



International Traffic Safety  
Data and Analysis Group

**vti**

# **Risk factors for bus drivers' health and safety**

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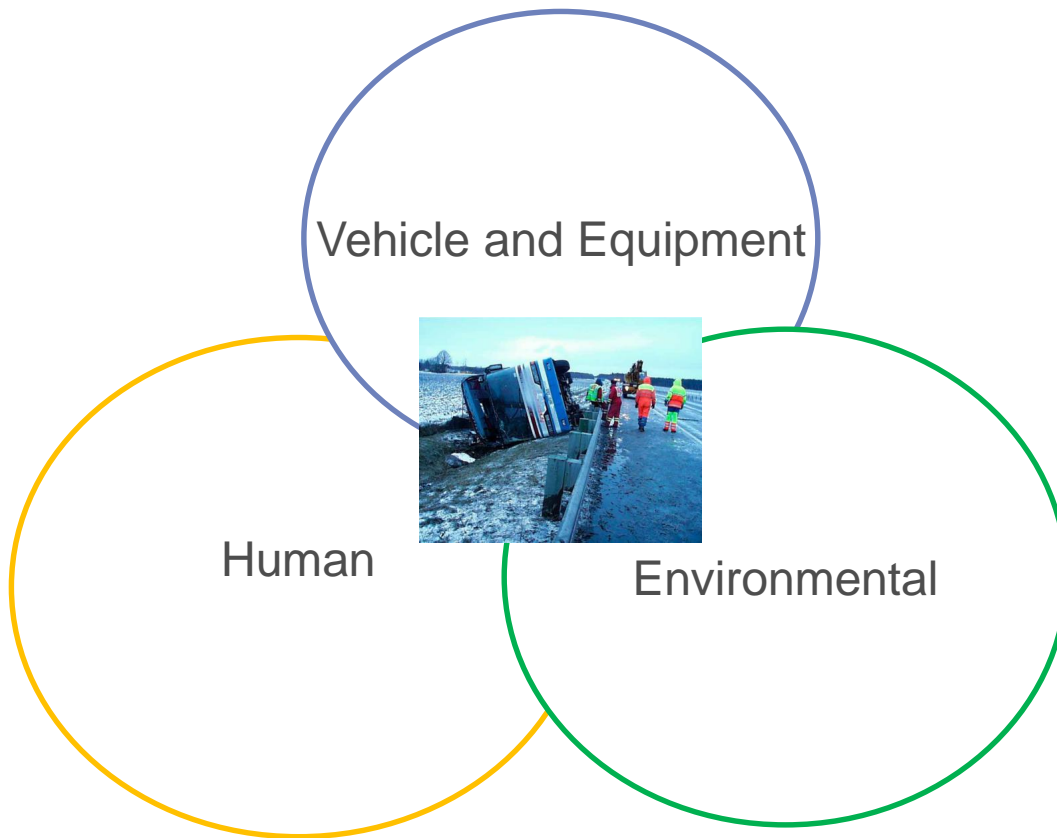
# Crash statistics

- Bus- and coach **fatalities** represent 0.3–0.5% of all traffic fatalities
- Fatalities are more frequent on rural roads
- Rollovers occurred in almost all cases of severe crashes
- Ejection is the most dangerous injury
  
- The vast majority of all bus and coach **casualties** occurred on urban roads
- Boarding and alighting caused about one-third of all injury cases










Source: Albertsson and Falkmer, 2004

# Multiple reasons behind



# Bus drivers daily work

- Bus drivers working environment is demanding
  - Lack of driver ergonomics
  - Lot of secondary tasks
  - High cognitive load
  - Stress caused by factors out of their control (congestions, interactions with passengers etc.)
  - Risk of threats and violence
- Driving the bus is a rather low status job
- Shift work – Split shift is common
- Working alone

Category	Source of distraction	Category	Source of distraction
 Technology	<ul style="list-style-type: none"> <li>- Radio (V);</li> <li>- Radio handset (V);</li> <li>- Ticket machine (V);</li> <li>- Mobile phone (V);</li> <li>- Personal entertainment e.g. Ipod (V);</li> <li>- Passenger technology</li> </ul>	 Bus cabin	<ul style="list-style-type: none"> <li>- Rattles (e.g. ticket machine);</li> <li>- Faulty sun visor;</li> <li>- Adjusting seat;</li> <li>- Adjusting seat belt;</li> <li>- Adjusting steering column;</li> <li>- Operating climate controls</li> </ul>
 Operational	<ul style="list-style-type: none"> <li>- Issuing tickets (V);</li> <li>- General broadcasts;</li> <li>- Personal broadcasts;</li> <li>- Recording broadcast details (V);</li> <li>- Communicating with Transport Operation Centre;</li> <li>- Timetable;</li> <li>- Reading route journal (V);</li> <li>- Amending route journal (V);</li> <li>- Changing route section points;</li> <li>- Bus stopping alert;</li> <li>- Hand brake warning alert;</li> <li>- Raising/lowering the bus (V);</li> <li>- Opening and closing the bus doors</li> </ul>	 Infrastructure	<ul style="list-style-type: none"> <li>- Roadside advertising;</li> <li>- Lane width;</li> <li>- Road layout;</li> <li>- Road signage</li> </ul>
 Passenger	<ul style="list-style-type: none"> <li>- Passenger conversations;</li> <li>- Passenger enquiries;</li> <li>- Talking to passengers (V);</li> <li>- Unruly passengers;</li> <li>- Non-paying passengers;</li> <li>- School children;</li> <li>- Elderly &amp; disabled passengers;</li> <li>- Passengers with infants;</li> <li>- Monitoring bus stops;</li> <li>- Assisting passengers (V);</li> </ul>	 Environmental	<ul style="list-style-type: none"> <li>- Weather conditions e.g. glare</li> </ul>
		 Personal	<ul style="list-style-type: none"> <li>- Fatigue;</li> <li>- Incapacitation;</li> <li>- Sickness;</li> <li>- Medication;</li> <li>- Inexperience;</li> <li>- Eating;</li> <li>- Drinking</li> </ul>



*Swedish bus driver in a study about split shift*

Source: Svensson och Eriksson, 2009, Tse et al, 2006, Salmon et al 2011

## Physical health

The literature indicate four categories of morbidity

- Cardiovascular diseases (heart etc.)
- Gastrointestinal disorders (stomach etc.)
- **Musculoskeletal problems**
- **Fatigue**

# Musculoskeletal disorders

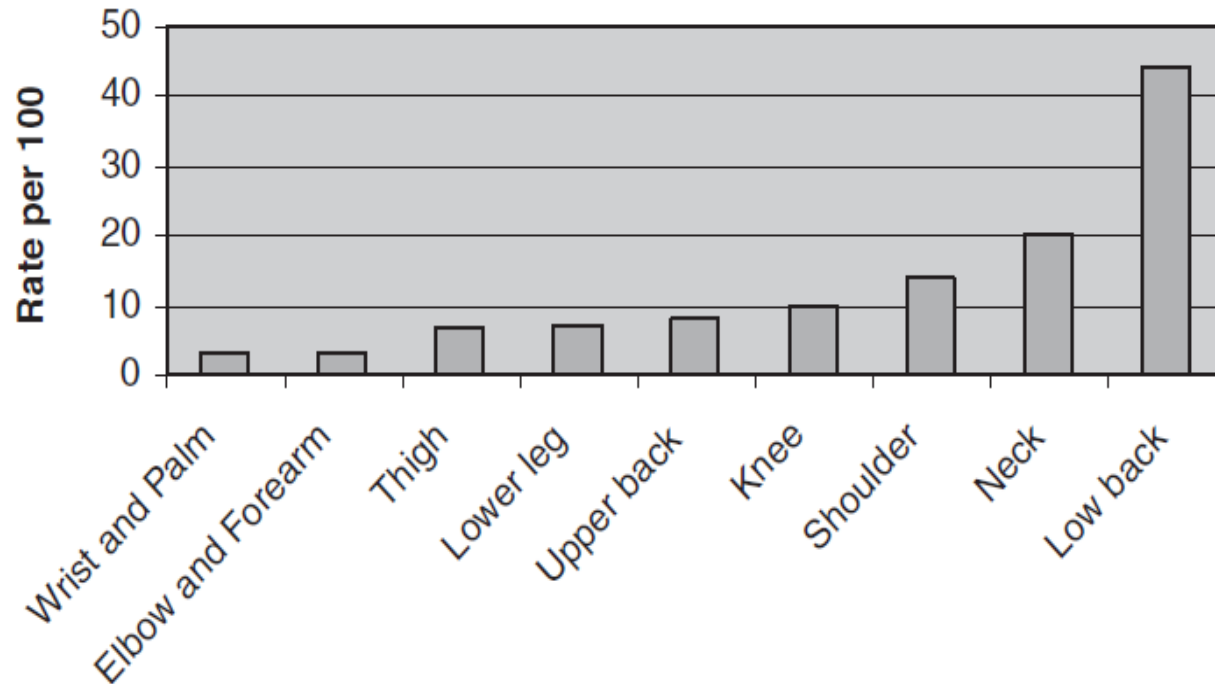
**Lower back-, neck- and spinal pain is common reported in literature**

- Whole body vibrations
  - Static postures/sitting
  - Frequent twisting of the spine
  - Frequent sharp turns of the head to the left and right
- 
- Job dissatisfaction
  - Low supervisor support
  - High psychological demands
  - Frequency of specific job problems

Sources: Tse, 2006, Lewis & Johnson, 2012 Holme et al 1977, Backman 1983,  
Winkleby et al 1988

# Pain

384 male urban bus drivers in Israel

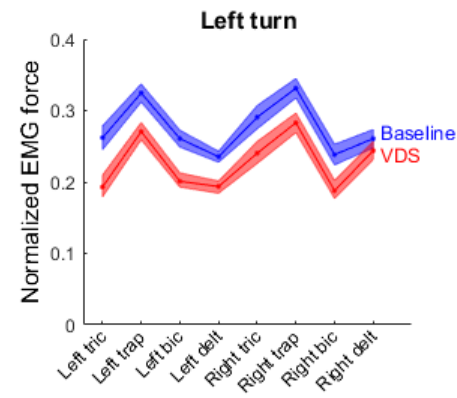
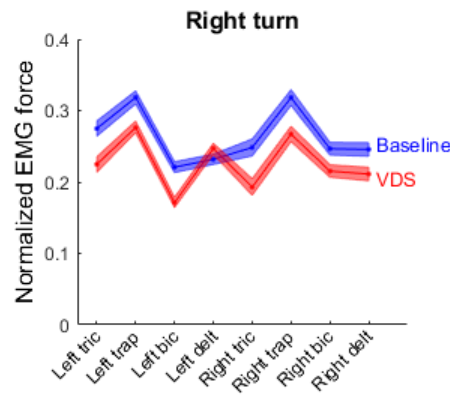
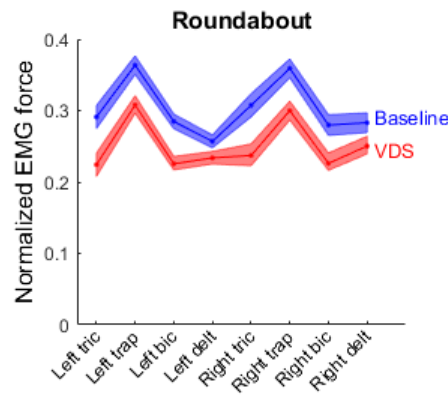
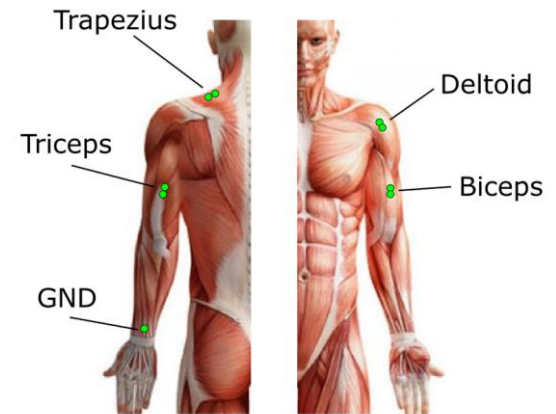


**Fig. 1. The 12-month prevalence of work-related musculoskeletal pain by body region in professional urban bus drivers.**

Source: Alperovitch-Najenson; Katz-Leurer, Santo, Golman; Kalichman, 2010

# Volvo Dynamic Steering (VDS)

The VDS aim to provide a **self-centring steering wheel with directional stability**, leading to a working situation where the driver can manoeuvre the bus with less force.



Reduction: Roundabouts: 17.3%

Right turns 14.1%

Left turns 17.9%

Ahlström et al. Submitted, 2017



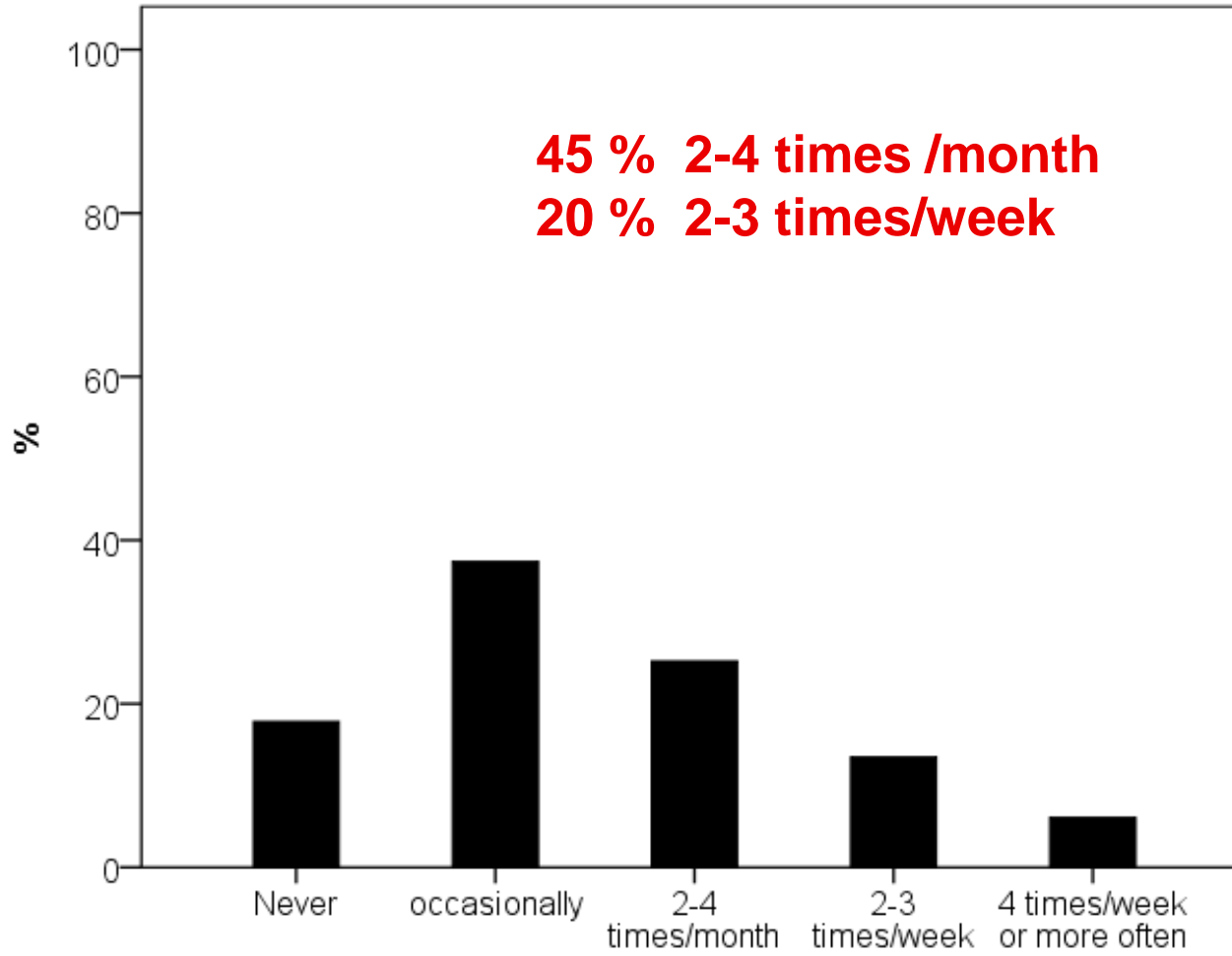
# Driver fatigue

## *Swedish bus drivers – 232 drivers*

- Sleep too little - 41 % *(police – 23%)*
- Not rested when waking up - 37 % *(police - 30%)*
- Working hours contribute to sleepiness - 56 % *(police – 37%)*
  
- Sleep Apnea – 15 %

Source: Anund et al 2014

# “How often do you have to fight sleepiness in order to stay awake while driving the bus”.



**Sleepiness index**  
the **overall stress level**  
the last three months  
predict those that has to  
fight

## Split shift – 232 drivers

64% did not perceive split shift as problematic

36% perceived split-shift working as a major problem

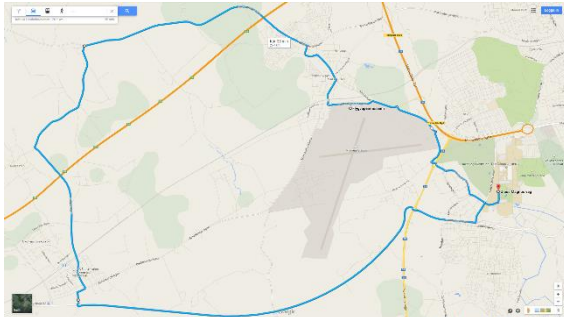
Significant negative effects of split-shift working were related to:

- poorer self-rated health
- higher stress
- more sleep and fatigue problems
- lower satisfaction with work and working hours
- poorer work-life balance

Ihlström et al 2017

# Experiment on real road – split shift situation

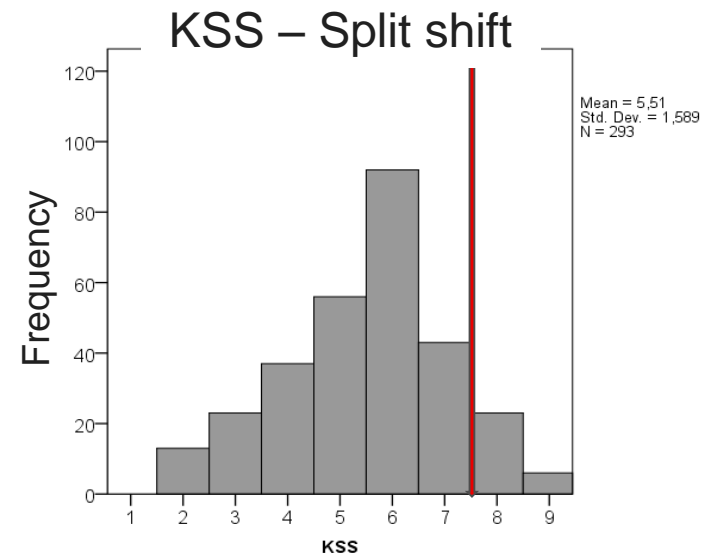
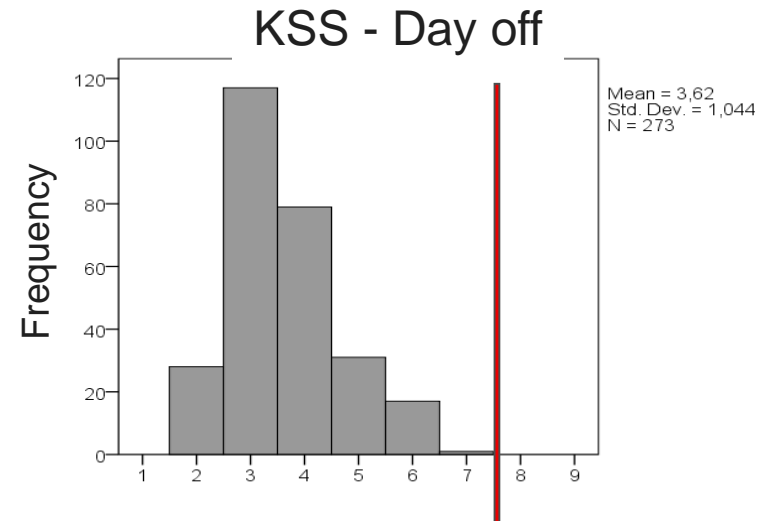
- 18 drivers – 9 males/9 females
- Driving twice – both times in the afternoon
- Once after a day off shift – once after a morning shift
- Data about the drivers sleepiness and performance



# Result

- 7 out of 18 bus drivers reached severe level of sleepiness (>7)
- 1 felt asleep while driving
- The same difference as start - end of night shift

Rate	Verbal description
1	extremely alert
2	very alert
3	alert
4	rather alert
5	neither alert nor sleepy
6	some signs of sleepiness
7	sleepy, but no effort to keep alert
8	sleepy, some effort to keep alert
9	very sleepy, great effort to keep alert, fighting sleep



# Conclusion

- It is safe to go by the bus (<0.5% of fatal crashes)
- Boarding and alighting cause injuries in urban environments
- The bus drivers working conditions are demanding
- It is important to have a holistic view considering bus drivers conditions and what causing increased risk (braking, acceleration, interaction with VRUs)
- Physical and psychological aspects, poor health and reduced sleep quantity and quality are important factors to consider.
- Driver fatigue is a major problem for the drivers, also stress is a problem

*The work toward an increased use of Public Transportation in city needs to consider the bus drivers working conditions in order guarantee safe and health transportations for users but also for drivers.*

**Thank you for listening!**