58th CIECA CONGRESS DRESDEN 2026

Objective and subjective parameters of road safety after cannabis consumption: A driving simulator study.

Thomas Wagner, PhD, Traffic Psychologist, DEKRA Automobil GmbH

AGENDA

58th CIECA CONGRESS DRESDEN 2026

- ***Project Partners:***
  TU Dresden, Institute for Work and Health at the DGUV & DEKRA DTC Klettwitz
- ***Data collection: From July to September 2025***

01 Study design and sample

02 Self-assessment of intoxication

03 Factors influencing subjective driving safety (self-assessment)

04 Subjective and objective parameters of driving behavior

05 Conclusion

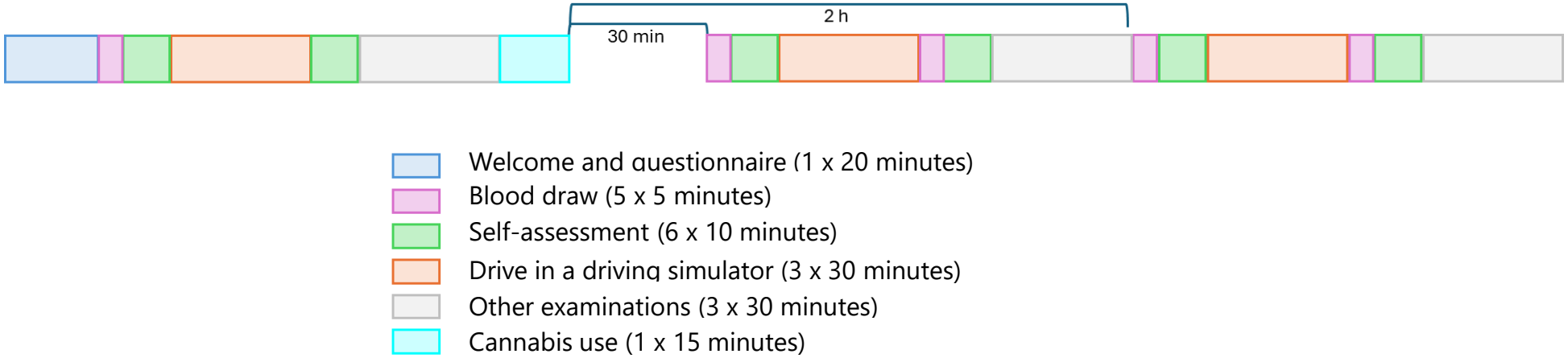
58th CIECA CONGRESS DRESDEN 2026

01 Study design and sample

Design Frame I

58th CIECA CONGRESS DRESDEN 2026

- **Data collection - Flowchart**
- Selection of participants via an online questionnaire
- Experimental Trial at the driving simulator: 5.5 hours (each subject)
- Max. 3 participants per data collection day,
- 3 driving sessions with 30 minutes intervals each
- Sample of N=41 Subjects, average age 24 years, 33 were male

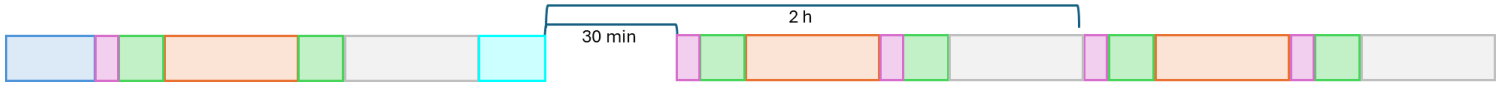


Design Frame II

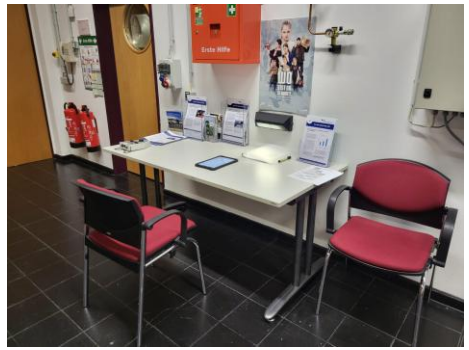
Details on the study procedure:

Self-assessment (10 minutes each)

Driving course included various situations on rural roads (e.g., animals crossing the road) and in urban traffic (e.g., cars braking suddenly)



Place to fill out the questionnaire



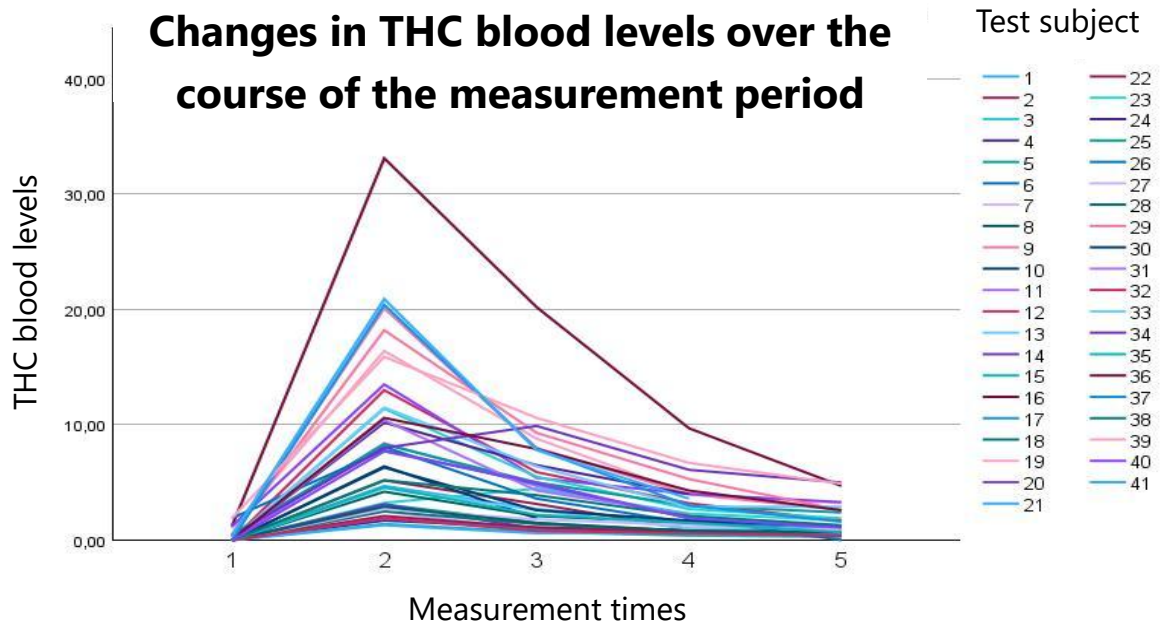
Operating room

Driving simulator

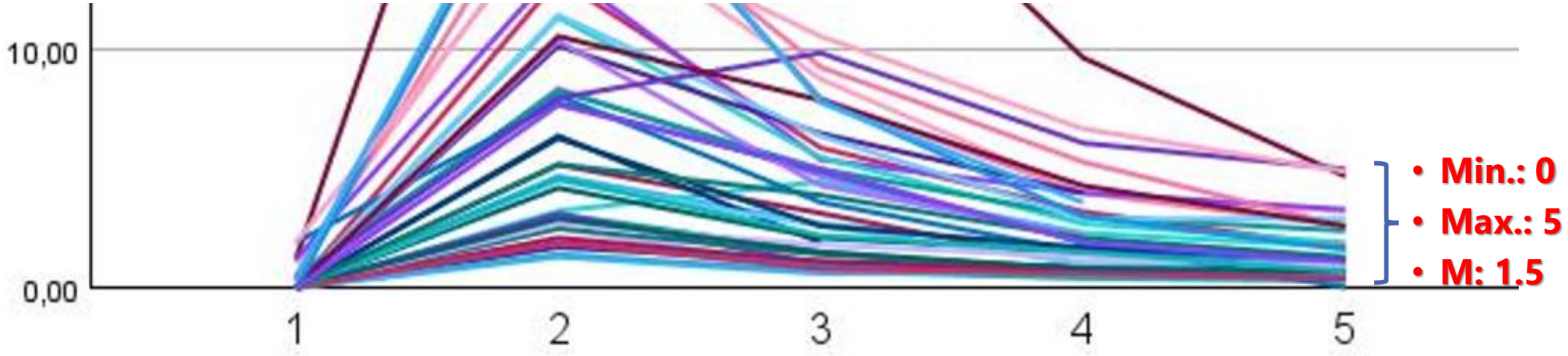
58th CIECA CONGRESS DRESDEN 2026

02 Self-assessment of intoxication

Results 1



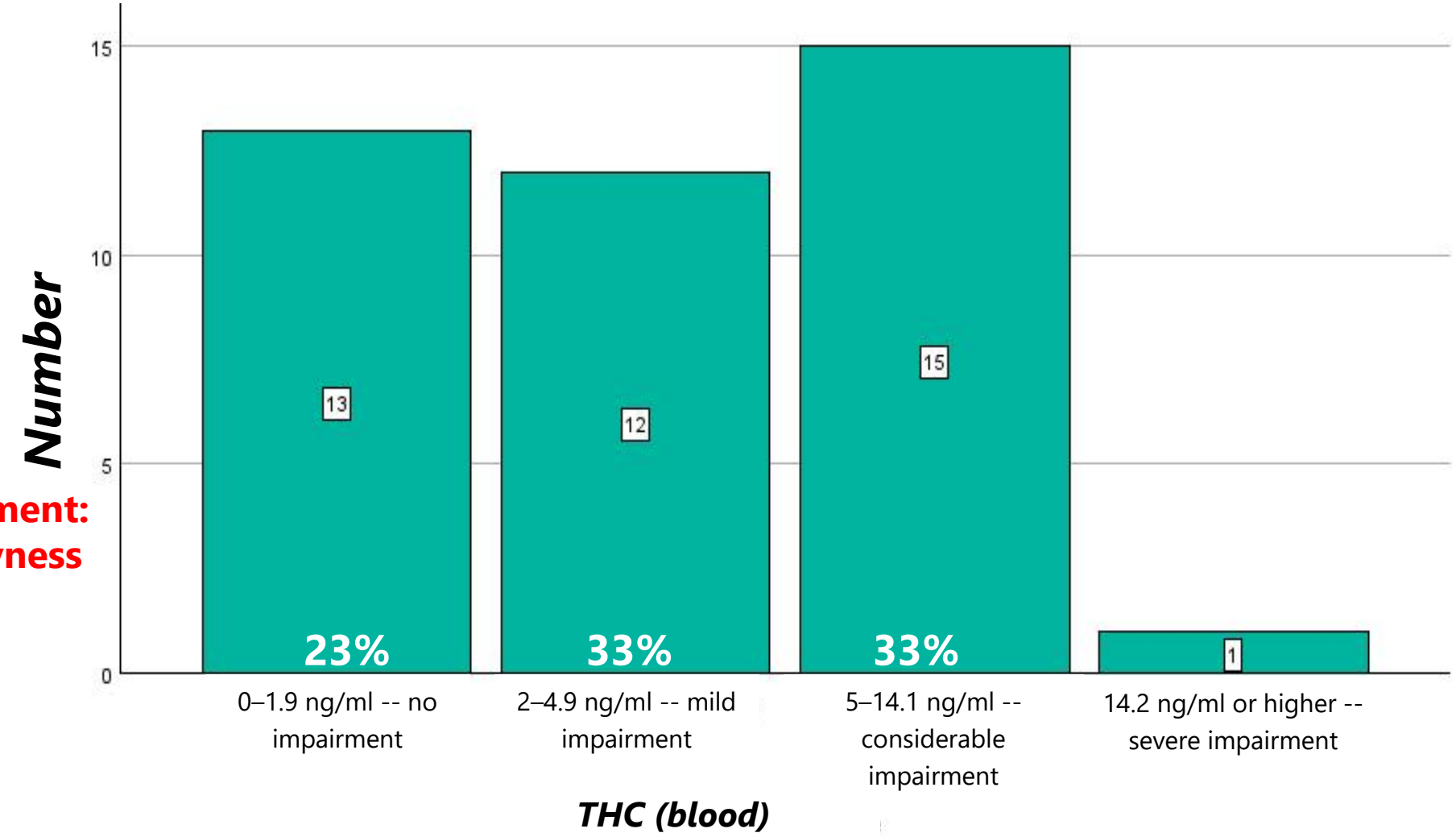
Measurement times:
1: Before cannabis use
2: 30 minutes after cannabis use
3: 75 minutes after cannabis use
4: 120 minutes after cannabis use
5: 165 minutes after cannabis use



- **Min.: 0**
- **Max.: 5**
- **M: 1.5**

Results 2

Distribution of THC levels after the first driving session

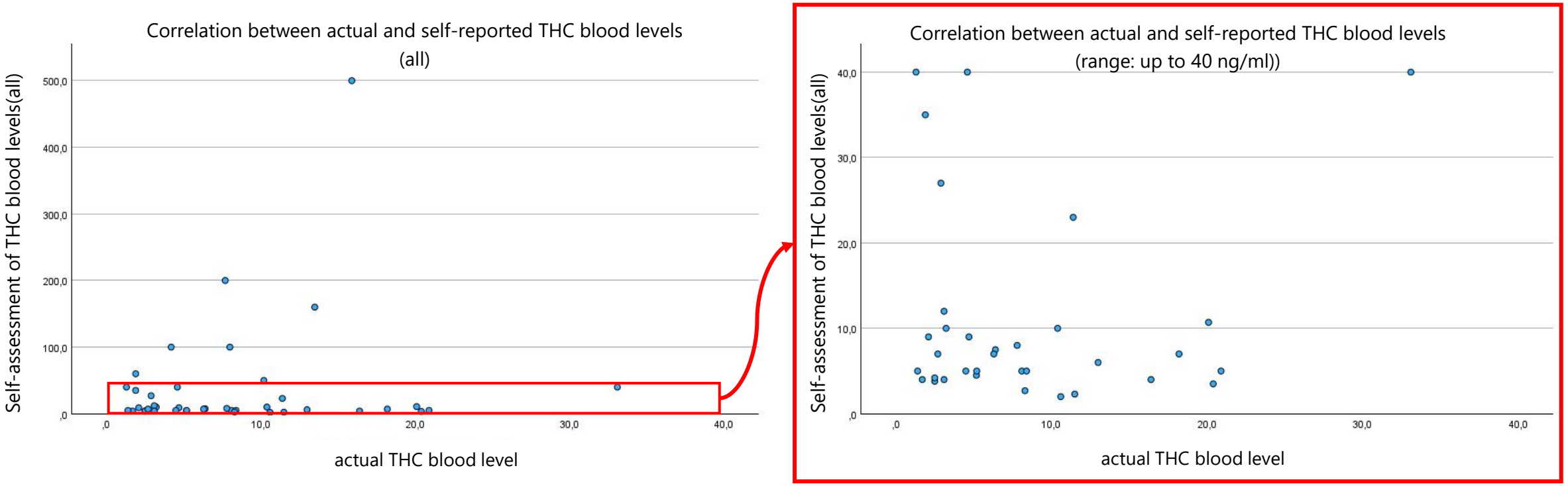


Self-assessment: Road Readyness (yes):

Results 3

58th CIECA CONGRESS DRESDEN 2026

Research question: Do objective and subjective THC levels correlate?



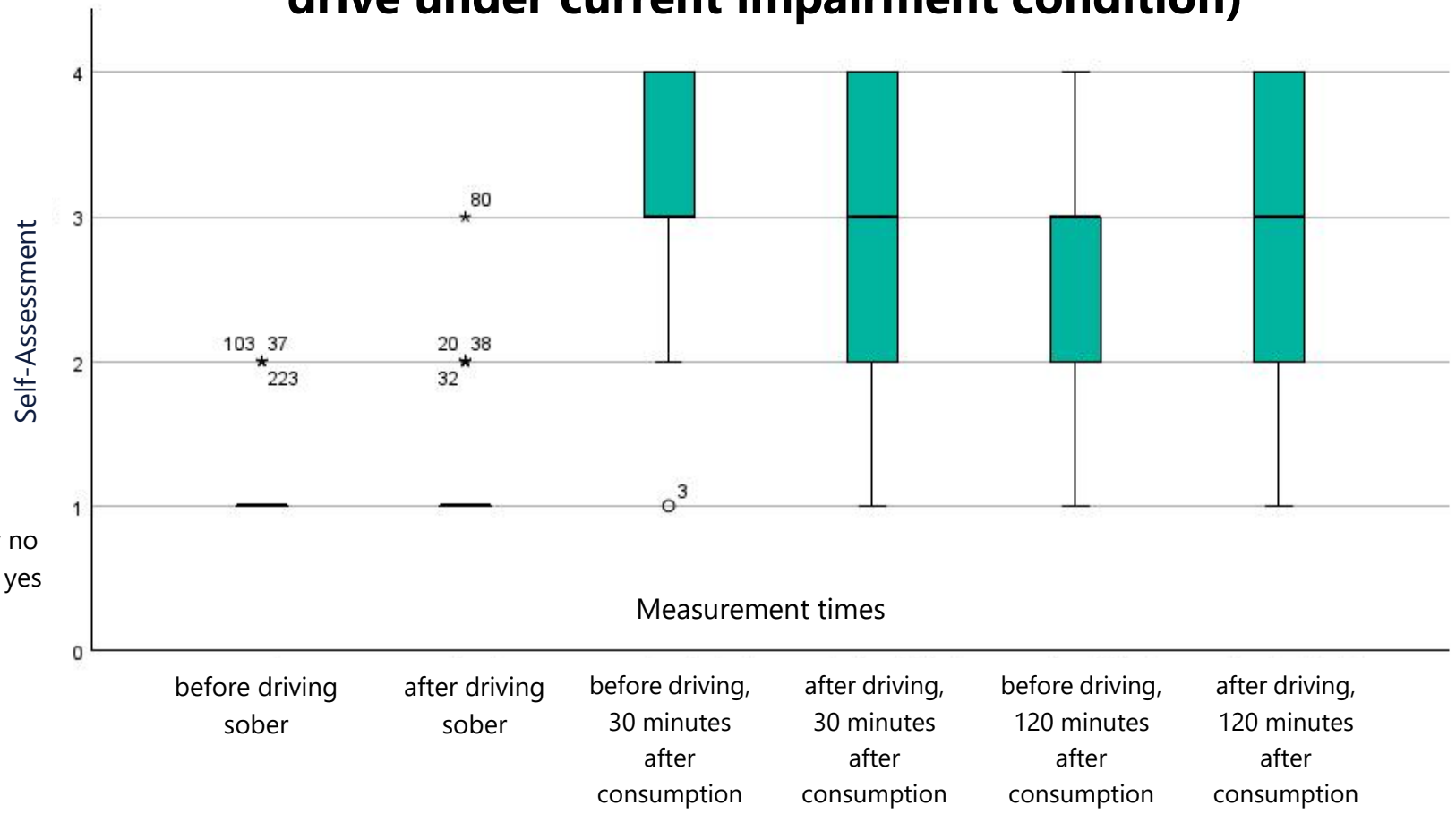
→ Data on actual and self-reported THC blood levels prior to the first driving session under the influence of cannabis

Correlation between actual and self-reported THC blood levels:
r = .16, p = .32; Differences between actual and self-reported THC levels: average deviation of +29.22 ng/ml.

03 Factors influencing subjective driving safety („Am I street Ready?“)

Results - 4

Self-assessment regarding „street readyness“ (would I drive under current impairment condition)



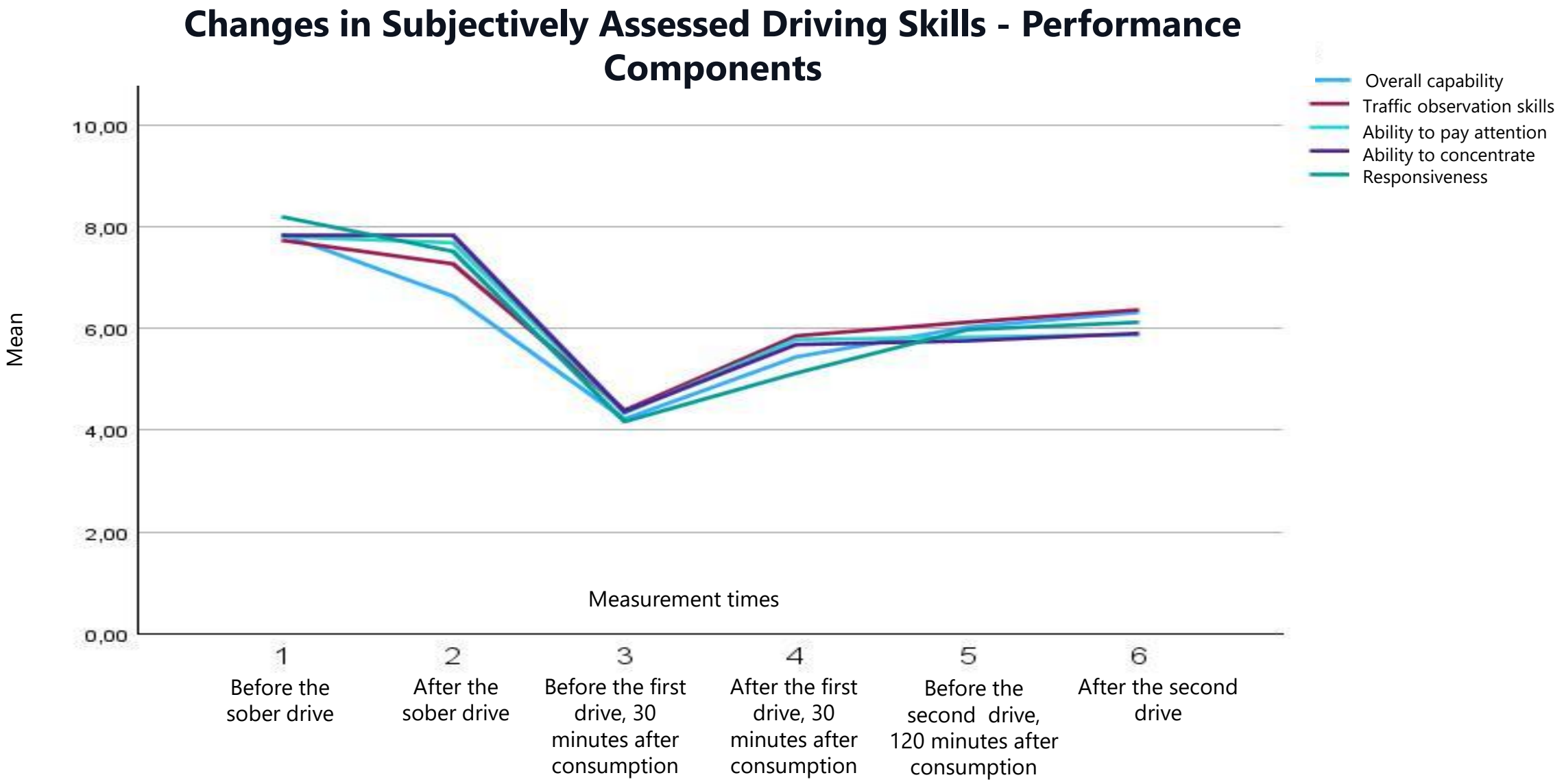
4= no
2= more likely no
3= more likely yes
1= yes

Differences between measurement time points:

-Measurements taken before and after each drive do not differ significantly from one another

-There are significant differences between all measurements except between measurements 4 and 6 (both taken after the two cannabis-induced drives)

Results - 5


Changes in Subjectively Assessed Driving Skills - Performance Components
Overall capability
Traffic observation skills
Ability to pay attention
Ability to concentrate
Responsiveness
Mean
10,00
8,00
6,00
4,00
2,00
0,00
Measurement times
1
Before the sober drive
2
After the sober drive
3
Before the first drive, 30 minutes after consumption
4
After the first drive, 30 minutes after consumption
5
Before the second drive, 120 minutes after consumption
6
After the second drive

Results - 6

BLOCK 1: Fixed Factors & Driving Experience	Before the first drive under the influence of cannabis
Age, Gender, Years of driving license held, Driving experience in KM, Subjective driving experience: **No Relevance for predicting driving ability (subjective rating)**	

BLOCK 2: History of Cannabis Use	Before the first drive under the influence of cannabis
Frequency of consumption, Age at first use, Self-rated cannabis tolerance, Number of times having driven under cannabis influence before: **No Relevance for predicting driving ability (subjective rating)**	

Research question: What factors predict subjective driving ability (self-assessment of driving safety)?

→ Driving ability = Self-assessment of whether one feels capable of driving a car in one's current condition

58th CIECA CONGRESS DRESDEN 2026

BLOCK 3: Current driving ability	Before the first drive under the influence of cannabis		After the first drive under the influence of cannabis	
	Correlation with driving ability	Regression coefficient	Correlation with driving ability	Regression coefficient
Self-Assessment of Performance	**0,58****	**-0,04**	0,65**	0,40*
Self-Assessment of Driving Ability	**-0,74****	**-0,34***	-0,68**	-0,23*
Self-assessment compared to others	**0,37***	**-0,11**	0,30	-0,08
Self-Assessment Confidence	**-0,47****	**-0,09**	-	-
		Significant change in R^2 for Block 3 (R^2=0.63; p=0.004)		Significant change in R^2 for Block 3 (R^2=0.62; p=0.002)

Research question: Predicting One's Driving Fitness

Results - 7

58th CIECA CONGRESS DRESDEN 2026

Research Question: What effect do serum THC levels and frequency of use (THC-carboxylic acid in hair) have on subjective driving ability (self-assessment of driving safety)?

Fixed effects	Coefficient	Significance
Constant term	3.721	$p < .001$
THC blood levels	-0.043	$p = .078$
Frequency of use	-0.275	$p = .018$
THC blood levels * Frequency of use	0.025	$p = .023$

THC blood levels before and after the first driving session **do NOT correlate** with subjective driving ability:

- Before driving: r = -0.039 (p = 0.807)
- After driving: r = 0.034 (p = 0.834)

Frequency of use is more important than the current THC blood level

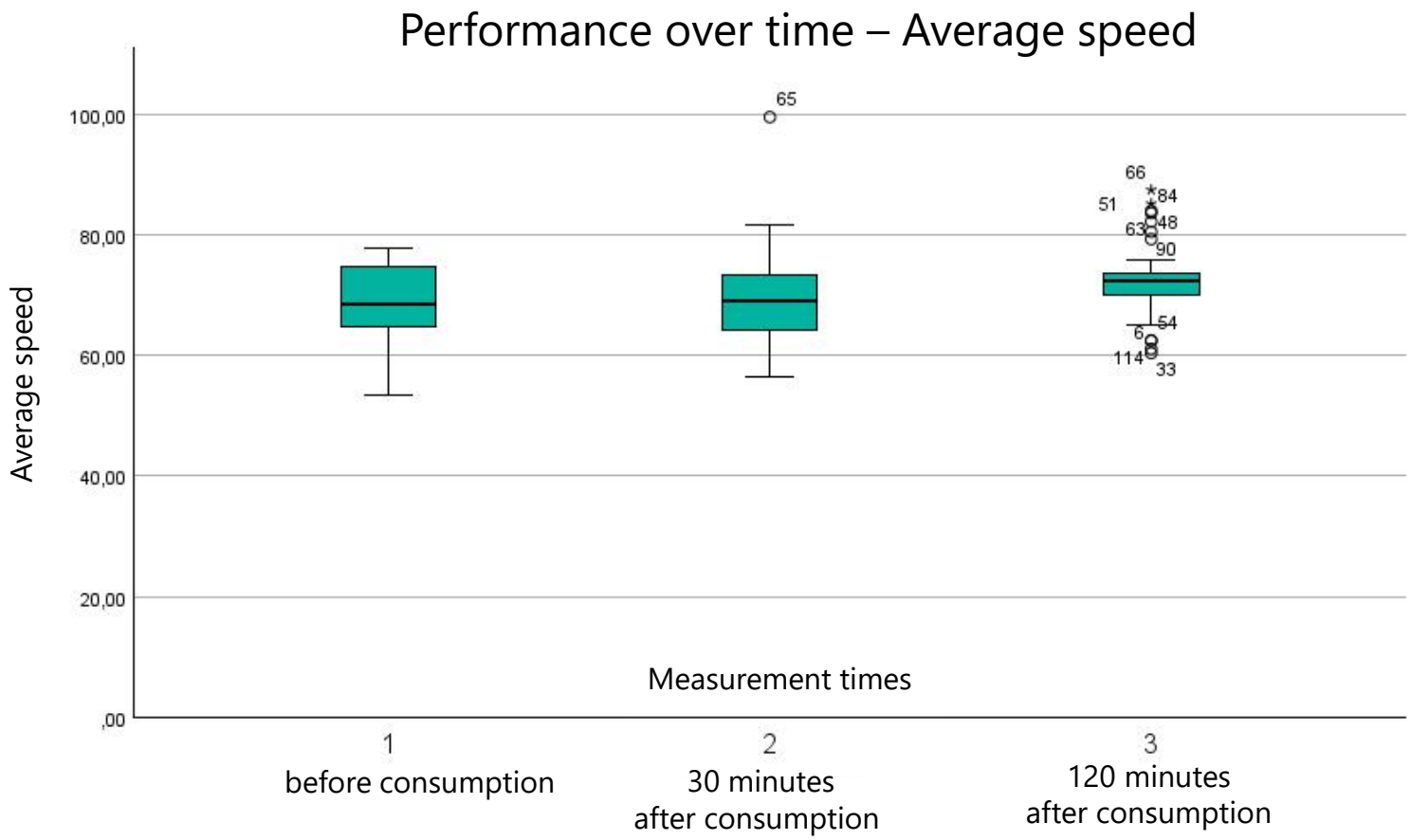
Frequency of use moderates the relationship between blood THC blood levels and subjective self-assessment of driving ability

Subjective driving ability (self-assessment)

58th CIECA CONGRESS DRESDEN 2026

04 Subjective and objective parameters of driving behavior

Results - 8



Further details:

- Speed limit: 80 km/h
- Drive 1:
  - 0 people exceeding 80 km/h
- Drive 2:
  - 3 people exceeding 80 km/h
  - 20 people drive slower than in Run 1
- Drive 3:
  - 6 people exceeding 80 km/h
  - 12 people are driving slower than in Run 1
- Very large differences between participants

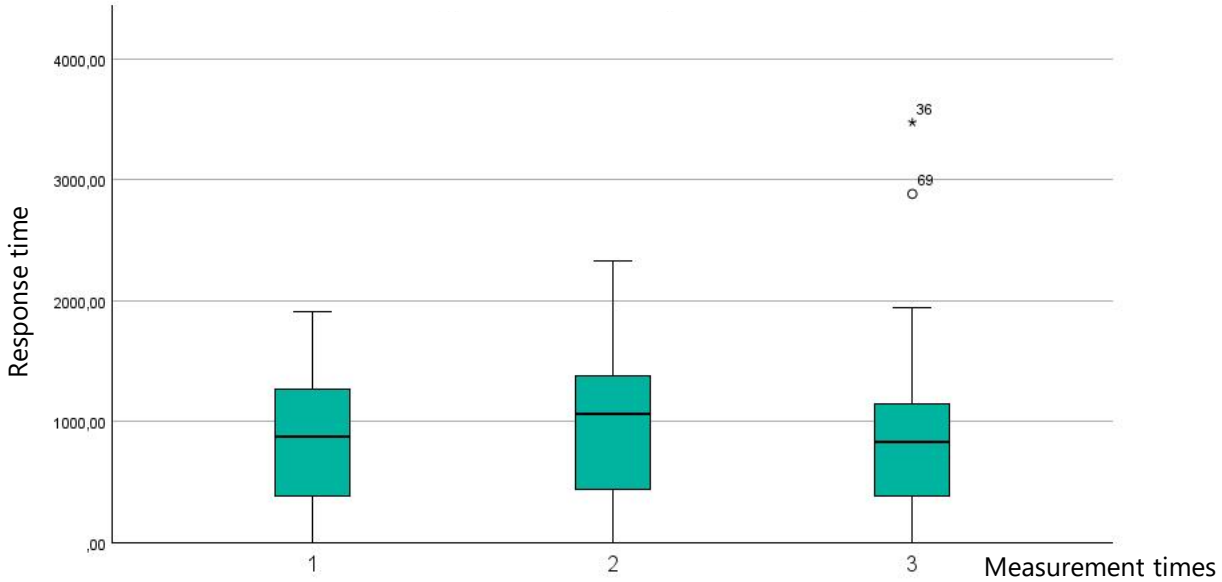
Road characteristic :

- 800 m long country road in the forest
- Narrow road without a middle strip
- Several oncoming vehicles
- No crossroads, braking, or reaction maneuvers

Results - 9

Performance Trends – Reaction Times in Two Different Traffic Situations

Reaction time trend (scenario: wild boar) over the measurement intervals



driving while sober

Drive 30 minutes after consumption

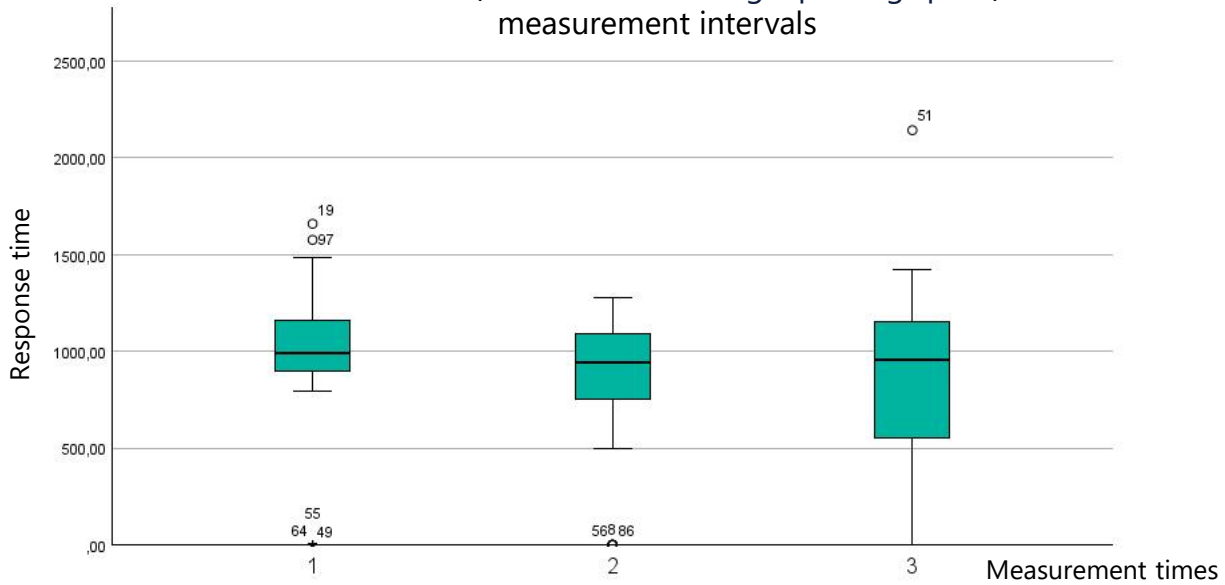
Drive 120 minutes after consumption

19 people had longer reaction times than in Drive 1

3 people showed no reaction

19 people had longer reaction times than in Drive 1

Reaction time trend (scenario: Car exiting a parking space) over the measurement intervals



driving while sober

Drive 30 minutes after consumption

Drive 120 minutes after consumption

13 people had longer reaction times than in Drive 1

1 person showed no reaction

17 people had longer reaction times than in Drive 1

Do subjective changes in self-assessment from sober to intoxicated correspond with objective changes in performance measures?

Comparison of actual and self-reported speed compliance between the first/second measurement run under cannabis influence versus driving sober in %

First Drive		Self-reported speed		
Actual speed		21.95	29.27	51.22
		2.44	46.24	48.78
		24.39	75.61	100

Second Drive		Self-reported speed		
Actual speed		19.51	51.22	70.73
		4.88	24.39	29.27
		24.39	75.61	100

Comparison of actual and self-assessed reaction time **(animal crossing)** between the first/second measurement run under cannabis influence versus driving sober in %

First Drive		Self-assessed responsiveness		
Actual respon-siveness		2.63	47.37	50.00
		10.53	39.47	50.00
		13.16	86.86	100

Second Drive		Self-assessed responsiveness		
Actual respon-siveness		9.76	43.90	53.66
		9.76	36.58	46.34
		19.52	80.48	100

Comparison of actual and self-assessed reaction time **(Sudden pulling out of a parking space)** between the first/second measurement run under cannabis influence versus driving sober in %

First Drive		Self-assessed responsiveness		
Actual respon-siveness		5.00	57.50	62.50
		7.50	30.00	37.50
		12.50	87.50	100

Second Drive		Self-assessed responsiveness		
Actual respon-siveness		14.63	43.90	58.53
		4.88	36.59	41.47
		19.51	80.49	100

58th CIECA CONGRESS
DRESDEN 2026

05 Conclusion

Summary

58th CIECA CONGRESS DRESDEN 2026

- Self-assessment of the THC level in blood serum and its comparison with legal limit is complicated and hampered
- We observe a disconnection between intoxication and the perception of impairment and driving ability = Hysteresis-Effect
- Characteristics of driving behavior resulting from intoxication are distorted by average values; Participants' self-assessment of their driving performance was only partially accurate. It depends on factors related to subjective driving competence and tolerance
- Criticism and Limitations of the study

58th CIECA CONGRESS
DRESDEN 2026

Suggestions?

Questions

Thank you!


58th CIECA
CONGRESS
DRESDEN 2026