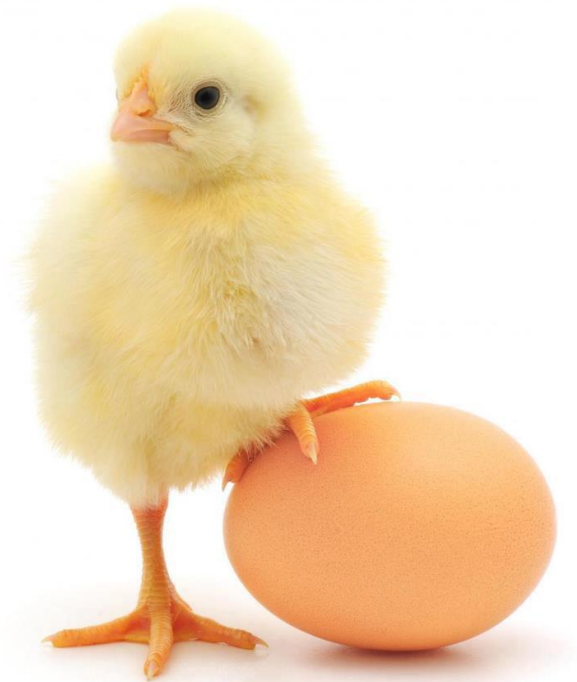


# **Impulsivity and altered reward processing as vulnerabilities for gambling disorder: A study in unaffected siblings**

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# Declaration of interests

*Funding sources:* The research leading to these results received funding from the **Medical Research Council** and support from the **National Institute for Health Research** Imperial Biomedical Research Centre. The National Problem Gambling Clinic receives some of its funding from the **Responsible Gambling Trust**.

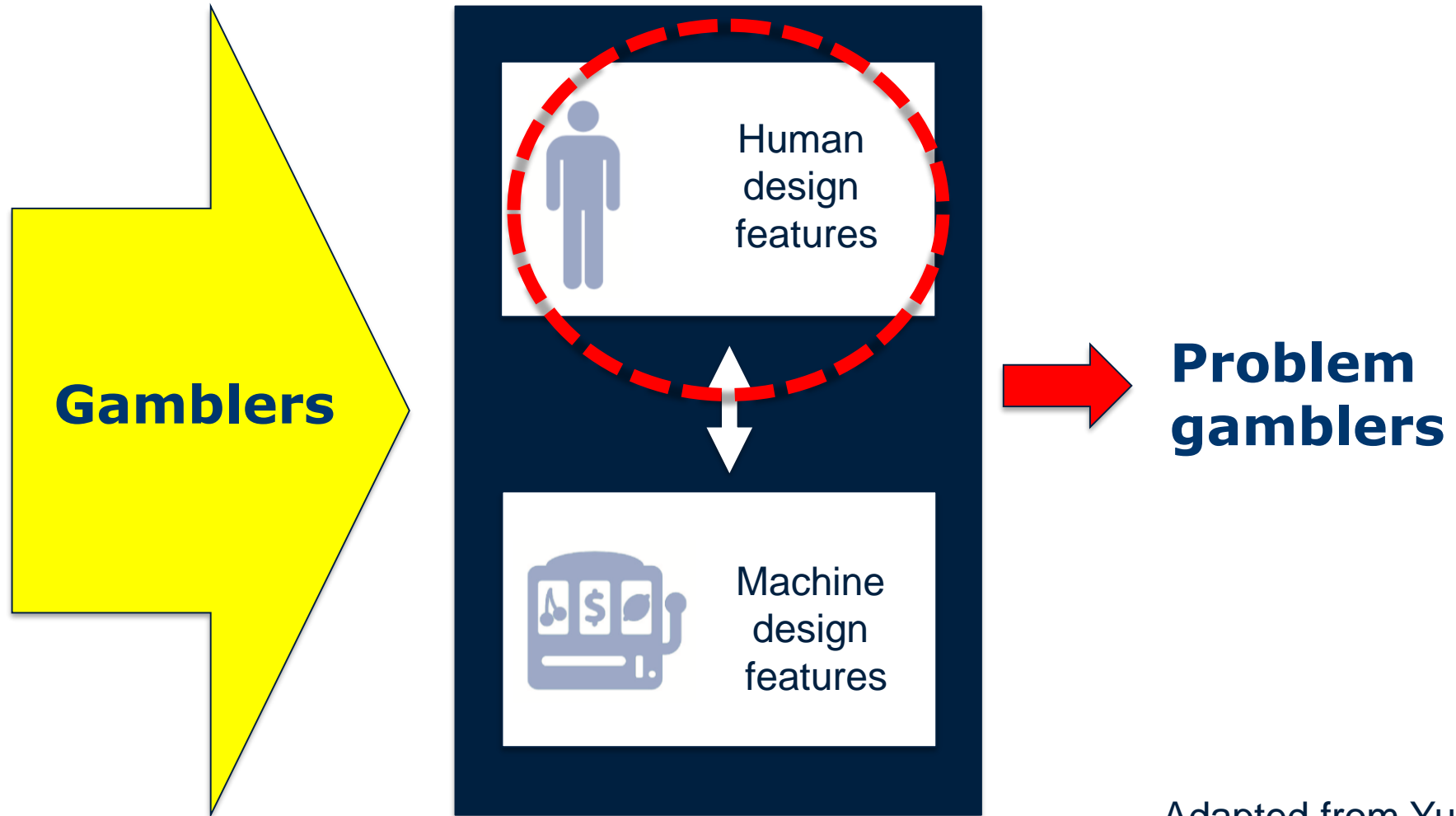
I am a postdoctoral research fellow at The Centre for Gambling Research at UBC. The centre is funded by the **Province of British Columbia** and the **British Columbia Lottery Corporation**, a crown corporation. My current work is funded by **Natural Sciences and Engineering Research Council** (Canada).

I have received a speaker honorarium from the **Massachusetts Council on Compulsive Gambling** (USA) and accepted travel/accommodation for speaking engagements from the **National Council for Problem Gambling** (USA) and the. **4<sup>th</sup> International Multidisciplinary symposium in gambling addiction**. I have not received any other direct or indirect payments from the gambling industry or any other groups substantially funded by gambling to conduct research or to speak at conferences or events.

*Conflicts of interest:* I have no other conflicts of interest to declare.

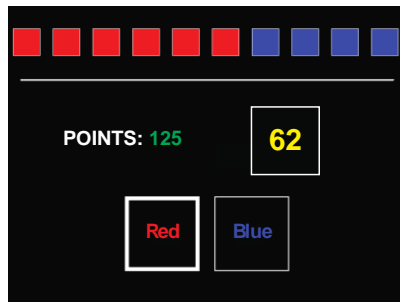
*Constraints on publishing:* No constraints on publishing have been imposed.

# Understanding problem gambling

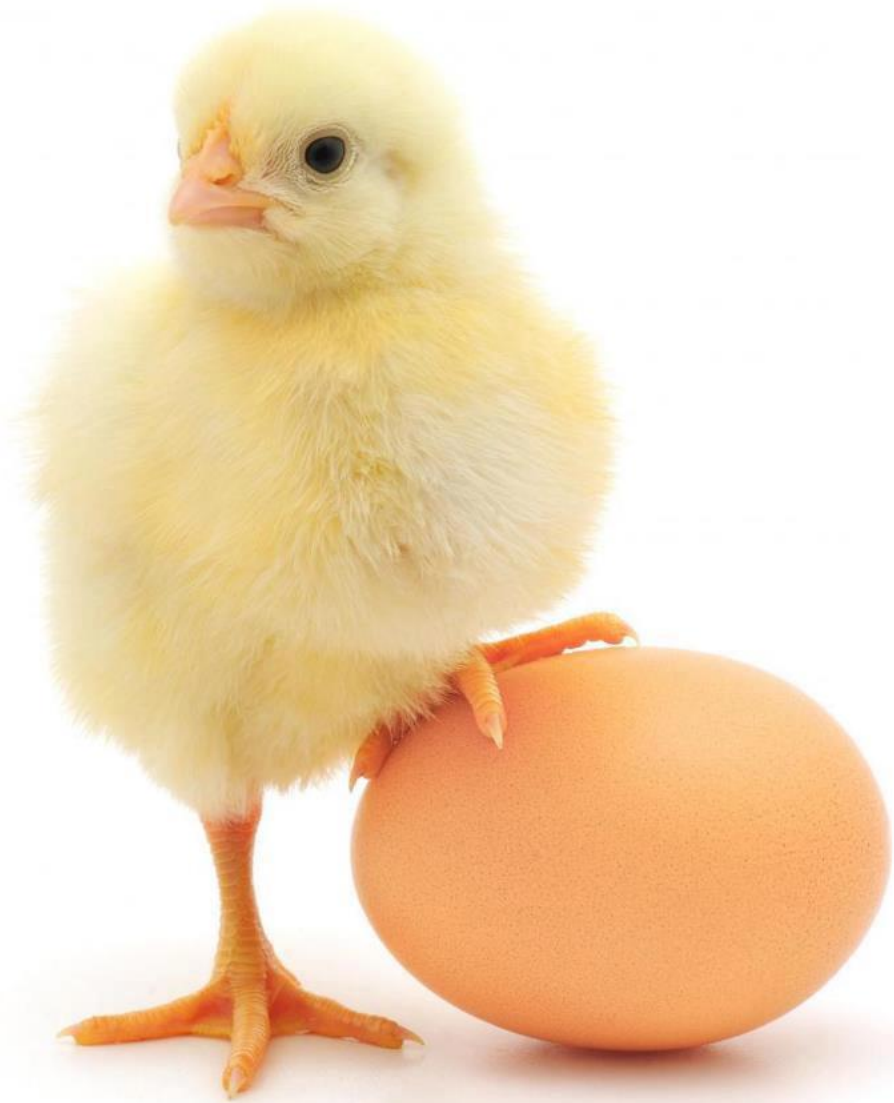


Adapted from Yucel et al. (2018)

# Vulnerabilities for gambling disorder?

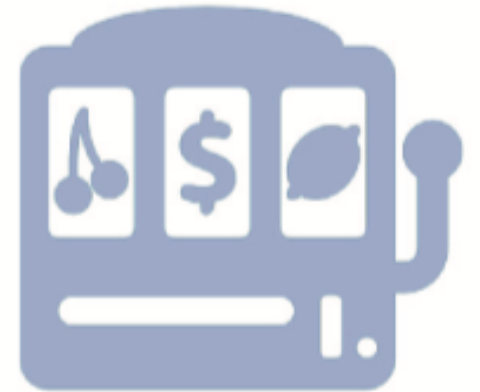


- Increased impulsivity
  - UPPS-P
- Increased Risky decision-making
  - Cambridge gambling task
- Reduced neural response to wins
  - fMRI of a slot machine simulation

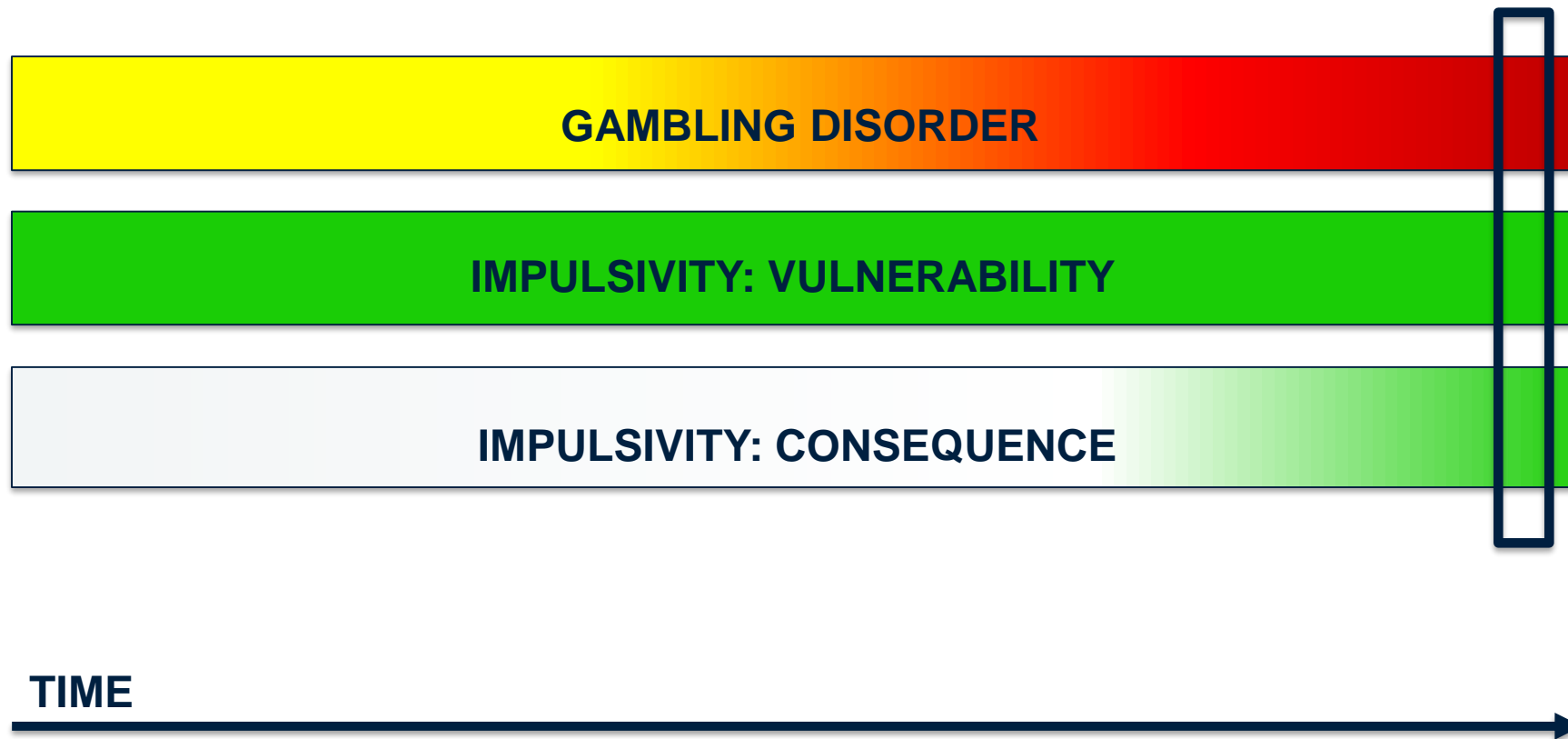


# Why is this an important question?

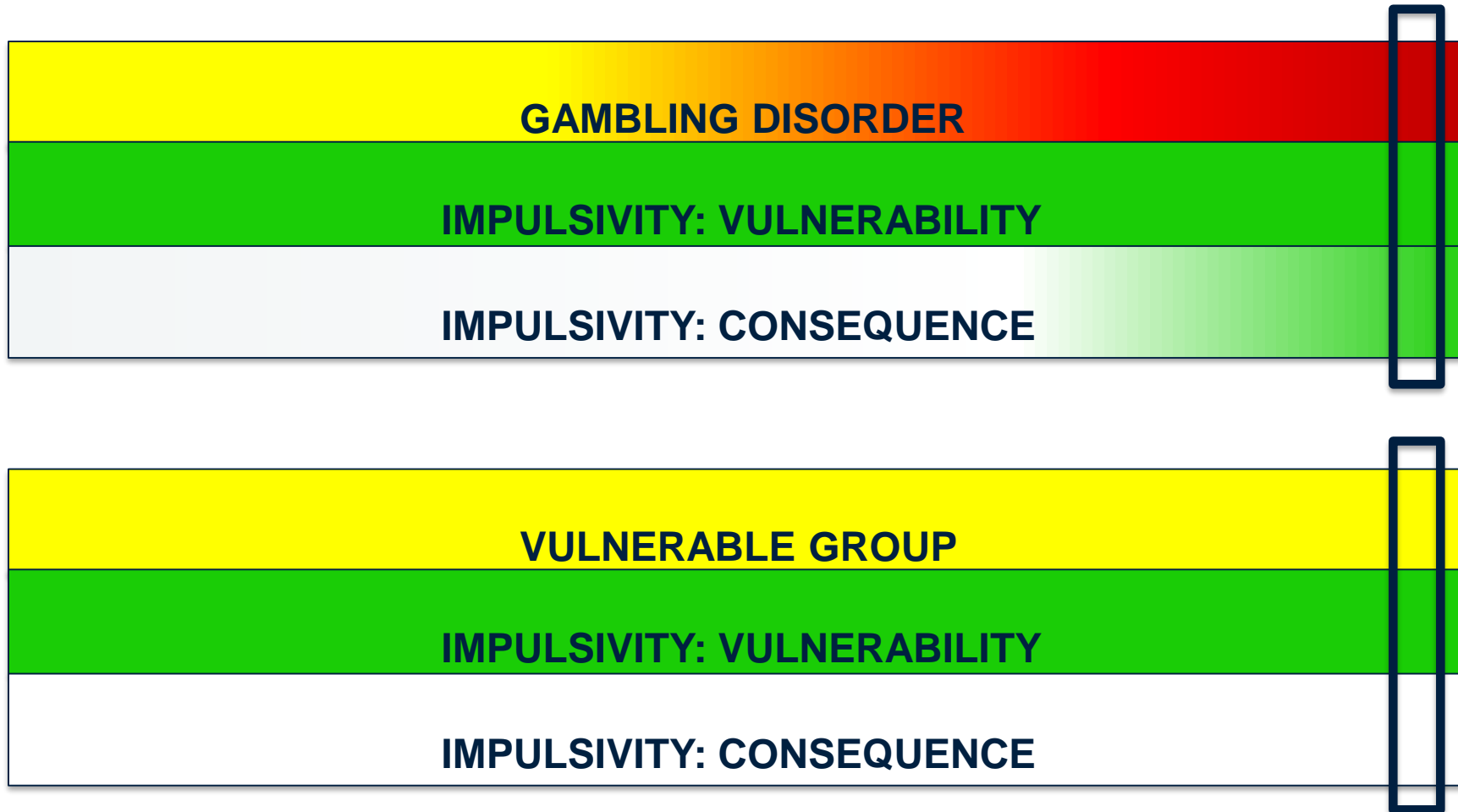
- Characterize the development of gambling disorder
- Identify risk-factors for the development of gambling disorder – help prevention
- May inform research on ‘machine design features’ to identify those features that may be harmful to vulnerable populations



# Cross-sectional studies



# An alternative design





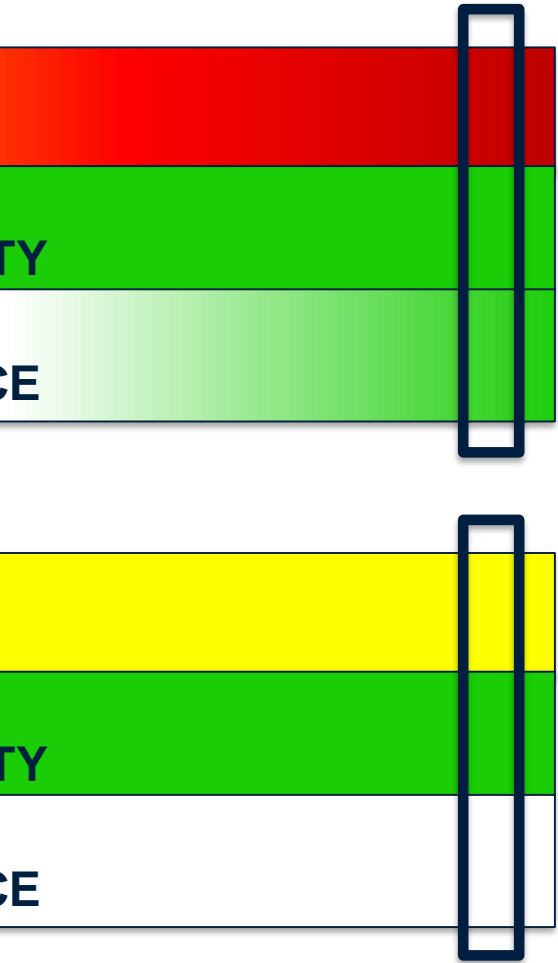
# A vulnerable group?

- Gambling disorder has a genetic component
  - Heritability = 50-60% (Lobo and Kennedy – 2009)
- First degree relatives of those with gambling disorder are at a higher risk of developing a gambling problem
  - 8.3% vs. 0.7% (Mann et al. – 2017)



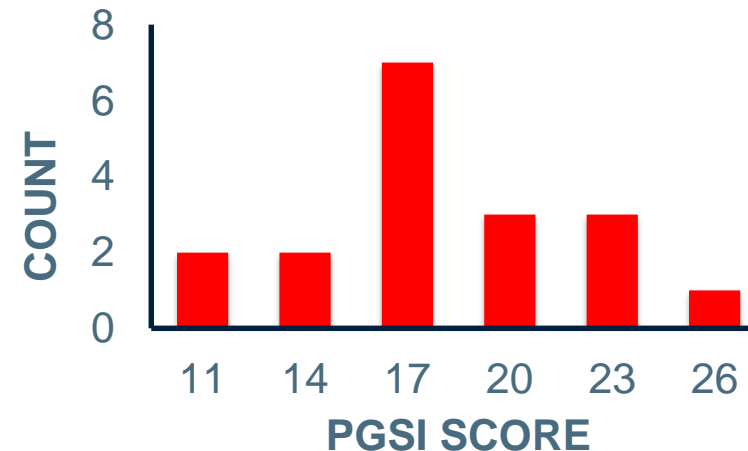
# Our question

- Do unaffected siblings show the same neurocognitive profile as patients with gambling disorder?



# Gambling disorder participants

- CNWL Problem Gambling Clinic
  - Central London location
  - Within month of starting treatment
- Met DSM 5 criteria for gambling disorder
- Scored 8 or higher on the Problem Gambling Severity Index
- All male
- Mean age = 28.5 years



# Sibling participants

- No current or past gambling problem
- Had a brother or sister with a current gambling problem
  - Confirmed by telephone (PGSI of 8+)

**Do you have a brother or sister who has a gambling problem?**



If so, we are looking for people like you to take part in a brain imaging experiment in London

phone: *[contact telephone number]*

email: *[contact email address]*

We are looking for siblings of gamblers to take part in an experiment investigating gambling and addictions. You need to be aged 20-60 and fluent in English. We will reimburse you for your time and travel expenses.

**Contact *[contactname]* (details above) for more information.**



# Study design

**18 patients with  
gambling disorder**

**VS.**

**17 matched controls**

**Matched:**

Age, Alcohol use  
Smoking status, IQ

**Gamblers scored higher:**

Beck depression inventory  
Beck anxiety inventory

**15 unaffected  
siblings**

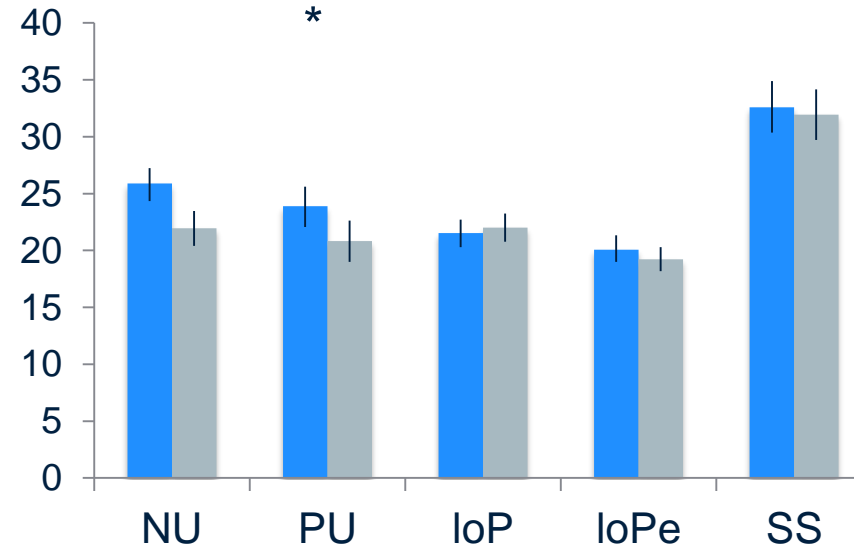
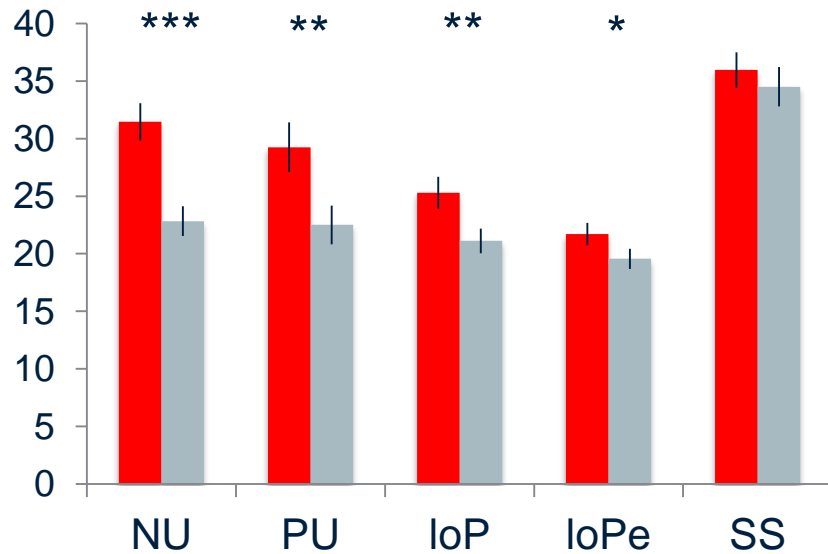
**VS.**

**16 matched controls**

# Impulsivity: UPPS-P

**GAMBLERS** vs. CONTROLS

**SIBLINGS** vs. CONTROLS



NU = Negative urgency  
PU = Positive urgency  
loP = Lack of premeditation  
loPe = Lack of perseverance  
SS = Sensation seeking

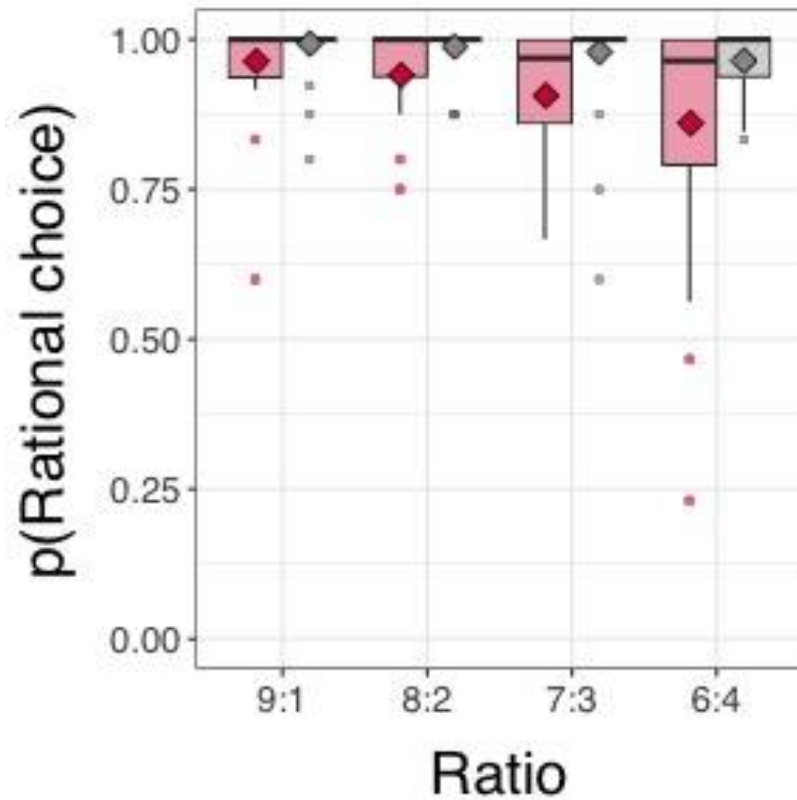
# Cambridge gambling task

- Cambridge Gambling Task
  - *Which* box (red or blue) hides the yellow token?
  - *How much* would you like to bet?

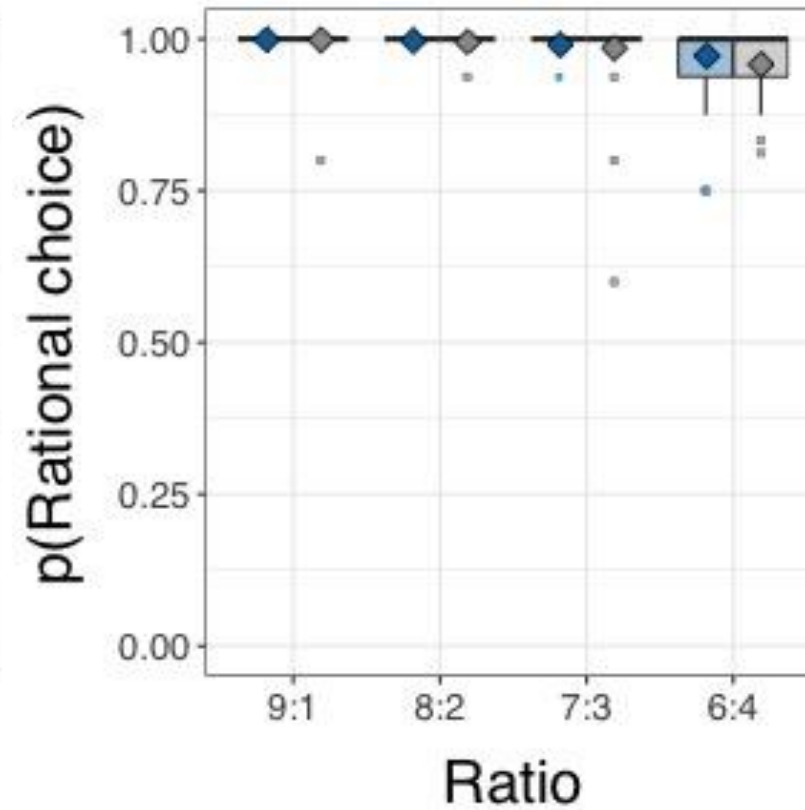


# Which colour?

**GAMBLERS** vs. CONTROLS



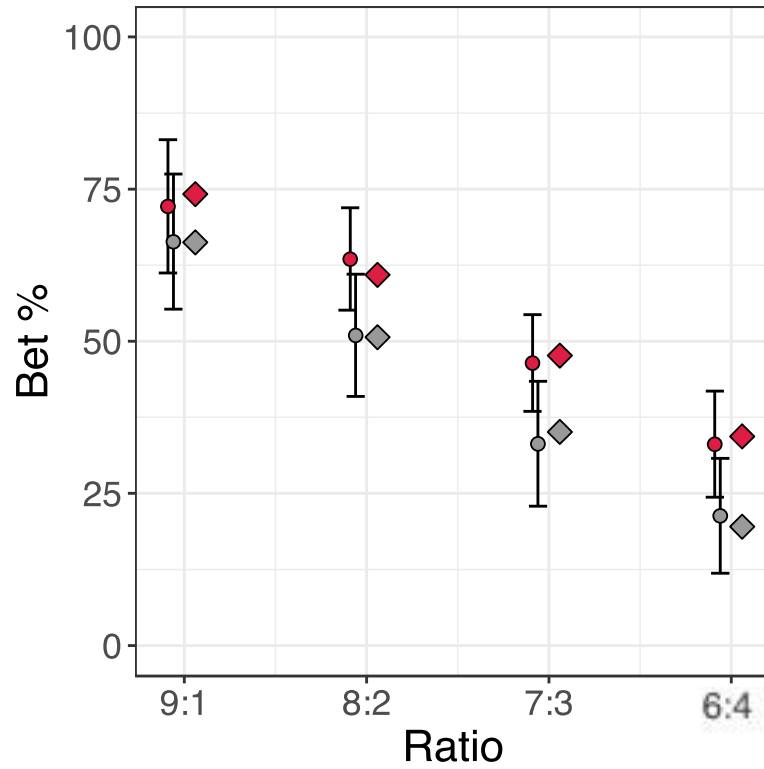
**SIBLINGS** vs. CONTROLS



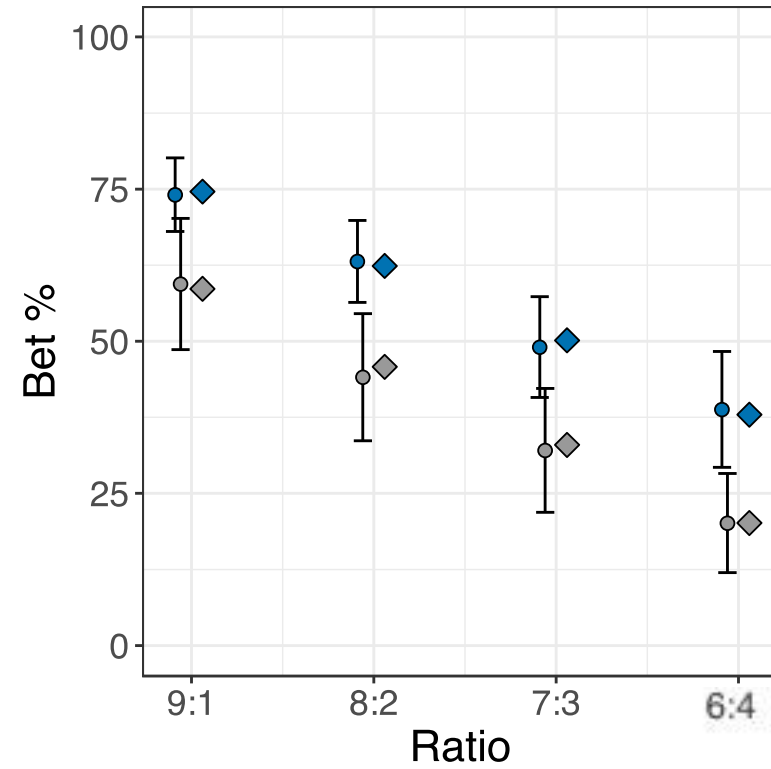


# How much?

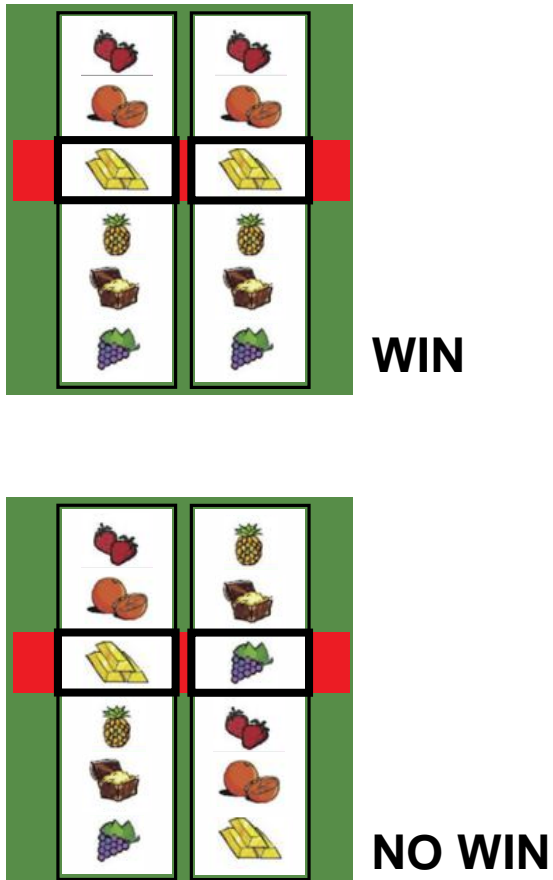
**GAMBLERS** vs. CONTROLS



**SIBLINGS** vs. CONTROLS



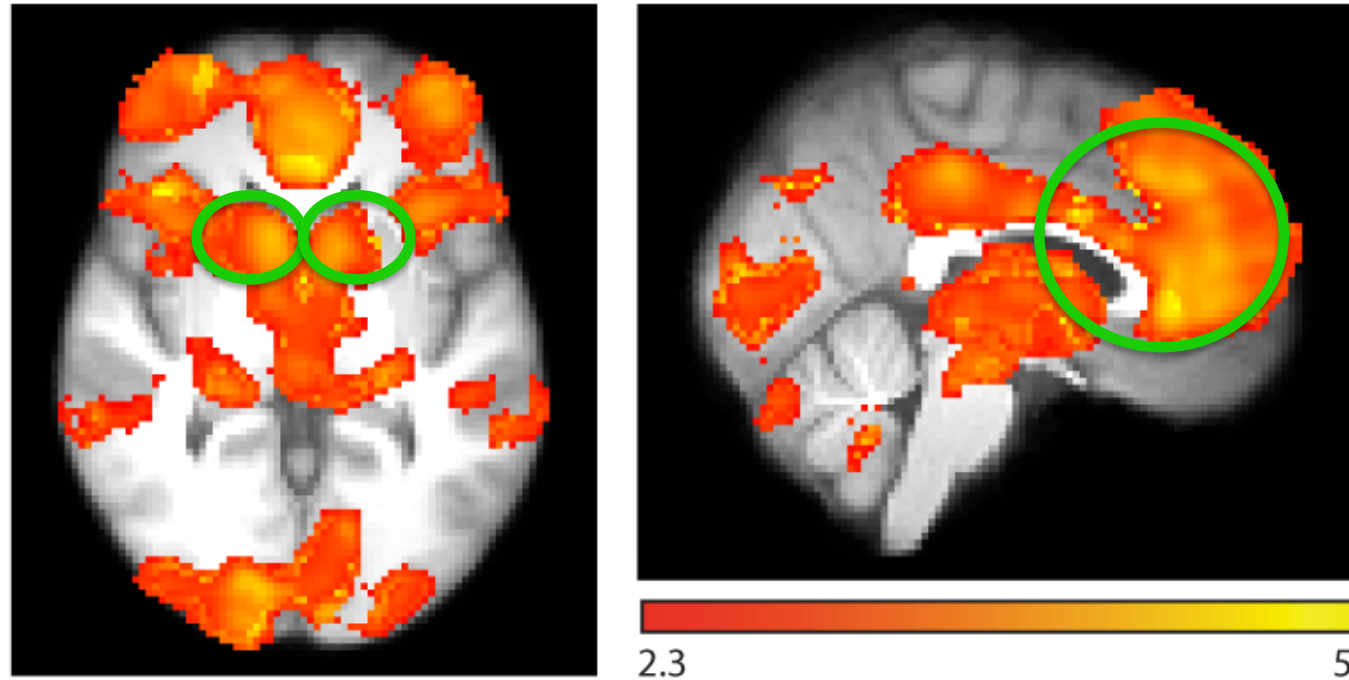
# Neural response to rewards



## Slot machine task

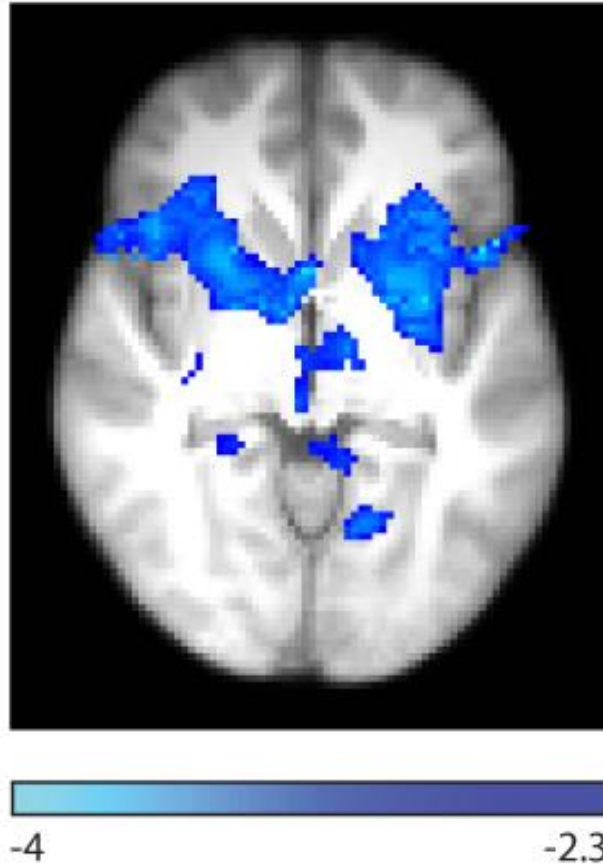
- Functional MRI
- Unpredictable wins in 1/6 of trials
- 5/6 trials do not result in a win

# Win related activity



**WIN  $\gt$  No WIN in Gamblers**

# Win related activity



**Gamblers:** Negative correlation with gambling severity

# Results summary

- Impulsivity
  - Increased in **gamblers** and **siblings**
- Cambridge gambling task
  - Bet increased in **gamblers** and **siblings**
  - Rational decision decreased in **gamblers** but **NOT** in **siblings**
- Neural response to wins
  - No group differences in **gamblers** or **siblings**
  - Correlation between PGSI and win response in **gamblers**

# Conclusions

- We have identified several differences between patients with gambling disorder and controls that are likely to represent a vulnerability for the development of gambling disorder.
- These differences are related to financial decision making, planning for the future during heightened emotions, and not in how the brain processes the receipt of rewards
- **NEXT STEP:** looking at decision making in the brain?

# Acknowledgements



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# Group characteristics – sibling study

	<b>GD</b>	<b>Control s</b>		<b>Siblings</b>	<b>Controls</b>	
<b>Age, median (range)</b>	28.5 (21 – 51)	30 (20 – 58)	W = 143, <b>p = .75</b>	31 (21 – 51)	29 (20 – 58)	W = 111.5, <i>p</i> = .87
<b>IQ</b>	111 (83 – 134)	121 (78 – 131)	W = 192, <b>p = .20</b>	116.13 (2,66)	113.13 (2.59)	$t_{(28.89)} = 0.81$ , <i>p</i> = .42
<b>PGSI, median (range)</b>	18 (10 – 25)	0 (0 – 2)	-	0 (0-1)	0 (0)	-
<b>BAI, median (range)</b>	8 (0 – 33)	2 (0 - 17)	W = 71.5, <b>p &lt; .01</b>	2 (0 – 25)	1.5 (0 – 9)	W = 98, <i>p</i> = .39
<b>BDI -II, median (range)</b>	14.5 (1 – 46)	3 (0-10)	W = 24, <b>p &lt; .001</b>	2 (0 -23)	0 (0 – 7)	W = 79, <i>p</i> = .096
<b>Alcohol use (AUDIT)</b>	6 (1 – 8)	5 (0 – 9)	W = 151, <i>p</i> = .96	4.6 (0.59)	4.5 (0.58)	$T_{(28.93)} = 0.12$ , <i>p</i> = .91
<b>DAST – N ever used drugs (range of scores)</b>	6 (1 – 2)	6 (1 – 5)	-	4 (1)	4 (1 – 5)	-
<b>N smokers</b>	6	7	-	7	3	-
<b>FTND</b>	2.67 (0.99)	3.29 (0.92)	$t_{(10.7)} = 0.46$ , <i>p</i> = 0.66	0 (0)	5 (1 – 7)	-
<b>GRCS</b>	89 (41 – 109)	26 (23 – 55)	W = 3, <b>p &lt; .001</b>	29 (23 – 69)	24 (23 – 43)	W = 90.5, <i>p</i> = .23