



The Impact of Stimulant "Drug Holidays" on Driving Performance in Adults with ADHD: Preliminary Results from a Simulated Driving Trial

1 Background

ADHD-Related Driving Risks

Core ADHD symptoms, especially inattention and impulsivity, are significantly associated with impaired driving behavior and a higher risk of traffic accidents.

Benefits of Medication

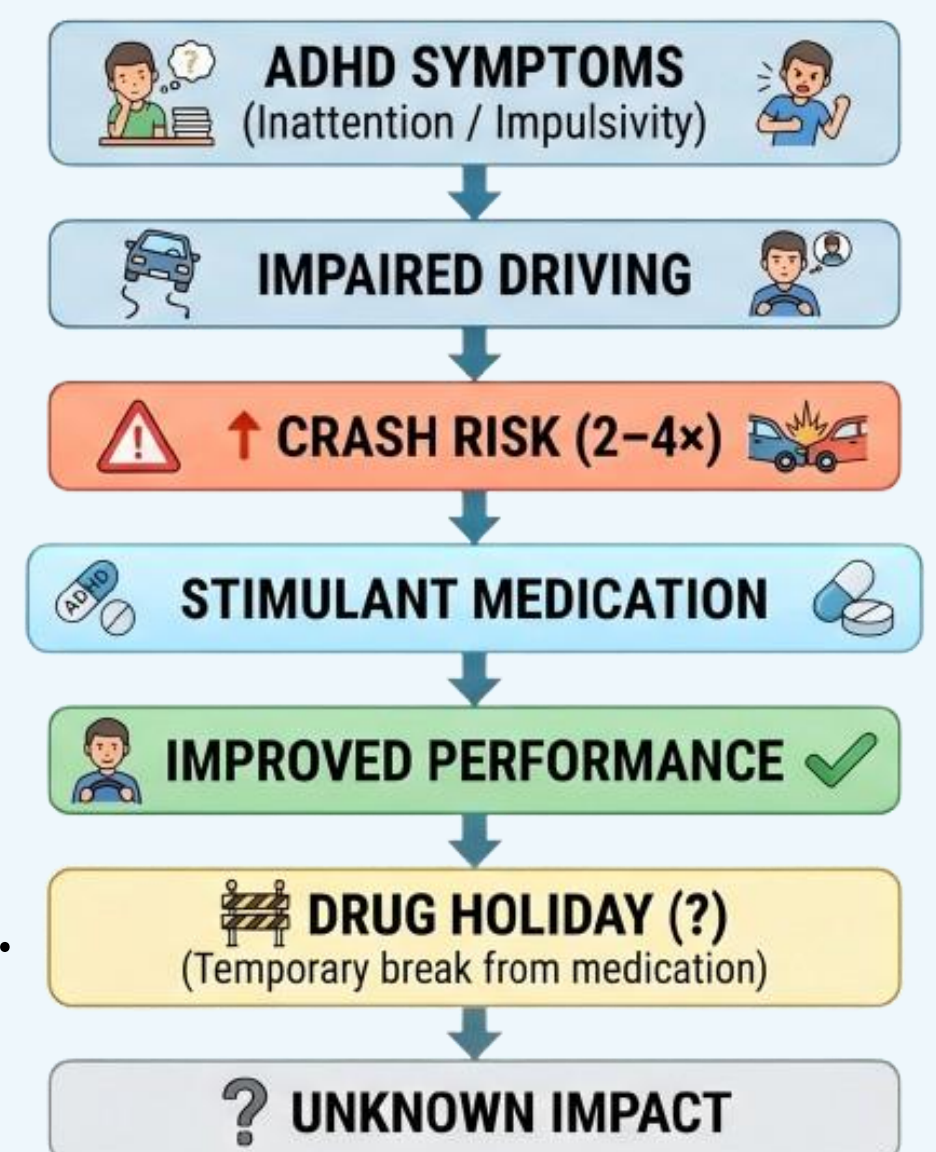
Fixed dose of stimulant medications have been shown to effectively improve overall quality of life, including driving performance, with faster reaction times, more stable lane-keeping, and reduced crash rates.

Drug Holidays

It is common practice for patients to take short medication breaks (eg., 3-day long on the weekend) due to adverse side effects or personal preferences.

Knowledge Gap

The specific impact of such drug holidays on driving safety remains largely unexplored, especially in the context of personalized dosing.



2 Methods

Study design

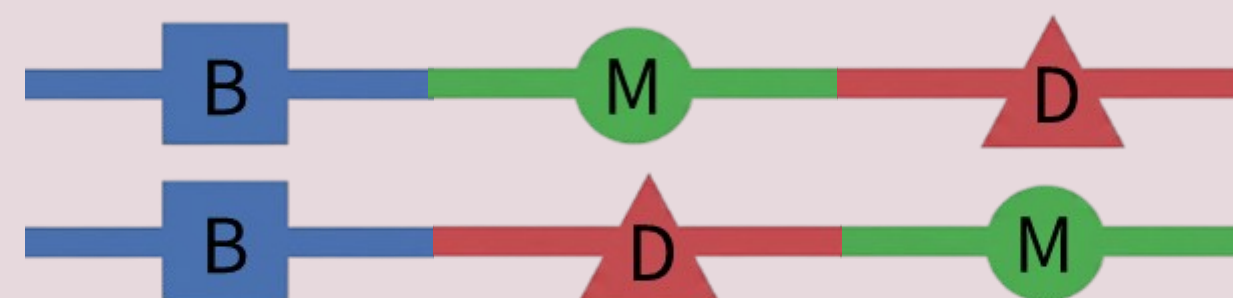
Single-center, observer-blinded, randomized crossover trial

Conditions

- Baseline (B): Usual personalized stimulant dose
- Medicated (M): Usual personalized stimulant dose
- Drug holiday (D): 3-day complete withdrawal (Visits 2 and 3 randomized between M and D conditions)

Task

40-minute nighttime drive in a high-immersion simulator



Participants

22 adult ADHD drivers (preliminary analysis N=10)

Primary endpoint

Driving performance measured by Integrated Driving Score (IDS)

Hypothesis

Driving performance will be significantly altered in the drug-holiday condition.

3 Preliminary Results

Overall Performance - Integrated Driving Score (IDS₄)

IDS₄ is a composite z-score derived from four driving parameters:

- Standard Deviation (SD) of Lateral position from ideal track (m)
- Standard Deviation of Speed (km/h)
- Standard Deviation of Distance to leading vehicle (m)
- Out-of-Lane Time Ratio (%)

$$IDS_4 = z_{SDLP} + z_{SDS} + z_{SDD} + z_{ILD}$$

$$z_p = \frac{x_p - \bar{x}_p}{s_p}$$

where $\bar{x}_p$ and s_p denote the sample mean and standard deviation of parameter p.

Key Finding: A 3-day drug holiday led to a marked increase in IDS₄ by nearly 2 standard deviations, indicating significantly poorer overall driving performance (t = -6.93, p < 0.0001).

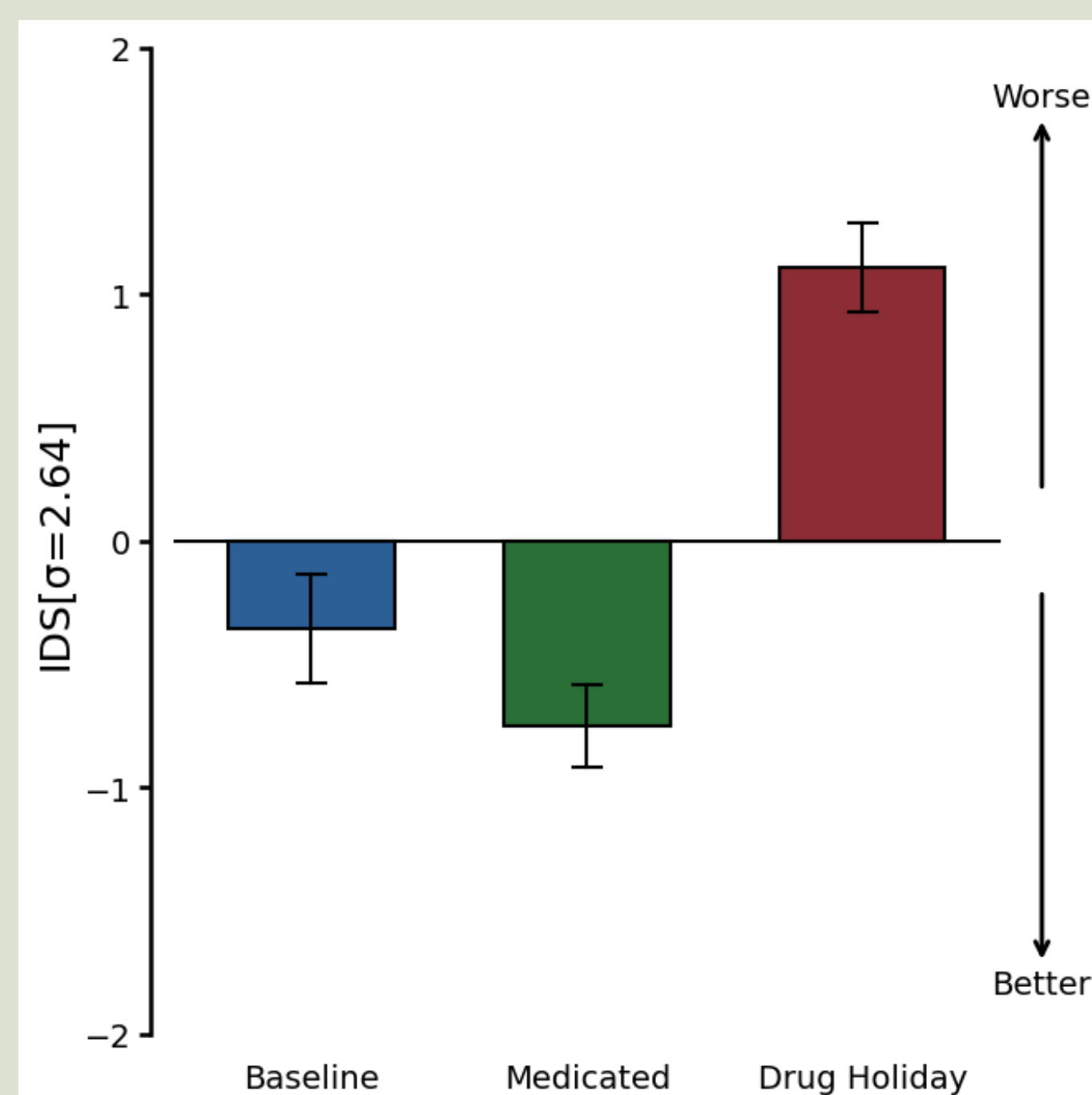


Fig.1: Impact of a 3-day drug holiday on overall driving performance (IDS). Higher scores indicate worse performance. Error bars represent SE.

SDLP - Standard Deviation of Lateral Position

As a primary metric for driving performance, SDLP measures a vehicle's lateral weaving to evaluate the driver's steering control and sustained attention. A 3-day Drug Holiday (D) led to a significant increase in SDLP, indicating greater lateral weaving compared to both Baseline (B) and Medicated (M) conditions.

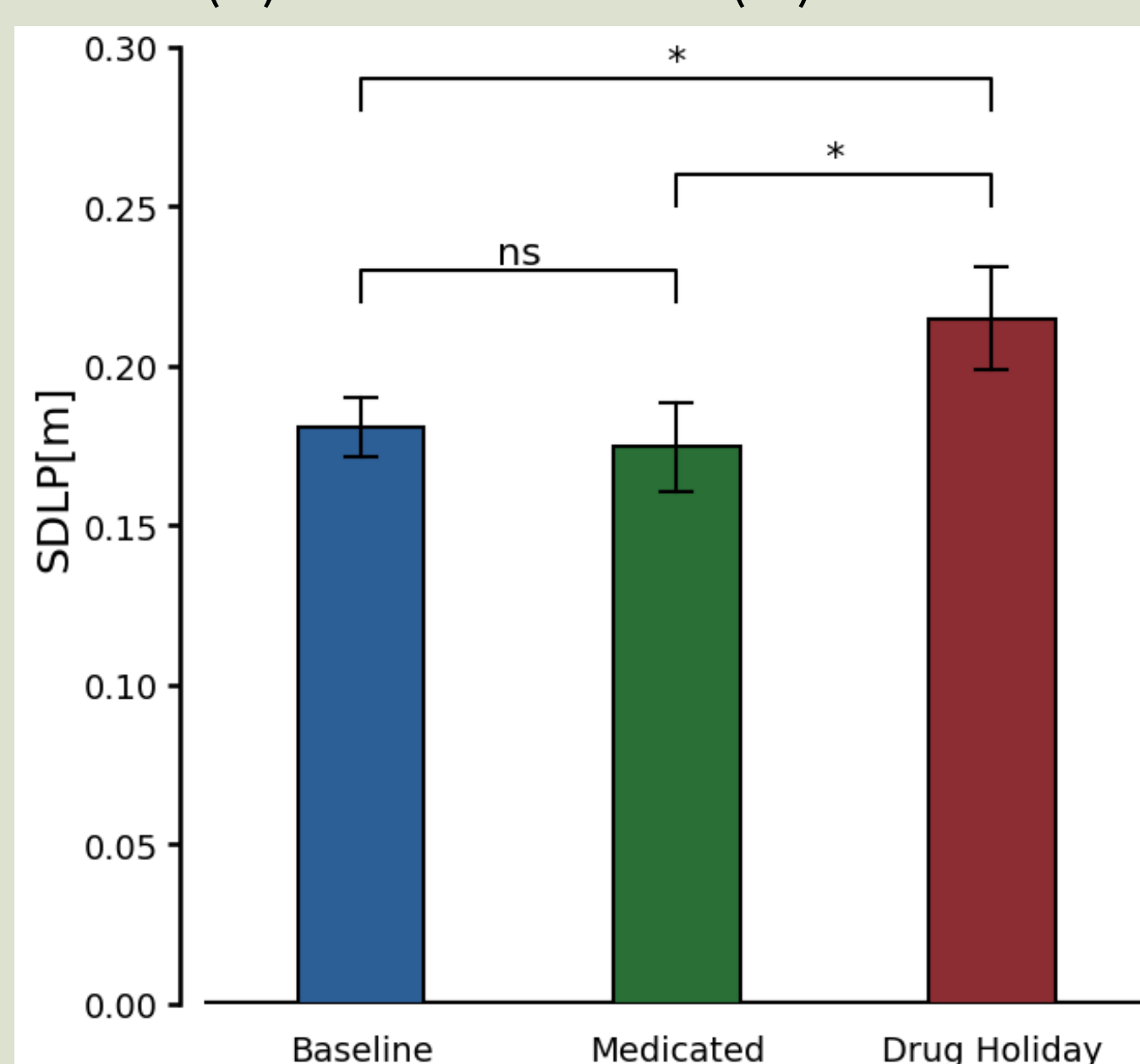


Fig.2: Overall SDLP across driving conditions. The drug holiday (D) significantly increased lateral weaving compared to Baseline (B) and Medicated (M) states (p < 0.05). There was no significant difference between B and M (ns).

Lane-keeping stability gradually deteriorated over the 40-minute drive across all conditions, reflected by an upward trend in SDLP.

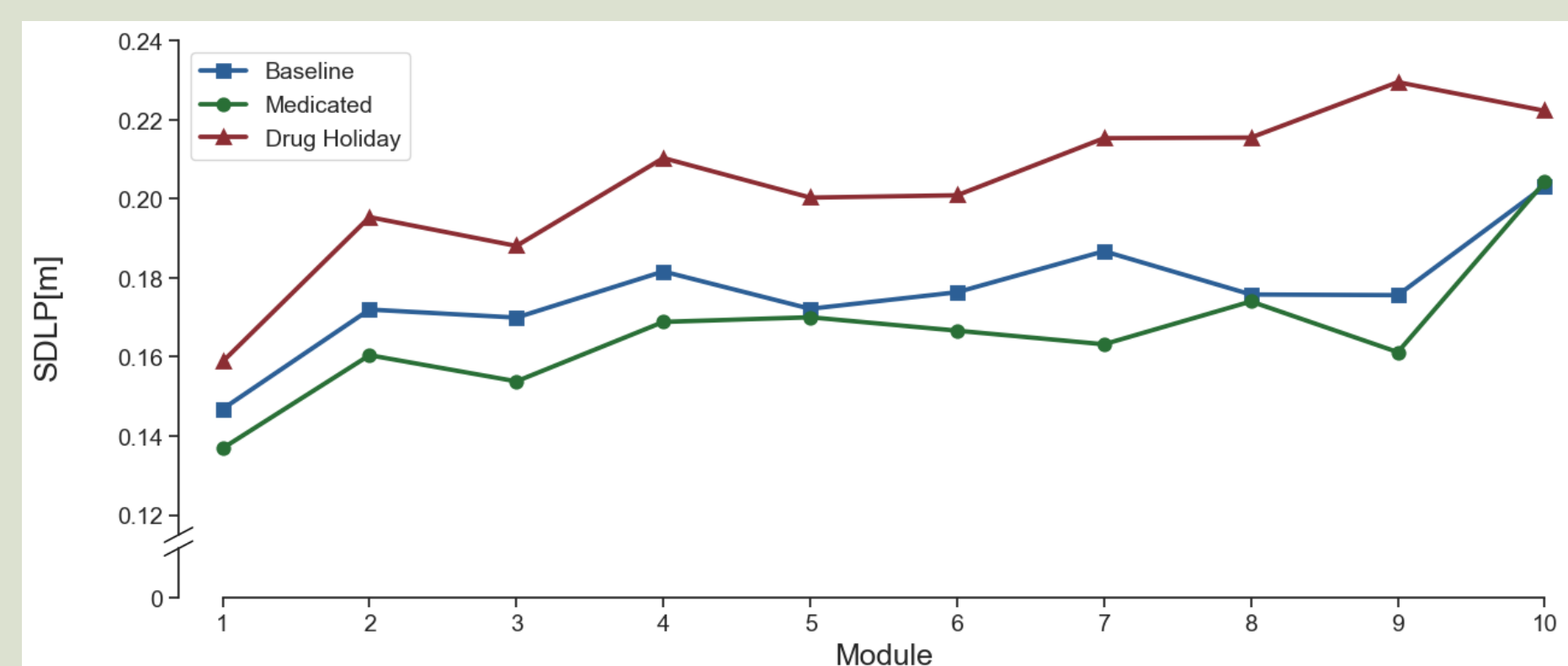


Fig.3: SDLP across the 40-minute drive (10 modules). While performance generally deteriorated over time across all conditions, SDLP during the drug holiday (D) remained consistently elevated compared to B and M states.

KSS - Karolinska Sleepiness Scale

To investigate the lane-keeping deterioration, we assessed drivers' subjective sleepiness using the Karolinska Sleepiness Scale (KSS, 1 = extremely alert, 10 = extremely sleepy, can't keep awake).

While driving increased sleepiness across all conditions, the Drug Holiday (D) caused significantly higher subjective sleepiness scores than both Baseline (B) and Medicated (M) conditions overall.

Most strikingly, participants on the drug holiday (D) were slightly sleepier before driving than they were when medicated (M) after the drive, yet their lane-keeping (SDLP) at the beginning of the drive was substantially better. This clear dissociation indicates that driving impairment is not solely driven by sleepiness.

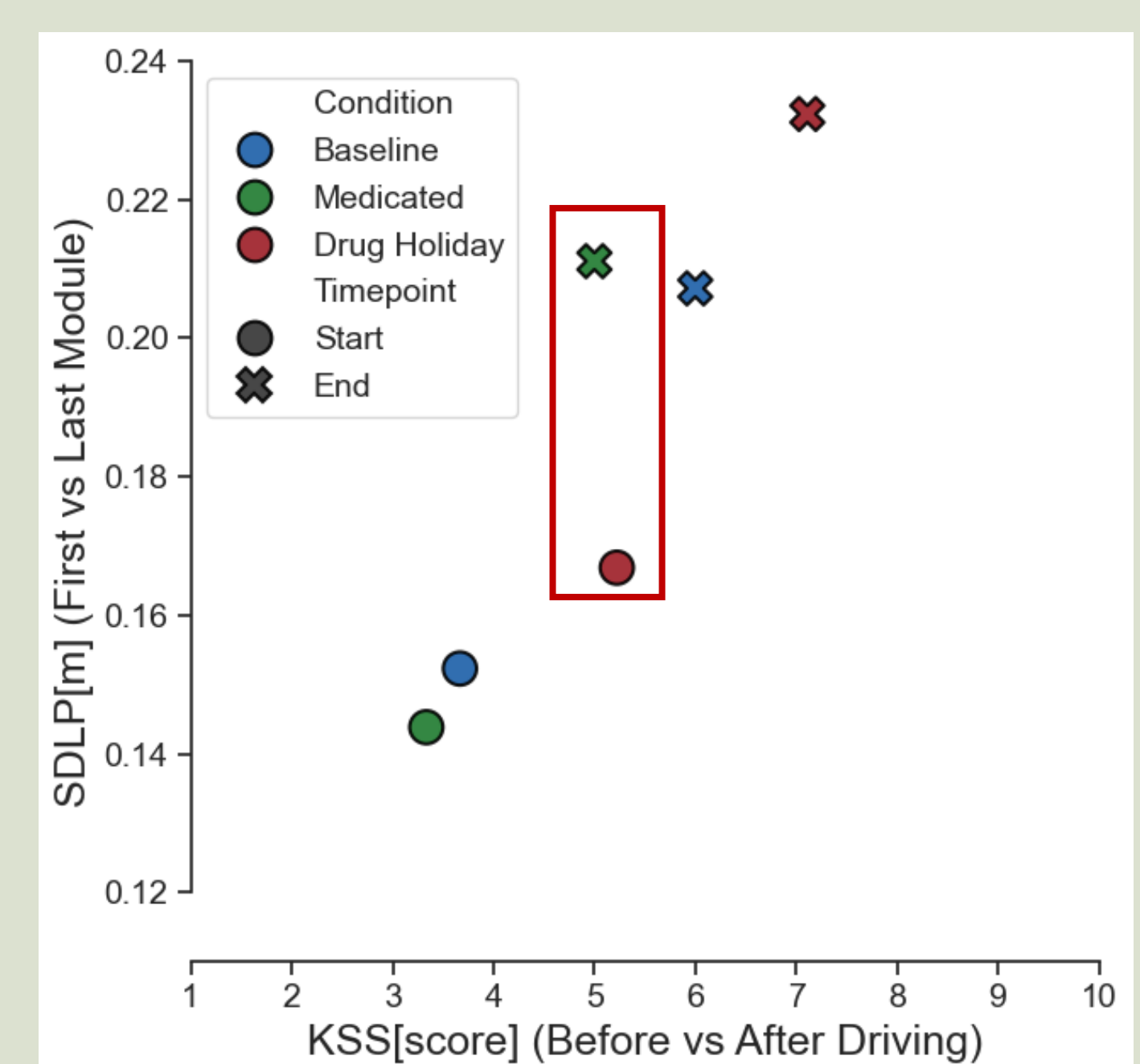


Fig.4: KSS vs. SDLP (start vs. end). Boxed: drug-holiday start (red) shows higher sleepiness but lower SDLP than medicated-drive end (green).

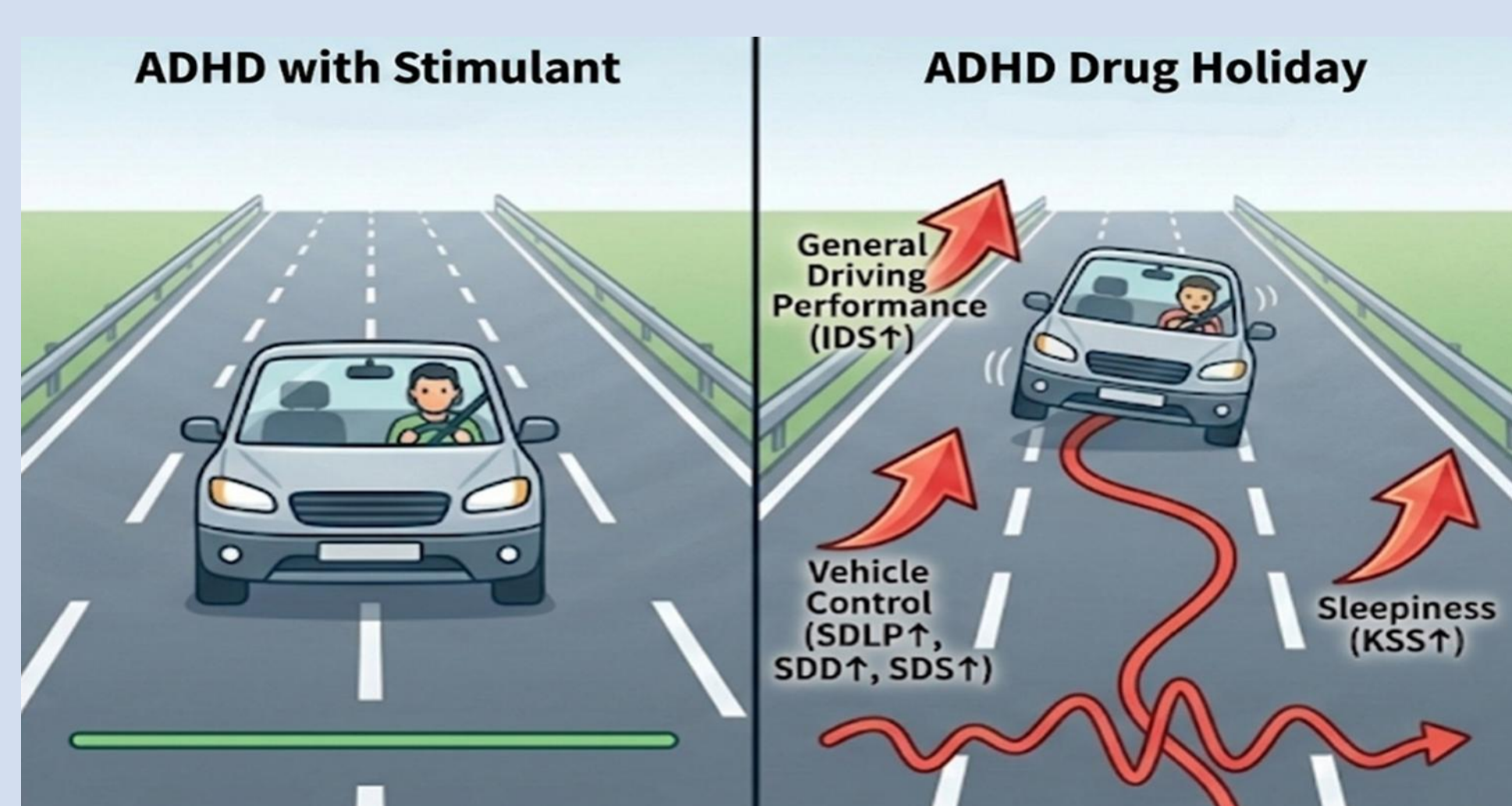
4 Conclusion

Drug holidays significantly affect adults with ADHD

- Lower general driving performance (IDS↑)
- Lower vehicle control (SDLP↑, SDD↑, SDS↑)
- Higher sleepiness (KSS↑)

Takeaway:

Patients should be advised not to drive during a stimulant drug holiday.



Authors

Nan Li¹, Veronika Gambin¹, Boris Quednow², Pascal Burger³, Ana Buadze², Benjamin Offenhammer², Kristina Keller, Stefan Lakämper¹

¹ Department of Traffic Medicine, Zurich Institute of Forensic Medicine, University of Zurich

² Department of Adult Psychiatry and Psychotherapy, University Hospital of Psychiatry Zurich

³ ZADZ AG – Center for Anxiety and Depression Treatment Zurich

Email: nan.li@irm.uzh.ch