

Driving performance in chronic insomnia:
Evidence from a multiscenario driving simulator study

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BACKGROUND & AIM

Chronic insomnia affects about 10–15% of adults and is associated with impairments in attention, executive functioning and vigilance. Epidemiological studies link insomnia to higher crash risk, yet simulator and on-road studies have reported inconsistent effects on vehicle control.

We examined whether insomnia-related driving impairment varies across rural and urban environments with different cognitive demands, with and without conversational distraction.

METHODS

Participants. 25 drug-free patients with chronic insomnia (DSM-5-TR / ICSD-3-TR), recruited from the Sleep Study Unit, Eginition Hospital, and 26 healthy controls matched for age, sex and driving experience. Mean age 44.2 years.

Road	No distraction	Conversation
Rural 2.1 km · 70 km/h	S1	S3
Urban 1.7 km · 50 km/h	S2	S4

Procedure. High-fidelity FOERST fixed-base simulator (three screens, 170° field of view, 60 Hz), daylight and clear weather. Distraction: continuous open-ended auditory-verbal conversation with the investigator, outside the field of view. Fixed-length routes with 2–7 unexpected hazards each (pedestrian, child, animal, car pulling out).

Outcomes. Mean speed, SDLP, minimum / mean / maximum reaction time (RT) to hazards, and crash ratio (crashes per hazard).

Assessment & analysis. AIS, ISI, PSQI, HADS, STOP-Bang and a one-week sleep diary. Group comparisons with effect sizes; regression adjusted for age and sex; group × scenario mixed ANOVA on log-transformed outcomes.

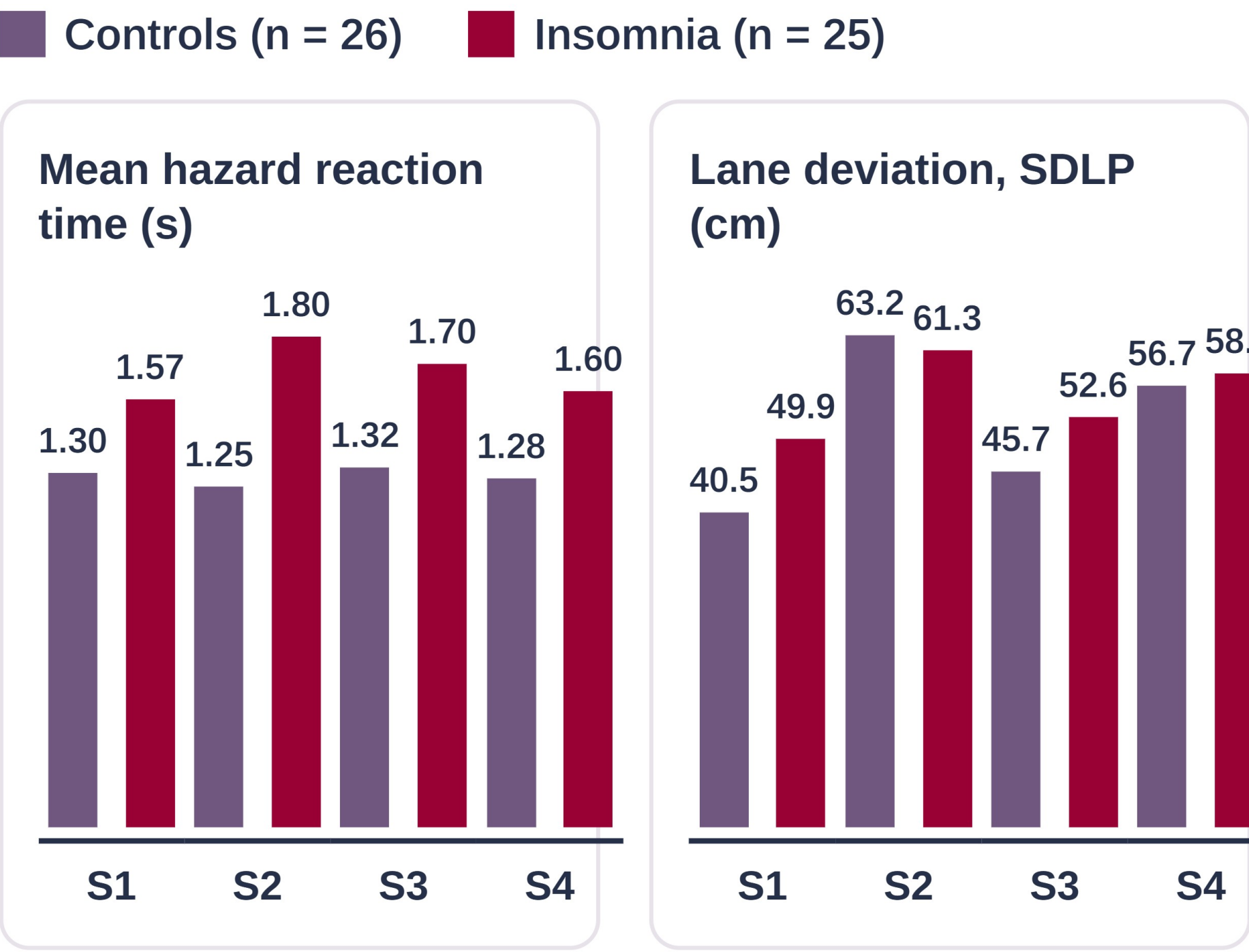
RESULTS

Table 1. Overall driving performance

Outcome	Controls mean (SD)	Insomnia mean (SD)	Adj. p
Mean RT (s)	1.29 (0.05)	1.67 (0.10)	< .001
Minimum RT (s)	1.14 (0.11)	1.54 (0.09)	< .001
Maximum RT (s)	1.44 (0.12)	1.83 (0.17)	< .001
SDLP (cm)	51.53 (6.94)	55.49 (4.75)	.017
Mean speed (km/h)	37.65 (5.07)	38.50 (4.62)	.228
Crash ratio	0.11 (0.09)	0.12 (0.12)	.971

RT = reaction time to unexpected hazards; SDLP = standard deviation of lateral position. Adjusted p-values control for age and sex.

Figure 1. Group means by scenario



S1 rural · S2 urban · S3 rural + conversation · S4 urban + conversation. Mean RT: adjusted p < .001 in every scenario. SDLP adjusted p, S1–S4: < .001, .632, .398, .082.

Table 2. Sleep and mood questionnaires

Scale, mean	Controls	Insomnia	p
Athens Insomnia Scale	2.38	13.52	< .001
Insomnia Severity Index	2.96	14.80	< .001
PSQI	2.58	9.96	< .001
HADS – Anxiety	4.69	8.08	.005
HADS – Depression	5.20	10.44	< .001
STOP-Bang (OSA risk)	1.23	1.72	.135

KEY FINDINGS

- All three hazard reaction-time indices were slower in insomnia across all scenarios (adjusted p < .001, except maximum RT in S4: p = .011).
- SDLP was higher overall (adjusted p = .017), particularly in rural driving without distraction (S1: adjusted p < .001).
- Group × scenario interactions were significant for SDLP and minimum / mean RT (p < .001); the RT gap was largest in urban driving without distraction (S2).
- Mean speed and crash ratio did not differ significantly.
- Questionnaires and sleep diaries showed poorer sleep continuity and quality, more severe insomnia, and higher anxiety and depressive symptoms.

CONCLUSIONS

Driving impairment associated with chronic insomnia appears to be context-dependent. Reaction time to unexpected hazards was the most sensitive and stable indicator of impairment across conditions. These findings support the use of context-specific simulator paradigms to evaluate the impact of insomnia on road safety.

LIMITATIONS

Small, clinic-recruited sample. Simulator and daylight only. One route per condition and unscripted conversation. No actigraphy or polysomnography. Findings do not establish individual fitness to drive.

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CONFLICT OF INTEREST
The authors declare no conflicts of interest.

TAKE-HOME MESSAGE

+0.38 s

Slower mean reaction to unexpected hazards, in **all four** scenarios (1.67 vs 1.29 s; adjusted p < .001)

+9.3 cm

More lane deviation (SDLP) on the **rural road without distraction** (49.9 vs 40.5 cm; adjusted p < .001)

No difference

in mean speed or crash ratio between groups, in any scenario