Explorative Data Analysis, Shiftwork, Staffing demand

Objective
Working hours of employees, particularly in the service industry, vary widely from day to day and week to week. These shifts may be highly irregular, utilize split shifts and extended work hours, include periods of stand-by time, etc. With the dissemination of planning software as well as time & attendance systems but also of other systems processing, for example, times of customer calls, events and sales data – an assembly of large data-sets evolves with information on actual working hours as well as on information regarding the actual work load. Classical software for the analysis of time-series does not appropriately deal with the specifics of working time. The objective of the software development that led to Time Intelligence was to make it feasible to ease the analysis of such working time related data. Such analysis should facilitate the detection of discrepancies between work-force demand and work-force supply thereby minimizing understaffing and corresponding pressure on employees as well as overstaffing and avoidable costs.

Method
Based on a dozen prototype projects where such analysis was done with ever more complex Excel spreadsheets we identified critical issues for such software and developed a web-based program that overcomes the shortcomings of existing software packages (i.e. the limited number of rows in Excel, poor performance of general purpose databases and their missing time-related functionality, complexity of statistical software, lack of workflow support for the collection of data and dissemination of results).

Results
The software supports the fast, interactive management of large time related data sets and has already been used in 10 projects (2004/12-2005/3). A crucial feature is very flexible annotation of time related data, e.g., to be able to distinguish holidays from normal days, special days and special periods of time. It supports several transformations of time, a drill-down facility and various flexible visualizations (e.g., staffing on different days of the week in different seasons). The software scales well, several 100,000 records can be processed in seconds. It is easy to import data sets and append them later on with automatic update of calculations.

Conclusion
Already the existing projects indicate that new insights can be gained and that a flexible analysis (ideally in a working group that allows for interpretation and discussion) is crucial for actual projects. The presentation will give an example of how staffing demand for regular work and stand-by duties (over different times of the day, days of the week) can be analysed for a Birth Station in a small hospital.
Profiles of sleepiness and melatonin during day and night shifts

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Keywords: Dayshift, nightshift, melatonin, sleepiness, urine

Recent epidemiologic studies have indicated that work at night is a risk factor for development of breast cancer. The melatonin hypothesis links the irregular exposure to light, when working at night, to increasing circulating levels of oestrogen, which may promote breast cancer growth, through melatonin. The objective of the present presentation was to evaluate the association between sleepiness and melatonin using logbook data for sleepiness collected concomitantly with urine samples. The data presented are a subset of data from a study on 6-sulfatoxy-melatonin in urine obtained from nurses working on either day, evening, night or mixed shifts. Data from 27 nurses on dayshift and 50 nurses with nightshift are reported here. Sleepiness was assessed by use of the Karolinska Sleepiness Scale (KSS). The item was formulated ‘How do you feel right now concerning sleepiness?’ and responded to on a scale with 9 steps, indicating: (1) "very alert", (3) "alert", (5) "neither alert nor sleepy", (7) "sleepy, but no difficulty remaining awake", and (9) "extremely sleepy, fighting sleep". Assessments were made simultaneously with collection of spot urine samples. Spot urine samples were collected during 24-hours periods on a work day and a day off. Concentration of 6-sulfatoxy-melatonin was measured by use of a competitive ELISA purchased from IBL, Germany. Data were analyzed using a mixed procedure with autoregressive covariance structure.

On working days nurses on nightshfits had opposite 24-hours sleepiness profiles from nurses on dayshifts. On days off the 24-hours sleepiness profiles were similar regardless of type of shift. Higher concentrations of 6-sulfatoxy-melatonin were associated with higher sleepiness, except during workdays for nurses on night shifts. In conclusion, working at night interferes with the association between profiles of sleepiness and concentrations of 6-sulfatoxy-melatonin.
Measuring the impact of work hours redesign on the employee: the Working Time Change Impact Scale (WTCIS)

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Keywords: shift roster redesign; measurement of change impact, structural equation modelling

The paper reports the development of a survey scale to measure the impact of work hours change on the employee. The measure was developed using two samples: Group 1, n=352 and Group 2, n=313. Both groups were blue collar manual workers working at different processing plants in the Australian meat processing industry. In both plants work hours were redesigned as a compressed work week (Tepas, 1994) with a change from five Monday to Friday 6 to 8 hour day shifts – shift length based on a job and finish piece work tally system – to working 4 x 10 hour day shifts that included rostered Saturday working.

To measure the working time change impact a scale covering the two primary occupational stressors associated with shiftwork (i.e. unsocial hours and fatigue) and the principal employee advantage of the compressed work week (i.e. greater time availability outside of work) – Smith and Wedderburn, 1998 – was developed using one factor congeneric measurement models (Joreskog, 1971 and 1994) generated with Group 1 and independently cross-validated with Group 2. The original shift change impact survey items were part of a larger questionnaire survey (Garrett, 2001) administered individually and in small groups.

The WTCIS reliability results for Group 1 and for the independent replication sample, Group 2, were:

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<th>Group 1</th>
<th>Group 2</th>
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<tr>
<td>Unit weight scale reliability</td>
<td>0.915</td>
<td>0.910</td>
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<tr>
<td>Maximised scale reliability (factor score weighted)</td>
<td>0.924</td>
<td>0.930</td>
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The comparative model fit statistics, internal reliability results, the independent cross-validation results and the use of the WTCIS are discussed.


60
BASS 4 – a software to assess the quality of working hours in relation to risks for safety, health and well-being

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Keywords: risk analysis, health, well being, software

Problem
In the assessment of working hours and stress relating to working hours in the context of statutory risk analyses ergonomic knowledge must be taken into account. The simple assessment of compliance with legal and agreed requirements is not sufficient, as can be shown by the increased accident risks and health disorders which are clearly related to working time, even within legal limits. The great complexity of the subject to be assessed quickly leads to the conclusion that this cannot be done effectively without technical support. Against this background the question has been raised whether it is feasible to use computer based instruments for an ergonomic design of working hours for the assessment of risks associated with the design of working hours. An appropriate software tool should offer the possibility for a simple and manageable assistance within this context, especially for the appraisal of risks to health and well being and the development of risk-minimizing solutions.

Methods
Regression analyses between characteristics of the quality of a work schedule and the employees’ health complaints from a survey on flexible work hours¹ have been conducted for this purpose. Violations of legal and ergonomic criteria as well as a total index for the quality of a schedule as assessed by BASS 4 have been used as predictor variables for predicting physical and psychological health impairments (criterion variables).

Results
Clear correlations between the BASS 4 – benchmarks and the incidence of different health problems as well as impairments of social life can be shown, e.g. violations of daily rest are related to health and fatigue, and the sequence of shifts to problems of social and family life. The results show that (non-)compliance with legal and ergonomic requirements of schedules assessed by an evaluation with BASS 4 can be used for predicting physical as well as social impairments.

Conclusions
BASS 4 seems a promising tool to be employed in statutory risk analyses, although more empirical evidence is needed for substantiating the relationships found in this study, preferably from field studies from different industries in order to test these relations under different working conditions.

Subjective sleepiness on a 6h on - 6h off sea-watch system - effects of time on watch

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Keywords: Sea-watch, Subjective sleepiness, sleep, time-on-task

As in other industrial sectors the irregular work hours within shipping may cause fatigue and thereby endangering safety. There are several different sea-watch systems that are used to make around-the-clock operations possible. Sea watch systems, although being fast rotating, also, in contrast to many other industrial settings, give opportunities to sleep during free-watches in close proximity to work periods. Apart from how this affects sleepiness and the possibility to sleep, it is interesting to study if sleepiness depends on time on watch. The present study addresses the change of sleepiness within and across watches as a function of time of day. The watch-system studied was 6-hours on/6-hours off. The study was conducted using a realistic bridge simulator under "ship-like" circumstances with 12 experienced officers (half from the Swedish Navy and half from the merchant marine). Subjective sleepiness (the 9 point Karolinska Sleepiness Scale; KSS, Åkerstedt & Gillberg, 1990) was recorded every 30 minutes during watches and free-watches (the latter provided that the subjects were awake). At the end of each free-watch subjective sleep parameters were recorded (provided that the subjects had slept). Data were collected from the four possible watches/free-watches: 00-06h, 06-12h, 12-18h, and 18-24h) in balanced order. The mean hours asleep during free-watches varied significantly (F3/18=22.9, p<0.0001) as a function of time of day: 4.4, 4.1, 1.5 and 2.6 hours during the free-watches (in chronological order from 00-06h). The results also showed that there were significant differences (F3/30=5.3, p<0.005) in the mean levels of sleepiness among watches with the highest levels 00-06h (KSS 5.1) and 06-12h (4.8). There was also a significant (F 11/110=13.2, p<0.0001) and progressive increase in sleepiness within watches. This increase was evident for all watches, except the 06-12h watch. The highest level of sleepiness (around KSS 7) was reached at the end of the 00-06 watch. When comparisons were made between awake ratings off-duty and on watch from coinciding points in time (the first two half-hours between 12h and 18h, the first two half-hours between 18h and 24h, and the first half-hour between 00h and 06) the results showed that sleepiness was rated significantly (F1/10=7.4, p<0.02) lower when the subjects were on watch.

The possibility to obtain sleep varied across time of day as might be expected from circadian factors. The same was true for mean levels of sleepiness during watches. Interesting to note is that in spite of sleep immediately before the 00-06h watch, sleepiness increased to KSS 7 at the end of this watch, which is comparable to what we have recorded at the end of traditional night shifts (e.g. Gillberg et al., 2003). Perhaps the most interesting finding was the time-on-watch effect on sleepiness. At the start of the watches a suppression of sleepiness was evident. This effect disappeared towards the end of the watches. This initial "masking" of sleepiness might be explained by the mental effort needed to take control over the situation on the bridge.

Smart shifts: the trade-off between productivity and flexibility

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Keywords: productivity, flexibility, smart shifts, health, work-life-balance

The pressure on working longer hours per week, per year and over life time is increasing. Do we indeed need to work longer, and harder and at what costs? At the level of the organisation, we need to balance productivity with flexibility and innovation, but also with the employee’s need to stay healthy and employable over the life course (Goudswaard 2003, Klein Hesselink and Miedema 2003). How can we cope with these challenges and find a balance between the various interests?

The field study, that we present here, is part of a larger program, in which TNO is developing smart solutions to these challenges. This program is developed in cooperation with industry. The overall goal is seeking a balance in higher productivity and better health and work life balance.

Our case company (operating in the semi-conductor industry) needed to increase the productivity during the upturn and planned to introduce 7*24 business hours in 5 shifts. In a participative approach the company’s need for higher productivity and flexibility is analysed, and solutions to these needs are developed. Our analysis revealed the costs and benefits of increasing business hours (see figure).

The results show that a smart semi continuous work schedule (2 shifts) is a better option for flexibility and innovation, as well as for health, work life balance and employability. In this version of two shifts, half of the staff works in evening and on Saturday, and no staff works during the night and on Sunday. The results also show that adding three more shifts does not correspond automatically with a three times higher productivity.

The presentation will highlight the (sometimes contradictory) needs for flexibility and productivity, the participative process of the development of a smart work schedule and the benefits of this work schedule for both company and employees.

![Figure. Cost and benefit analyses (higher score means better results)](image)

Ergonomic Evaluation of Musculoskeletal discomfort among Public buses drivers days

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Bus Drivers are subjected to vibration and indices of fatigue, discomfort and Musculoskeletal disorders that are directly related to the characteristics of the vehicle and ergonomic design. Vibrations are transmitted to the buttocks and back of the driver along the vertebral axis via the base and back of the bus seat.

In addition, the pedals and steering wheel transmit additional discomfort to the feet and hands of the drivers. These vibrations and discomfort, in combination with a seated posture, produce a measurable level of discomfort for the driver, especially during journeys of long duration. Moreover, prolonged exposure can result in a range of physiological problems such as postural instability, cramp, and numbness.

This is a cross-sectional study, 178 male drivers were randomly chosen and participated in the study.

Tool of identification of these disorders were ergonomic checklist, observation of jobs, measurements of fatigue and questionnaires. Also SEMG signals were recorded bilaterally from cervical erector spine and external oblique muscles.

Surveying shown that % 85 according had low back pain shoulder, neck and legs %76 had there discomfort during long duration of bus driving. Also it showed that by increasing the hours of work per week and bad design of driver seat the risk of musculoskeletal disorder increases. Subjects rating of their total discomfort significantly increased during the trial. The effects for local discomfort were the same as for total discomfort, so only total discomfort measures will be discussed.
Working time autonomy at health care

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Keywords: shift work, health care, working time autonomy, participatory planning, wellbeing

Introduction
In hospitals and health care centers traditionally the head nurse of the ward makes the shift schedules. This was a project for increasing the working time autonomy for the staff. The workers were given an opportunity to schedule their shifts by participatory planning so that working time laws, operation of the ward, equality, and rightfulness were fulfilled. The head of the ward was responsible for to support and guide the staff in planning. Also the ergonomic recommendations were introduced to the personnel.
The aim of this study was to investigate the effect of working time autonomy on the physical, mental, and social wellbeing of health care workers, and the function of the work community.

Material and methods
Altogether 17 health care wards, both in municipal and specialized hospital, participated the study. The basic questionnaire was made in 2003 before the actual change of the planning practice. The follow-up questionnaire was performed in 2005. The questionnaire was a modification of the Standard Shiftwork Index (Barton et al., 1995) with questions about working times, stress and strain, work community and background information of the subjects.
There were 255 and 213 respondents, and the response rate was 75% and 53%, respectively. The majority of the subjects were women (89% vs. 91%). The mean age was 41 and 42 years, respectively. 62% and 61% worked in three shifts, 25% and 26% in two shifts, and 11% had day work, respectively. 86% and 87% of the subjects were nurses, the rest were both head nurses and assistants.

Results
According to the follow-up questionnaire, the working time arrangements were altered during the project. The rhythm of consecutive working days and free days was made more suitable for the workers and also some ergonomic improvements were realized. The opportunity to influence own working times increased considerably. The most prominent result was that, the affect of the three-shift and two-shift work on the private life was less disturbing than before. The results showed the improved family life and more easiness to combine the social life and hobbies. The effect of working time autonomy was also positive on overall wellbeing, perceived health, sleep, and alertness of the workers.
The participatory planning did not effect the health care work itself. There was more haste and hurry at work and also more overtime work was done than before. The physical and mental strain of the workers remained the same or even increased. However, the atmosphere in the wards was mainly good, and it also improved during the project with less controversy between the co-workers.

Conclusion
The project for working time autonomy was successful, especially the combination of work and private life improved. Still, maintaining the work ability of health care workers needs attention on their physical and mental work capacity, as well as constant up-keeping of the function of the work communities.
Night-time work and melatonin among Danish nurses

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Keywords: Night-time work, shift work, nurses, urinary 6-sulphatoxymelatonin

There is growing evidence that shift-work may increase the risk of breast cancer. In three independent studies from Denmark and the USA, increased risk of breast cancer among women, who have non-day time work including shift work has been found. The mechanism behind ("the melatonin hypothesis") predicts that irregular exposure to light at night suppresses the normal pineal melatonin production, which reduces its oncosstatic properties, and in turn stimulates the circulating oestrogen level, which may promote breast cancer growth.

The present study aims to study whether Danish nurses working in evening and night shift secrete less melatonin during 24 hours compared to nurses in day shift in a working day and a day off. Further, to study diurnal excretion profiles of 6-sulphatoxymelatonin in nurses working in day, evening, and night shifts.

In total 171 nurses were included in the study. Of the respondents 27 nurses worked in day shift, 12 nurses in evening shift, 50 nurses in night shift, and 82 nurses in mixed shift. Spot urine samples were collected from respondents on a work day and on a day off and analyzed for 6-sulphatoxymelatonin. A competitive ELISA purchased from IBL, Hamburg, Germany was used for determination of 6-sulphatoxymelatonin in urine. Participants filled in the Karolinska Sleep Diary when sampling urine. The sleep diary included 18 items on quality of sleep, sleep length to be answered after waking up in the morning. Data were analyzed using a mixed procedure with autoregressive covariance structure.

The quality of sleep did not differ between the day, evening, night, and mixed shift. The quality of sleep was scored higher on a day off compared to a working day. The respondents excreted lower concentration of 6-sulphatoxymelatonin in urine on a work day compared to a day off regardless of shift. The difference between work day and day off was significantly lower for day shift (6%) compared to the other shift (11-16%). On a work day respondents working at day shift excreted the highest concentration of melatonin.

In conclusion the present study find that respondents working in evening, night, and mixed shifts result in lower excreted urinary 6-sulphatoxymelatonin.
The effects of partial sleep deprivation and work pace on subjective stress, catecholamines and heart rate during a 12-hour work shift among professional process operators

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Keywords: sleep deprivation, stress, heart rate, 12-hour shifts, process operators

Introduction
Sleep deprivation is generally regarded as a stressfull condition and cumulative sleep deprivation has been found to be related with the activation of autonomic nervous system and some increases in stress hormones and blood pressure. On the other hand, acute sleep deprivation may be related with euphoria and sleep deprivation has been used clinically as a treatment for depression. Sleep deprivation, monoty and 12-hour shifts are frequent conditions in industry, with rather similar effects on subjective and objective sleepiness (1). In this study, we aimed at examining the interactive effects of one night of partial sleep deprivation (SD) and work pace on mood and physiological stress during a 12-h day shift.

Methods
Twelve male experienced process operators (age 28-56 years) were studied during four experimental day shifts and the preceding nights. The 12-h shifts differed from each other in terms of the amount of preceding night sleep (11:00 p.m. - 06:30 a.m. or 2:30 a.m. - 6:30 a.m.) and work pace (slow or fast). All shifts contained four work simulation sessions (distillation process) of 1.5 hours and each of them included a 15 min alarm session. Mood was measured with the Profile of Mood States (Finnish version) at the end of each work simulation session. Urinary catecholamines were collected twice during the work shifts and heart rate (HR) variation was analysed in each work session. A linear mixed model for repeated measurements was used to test the effects of SD, work pace, time of the day and their interactions on stress.

Results
Both SD and low work pace decreased subjective tension and anxiety (p< .023 - .006). SD tended to decrease mean HR (p< .06), noradrenalin (p< .053) and the low frequency band of HR (p< .065) at work, but the effects were not significant. SD decreased vigor (p< .017) and increased confusion (p< .006). SD increased fatigue, but only during the monotonous work shifts as shown by their significant (p< .049) interaction. Time of the day (four time points during the shift) was related with the decreased vigor (p<.024) and norepinephrin (p<.018) and strong variations in HR (p<.001), LF (p<.003) and the LF/HF frequency bands (p<.033) of the HR.

Conclusions
It is concluded that one night of partial sleep deprivation has mainly stress relieving effects, similar to monotony, among professional process operators.

Shift scheduling in irregular train transportation shift systems

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Shift scheduling and sleep has been studied extensively in regular shift systems but to a lesser degree in irregular shifts. A series of field studies (1,2,3) were carried out among Finnish train drivers and traffic controllers to study the effects of irregular shift systems on sleep and sleepiness and to develop recommendations for ergonomic shift scheduling and optimal sleep in the irregular shift systems. 126 randomly selected male train drivers and 104 railway traffic controllers were investigated by a questionnaire and sleep/work diaries during 21 consecutive days during the irregular shift system. Based on the obtained data of 2482 days, the prevalence of severe sleepiness at work (i.e. Karolinska Sleepiness Scale 7 or higher), the length of main sleep period and napping were modelled by a series of logistic regression analyses for repeated measurements (GEE), using factors related to the shift system, sleep-wakefulness and individual differences as explanatory variables.

The odds ratios showed that the risk for severe sleepiness at work was 6-14 times higher in the night shift and about twice as high in the morning shift compared with the day shift. The prevalence of severe sleepiness varied between 36-62% and that of dozing off at work between 9-31% among the train drivers depending on the current shift condition, 28-50% of the traffic controllers reported dozing-off during the night shifts. The main sleep period before the first night shift was shortened by about 2 h when the morning shift immediately preceded the night shift as compared with the combinations containing at least 36 h of free time before the night shift (reference combination). Among the different shift combinations, the main sleep period before the night shift was most curtailed (up to 2.9-3.5 h) between two night shifts. Afternoon napping increased when the morning or the day shift immediately preceded the night shift, the odds being 4.4- 4.8 in comparison with 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 with the sleep period after a free day. The risk of severe sleepiness and dozing-off at work were not significantly related with the preceding shift combination or time-off period before the shift but they were significantly related with the shift length, starting time of the morning shift (severe sleepiness) and the length of the preceding sleep. Individual sleep need increased sleeping time and the risk for severe sleepiness. Aging did not affect sleep before the morning or night shifts or dozing-off at work but was actually related with a somewhat lower risk for severe sleepiness among the train drivers.

Shift scheduling guidelines for irregular shift systems have been developed based on the data. The recommendations focus on the timing of the night and morning shifts, the criteria for the use of "quick return" morning-night and day-night combinations and the use of napping in different shift combinations.

Ethnic shiftworkers’ chronotype, time and sleep disturbances

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Keywords: Chronotype, time, shift work, sleep disturbance, ethnicity

Sleep-loss and sleepiness are frequent complaints of nurse shiftworkers. However, sleep disturbances among nurses of different socio-cultural groups are not known. Objectives: A study to compare time use, chronotype and sleep disturbances in American Indian (AI/AN) and White, non Hispanic (WNH) nurse shiftworkers was carried out. Based on projected demographic changes, a greater number of ethnic minorities are expected to enter the workforce including American Indians. Socio-cultural influences on sleep disturbances and sleepiness are not known. Polychronity, a preference for working with or managing several people or tasks simultaneously is a temporal concept thought to be prevalent in AI/ANs (1). Time awareness (2) and morningness, associated with more sleep disturbance complaints have not been studied in American Indians. The relationships among polychronity, sleepiness and sleep disturbances have not been reported. Methods: AI/AN (n=58) and (n=139) WNH nurses, 25 years or older, working shifts completed an Internet survey comprised of recognized shiftwork measures. Data were collected on sleep disturbances (sleep disturbance effects, perceived sleep need and obtained and naps), sleepiness, time awareness, polychronicity, chronotype and demographics. Results: Contrary to expected AI/AN reported being more monochronic time users than WNH nurses. This may be a factor of the method used to collect the data and needs further examination. AI/AN nurses reported greater time awareness (mean); however, too few subjects reported high or low time awareness, so further analysis by time awareness group was not carried out. Associations were found among perceived sleep disturbance questions, nap duration and perceived sleep needed and obtained. WNH nurses reported greater situation sleepiness and longer and more frequent nap periods than did AI/AN nurses. For both ethnic groups, perceived sleep needed was associated with first period nap duration, but was inversely associated with mean levels of time awareness. Perceived sleep needed was significantly shorter than sleep reportedly obtained and shorter than the minimum (7-hours) of sleep suggested for good health. Conclusions: AI/AN nurses were less polychronic time users than were WNH nurses and had greater time awareness. WNH nurses perceived greater situational sleepiness, longer and more frequent first-period naps and perceived more sleep disturbance effects than did AI/AN nurses. This is the first study examining AI/AN nurses sleep disturbances. Due to the limited sample size, the findings should be viewed with caution. Associations among individual differences, factors recognized to effect shiftwork-related naps, situational sleepiness and sleep disturbances are associated with shiftwork tolerance. However, individual differences such as time use, lifestyle, and social customs are not the same among groups, and more research is needed to examine ethnic differences and sleep disturbances.

Objective sleep disturbance measures in ethnic nurse shift workers

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Shiftwork is a working condition that involves more than 15 million workers and is linked to shiftwork intolerance (sleepiness, sleep disturbance complaints). Individual differences such as chronotype (morningness/eveningness) and time sense (time awareness, polychronicity) are suggested to be associated with shiftwork tolerance (1). With the changing workforce demographics, there was a need to examine shiftwork tolerance in different socio-cultural groups such as American Indian/Alaskan Natives (AI/AN). Objective: A two-phase study examined individual differences, situational sleepiness and sleep disturbances in AI/AN and White non-Hispanic (WNH) nurses. In Phase One, data were collected using a secured Internet survey (shiftwork questions, demographics, chronotype, time sense, sleepiness). In Phase Two, objective activity/rest data were collected using a wrist-worn Actiwatch™. Twenty-two nurses were recruited to collect activity/sleep data. Each nurse collected data for a five-day period that included two (12-hour) night shifts. While collecting activity data, each nurse recorded noise, exercise, intake (type and amount), naps, bed sharing, and smoking in a diary. A comparison sub-sample of AI/AN (n=7) and WNH (n=7) nurse shiftworkers were used for further data analysis. Individual differences, sleepiness, perceived and objective sleep measures were compared between groups. Results: WNH nurses working night shift had less total sleep in 24-hours (activity data) than did AI/AN nurses. AI/AN nurses perceived fewer sleep disturbance effects and less situational sleepiness than did WNH nurses. Conversely, AI/AN nurses’ sleep efficiency ratio was lower and their "wake after sleep onset": occurred more frequently. Objective measures of assumed sleep length and actual sleep length were similar between ethnic groups; however, perceived hours/minutes of sleep needed, assumed sleep needed and actual sleep length (objective measures) were significantly less than the recommended 7-hours of sleep needed for good health. Conclusions: For this sample, the findings suggest that AI/AN had more measurable sleep disturbances than did WNH nurses. And while AI/AN and WNH nurses’ actual sleep duration were similar, both groups received less sleep than needed; less sleep than reportedly obtain; and less sleep than the recommended amount needed for good health. These findings suggest that nurses, working shiftwork are unaware of how much sleep they need and how little sleep they receive. This lack of awareness may contribute to poor shiftwork tolerance and shiftwork-related health conditions. More studies are needed to confirm these results.

The relationship between shiftwork and the work ability: results from a Brazilian pharmaceutical company.

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Keywords: shiftwork; pharmaceutical industry; occupational health; work ability; workers.

Introduction

The work in shifts / nights is present in the life of many workers in Brazil, due to, among other factors, the needs generated by the globalization process. In this scenario, in order to be competitive, industries, services, and commerce, must be open 24 hours a day, creating an increase in the required work hours. The workers functional ageing has been a concern to researchers and governments and justifies the evaluation of the working class with the objective of defining strategies to prevent health related absences and early retirement.

Aim

The aim of this study was to evaluate the shiftworkers profile in a Brazilian national pharmaceutical industry and to assess the relationship between shiftwork and work ability.

Methods: The study is characterized as a cross sectional study with a sample of 160 workers distributed within three shifts (first: from 6:00am to 2:00pm; second: from 2:00pm to 10:00pm; and third: from 10:00pm to 6:30am). A questionnaire was used, which included questions about the subject socio-demographic characteristics, his or her work, health, lifestyle, and Work Ability Index. The results were then statistically analyzed (Fisher’s Exact Test, Mann-Whitney test).

Results

The male population represented 58.12% of the workers; 40% was in the ages between 25 and 29, and 38.75% were younger than 25; 57.50% were single and 73.12% had no children. Regarding education, 70.62% had at least 11 years of study or a complete or partial technical high school course; 14.38% had some university education and 7.5% had a university degree. The work shift was distributed as follows: 42.50% of the subjects worked on the first shift, 48.12% on the second and 9.38% on the third. From the total, 54.38% had already worked on a night shift at some point in time. From the night shiftworkers (9.38%), only 8.13% claimed to have sleeping problems.

The company under study employs 25 disabled people and 40% of this group (n=10) was included in this research. A significant statistical relation was found between the WAI and the type of disabling condition (Mann-Whitney test). The disabled population amounted to 6.25% of the studied sample. In regards to self-referred diseases, 63.75% of the population stated they did not have any disease in their own opinion, and 52.50% stated they did not have diseases diagnosed by a physician. When asked about their own health compared to that of others, 26.25% claimed to be as well as, while 25% stated they were better than the average population of the same age; 60.63% pointed out at least one work-related factor that caused them fatigue or stress. The excellent WAI score was obtained by 60.62% of the population, with 35.64% scoring good and only 3.74% moderate. The average of the WAI score for the first shiftworkers was 43.4, with 44.2 for the second, and 44.1 for the third.

Conclusion

The sample used for the study was composed of young, healthy workers who had a good education level and an active physical and metal life. The company under study was distinct in terms of equipment technology, employees training and benefits. In summary, through the present study, no relationship between the WAI and work shift was identified.

Individual differences in adjustment at an early stage of shiftwork experience

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Keywords: individual differences, sleep, shiftwork

Objectives
Cross-sectional studies have shown that sleep disturbances are the most prominent problem related to shiftwork. Individual differences in adjustment to shiftwork are well known. Limited research has focused on predictors for these individual differences. It was the goal of our study to examine whether baseline measurements (i.e. before the subject had any shiftwork experience) were related to effect measurements (i.e. after the subject had started shiftwork).

Methods
In this abstract, results of the initial part (baseline and first follow-up) of a longitudinal study are presented. Participants were 26 police officers (20 to 46 yrs; 15 males, 11 females) who were measured at baseline and after 13 weeks (sd:4) of shiftwork experience (follow-up). At baseline, they filled out questionnaires for morning-eveningness, rigidity of sleeping habits and vigorousness. Actigraphy and sleeplogs were used to measure total sleep time (TST) and sleep-efficiency (SE) during nocturnal sleep over a period of 5 days. At follow-up, TST and SE were measured again during day-sleep after the night shift (1-4 shifts).

Results
Linear regression analyses were performed with the percentage change scores in TST and SE as criterion variables and ‘morning-eveningness’, ‘rigidity of sleeping habits’ and ‘vigorousness’ as predictor variables. Rigidity of sleeping habits appeared to be a significant predictor for the percentage change score in TST ($ß = -.651$, $p <.01$). Using the score ‘22’ on the rigidity of sleeping habits scale as cut-off-point, a subgroup of flexible types (high scores) and a subgroup of rigid types (low scores) were formed. Significant differences between the two subgroups were found for the percentage change score in TST ($t = -4.15$, $p < .01$). For ‘flexible types’ (N=14, 7 males), the mean percentage change score in TST was 111% (sd:18). For rigid types (N=12, 8 males), mean percentage change score in TST was 86% (sd:10), showing curtailed sleep during follow-up compared to baseline.

Conclusion
These results show inter-individual differences in the sleep response to a brief first period of shiftwork, with rigidity of sleeping habits as predictor. Flexible types were capable of compensating their increased sleep need, while rigid types showed a sleep deficit after the night shift. This study supports earlier research, showing flexibility of sleeping habits to be related to better adjustment to shiftwork (1).

A mathematical model for home help staff scheduling based on questionnaire survey results

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Keywords: home help, staff scheduling, questionnaire survey, mathematical programming model

Home help organizations provide services at respective users’ homes at a time that is convenient for the user. Helpers, with time window constraints for their working hours, must be assigned to these services in order to make sure that the services are provided. There are also many other types of constraints and requirements that a scheduler has to consider when producing an adequate schedule and so it usually takes a considerable amount of time. Our aim is to alleviate such scheduler’s workload while keeping the service-quality level that is required, by developing computer-aided support system with an efficient algorithm. When considering this scheduling problem, we realized that this problem has similar characteristics to the nurse scheduling problem [1] in terms of the quality of services and the workload for staff. Therefore, we plan to apply algorithms based on an efficient approach for nurse scheduling to home help staff scheduling.

In this paper, we introduce a mathematical programming model of the home help staff scheduling problem based on the questionnaire survey that we conducted in December 2004. This questionnaire survey used open and closed questions to encourage the schedulers to give a detailed description of their task. These descriptions enabled to us to create an adequate model on which to construct efficient algorithms.

We sent the questionnaires to all of the 2283 home help organizations in Tokyo and 387 organizations replied, where the collection percentage was 17 %. The average time taken to schedule helpers per organization per scheduling period was 7.1 hours and the maximum time was 168 hours including thinking time, although 36% of the organizations use some computer software concerning staff scheduling. The average number of users who require services was 69.4, the minimum number was 1 and the maximum number was 976. The average number of users whom a helper provides services was 2.1, the minimum number was 0.1 and the maximum number was 6. The average times of the minimum and maximum travel time between users were 5.6 minutes and 35.9 minutes respectively. The consideration described as most important for scheduling was to make certain that each service is provided at the exact time required by the user. Next, was the chemistry between the user and helper. We were also able to rank many other requirements in terms of importance and how difficult they were to satisfy.

The overwhelming feeling from this survey was that schedulers found the task difficult, and it was often hard even to estimate the number of helpers needed. Therefore we show a simple estimation method based on linear programming in order to arrange for appropriate helpers for each day before making a schedule in detail. Then we propose an approach that solves each of the subproblems, where a subproblem is defined as scheduling staff on a specific day.

The circadian rhythm in subjective sleepiness and shiftwork tolerance

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Keywords: Individual differences, longitudinal design, cosinor analysis, mixed models

Objective
The present study aimed to estimate the importance of the circadian rhythm in tolerance of two very similar shift schedules before and after a change of the timing (sequence) of the shifts.

Method
67 shift workers (42 male, 25 female, age 40.7± 9.98 std) at a paper mill were studied before and after a change of the shift schedule with 5 years in between. The original schedule was a very rapidly rotating schedule (N-A-M-X repeated 7 times + 8 days off) and it was pushed 8 hours forward in time i.e. the ordering of the shifts was (also) changed (MN-A-X-X).

The subjects were followed with a diary for approximately three weeks before and after the shift change. The diary covered many aspects of sleep however, the present study focused only on bihourly ratings of sleepiness during work (Karolinska Sleepiness Scale, KSS, 1=very alert, 9=very sleepy, fighting sleep, difficulty staying awake). Data was analyzed by means of linear mixed effects regression analysis that makes it possible to explicitly estimate individual differences as latent variables (random effects). A standard cosinor analysis was used to estimate the circadian rhythm however, the model also included dummy variables for shifts and time to control for the initial level and progression of sleepiness during the shift. In addition, interaction terms were included to estimate the change in the circadian rhythm after the change of the shift schedule. Satisfaction with work hours (1-5) was chosen as an indicator of tolerance and further used as a dependent variable with circadian parameter as predictors. A total of 7611 observations were used to estimate the circadian parameters.

Result
The estimated circadian phase showed a significant relation (b=.34, p=.012) with a questionnaire item of diurnal type (1=extreme morning type, 4=extreme evening type). The results indicate that the group mean acrophase (before/after mean±sem: 5.38±1.6h/4.89±1.5h) was advanced after the shift change (p=.012) however, the analyses also indicated significant (p<.001) individual differences in all estimated parameters. Circadian phase (b=-.31, p=.002) and the shift in circadian phase (b=.33, p<.001) were highly significant predictors of satisfaction after controlling for gender (b=-.52, p=.035) and age (b=-.01, p=.433). In a follow up model, the absolute shift in circadian phase showed a negative trend (b=-.20 , p=0.063) with satisfaction with work hours.

Conclusion
The results suggest that the circadian phase in sleepiness was important for shift work tolerance. The earlier the phase, the more satisfied. The shift change was followed by a group level advancement of ≈30 minutes however, the result also showed that this advancement was counteracted by the more tolerant shiftworkers, as indicated above by the positive coefficient (b=.33) for phase shift and negative trend for absolute phase shift (b=.20). Shift work tolerance was predicted by circadian rhythm stability in the presence of a changed shift schedule.
24-hour oscillations in recognition accuracy of laterally exposed stimuli

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Keywords: 24-hour oscillations, recognition accuracy

There have been shown different recall scores depending on the time when the stimuli were acquired what has been explained in terms of different processing strategies (shallow and semantic) and attributed to daily changes in hemispheric dominance (1). Somehow different results have been demonstrated in the short-term memory performance rhythms in the constant routine research (2).

The aim of this study was to answer the question: “What are the 24-hour endogenous trends of recognition accuracy of laterally exposed stimuli processed on a shallow and on a semantic level?”

During the 24-hours constant routine studies memory performance of 30 students, 10 female and 20 male (aged 21-27 years) were measured 8 times, every 2.5-3 hours starting from 06.30 hour. The materials used were parallel sets of words and pictures. The sets to be analysed semantically were proceeded by a question concerning stimuli meaning. The stimuli were exposed for 180 ms at a random order in either the left or the right visual field on the computer screen by purposely-designed software program. The subjects were to press one of two buttons while reacting to picture or word while answering the question concerning stimuli meaning. During recognition, immediately following stimuli processing, all already presented stimuli plus half of that number of new ones were shown in the middle of the computer screen. The subject were to press one of the two different buttons while reacting to the “old” (already seen) or the new stimuli.

Four factor analysis of variance (ANOVA) have been performed on the accuracy data. The factors were measurement time (MT; 8), level of processing (LoP; 2), visual field (VF; 2), and stimulus (S: 2). There have been found significant interaction of MT, VF, and LoP (F(8, 187)=2.882, p=.007) indicating different 24-hour oscillations of recognition accuracy depending on the visual field and level of stimuli processing. From 06.30 till 12.30 and from 18.30 till 21.30 there were periods of dominance of the RVF over LVF in recognition accuracy of the stimuli processed semantically accompanied by lack of difference in recognition accuracy of stimuli processed shallowly. At 15.30 and 03.30 there were times of lack of differences between visual fields in recognition accuracy of stimuli processed semantically accompanied by dominance of RVF over LVF in recognition accuracy of the stimuli processed at the shallow level.

The results show a pattern of relation between visual fields/brain hemispheres and processing levels/strategies consisting of alternating periods of symmetry in recognition accuracy of stimuli processed at the semantic level accompanied by asymmetry in recognition accuracy of the stimuli processed on the shallow level and vice versa. Two periods of significantly better and two periods of significantly worse performance in the RVF/left hemisphere and LVF/right hemisphere may suggest ultradian rhythmicity in the brain hemispheres activity.

1. Folkard S. Time of day and level of processing, Memory and cognition, 1979; 7:247-252.
Ultradian and asymmetric rhythms of laterally exposed stimuli processing

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Keywords: ultradian rhythms, hemispheric asymmetry

There have been demonstrated circadian rhythms in information processing and different times of predominance of maintenance and semantic processing strategies (1) what have been suggested (1) and partly proved to be associated with daily changes in hemispheric dominance. It has been shown that in operator stands the nature as well as the amount of information visually captured change accordingly to the hour of work, even if work requirements remain the same (3). On the other hand, studies searching for higher rhythms frequencies have demonstrated ultradian and asymmetric rhythms of different indices of hemispheric activation (3). The aim of this study was to test the following hypotheses: (i) speed of shallow and semantic encoding of laterally exposed stimuli changes daily in an ultradian manner (ii) ultradian rhythms of encoding speed of stimuli addressed to the left hemisphere differ in the period length from those addressed to the right hemisphere.

During 24-hours constant routine studies memory performance of 30 students, 10 female and 20 male (aged 21-27 years) were measured 8 times, every 2.5-3 hours starting from 06.30 hour. The materials used were parallel sets of words and pictures. The sets to be analysed semantically were proceeded by a question concerning stimuli meaning. The stimuli were exposed for 180 ms at a random order in either the left or the right visual field on the computer screen by purposely-designed software program. The subjects were to press one of two buttons reacting to picture or word or answering the question concerning stimuli meaning. The time series of each subject’s speed of encoding was analysed using non-linear least-squares technique. Two significant ultradian components with shorter and longer periods were found for 20 subjects’ complete data. Dominant periods were analysed using three factorial ANOVA to find out factors determining period lengths. The factors were level of processing (LP: shallow and semantic), visual field (right RVF and left LVF), and stimulus (S: a word and a picture).

There have been found significant interaction VF x S (F(1,16)=6,086, p=.025) and LP x S (F(1,16)=7,166, p=.017) on the periods length. Rhythms of words processing speed in the RVF/left hemisphere was of longer period (mean=10.77 h) than that in the LVF/right hemisphere (mean=8,61) while for pictures there were no statistically significant difference in that respect. The rhythm of semantic words processing speed had significantly longer period (mean=11.97) than he rhythm of shallow processing speed (mean=9,76). If semantic processing and word processing is associated with the left hemisphere (and if lateral exposure enables at least starting the processing separately by each hemisphere) the findings may mean that rhythms of processing speed in the left hemisphere have longer average period than rhythms of processing speed in the right hemisphere. These means an asymmetry in the rhythmicity of processing speed of brain hemispheres. What are the recommendations for the shift system design at e.g. operators stands if information processing changes in ultradian manner?

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A checklist for assessing accumulated fatigue due to overwork

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Keywords: overwork, long working hours, fatigue, cardiovascular disease, sleep

Background
In Japan health hazards that are associated with overwork are a social problem. According to the 2003 Labor Force Survey, more than 6 million people work more than 60 hours per week. In 2003, 312 cases of cerebrovascular and ischemic heart disease were recognized by the Ministry of Health, Labor and Welfare (MHLW) as occupational and caused by overwork (Karoshi). In 2002, MHLW launched a “Comprehensive Program for the Prevention of Health Impairment Due to Overwork”. To support this program and as a tool for management, we have developed a checklist to evaluate accumulated fatigue due to overwork. Accumulated fatigue can be defined as a state that is caused by overwork and may induce disease (Fig.1).

Design of the checklist
The checklist, with a total of 21 items, consists of four subscales; specifically, overtime working hours (one item), other job stressors (5 items), sleep-rest (3 items), and subjective symptoms (12 items). The accumulated fatigue is evaluated into four grades using the results of the four subscales.

Association between accumulated fatigue and diseases
A cross-sectional study (n=383 subjects) was conducted to examine the association between accumulated fatigue, as evaluated by the checklist, and the incidences of diseases during the previous six months. The incidence of several diseases in the group with high accumulated fatigue was significantly higher than that in the group with low accumulated fatigue.

Conclusion
The checklist may be useful for the evaluation of health risks in individuals and at workplaces caused by overwork.

Fig.1. Relationship between overwork, accumulated fatigue, and disease
Studying the interplay between working time arrangements and work family conflict: the need for cross-national comparisons

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Keywords: working hours, work schedules, work-family conflict

Recently the role of working time arrangements in the onset and course of fatigue was studied in a large prospective cohort study (1) in the Netherlands. From these studies it became clear that both the duration of work (including overtime work), and work schedules (e.g. shift work) are important risk factors for the development of both fatigue (2) and work family conflict (3). However, the same studies also revealed that both fatigue and work family conflict are important reasons for employees to change their working hours and / or their work schedule (3, 4).

Fatigue and work family conflict proved to be risk factors for quitting shift work (RR=1.76; CI 1.36-2.29 and RR=1.46; CI 1.12-1.91 respectively). High work-family conflict further went together with an increased probability of changing working hours over time both in men (RR=1.36; CI 1.08-1.72) and women (RR=2.04; CI 1.18-3.52).

As such, working time arrangements indirectly play an important role in individual decisions with respect to labor participation. However, since fatigue and work-family conflict are highly prevalent among employees it is highly likely that the effects will not be limited to the individual worker only, but may extend further to his or her family, and to effects on demography and labor force participation as well.

So far however, the interplay between working time arrangements and work-family conflict and subsequently on demography and labour force participation is largely unknown. This is probably due to the fact that the effect of work-family conflict on these outcomes cannot be studied within one country only, because national policies and facilities to balance work and family life will largely influence the relationship between work-family conflict and these outcomes. Moreover, where it is relatively easy to reduce and adjust working hours, to better fine tune work and home responsibilities in the Netherlands, this may not be so easy in other countries (e.g. Denmark).

The presentation will focus on the need for, the possibilities and the main advantages of cross-national studies with respect to the effects of work-family conflict / working time arrangements on demographics and labour force participation. It will be argued that these cross-national studies are an invaluable approach for both research on work-family issues and for meeting European societal goals aimed at increasing labour force participation.

Reliability and predictability of flexible working hours – effects on health and well being

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Keywords: working hours, reliability, predictability, flexibility

Objectives
New findings about flexible work hours show that the level of variability of work hours and the influence, which employees have on scheduling their work hours clearly affect their health and well being: Employees with highly variable work hours and lack of influence on the arrangement of their work hours obviously show impairments in health, family and social life; this is the same pattern of impairment as is usually found in shift workers1. This might be due to the fact that variable flexible work hours, like shift work, might lead to desynchronization. Whereas the variability of working hours in shift work is rather regular, this needs not be the case with flexible work hours. It could thus be that besides the variability the reliability and/or predictability of flexible work hours are also (or in combination with the variability) responsible for the observed impairments, because unpredictability and unreliability might add to desynchronization, affecting the organisation, planning and conduct of social life. It could therefore be of special importance how reliable such a schedule of flexible work hours is. Emergencies and their frequencies as well as unforeseen overtime can affect the reliability of such a schedule, just as short-term announcement in working on demand. This has not yet been investigated.

Method
Data of the study by Janßen und Nachreiner (2004) and from the 3rd survey from the European Foundation on working conditions in all EU member countries were analyzed (using multivariate analyses) for the influence of the predictability of working hours on health complaints and social life.

Results
The results show that predictability and/or reliability do play an important role in shaping the effects of flexible working hours, especially in the area of social impairments, while impairments of health are stronger determined by variability of working hours per se. These results could be cross validated between both studies.

Conclusions
From an ergonomic point of view flexible work schedules should thus be designed with low variability and sufficient predictability and reliability to prevent impairments in health and social well being.

Train Drivers’ Sleep Quality & Quantity During Extended Relay Operations

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Keywords: Sleep EEG, train drivers, shift-work, subjective sleep quality

Objectives
Relay operations are an important mode of freight transportation within Australia. In the past, major relay operations in Australia have occurred mainly east-west but more recently, the south-north track has been completed. Relay work requires multiple crews to drive the train continuously from one specified destination to another and return. Importantly, the nature of relay work requires train drivers to sleep on-board during designated resting shifts with noise, light and movement all potentially impacting on their sleep. The main aim of the present study was to investigate the quality and quantity of sleep obtained in on-board rest facilities (relay vans). This study will be the first to investigate train drivers’ sleep using Polysomnography during extended (4-day) relay operations.

Methods
Drivers (n=8) working the Port Augusta to Darwin relay operation volunteered to participate in the study twice (16 trips). The first leg of the trip (from Port Augusta to Darwin) typically took approximately 40h followed by an overnight rest in Darwin (between 8-12h), prior to return. Two crews, each consisting of 2 drivers, changed every 8h, giving the crew an 8h rest in the relay van prior to each 8h working shift. Home sleep data was collected for the two sleeps prior to each trip using a standard 5 channel EEG montage. Additionally, all sleep periods during the relay trip were recorded. Subjective sleep quality ratings were collected following each sleep period.

Results
Preliminary analysis from 6 trips (n=5) indicates that drivers obtain an average of 3.2h sleep during each 8h opportunity in the relay van. Specifically, they obtained an average of 29.4mins (14.7%) slow wave (SWS) and 43.6 mins (20.8%) Rapid Eye Movement (REM) sleep per period (Figure 1), compared to 42.5mins (10.6%) and 101.6 mins (27.0%) in the home sleep period (6.3h TST). Interestingly, sleep onset latency (SOL) - to stage 1 - was 13.6 mins during the relay trip, while the average SOL at home was more than double, 31.1mins. Sleep efficiency was below 75% for all sleep periods at home and during the relay operation. Finally, subjective sleep quality ratings did not differ, with drivers reporting ‘average’ sleep quality for both home sleeps and those during the trip.

Conclusions
While still in progress, results to date show that SOL in relay vans was less than half of that at home, suggesting a higher sleep propensity. This is likely a reflection of the irregular work schedule and fatigue levels throughout the trip. It is apparent that on-board sleeping conditions are not affecting sleep initiation nor efficiency. Nonetheless, drivers sleep only 3.2h each resting shift and the question remains as to whether this is sufficient.

Fig 1. Means±SEM minutes of SWS and REM sleep (n=5)
Shiftwork and work autonomy - clocking out of work organization?

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Keywords: night work, participation, absence of control, autonomy, des-integration

The shift work literature often emphasizes that night shift is typically experienced as a shift with greater freedom because of reduced presence of management. However, the nature of this freedom and its connection to work organization are far from clear. This study seeks further to understand this increased freedom and its relationships with work organization and participation.

The study was accomplished in a company producing kitchen units. Production was organized along assembly lines with 480 of the employees engaged in team work. The factory operated continuously with a mix of permanent day, evening and a double day rotating system. Information was collected using questionnaires from 334 of the 480 team workers (response rate 70%). This study included measures of team processes, influence, and job satisfaction. Data analysis, using two-tailed t test and chi-square were used to contrast results between subgroups of day and shift workers. Influence was analyzed at proximal and distal levels and in total.

Key findings are: The comparison of day workers and all shift workers shows that shift workers perceive less influence at the individual level (proximal p<0.000; total <0.000), at team level (proximal p<0.004; total <0.012) and employee collective level (proximal p<0.007; total 0.015). The shift group experience less job satisfaction than day workers (p<0.02). Whilst night shift workers (N=68) differ significantly from day shift workers at all of the above levels of influence, evening shift (N=59) and day shift workers differ only at the individual level.

The results highlight that the freedom associated with night work can best be understood as freedom from management surveillance and not as freedom to act and develop through participation in work autonomy and organizational decision making.
Subjective assessment of performance during total sleep deprivation

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Keywords: subjective assessment, performance, motor vehicles, total sleep deprivation

Objectives
This study examined the time points at which individuals undergoing total sleep deprivation (40 hours) felt that they were no longer capable of driving accurately and safely.

Methods
Twenty participants (10m, 10f, 18-25y) participated in a 40-hour sleep deprivation protocol commencing at 0800h, with 2-hourly testing sessions which included the Psychomotor Vigilance Task (PVT) and a subjective performance questionnaire. The questionnaire consisted of a series of four Likert-type 7-point, behaviourally-anchored questions, with a neutral statement at 4. A response of less than 4 indicated that the participant felt they would be unable to drive adequately. The questions asked how (1) safely the individual believed that they could drive at that point in time, (2) how quickly they could respond to a driving emergency, (3) how well they could stay in their lane, and (4) how confident they would be letting someone in their condition drive a loved one.

Results
On average, participants’ responses fell below 4 at 2300h [15h of wakefulness] when asked how confident they would be letting another drive a loved one, at 0100h [17h] when asked how quickly they could respond in an emergency, at 0500h [21 hours of wakefulness] when asked how safely they could drive and at 0700h [23h] when asked how well they could stay in their lane. A baseline for PVT performance was calculated from the daytime scores [0900h – 1700h], and analysis indicated that performance dropped significantly ($F_{1,19}=5.14$, $p <0.05$) below baseline at 0100h (i.e. after 17 hours of wakefulness).

Conclusions
Participants felt that they could drive safely, staying in their lane until 0500-0700h (21-23 hours awake), considerably later than their performance capability, as indicated by the PVT, dropped below baseline levels. As a relative comparison, previous studies indicate that this degree of sleep deprivation is associated with performance decrements equivalent to those produced by blood alcohol levels greater than 0.05% [1,2], the legal driving limit in Australia. Nevertheless, participants felt unable to adequately respond in an emergency situation much earlier (0100h), at approximately the same time as performance capability fell below baseline. Interestingly, participants indicated that they would not trust others to drive their loved ones from 2300h, even before the objective performance decline.

Validation of Heat Stress Indices in Mobarake Steel Complex

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Keywords: Heat Stress, Heat stress index, validity, Rational indices, Empirical indices.

Introduction
For evaluation of the heat load, that workers exposed with it, some indices have been already introduced and comparison. In the present study validity of some of these indices have been evaluated.

Material and Methods
Conventional thermometer, kata- thermometer, WBGT instrument, Globe temperature instrument and Hygrometer were used for assessing indices and environmental parameters. Firstly, the unit of foundry was divided to 15 stations and these parameters were measured and data were collected. Special equations were applied for calculating of heat stress indices. In this study 90 healthy and acclimatized men were chosen and then mouth, core and skin temperatures of these men were measured and recorded. The results analyzed by SPSS program and correlation coefficient (r), Mean and standard deviation for each of factors were obtained.

Results
In this study, mean, minimum, maximum and SD for environmental factors and desirable indices were calculated. Then relation between personal factors (mouth, core and skin temperatures) with environmental factors and indices were assessed. There relationship between heat stress and environmental factors was not significant (P>0.05). Heat stress index, P4SR (P= 0.005) had the most relationship, whereas other indices showed no significant relationships.

Discussion
In this study, a meaningful relationship was found between P4SR and all of other variables. Therefore in this research P4SR index was selected as the valid index. A strong and meaningful relationship between desirable measured parameters have been seen. It is recommended that in separate study, not acclimatized persons be evaluated against the same conditions used in this study. Also other indices could be measured in other industries. (hot - humid or hot dry).

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Observations of Age-related Differences in Sleep, Performance and Alertness at an Australian Lead Smelter

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Keywords: age, sleepiness, alertness, performance, shiftwork, sleep propensity

Objectives
Some studies have indicated that people become less tolerant to shiftwork as they age. Evidence suggests that this intolerance is caused by changes to the internal biological clock, which in turn alters the sleep/wake cycle and alertness levels of many older people. This study investigates the effect age has on shiftworkers on a repeating 12-hour shift schedule (two days, two nights, four off).

Methods
Subjective (sleep and work diaries) and objective (performance and activity) data on sleep and work schedules from 12 subjects was collected for a 14-day period. Subjects were allocated into two age groups; younger (n=6, mean age 31.83 years S.D. 2.14) and older (n=6, mean age 51.88 years, S.D. 4.61). Mixed model analysis of sleep duration and quality was performed as was a time series correlation of the sleep propensity curves of the younger and older groups.

Results
Older subject's performance declined earlier and at a faster rate during the two night shifts than the younger group. There were no significant differences in total sleep time, sleep efficiency or sleep latency between the older and younger age groups. Analysis of the sleep propensity curves indicated that the younger group was 20% more likely to nap prior to the first night shift and 30% more likely to sleep after arriving home from the second night shift. The subjective sleep quality of the younger group was also significantly better than the older group.

Conclusions
These results indicate that the performance of older workers is affected more than their younger counterparts during night work, although this is not necessarily caused by changes in sleep timing or quality as previously reported, but rather differences in sleep strategy.
Predicting the Timing and Duration of Sleep in an Operational Setting using social factors

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Keywords: mathematical modelling, sleep regulation, shiftwork, mixed model regression

Objectives
In recent years there has been increasing interest in the use of bio-mathematical models to predict alertness, performance and/or fatigue in operational settings. They are generally formulated using Borbély’s model of sleep regulation (1) using sleep/wake data derived from a laboratory environment, the estimates of which are then used to predict fatigue, performance and/or alertness. We have investigated the interaction between social and biological factors which determine the timing and duration of sleep during break periods in order to create a mathematical model which can better predict sleep in the field.

Methods
Participants were 20 male shiftworkers (mean age ± SD; 40.89 ± 9.63) at an Australian lead smelting plant who volunteered for a 14-day field study. Participants continued their regular schedule while wearing activity monitors and completing sleep and work diaries.

The theoretical sleep timing model underpinning this analysis consists of separate formulations for short (<32 hours) and long (>32 hours) break periods. Longer break periods are split into three distinct phases; recovery (break start until first local night), social interaction (first local night until last local night) and anticipation phases (last local night until break end) in order to exploit potential differences specific to each. Furthermore, an iterative procedure combining prediction and retrodiction (i.e. using future shift timing information to predict sleep timing during a current break), was developed to optimize predictive ability.

Results
Analysis of the data found an interaction between the social and circadian sleep pressures, which changed over the break period. The model accounted for 67-99% of the variance compared to 52-73% for existing models.

Conclusion
Social and circadian pressures play important roles in regulating sleep for shiftworkers and their dynamic interactions can be modeled to regulate sleep.

Participatory planning of irregular three-shift work and well-being

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Keywords: intervention, participatory planning, forward rotation, well-being

Irregular three-shift work is related to a higher risk of sleep and health complaints, and it also creates social and domestic disruption. Recommendations for more ergonomic shift schedules include, for example, reduction of night work, quickly forward rotation of shifts (Morning - Evening - Night shifts - Free days), some free weekends per month, and all as regular as possible. To diminish both the physical and social burden caused by the shift system, the employees themselves, or their representatives, should take part in the planning of new shift schedules.

A controlled intervention study was carried out in two departments of the Finnish Civil Aviation Administration. Both the study group (n=22) and the control group (n=19) had irregular three-shift work: lists were made for 3 week periods. The employees took part in the planning process of the new system together with their superior and the shift expert. The new shift schedule was irregular as well, but because of the forward rotation it included less so-called quick returns from evening to morning shift where the rest period remains short. The number of single free days was smaller in the new system, and it also included more free weekends. Simultaneously with the intervention, however, other changes were enforced by the company in the intervention department e.g., increase of average working hours and less staffing during the week-ends. These changes had already been implemented in the control department two years earlier. The questionnaire data were gathered in two phases: in January 2002 before the intervention and May 2003 after the intervention period of four months (response rate 76 - 88).

Based on a linear mixed model of repeated measurements, the new shift schedule had significant positive effects on the perceived well-being at work (interaction of intervention*time p=0.008), general health (p=0.082) and social life (p=0.052), when compared to the control group. There also was a tendency towards better adaptation to shiftwork: insomnia in different shifts, especially in morning and night shifts as well as on free days decreased somewhat. There also was a positive tendency regarding health outcomes: work ability was evaluated to be somewhat better and mental strain at a lower level after the intervention.

These positive effects would have been stronger with a larger sample and without other changes in the working time arrangements going on simultaneously. Nevertheless, the possibility to take part in the planning of a new, more ergonomic shift system had positive effects on well-being.
Optional Working Time Model

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Key words: Optional working time, older shift workers, part-time work, continuous shift system

One of the consequences of demographic change is that the European workforce is ageing. Therefore, it is necessary to develop new concepts of leadership, work organisation, personal development/qualification, and health promotion for an ageing workforce. As not all persons age at the same speed and in the same way, individualising human-resource measures seems indicated.

In a German glass processing company, the process of changing from a discontinuous to a continuous shift system with optional working hours was accompanied by the authors (Knauth et al., 2003). Options available to shift workers concerned choosing the length of the average working time (full-time: 37.5, part-time: 35.0 or 33.6 hours/week) and the annual holidays (5 fewer vacation days in exchange for 5 fewer shifts/year). The new shift system follows ergonomic recommendations for the design of shift systems. Although shift workers had to cope with the change from a discontinuous to a continuous shift system, the majority (86 per cent) voted in favour of the new system after a pilot period of one year.

63 shift workers completed questionnaires both before and approximately one year after the implementation of the new shift system. Age, gastro-intestinal complaints, and insufficient sleep showed significant multi-variant discriminatory effects on the decision in favour of part-time work as part-timers reached higher values in the preliminary test. The new shift system improved the workers' general well-being and sleep. Today, about 25 per cent of the shift workers work part-time in the continuous shift system.

In examining long term effects, it is highly useful to evaluate the effects of the continuous shift system on the workers' physical and psychological well-being as well as on their work–life balance after a certain period. This is why, about 10 years after the implementation of the new shift system with optional working time, we are planning a new questionnaire study. We intend to evaluate in greater detail the benefits and limitations of the optional working time model as well as the Work Ability Index (WAI) ratings of each age class. One key question of this study is about the workers' acceptance of the shift system.

Knauth, P., Hornberger, S. and Scheuermann, G. Wahlarbeitszeit für Schichtarbeiter
“Metabolic 5 years follow-up” among male day and rotating three-shift workers

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Keywords: obesity, BMI, lipids, prospective, shiftwork

To follow-up how the anthropometric and the metabolic data change in between male day and three-shift workers in a sub-cohort of the WOLF database during five years.

Methods

During 1996/97 until 2000/01 354 permanent day workers and 378 permanent three-shift workers in a pulp- and paper industry in the north of Sweden have been followed. Anthropometric individual data and blood lipids have been collected at the two occasions in a morning fasting state for the studied population. Individual counseling sessions were offered at both occasions performed by the occupational health nurses.

Differences of mean values of metabolic variables between 1996/97 and 2000/01

<table>
<thead>
<tr>
<th>Metabolic variables</th>
<th>Day workers</th>
<th>Difference of mean value</th>
<th>Shift workers</th>
<th>Difference of mean value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip circumference cm</td>
<td>308 &quot;-0.15&quot;</td>
<td>354 &quot;+2.07&quot;</td>
<td></td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Waist circumference cm</td>
<td>311 &quot;+1.93&quot;</td>
<td>355 &quot;+0.63&quot;</td>
<td></td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Waist/Hip ratio</td>
<td>308 &quot;+0.02&quot;</td>
<td>354 &quot;-0.01&quot;</td>
<td></td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>314 &quot;+0.56&quot;</td>
<td>358 &quot;+0.59&quot;</td>
<td></td>
<td>0.796</td>
<td></td>
</tr>
<tr>
<td>Total cholesterol mmol/l</td>
<td>319 &quot;+0.15&quot;</td>
<td>369 &quot;+0.40&quot;</td>
<td></td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>HDL-cholesterol mmol/l</td>
<td>318 &quot;+0.01&quot;</td>
<td>367 &quot;+0.10&quot;</td>
<td></td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Triglycerides mmol/l</td>
<td>318 &quot;+0.28&quot;</td>
<td>368 &quot;+0.22&quot;</td>
<td></td>
<td>0.384</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

Five years follow-up of permanent day and shift workers showed that waist-circumference had a more favourable change in shift workers. On the other hand the hip circumference increased significantly more in shift workers. No significant difference was seen with the BMI value. Total cholesterol and HDL-cholesterol increased more in shift workers. (1)

Sleep, health and well-being among police officers: effects of shift scheduling

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Keywords: work-non work conflict, sleep length, sleepiness, attitudes

Objectives of the study
During the last decade Swedish police officers’ working hours have changed from rapidly rotating schedules (with only 8 or 9 hours rest between shifts) to more flexible shift systems. The flexible shift system means that the work hours are planned for periods of 4-6 weeks and the level of staffing is related to the presumed workload. Within these limits, the shift worker’s can select the shifts, which they prefer to work. However, they might also be forced to work (unattractive) shifts, e.g. during weekends. The aim of the present study was to use a rather unique opportunity to compare the flexible shift systems with traditional shift schedules with respect to sleep, well-being, health and attitudes to work hours within the same occupation.

Method
A questionnaire was distributed to 2000 randomly selected police officers. 76% responded to the questionnaire, of which 620 where working three-shift systems, including night work. The shift workers could be divided into four groups: (1) flexible shift systems: 337 subjects, (2) rapidly rotating systems (rest time between shifts: 8-9 hours): 172 subjects, (3) semi-rapid rotation (2-4 similar shifts in a row and rest time between shifts 11-16 hours): 45 subjects, and (4) others: 61 subjects (this group was excluded from the analysis, 5 subjects did not answer the questions about shift system). The groups did not differ with respect to gender (26% females), but the semi-rotation group was slightly younger (37 years, compared to 42 years for the other groups, p<0.003).

Results
The rapidly rotating group included more individuals that were dissatisfied with the work hours (22%, semi-rapid rotation: 14%, flexible: 12%, p<0.001) and the possibilities to influence work hours (36%, semi-rapid rotation: 18%, flexible: 17%, p<0.001). The groups did not differ with respect to self-rated health (approximately 5% reported poor health), disturbed sleep (approximately 28% reported regular problems with insomnia) and sleepiness symptoms. However, the rapidly rotating group reported shorter sleep length in connection with the morning shift (6.2±0.08 hours compared to 6.5±0.07 for the other groups, p<0.01) and during daytime after the night shift (5.1±0.10, semi-rapid rotation: 5.8±0.23, flexible: 5.3±0.08, p<0.01). Sleep length during days off did not differ between groups (approximately 8.5 hours). However, when age was added as a covariate the differences in sleep length disappeared. The rapidly rotating group also complained more of insufficient rest and recovery between work shifts (13% reported frequent problems, semi-rapid rotation: 2%, flexible: 4%, p<0.001). They also complained more of work hours interfering with social interactions (with family and friends). However, the flexible work group complained more of insufficient headway to plan life outside work (40% vs. 10% for the other groups, p<0.001).

Conclusions
There were no differences between the shift systems with respect to sleep, health and sleepiness. However, there were some indications that the rapidly rotating shift system was inferior to the other two systems with respect to well-being, e.g. more problems with insufficient recovery, social problems and a more negative attitude to work hours. The flexible shift system was well-liked, however problems related to planning of the social life situation outside work were frequently reported.
Characteristics of companies using new working time schedules

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Keywords: shift work; annualized working time hours; on call work; employees; companies

Objectives
After world war two, many new working time schedules emerged in western countries. We studied the backgrounds of companies using two of them (annualized working time hours and on call work) and compared these with organizations applying classical shift work.

Method
Every two years the Dutch OSA Institute of Labor Studies carries out a survey among a stratified sample of Dutch companies with at least 5 employees. In 2001 a net sample of 3199 companies was investigated by means of an oral interview. Nineteen background characteristics were selected for further analysis. Results were analyzed by means of logistic regression.

Results
Shift work is used in about 30% of all Dutch companies. We confirmed the hypothesis that shift work is applied in large and economically stable organizations (1.99 times more often in organizations of 100 or more employees; 0.57 less often in organizations with a co-working owner; 0.77 less often in organizations with increasing costs), with stably contracted personnel (1.37 more often shortness of personnel) and a stable market share (0.75 less often in organizations that operate in a strongly competitive sales market).

A system of annualized working time hours is used in 18.6% of all Dutch organizations. We confirmed that this working time method is applied by stable organizations with stably contracted personnel that operate in a cyclic but in the long term slowly changing sales market (1.85 times more often seasonal market cycles; 1.67 more often changes in organization volume). They cope with the temporary use of new personnel by attraction of temporary employment agency personnel (1.56).

On call work is applied in 23.1% of all Dutch organizations. These mostly small organizations (1.55 more often in organizations of 10-49 employees) operate in competitive and short term unstable sales markets (1.52 more often). The do not face shortness of personnel (0.52 times less often), have a high percentage of contracted personnel (1.82 more often), and hire more often temporary agency office workers (1.71). They face strong increases in production costs (2.22 more often) in the nearby future.

Conclusions
2001 was an economically favorable year with only a beginning of decline. Results may be colored by a relatively large need of companies for having more qualified personnel, but also by care to cut labor investments. Applying working time strategies may be a question of a more complex choice system, compared to the nineteen variables we analyzed. At the same many working time strategies are applied in Dutch companies, so that it is likely that we did not analyze the entire picture.
Compensation for unfavourable characteristics in irregular individual shift rotas in a TV company

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Key words: Irregular shifts, TV, bonus system, compensation

Some employees of TV companies, e.g. those who produce field programs, have to cope with very irregular rotas and frequent sudden deviations from schedule. Many complain about negative effects on their well-being and private life. Therefore, a working group composed of employer and council representatives as well as researchers developed a so-called 'bonus system' (Knauth et al, 2001).

Based on the criteria of the "BESIAK" system (Schönfelder and Knauth, 1993) the following list of criteria for ergonomic assessments of irregular shift systems was developed:

<table>
<thead>
<tr>
<th>No.</th>
<th>Criterion</th>
<th>Potential Effects on</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Proportion of night hours worked between 10 pm and 1 am and 6 am and 7 am</td>
<td>Health</td>
</tr>
<tr>
<td>2</td>
<td>Proportion of night hours worked between 1 am and 6 am</td>
<td>Health</td>
</tr>
<tr>
<td>3</td>
<td>Number of successive night shifts</td>
<td>Health</td>
</tr>
<tr>
<td>4</td>
<td>Number of successive working days</td>
<td>Health</td>
</tr>
<tr>
<td>5</td>
<td>Number of shifts longer than 9 hours</td>
<td>Health</td>
</tr>
<tr>
<td>6</td>
<td>Proportion of phase advances</td>
<td>Health</td>
</tr>
<tr>
<td>7</td>
<td>Hours off at weekends</td>
<td>Value of leisure</td>
</tr>
<tr>
<td>8</td>
<td>Work hours between 5 pm and 1 pm from Monday to Friday</td>
<td>Value of leisure</td>
</tr>
<tr>
<td>9</td>
<td>Number of working days with leisure time in field productions</td>
<td>Value of leisure</td>
</tr>
<tr>
<td>10</td>
<td>Sudden deviations from the planned shift rota</td>
<td>Long-term leisure planning</td>
</tr>
</tbody>
</table>

Individual rotas are evaluated retrospectively. If pre-defined criteria thresholds are surpassed, bonus points are added to the person's account. In general, more bonus points add up to more free time. Money will be paid in compensation for some criteria only in special circumstances.

Initial experiences gathered during a pilot period will be reported.

In summary: To avoid additional days off (or unnecessary expenses), the bonus system forces the employer to design individual rotas, which are better for the health and leisure time of the employees.


Investigating the nutritional perceptions of day vs. shift Correctional workers over a period of seven days.

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Keywords: Food intake, nutritional perceptions

The aim of this study was to assess the nutritional perceptions of correctional officers (day vs. shift) over a period of one week. Three aspects of nutritional perceptions relating to the intake from the five core food groups (vegetables, dairy products, meat products, fruits, and cereals and/or grains) were investigated. Specifically, participants were asked to report how many servings from each food group should be consumed each day; how much they believe they do consume each day; and finally, over a period of seven days report how many servings from each of the food groups they believe they actually consumed each day. Twenty-seven Shiftworkers (Age: M=46.96, SD=8.28) and 17 Day workers (Age: M=50.24, SD=7.65) participated in this study. A Multiple Analysis of Variance (MANOVA) indicated that there were no significant differences with regard to Day vs. Shift-workers perceptions of how many servings of the five food groups should be consumed. However, Day workers reported that they do consume significantly more dairy products in comparison to Shiftworkers. In addition, Day workers also reported consuming significantly more servings of dairy products (actual) in comparison to Shiftworkers. Further analysis of daily consumption rates by Work type (day vs. shift) and Did today (day shift, afternoon shift, night shift, and day off) indicated that Day workers reported no significant differences in consumption rates across the food groups on day shifts vs. days off. However, in contrast, Shiftworkers reported significant differences in their consumption rates for vegetables, dairy products, fruits, and cereals and/or grains across shifts and days off. The findings from this study provide further support for the research indicating that Shiftworkers, in comparison to Day workers, are at a greater risk of poorer dietary habits. Additional discussion of these findings in relation to the dietary recommendations as outlined by the Australian Department of Health and Ageing (ADHA, 1998) will be outlined.
Risks associated with irregular hours of work by hospital anesthesiologists

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Keywords: Irregular hours of work, anesthesiologists, workload, chronic fatigue, risk assessment

Aim
Health and safety risks among health care workers are known to be closely associated with their irregular hours of work (Sakai et al. 1997). This association was discussed based on questionnaire studies on the workload of hospital anesthesiologists and the application to their work of the Night and Shift Work Checklist (Kogi 2004).

Methods
A questionnaire about working time arrangements and working conditions of hospital anesthesiologists was distributed to 116 university hospitals and 1525 general hospitals in different parts of Japan, with valid replies obtained from 71% and 47%, respectively. Another questionnaire about workload and work-related health conditions was distributed to 800 anesthesiologists, with valid replies from 34%. Most anesthesiologists engaged in anesthesia of patients during operations in hospitals were working irregular, long-hour shifts. The questionnaire replies and the results of applying the Night and Shift Work Checklist were examined to discuss the types of support measures to reduce risks related to irregular hours of work and chronic fatigue of these anesthesiologists.

Results
On the average, an anesthesiologist dealt per month with 25 anesthetic cases in university hospitals and 32 cases in general hospitals. Thus anesthesiologists worked per month 4.2 night duties and 5 overnight standby duties (108 overtime hours) in university hospitals and 2.6 night duties and 11 overnight standby duties (53 overtime hours) in general hospitals. In over 90% of these hospitals, anesthesiologists had to work a full day shift on the day following a night or standby duty. This often led to long portal-to-portal time exceeding 36 hours. Anesthesiologists dealing with 38 or more cases per month were engaged on the average in 11.8 long-hour operations lasting 6 hours or more resulting in evening or night overtime hours on 15 days per month. As a result, most anesthesiologists complained of their chronic fatigue. They felt their workload was often excessive. Many of them had to attend long-hour operations alone. Over 90% stated that it was difficult to keep alert when doing anesthesia for more than 4 hours without a break. Those who were anxious about medical errors during their work accounted for as many as 59%. The scores of fatigue symptoms due to work were significantly higher among those working 81 or more overtime hours per month compared with those working less than 40 overtime hours. The well-being scores were significantly lower in the former group. The results of applying the checklist to the night and shift work of these anesthesiologists pointed out the urgent need to improve the working time arrangements and ergonomic conditions of work together. This was also confirmed by the questionnaire replies urging support for reducing associated health and safety risks.

Conclusions
The results suggested a strong need to coordinate the work assignments of hospital anesthesiologists. It is recommended to avoid excessively long work shifts, reduce workload during night duties, apply ergonomic measures in anesthetic work and improve resting conditions.

Does the light condition during night shift work affect daytime tracking task and self-evaluated sleepiness?

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Keywords: light environment, after night shift work, tracking task, self-evaluated sleepiness

Introduction
In recent years, the number of part-time night shift workers, such as university students who are not able to sleep after night shift work because they must attend class during the daytime, has increased in Japan. In our previous study, the effects of a nap and bright light have been reported in order to improve human performances and physiological conditions after night shift work. However, there are many kinds of night shift work and also a variety of lighting conditions. Therefore, the objective of this study was to investigate whether or not lighting difference during simulated night shift work has an effect on daytime tracking task and self-evaluated sleepiness.

Method
Four days were required to complete this experiment since there were three levels of lighting (3000-5000lx, 1000-1500lx and 100-200lx) during simulated night shift work (22:00-6:00) and night time sleep. The four days were carried out at random and a period of one week was given between each of the days. The subject’s performances were measured and evaluated by the time it took to complete a tracking task, i.e., coordination test and the number of errors. The test was given at 21:00, 6:00 and during one hour intervals from 8:00 to 19:00 after simulated night shift work and night time sleep. Each subject’s self-evaluated sleepiness was measured and evaluated by a visual analog scale (VAS) at one hour intervals from 21:00 to 19:00. Six healthy university students (male: 3 subjects, female: 3 subjects) participated in this experiment. The individual circadian rhythm type of the six subjects by the Japanese Morningness-Eveningness test was “neither”.

Result
The score for VAS during simulated night shift work was found to be the lowest in the light condition of 3000-5000lx. However, a change in score for VAS did not continue during the daytime. The time it took to complete a tracking task such as coordination test and the number of errors after simulated night shift work did not show any noticeable change. As for the reason of the result, the effect of lighting conditions during simulated night shift work on human performance such as tracking task and self-evaluated sleepiness did not show in the day time because sleepiness after sleep deprivation of 24 hour or more overlapped the effects of the lighting conditions.
Accidents in bus and tram drivers - length of duty and time of day effects

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Keywords: Accidents, public transport, shift work

Public transportation is typically provided for most of the day or even around the clock necessitating shift schedules for drivers and other personnel. Often split shifts, shifts with varying lengths and varying begin and ending times are applied to account for the strongly varying demand. Only few investigations have inquired into the accident and injury risk in relation to hours at work and time of day (for a recent overview see Folkard & Akerstedt 2004). Concerning bus and tram drivers' accident risk in relation to working hours there is even less evidence. The problem of vehicle accidents and fatigue has been discussed by Horne and Reyner (1999). Profound circadian effects have been found with sleepiness being particularly evident during and after night shifts. However, local area public transportation is typically organized without a night shift, and compared to long-distance driving there are often less problems concerning rest breaks. Hence for the specific conditions pertaining to local area public transportation there are almost no data concerning accident risk to date.

The study was conducted to provide some evidence about the relationship between aspects of the shift schedule and accidents in local area public transportation. Data were provided by the public bus and tram company of a county capital for the period from August 1999 through April 2004. During this period the driving staff comprised on average of 230 employees. More than 3 Million driving hours were covered in the data files. For each driver and each day the files contained the working schedule (begin and end of each shift, type of shift, etc.) and furthermore for every incident a comprehensive compilation of the circumstances was retained. Accidents and injuries (incidents) were scrutinized to select those in which the driver was involved (the majority of incidents were without any relation to the drivers' behavior, such as a door that would not open or a passenger falling on the way out). As explanatory variables only schedule and traffic related data were considered (hence drivers' characteristics such as gender, age, years of employment etc. were not included in this analysis).

Analysis was done by Poisson regression.
Overall 268 driver related accidents occurred amounting to an average of ~1 accident per 10,000 driving hours. Number of accidents per driver were between 0 and 6 and followed closely a Poisson distribution. Hazard ratios increased after 18:00 until 22:00 (after 22:59 and before 4:00 no accidents occurred, however, only few drivers were on duty at these times of the day). Also significantly elevated hazard ratios were computed for 04:00, 09:00, and 14:00. Accident risk was significantly higher on holidays as compared to workdays and tended to be higher at the beginning of shifts.
There is clear evidence for a circadian variation in accident risk since in the early morning hours risk is higher and increases after 6 pm. However, there are smaller peaks at 9:00, possibly due to a change in traffic conditions, and at 14:00 that may be related to the noon dip in performance. The higher risk on holidays may be attributed to the less predictable behavior of road users.

The dynamics of recovery following moderate and severe sleep loss

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Keywords: sleep loss, sleepiness, neurobehavioural performance, recovery

Objectives
A significant body of research has demonstrated the detrimental impact that sleep loss has on sleepiness and performance. In contrast, few studies have systematically investigated the subsequent recovery of neurobehavioural function. The aim of the current study was to determine the rate of recovery of sleepiness and performance following moderate and severe sleep loss, and the impact of recovery sleep duration on recovery.

Methods
Thirty healthy non-smokers, aged 18-35 years, participated in one of three conditions: moderate sleep loss, moderate sleep loss with restricted recovery opportunity, or severe sleep loss. Each participant attended the laboratory for 8-9 consecutive nights: an adaptation and baseline night (2300-0800hr), one (moderate) or two (severe) night(s) of wakefulness, and five consecutive recovery sleep opportunities. Recovery sleep opportunities involved either 9-hours (2300-0800hr) time in bed (TIB), or were restricted to 6-hours (0200–0800hr) TIB. On each experimental day, 20-minute MSLTs were performed at 1000hr and 1600hr. Performance and subjective alertness were assessed at 2-hourly intervals using a battery of tasks, including a 10-min PVT. PSG data was collected for each sleep period.

Results
Analysis of data from the moderate sleep loss group (normal and restricted recovery opportunity) indicated that all measures of neurobehavioural function significantly deteriorated during the period of wakefulness. Significant differences were observed between the two groups during the recovery phase (Figure 1). For participants allowed 9-hrs TIB, sleep onset latency (to stage 2) was significantly shorter than baseline until the second recovery day (Figure 1a), while PVT response speed (1/RT*1000) and subjective alertness returned to baseline levels following the first recovery sleep (Figure 1b/c). In contrast, sleep onset latency, response speed and subjective alertness all remained significantly below baseline following all of the 6-hour recovery sleeps.

Conclusions
Following moderate sleep loss, one 9-hr recovery sleep opportunity is sufficient for recovery of performance and subjective alertness, while two are required for recovery of physiological sleepiness. In contrast, five consecutive 6-hour recovery sleep periods are insufficient to reverse the effects of moderate sleep loss and restore waking function. Data from the third group (collection still in progress) will enable us to determine the rate of recovery when sleep loss is more severe.

Figure 1. Sleepiness, performance and subjective alertness following moderate sleep loss and five consecutive 9-hr (triangle) or 6-hr (cross) recovery sleeps.
Do short layovers allow pilots sufficient opportunity to recover?

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Keywords: International pilots, sleep, performance, layover length

Objectives
For Australian pilots, short slips (layovers) are a feature of many international patterns. However, anecdotal reports suggest that pilots find patterns with short slips more fatiguing and harder to recover from. The current study aimed to determine whether pilots operating international patterns with short slips (<40 hours) have sufficient opportunity to recover prior to the return (inbound) flight.

Methods
Seventeen international pilots (9 Captains, 8 First Officers) operating a direct return pattern from Australia to Los Angeles, with a short (n=8, mean±stdev=39±0.8hrs) or long (n=9, mean±stdev=62.2±1.0hrs) layover, wore an activity monitor and kept a sleep/duty diary prior to, during and after the pattern. Immediately before and after each flight, pilots completed a 5-minute PalmPilot-based reaction time task. All flights were of comparable duration (outbound=15.5±0.5hrs, inbound=14.6±0.7hrs) and timing.

Results
The amount of sleep obtained inflight did not vary as a function of layover length. On average, pilots obtained 2.2±0.8 and 3.7±0.8 hours during the outbound and inbound flight, respectively. As expected, pilots with the longer layover obtained more sleep in total during layover (19.6±2.6 vs 13.9±2.8 hours), due to more sleep opportunities (3.4±0.7 vs 2.4±0.5). However, mean layover sleep length (for main sleep periods, excluding naps) and sleep obtained in the 24 hours prior to the inbound flight did not significantly differ (Figure 1). Overall, post-flight performance was significantly poorer than pre-flight (Figure 2). For pilots with a short layover, performance prior to the inbound flight at the end of layover remained significantly below pre-trip performance. In contrast, performance prior to the inbound flight did not differ from pre-trip for those with the longer layover.

Conclusions
The data suggests that short slips (<40 hour) do not allow pilots the opportunity to obtain sufficient sleep to reverse the effects of fatigue accumulated during the outbound flight. As a result, they are more fatigued prior to the inbound flight than those with a longer layover.
Six hour day – effects on health and gender equality?

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Keywords: gender equality, gender segregation, unpaid work, ill health

Despite the fact that Sweden has legislated much regarding equal opportunities the last centennial, we are still far away from the target of gender equality at the labour market. Sweden has still a segregated labour market (both regarding gender and ethnicity), and the effects concerning salary and activity are especially visible in the public sector. 51 per cent of the women in Sweden worked in the public sector and 49 per cent in the private sector year 2003. 19 per cent of the men in Sweden worked in the public sector and 81 per cent in the private sector the same year.

This segregation has been of both political and scientific interest, partly due to its demonstrated strong relationship with health. While it is well established that many occupations and organisations are partly or greatly dominated by one of the two genders we have a more limited understanding of the extent to which this impinges on health. The relation between gender segregation at the labour market and health has been demonstrated when indicators of ill health are based on self-reports, diagnosed by a physician, or reflected in the rates of sick leave.

However, women have more often part-time jobs and temporary jobs that weaken their position at the labour market. The segregation at the labour market leads to, in general, larger income for men. Regarding family life, men and women share the work more today, than what was usual just 10-15 years ago. One consequence of women’s lower income is a larger reasonability for the unpaid work. How we manage to combine the different parts of life has a conclusive effect on our health.

When the base line measurements has been performed, we can see that women spend more time for home and children then men. We can also see that women experience their household work as more physical demanding on a free day than a working day, comparing to men, where the opposite is true. Regarding the individual health, more women than men proved to ill health. During the presentation, we will present more specific data on: gender distribution of household tasks, physical demands in unpaid work and various health effects.

In the order in which they appear
Optimal work rest schemes and working hours in manufacturing environments

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Keywords: work rest schemes, working hours, flexibility, discomfort, worker’s satisfaction

One of today’s major challenges in manufacturing industries is the maximization of flexibility. One aspect of flexibility concerns the ability to deal with the fluctuations in the volume demand. Many companies are exposed to relatively short periods of times (about one or two months), where volume demands are significantly higher compared to the rest of the year. Temporary extra lines or extra shifts are relatively expensive solutions. It is preferable to temporarily modify the working hours and work rest schemes, specifically extend the working days and introduce alternating pause schemes. The question is how these measures would affect the worker and the production rates. In a series of experiments we tested the effects of alternating pause schemes and extended working days in different companies. This paper describes the results of an investigation into the effects of alternating pause schemes in one company (Philips DAP, a producer of shavers).

This approach included the addition of two extra workers to a line of twelve workstations that are normally manned by twelve workers. Hereby, the operators are able to take their breaks alternately in couples of two. The advantage is that the line keeps running during the breaks. Another advantage might be that the total pause time per day for each worker was increased (1, 2).

Fourteen female operators took part as a subject. These operators were tested in three conditions. In the rational condition T, twelve operators were involved who took all breaks together. In the two alternative conditions A1 and A2, fourteen operators took their lunch break all together, but all short breaks were taken alternately. The pause schemes were different across all three conditions resulting in pause times of 70, 80 and 85 minutes, in T, A1 and A2 respectively.

The new approach resulted in an increase in line output of 12 to 16% in A1 and A2. On the operator level, we observed no differences in productivity, despite the differences in total pause time across conditions. Simultaneously, physical loads on the neck and shoulders, expressed by the level of discomfort, were found to be significantly lower in A2. A majority of the operators entitled this alternating break scheme as ‘pleasant’ (90%), but wanted the scheme to be applied only during the periods of peak demand because of social aspects (80%).

In conclusion, an increase in volume flexibility can be achieved by adding two extra workers and by applying an alternating work rest scheme (and thus, without a costly reconfiguration of the line.) Meanwhile, the application of more pause time in A2, resulted in the experience of less discomfort by the workers, while the extra pause time did not lead to any reduction in productivity per worker, which is in line with previous observations.

Light behaviour of shift workers in connection to day sleep

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Keywords: light, shift work, alertness, sleep

Light behaviour in connection to night work might have an influence on the adaptation to work as well as for recovery sleep. The aim of the present study was to investigate the effects of artificial bright light at work on sleepiness and recovery sleep. But also the natural daylight exposure during day sleep and during free time was studied. A group of permanent night workers (n=22) worked on 12-hour shifts (18.00-06.00) three days every week. The group worked at a postal service centre sorting packages. The workers had a mean age of 52 years (27-63 yrs) and half of them were women. As a part of the experiment they were exposed to either bright light (1500lux at eye level) during breaks or normal light (NL) exposure for two weeks in a crossover design. They were also questioned on sleep disturbances in connection to day sleep (eight questions) and natural light exposure levels in the bedroom. During the study period the workers wore actigraphs with light sensors and answered daily questions on sleep, sleepiness and of natural daylight exposure. Most workers (77%) claimed that they had a room separated from the rest of their home used for recovery sleep. On a 6-point scale ranging from complete dark to full day-light, 23% claimed to have an almost dark sleep environment, 36% had a semi-dark surrounding and 40% had enough light to read or full day light during day sleep.

Two groups were formed according to the exposure level in connection with sleep and compared on questions of sleep disturbances. Those stating more problems with disturbed sleep took greater care in blocking out-door light during day sleep (t-test, p=0.010) and those not taking great care of blocking the light claimed to sleep more heavily (t-test, p=0.026). Another question gave estimations of how many percent of daylight that could be blocked out by various window shadings in the bedroom. The answers demonstrated that 58% (range 15-98%) of the outdoor light could be blocked out by shades. When using blocking percentages to form two groups, a few aspects of sleep disturbance became significant, that is, those with less blocking never or seldom woke up repeatedly and had less difficulty to fall asleep again (p=0.033). The amount of natural light received at daytime during the study period (January and Scandinavian winter) was 65 (±19) minutes in connection to night work. This exposure mainly occurred after day sleep. This was significantly less than the amount of exposure on free days that reached 98 (± 20) minutes (ANOVA, F=2.7, p=0.017). The total amount of natural light received during the study weeks did not appear to influence (in multiple regressions) day sleep quality and neither did sex and age. The results also showed that the estimated recovery after night shift was better after experimental exposure to bright light. (9-point scale, 1=much better, 9 much worse, mean BL=3.5; mean NL=5.0, t=4.2, p=0.001). When questioned about the estimated number of days needed for recovery after a sequence of night shifts, the bright light condition yielded fewer days for recovery (mean BL=1.17; mean NL=1.61, t=3.4, p=0.005). Thus, night workers on 12-hour shifts seem to receive rather much natural daylight exposure, also during the darkest period of the year, probably more than many others workers. This strategy is likely to promote a day-orientation of the circadian phase and would be a recommended strategy when involved in a quickly rotating schedule. It seems that reducing light levels during the sleep period can prevent day sleep disturbances.

Conclusion

Night workers seem to adjust the light level during day sleep according to their experience of sleep disturbances; good sleepers take less precautions blocking out natural light.
The Effect of Long Working Hours on Health and Safety of Women Workers in Diverse Manufacturing Industries
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Keywords: long working hours, occupational illness, hazard exposures, women workers

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 long working hours on health and safety of women workers in diverse manufacturing industries. This was conducted in an export zone involving 31 industries and an interview with 613 women workers. The results showed that most of the respondents worked overtime (75.8%) compared to only 24.2% who did not. In fact, 33.9% and 33.2% of the workers in the garments and electronics said that they were required to do overtime work in order to finish their work, while about 27% for each industry said that they did it to receive additional pay for the overtime work. The workers aid in the interview that overtime is a prerogative of management. For hazard exposures, workers in the electronics industry reported the following hazard exposures: high temperature at 31%, intoxicating odor at 25.8%, cold temperature at 20.6%, noise at 19.7%, prolonged standing at 18.8% and then radiation at 18%. On the other hand, the workers in the garment industry reported the following hazards: high temperature at 28.4%, dust at 18%, intoxicating odors at 17.5% and then noise at 13.6%. The electronics industry was characterized by both cold and heat exposures because of the various processes done for the manufacture of electronics. Those that are very sensitive to heat are done in maintained cold temperatures. The work processes in both electronics and garment industries emit these hazardous elements and present adverse work conditions. The very nature of the technology and the process necessitates the emission of these hazards.

Results also showed that the illnesses occurred after the work shift (57.4% for garments and 58% for electronics), when work was perceived to be too much and when the workplace was too warm or hot. This shows the work-relatedness of the illnesses. The overall good physical health of workers is affected by overtime and mental work. Workers who have autonomy in making use of their own strategy to accomplish their work are likely to have better level of physical health. Those under close monitoring are more likely to have low level of physical health. Cases of low physical health are less common in medium industries. Poor quality of work and exposure to hazardous work also increase chances of having low physical health among workers. The study looked into the occupational hazards and injuries among 500 workers in 10 semiconductor industries in Cavite Export Processing Zone in the Philippines. The subjects included only those who were doing extended shiftwork beyond 8 hours, specifically 12 hours. Industries were classified as either small, medium or large scale industries based on the number of workers in the company. This is a parametric study using stratified sampling where instruments included workplace ambient monitoring, safety investigation, medical records review, survey questionnaires and interviews. For the 500 workers given questionnaires, problems cited for work conditions included poor housekeeping, slippery floors, uneven floors, no machine guard, insufficient work area, and insufficient warehouse/storage area. These conditions may predispose a worker to accidents and injuries. The top five most frequent stressors for both males and females were overtime, fast-paced work, repetitive work, mental fatigue and visual strain. The most prevalent injury was cuts and bruises at 65.5%. When hazards and injuries were associated for this group of extended shiftworkers, the results showed significant association between the following: noise with hearing loss (p=0.19), poor illumination with eye strain (p=0.007), muscle injury with vibration (p=0.46), excessive work with low back injury (p=0.00), slipping with poor housekeeping (p=0.021), slippery floor with falls (p=0.32), and with uneven floors (p=0.003).

The injury data from the medical clinic for one year indicated 27 cases of laceration, 25 cases of punctures, 9 cases of chemical burns, 4 cases of fractures, and 3 cases each of amputation and eye injuries. All these injuries occurred in the workplace due to lack of machine guards, improper use of tools, non-ergonomically designed tools, fast workplace and unsafe conditions. Three amputations of the middle crease of the hand extending to all fingers were also noted. From the baseline data, the proposed safety risk assessment index is shown.
Safety issues in the workplace confronting those in extended shiftwork

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Keywords: Extended Shiftwork, Safety Issues, Manufacturing workers, Export Zone

The study looked into the occupational hazards and injuries among 500 workers in 10 semiconductor industries in Cavite Export Processing Zone in the Philippines. The subjects included only those who were doing extended shiftwork beyond 8 hours, specifically 12 hours. Industries were classified as either small, medium or large scale industries based on the number of workers in the company. This is a parametric study using stratified sampling where instruments included workplace ambient monitoring, safety investigation, medical records review, survey questionnaires, and interviews. For the 500 workers given questionnaires, problems cited for work conditions included poor housekeeping, slippery floors, uneven floors, no machine guard, insufficient work area, and insufficient warehouse/storage area. These conditions may predispose a worker to accidents and injuries. The top five most frequent stressors for both males and females were overtime, fast-paced work, repetitive work, mental fatigue, and visual strain. The most prevalent injury was cuts and bruises at 65.5%. When hazards and injuries were associated for this group of extended shiftworkers, the results showed significant association between the following: noise with hearing loss (p=0.19), poor illumination with eye strain (p=0.007), muscle injury with vibration (p=0.46), excessive work with low back injury (p=0.00), slipping with poor housekeeping (p=0.021), slippery floor with falls (p=0.32), and with uneven floors (p=0.003). The injury data from the medical clinic for one year indicated 27 cases of laceration, 25 cases of puncture cases of chemical burns, 4 cases of fractures, and 3 cases each of amputation and eye injuries. A number of injuries occurred in the workplace due to lack of machine guards, improper use of tools, non-ergonomic designed tools, fast workplace and unsafe conditions. Three amputations of the middle crease of the hand extending to all fingers were also noted. From the baseline data, the proposed safety risk assessment is shown.
Role of the nonvisual photoreceptors in the regulation of diurnal biological periods

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Keywords: nonvisual photoreceptors, retina, pineal organ, deep brain photoreceptors, cryptochromes

The circadian periodicity of the organism is determined by a self-regulating transcription loop, that has an approximately 24 hour-long period. This clock-system is entrained by light-dark cycle of the environment perceived by the nonvisual retinal, pineal, and deep brain photoreceptors.

The retinal nonvisual light perception influences the suprachiasmatic nucleus, the primary pacemaker of the brain. As neither rod nor cone photopigments seem to participate in the nonvisual photoreception, additional molecules like cryptochromes imunocytochemically localized to photoreceptors were supposed to play a role in this function (David et al., 2003).

The pineal organs of submammalian vertebrates contain cone-like photoreceptors and detect illumination of the environment. The mammalian and human pineal is generally considered a light-insensitive organ, however, the expression of phototransduction cascade molecules – predominantly in young animals - may contribute – by means of melatonin secretion - to a light-perceptive task in the perinatal setting of diurnal rhythmicity (Vigh et al. 2002).

The deep brain photoreceptors are hypothalamic and septal nuclei of the periventricular cerebrospinal fluid (CSF)-contacting neuronal system in submammalians. Various opsins and other members of the phototransduction cascade have been demonstrated in telencephalic and hypothalamic groups of these neurons. In the present work cryptochrome immunoreactive and negative cells were distinguished among these CSF-contacting neurons of various vertebrates. Further investigations are already in progress to test whether similar molecules are localized in CSF-contacting neurons of mammals and human hypothalamic nuclei and if they have a role in the regulation of circadian and circannual periodicity.


Job satisfaction and work ability among educators

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Keywords: job satisfaction, work ability, educators, occupational health, higher education.

The purpose of this study was to investigate the correlation between job satisfaction of educators working at a higher education institution and their work ability. A descriptive epidemiological survey has been carried out, based on a cross-section quantitative approach. The study included 154 educators, out of which 78 (50.6%) were male and 76 (49.4%), female; the average age was 39.27 (SD=8.17). Data collection was performed by means of three questionnaires: 1) Socio-demographic and functional data; 2) OSI (Occupational Stress Indicator) scale (Robertson et al, 1990); and 3) Work Ability Index – WAI (Tuomi et al, 1994). The Spearman test correlating job satisfaction and WAI was applied to the whole group of educators, according to the pertinent work area. The chi-square test was applied to investigate the association between the WAI and each of the psycho-social factors included in the job satisfaction scale. The Spearman and the chi-square tests were also employed to investigate the relationship existing between the WAI and socio-demographic and functional variables. Job satisfaction and WAI showed a statistical correlation (r=0.2316/p=0.0038); this demonstrates the relevance of the two variables concerning workers health. Upon analyzing each psycho-social aspect within the job satisfaction scale, an association between nine out of the twenty two aspects comprising the scale and the WAI was observed. In the analysis carried out by work area, a correlation between job satisfaction and WAI was observed in the group of educators working in the health care area (r=0.4645/p=0.0001). In this group, an association between the WAI and the fact that the professional had another job was also observed (p=0.0268). On the other hand, the analysis of the whole group of educators didn't show any association between the WAI and the work shift, sex or the fact that the professional had another job. No correlation between the WAI and the work load variables (hour/classes given + extra-classroom hour/classes), age, and seniority at the institution could be observed. It may well be that professionals working in the health care area tend to perform other activities within the same area that demand a strong cognitive effort, and this might impair their performance at work. Job satisfaction, in turn, might contribute to improve the professional's work ability.

Employee attitudes towards a fatigue risk management system

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Keywords: fatigue, management, attitudes, strengths, weaknesses

Governments, regulators and industry have widely acknowledged workplace fatigue as a significant occupational health and safety risk. This has become particularly evident in several high-consequence industries such as transportation, medicine, mining, nuclear power and manufacturing. To better-manage workplace fatigue, many industries have started to implement performance-based fatigue risk management systems [FRMSs]. Such approaches have been implemented either in place of prescriptive duty limitations, or along side existing rules. The basic premise of the performance-based FRMS is to allow organizations to determine acceptable controls for safety and appropriate management styles for their own circumstances, rather than imposing rigid, inflexible rules.

**Objectives**
The study aimed to evaluate the overall efficacy of a trial FRMS within the Australian aviation industry. The success of any new program implementation is highly dependent upon the attitudes and opinions of key stakeholders [1]. The major objective was therefore to report the attitudes of aviation management and flight crew representatives regarding the FRMS evaluation.

**Methods**
At the time the study was conducted, 21 organizations were participating in the trial FRMS. Management and flight crew representatives from each participating organization were invited to attend an interview with the researchers. Each interview was structured to survey attitudes regarding the FRMS in general, and highlight strengths and weaknesses of the system.

**Results**
The overall consensus of both management and flight crewmembers was that the FRMS had a positive impact on operations. Participants were also asked to rate the FRMS efficacy in preventing fatigue related accidents and/or incidents. Results showed that 14.6% of participants perceived that the FRMS was ‘very effective’ in preventing fatigue related accidents and/or incidents; 46.3% as ‘effective’; 19.5% as ‘average’; 12.2% as ‘not very effective’; and 7.3% as ‘not at all effective’. The reasons for these responses were explored in terms of strengths and weaknesses, as shown in the table below.

<table>
<thead>
<tr>
<th>STRENGTHS</th>
<th>WEAKNESSES</th>
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<tr>
<td>Increased awareness of fatigue</td>
<td>The current application of fatigue modelling</td>
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<tr>
<td>Operational flexibility</td>
<td>Potential for abuse</td>
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<tr>
<td>Increased productivity</td>
<td>Decreased productivity</td>
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<tr>
<td>Less complex than prescriptive duty rules</td>
<td>Work-load for development of the FRMS</td>
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<tr>
<td>Clearer sharing of responsibility for fatigue</td>
<td>Increased potential for legal liability</td>
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<tr>
<td>Scientific basis for fatigue management</td>
<td>Absence of risk assessment</td>
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**Conclusions**
While the study highlighted many areas for potential improvement in future FRMS attempts, the overall positive response to the program was promising. Specifically, participants favoured the FRMS approach over more prescriptive duty limitations. Many of the weaknesses highlighted by participants may be explained by a lack of information provided to them throughout the FRMS design and implementation process. In the future, a greater level of consultation should be conducted with all stakeholders to ease any potential concerns, and potentially lead to a smoother FRMS implementation process.

Are subjective ratings of fatigue based on actual sleep obtained?

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Keywords: fatigue, management, subjective ratings, Samn-Perelli, sleep

Objectives

Industry is increasingly being required to manage the risk of fatigue through the prescription of maximum duty and minimum break times. As an additional level of control, many fatigue management policies state that if an employee feels unfit for work due to fatigue, it should be reported to management. This additional level of control relies on the assumption that subjective ratings of fatigue are based on appropriate criteria, such as inadequate restorative sleep or excessive wakefulness. The objective of the current study was to determine whether sleep quantity was a major criterion for estimating self-ratings of fatigue.

Methods

An existing dataset from the Australian transportation industry was used to determine subjective ratings of fatigue on the 7-point Samn-Perelli [SP] alertness scale, and sleep quantity from sleep diaries and wrist actigraphy data. The frequency of individuals who obtained various sleep thresholds was calculated for each score on the SP scale.

Results

SP ratings were grouped to indicate 3 levels of impairment: alert, moderately tired and extremely tired. As shown in the figure below, when individuals had greater than 5 hours sleep, ratings on the SP scale remained relatively stable. However, when individuals had less than five hours sleep, individuals were increasingly more likely to report feeling extremely tired.

Conclusions

The results indicated that some participants based their subjective SP ratings on actual sleep. However, only 33.3% of participants reported feeling ‘extremely tired’ after less than 2 hours of sleep in the prior 24 hours. Research indicates that performance becomes impaired after obtaining less than 5 hours sleep [1]. Therefore, 66.6% participants based their subjective SP ratings on criteria other than sleep obtained. If sleep obtained is, indeed, the major determinant of workplace fatigue, it can therefore be determined that subjective ratings on the SP scale are not a reliable control of workplace fatigue. Further research is needed to explore other methods of collecting subjective ratings of fatigue, and alternative levels of control for fatigue management.

Working patterns of UK train drivers – a questionnaire study

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Keywords: shiftwork, train drivers, fatigue, health, coping strategies

Objective
To determine the working patterns of train drivers, their attitudes towards and preferences for different shifts, to investigate their health and well-being, including sleep problems and to understand the coping strategies used to combat both fatigue and stress at work. The study was part of a larger programme of work commissioned by the Rail Safety and Standards Board.

Method
A questionnaire survey to investigate a number of issues relating to shiftwork and fatigue was designed, then piloted with train drivers (N = 114) to ensure that it was fit for purpose. Following minor modifications, the questionnaire was sent to 2672 train drivers from six passenger train operating companies. An overall response rate of 20% was achieved (N = 460).

Results
The mean age of drivers was 41, with 97% of respondents being male. The drivers reported working for an average of 39.2 hours per week, compared with a contracted average of 35 hours, and 6% typically worked over 50 hours per week. Most worked on all types of shift (early, day, late and night). The mean shift duration varied between approximately 8.5 hours on the early shift, for which the average start time was 05:00, to over nine hours on the day shift. Drivers reported that they typically worked between four and five of the same type of shift in a row. There were specific questions relating to night shifts, which were worked by 66% of the sample. For the majority (73%), working nights impacted on their quality of life, although most (61%) thought that they could cope reasonably well. Nights were by far the least popular type of shift, with over 60% positively disliking them, but, when asked on which shift they thought they made the most mistakes, 80% responded ‘early shifts’ and fewer than 10% ‘nights’. Drivers reported typically working between five and six days without a rest day, with a maximum in the last 12 months between nine and 10. The average number of consecutive rest days was reported as 2.6, with a minimum in the last 12 months of 1.5. The average rostered break was 35 minutes, with the total of all breaks within a duty period averaging 50 minutes. However, there was some indication that the quality of the break could be a problem, with many reporting an inability to relax and recuperate. Overtime was worked by the majority of drivers, and averaged 18 hours per month. The responses to the question on overtime were varied, with 31% saying that they were happy with it and did not want to change, while 36% said that they would not work overtime if given the choice. The main reason for working overtime was to earn more money, closely followed by being asked to do so by a colleague or supervisor. The majority of drivers (68%) considered their health to be good or excellent. Sleep problems were reported by 56%, with 16% of drivers reporting symptoms of sleep apnoea. Popular coping strategies for mitigating fatigue were getting fresh air, eating or drinking, and drinking caffeinated drinks. The majority (60%) expressed overall job satisfaction, but only 30% were satisfied with their shift system, while 34% were dissatisfied.

Conclusions
These results highlight the variability of shifts, the effects of early starts and the impact of overtime on the actual pattern of work.
Working time and workers’ needs and preferences in industrialized countries: Finding the balance

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This paper summarizes the results of a recently published ILO study 1 on working time trends in selected industrialized countries (the EU Member States, Australia, Japan, and the US), with a focus on the emerging issue of workers’ needs and preferences regarding their hours of work, including the extent to which workers are able to influence these hours. This study examines working time preferences from a number of different perspectives—at national level, at enterprise level, from the viewpoint of families (households), and from a gender perspective. The study demonstrates that there are substantial gaps between the actual hours of work and working time arrangements that currently exist, and workers’ needs and preferences regarding working time. In particular, it confirms previous research that there is a substantial group of workers with ‘excessively’ long hours of work in comparison with their preferred hours, and simultaneously, a substantial group of workers whose hours of work are actually shorter than they would prefer. In addition, both the household and gender perspectives reveal a strong gender dimension in the ‘gap’ between actual and preferred hours, which manifests itself in the labour force participation decisions of families and individual workers. The study also reviews the implications of these imbalances or ‘gaps’ between actual and preferred working time on workers’ ability to balance their work responsibilities with other aspects of their lives. The report concludes with a set of suggestions for both national and enterprise-level policies which are designed to promote improved ‘work-life balance’ by applying the ILO’s concept of Decent Work to address these working time ‘gaps.’ The result is a comprehensive set of policy suggestions designed to better reflect workers’ needs and preferences regarding their working time.

1 Jon C. Messenger (ed.) 2004. Working time and workers’ preferences in industrialized countries: Finding the balance (London and New York, Routledge). This report is the result of a collaborative effort involving five different researchers: three ILO staff—Sangheon Lee, Deirdre McCann, and Jon Messenger—plus Dominique Anxo of the Centre for European Labour Market Studies at the University of Gothenburg and Colette Fagan of the Department of Sociology at the University of Manchester. Mr. Messenger is the General Editor of the publication.
Social corporate responsibility management and workers perceptions of fatigue and workability

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Keywords: Social corporate responsibility, workability, fatigue, textile industries, shiftworkers

Objective
To analyze differences on perception in working conditions, workability, and fatigue among workers of textile industries in different stages of development in Corporate Social Responsibility (CSR).

Rationale
In socially responsible corporations the interests and needs of the stakeholders (shareholders, employees, consumers, environment, government, etc) are taken into consideration in order to satisfy them all, not only shareholders or owners. CSR is an up-to-date issue around the world. It is likely that there will be an increase number of companies developing CSR projects. It is not yet known if workers in companies committed to carry out business, taking into account corporate social responsibility programs have different working conditions and perceive less fatigue and a higher work ability in accordance to their CSR scores.

Methods
One hundred and twenty six shiftworkers, of 5 textile plants located in the state of São Paulo, Brazil, working in warping and fabric production filled out a questionnaire on demographic, working conditions and life style aspects, fatigue self-evaluation, and workability. These plants belong to three different companies that had, according to a specific evaluation (www.ethos.org.br) different scores in CSR, leading to 2 CSR score groups. In these five plants there were five different shiftwork schedules of 8 and 12 hours, fixed and rotating shifts. Seventy of these workers were individually interviewed, and were asked about their perceptions on CSR status of their companies, as well as encouraged to present suggestions to improve it.

Results
No significant differences ($p > 0.05$) were found between results of fatigue and workability index comparing plants, shifts and CSR score groups, in spite there is a significant difference in the perception of working conditions ($p = 0.008$) among the CSR score groups. Statistically this difference is mostly explained by the quality of meals (one company did not offer meals) and wages.

Workers' from all plants suggested similar CSR projects, such as: the improvement of living conditions of poor neighborhood communities, including daycare, schools and hospitals construction, environmental projects, the improvement of their own working conditions (including noise control, better co-workers and supervisors relationships, efforts rewarding, greater autonomy at work, continuing technical training, and meals at work provided by the companies). Multivariate analysis for fatigue and workability included similar variables in both CSR score groups evaluated.

Conclusions
Plants with CSR projects do not necessarily present good working conditions, a diminished fatigue perception or better workability. It is recommended that workers should be taken into consideration when companies develop their CSR programs.

Further studies evaluating larger groups of workers and for longer periods of time are necessary to check long-term positive effects of CSR programs on workers’ health and safety.
Profile of early riser workers in the morning shift at Wholesales Food Market.

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Keywords: shiftwork; small enterprise; occupational health; informal work; workers.

Introduction
Small and micro enterprises are of fundamental importance for the economic development in different countries, and in this kind of enterprises the working conditions are not always adequate. The work in early shift, shiftwork and night work is recognised as risk factors in relation to health and well-being and complaints of “disturbed sleep” are the main problem.

Aim: The aim of this pilot study was to evaluate the profile of early riser workers in the morning shift at a wholesales food market in relation to their sleeping patterns.

Methods
The study is a cross sectional survey with a sample of 61 workers divided into proportional groups according to their total numbers at the facility. In relation to the function proportions were: 55.74% of commerciants/rural workers; 13.11% of formal paid jobs and 24.59% of informally contracted workers. All begun working by 5 a.m. at least three times per week. An semi-structured questionnaire was used to record data on individual socio-demographic characteristics and aspects of work, health and lifestyle.

Results
The male population represented 85.25% of the workers; 40% was aged between 14 and 71, with mean age of 38.2 years (SD 13.79) and 40.98% were over age 39. Married workers were 73.8% and 70.49% had siblings. Early rising between 3 and 5 a.m. was the rule for 67.21% of interviewed workers, and 44.26% reported sleeping less than six hours a day during workdays. Over 1/3 told that their work settings bring illnesses (36.07%) and complained of early rising and irregular sleeping. Thirty two of them pointed out of at least one health problem or disease with an average of 1.5 complains per worker; 24.59% referred musculoskeletal disease, 9.84% referred respiratory diseases; 9.84% digestive diseases and 8.2% endocrine and metabolic diseases. Five out of 61 reported having had a work accident during the last year.

Conclusion
The main problems were found in relation to the daily working hours, considered too long by many workers, irregular sleeping and early rising with less sleeping hours than they feel necessary.


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Effect of sleep patterns on Body Mass Index in a truck driver population

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Keywords: truck driver, obesity, Body Mass Index, sleep.

Truck drivers have high prevalence of sedentary habits, inadequate diet, and obesity (Korelitz et al., 1993). Considering the recent findings indicating that short sleep duration is a risk factor for obesity in an adult population (Vorona et al., 2005), the present study aimed at verifying the effects of sleep patterns on body mass index (BMI) in a truck driver population. The study sample consisted of 9,235 truck drivers who participated in a campaign promoted by a highway company in the State of São Paulo, Brazil. This campaign offered truck drivers who used the highway a medical and laboratorial evaluation. The truck drivers completed a questionnaire concerning demographics data, sleep duration (less than 8h/day; 8h/day; more than 8h/day), medications consumption, and medical problems. Also their body weight and height were registered. The mean age (±SD) of the truck drivers studied was 39.4±9.8 yrs. Among 9,235 drivers included in the study, 1,362 (14.8%) were on medications, and 648 (7.0%) were diabetics. The mean BMI (n=9,235) was 27.7±4.4 kg/m2, considering all drivers. The mean BMI (n=7,350) was 27.5±4.4 kg/m2, excluding the diabetics and those who were on medications. Drivers with shorter sleep length had greater BMI. In addition, the sleep duration was an independent factor associated with BMI (p<0.0008). Even excluding the diabetics and those who were on medications, the sleep duration was an independent factor associated with BMI (p<0.0032). In conclusion, our study supports the hypothesis that sleep deprivation is a risk factor for higher BMI, which in turn is a risk factor for obstructive sleep apnea in truck drivers (Moreno et al., 2004).

Impact of shift work on cardiovascular risk factors

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Keywords: shift work, work schedule, epidemiology, cardiovascular disease, risk factors.

Objectives
Shift work was considered to be an increased risk of cardiovascular diseases. To investigate the impact of shift work on cardiovascular risk factors, prevalence of metabolic syndrome and change of parameters during 9-years were compared between groups devided by the total years engaging in shift work.

Methods
The subjects were 1,561 male employees aged 18-45 at baseline who were engaged in manufacturing sites and participated in both health examinations held in 1993 and 2002. Information included occupational history and health related behaviors was obtained in 2002. The subjects were divided into four groups by the total years engaging in shift work: 0 year (group A, n=379), 1-4 years (group B, n=258), 5-9 years (group C, n=220), and 10 years and more (group D, n=704). Changes of body mass index (BMI), blood pressure, serum lipids level and glycohemoglobin A1c were compared between four groups after adjusting for age (ANCOVA).

Results
There were no significant difference between four groups in age, physiological data and biomarkers at baseline. However, in the last year of follow-up period, systolic blood pressure and serum cholesterol level were different significantly between four groups, showing the highest value in group D and the lowest value in group A. The percent of changes of each variable during 9 years were compared by four groups. An increase of BMI was the largest in group D with significant difference. The changes of the other variables were not significant different between the groups. Smoking index (number of tobacco per day * years of smoking) and drinking were also increased with history of shift work.

Conclusion
Length of years of shift work related to body weight gain, and induced differences in level of serum cholesterol level and blood pressure in future.
Quality of shift schedules and absenteeism in public transport operations

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Keywords: shift schedules, absenteeism, public transport

Problem
In a research project on working hours in the transport sector in Germany¹ the question of possible impairing effects of different work schedules in public transport operations has been addressed, in particular relations between the quality of shift schedules and absenteeism have been analyzed.

Methods
Data from 5 public transport companies (total n > 4,000) operating in urban areas have been analyzed. First, shift schedules were evaluated according to violations of legal, agreed and ergonomic criteria. Company absenteeism records were then converted into a format allowing a comparison across and within companies, and the related to the evaluation of shift schedules.

Results
The results show that shift schedules in public transport are far from being acceptable from an ergonomic point of view, some of them showing even violations of legal provisions – although subjected to co-determination by the works councils. However, there was substantial variation in the quality of shift schedules, showing that the companies use different strategies for developing shift schedules. There was also substantial variation in absenteeism rates, both within and between companies. However, no clear cut, simple relations between the (total) quality of the shift schedules and days lost due to illness could be found. On the other hand regression analyses using different violations of legal and ergonomic design criteria as predictors and absenteeism rates as dependent variables showed a substantial relation between specific characteristics of the shift schedules and absenteeism rates for the drivers working under these schedules. A multiple correlation of R² = .43 has been found (n.s.) for the 15 schedules analyzed, but weighting each schedule with the number of drivers working under this schedule increases the multiple correlation to .56 (p<.01). Using individual criteria in the regression analyses increased the correlations, both on the aggregated as well as on the individualized level. Most prominent predictors for days lost were characteristics related to daily / weekly rest hours and rhythmicity of the schedules. Analyses will be continued, using different weighting of different sets of criteria.

Conclusions
Shift schedules in public transport operations should be improved in order to reduce absenteeism.

Dimensions of working time and well-being

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Keywords: duration, timing, tempo, and autonomy of working time, well-being

The aim of the paper is to examine the relationships between working time and well-being. Earlier studies show that long working week, unsocial working hours and high working time tempo have usually negative, and working time autonomy positive effects on employees’ well-being. Usually these effects have been studied separately. This study involves several aspects of working time and compares their relations to well-being. Empirical analyses are based on European working conditions surveys. The European Foundation for Improvement of Living and Working Conditions (Dublin) has collected European comparative survey data on working conditions in 2000 (n=21,703) in 15 EU member countries and in 2001 in 12 EU candidate countries (n=11,057). For the analysis, these two data sets are merged into one pooled data (n=32,760).

We separate four dimensions of working time: the number of hours worked (duration), when (timing) the hours are worked, work-time intensity (tempo), and the degree of time autonomy individuals have over their working hours (time autonomy). Duration of working time is defined as proportion of respondents having long working week: 23% worked 45 or more hours per week (usual working hours in the main paid job). Timing of working time is defined proportion of respondents working at least once a month outside normal working hours (daytime, Monday-Friday) (four items, rel=.69). Almost half of the respondents (46 %) worked in evenings, 19 % at nights, 54 % at weekends and 19 % in shifts. Altogether 66% had at least one of these working time arrangements. Working time tempo is defined as perceived time pressure at work (two items, rel=.67); 56 % reported that their job involve working at very high speed and 55% said that their job involve working to tight deadlines at least one quarter of the time. Working time autonomy is defined as possibility to influence one’s working time (one item): 42% of the respondents reported that they could influence working time.

Well-being involves psychological and social well-being. Psychological well-being is defined as work-related psychological symptoms (five items, rel=.70); e.g., 28% of the respondents reported that their work affect stress, 28 % overall fatigue, 11% irritability, 8 % sleeping problems, and 7 % anxiety. Social well-being is defined as a fit of working hours and family and social commitments outside work (one item); most respondents reported that their working hours fit very well (34%) or fairly well (46 %) with their other commitments.

The relationships between working time dimensions (antecedents) and well-being (consequences) are analysed by using covariate analysis. Besides working time dimensions, the model includes eight sets (gender, age, family status, children industry, employment status, occupation, establishment size, and country) of covariates variables. According to the results, all four dimensions of working time predict well-being, although in different extent. Psychological well-being is best predicted by high tempo of working time and unsocial hours. On the other hand, social well-being is best predicted by long working week and unsocial hours.
Predicting tolerance to shift work - sleep dominates

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Keywords: shift work, sleep, satisfaction with work hours

Objective
Shift work is associated with a number of problems – sleep disturbances, fatigue, accident risk, gastrointestinal problems, cardiovascular disease, interference with social functioning, long term disease, dissatisfaction with work hours and others. Satisfaction with work hours probably constitutes the overall evaluation of an individual's problems in shift work and determines absence behavior and turnover. However, we have very little information on what determines the degree of satisfaction. This may be crucial to understanding the mechanism of shift work maladaptation and provide insight into countermeasures. The present study sought to investigate possible predictors among overall health, social difficulties, sleep/sleepiness problems in relation to shifts and days off.

Method
400 shift workers on a very rapidly rotating 3-shift schedule filled out a questionnaire on attitudes, sleep, health, etc. Satisfaction with work hours (1-5 from very negative to very positive) was selected as the dependent variable in a multiple regression analysis and a number of background variables, global problems and shift-related problems were used as predictors.

Results
The significant predictors became Post-Night(N)-shift sleep difficulties (Beta=0.26), Pre-Morning(M)-shift sleep problems (0.24), Day-off sleep problems (0.23), Sleepy on N-shift (0.11), and Anxiety/depression (0.11); R2=0.65 p<.001). Age, gender, housing, marriage status, number of children, sleep duration on shifts and days off, physical work load, work demands, influence at work, diurnal type and others had no or marginal univariate relation to satisfaction. Having time for social activities, sleepiness on M-and E-shifts and days off, as well as sleep problems on E-shifts, overall complaints of gastrointestinal problems, and pain had univariate relations to attitude, but did not enter the multivariate stepwise regression.

Conclusion
It appears that the main determinants of attitude to work hours in shift workers are sleep problems in relation to N&M-shifts and leisure time. Anxiety/depression may play a role.
Fatigue and mood correlates of sleep length in three age groups

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Keywords: sleep need, sleep deficit, fatigue, mood

There is little doubt nowadays about the vital role of sleep in humans. This study aims to trace the consequences of insufficient sleep (in terms of chronic sleep reduction, rather than acute sleep deprivation) for subjective health estimations: mood, cognitive performance, and fatigue. The differences between three age-social groups (school children, university students, young employees) were analysed.

Material and method

“Age group” in this context reflects the social situation of subjects and is strictly connected with their work time organization: adolescents (n=191) were subjected to tough school time-tables with starting times often before 8 a.m.; students (n=115) had more flexible schedules and more free time; young adults (n=126) were engaged in various systems – regular morning schedules, irregular daytime hours, or day & night shifts. The analysis was based on several subjective measures: declared need for sleep, self-reported sleep length (sleep index, i.e. the ratio of real sleep length to declared sleep need, was calculated), chronic fatigue scale comprising 7 “fatigue”, 4 “mood” and 3 “cognitive” symptoms, and daytime sleepiness (Epworth Sleepiness Scale).

Results

Declared sleep need decreased in subsequent age groups: from 9h 23min in secondary school pupils, through 8h 22min in students, to 7h 37min in young employees; consequently, the discrepancy between preferred and real sleep length (sleep deficit) was largest in adolescents (106 minutes). Females showed significantly greater sleep need than males (p=.025) and higher scores (more complaints) in all spheres: fatigue, mood and cognitive problems (p<.000); they also exhibited more daytime sleepiness (p<.000). Sleep index correlated significantly with all health issues in women (p<.000), while in men only with fatigue symptoms (p=.013). Real length of sleep did not relate to mood and fatigue issues, while declared individual sleep need did show significant associations: long sleepers reported more fatigue symptoms, as well as affective and cognitive problems in younger groups. The relationships of sleep variables with mood and fatigue were more distinct in the group of adolescents, indicating their higher susceptibility to sleep deficit. Sleep index in adolescents correlated with almost all the symptoms, especially with feeling tired on awakening (r= -.39), excessive sleepiness and apathy (-.31), while in students with reluctance to any effort (-.37), excessive sleepiness (-.36), and problems with concentration (-.28). In the group of employees problems with memory (-.26), excessive sleepiness (-.23) and problems with taking decisions (-.22) were associated with sleep loss.

Conclusions

Insufficient sleep seems to cause more severe effects in females than in males. The associations of sleep need and sleep index with mood and fatigue were more pronounced in younger subjects. It was somewhat surprising that fatigue symptoms in school children and students were as frequent as in hardly working adults. Since the problem of sleep loss effects starts in adolescence, students’ work time organization needs more attention.
Shiftwork and Aviation: focusing on maintenance technicians’ health

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Keywords: shiftwork, maintenance technicians, health, working conditions

It is very well known that irregular working hours and shift work, particularly that including night work, can have a negative impact on health due to a mismatch between the biological functions and the environmental synchronizers, which can cause a significant interference on sleep/wake cycle and circadian rhythms, with short term negative effects such as fatigue, sleepiness, insomnia, dyspepsia or impaired performance efficiency. In the long run severe sleep disturbances, chronic fatigue, chronic anxiety or depression, gastrointestinal and cardiovascular disorders are the main consequences (Costa 1996). According to Kandolin (2001) shift work and long work shifts and overtime are often associated with a lowered level of mental well-being, with symptoms such as fatigue and distress. Several authors agree that exercise can mitigate some of these symptoms (Griffiths, 1996). In the aviation context maintenance technicians perform an essential and crucial role during 24 hours of the day and night. They have to perform their tasks with same accuracy during the day or night. So the aim of this study was to investigate the relationship among shiftwork, stress, physical activity habits and sleep difficulties in this group. 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 sample consisted of 200 maintenance technicians. The results showed that more than 55% of maintenance technicians were stressed, 48% of them do not practice physical activity regularly and approximately 40-65% of maintenance personnel reported experiencing some particular sleep disturbances. The results also showed that there is a significant relation between physical activity and stress (p<0,05). Furthermore, data suggest that stress and sleep disturbances are strongly related to each other (p<0,001). In order to have equity on health and well-being of shiftworkers, it is crucial to start balancing interests between maintenance technicians and their working conditions in order to keep the 24 hour aviation working safely.


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Fatigue and daytime sleepiness among construction workers

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Objectives
It is common that building contractors sometimes offer workers to live in building site camps in the proximity to the work site. While this allows workers to focus on the job and work longer hours it limits the possibilities of everyday social interaction with spouses and children. In the present case, it was of interest to investigate whether extended work hours and living in building-site camps was associated with increasing signs of fatigue, physical exertion and sleepiness at work.

Participants
Two groups of workers engaged in heavy concrete work and steel armoring were examined. The first group (n = 19) of participants (camp group) lived in building site camps and worked extended hours (i.e. between 0600 and 1800). The scheduling demanded workers to work cycles of 2 weeks in a row with 1 week off. The second group (n = 19) of participants (non-camp group) worked ordinary hours between 0700 and 1600 and returned home after each workday. The mean daily transportation time to and from work was 80 minutes. The mean age in the camp group was 42 years (SD 11). The mean age in the non-camp group was 40 years (SD 9).

Approach and Methods
Self-ratings of sleepiness (KSS), physical exertion (CR-10), and fatigue were obtained daily during three consecutive weeks. Due to poor compliance during the week off, only the data obtained during the two workweeks were analyzed. Factorial predictors were: workday (10 levels; Monday to Friday x 2), time (5 levels; work start, 1st break, lunch, 2nd break, and end of work for ratings of KSS and CR-10) and group (2 levels; camp and non-camp). Fatigue ratings were only obtained at bedtime. Data were evaluated in a repeated measures design allowing for the flexible modeling of the co-variance structure.

Results
There were no differences between workdays. As expected, both KSS and CR-10 ratings were sensitive to time of day (p’s <0.001). The camp group reported higher sleepiness (p<0.001), physical exertion (p<0.001) and fatigue scores (p=0.018) and had a markedly different pattern of sleepiness and physical exertion ratings (interaction: group by time of day; p’s <0.001), when compared to the non-camp group. Specifically it was observed that the camp group exhibited less variability in mean scores across the workday for both KSS and CR-10 ratings (i.e. flatter curves).

Conclusion
Even if the camp group reported longer periods of fatigue at work there were no sign of fatigue build-up in neither group. Yet, the pattern of fatigue, sleepiness and physical exertion ratings indicate that extended work hours and living in building site camps is associated with feelings of insufficient recovery.
Effects of Fatigue on Flight Crews’ Non-technical Performance

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Keywords: fatigue, non-technical skills, safety

Objectives
Flight deck operations require a range of skills that are both technical (e.g., aircraft handling and configuration) and non-technical (e.g., situation awareness, communication) in nature. Non-technical skills can be particularly important during high-risk situations, however little research has considered the impact of fatigue on non-technical performance in complex environments. The aim of this study is to investigate the effects of fatigue on flight crews’ non-technical performance in a realistic operational setting.

Method
Volunteer flight crew from an Australian commercial airline participated in the simulator-based study. The study adopted a between-subjects design, with two conditions: 1) fatigued, where crew performance was assessed on return from an international duty pattern; and 2) non-fatigued, where crew performance was assessed after four consecutive days of rest. Crew were assessed in a simulated flight sector between two Australian airports. The scenario included a critical event requiring each crew to make a complex decision. During the session, trained expert observers assessed crews’ non-technical performance using an observational methodology.

Results
Analyses consider: 1) the non-technical performance of fatigued and non-fatigued crews during a simulated flight, and 2) the impact of non-technical performance on operational outcomes. Furthermore, several implications for aviation safety will be highlighted.

Conclusions
This study provides new data on the impact of fatigue on non-technical performance in aviation. Given that non-technical skills can play a critical role in maintaining safety, understanding the impact of fatigue on non-technical performance can have a number of implications for management of safety and fatigue in aviation.

Research supported by QANTAS, Civil Aviation Authority, Australian and International Pilots Association, and the Australian Research Council.
The impact of international flights on the sleep, neurobehavioural performance and subjective alertness of commercial aviation pilots.

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Objectives
International commercial aviation pilots may experience decreased alertness and impaired performance due to irregular sleep schedules, long duty days, night flying, and multiple time zone changes. The aim of this study was to examine the impact of international flights on pilots’ sleep, neurobehavioural performance, and subjective alertness throughout a duty schedule (i.e. pattern).

Methodology
Nineteen pilots (10 Captains, 9 First Officers) participated in the study. Pilots wore wrist activity monitors and completed sleep and duty diaries during an 8- or 9-day return pattern from Australia to Europe via Asia. The pattern included four flights: (i) Australia-Asia, (ii) Asia-Europe, (iii) Europe-Asia, and (iv) Asia-Australia. Before and after each flight, pilots completed a 5-minute PalmPilot-based sustained attention task and self-rated their level of alertness. Pilots’ sleep in the prior 24h, inverse of mean response time on the sustained attention task, and self-rated alertness were each compared before and after flights using paired-samples t-tests.

Results
For all four flights, sleep in the prior 24h, sustained attention (see Figure 1), and self-rated alertness were significantly lower at the end of the flight than the start of the flight (all \( p < 0.05 \)).

Conclusions
The results indicate that pilots’ sleep, neurobehavioural performance, and subjective alertness are lower after international flights compared to before flights. These findings highlight the importance of effective countermeasures (e.g. in-flight napping) during international flight operations.

Figure 1. Performance on a sustained attention task before and after international flight sectors.

Research supported by QANTAS, Civil Aviation Authority, Australian and International Pilots Association, and the Australian Research Council.
The role of supportive work environments in reducing work life conflicts

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Keywords: Shiftwork; nursing; work life conflict; social support

Nursing in Australia and elsewhere is in crisis because of high rates of voluntary turnover. Organisational factors are the leading causes of turnover. The most critical include shiftwork (and its negative health effects), inadequate control over rosters and workload, work-life conflict, lack of autonomy, inadequate support from managers and coworkers, insufficient recognition of professional skills and knowledge and job dissatisfaction. This study forms part of the first phase of a larger longitudinal research project being conducted across 3 large metropolitan hospitals and reports the results from phase one. The aim of the larger research project is to use shiftwork, stress, social identity and communication accommodation theories to develop and apply a theoretical framework to the hospital-based nursing sector that explains the current turnover crisis through an examination of the relationships between work environment factors, health, wellbeing, job satisfaction and voluntary turnover intention. The aim of phase one was to use Structural Equation Modeling to test a model of the proposed relationships between the variables on the sample of 1863 nurses. Then, to determine the points in the model where intervention may reduce the impact of work life conflict on the job dissatisfaction, turnover intention and negative psychological and physical health effects of shiftworkers. The resultant model which showed a good fit, showed a complex set of interrelationships amongst the variables. There was a direct relationship between job satisfaction and turnover intention such that, as job satisfaction decreased, there was a corresponding increase in turnover intention. There was a direct relationship between physical symptoms and psychological wellbeing, in that, as psychological wellbeing decreased there was a corresponding increase in physical symptoms. Supervisors played a private role in assisting staff to form cohesive teams, develop team identity and to develop or utilize appropriate coping strategies. In teams where supervisors gave good quality support to staff that included tangible, emotional and informational support it assisted staff to feel they had more control over their work environment, which lessened their work life conflict. As work life conflict decreased there was a corresponding decrease in psychological symptoms and an increase in job satisfaction. Coworkers’ support of one another also played a key role in creating teams that were cohesive and enabled the utilization of appropriate coping strategies. Team cohesion, combined with appropriate coping strategies, enabled staff to deal with interpersonal conflict more appropriately and gave a sense of control over the work environment. Coworkers’ ability to give support, however, was strongly influenced by the quality of support provided by supervisors.
Medical Surveillance of Shift Workers in a large chemical Company

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Keywords: medical surveillance, fitness for shift work, health promotion, health management

Objectives
The aim of the present study is to describe the trends in frequency and causes of non-fitness for shift work among BASF employees as assessed through regular occupational medical surveillance, and to evaluate the changes in fitness that may be achieved through health initiatives.

Methods
At the Ludwigshafen site of BASF, approximately 11,000 employees work in a continuously rotating 12-hour shift system. All of our shift workers are offered regular medical examinations that include expert advice on healthful living. Additionally, specific preventive health programs have been carried out since 1989 that include one-week shift-specific health promotion seminars, courses in nutrition and coping with stress, smoking cessation programs, and a screening for gastrointestinal infection with Helicobacter pylori followed by eradication therapy by family physicians if indicated. Between 2000 and 2004, 11,940 employees underwent a total of 24,158 medical follow-up examinations. Fitness for shift work and the reasons for non-fitness were assessed and compared with similar assessments made during 1989.

Results
Medical examinations confirmed fitness for shift work in 96.6 % (n = 23,347) and fitness with certain restrictions in 3.0 % (n = 724) of the examinations. In 0.2 % (n = 45) employees were found to be temporarily unfit and in another 0.2 % (n = 42) permanently unfit for shift work, the main reasons being severe obesity, unstable diabetes mellitus and major cardiovascular disorders such as coronary artery disease. Compared to 1989, there was a significant decline of temporary non-fitness for shift work from 2.5 to 0.2 % and of permanent non-fitness from 3.4 to 0.2 %. Although the current study group was younger (mean age of 45.9 in 1989 and 42.5 years in 2004), the improvements in fitness could not be explained by age differences alone.

Conclusions
Although influences such as healthy worker selection might have contributed to our findings, regular medical examinations coupled with expert advice on healthy lifestyle and specific health promotion programs appear to play an important role in the improvement of health status among shift workers.

Sleep quality, health perception, burnout and work ability in Polish nurses

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Keywords: sleep quality, nurses, shift work, subjective health, work ability, burnout

Introduction
Work time organization may have an immense effect on sleep amount and timing. Individual sleep requirement varies and its association with health is not proven. On the other hand sleep deficit is regarded as factor affecting health and quality of life to a large extent. The aim of this paper is to compare self reported health, burnout and work ability in nurses characterized by various coverage of their qualitative and quantitative sleep requirements, with respect to their work time schedule.

Material and methods
In the population of 3155 Polish hospital nurses participating in European NEXT study (Hasselhorn et al.2003) three subgroups differing according to work schedule were identified: 535 day workers (aged 42.47±7.74), 2404 nurses working 12-hrs shifts (aged 37.77±6.83) and 115 nurses employed in 8-hrs 3-shift system (aged 37.73±6.69).

The anonymous questionnaire concerned the individual characteristics of the subjects, their family situation, work load and work organization, their well-being and life outside the work. Work ability was assessed with Work Ability Index (FIOH), job burnout (emotional exhaustion) with Copenhagen Burnout Inventory, general health perception (GHP) was measured by modified COPSOQ scale. Subjects reported the quality and sufficiency of their sleep on work days and the days off.

Standard statistical analyses were done with use of SPSS 11.

Results
In the group studied 53.7% of nurses reported an insufficient amount of sleep, to greater of lesser extent, on work days. Corresponding figure for days off was 19.5%.

Insufficient amount (IAS) and quality (IQS) of sleep on work days were reported more frequently by nurses working 12-hrs shifts (IAS: 56.8%; IQS: 67.6%) as compared with day workers (IAS:42.2%; IQS: 49.7%) and 8-hrs shift workers (IAS: 47.4%; IQS: 51.3%). A similar picture for the days off emerged.

The three subgroups of nurses did not differ as far as WAI, GHP and burnout scores were concerned. Nurses reporting insufficient amount and quality of sleep on work days revealed significantly higher burnout, lower WAI and GHP scores in all three groups.

Conclusion
Amount and quality of sleep are important factors influencing well-being and work ability; their role raises in case of shift work.

Changes of working schedules through the life's course

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Keywords: shiftwork systems, irregular daywork systems, age, gender, occupational career

Objectives
For a large number of people, exposure to atypical working schedules is only a limited stage of their occupational career. One aspect of this fact is well recognized, particularly in reference to the methodological rule to control the healthy worker effect by comparison of individuals engaged in shiftwork at the time of study both with dayworkers and past shiftworkers. But this effect is only one part of the whole situation and, presently, the exposure’s global story to various working schedules is not well documented, despite studies such as for instance those of Costa (1) or Presser (2).

A contribution to a better knowledge of occupational stories from the working time point of view has been brought by a secondary analysis from longitudinal data of the French ESTEV epidemiological survey, covering a large sample of men (10789) and women (7906) interviewed 2 times at five years apart (1990, 1995).

Methods
The ESTEV Survey was carried out on a random sample of workers from four birth years (1938, 1943, 1948, 1953). The collected information enables to compare four categories of working schedules : 1) regular daywork systems (n= 11393 at the first phase of the survey), 2) alternating shiftwork (n= 2897), 3) fixed shiftwork systems (n= 945), 4) irregular daywork systems (n=1631).

Beside that a detailed information is available about interviewees’ personal situation, their job’s constraints and their health state.

Results
The comparison of working schedules used by each worker at the 2 phases of the survey gives various types of progress :
- 4 types of stability (same working schedules at the 2 times)
- 12 types of change from one kind of working schedule to another.

The frequency of these different situations appears variable. The highest percentage of people on the same working schedules at the 2 times is regular dayworkers, and alternating shiftworkers have the second rank. The stability is largely weakest for Fixed shiftwork and Irregular working schedules. This ranking is the same for men and women but the level of each case tends to be higher for men. The various types of change show similar pattern according to the age with only small differences between youngest and oldest. On the base of these analysis the personal stories of workers appear more complex than a simple process of going from the more to the least demanding working schedules as age increased.

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

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Keywords: extended working hours, health, well being

Problem
The recent discussions about working hours are marked by requests for an extension of working time over all reference periods. Following these discussions, the draft of the revision of the EU-directive on working time allows for a maximum of 65 hours per week. The question, however, is whether such an excessive amount of working time per day / week is without detriment to health and safety. Whereas several studies have shown an exponential increase of accidents after the 7th or 8th hour of daily working time little is known about the effects of extended working hours on health. It is thus obvious that there is a clear need for empirical studies investigating any such relationship before such working hours can be accepted from an ergonomic point of view.

Methods
In a secondary analysis of the data of the 3rd survey of the European Foundation regarding working conditions in all EU member countries in 2000, correlations between the number of weekly working hours and the incidence of health complaints were investigated. For these analyses only employed respondents were selected, in total, about 17,000 have been included.

Results
Clear and powerful correlations (up to .9, based on aggregated data) between the length of the working week and the frequencies of different health complaints, as well as of social impairments could be found. Based on these results, every extension of working time is connected with increased risks of health and well being. Furthermore the results show significant interaction effects with age, shift work, monotony of the task and environmental stressors. At the moment a cross validation of theses results for the (former) accession countries is conducted, this seems important, because longer working hours can be found here in general. Comparative results from both studies will thus be presented.
Regulatory approaches to the management of fatigue in transportation: A comparative analysis

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Keywords: fatigue, work hours, shiftwork, regulation, transportation

Fatigue in transportation is a major safety concern. One mechanism to address fatigue is limiting working hours. Regulations limiting working hours were investigated for various transportation modalities (road, rail, aviation, maritime) for four English speaking nations, as well as two countries in the European Union and the specialist bodies of the United Nations. The regulatory approaches showed substantial variation. Four dimensions were identified as important features of the regulatory approaches: (1) approaches that prescribe specific features of the rota, including maximum allowable number of working hours and minimum off duty hours, as distinguished from approaches where the regulation is framed in terms of a desired outcome, e.g. the management of fatigue. (2) How directly prescribed features are related to the desired outcomes: for example, duration of opportunity for sleep is directly related to fatigue, and maximum working time an impact on the duration of opportunity for sleep. (3) industrial relations: the roles of management, workers’ council/union groups, external agencies and supervisory bodies. (4) How effectively and appropriately do prescriptive regulations distinguish specific conditions and situations.

Most regulations have prescriptive elements, but many of them refer to very general features of working time (e.g., max. hours per week). Relatively few regulations directly seek to manage fatigue. Eight criteria were identified from the literature as possible principles that might be considered in fatigue management regulations: time of day, circadian rhythms, duration of opportunity for sleep, sleep quality, work time predictability, recovery of sleep debt, maximum duration of work and opportunity for short breaks. Comparison of existing regulations against these criteria revealed that overall few regulations appeared to address fatigue by prescribing corresponding criteria. The most direct was UK aviation addressing six, the poorest were US and Canadian marine which did not satisfactorily address any of these criteria. From the analysis, the average was 3 criteria. Furthermore, the rail and maritime regulations were generally rated as addressing fewer criteria directly compared to road and aviation. In the European regulations, prescription of features is often strongly connected to consent of workers’ councils or trade unions - e.g., working hours must not exceed 9h per day, but with the consent of the workers’ council they may be 10h. The shift schedule needs the approval of the workers’ council. While such approval is often a question of pay, typically also working conditions and safety concerns are strongly considered. It is concluded that there is scope for improvement of many of the current prescriptive regulations. We discuss several hybrid alternative compliance approaches, e.g. an approach where operators can choose between two options: (1) a prescriptive zone where operators are required to comply with regulations designed to manage fatigue and (2) a non-prescriptive risk management zone with a requirement to do all that is reasonable to manage risks associated with fatigue.
Health and well being in pilot-rosters developed by workers themselves

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Within KLM criteria for work rosters are established in the collective labor agreement between management and unions. Based on these criteria rosters are usually developed by specialists. After the September 2001 occurrences the aviation industry had to find ways to remain profitable. KLM management and unions had decided together that in several departments with irregular working hours pilot-rosters could be developed and tested. The workers themselves should develop these pilot-rosters and the criteria were relaxed. The pilot-roster was required to fall within national legal limits. Pilot-rosters were required to bring improvements, both for the company (10% increase in productivity or cost reduction) as well as for the workers.

Health and well-being are important for both the worker and the company and it was decided to assess these aspects. Two methods were used for the assessment:

- Model calculation. The RRPA (Roster Risk profile Analysis) has been developed to assign scores on nine physical and social aspects.
- Survey: Worker opinion was assessed with a questionnaire.

Nine departments were selected to develop and test a pilot-roster. For each of these RRPA calculations were made for the old and for the pilot roster. Questionnaires were administered during the old roster and during the pilot-roster. Results of RRPA analysis and questionnaires for the old roster and for the pilot roster were compared.

During the study it became evident that workers often swap duties so the actual rosters can differ from the planned roster. RRPA calculation is done on planned roster, so the results may not be valid for the actual roster. Furthermore, in several departments manpower planning for the pilot-roster was inadequate which led to high workload. This has created a general negativity towards the pilot-roster. Consequently this has resulted in low scores in the questionnaire that may not reflect the pilot-roster itself.

The general conclusion of the project was that all pilot-rosters have shown the required improvement in productivity. Some pilot-rosters have also shown improvements on health and well being. One obvious example is a pilot roster that leads to removal of the night shift. Other pilot-rosters did not show improvements or a change for worse. In these instances recommendations are given to take measures for this to be reversed.
Long work hours and moonlighting among Brazilian nurses. A time use study

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Keywords: long work hours, moonlighting, nursing, 12-h shifts, time use

Nursing personnel at Brazilian hospitals are usually submitted to long shifts, with no consecutive working nights. This is often associated to a high rate of moonlighting among those professionals. In this study we used the time budget method to compare day- and night workers as to the time dedicated to different activities, with emphasis on the analysis of those that hold a second job.

Data was gathered in the period 2003-2004 at two hospitals. Both of them adopt 12-hour day (7:00 am to 7:00 pm) and 12-hour night (7:00 pm to 7:00 am) shifts. Data collection was based on a structured form that was filled by the workers for at least five consecutive days. It included information on time dedicated to the following activities: (i) work, (ii) sleep, (iii) rest, (iv) leisure, (v) housework, (vi) commuting, (vii) personal hygiene, meals, sports (viii) childcare and care of other people, and (ix) study. Considering previous data indicating that workers at those hospitals are allowed to sleep during the night shift (1), the time dedicated to sleep was analysed according to its occurrence at home or on the job. Data analysis included comparisons (Mann-Whitney test) between day- and night shift workers as to the time dedicated to each activity. Concerning night workers, those who had one job were compared to those who held a second job. In addition, the Spearman coefficient test was used to analyse the correlation between the time dedicated to work and each activity.

The study group comprised 119 workers of various skill types and levels. Data here presented refer to 63 workers (57 women and 6 men; 17 nurses and 46 nurse assistants, mean age 35.2 - SD: 10.5 years). They were classified into the following groups: those who have only one job at daytime (DAY 1; N=19); those who have only one job at night time (NIGHT 1; N=25); those who have a night job at the studied hospital and daytime job at another hospital (NIGHT DAY; N=20). The only significant difference between DAY 1 and NIGHT 1 groups refers to the time dedicated to sleep: day workers slept significantly more at home (p=0.02), whereas night workers slept more on the job (p<0.001), with no difference as to the total sleep time (p>0.05). The NIGHT DAY group slept significantly more on the job, as compared to the NIGHT 1 group (p=0.01). Among DAY 1 workers, the time spent at work was negatively related to time dedicated to childcare/care of other people (p=0.01). Among the NIGHT DAY group, the more time dedicated to work, the lesser the time dedicated to leisure, (p<0.01) to total sleep (p<0.05), and to sleep at home (p<0.01). No significant correlation between time dedicated to work and all activities was detected in the NIGHT 1 group.

Sleeping on the job during the night shift seems to compensate for the less sleep among night workers, in relation to day workers. On other hand, besides sleep, no other activity item was shown to differ between day and night workers that hold one job. These findings point to the necessity of advising hospital administrators of the importance of giving allowance to sleep during the night shift. The negative association between time dedicated to work and childcare activities only in the DAY 1 group may be related to a higher frequency of complaints on lack of time for children, an issue that deserve to be studied, provided that this is essentially a feminine group. Night workers who hold two jobs also benefit from the sleep at the hospital; results also suggest that this group have their sleep and leisure patterns affected by the time dedicated to work. Proposals concerning the regulation of nursing activity that rely on exclusive employment and higher pay are essential to change the moonlighting pattern of Brazilian nurses, as commented by Soares et al. (this issue).
Can a shorter PVT be used as a reasonable substitute for the 10-minute PVT?

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Keywords: sustained wakefulness, test length, neurobehavioural performance

Objectives The 10-minute psychomotor vigilance task (PVT) is commonly used in laboratory studies to assess the impact of sleep loss, sustained wakefulness and/or time-of-day on neurobehavioural performance. In field settings though, it may be impractical for participants to perform a test of this length. The aim of this study was to identify a performance measure that is sensitive to the effects of fatigue, but less burdensome than a 10-minute test.

Methods Fifteen participants (10 female, 5 male, mean age = 21.7 years) slept in the sleep laboratory overnight then remained awake for 28 hours from 0800h. During every second hour, participants completed three PVTs of differing duration (10 minutes, 5 minutes, 90 seconds).

Results For the 5-minute/10-minute comparison, ANOVA indicated that mean response time (RT) was significantly affected by test length ($F_{1,14}=26.9, p<.001$) and hours of wakefulness ($F_{13,182}=46.1, p<.001$), but not by their interaction ($F_{13,182}=1.7, ns$). There was a strong correlation between mean RT on the 5- and 10-minute PVTs ($r=.88$). For the 90-second/10-minute comparison, ANOVA indicated that mean RT was significantly affected by test length ($F_{1,14}=65.9, p<.001$) and hours of wakefulness ($F_{13,182}=29.7, p<.001$), and also by their interaction ($F_{13,182}=6.0, p<.001$). There was a strong correlation between mean RT on the 90-second and 10-minute PVTs ($r=.77$).

Conclusions The effects of hours of wakefulness on neurobehavioural performance were similar for the 5-minute and 10-minute PVTs. In contrast, performance on the 90-second PVT was less affected by hours of wakefulness than on the 10-minute PVT. In addition, performance on the 10-minute PVT was more highly correlated with the 5-minute PVT than the 90-second PVT. These data indicate that the 5-minute PVT may provide a reasonable substitute for the 10-minute PVT in circumstances where a shorter than 10-minute test is required.

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The sleep/wake profiles of shiftworkers at the start and end of work periods

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Keywords: rail, aviation, duty periods, sleep, fatigue

Objectives. Previous research indicates that neurobehavioural performance is impaired as prior sleep decreases and/or prior wake increases. The aim of the current study was to determine the sleep/wake profiles of shiftworkers at the start and end of work periods.

Methods. More than 400 shiftworkers (locomotive engineers and commercial aviation pilots) collected sleep/wake and work/rest data for at least 2 weeks while they worked their normal duty schedules. Participants were permitted to nap during duty periods.

Results. At the start of work periods, participants had (i) obtained 7.6 (±1.9) [average (±st.dev.,)] hours of sleep in the prior 24 hours, (ii) obtained 14.6 (±2.8) hours of sleep in the prior 48 hours, and (iii) been awake for 5.0 (±3.7) hours (Figure 1). At the end of work periods, participants had (i) obtained 6.1 (±2.1) hours of sleep in the prior 24 hours, (ii) obtained 13.3 (±2.9) hours of sleep in the prior 48 hours, and (iii) been awake for 8.6 (±5.4) hours (Figure 2).

Conclusions. In most cases, participants obtained a reasonable amount of sleep prior to beginning work, and were not awake for an unreasonable period of time prior to finishing work. From a risk management perspective, it is important for employers to determine whether exceptions (i.e. insufficient sleep, excessive wake) are due to organisational or personal factors.

Figure 1. Prior Sleep/Wake at Start of Work. Figure 2. Prior Sleep/Wake at End of Work.

Research supported by the Australian Research Council.
Alertness of aircrew during ultra-long-range flights

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Keywords: alertness, sleepiness, aircrew, in-flight rest

Background
The new A340-500 aircraft has a greater range than previous passenger aircraft, with the potential for flights of over 20 hours. This increased flight duration raises questions about how aircrew maintain alertness during such long duty periods. Previous modeling work suggested that this type of flight could be operated with a double crew (four pilots: two pilots comprising the main crew and the other two the relief crew), based on the assumption that each pilot was given the opportunity to take two rest periods during the course of the flight. This field study investigated the alertness and sleep of pilots operating ultra-long-range flights between Singapore and New York.

Study objectives
To assess crew alertness and sleepiness during ultra-long-range flights.

Methods
The study was completed over a three month period. However, the details reported here relate only to the first two months of data collection. During the first month of the study, sleep and duty diaries were distributed to all pilots operating the Singapore to New York route. Pilots were asked to provide subjective assessments of all sleep periods and to rate their sleepiness (Karolinska Sleepiness Scale) and levels of fatigue (Samn-Perelli scale) at regular intervals during duty periods. In the following month this was supplemented by activity and performance monitoring. Activity data were used as an objective measure to confirm the timing of subjective estimates of sleep provided in the diaries. A short reaction time task was presented on a palm-held computer.

Results
A total of 131 diaries were returned from 97 different pilots. During the outward flight the average duty period was 21.0 hours and for the return flight it was 20.6 hours. On all flights, the cruise phase was divided into either four or five rest periods with crews alternating between duty and rest. In general, the relief pilots took the first, third and possibly fifth rest periods, whereas the main pilots took the second and fourth rest periods. Individual bunk facilities were provided. During the outward flight the main crew, who would normally be at the controls for landing, reached their highest level of fatigue and sleepiness just before their second rest period (i.e. fourth rest period during the flight). For the relief pilots, the lowest level of alertness occurred at the end of the flight. A similar trend was observed during the return flights, although initial levels of alertness were slightly lower and the difference between crews at the end of the flight was less marked. On average, crews reported sleeping for 3.62 hours per flight and there were seven occasions when an individual claimed not to have slept at all. Based on an analysis of mean correct response time, the slowest responses for both main and relief pilots occurred at the end of the flights.

Conclusions
These results show that this operation can be sustained by a double crew, providing that the rest facilities are of a sufficient quality, as in this study.
Individual differences in adaptation to changes in sleep-wake timing

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Keywords: circadian disruption; circadian adjustment; individual differences

Shift workers are required to work at various times across the 24-hour day, with working hours typically placed during periods endogenously suited to sleeping. The endogenous circadian system is relatively slow to adjust to rapid adjustments in sleep-wake behaviour; and as a result shift workers tend to be in a constant state of circadian misalignment. Methods to increase the rate of adaptation to new shift schedules are currently being investigated. Circadian adaptation to new sleep-wake schedules depends on light:dark exposure, timing and duration of sleep, and potentially sleep loss incurred during schedule changes. This experiment investigated circadian adaptation following systematic alterations in the timing and duration of sleep. As part of a larger study, n=63 healthy subjects (38m, 25f; aged 21-45y) completed a 15-day experiment. Following one baseline night (23:30-07:30), subjects were assigned to a morning or afternoon sleep protocol. In the morning protocol, subjects remained awake for 20h, followed by 8h TIB (03:30-11:30). In the afternoon protocol, subjects remained awake for 28h, followed by 8h TIB (11:30-19:30). Subjects were then randomized to 4h, 6h or 8h TIB for 10 days. In the morning conditions, all restricted sleep periods terminated at 11:30; in the afternoon conditions, all restricted sleep periods terminated at 19:30. Every condition ended with two nocturnal recovery sleep periods (23:30-09:30). Subjects remained in the laboratory throughout, with fixed light levels (<50lx during waking; <1lx during sleep periods) and ambient temperature (24±1ºC). Rectal temperature was measured at 6min intervals to assess circadian phase. Phase changes were estimated using Lomb-Scargle periodogram analysis. For the first near-24h periodicity detected in each subject, the deviation from 24h was recorded as the average daily phase shift. Additionally, a mixed-effects regression analysis was performed to account for the effect of sleep on temperature profiles, allowing for individual differences in daily phase shifts. Subjects in the 4h, 6h and 8h morning sleep conditions appeared to shift 0.09±0.36h, 0.26±0.15h and 0.22±0.25h per day (mean±s.d.), respectively. Subjects in the 4h, 6h and 8h afternoon sleep conditions appeared to shift 0.04±0.77h, 0.53±0.54h and 0.51±0.73h per day. There was a trend for a relationship between the magnitude of the shift and the duration of the sleep period (F[2,56]=2.58, P=0.09), but no significant relationship with timing of sleep (F[1,56]=1.48, P=0.23). For all conditions except the 4h TIB afternoon sleep condition, a greater proportion of subjects phase delayed than advanced (76-86% delaying). In the 4h TIB afternoon sleep condition approximately 50% of subjects phase delayed. When phase advancing and phase delaying were examined separately, afternoon timing of the sleep period was found to significantly increase the amount of shift in the delayers (F[1,40]=27.7, P<0.01), but not in the advancing (F[1,10]=1.56, P=0.24). The average shifts obtained by mixed-effects regression analysis did not appear significantly different from those obtained with the Lomb-Scargle method, suggesting that these results may not have been critically confounded by the effect of sleep on core body temperature, nor by systematic individual differences in phase shifting. Our findings indicate that the magnitude of phase shift following abrupt displacement of sleep depended on the timing of the chronically restricted sleep period more so than on its duration, which is consistent with what published phase response curves to light would predict. Phase delays were more common than phase advances regardless of condition, implying that the direction of shift may have been dependent upon factors unrelated to the experimental conditions.
Effects of nap opportunities on sleep architecture during the simulated two consecutive night shifts

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Keywords: consecutive night shift, simulated night shift, nap opportunity, sleep architecture

We have proposed to take two-hour naps during the consecutive night shifts, given the hypothesis that it would be the same sleep architecture balance during the subsequent daytime sleep as that during usual nighttime sleep. However, it is difficult for night workers to take the naps because of their busy practice, even if only for the two night shifts in a row. On the other hand, the previous study concerning sleepiness on the two consecutive night shifts has stated that the level of sleepiness decreased on the second night. Therefore, the objective of this study was to investigate whether or not the nap on the second night shift has effect on sleep architecture during the subsequent daytime sleep. The subjects were eight healthy male students (mean age±SD; 21.5±2.7). Two conditions of nap opportunity were designed during the simulated two consecutive night shifts. In one condition, the nap was taken between 02:00 and 04:00 only on the first night shift (One-Nap condition) and the other, the nap was taken on both night shifts (Two-Nap condition). Main daytime sleep was between 12:00 and 18:00 for these two consecutive days, irrespective of nap conditions. All subjects took part in both conditions with counterbalance. Polysomnography was performed and scored by conventional manner. Regarding sleep variables in the nap during first night shift and the subsequent daytime sleep, there were no significant differences under nap conditions. The amount of stage W during the daytime sleep after the second night shift increased significantly for the Two-Nap condition (t[7]=-3.67). The amount of stage 2 and 4 during the daytime sleep after the second night shift decreased significantly for the Two-Nap condition (stage 2: t[7]=2.52, stage 4: t[7]=3.77). The sleep architecture of a six-hour sleeping period (two-hour nap on the second night shift and subsequent first four-hour daytime sleep) in the Two-Nap condition were compared with that of a six-hour daytime sleep in the One-Nap condition. Consequently, the amount of stage 2 decreased significantly in the Two-Nap condition (t[7]=4.12). Furthermore, the effects of an eight-hour sleeping period on the second night shift, consisting of two-hour nap and subsequent six-hour daytime sleep in the Two-Nap condition were compared with a six-hour daytime sleep on the second night shift in the One-Nap condition. The result showed that the amount of stage W and stage 1 extremely increased for the Two-Nap condition (t[7]=5.14 and t[7]=2.61, respectively). In this study, however, when comparing the sleep variables, we found no significant differences in the stage REM between two nap conditions. Therefore, although taking the two-hour nap during the second night shift decreased the amount of stage 2 and 4 during the subsequent daytime sleep, this did not link to the sleep architecture balance same as the nighttime sleep. It was assumed that daytime sleep was started at noon, which is slightly later than the time when REM sleep usually increases.

<table>
<thead>
<tr>
<th>2nd night shift</th>
<th>One-Nap condition</th>
<th>Two-Nap condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>daytime sleep (6h)</td>
<td>nap+first 4h daytime sleep (2+4=6h)</td>
</tr>
<tr>
<td>Stage W</td>
<td>50.5 ± 30.8</td>
<td>100.4 ± 37.2 **</td>
</tr>
<tr>
<td>Stage 1</td>
<td>34.2 ± 17.5</td>
<td>40.4 ± 14.4</td>
</tr>
<tr>
<td>Stage 2</td>
<td>128.6 ± 22.5</td>
<td>106.0 ± 31.0 *</td>
</tr>
<tr>
<td>Stage 3</td>
<td>47.6 ± 16.5</td>
<td>37.9 ± 9.9</td>
</tr>
<tr>
<td>Stage 4</td>
<td>45.3 ± 19.9</td>
<td>27.4 ± 11.6 **</td>
</tr>
<tr>
<td>Stage REM</td>
<td>53.8 ± 18.7</td>
<td>47.8 ± 12.6</td>
</tr>
</tbody>
</table>

***p<0.001, **p<0.01, *p<0.05

Financial support for this study was provided by Prof. Yoshio Saito.
Irregular working hours stimulate cortisol awakening response during work days

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Keywords: irregular shiftwork, salivary cortisol, stress

Introduction
The 24-hour culture in modern media work and irregular shifts may markedly enhance the psychological pressures of work. Hypothalamic-pituitary-adrenal axis is one of the main stress adaptive systems in humans. Glucocorticoids released eg. from the adrenal medulla exert effects on metabolic, reproductive and immune systems, with a diurnal oscillation in the secretory activity of this system (1). Environmental factors modulate the oscillation and in chronic stress the balance of the cycles may be disrupted. In prolonged stress the overall cortisol level may be increased (2).

Aim
To analyse the salivary cortisol response and self-reported stress in media personnel with or without irregular shift work (ISW).

Objectives
82 persons with ISW and 54 daytime workers were randomly drawn for this study from a sample of 750 media workers working irregular shifts and an equal number of daytime workers.

Methods
Five saliva samples (Salivette™-tubes) were obtained on a work day (both groups) and second day off work (ISW group only) at the following times: (1) on waking up; (2) 60 min later; (3) 3 hours later; (4) 8 hours later; and (5) at bedtime. The salivary cortisol levels were measured using a commercially available luminescence immunoassay for the quantitative determination of cortisol in human saliva.

Results
The salivary cortisol of 60 minutes sample was in average fivefold higher at the workday morning than at the day-off morning (p<0.001) (figure 1). The salivary cortisol ratio was significantly higher (p<0.05) among the persons reporting to be rather or very much stressed than among less stressed IRW subjects during the workdays (figure 2).

Conclusion: The found enhanced activation in cortisol secretion after awakening in the present study may imply that stressful work environment and irregular shift work in particular may have effects that may become detrimental to health.

This study has been supported by grants from the Finnish Work Environment Fund.
Impact of shift, type of activity, and life style upon the work ability of workers from the extrusion segment.

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Keywords: work ability index, fixed work shifts, ergonomic job analysis.

Objective
The purpose of this study was to estimate and compare the work ability of workers submitted to fixed shifts, holding three different positions at six companies in the segment of plastics in the State of Santa Catarina, Brazil.

Methods
A cross-section study was carried out with the participation of 136 workers submitted to fixed shifts (morning, afternoon and night) occupying three different working positions at six companies belonging to the segment of plastics. Out of the six companies surveyed, three complied with the following schedules: from 05:00h to 13:00h; from 13:00h to 21:00h; from 21:00h to 05:00h. At the three other companies the shifts were scheduled as follows: from 06:00h to 14:00h; from 14:00h to 22:00h; and from 22:00h to 06:00h. The laborers age ranged from 19 to 62, and the average age was 30.5 (± 7.7 years). Their work ability was estimated based on the Work Ability Index- WAI - questionnaire (Tuomi et al., 1994). A questionnaire on socio-demographic data and life style was also applied. The physical and cognitive demands required by each working position were evaluated using the Ergonomic Job Analysis Procedure- AET (Rohmert & Landau, 1979), which was applied to the three working positions (assistant, extruder and supervisor) studied.

Results
Most workers (87%) were assigned a good or excellent WAI; only 0.7% of the workers studied were assigned the lowest classification. Although the general work ability was considered high, a significant correlation between the WAI and the variables relative to life style and socio-demographic data, such as age (R=-0.19; p=0.02), body mass index (R=-0.26; p=0.002), physical activity (F=9.18; p=0.002) and smoking habits (F=8.19; p=0.0019) was observed. As for the WAI, no differences between the shifts were observed (F=0.96; p=0.38). Nevertheless, the analysis per working position (F=0.96; p=0.38) showed a significant reduction in the WAI recorded for assistants working at the night shift (F=4.35; p=0.017), but such reduction was not found in the case of the workers performing the functions of extruder or supervisor.

Conclusion
The impact of the night shift upon work ability is associated with the function performed. Work positions demanding a greater physical effort seem to lead to a higher reduction in the work ability when the activity is performed during the night shift. In addition, it would be necessary to start following up their work ability before they turn to 30, as even young laborers show signs of functional aging as a result of the poor conditions prevailing in their everyday life and also at work.

BASS 4 – a software for the ergonomic evaluation of flexible work hours

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Keywords: flexible working hours, software, evaluation

Problem
In a project supported by the German Federal Ministry for Education and Research a computer program for the evaluation and design of shift schedules\textsuperscript{1} has been developed, taking work load as well as economic aspects into account. Another aim of the project was to use this software for the evaluation of past and the scheduling of future flexible work hours, using ergonomic, legal and agreed evaluation criteria as well as the new work load and economic modules of the program. However, the existing user interfaces were not applicable for the input and evaluation of flexible work hours. Reasons are 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 with usually fixed shifts) and contain a multitude of different "kinds of shifts" with very different start and end times and lengths of activity (as opposed to a certain number of fixed shifts in shift scheduling). Furthermore the applicability, suitability and specification of ergonomic and legal criteria had to be tested within the context of flexible work hours.

Methods
The existing user interfaces have been redesigned. In order to specify a schedule, the flexibility module provides an easy to use interface to enter dates, sign up times, sign off times and times off. The graphically represented schedule contains exact dates and weekdays (for a maximum of up to one year) and allows to takes numerous ergonomic, legal, agreed as well as economic criteria into account at the same time. Violations of these criteria are presented graphically in the schedule. Entering future or planned working hours indicates (in-) acceptable working times and thus supports an ergonomic design of flexible working hours.

Results
The flexibility module of bass 4 allows users to recognise and interpret the amount of critical legal and ergonomic parts in the schedules. The aim is to reduce risks and improving work-life balance as well as health and costs.

1. Schomann C; Stapel W; Nickel P; Eden J, Nachreiner F. BASS 4 — a software system for an ergonomic design and evaluation of working hours. In: Journal of Public Health, 2004
Relationships between chronological age and various health-related outcomes in air traffic controllers

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Air traffic control is a safety-critical occupation that requires the provision of aircraft separation services on a 24/7 basis. Most controllers are required to work rotating shift schedules. A large portion of the controller workforce entered duty following the 1981 strike and a sizeable number will be reaching mandatory retirement within the next decade. Data from a recent survey were used to understand the relationship of controller age with sleep, fatigue, and selected health variables.

Method
The Standard Shiftwork Index (1), adapted for the air traffic control workforce, was used because it addresses numerous measures that have been traditionally viewed as outcome variables. This study focused on age-related differences on subscales measuring sleep, chronic fatigue, and selected measures of health and well-being. Separate ANOVAs were conducted to assess differences across controller age groups. Data analyses were focused on Certified Professional Controllers (CPCs) who were actively involved in controlling traffic.

Results
The overall sample was representative of the controller workforce. The CPC sample was comprised of 476 women (14.7%) and 2,759 men. For our comparisons, CPCs were placed in six age groups (18-35, 36-40, 41-45, 46-50, 51-55, and >56 yr). A majority of the CPCs fell in the 36-45 yr group (58.3%). When compared with the SSI normative group (2), CPCs evidenced lower levels on several measures. They did, however, report higher job satisfaction. Overall, 20% of the CPCs reporting that they felt “quite a bit” to “extremely” stressed at work compared with 24% in the 1999 U.S. national sample; both very similar to those of the normative group. The relationship with age was curvilinear, with the youngest and oldest age groups reporting the lowest levels of stress. The relationship between age and job satisfaction was also curvilinear, with the lowest job satisfaction occurring for the middle age groups. Neither the cardiovascular nor digestive ANOVAs were significant. However, item-level comparisons of responses to questions that comprised these scales revealed expected age-related differences. Variations in sleep quality were influenced by age, with individuals 40-50 yrs experiencing the lowest quality of sleep. For responses to questions regarding mental sharpness at various times across the work day, CPCs in the two oldest age groups reported higher levels of mental sharpness at the start and close of the early morning shifts than their younger colleagues. These and other outcomes suggested that older subjects may have developed more effective coping strategies for early morning shifts.

Discussion
The cross-sectional comparisons should be viewed with some caution, since there were a number of factors that could have contributed to cohort differences. For example, over time, some controllers leave the field and/or move to supervisory/managerial positions. These outcomes suggested that there was little evidence that controllers who had continued to work traffic experienced significant negative changes in overall health and well being, when compared with younger controllers. Older controllers generally reported higher levels of job satisfaction and lower stress than middle-aged controllers.

Fatigue at the end of shift: an example from long-haul aviation

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Keywords: sleep, subjective, fatigue, long-haul, aviation

Objectives. In industries employing shiftwork, the level of fatigue experienced by workers at the end of a duty period can be particularly critical in maintaining occupational safety. For example, in the aviation setting, the descent and landing phases of flight are associated with increased potential for error and increased risk of incidents or accidents [1, 2]. The aim of the current study was to examine the factors that influence the subjective fatigue experienced by commercial flight crew at the end of long-haul flight sectors.

Methods. 145 international flight crew with mean (± s.d.) age of 41.9 (± 9.9) years wore wrist activity monitors and completed sleep and duty diaries for at least 15 consecutive days. Subjective assessments of fatigue were reported on the Samn-Pirelli scale [3] immediately prior to and following 486 long-haul flight sectors. Mixed model regression was applied to assess the relationship between subjective post-flight fatigue and numerous a priori determined operational and physiological variables (i.e. flight duration, number of crew on duty, age, prior sleep/wake, time of day).

Results. Analyses revealed that the significant predictors of post-flight fatigue were (i) sleep obtained in the 24 hours preceding flight (t=-2.71, p<0.01), (ii) subjective fatigue prior to flight (t=2.12, p<0.05), (iii) subjective recovery value of the last in-flight sleep period [i.e. the difference in fatigue before and after sleep] (t=-2.56, p<0.05), and (iv) subjective quality of the last in-flight sleep (t=-4.68, p<0.001, Figure). The variables specified in the model accounted for 9.14% of the variance in subjective fatigue at the end of long-haul flight sectors.

Conclusions. This study reveals some of the factors that can be an indication of fatigue at completion of shift. The results suggest that obtaining good quality sleep during the final in-flight rest period can reduce fatigue during the final phases of flight. Further investigation of fatigue during long-haul flight will assess objective psychomotor vigilance measures of fatigue and factors affecting this.

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Figure. Represents mean (+s.e.) subjective fatigue at flight end for each level of quality of last in-flight sleep period.

Longer-term 12-hour rota effects on mood, sleep and fatigue

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Keywords: 12-hour shifts, sleep, fatigue, longer-term impact

Shift and night work contribute to disruption to the optimal functioning of workers, and to concerns regarding productivity and safety for the employer (1). Changes to working hours and shift rotas remain a primary intervention in order to improve working conditions and consequences (2). Reviews comparing 8- and 12-hour shift systems have suggested the effects of 12-hour rotas to be equivocal, and have noted the need for longitudinal research because the effects of longer-term exposure to extended workdays have been relatively uncharted in any systematic way (3). However, fatigue and safety remain to be concerns, especially in relation to night shifts. This study examined the longer-term patterning and outcomes of mood, sleep and fatigue-related variables in power generation shiftworkers following a change from a rotating 3-shift system to a 2-shift 12-hour rota. A repeated measures design was used to gather self-report data on sleep quality, drowsiness and fatigue (4), as well as critical flicker fusion (cff) thresholds (5), an index of fatigue. Baseline measures were taken on the original 3-shift rota 2 months prior to the change. Measures were then taken over a period of 88 weeks on the new 12-hour rota. There were general improvements in positive activation (Wilcoxon’s Z=-3.32, sig.=.001) and decreases in negative mood and tension/anxiety (Z=-2.66, sig.=.008; Z=-2.04, sig.=.042 respectively) from baseline to trial. Global comparisons between baseline and trial showed either stability or a significant improvement in night shift-related sleep and fatigue outcomes (e.g. increased sleep quality, Z=-3.23, sig.=.001; lower drowsiness Z=-2.06, sig.=.039; greater N shift adjustment, Z=-3.46, sig.=.001; higher cff threshold, Z=-2.11, sig.=.035). The improvements appeared to be fairly robust whereby a similar pattern of results emerged when comparing baseline with week 88. The trends for these variables from baseline through four phases of the trial up to and including 88weeks show a tendency for improvement over time. There was also a reduction in accidents from baseline to trial (Z=-2.45, sig.=.014) that supports the general finding that persistent improvements appear to have resulted from the change to a 12-hour rota. These findings, suggest that changes to shift rotas can result in benefits in terms of improved mood and sleep and decreased fatigue and accidents in the longer-term. The debate about the appropriateness of compressed workweeks will continue but evidence such as this offers some support for the implementation of 12-hour rotas where conditions allow.

Morningness-Eveningness as preferred sleep and wake times: Relationship to choice of fixed shifts, stress, health and social disruption

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Keywords: Morningness-Eveningness, fixed shifts, stress, health, social and family life

Humans vary in their preference for the timing of rising and going to bed, in their levels of alertness and in their ability to perform certain tasks during the day (1). Morning types may find it harder to adjust to night work because they demonstrate a relatively earlier circadian phase than evening types. There is evidence that morning types react to late shiftwork with sleep deficiency, an associated negative impact upon well-being and decreased circadian adjustment to shiftwork (2-3). This study examined morningness-eveningness, expressed behaviourally by preferred sleep times (M sleep time range 2100-2300; E sleep time range 2400-0300), and waking times (M waking time range 0500-0700; E waking time range 0900-1200) in a subsample of health service shiftworkers. The time boundaries approximated those indicated on the M-E Questionnaire(4). M types n=162; E types n=104. Only participants who actively chose to work fixed day, evening or night shifts were included. It was hypothesised that preferences would be reflected by the type of fixed shifts chosen. There was a significant association between M-E and fixed-shift choice ($\chi^2=39.71$, sig<.001), this was delineated by significantly more M-types choosing fixed days ($\chi^2=34.27$, sig<.001) and significantly more E-types choosing fixed nights ($\chi^2=9.84$, sig<.01). Main effects of M-E on sleep quality suggested that E types achieved better sleep quality on day, evening and night shifts (F=5.74, p<.05; F= 6.13, p<.05; F= 5.63, p<.05 respectively). No significant association was observed for fixed evening shifts. In light of this, self-report data were analysed in relation to fixed day and night shifts only. There were no interaction or main effects (shift type x M-E type) on stress, physical or mental health. Some aspects of social disruption were subject to significant interaction effects - sufficiency of time: for hobbies F= 4.84, p=.<.05; for organised activities outside of work such as parents groups, training, union work F= 5.17, p<.05; (time for friends approached significance F=3.08, p=.08), with M types finding greater difficulty in these areas on fixed N shifts. Thus, it appeared that the main outcome of M-E (based on preferred sleep and rising times) was, in this case, behaviourally related to choice of work schedule. M-types appeared to have consistently poorer sleep quality irrespective of type of shift, and while some main effects of ME and shift type emerged few significant interactive effects upon health and social life were observed.

Napping on night shifts: Is more better?

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Keywords: Napping, 12-hour night shifts, drowsiness

Napping on shift has been shown to result in functional benefits compared to not napping (1-5) but despite the potential for sleepiness and fatigue to affect performance and safety on night shifts the use of napping in work is not a widely accepted practice (6). This study examined the relative effects of different frequencies of napping on 12-hr night shifts (start19:30-end07:30). The facility to take a nap in a quiet room while working on 12-hr night shifts was introduced for a group of power generation workers. Take-up was not universal amongst the 114 shiftworkers involved, but it was possible to determine two groups based on those that napped for 10 to 30\% (n28) of their night shifts (LFN group), and those who napped between 70-100\% (n9) of their night shifts (HFN group) over a 22-month period. The two napping frequency groups did not differ significantly in age, shiftwork experience, nap durations on-shift (LFN mean=24.6mins; HFN mean= 25.6mins.), N shift caffeine intake or the quality of sleep following night shifts. MANOVA revealed that napping frequency was associated with significant main effects on variables specific to the night shift (Pillai’s trace $F=52.00, p<.001$). Bonferroni adjustment set a probability value $p=.006$ for statistical significance. Higher napping frequency was reflected by lower drowsiness on N shift ($F=7.45, p=.008$); greater reported night shift adaptation ($F=16.81, p<.001$); lower N shift fatigue ($F=18.08, p<.001$); lower compensatory effort on N shift ($F=9.92, p<.005$); higher critical flicker fusion threshold ($F=10.61, p<.005$); higher positive activation ($F=12.52, p<.005$); lower negative activation ($F=20.48, p<.001$) and lower tension/anxiety ($F=9.66, p<.005$). A mixed ANOVA (repeated measures over time on shift by nap frequency) revealed no interaction effect but there was a main effect of time on drowsiness ($F=123.83, p<.001$). Post-hoc comparisons suggested that, while the differential is maintained throughout the N shift, the main effect of nap frequency on drowsiness was located in the first few hours ($t=3.77, p<.001$; $t=2.90, p<.01$) and last hours ($t=2.09, p<.05$) of the 12-hr night shift. These results further support earlier research that has reported the beneficial effects of napping on night duties (2,5).

Conflicting interests at a Brazilian hospital: controversial 24-hour shifts for nurses

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Working arrangements in Brazilian hospitals differ from those of other countries in that nursing staff is not required to work consecutive nights. Generally they work a 12-hour shift (from 7 a.m. to 7 p.m. or 7 p.m. to 7 a.m.) followed by 36 (or 60) hours off duty. This study is designed to examine the experience of introducing 24-hour shifts, by way of a case study at a public hospital in Rio de Janeiro, Brazil, where the 12/60 system (12-h shift followed by 60 h off) was replaced by a 24/120 arrangement in some in-patient departments.

Data was gathered from 2000 to 2004, by the following quantitative and qualitative methods: (i) individual interviews with health workers active in a range of positions in the hospital hierarchy, (ii) informal conversations with nurses who held chief nursing officer positions at the time, (iii) analysis of monthly rotas in seven departments working round the clock and (iv) information from a questionnaire on workers on 24-hour shifts in 2000.

The figures reveal an intense debate over legitimisation of the 24-hour shift. Among the three nurses that succeeded one another as chief nursing officer, attitudes towards this shift arrangement ranged from allowing its adoption to totally prohibiting it. These different positions are reflected in the monthly rotas: at times the 24-hour shift appears frequently (in 2000), at others dramatically less often (in 2002), and it began to reappear in some departments in 2004. Of the 74 workers (72 women) who worked 24-hour shifts in 2000, 41 (55%) would prefer always to work these hours, 9 (12%) would like to get off the shift immediately, 19 (26%) would like to get off at some point, while 5 (7%) were undecided. The advantages of 24-hour shifts, according to some workers and nursing officers, relate to having more time to be with their families and for domestic chores, to the lower cost of having to travel to the hospital less often and the greater ease of reconciling that with a second job. Respondents often mentioned the wear of the long working hours: according to a woman worker, it can “take up to three days to recover from a 24-hour shift”. On the other hand, according to another worker, being mentally prepared and having a responsible attitude towards patient care are elements that help surmount that fatigue. The arguments against the 24-hour shift reflected the idea that the profession of nursing requires dedication and care, which was considered incompatible with working 24 hours straight, according to some of the nurses who held (or hold) chief nursing officer positions.

The study addresses a complex situation that involves matters of convenience among workers, in addition to the characteristics proper to the profession of nursing. The need to hold two jobs – acknowledged to be typical among nurses in Brazil (1) – permeates the discourses favourable to the 24-hour shift (among both workers and some chief nursing officers), to the detriment of quality of care. Although this is a case study, there is evidence that the 24-hour shift is a reality in other public hospitals in Brazil. Proposals to regulate the exercise of nursing with a view to valorizing the profession on the basis of exclusive employment and higher pay are essential to reverse this trend.

Circadian variation of heart rate variability modified by severe sleepiness and work intensity in a weekly rotating 12-hour shift system

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Keywords: Heart rate variability, 24-hour ECG recordings, shift, Circadian variation, work intensity

Objectives
The objective of this study was to study the circadian patterns of heart rate variability among shift workers in a weekly rotating 12-hour shift system.

Methods
The study population consisted of 100 workers, who were randomly selected among 25000 workers of a Korean car factory. 85 workers completed 24-hour ECG recordings (Marquette) for one day shift (08:00-20:00h) and 50 workers for one night shift (20:00-08:00h). 24 hour trends of the circadian variability of the HR variability (time and frequency domains) were analyzed according to subjective ratings of severe sleepiness (Karonlinska Sleepiness Scale 7 or higher) and work intensity (Borg scale 15 or higher).

Results
The circadian variation of heart rate variability (HF, LF or LF/HFratio) during the work and sleep cycle decreased among the night shift workers with severe sleepiness (KSS>=7) at the end of the night shift compared with night workers with less severe sleepiness (KSS<7) at the end of the shift or day workers. Similarly, the circadian variation of heart rate variability (HF, LF or LF/HFratio) between the work and sleep cycle decreased among the night shift workers with higher work intensity (Borg>=15) at the end of work compared to other groups (night shift workers with lower work intensity (2<=Borg<=14) and day shift workers with higher work intensity (Borg>=15) as well as the lower work intensity (2<=Borg<=14) at the end of work.

Conclusions
During the night shifts, the circadian variation of the HF and LF/HFratio component of the heart rate variability decreased reflecting significant reductions in cardiac parasympathetic activity of the shift workers. The study indicates that the normal circadian rhythm of autonomic activity is blunted among night shift workers who are very sleepy or have high physical work during the night shift.

Figure 1. 24-hour trends in the High Frequency (HF) component according to work intensity (Borg scale) during day shift and night shift.
Trends in the incident risk of train drivers

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Keywords: shiftwork, train drivers, fatigue, incidents, risk

Objective
To determine whether the incidence of Signals Passed at Danger (SPADs) in the UK rail industry is related to the pattern of work and rest of the train drivers. This was part of a larger programme of work commissioned by the Rail Safety and Standards Board.

Method
The analysis was based on a data set comprising 2821 SPADs, representing all such incidents reported in the UK between January 1998 and May 2003. Approximately 75% of these were retained for analysis, after excluding those where the information was incomplete or where it was not clear whether the driver was implicated. The information collected on each SPAD included the rostered start and end times of the duty period during which the incident occurred, the actual duty start time and the start and end time of the main scheduled break. In addition, details were available of the pattern of work and rest over the 12 days preceding the incident. The main factors that were analyzed with respect to the SPAD risk were time of day, time on task (i.e. continuous duty without a break) and consecutive shifts. The exposure to risk, related to time of day and time on task, was estimated from the distribution of these variables over the days on which a SPAD had occurred. For time of day, it was assumed that the exposure was proportional to the square of the number of drivers on duty at a particular time. The exposure related to consecutive shifts was estimated from the shift sequences over the previous 12 days.

Results
The highest frequency of SPADs was during the period between 08:00 and 19:00, corresponding to the times of greatest activity. After correcting for exposure, the peak in risk was between midnight and 04:00, and the trend with respect to time of day was similar to that observed in road traffic accident risk and industrial performance measures (1). With respect to time on task, the highest SPAD frequency was between 1.5 and 4 hours. However, the corrected frequency increased for the first 1.5 hours, remained relatively stationary until 4.5 hours and then increased again, until the risk after six hours on task was more than double that between two and four hours. Approximately 25% of SPADs occurred on the first day back, with fewer on each of the succeeding days. However, after correcting for exposure, the risk was similar over the first five days, and increased thereafter, doubling after 10 consecutive days.

Conclusions
These results should be interpreted with some caution since, as is generally the case with accident and incident data, they may be influenced by unknown or unreported confounding factors. For example, the trend in time on task has not been corrected for effects of unscheduled breaks, concerning which little information is available. Nevertheless, there is clear evidence of a steep increase in risk after more than five hours without a break and after more than six consecutive working days.

Flight crew shift patterns, performance and fatigue

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Keywords: flight-crew, performance, fatigue, risk, LOSA

EasyJet flight crew operate under a 6/3-shift pattern that incorporates fatigue inducing phase shift effects (6 duty days, 3 rest days: 3 early followed by 3 late shifts), in accordance with UK CAA FTL policy. In response to several high-risk incidents, for which fatigue was cited as a causal factor, a slow wave shift pattern (5/2/5/4 shift pattern: 5 early shifts, 2 days off, 5 late shifts and 4 days off) was designed to alleviate circadian disruption and performance decrements and was trialled under a temporary alleviation against UK CAA FTL. A Human Factors Monitoring Program (HFMP) was implemented to investigate the relative impact of the two shift patterns as a function of operational risk, flight crew fatigue and performance. The programme utilised an integrated safety data management approach, and included: A Line Operations Safety Audit (LOSA) incorporating a PSF (Performance Shaping Factor) codebook and Fatigue Behavioural Markers (750 sectors); Flight Data Monitoring (FDM); Predictive fatigue modelling (FAID®); activity monitoring (Actiwatch®); sleep diaries; simple reaction time task (SRT); Demographic surveys; Archive Air Safety Reports; crew sickness rates & duty hours. The results indicated that there were significant decrements in crew operational performance across the 6/3 roster. LOSA Error and FDM trace events peaked on duty days 1 and 4 reflecting circadian disruption due phase shift effects. Failure-To-Respond errors increased through the pattern showing cumulative fatigue effects and this was predicted by FAID, with a correlation coefficient of .95. Threat management increased to 100% by duty days 3 to 5 under 5/2/5/4 compared to 78% on duty day 6 under 6/3. FDM analysis recorded a significantly lower number of serious events (60-80% reduction) on the 5/2/5/4 pattern. LOSA data indicated a 46% reduction in overall error rates, with significant reductions in intentional non-compliance, decision errors and undesired aircraft states. The SRT indicated that cognitive performance was stable across the 5/2/5/4 pattern. The peak fatigue risk and index figures under FAID showed a 50% performance increase. A survey indicated that 91% of pilots stated they felt less fatigued under the new roster. The 6/3 roster represented unacceptable levels of operational risk. The results indicate that a mitigation of phase shift effects and reduction in duty days worked under the 5/2/5/4 pattern has led to enhanced operational performance. easyJet was granted a permanent alleviation to work outside FTL at all 16 operational bases. The 5/2/5/4 pattern has now been rolled out across the easyJet network.
The vulnerability of the rat myocardium to acute hypoxia depends on the light – dark cycle

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Keywords: LD cycle, acute hypoxia, electrical stability of the heart, heart rate, rat

Objectives
Although it is generally accepted that some disorders of pulmonary ventilation belong to the group of proarrhythmogenic factors, the relation between the myocardial sensitivity to acute hypoxia and development of ventricular arrhythmias was not studied 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. Thus 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 – dark regime 12 : 12 h, ketamine/xylazine anesthesia 100mg/15mg/kg, i.m., open chest experiments). The conditions of the normal artificial ventilation and reoxygenation $V_T = 1$ml/100g, respiratory rate 40 breaths/min, hypoventilation $V_T = 0.5$ml/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 of the control VAT values were not found between the light (1.90 ± 0.84 mA) and dark (1.88 ± 0.87 mA) periods of the regime 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 periods of day during 20 minute hypoventilation, the higher VATs were found in the dark period 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) in the single steps of the measurements. Reoxygenation partly rectified the VAT to prehypoventilatory values in the both light periods 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 period of day against hypoventilatory values.

Conclusion
It is concluded that the rat myocardial vulnerability to disorders of pulmonary ventilation induced acute hypoxia fluctuates in the dependence on the light - dark cycle. Substrate for arise and development of the ventricular arrhythmias is produced during the whole period of hypoventilation and only in the light (sleep) period of the rat regime day. Cardioprotective effect was seen only in the dark (active) period and probably, the limit of this cardioprotection depends on the duration of hypoventilation. Reoxygenation recovers the electrical stability of the heart to the initial, prehypoventilatory value in the both light periods of the rat regime day, what probably means that hypoventilation is not adequate stimulus for the production of stable substrate for the development of the reoxygenation arrhythmias. The recovery of VAT is probably more effective during light than dark period of day. The VAT decrease signalizes the increased vulnerability of myocardium or larger extent of the reoxygenation injury of myocardium in active period of day.
Psychosocial work factors predicting daytime sleepiness in day and shift workers

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Keywords: Daytime sleepiness, Job satisfaction, Depressive symptoms, Work schedules

Objectives

Work organization, in addition to working time arrangements, might contribute importantly to daytime sleepiness¹. The present study was designed to identify the psychosocial work factors to predict daytime sleepiness in a sample of day and shift workers.

Methods

Participants working at a pulp and chemical factory completed an annual questionnaire regarding psychosocial factors at work using US National Institute for Occupational Safety and Health Generic Job Stress Questionnaire (quantitative workload, variance in workload, job control, support from supervisor, coworker, or family, job satisfaction, and depressive symptoms [the Center for Epidemiologic Studies Depression Scale]), sleep habits, and daytime sleepiness (the Epworth Sleepiness Scale, ESS²) for three years in a row from 2002 through 2004. Response rates ranged 94.6 to 99.0%. The present analysis included 60 day workers (11 women, mean age in 2002: 44.7 years; 49 men, 45.3 years) and 61 shift workers (all men, 43.2 years) who participated in all three years of the study. A repeated-measures analysis of variance was used to test the effects of the level of psychosocial work factors (dichotomized at the mean) in 2002 on the ESS scores in subsequent years by worker group. The Greenhouse–Geisser procedure was applied to correct for violations of sphericity.

Results

Despite no significant differences in day workers’ ESS scores between high and low groups of variance in workload or depressive symptoms in 2002, the ESS scores in 2003 or 2004 were significantly higher for the high group of these two measures than for the corresponding low group. No significant differences were observed in the ESS scores of shift workers between high and low levels of job satisfaction and depressive symptoms in 2002. But the shift workers with low job satisfaction and high symptoms of depression showed significantly greater ESS scores in 2003 and 2004 than those with opposite characteristics. The above results, except depressive symptoms for day workers, remained significant after adjusting for insomnia symptoms, total sleep time, and present illness as covariates.

Conclusions

Increased variance in workload may lead to a subsequent increase in daytime sleepiness for day workers. Low job satisfaction and high depressive symptoms may serve as predictors of elevated daytime sleepiness for shift workers. The results suggest that redesigning these aspects of work environment would yield favorable effects on daytime sleepiness.

Patterns of sleepiness among high schoolers who work and don’t work

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Keywords: Teen workers, sleepiness, sleep, Karolinska Sleepiness Scale

Introduction and objectives
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 about sleep was conducted among high school students who work and don’t work in São Paulo, Brazil, showed different patterns of sleep between the two groups (Teixeira et al, 2004). The aim of this study was to evaluate patterns of sleepiness, comparing working and non-working students, girls and boys, in paid and unpaid jobs.

Methods
A field study was carried out among high school students, attending evening classes (19:00-22:30h), of a public school of São Paulo, Brazil, during 2002 to 2004. Ninety-three students, ages 14-21 years old participated. The participants filled out consent forms. Students groups were: working students (28 males - MW and 23 females - FW), non-working students (17 males - MNW and 25 females - FNW). Mean weekly working hours were 45.0 (SD= 2.0h). 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 were also reported during 12 consecutive days. In the same period, Karolinska Sleepiness Scale was reported at least 6 times per day: waking up time and every three hours since then, and before going to bed. Main variables were tested using Wilcoxon tests for dependent samples.

Results and discussion
During the working week, self-evaluation of sleepiness showed that female worker students had different patterns of sleepiness than non-working. Female worker teens were sleepier than non-workers by the end of the evening (around 22:00 hours) during school days (Mon-Fri) (p<. 04). No significant differences (p>.05) were found comparing working and non-working boys. Evaluating sleepiness behavior of these four groups it can be seen a large standard deviation. This can be explained by the variations of waking and sleeping times between non-working students. Working teens must follow a stricter routine of their sleep-wake cycle than non-workers. An irregular sleeping schedule would be impracticable to cope with the double journey. Taking into account the importance of extra-curricular activities, as well as peers social relations, further investigations are necessary to understand the interference of social and work components in the outcome behavior of somnolence.

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Rest break schedules and accident risk

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Keywords: Rest-breaks; accidents; risk; temporal trends

Objectives
To examine trends in accident risk over varying durations of continuous work that are interspersed by rest breaks of various lengths. Comparisons are made between on- and off-track work, in weekly rotating 2- and 3-shift systems operating in two locations within the same organization.

Methods
Records of all on-duty injurious accidents that occurred over 12 months at a large engineering company were examined (N = 8682 records), using hierarchical log linear analysis. The 3-shift system involved 8-hour shifts starting at 0800, 1400 and 2200. At site 1, a shift comprised 4 work periods lasting either 105 or 120 minutes, each separated by breaks of 15 minutes. At site 2, a shift comprised 3 work periods of between 120 and 160 minutes, separated by breaks of 15 and 30 minutes. The 2-shift system comprised a 8 hour 40 minute day shift starting at either 0800 (site 1) or 0730 (site 2), with 5 work periods of between 75 and 100 minutes in duration, separated by breaks of either 15 or 40 minutes; and a 10 hour night shift starting at either 2045 (site 1) or 2030 (site 2), with 6 work periods of between 45 and 150 minutes, separated by breaks of between 15 and 45 minutes.

Results
In most cases, there was an increase in risk from the first to the last 30 minutes of continuous work. The main exceptions were no change in risk in the first work period on the 3-shift system at site 1; and a decrease during the last work periods on the 3-shift system (both sites). In most cases, risk decreased following a break, returning close to the levels observed in the first 30 minutes of the preceding work period. The exceptions were on the 3-shift system at site 1, where there was no change in risk following the first break, and only a relatively small (non-significant) decrease after the third break. The trends did not differ between shifts, or between on-track and off-track work.

Conclusions
The results largely support earlier findings that rest breaks are an effective means of controlling the accumulation of risk during shiftwork (Tucker et al, 2003). Exceptions to the general trend may be due to particular activities undertaken at the beginning and end of shifts that affect risk.

Effect of the working patterns of UK train drivers on fatigue – a diary study

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Keywords: shiftwork, train drivers, fatigue, early starts, duty length

Objective
To identify issues relating to fatigue arising from the current working patterns of UK train drivers. The study was part of a larger program of work commissioned by the Rail Safety and Standards Board.

Method
Detailed information about the shift patterns and levels of fatigue of train drivers were collected using a diary comprising 28 pages relating to duty periods and 28 corresponding pages about sleep immediately preceding each duty. A total of 1635 diaries were distributed to five passenger train companies and the respondents were instructed to complete the diary for 28 duty periods or for a maximum of six weeks. The data were analysed to identify the factors contributing to fatigue at the start and end of a shift, the level of mental tiredness associated with the shift as a whole, and the duration of sleep prior to an early start. The analyses were based on an unbalanced repeated measures analysis of variance model.

Results
Data were collected from 105 drivers who completed a total of 2516 individual duty periods, an average of 24 per driver. More than a third (37.7%) of shifts were categorized as early starts, 30.9% as day shifts, 25.0% as late finishes and only 6.3% as night shifts. The average shift duration was 8.16 hours and involved 4.99 hours of driving. The total duration of scheduled breaks was just under an hour (0.92 hours) on all shifts, although unscheduled breaks were longer on the night shift. On nearly half the duties, the longest period of duty without a break was between 2.5 and 4.0 hours, with the highest average (3.4 hours) on the early starts. ‘Heavy eyelids’ (unintentional closing of the eyes while driving) were experienced on 35.8% of all early starts and 31.5% of all night duties, whereas naps were taken on 9.0% of early starts and 43.4% of night duties. Time of day was the most important factor contributing to fatigue at the start of a shift (p<0.001), with the highest levels of fatigue in the early morning. Over the shift as a whole, in addition to time of day, the other main factors were the length of the shift, the time spent driving, the maximum continuous time spent in the cab and the type of shift (all p<0.001). The most tiring was the night shift, closely followed by early starts. The tiring effect of both length of duty and the maximum continuous time spent in the cab varied with the type of shift (p<0.001 and p<0.01, respectively) and was very much stronger on early starts. The main factors influencing the duration of sleep prior to early starts were the start time itself and the sequence number of the early start (both p<0.001). Sleep reduced from 7.08 hours prior to late morning start times to 4.77 hours prior to start times between 04:00 and 04:30. During a sequence of early starts, sleep increased by 0.36 hours from the first to the second duty, and by a further 0.22 hours from the second to the fourth. However, it reduced by 10 minutes for every hour that the start time advanced relative to the previous start time.

Conclusions
The main issues that have been identified relating to fatigue include long duty periods (particularly on nights and duties with early starts), long periods of driving without a break, the continuous time spent in the cab (particularly on duties with early starts), and shift variability. Early starts are a feature of railway operations, and may be associated with particular problems when effects due to the restriction of sleep prior to duty are exacerbated by high work rates in the morning hours.
Variations of melatonin and stress hormones under fast-rotating extended shifts

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Keywords: 6-sulphatoxymelatonin, electromagnetic radiation, radiofrequency range

The fast-rotating extended shifts are common in broadcasting (BC) and TV stations in our country. Numerous investigations show that melatonin and its main metabolite 6-sulphatoxymelatonin (aMT6s) retain the typical diurnal time-of-day variations under fast-rotating shift schedules. Low-level radiofrequency electromagnetic radiation (EMR) from GSM (1, 2) was not found to raise changes in melatonin secretion, but there are no data on the effect of higher intensities, as they usually occur in the occupational environment.

The aim of the study was to follow the time-of-day variations in aMT6s and stress hormones in operators under fast-rotating extended shifts and radiofrequency EMR exposure to obtain an indirect indicator of the biological adjustment.

Methods
The study comprised 36 male operators as follows: 12 BC station operators (6-25 MHz), 12 TV station operators (66.5 – 900 MHz) and 12 satellite (SAT) station operators (5.850 – 6.425 GHz) working extended shifts (16-18 hours) with 24-hour stay in the stations, followed by three days off. The EMR exposure was measured and the time-weighted average (TWA) showed high-level exposure with the BC station operators (TWA mean=3.10 µW/cm² and TWA max=137.00 µW/cm²), low-level with the TV station operators (TWA mean=1.89 µW/cm² and TWA max=5.24 µW/cm²) and very low exposure with SAT station operators, used as a control group. The excretion rates of aMT6s and stress hormones were followed on four hour intervals during the extended shifts. The aMT6s and cortisol were assessed with radioimmunological kits, the catecholamines by spectrofluorimetric method. The confounding factors were followed and showed no differences between the studied groups. The psychosomatic complaints and fatigue were studied, too. The data were analyzed by tests of between-subjects effects (SPSS).

Results
The aMT6s retained the typical diurnal pattern with highly significant time-of-day variations (p<0.000). No effect of radiofrequency EMR on aMT6s excretion rates was found. The tests of between-subject effects revealed significant time-of-day variations of the studied stress hormones, as well as significant effect of high-level radiofrequency EMR exposure 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. The increase of stress hormones was the most pronounced during the first four hours of the shift. The effect of low-level exposure did not reach significance, but for cortisol it was in the frame of trend. The total 24-hour excretion of cortisol and noradrenaline correlated with TWA mean and TWA max.

Conclusion
The variations of aMT6s retained the typical diurnal pattern under fast-rotating extended shifts and radiofrequency EMR. The excretion rates of stress hormones indicate pronounced activation of hypothalamic-pituitary-adrenal axis under high-level radiofrequency EMR and moderate activation of the axis under low-level exposure. The operators were able to tolerate the extended shifts, but counter measures for reduction of high-level radiofrequency EMR exposure are recommended, both by technical solutions and limiting the time of worker’s exposure.
Sleep quality and subjective health parameters in shiftworkers

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Keywords: sleep, shiftwork, epidemiology, PSQI, ESS

Background
Several epidemiological studies indicate a number of health risks in shift workers. New legislation in Belgium regarding a more stringent and intensified medical occupational surveillance of night- and shift workers implies a greater focus on these health risks. Until now, few studies in Belgium have investigated the interaction between changed sleep patterns in these populations and (subjective) health.

Objective
To assess the sleep quality and to explore its association with (subjective) health parameters in a population of shift workers of a chemical plant.

Methods
A sample of 119 male shift workers received a self-administered questionnaire, of which 113 workers completed the questionnaire under the guidance of the company doctor or nurse, during working hours. The questionnaire contained, besides a number of general demographic and health parameters, two international standardised sleep questionnaires: the PSQI (Pittsburgh Sleep Quality Index) and the ESS (Epworth Sleeping Scale). The subjective health parameters were dichotomised and evaluated in relation to the tertiles of the scores of the two sleeping scales using the Chi-square test. Odds ratios (OR) were calculated with a 95% confidence interval (CI).

Results
Mean age was 37.0 years (±9.11). The average working time in a shift system was 13.1 years (±8.1). 43.8% of the workers smoked and average coffee intake per shift was 3.5 cups. The average PSQI was 7.89±3.18. The average ESS was 8.56±4.36. Regarding the PSQI, an indication of the overall sleep quality, there was a significant difference in problems reported between the different tertiles: stomach problems, musculoskeletal problems, fatigue, waking up tired, having trouble concentrating and stress. Comparing the third tertile (T3) to the first (T1), logistic regression showed significant odds ratios for PSQI regarding stomach problems (OR=4.19), musculoskeletal problems (OR=3.76), fatigue (OR=40.25), waking up tired (OR=15.61), having trouble concentrating (OR=10.43) and stress (OR=6.18).

Regarding the ESS, indicating the sleep propensity when awake, there was a significant difference between the tertiles for the following problems reported: headache, fatigue, general lassitude and waking up tired. Comparing T3 to T1, logistic regression only showed significant odds ratios for ESS regarding fatigue (OR=8.80) and waking up tired (OR=2.92).

Conclusion
In this small population, the sleep quality is quite poor and there is a (associated) high sleep propensity. Indicators of a poor sleep coincide with a significant higher number of subjective health complaints, parallel to what has been found in international studies. These findings stress the importance of health promotion in shift workers, in general and specifically with regard to their sleep quality.
Shift work, death from ischaemic heart disease, social class and healthy shift worker effect

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Keywords: Shift work, IHD, Social class, Healthy-Shift-Worker-Hire-Effect (HSWHE), Healthy shift-Worker-Survivor-Effect (HSWSE)

Objective
To investigate the relationship between shift work and death from ischaemic heart disease (IHD) and the effects of social class and healthy shift worker effects on this relation.

Methods
A nested case-referent study within an industrial cohort of men was used. Setting: A site of a nuclear fuel company in the North-West of England. Cohort consisted of workers who joined a site of a nuclear fuel company in the North-West of England aged 50 years old or under between 1 January 1950 and 31 December 1998 and worked there at least 30 days. Cases (635 workers) were all cohort members who died of ischaemic heart disease (ICD 410-414) in the period 1950-1998 aged 75 or under. For each case, a referent worker who was alive at the time of the cases' death was chosen from the cohort, matched on age and the year of starting work at the same site, with a maximum difference of five years being allowed on each variable. Deaths from ischaemic heart disease were coded from the death certificate. Work status (shift work or day work) and duration of shift work was determined for cases from their total employment, and for referents for employment up to the time of the corresponding case's death. The main source of information was historical personnel records, including pay codes which differed for day work and shift work. Pre-employment weight, height, systolic and diastolic blood pressures and smoking extracted from each worker’s medical records were considered as confounding factors. Social class at first employment was considered as a specific potential confounder and extracted from job titles and job codes. Conditional logistic regression analysis was used to estimate odds ratios (ORs). Bias due to the HSWHE (selection into) was also addressed by comparing relative risks (RR) immediately after the employment and after 10 years follow-up. The HSWSE (selection-out bias) was addressed by examining the differences in RR based on activity at the time of cases death and RR for long-term shift workers with day workers.

Results
55% of subjects had been worked as shift workers for at least 30 days. Among referents, 78% and 41% of shift and day workers belong to lower social class groups (either social class-4 or social class-5) respectively. The odds ratios for shift workers compared to day workers, after adjustment for SBP, DBP, body mass index, height, smoking, duration of employment, employment status and restricted to those who survived 10 years after hire were 1.11 (90% CI: 0.90 – 1.37). This relative risk decreased to 1.05 (90% CI: 0.84 – 1.31) after inclusion of social class. There was no relationship between risk of death from IHD and duration of shift work.

Conclusion
No excess risk of death from IHD for shift workers was found in this study. Social class appeared to be a positive confounder of the relationship between shift work and IHD. There was no overall the HSWHE in terms of measured pre-employment health status. Some evidence was seen for the HSWSE based on excess risk of death from IHD immediately after leaving shift work and relative risk of death from IHD for long-term shift workers.

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