

# The role of neurocognitive functioning in the day-level association between substance use and medication adherence among HIV-positive gay and bisexual men

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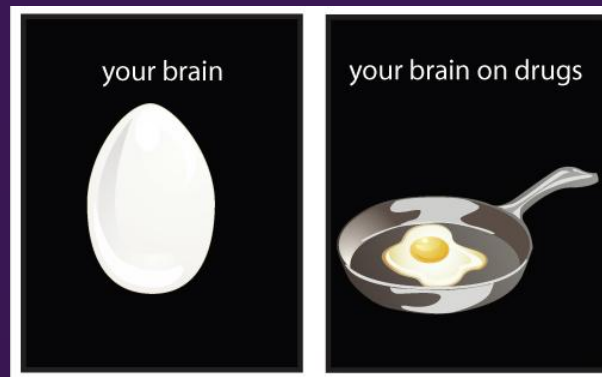
# Background

- Adherence to ART is critical both to the health of HIV-positive individuals and reduced transmission to HIV-negative sex partners (i.e., TasP)
- Substance use has been shown to be associated with poorer adherence to ART regimens
- Deficits in executive function and decision making have also been shown to reduce adherence to ART



# Background (cont'd)

- Recent work has begun to look at the interaction of neurocognitive functioning and substance use on adherence
  - Thaler et al. (2015) found that individuals with neurocognitive deficits and substance use disorder had the poorest adherence
- Less work has been conducted examining the daily co-occurrence of daily substance use and ART non-adherence and how neurocognitive functioning may impact this association



# Aims

1. Examine performance on the Iowa Gambling Task (IGT) among a sample of methamphetamine-using GBM with HIV
  - a. Can growth curves be used to model performance over time and how does average performance look for this sample?
2. Examine the association between IGT performance, substance use, and daily medication non-adherence
  - a. Are there main effects of individual-level IGT performance and daily substance use on non-adherence and do they interact?

# Method

# *ACE: Intervention Targeting Medication Adherence and Methamphetamine Use for HIV+ MSM*



Principal Investigator:	Jeffrey T. Parsons, PhD
Co-Investigator:	Sarit Golub, PhD
Project Director:	Julia Tomassilli, PhD
Clinical Supervisor:	John Pachankis, PhD
Education Supervisor:	Jose Nanin, EdD
Neuropsych Coordinator:	William Kowalczyk, PhD
Senior Data Analyst:	Tyrel Starks, PhD
Recruitment Director:	Kevin Robin
Graphic Designer:	Chris Hietikko, MFA

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# Participants & Procedures

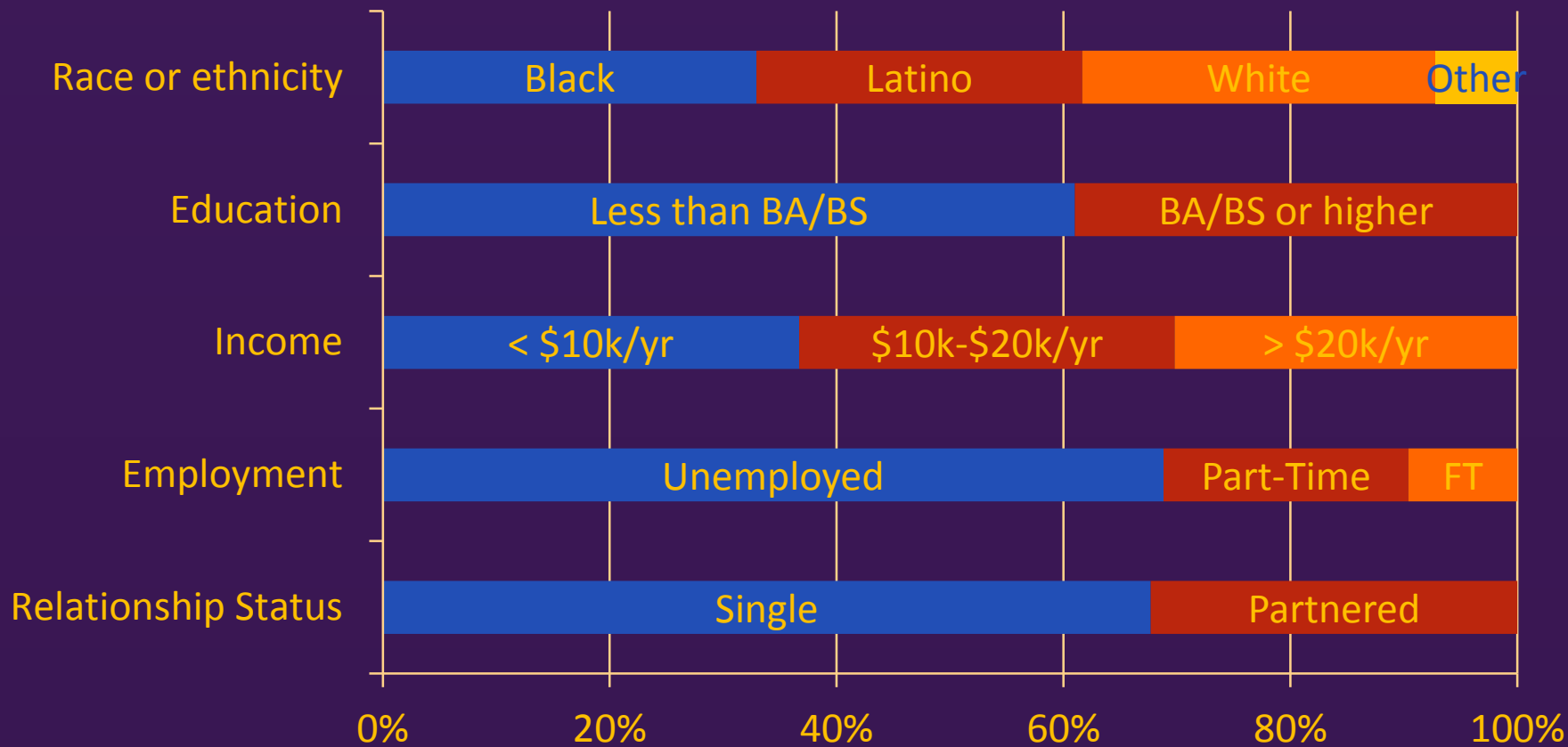
- 210 HIV-positive GBM who use meth and have problems with adherence
  - Verified HIV-positive
  - At least 3 days of medication non-adherence in past 30 days
  - At least 3 days of methamphetamine use in past 90 days (1 in 30 days)
- Multi-component RCT of a behavioral intervention with visits every 3 months for one year (i.e., BL, 3M, 6M, 9M, 12M)
  - ACASI measures
  - Timeline follow-back (TLFB) interview
  - Structured clinical interview
  - Neurocognitive testing ( $n = 168$ )
  - Blood sample (CD4+ and viral load)
  - Intervention or education sessions

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# Participant Demographics (N = 168)



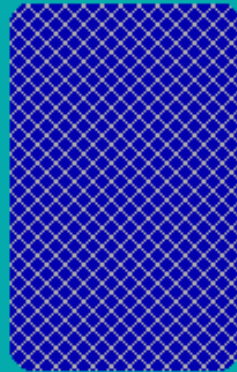
Mean age = 40.7 (range: 24 – 63)



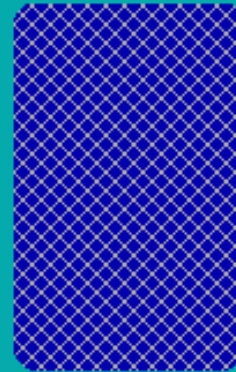
*WIN \$120!*



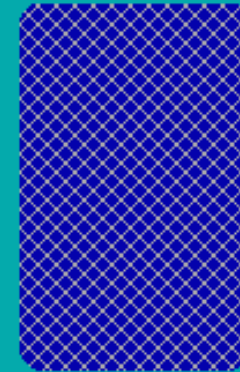
A'



B'



C'



D'

# Iowa Gambling Task (computerized)

Four decks to choose from (total of 100 draws)

**“I’m going to give you a \$2000 credit to start the game”**

**“The goal of the game is to win as much as possible, and if you can’t win, avoid losing money as much as possible.”**

**“Some decks are worse than the others. You may find all of them bad, but some are worse than the others. No matter how much you find yourself losing, you can still win if you stay away from the worst decks”**

Deck A

1. Win \$100
2. Win \$120
3. Win \$80,  
*Lose \$150*
4. Win \$90
5. Win \$110,  
*Lose \$300*
6. Win \$100
7. Win \$80,  
*Lose \$200*
8. Win \$120
9. Win \$110,  
*Lose \$250*
10. Win \$90,  
*Lose \$350*

**Total: \$1,750**Deck B

1. Win \$100
2. Win \$80
3. Win \$110
4. Win \$120
5. Win \$90
6. Win \$100
7. Win \$90
8. Win \$120
9. Win \$110,  
*Lose \$1,250*
10. Win \$80

**Total: \$1,750**Deck C

1. Win \$50
2. Win \$60
3. Win \$40,  
*Lose \$50*
4. Win \$55
5. Win \$55,  
*Lose \$50*
6. Win \$45
7. Win \$50,  
*Lose \$50*
8. Win \$45
9. Win \$60,  
*Lose \$50*
10. Win \$40,  
*Lose \$50*

**Total: \$2,250**Deck D

1. Win \$50
2. Win \$40
3. Win \$45
4. Win \$45
5. Win \$55
6. Win \$60
7. Win \$40
8. Win \$55
9. Win \$50
10. Win \$60,  
*Lose \$250*

**Total: \$2,250**

# Iowa Gambling Task Scoring

- Data are split into 5 trials of 20 card selections each
  - Scores calculated by subtracting the number of “bad” deck selections (A and B) from the number of “good” deck selections (C and D)
- Initial trial is thought to be the result of random guessing and “getting to know” the decks
- In subsequent trials, the typical individual’s score should increase consistently
  - Implicit preference is developed for the “good” decks

# Aim 1:

## Using latent growth curves to estimate performance on the IGT

# Aim 1 Analytic Procedures

- Utilized *Mplus* version 7.31 to conduct latent growth curve analysis of the IGT trials (1-5) examining 3 models:
  - LGC with intercept and linear slope
  - LGC with intercept, linear slope, and quadratic slope
  - LGC with intercept and free slope (i.e., pattern estimated)
- Output factor scores for the best-fitting model

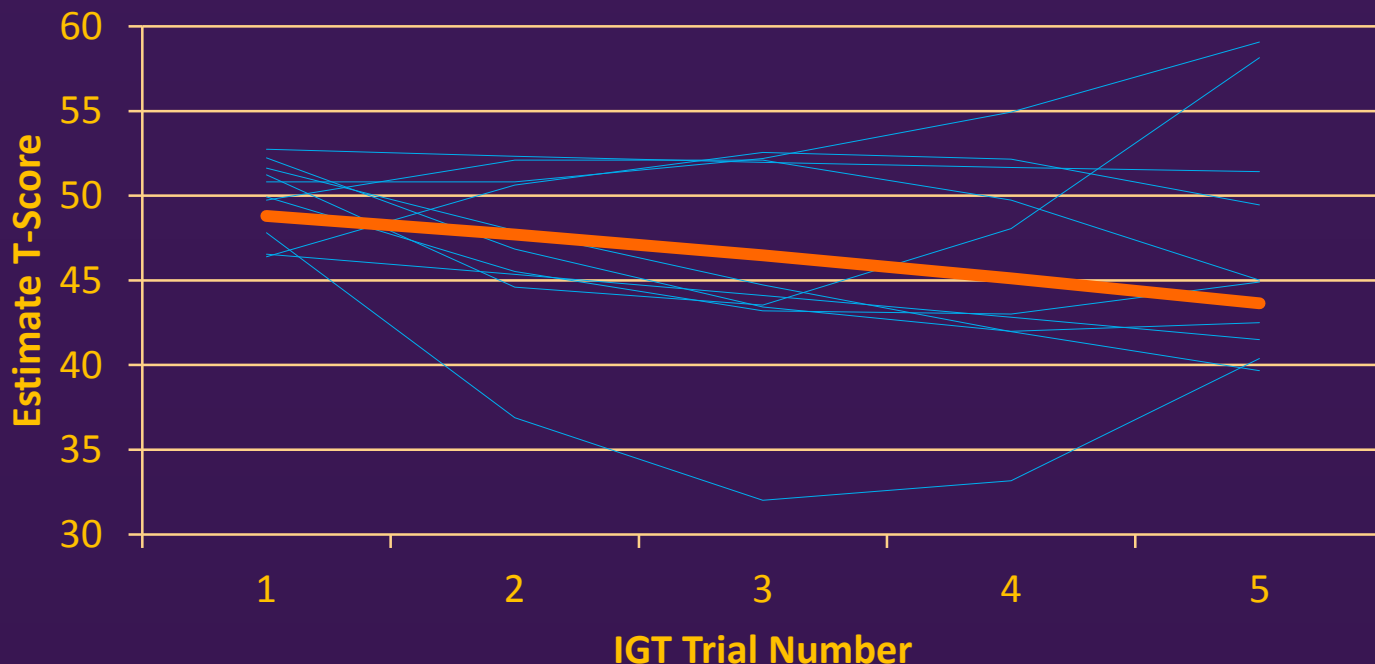
# Aim 1 Results: Comparing Models

	Model 1: Linear	Model 2: Quadratic	Model 3: Free
Chi-square <i>p</i> -value ( <i>ns</i> )	0.01	0.37	< 0.001
RMSEA (< 0.08)	0.09	0.02	0.13
CFI (> 0.95)	0.75	0.99	0.59
TLI (> 0.95)	0.75	0.99	0.42
SRMR (< 0.06)	0.09	0.04	0.07



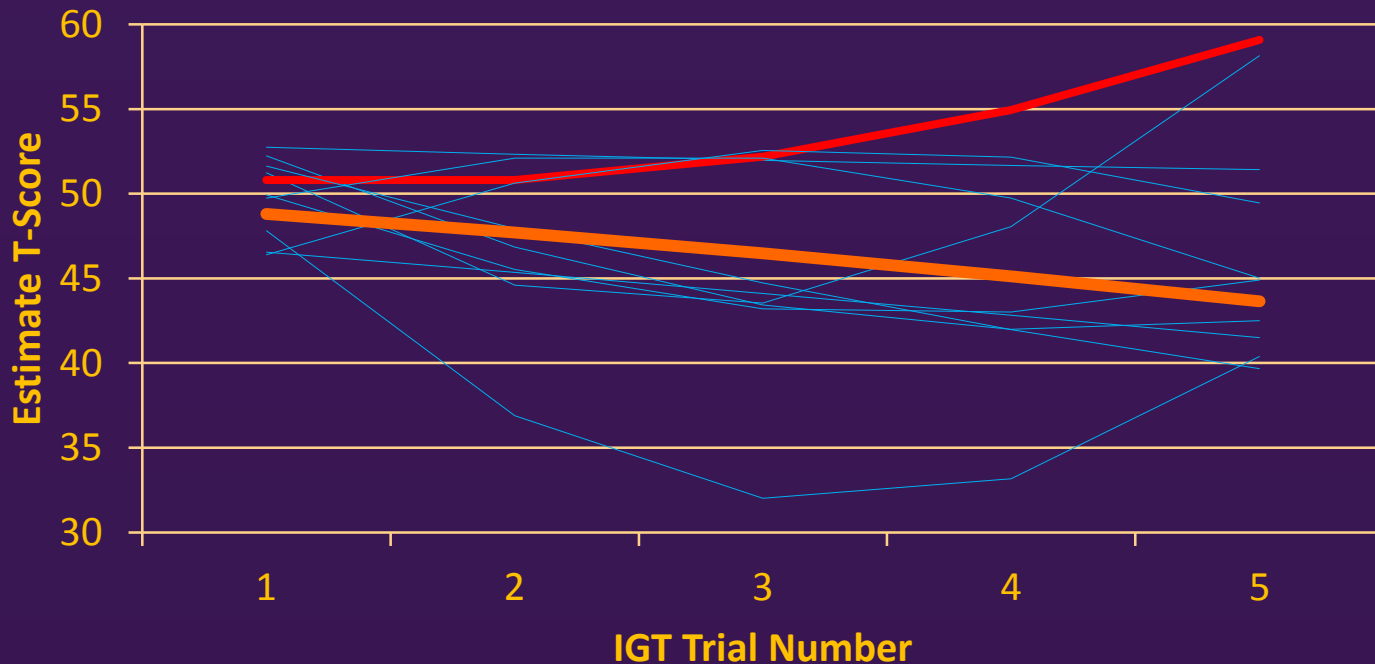
# Aim 1 Results: Average Performance

- Average Intercept = 48.8 ( $p < 0.001$ ), Variance = 60.1 (*ns*)
- Average Linear Slope = -1.1 (*ns*), Variance = 88.5 ( $p = 0.002$ )
- Average Quadratic Slope = -0.1 (*ns*), Variance = 4.8 ( $p < 0.001$ )



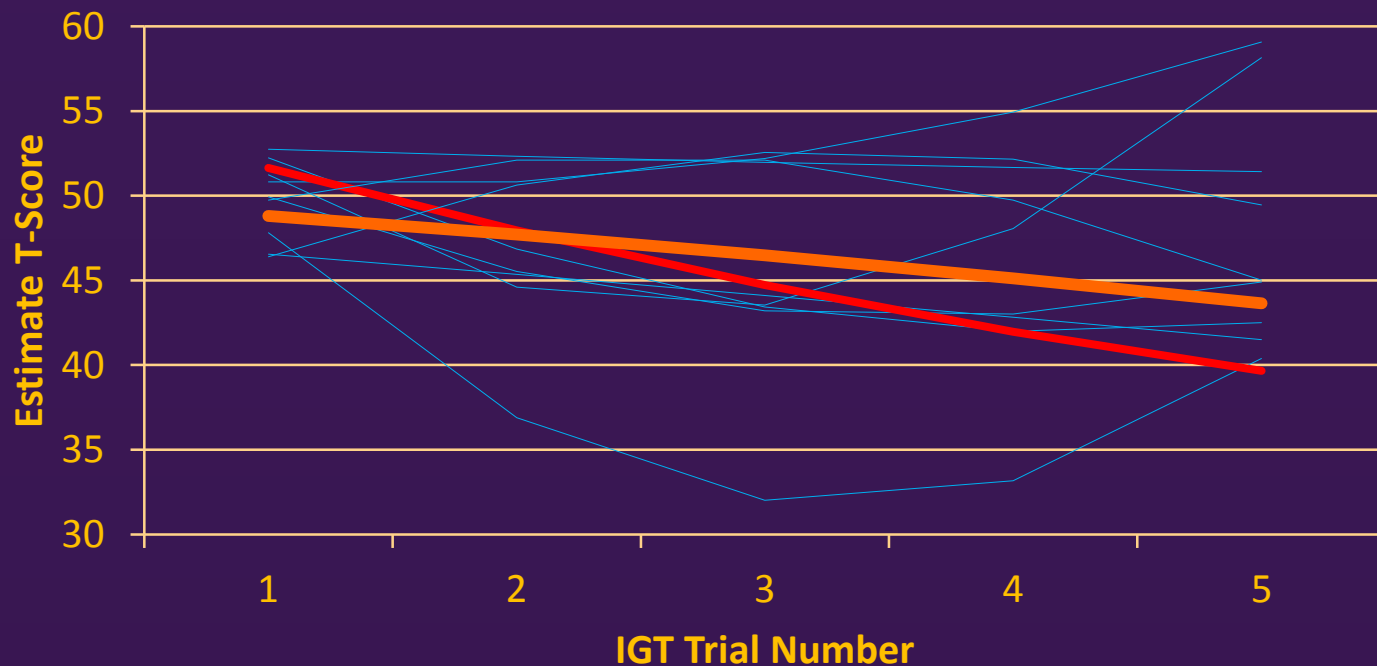
# Aim 1 Results: Average Performance

- Average Intercept = 48.81, Variance = 59.83 (*ns*)
- Average Linear Slope = -1.04, Variance = 87.81 ( $p = 0.002$ )
- Average Quadratic Slope = -0.06, Variance = 4.71 ( $p < 0.001$ )



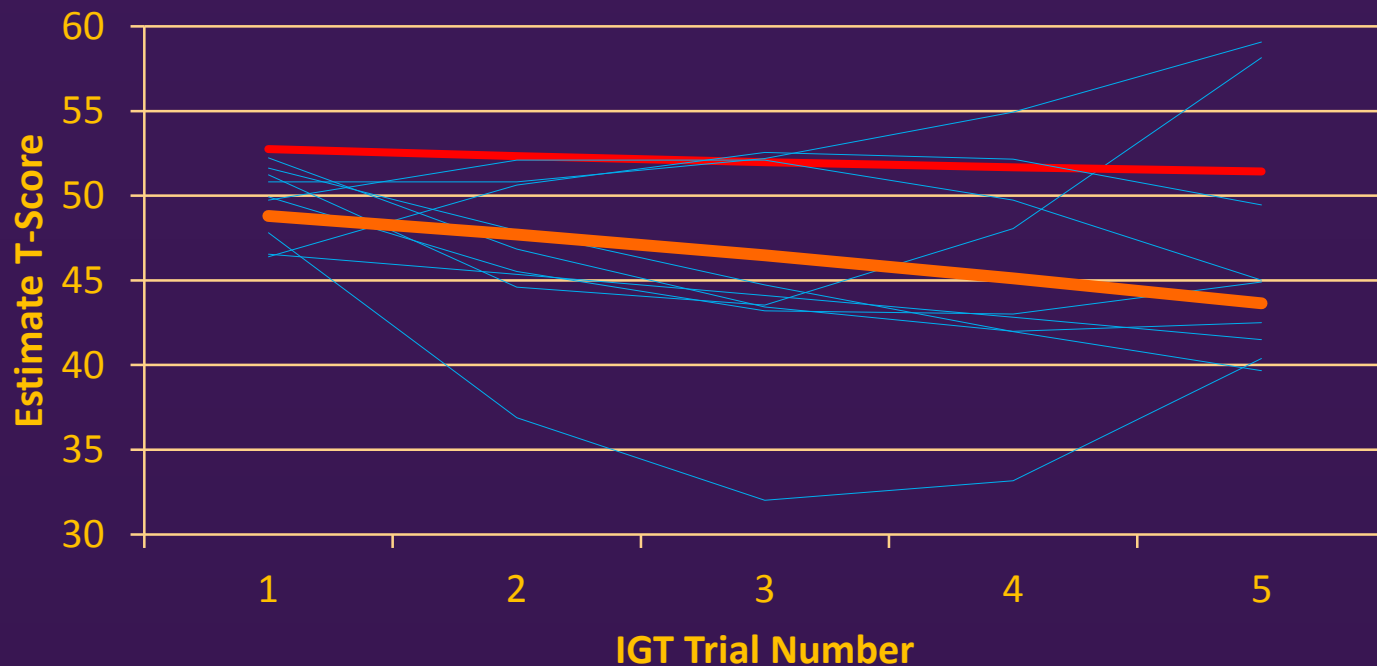
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**Aim 2:**  
**Examining the association of IGT  
performance with medication non-  
adherence**

# Aim 2 Analytic Procedures

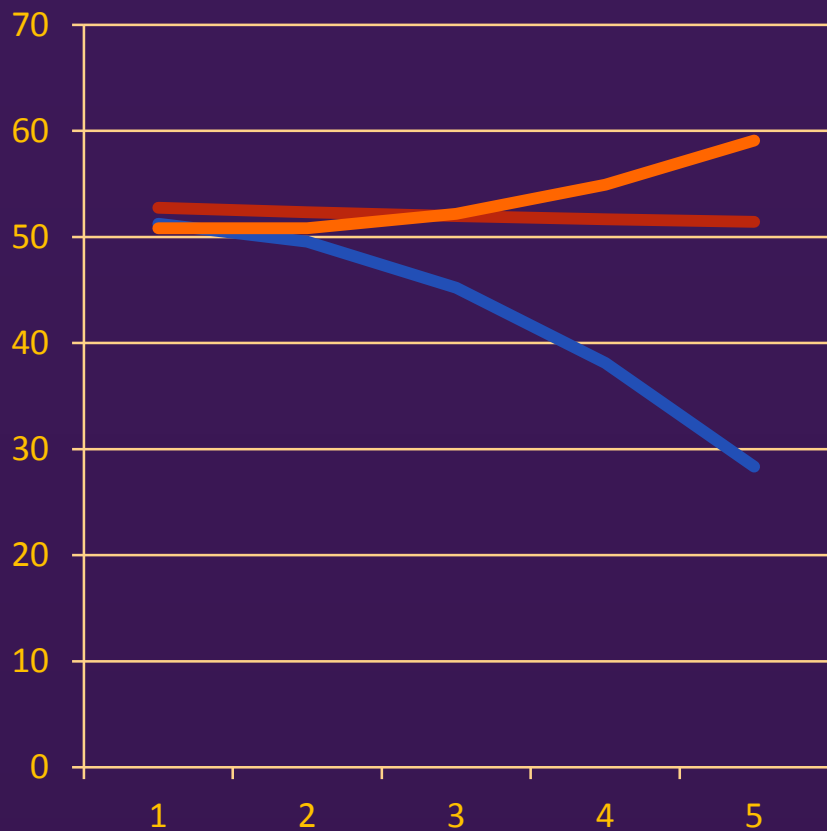
- Conducted multilevel models utilizing TLFB days (level 1) nested within individuals (level 2) in SPSS 22
  - 2352 days' worth of data
  - AR(1) structure for the repeated measures
- Outcome variable was dichotomous (non-adherence = 1, adherence = 0) and modeled using a logit link
  - Level 1 (day-level) predictors: heavy drinking (y/n), marijuana use (y/n), club drug use (y/n)
    - Club drugs = cocaine/crack, ecstasy, ketamine, GHB, and methamphetamine
  - Level 2 (individual-level) predictors: white race (vs. non-white), IGT intercept, IGT linear slope, IGT quadratic slope
  - Cross-level interactions: IGT quadratic slope with each substance use variable

# Aim 2 Results: Model Parameters

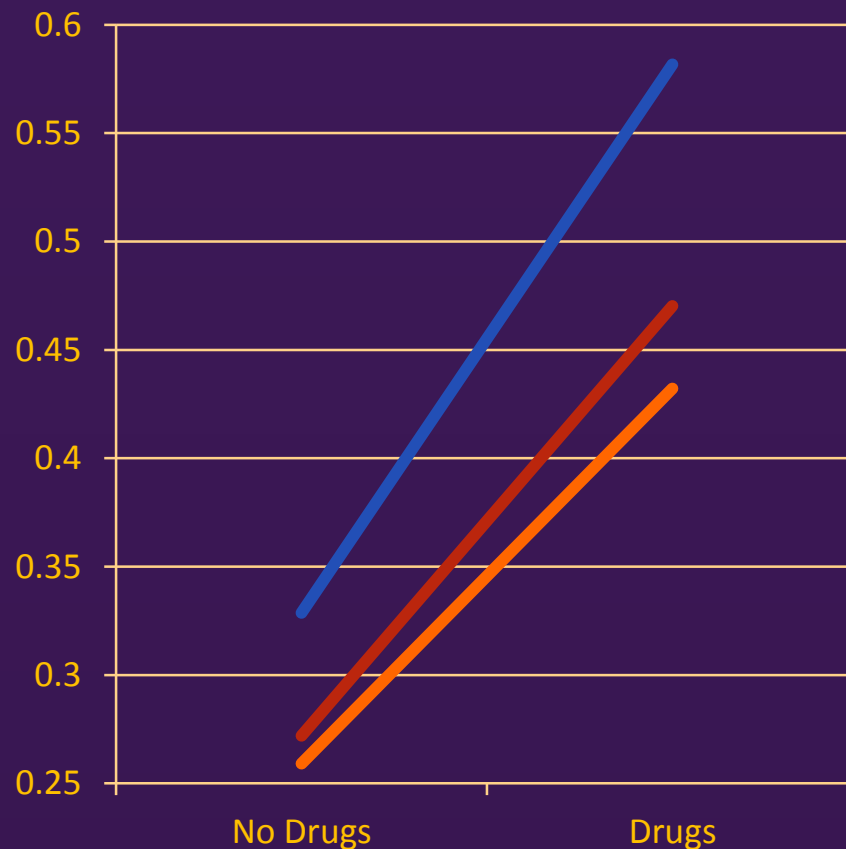
	<b>B</b>	<b>S.E.</b>	<b>AOR</b>
<b>Level 1 effects of substance use</b>			
Heavy drinking	0.85	0.15	2.33***
Marijuana	0.11	0.13	1.11
Club drugs	0.87	0.10	2.38***
<b>Level 2 effects of IGT performance</b>			
Intercept	-0.02	0.02	0.98
Linear slope	-0.03	0.04	0.97
Quadratic slope	-0.17	0.14	0.84
<b>Cross-level interactions</b>			
Heavy drinking × IGT quadratic	0.01	0.09	1.01
Marijuana × IGT quadratic	-0.04	0.08	0.96
Club drugs × IGT quadratic	-0.13	0.06	0.88*

# Aim 2 Results: Interaction Plot

## IGT Performance



## Probability of Daily Non-Adherence





# Discussion

# Summary of findings

- A quadratic trend was the best fit to IGT performance over the course of the task
  - Non-significant variation in intercepts, but significant variation in linear and quadratic slopes
- Average IGT performance worsened across trials in this sample
  - A majority of participants would meet criteria for impairment



# Summary of findings (cont'd)

- Daily heavy drinking (5+ drinks) and club drug use were associated with greater odds of non-adherence on that day
- There was no main effect of IGT performance on adherence
- For those with worse performance on the IGT, daily club drug use was more strongly associated with non-adherence on that day



# Limitations

- Sample was selected for meth use and adherence difficulties
  - Different patterns may emerge when examining a less specific population
- Substance use and adherence were self-reported and collected retrospectively
- Only one neurocognitive task was utilized and findings may result from one or several potential deficits



# Implications & Conclusions

- Daily substance use—particularly club drugs—undermines individuals' adherence
- Decision making deficits did not appear to directly influence adherence behaviors
- Rather, difficulties with decision making may further sensitize the brain to the negative effects of drug use
- Assessing neurocognitive functioning using brief, mobile assessments may provide novel information to inform treatment
  - Particularly important for HIV-positive substance users

# Acknowledgements

- The entire team of CHEST staff, interns, volunteers, and recruiters, with special thanks to Tyrel Starks, Bill Kowalczyk, Chloe Mirzayi, and Anita Viswanath
- National Institute on Drug Abuse
  - Intervention targeting medication adherence and methamphetamine use for HIV+ men (R01-DA023395; PI: Parsons; PO: Shoshana Kahana)
  - Developing a mobile emotion regulation intervention for HIV-positive men (K01-DA039030; PI: Rendina; PO: Will Aklin)
- Our participants who volunteered their time



# Thank you!

For further questions or a copy of these slides, please email me:

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