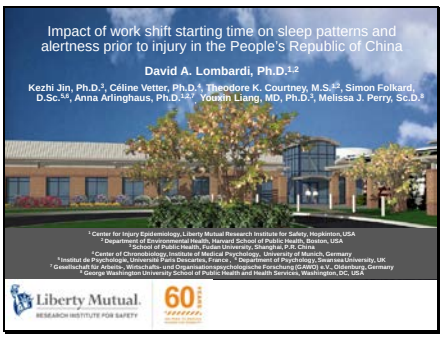
Slide 1



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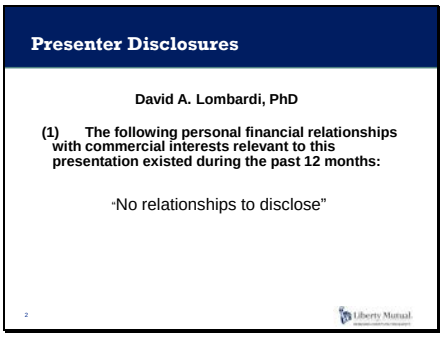

Slide 3

Slide 4

Study Objectives

- Early work shift start time and night shifts associated with reduced sleep duration, poorer sleep quality and increased fatigue (Härmä, 1993; Folkard & Lombardi., 2005; Willamson et al., 2011; Vetter et al., 2012; Judah et al., 2013)
- This study investigates the impact of work shift starting time on sleep duration, sleep quality, and alertness / sleepiness among:
  - A large epidemiological field study of hospitalized adults with severe work-related hand injury in the People's Republic of China (PRC) (Jin, Lombardi et al., 2012; Lombardi, Jin et al., 2014)

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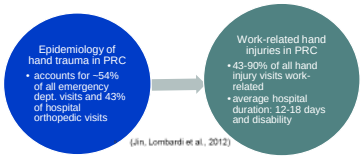
Background – Injury in the PRC



- Recent study of 3479 frontline Chinese workers in 60 factories (2008–2009) reported highest risk factors for injury were: working >55 hours per week (OR = 1.64, 95% CI: 1.21–2.22) and high mental work stress (Yu et al., 2012)

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Study Population*

- Workers admitted for treatment of sudden-onset, traumatic injury to the upper-extremity
  - 2 ½ year period from 11 hospitals in 3 industrial cities in the PRC: Ningbo, Wuxi and Liuzhou
    - + Inclusions: laceration, crush, avulsion, puncture, fracture, contusion, amputation & dislocation to fingers, hand & wrist
    - – Exclusions: sprain, strain, needle-stick injuries, falls. burns

*Jin, Lombardi, et al. Inj Prev April 2007

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Interview Procedure

Study approved by IRC of LMRIS, IRB of HSPH, FSPH

730 hospitalized workers screened by physicians and informed consent obtained

703 (96.4%) completed a face-to-face interview within 4 days of injury in a clinic using structured questionnaire in Chinese (cross-translated) by trained interviewers

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Methods

- For this analysis workers reported:
  - ✓ Injury date and time
  - ✓ Timing of work schedules and rest breaks
  - ✓ Sleep start and wake time (time before injury and two previous days)
  - ✓ Sleep quality (time before injury and two previous days); scale 1-10
  - ✓ Alertness/sleepiness (time of injury and two previous days) using the Karolinska Sleepiness Scale (1-9) (Akerstedt et al., 1990)

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Methods – Statistical Analysis

- ANCOVA Model
  - Dependent variables:
    - Sleep duration, Sleep quality
    - Alertness / sleepiness at the time of injury
  - Main effect: Work shift starting time (8 x 3h increments across the 24h day)
  - Covariates: age, gender, daily shift duration, workdays per week, day of injury and interactions, sleep quality, alertness / sleepiness
  - Test of interaction: Work shift starting time x gender

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Demographics, Work Hours and Sleep

Characteristic		
Gender (N=703)	n	(%)
Male	527	75.0
Female	176	25.0
Occupation (top 3)		
Machinery mfg.	149	25.0
Fabricated metal mfg.	110	18.5
Motor vehicles mfg.	57	9.6

	N	Mean	Std. Error	95% Confidence Interval Lower	Upper
Age	703	31.8	0.39	31.0	32.6
Daily shift duration (hrs.)	703	9.5	0.08	9.3	9.7
Days worked/week	703	6.4	0.04	6.3	6.5
Total weekly work hours	700	55.7	0.56	54.6	56.8
Break duration (total hrs.)	703	0.8	0.04	0.8	0.9
Sleep duration (hrs., time before injury)	700	8.5	0.07	8.3	8.6

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Shift and Sleep Times

24-hour clock, local time	Shift Starting Time n	%	Sleep Start n	%	Sleep End n	%
00:00 - 02:59	15	2.1	65	9.3	3	0.4
03:00 – 05:59	16	2.3	5	0.7	63	9.0
06:00 – 08:59	541	77.3	17	2.4	526	75.0
09:00 – 11:59	18	2.6	30	4.3	28	4.0
12:00 – 14:59	17	2.4	22	3.1	23	3.3
15:00 – 17:59	41	5.9	1	0.1	36	5.1
18:00 – 20:59	40	5.7	119	17.0	10	1.5
21:00 – 23:59	12	1.7	441	63.0	13	1.9

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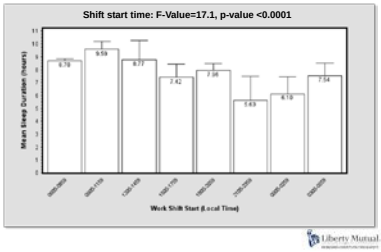
Mean (±95% CI) Sleep Duration (night before injury) by Work Shift Starting Time (3 h categories)



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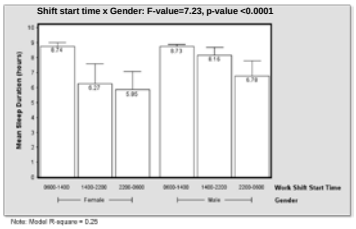
ANCOVA Results
Mean (±95% CI) Sleep Duration (night before injury) by Gender and Work Shift Starting Time



Note: Model R-square = 0.25

*Variables not significant in initial model include number of days worked per week and day of injury.

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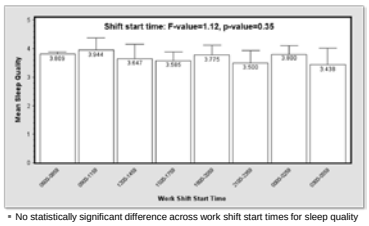
Sleep Quality (last sleep before injury) by Work Shift Starting Time (3 h categories)



- No statistically significant difference across work shift start times for sleep quality

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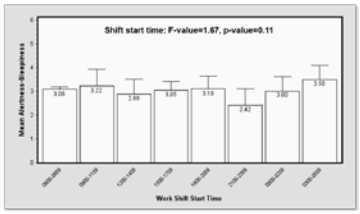
Karolinska Sleepiness Scores (KSS) (at time of injury) by Work Shift Starting Time (3 h categories)



- Alertness/sleepiness based on the KSS (generally alert) did not vary significantly across shift starting time.

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Summary of Results

- Overall mean sleep duration shortest for workers starting shifts at "21:00-23:59" (5.6±0.8h), followed by midnight "00:00-02:59" (6.1±0.6h)
- Statistically significant interaction ($p<0.05$) between gender and work shift starting time on mean sleep duration
  - Males, 5.6h at ("21:00-23:59")
  - Females, 4.3h at ("24:00-02:59" and "1500-17:59")
- Sleep quality (generally quite well) and alertness / sleepiness based on the KSS (generally alert) did not vary significantly across shift starting time.

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Discussion

Limitations

- Self reported wake and sleep times, sleep quality, and alertness / sleepiness scores (recall bias)
- Subjects from case-crossover study (within-person design), thus no controls which to compare our results
- Small sample sizes within work shift start time categories when stratified by gender

Strengths

- Short period between work injury and the follow-up interview of worker (median of four days)
- Workers hospitalized (confirmation of injury outcome)
- Heterogeneous group of occupations (external validity)

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Discussion

- Consistent with findings from other countries, shortest sleep durations occur when work shifts start in early morning or late at night in the PRC
- However, PRC workers on average in this study slept an average of 8.5h on workdays
  - Consistent with 2013 China Sleep Quality Index that reported those in PRC sleep an average of eight hours and 50 minutes per day
  - Much longer than a typical US day worker who sleeps on average, 6.4h on workdays, 7.4h on free days (Sleep in America Poll, 2012)
  - This may help to explain the higher than expected alertness / sleepiness KSS scores at the time of injury

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Questions or Comments?

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ORIGINAL ARTICLE

The impact of shift starting time on sleep duration, sleep quality, and alertness prior to injury in the People's Republic of China

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