Being Awake is Not Enough

Mike Harnett, VP Human Factors
SIX Safety Systems Inc.

Misguided Beliefs
• Sleep is controllable by workers
• Equate sleep with laziness or not caring
• Still confuse sleeplessness and long hours with vitality and high performance
• We have to get the shot!
• It’s just the way it is

Part of the Problem is...
• We don’t know how BIG the problem is!
  – Not collecting the right metrics
  – Employees afraid to admit or talk about it
  – Employees never been asked

We asked!

2015 BC Film Industry Survey
Over 60 questions addressing sleep, health and lifestyle issues

<table>
<thead>
<tr>
<th>Percent</th>
<th>IATSE Local 891</th>
<th>UBCP/ACTRA</th>
<th>ACFC</th>
<th>DGC Canada</th>
<th>Teamsters Local 155</th>
<th>IATSE 669</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>56%</td>
<td></td>
<td>23%</td>
<td>17%</td>
<td>14%</td>
<td>7%</td>
<td>6%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Over 2200 responses

Fatigue is...
• A decreased capacity to perform mental or physical work due to inadequate restorative sleep
• Fatigue accumulates
• Direct effect on physical, mental and emotional health

Drowsiness Is...
• A state of sleepiness accompanied by lack of energy
• Drowsiness fluctuates
• The more fatigue, the more drowsy episodes
• Has an immediate effect on performance, errors, stress tolerance, etc.
Being Awake is Not Enough

Sleep Wake Cycle

- Circadian drive
- Homeostasis sleep drive
- Melatonin

Body Temperature Curve and the Master Clock

- Alert
- Drowsy

Light and Melatonin

- Natural sleep hormone synthesized and secreted at night
- Light at inappropriate times can depress production
- Age reduces production
- Powerful anti-oxidant

Adjusting the Body Clock

- Referred to as “entrainment”
- 1 day to adapt for every hour of shift change
  - Shifting 3 hours means 3 days to adapt

The Reality of our Species

- Can never “fully” adapt to working at night
- Any shift adaptation gained doesn’t last
- Rotating and erratic schedules are the hardest to synchronize

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How much sleep is enough?

- Adults need between 7-9 hrs minimum
- Erratic sleep does the most harm
  - 97% of rhythmic genes fall out of sync
  - contributes to psychiatric disorders
  - 70% of survey respondents reported erratic sleeping patterns

Why Productions should be concerned!

<table>
<thead>
<tr>
<th>Sleep Duration (hrs)</th>
<th>Days Absent Per Working Year (DWY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>7.40 8.96</td>
</tr>
<tr>
<td>8</td>
<td>6.03 7.74</td>
</tr>
<tr>
<td>7.75</td>
<td>6.11 7.54</td>
</tr>
<tr>
<td>7</td>
<td>6.27 7.85</td>
</tr>
<tr>
<td>6</td>
<td>5.89 6.35</td>
</tr>
<tr>
<td>5</td>
<td>5.46 5.96</td>
</tr>
</tbody>
</table>

Absence rates doubled with less than 6 hours sleep

Lallukka et al. Sleep, May 2014

Health Impacts

- Physical Health:
  - Stroke and cardiovascular disorders
  - Digestive disorders
  - Kidney disease and scarring
  - Rheumatoid arthritis
  - Fertility problems
  - Various cancers
  - Obesity
  - Hypertension and diabetes

- Emotional and Mental Health:
  - Aggressive and intolerant
  - Impulsive
  - Mood swings
  - Irrational
  - Decreased motivation
  - Depression
  - PTSD
  - Dementias
  - Alzheimer's Disease

Sleep Medications

- Sleep disorders affect 40% of Canadians
- 20 million sleep aids prescribed in 2015; growing 2-3X faster than any other class of drug
- Sleep meds treat the symptoms, not the problem
- Melatonin NOT to be taken by those with depression

Survey Results

<table>
<thead>
<tr>
<th>Sleep Aids</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescription Drugs</td>
<td>16%</td>
</tr>
<tr>
<td>Alcohol</td>
<td>22%</td>
</tr>
<tr>
<td>Non-prescription Drugs</td>
<td>27%</td>
</tr>
<tr>
<td>Exercise</td>
<td>30%</td>
</tr>
</tbody>
</table>

Do you, or have you been told, that you snore or gasp during the night?

<table>
<thead>
<tr>
<th>Always</th>
<th>Often</th>
<th>Seldom</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>12%</td>
<td>26%</td>
<td>38%</td>
<td>25%</td>
</tr>
</tbody>
</table>

2015 Film Industry Survey

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Fatigue and Cognitive Skills

- Mental tasks longer than 30 min deteriorate if tasks are monotonous or tedious
- More difficulty with complex decision making and interpretation
- Cognitive impairment can last up to 5 years after stopping shift work

Fatigue and Driving Tasks

- Routine, highly-over-learned task
- Uniquely vulnerable to
  - momentary lapse of attention
  - slower reaction times
  - diminished steering performance
  - less ability to keep safe distance

Have you ever nodded off behind the wheel driving home after working on a production?

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Rarely, but I have</th>
<th>Occ (at least once/month)</th>
<th>Freq (at least once/week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Level for MVC</td>
<td>11.5</td>
<td>5.4</td>
<td>1.9</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Impaired is Impaired

- 17 hours of wakefulness = .05% BAC
- 22 hours of wakefulness = .08% BAC
- 24 hours of wakefulness = .10% BAC

Subjectiveness ≠ Accuracy

- Objective: PVT performance index
- Subjective: KSST subjective sleepiness

Fatigue & Performance

- Decreased Learning Ability
- Under-estimation of Risk
- Reduced Reaction Time
- Poor Problem Solving
- Slowed Information Processing
- Difficulty Focusing
- Flawed Logic
- Less Balance, Coordination
- Loss of Situation Awareness
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How often does fatigue interfere with concentration?

- **Never**: 5%
- **Rarely**: 18%
- **Sometimes**: 53%
- **Frequently**: 20%
- **Almost Always**: 4%

2015 Film Industry Survey

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How often does fatigue interfere with motivation?

- **Never**: 7%
- **Rarely**: 17%
- **Sometimes**: 45%
- **Frequently**: 25%
- **Almost Always**: 7%

2015 Film Industry Survey

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Fatigue and Safety

<table>
<thead>
<tr>
<th>Hours of Sleep</th>
<th>&lt;5</th>
<th>5-5.9</th>
<th>6-6.9</th>
<th>7-7.9</th>
<th>8-8.9</th>
<th>9-9.9</th>
</tr>
</thead>
<tbody>
<tr>
<td># of injuries per 100 workers</td>
<td>7.89</td>
<td>5.21</td>
<td>3.62</td>
<td>2.27</td>
<td>2.50</td>
<td>2.22</td>
</tr>
</tbody>
</table>

Lombardi DA, Folkard S, Willetts J, Smith G. Chronobiol Int. 2010

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Shift Length Relative Risk

- **Relative Risk**: 2.5 (↑27%)
- **Relative Risk**: 2.0 (↑13%)
- **Relative Risk**: 1.5
- **Relative Risk**: 1.0

Folkard and Tucker, Liberty Mutual

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Timing of Incidents

- **Morning**: Relative Risk
- **Afternoon**: ▲18%
- **Night**: ▲30%

Folkard and Tucker, Liberty Mutual

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Leadership

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Assessing for Fatigue Related Risk

- Schedule Review
- Biomathematical Modeling
- Workload Analysis

FAID Biomathematical Analysis

- Five 12 hour shifts with shifting start
  - 0600, 0900, 1200, 1500, 1800

Compliance by Hours

<table>
<thead>
<tr>
<th>Hours</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 hrs or less</td>
<td>2%</td>
</tr>
<tr>
<td>8-24 hrs</td>
<td>9%</td>
</tr>
<tr>
<td>24-40 hrs</td>
<td>5%</td>
</tr>
<tr>
<td>40-50 hrs</td>
<td>6%</td>
</tr>
<tr>
<td>50-60 hrs</td>
<td>31%</td>
</tr>
<tr>
<td>60 hrs or more</td>
<td>47%</td>
</tr>
</tbody>
</table>

Last 3 hours of last shift is high risk

FTL = 103

On average, how many hours a week would you work on a production?

- 8 hrs or less: 2%
- 8-24 hrs: 20%
- 24-40 hrs: 20%
- 40-50 hrs: 20%
- 50-60 hrs: 5%
- 60 hrs or more: 8%

Next to extended day shifts, weekly shifts extending past 60 hrs have the greatest relative risk of occupational injury or illness

What do you like/dislike about your production schedule?

<table>
<thead>
<tr>
<th>Likes</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexibility it offers/ Choose when to work</td>
<td>13%</td>
</tr>
<tr>
<td>Amount of time Off</td>
<td>13%</td>
</tr>
<tr>
<td>Variety (hours, location)</td>
<td>12%</td>
</tr>
<tr>
<td>Money / Overtime</td>
<td>12%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dislikes</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inconsistency/ Erratic schedules/ Shifting starts/Lack of notice</td>
<td>33%</td>
</tr>
<tr>
<td>Long hrs/ Late nights/ Short turnarounds</td>
<td>20%</td>
</tr>
<tr>
<td>Long commutes/ Dangerous and tired driving</td>
<td>13%</td>
</tr>
<tr>
<td>Night shoots/ Night work/ Early call times/ Fraturdays</td>
<td>12%</td>
</tr>
</tbody>
</table>

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Where are your risks?

• Are safety critical tasks planned during "circadian low" hours?
• Does day shift start before 6am?
• Do shifts frequently extend beyond 12 hours?
• Is there a minimum of 48 hours off between night and day shift changes?
• Has commuting been evaluated as a potential fatigue concern?

So you’re in charge...

A worker is yawnning, rubbing eyes, and moving slowly. You know he has at least 4 more hours to go. You ask how he’s doing and he responds:

“I’m OK, just a little tired”

What do you do?

Assessing for Fatigue Related Risk

Fatigue Accumulation and Incident Trajectory

1. Post Incident Investigation
2. FRAS
3. Procedural Checklists
4. Error Analysis System

Key Concerns in the Film Industry

• Not able to achieve efficient sleep
  – erratic and shifting production schedules
  – long hours on set
• Commuting distance to/from film location
• Prescription drugs and self-medicating to counteract fatigue and stress
• Those who are designing sets, setting up stunts, etc. impacting safety and health of others on set

Thank you for being a great audience!

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