Influencing Alertness Through Remote Coaching for Professional Drivers

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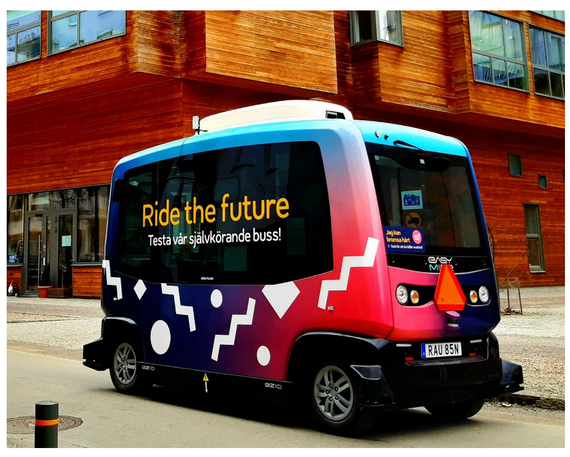
TRA TRANSPORT RESEARCH ARENA DUBLIN 2024
10th CONFERENCE • 15-18 April

Introduction

- **Alertness** is important for road safety. Alert drivers are more likely to exhibit safe driving behaviours and make **safe driving decisions**.
- **Driver fatigue** is associated with **increased crash risk**: 1.29 times the crash risk of driving without being fatigued [1]. Professional drivers are particularly vulnerable to driver fatigue e.g. [2] [3]. Unlike some other workplace hazards fatigue has both **work and personal contributing factors** [4].
- This work is part of the EC funded project PANACEA. The overall **aim** of the project is to create **a holistic monitoring and assessment system** which detects professional **drivers who are not fit to drive** and support them and their employers to manage the situation and put measures in place to prevent it happening again.

Research question: **Do safety drivers of autonomous vehicles experience fatigue?**



Method

- The PANACEA system uses input from sensors in the vehicle, workplace depot and on the driver to evaluate fitness to drive.
- Impairments addressed include fatigue, drugs (medicines and illegal) alcohol and stress.
- Project trials address 3 use cases (UC). UC-A in Sweden with autonomous shuttle safety drivers, UC-B in Greece with taxi drivers and powered-two-wheeler delivery drivers and UC-C in Spain with coach drivers.
- A quasi-experimental design involved data collection over a 4-week baseline and 4-week intervention period.
- The focus is the UCA autonomous shuttle drivers and the data collected during the baseline stage.

Remote coaching

The intervention period is designed to expose the drivers to several countermeasures delivered through a mobile phone app. Fatigue countermeasures included a **report of the drivers' levels of fatigue** measured in their vehicle and a **fatigue questionnaire** enabling drivers to contextualise their fatigue. Due to delays in data collection, only baseline data was available for the analysis reported here.

Measures

Background questionnaire:

- Overall sleepiness was measured using the Bordeaux Sleepiness Scale (BOSS) [5] [Max score = 8; scores of 3 or higher = increased risk of having sleep-related near miss or crash].
- Self-reported amount of sleep obtained and amount of sleep needed.

Subjective driver sleepiness:

- 5-point Likert scale from 1 = Never to 5 = always to self-report how often they had trouble keeping eyes open while driving during the past 30 days
- Sleepiness was reported once at the start and once at the end of shift using the Karolinska Sleepiness Scale (KSS).

Participants

- 8 autonomous shuttle safety drivers (mean age 47.8, SD = 8.2, 2 female, 6 male) who all work full time.
- Participants had held a car driving license for an average of 25.4 years (SD = 9.4, range 13 – 40).

References

1.Moradi et al.,: Sleepiness and the risk of road traffic accidents: A systematic review and meta- analysis of previous studies, Transportation Research Part F, 65, 620– 629. (2019)
2.ETSC: Tackling fatigue: EU social rules and heavy goods vehicle drivers. ETSC, Brussels (2011)
3.Vitols, K., & Voss, E.: Driver fatigue in European road transport. European Transport Workers' Federation (ETF), Brussels (2021)
4.Gander, P, et al.,,: Fatigue risk management: Organizational factors at the regulatory and industry/company level. Accident Analysis & Prevention, 43(2), 573-590 (2011)
5.Philip, P et al.,: The Bordeaux Sleepiness Scale (BOSS): a new questionnaire to measure sleep-related driving risk. Journal of clinical sleep medicine, 19(5), 957-965 (2023)
6.Miller, K. et al.,: Contributory factors to sleepiness amongst London bus drivers. Transportation research part F:, 73, 415-424, (2020)
7.Anund, A., et al.,: Factors associated with self-reported driver sleepiness and incidents in city bus drivers. Industrial health, 54(4), 337-346 (2016)

Results

BOSS and Sleep

- 2 drivers were identified as at positive risk of driver sleepiness (BOSS = 3 and 5).
- Participants reported needing an average of 6.9 hours sleep and obtaining 7.1 hours sleep.
- 5 out of 8 participants reported the same amount of sleep needed as sleep obtained, 2 reported obtaining more sleep than they needed, and 1 obtained less sleep.

Table 1: BOSS, Sleep need and sleep obtained

ID	BOSS	Sleep need (h)	Sleep obtained (h)
1	2	8	8
2	2	6	6
3	1	7	7
4	2	6	6
5	6	6	8
6	2	7	7
7	3	10	7
8	2	5.5	7.5

Experience of driver sleepiness

- 6 / 8 safety drivers (75%) reported never having experienced difficulty keeping their eyes open (last 30 days); 2 had some trouble keeping eyes open (Likert scale 2 & 3).
- No statistical difference between KSS at the start and end of a shift ($t(7) = -1.489$, $p = .18$).
- Six out of the total 148 shifts (4%) recorded ended up with a KSS of 7 (maxi-mum reported); only 2 participants reported KSS=7.

Table 2: KSS at the start and end of shift

ID	No. of shifts recorded	Mean KSS start shift	Mean KSS end shift	KSS change over shift
1	16	1.50	1.50	0.00
2	16	2.94	2.81	-0.13
3	17	3.00	3.12	0.12
4	13	3.31	3.23	-0.08
5	22	3.50	4.64	1.14
6	16	2.00	2.50	0.50
7	24	4.54	4.96	0.42
8	24	3.08	2.96	-0.13

- 2 participant's results suggested they experience more sleepiness than the others P5: BOSS = 5, sometimes had trouble keeping eyes open (Likert = 3) and greatest increase in KSS across shift.
- P7: BOSS = 3, sometimes had trouble keeping eyes open (Likert = 2) and highest mean KSS for both shift start and end.

Discussion and Conclusions

- Fatigue does not appear to be a challenge for shuttle safety drivers in the current study.
- This is different to other bus drivers in Sweden ([6] reported 19% have to fight to stay awake while driving the bus 2-3 times per week).
- The shuttle safety drivers reported getting as much sleep as they require however in a survey of London bus drivers, 70% reported not getting as much sleep as they need [7].
- The shuttles only operate during the day and do not require safety drivers to operate them early in the morning or late at night. This may give them more opportunity to get enough sleep.
- The shuttle drivers are a small sample who volunteered to learn a new skill of operating the shuttles and as may not represent the general bus population.
- Two drivers experienced more sleepiness than the others; if shuttles become widespread the need for safety drivers to work shifts is likely. This suggests **fatigue management is likely to be necessary for safety drivers** in the future.

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The PANACEA project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement number 953426