Towards an Integrative Transdisciplinary Framework for Understanding the Etiopathogenesis of Problematic Drinking: Insights from Deep Phenotyping and Network Modeling for Personalized Prevention

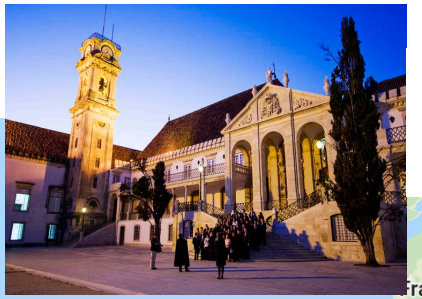
Jorge S. Martins, Ph.D.

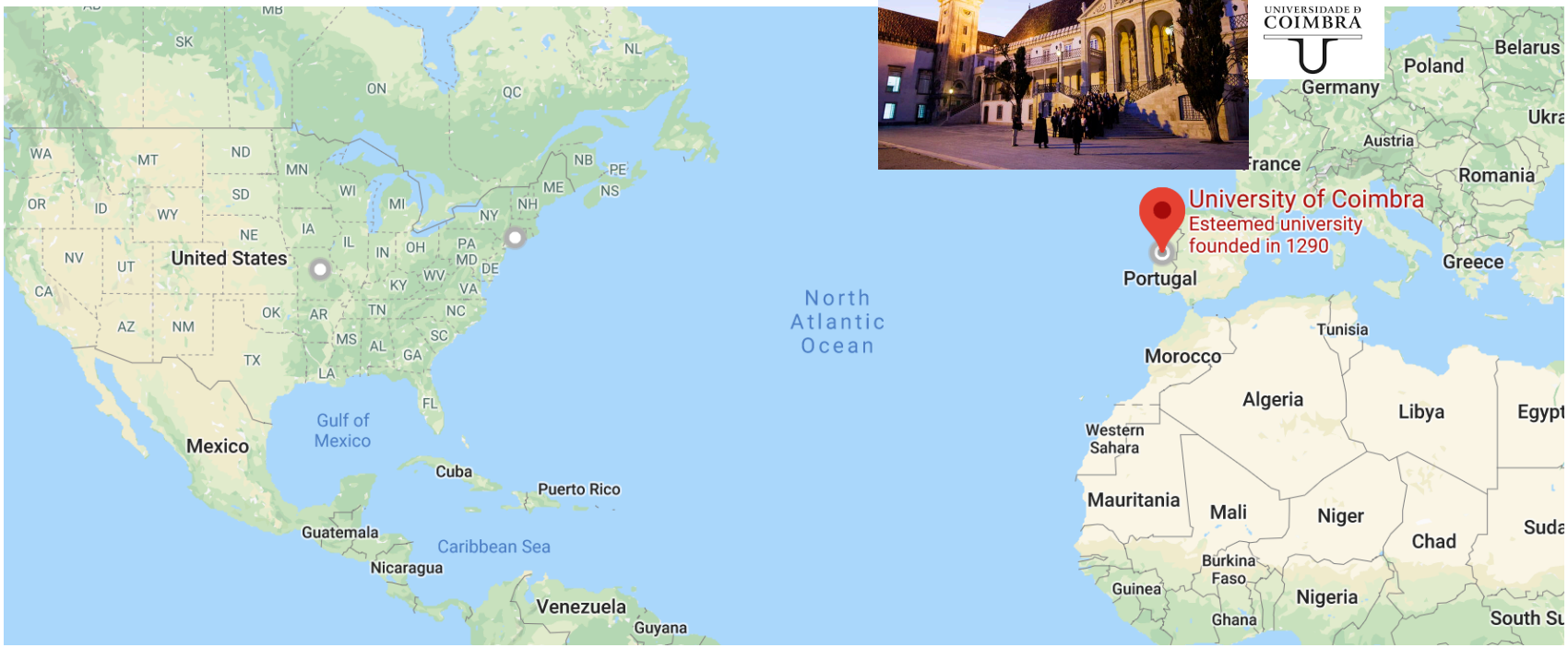
Yale Interdisciplinary Stress Center

Yale University

jorge.martins@yale.edu

Postdoc Background





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Background and Rational

- Problematic drinking including alcohol use disorder (AUD) is an etiologically and functionally heterogeneous condition (e.g., Litten et al., 2015)
- Current prevention and treatment interventions are still largely *ineffective*. Problem? Heterogeneity (Litten et al., 2015; Witkiewitz et al., 2019)
- It is imperative more and better research aimed at understanding this heterogeneity and its implications for prevention and intervention efforts.

RDoC, AARDoC, and ANA

Several recent initiatives have proposed core functional domains:

- **RDoC/NIAAA initiative** – mental/psychiatric disorders (see Insel et al., 2010)
  - Negative Valence Systems
  - Positive Valence Systems
  - Cognitive Systems
  - Social Processes
  - Arousal/Regulatory Systems
  - Sensorimotor Systems

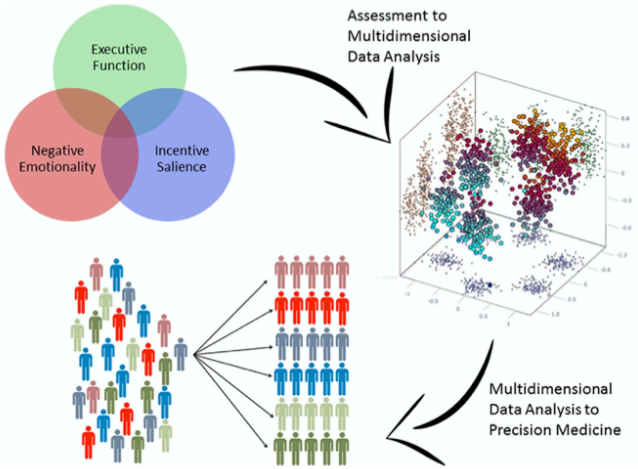
RDoC, AARDoC, and ANA

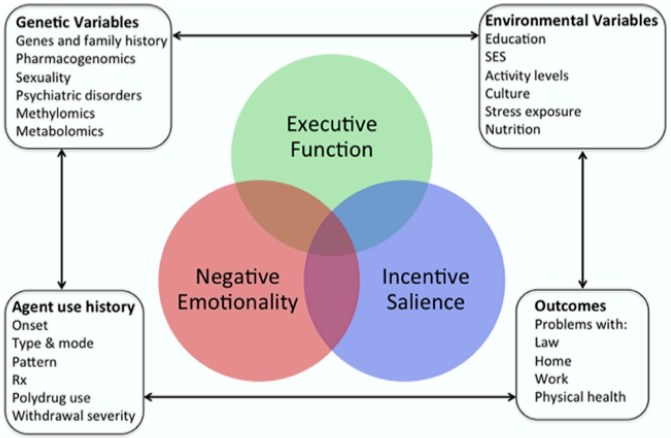
Several recent initiatives have proposed core functional domains:

- **Alcohol Addiction RDoC –** alcohol use disorder (Litten et al., 2015; Sher, 2015)
  - Reward
  - Stress
  - Affect Regulation
  - Incentive Salience
  - Executive Function
  - Social Processes

Addictions Neuroclinical Assessment (ANA)

- **Addictions Neuroclinical Assessment** – addictive disorders (Kwako et al., 2016)
  - Incentive Salience
  - Executive Functions
  - Negative Emotionality





Problems/Limitations

- These efforts need to be tailored for each specific condition (e.g., AARDoC)
- These initiatives failed to integrate disorder-specific and transdiagnostic domains
- These initiatives neglect the possibility that some domains may be more important than others

Alcohol-Related Core Functional Domains

Based on:

- Extensive literature review
- Recent advances in the neurobiology of addiction
- RDoC, AARDoC, and ANA initiatives

- **Seven functional domains**
  - Alcohol Sensitivity
  - Incentive Salience
  - Negative Emotionality
  - Alcohol Withdrawal
  - Executive Functions
  - Decision-Making/Risk Propensity
  - Self-Control/Disinhibition

Theoretical Framework and Analytic Approach

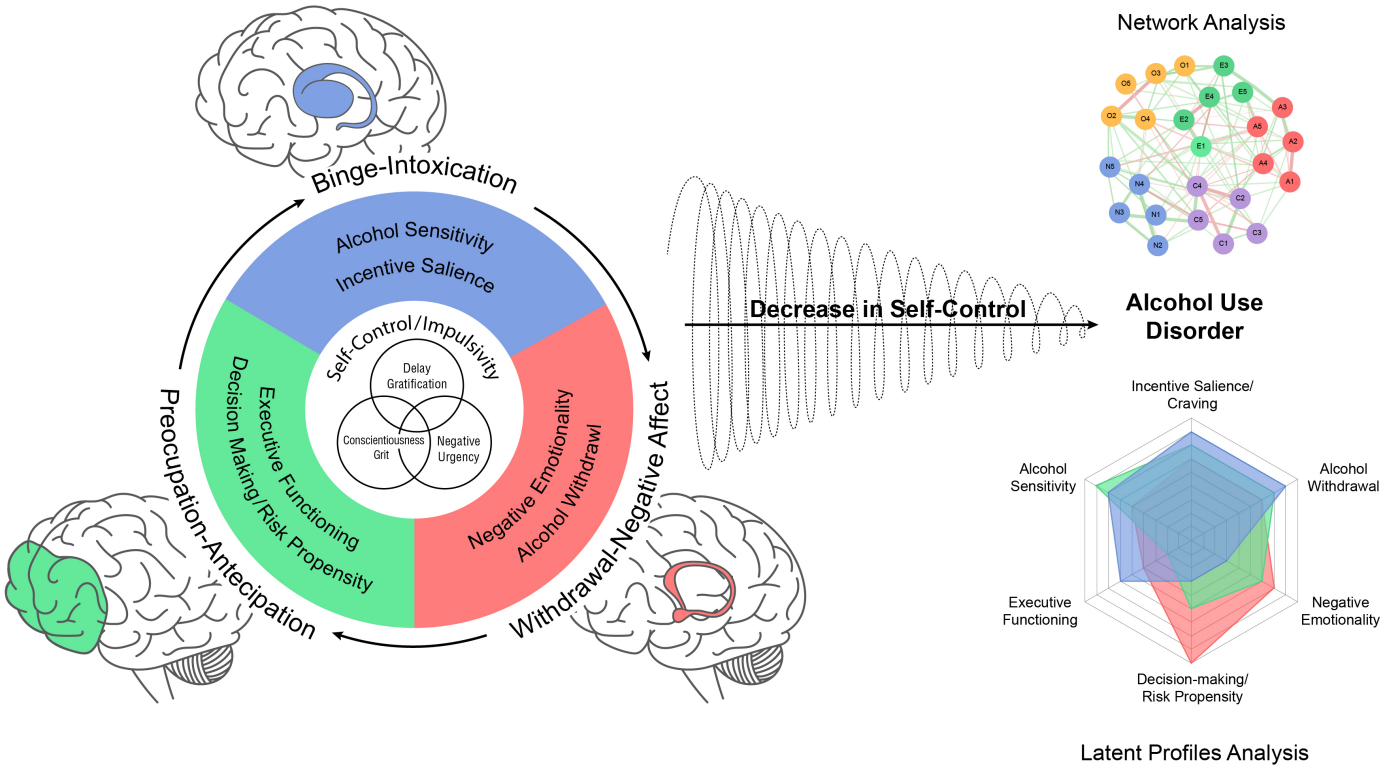


Figure 1. Theoretical framework and proposed data-analytic approach for understanding of heterogeneity in risk and protective factors related to harmful and hazardous drinking including AUD (adapted from Koob & Moal, 2006; Kwako et al., 2016, 2017), based on recent advances in the neurobiology of addiction and stages of the addiction of cycle (Koob & Le Moal, 2001, 2006; Kwako et al, 2016, 2017) and recent efforts to device an extensive addiction neuroclinical assessment (see Kwako et al, 2016, 2017, 2019).

SPECIFIC AIMS AND OBJECTIVES

Specific Aims and Objectives

- **Aim 1:** To determine the unique and specific effects of the hypothesized functional domains on alcohol use and related experiences.
- **Aim 2:** To determine the classification utility of varying combinations of functional domains in discriminating individuals at risk for harmful and hazardous drinking.
- **Aim 3:** To identify common profiles of functional domains that may either protect or place emerging and young adults at higher risk and explore their group-specific (i.e., latent classes) etiological processes for harmful and hazardous drinking.
- **Aim 4:** To identify the most "central" or influential functional domains for harmful and hazardous drinking.

METHODS

Participants

- 552 emerging and young adults – University of Missouri-Columbia
  - 18 to 29 years-old
  - Mean age = 18.92 (*SD* = 1.60)
  - 61% female
  - 81% White
- Eligibility criteria:
  - Fluent in English
  - Aged between 18 to 30 years old
- Compensated with either course credit or $20 (2-hour session)

Materials and Measures

Functional Domains

- Executive Functions:
- Attentional Control Scale (ACS) – Shifting
- Attentional Control Scale (ACS) – Updating
- Adult Executive Functioning Inventory (ADEXI)
- Number-Letter task
- Antisaccade task
- *N*-Back task
- Decision-Making/Risk Propensity:
- General Risk Propensity Scale (GRiPS)
- Risk Taking Index (RTI)
- Balloon Analogue Risk Task (BART)
- Iowa Gambling Task (IGT)
- UPPS-P Sensation-Seeking (UPPS-SS)
- Alcohol Sensitivity:
- Self-Rating of the Effects of Alcohol form (SRE)
- Alcohol Sensitivity Questionnaire (ASQ)
- Alcohol Withdrawal:
- Hangover Symptoms Scale (HSS)
- Alcohol Dependence Scale (ADS)
- Withdrawal Symptoms
- Incentive Salience/Craving:
- Obsessive-Compulsive Drinking Scale (OCDS)
- Appetitive Rating Task (ART)
- Adolescent Reinforcement Survey Schedule
- Alcohol-Approach Task (AAT)
- Negative Emotionality:
- Affect Balance Scale (ABS)
- Big Five Inventory (BFI) – Neuroticism
- Coping Motives (DMQ-R)
- Profile of Mood States (POMS)
- Self-Control/Disinhibition:
- Brief Self-Control Scale (BSC)
- Delaying Gratification Inventory (DGI)
- UPPS-P – Negative Urgency (UPPS-NU)
- Grit Scale
- BFI-2-S – Conscientiousness
- Abbreviated Impulsiveness Scale (ABIS)
- Disinhibition (ESI-bf)

Materials and Measures

Other Variables & Measures

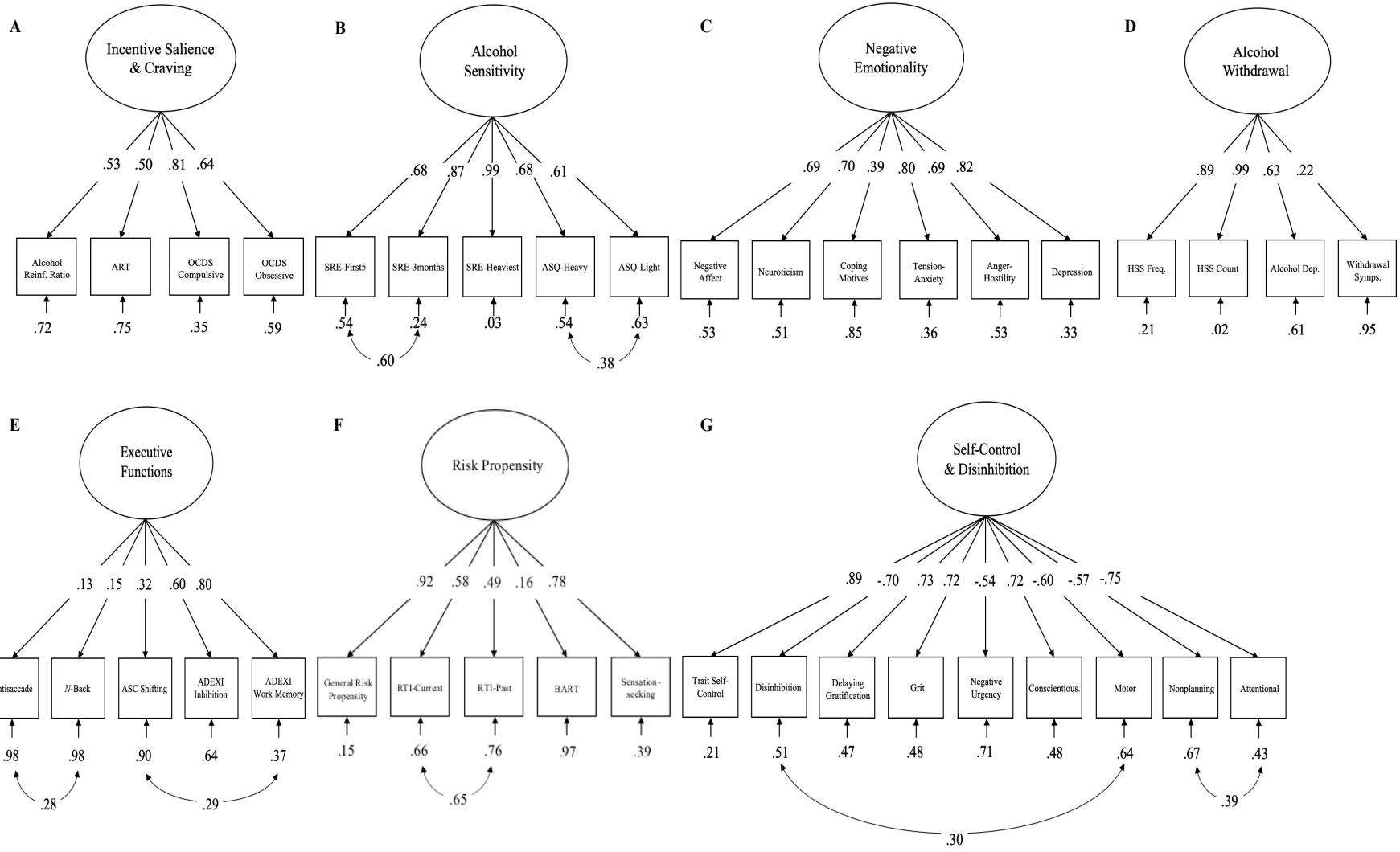
- Externalizing Deviancy:
- Externalizing Spectrum Inventory (ESI-bf)
- Internalizing Symptomology:
- Life Satisfaction (SLWS)
- Social Isolation (UCLA scale)
- Self-Esteem
- Intra & Interpersonal Protective Factors:
- Resilience (BRS)
- Motivation to Control Drinking (SM-A/MTF-A)
- Prosocial Behavior Tendencies (PTM)
- Family History & Situational Risk Factors:
- Family History of Alcoholism (FTQ)
- Trauma experiences
- Perceived stress

Procedure

- 2-hour lab session:
- Online survey through Qualtrics (50 minutes)
- Lab-based tasks:
  - Antisaccade task
  - Balloon Analogue Risk Task
  - Iowa Gambling Task
  - *n*-Back task
  - Number-letter task

RESULTS

Measurement Models of the Hypothesized Functional Domains



Fit Indices of Measurement Models

Table 4. *Fit Indices of Measurement Models Used to Derive Factor Score Estimates for Each Functional Domain.*

	Model Fit							
Functional Domain	χ^2	*df*	SRMR	RMSEA [90% CI]	CFI	TLI	FD	H
Executive Functions	2.18	3	.011	.000 [.000-.064]	1.00	1.00	.84	.71
Risk Propensity	0.47	4	.003	.000 [.000-.000]	1.00	1.00	.94	.89
Negative Emotionality	39.14***	9	.026	.078 [.054-.104]	.97	.95	.93	.87
Alcohol Withdrawal	10.86**	2	.028	.090 [.043-.145]	.99	.96	.99	.98
Incentive Salience/Craving	2.94	2	.014	.029 [.000-.094]	1.00	.99	.88	.84
Alcohol Sensitivity	6.97**	3	.015	.049 [.000-.099]	.99	.98	.99	.98
Self-Control/Disinhibition	141.89***	25	.043	.092 [.078-.107]	.95	.92	.95	.92

Note. *df* = degrees of freedom; SRMR = standardized root-mean residual; RMSEA = root-mean-square error approximation; CI = confidence interval; CFI = comparative fit index; TLI = Tucker-Lewis index; FD = factor scores determinacy; H = construct replicability.

*$p \leq .05$

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Aim 1: To determine the unique and specific effects of seven functional domains on alcohol involvement

Associations of Hypothesized Functional Domains

Table 7. *Summary of the Results for MIMIC Models Estimated for Each Hypothesized Functional Domain*

Predictors	Functional Domain																											
	Incent. Salience/Craving				Alcohol Sensitivity[a]				Negative Emotionality				Alcohol Withdrawal				Executive Functions				Risk Propensity				Self-Control/Disinh.			
	β	β_{SE}	*Z*	*p*	β	β_{SE}	*Z*	*p*	β	β_{SE}	*Z*	*p*	β	β_{SE}	*Z*	*p*	β	β_{SE}	*Z*	*p*	β	β_{SE}	*Z*	*p*	β	β_{SE}	*Z*	*p*
Demographics																												
Sex	-.12	0.06	-2.09	**.036**	.00	0.05	0.03	.975	.17	0.04	3.83	**<.001**	-.007	0.04	-0.17	.866	-.09	0.05	-1.92	.056	-.31	0.04	-7.09	**<.001**	.02	0.05	0.44	.658
Age	-.03	0.04	-0.61	.544	.01	0.02	0.53	.599	.003	0.05	0.07	.943	.03	0.03	1.12	.261	.11	0.06	1.83	.068	-.02	0.06	-0.36	.720	.12	0.05	2.35	**.019**
Race	.10	0.05	2.04	**.041**	.07	0.05	1.31	.191	-.14	0.05	-2.88	**.004**	.17	.04	4.17	**<.001**	.11	0.05	2.17	**.030**	-.05	0.05	-0.94	.350	.05	0.05	1.10	.272
SES	.21	0.05	4.64	**<.001**	.19	0.04	4.54	**<.001**	-.11	0.05	-2.23	**.026**	.14	0.04	3.35	**.001**	.06	0.06	1.00	.319	.13	0.05	2.65	**.008**	-.02	0.05	-0.39	.700
Alcohol Involvement																												
Age of onset of drinking	-.34	0.05	-6.95	**<.001**	-.26	0.06	-4.74	**<.001**	-.04	0.05	-0.88	.378	-.10	0.02	-6.60	**<.001**	.22	0.05	4.32	**<.001**	-.25	0.05	-5.42	**<.001**	.27	0.04	6.27	**<.001**
Typical alcohol use	.66	0.04	16.12	**<.001**	.43	0.04	10.21	**<.001**	-.05	0.05	-1.06	.291	.35	0.04	8.91	**<.001**	-.28	0.04	-6.80	**<.001**	.27	0.04	6.18	**<.001**	-.31	0.04	-7.33	**<.001**
Heavy episodic drinking	.71	0.04	19.88	**<.001**	.35	0.04	7.94	**<.001**	-.004	0.05	-0.78	.424	.43	0.04	11.35	**<.001**	-.25	0.04	-6.07	**<.001**	.27	0.04	6.53	**<.001**	-.31	0.04	-7.48	**<.001**
Binge drinking	.66	0.04	17.57	**<.001**	.37	0.04	8.34	**<.001**	.02	0.05	0.40	.691	.38	0.04	10.00	**<.001**	-.30	0.05	-5.93	**<.001**	.25	0.04	5.98	**<.001**	-.34	0.04	-8.14	**<.001**
Max. no. of drinks in 24h	.56	0.06	9.80	**<.001**	.62	0.05	12.23	**<.001**	-.005	0.00	-1.21	.226	.43	0.04	10.29	**<.001**	-.18	0.04	-4.20	**<.001**	.35	0.04	8.59	**<.001**	-.20	0.05	4.37	**<.001**
Harmful and hazardous drinking	.85	0.03	29.44	**<.001**	.42	0.05	8.30	**<.001**	.08	0.05	1.55	.122	.60	0.04	16.84	**<.001**	-.34	0.05	-7.09	**<.001**	.30	0.04	7.01	**<.001**	-.43	0.04	-11.67	**<.001**
Alcohol use disorder	.62	0.04	16.47	**<.001**	.20	0.05	4.19	**<.001**	.14	0.05	2.62	**.009**	.49	0.03	14.28	**<.001**	-.31	0.05	-6.64	**<.001**	.22	0.04	4.92	**<.001**	-.32	0.04	-7.74	**<.001**
Alcohol problems	.78	0.04	20.26	**<.001**	.27	0.05	5.39	**<.001**	.25	0.05	4.85	**<.001**	.54	0.04	12.35	**<.001**	-.42	0.05	-8.58	**<.001**	.33	0.04	5.51	**<.001**	-.49	0.05	-10.46	**<.001**
Externalizing Symptomology																												
Externalizing deviancy	.58	0.04	13.66	**<.001**	.26	0.04	6.28	**<.001**	.17	0.05	3.20	**.001**	.37	0.04	9.70	**<.001**	-.40	0.05	-7.58	**<.001**	.54	0.04	14.90	**<.001**	-.52	0.04	-14.45	**<.001**
Internalizing Symptomology																												
Life satisfaction	-.08	0.05	-1.69	.090	.04	0.05	0.99	.324	-.59	0.05	-17.82	**<.001**	-.08	0.05	-1.64	.102	.30	0.05	5.50	**<.001**	-.005	0.05	-0.11	.913	.40	0.04	9.36	**<.001**
Social isolation	.03	0.05	0.65	.516	-.10	0.05	-2.14	**.033**	.62	0.03	19.52	**<.001**	.03	0.05	0.56	.574	-.26	0.05	-4.95	**<.001**	-.09	0.05	-2.05	**.041**	-.25	0.05	-5.49	**<.001**
Self-esteem	.02	0.05	0.47	.638	.14	0.05	3.05	**.002**	-.50	0.04	-14.24	**<.001**	.02	0.05	0.33	.744	.22	0.05	4.71	**<.001**	.22	0.05	4.50	**<.001**	.24	0.05	5.22	**<.001**
Intra & Interpersonal Protective Factors																												
Resilience	-.17	0.05	-3.58	**<.001**	.04	0.05	0.85	.398	-.56	0.04	-14.74	**<.001**	-.19	0.05	-4.13	**<.001**	.34	0.06	6.00	**<.001**	.17	0.05	3.61	**<.001**	.42	0.04	9.96	**<.001**
Motivation to control drinking	.33	0.07	4.92	**<.001**	.02	0.05	0.52	.602	1.15	0.05	3.20	**.001**	.14	0.06	2.39	**.017**	-.15	0.06	-.59	**.010**	.17	0.05	3.43	**.001**	-.16	0.05	-3.10	**.002**
Prosocial behavior - public	.32	0.06	5.72	**<.001**	.09	0.05	1.84	.066	.07	0.05	-.36	.173	.20	0.05	4.12	**<.001**	-.20	0.07	-3.05	**.002**	.20	0.05	3.86	**<.001**	-.20	0.05	-3.66	**<.001**
Prosocial behavior - anonymous	-.09	0.13	-0.68	.497	-.01	0.05	-0.20	.838	.05	0.06	0.88	.377	-.06	0.05	-1.07	.285	-.24	0.17	-1.38	.168	.10	0.06	1.69	.090	.07	0.06	-.21	.227
Prosocial behavior - dire	-.04	0.06	-0.63	.526	-.02	0.05	-0.36	.719	.10	0.05	2.03	**.043**	-.89	0.05	-1.67	.095	.01	0.08	0.08	.938	.06	0.06	1.07	.286	.12	0.05	2.30	**.021**
Prosocial behavior - emotional	-.01	0.05	-0.14	.890	.05	0.05	1.00	.316	.20	0.05	4.07	**<.001**	-.09	0.05	-1.84	.066	-.08	0.07	-1.20	.232	.02	0.06	0.32	.746	.02	0.06	0.39	.696
Prosocial behavior - compliant	-.10	0.06	-1.89	.059	-.03	0.06	-0.59	.557	.05	0.05	0.91	.365	-.11	0.05	-2.10	**.036**	.10	0.06	1.56	.120	-.008	0.06	-0.14	.890	.16	0.05	3.10	**.002**
Prosocial behavior - altruistic	-.39	0.06	-6.20	**<.001**	-.05	0.06	-0.84	.399	-.08	0.06	-1.42	.157	-.14	0.04	-3.86	**<.001**	.31	0.09	3.57	**<.001**	-.25	0.05	-4.94	**<.001**	.26	0.05	4.91	**<.001**
Social support number	-.00	0.05	-0.03	.973	.10	0.05	2.09	**.036**	-.35	0.04	-8.36	**<.001**	-.02	0.04	-0.27	.787	.21	0.05	4.29	**<.001**	.04	0.05	0.75	.456	.17	0.04	3.87	**<.001**
Social support satisfaction	-.10	0.06	-1.78	.076	-.01	0.05	-0.30	.768	-.32	0.07	-4.89	**<.001**	-.11	0.05	-.16	**.030**	.19	0.05	3.96	**<.001**	.004	0.05	0.10	.925	.19	0.06	3.34	**.001**
Fam. History & Situational Risk Factors																												
Family history of alcoholism	.04	0.05	0.84	.403	-.03	0.04	-0.71	.477	.21	0.04	4.85	**<.001**	.05	0.04	1.24	.216	-.13	0.05	-2.40	**.017**	-.02	0.05	-0.47	.642	-.10	0.04	-2.37	**.018**
Trauma	.12	0.05	2.46	**.014**	.08	0.05	1.60	.109	.31	0.05	6.38	**<.001**	.07	0.04	1.57	.116	-.16	0.06	-2.85	**.004**	.21	0.04	4.73	**<.001**	-.17	0.05	-3.39	**.001**
Perceived stress	.24	0.05	5.36	**<.001**	.04	0.05	0.81	.421	.69	0.03	26.88	**<.001**	.20	0.05	4.21	**<.001**	-.48	0.05	-9.64	**<.001**	.07	0.05	1.44	.149	-.55	0.04	-14.81	**<.001**

Note. Bold *p*-values are significant at $p \leq .05$.

[a]Higher Alcohol Sensitivity scores reflect the need of more drinks to experience alcohol's effects and, therefore, lower sensitivity to the effects of alcohol.

Associations of Hypothesized Functional Domains

Table 7. *Summary of the Results for MIMIC Models Estimated for Each Hypothesized Functional Domain*

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Sex	-.12	0.06	-2.09	**.036**	.00	0.05	0.03	.975	.17	0.04	3.83	**<.001**	-.007	0.04	-0.17	.866	-.09	0.05	-1.92	.056	-.31	0.04	-7.09	**<.001**	.02	0.05	0.44	.658
Age	-.03	0.04	-0.61	.544	.01	0.02	0.53	.599	.003	0.05	0.07	.943	.03	0.03	1.12	.261	.11	0.06	1.83	.068	-.02	0.06	-0.36	.720	.12	0.05	2.35	**.019**
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SES	.21	0.05	4.64	**<.001**	.19	0.04	4.54	**<.001**	-.11	0.05	-2.23	**.026**	.14	0.04	3.35	**.001**	.06	0.06	1.00	.319	.13	0.05	2.65	**.008**	-.02	0.05	-0.39	.700
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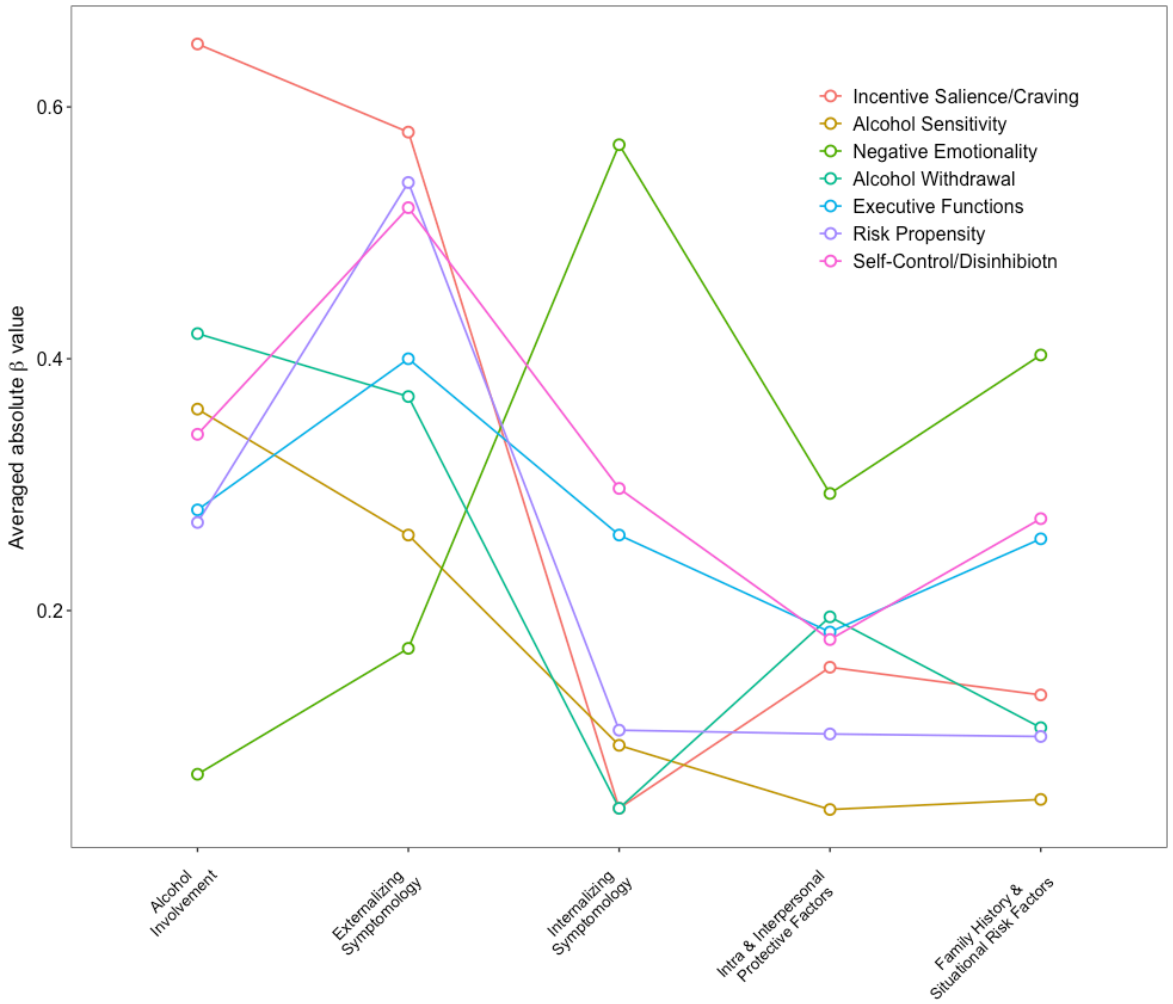
Age of onset of drinking	-.34	0.05	-6.95	**<.001**	-.26	0.06	-4.74	**<.001**	-.04	0.05	-0.88	.378	-.10	0.02	-6.60	**<.001**	.22	0.05	4.32	**<.001**	-.25	0.05	-5.42	**<.001**	.27	0.04	6.27	**<.001**
Typical alcohol use	.66	0.04	16.12	**<.001**	.43	0.04	10.21	**<.001**	-.05	0.05	-1.06	.291	.35	0.04	8.91	**<.001**	-.28	0.04	-6.80	**<.001**	.27	0.04	6.18	**<.001**	-.31	0.04	-7.33	**<.001**
Heavy episodic drinking	.71	0.04	19.88	**<.001**	.35	0.04	7.94	**<.001**	-.004	0.05	-0.78	.424	.43	0.04	11.35	**<.001**	-.25	0.04	-6.07	**<.001**	.27	0.04	6.53	**<.001**	-.31	0.04	-7.48	**<.001**
Binge drinking	.66	0.04	17.57	**<.001**	.37	0.04	8.34	**<.001**	.02	0.05	0.40	.691	.38	0.04	10.00	**<.001**	-.30	0.05	-5.93	**<.001**	.25	0.04	5.98	**<.001**	-.34	0.04	-8.14	**<.001**
Max. no. of drinks in 24h	.56	0.06	9.80	**<.001**	.62	0.05	12.23	**<.001**	-.005	0.00	-1.21	.226	.43	0.04	10.29	**<.001**	-.18	0.04	-4.20	**<.001**	.35	0.04	8.59	**<.001**	-.20	0.05	4.37	**<.001**
Harmful and hazardous drinking	.85	0.03	29.44	**<.001**	.42	0.05	8.30	**<.001**	.08	0.05	1.55	.122	.60	0.04	16.84	**<.001**	-.34	0.05	-7.09	**<.001**	.30	0.04	7.01	**<.001**	-.43	0.04	-11.67	**<.001**
Alcohol use disorder	.62	0.04	16.47	**<.001**	.20	0.05	4.19	**<.001**	.14	0.05	2.62	**.009**	.49	0.03	14.28	**<.001**	-.31	0.05	-6.64	**<.001**	.22	0.04	4.92	**<.001**	-.32	0.04	-7.74	**<.001**
Alcohol problems	.78	0.04	20.26	**<.001**	.27	0.05	5.39	**<.001**	.25	0.05	4.85	**<.001**	.54	0.04	12.35	**<.001**	-.42	0.05	-8.58	**<.001**	.33	0.04	5.51	**<.001**	-.49	0.05	-10.46	**<.001**
Externalizing Symptomology																												
Externalizing deviancy	.58	0.04	13.66	**<.001**	.26	0.04	6.28	**<.001**	.17	0.05	3.20	**.001**	.37	0.04	9.70	**<.001**	-.40	0.05	-7.58	**<.001**	.54	0.04	14.90	**<.001**	-.52	0.04	-14.45	**<.001**
Internalizing Symptomology																												
Life satisfaction	-.08	0.05	-1.69	.090	.04	0.05	0.99	.324	-.59	0.05	-17.82	**<.001**	-.08	0.05	-1.64	.102	.30	0.05	5.50	**<.001**	-.005	0.05	-0.11	.913	.40	0.04	9.36	**<.001**
Social isolation	.03	0.05	0.65	.516	-.10	0.05	-2.14	**.033**	.62	0.03	19.52	**<.001**	.03	0.05	0.56	.574	-.26	0.05	-4.95	**<.001**	-.09	0.05	-2.05	**.041**	-.25	0.05	-5.49	**<.001**
Self-esteem	.02	0.05	0.47	.638	.14	0.05	3.05	**.002**	-.50	0.04	-14.24	**<.001**	.02	0.05	0.33	.744	.22	0.05	4.71	**<.001**	.22	0.05	4.50	**<.001**	.24	0.05	5.22	**<.001**
Intra & Interpersonal Protective Factors																												
Resilience	-.17	0.05	-3.58	**<.001**	.04	0.05	0.85	.398	-.56	0.04	-14.74	**<.001**	-.19	0.05	-4.13	**<.001**	.34	0.06	6.00	**<.001**	.17	0.05	3.61	**<.001**	.42	0.04	9.96	**<.001**
Motivation to control drinking	.33	0.07	4.92	**<.001**	.02	0.05	0.52	.602	1.15	0.05	3.20	**.001**	.14	0.06	2.39	**.017**	-.15	0.06	-.59	**.010**	.17	0.05	3.43	**.001**	-.16	0.05	-3.10	**.002**
Prosocial behavior - public	.32	0.06	5.72	**<.001**	.09	0.05	1.84	.066	.07	0.05	-.36	.173	.20	0.05	4.12	**<.001**	-.20	0.07	-3.05	**.002**	.20	0.05	3.86	**<.001**	-.20	0.05	-3.66	**<.001**
Prosocial behavior - anonymous	-.09	0.13	-0.68	.497	-.01	0.05	-0.20	.838	.05	0.06	0.88	.377	-.06	0.05	-1.07	.285	-.24	0.17	-1.38	.168	.10	0.06	1.69	.090	.07	0.06	-.21	.227
Prosocial behavior - dire	-.04	0.06	-0.63	.526	-.02	0.05	-0.36	.719	.10	0.05	2.03	**.043**	-.89	0.05	-1.67	.095	.01	0.08	0.08	.938	.06	0.06	1.07	.286	.12	0.05	2.30	**.021**
Prosocial behavior - emotional	-.01	0.05	-0.14	.890	.05	0.05	1.00	.316	.20	0.05	4.07	**<.001**	-.09	0.05	-1.84	.066	-.08	0.07	-1.20	.232	.02	0.06	0.32	.746	.02	0.06	0.39	.696
Prosocial behavior - compliant	-.10	0.06	-1.89	.059	-.03	0.06	-0.59	.557	.05	0.05	0.91	.365	-.11	0.05	-2.10	**.036**	.10	0.06	1.56	.120	-.008	0.06	-0.14	.890	.16	0.05	3.10	**.002**
Prosocial behavior - altruistic	-.39	0.06	-6.20	**<.001**	-.05	0.06	-0.84	.399	-.08	0.06	-1.42	.157	-.14	0.04	-3.86	**<.001**	.31	0.09	3.57	**<.001**	-.25	0.05	-4.94	**<.001**	.26	0.05	4.91	**<.001**
Social support number	-.00	0.05	-0.03	.973	.10	0.05	2.09	**.036**	-.35	0.04	-8.36	**<.001**	-.02	0.04	-0.27	.787	.21	0.05	4.29	**<.001**	.04	0.05	0.75	.456	.17	0.04	3.87	**<.001**
Social support satisfaction	-.10	0.06	-1.78	.076	-.01	0.05	-0.30	.768	-.32	0.07	-4.89	**<.001**	-.11	0.05	-.16	**.030**	.19	0.05	3.96	**<.001**	.004	0.05	0.10	.925	.19	0.06	3.34	**.001**
Fam. History & Situational Risk Factors																												
Family history of alcoholism	.04	0.05	0.84	.403	-.03	0.04	-0.71	.477	.21	0.04	4.85	**<.001**	.05	0.04	1.24	.216	-.13	0.05	-2.40	**.017**	-.02	0.05	-0.47	.642	-.10	0.04	-2.37	**.018**
Trauma	.12	0.05	2.46	**.014**	.08	0.05	1.60	.109	.31	0.05	6.38	**<.001**	.07	0.04	1.57	.116	-.16	0.06	-2.85	**.004**	.21	0.04	4.73	**<.001**	-.17	0.05	-3.39	**.001**
Perceived stress	.24	0.05	5.36	**<.001**	.04	0.05	0.81	.421	.69	0.03	26.88	**<.001**	.20	0.05	4.21	**<.001**	-.48	0.05	-9.64	**<.001**	.07	0.05	1.44	.149	-.55	0.04	-14.81	**<.001**

Note. Bold *p*-values are significant at $p \leq .05$.

[a]Higher Alcohol Sensitivity scores reflect the need of more drinks to experience alcohol's effects and, therefore, lower sensitivity to the effects of alcohol.

Associations of Hypothesized Functional Domains



Associations of Hypothesized Functional Domains

Table 8. Summary of Regression Analyses Predicting Alcohol-Related Outcomes from *Hypothesized Functional Domains, Controlling for Age, Sex, Race, and SES.*

Predictor	Age of Onset Drinking			Alcohol Use			Heavy Drinking			Binge Drinking			Max. Drinks 24h			Harmful and Hazardous Drinking			Alcohol Problems			Risk			AUD		
	Adj. R^2 = .19			Adj. R^2 = .43			Adj. R^2 = .43			Adj. R^2 = .37			Adj. R^2 = .66			Adj. R^2 = .61			Adj. R^2 = .56			AIC = 483.78			AIC =544.75		
	b	SE *b*	β	*b*	SE *b*	β	*b*	SE *b*	β	*b*	SE *b*	β	*b*	SE *b*	β	*b*	SE *b*	β	*b*	SE *b*	β	*b*	SE *b*	OR	*b*	SE *b*	OR
Age	**0.13**	**0.04**	**.12**	1.88	7.06	.01	0.47	0.71	.02	-1.26	1.00	-.04	**0.61**	**0.12**	**.14**	-0.01	0.09	.00	**0.32**	**0.12**	**.07**	-0.02	0.07	0.98	**0.03**	**0.07**	**1.03**
Sex	0.01	0.15	.00	**-90.89**	**24.23**	**-.13**	**-7.60**	**2.42**	**-.11**	-6.7	3.42	-.07	**-5.26**	**0.4**	**-.36**	**-1.21**	**0.30**	**-.12**	0.31	0.43	.02	**-1.00**	**0.26**	**0.37**	0.08	0.24	1.09
Race	-0.34	0.18	-.08	4.66	29.50	.01	0.38	2.95	.00	-4.94	4.16	-.04	**1.21**	**0.48**	**.07**	0.35	0.37	.03	0.28	0.51	.02	0.32	0.33	1.38	-0.30	0.29	0.74
SES	-0.09	0.07	-.05	**26.09**	**11.83**	**.08**	1.93	1.18	.06	2.66	1.67	.06	**0.41**	**0.19**	**.06**	**0.31**	**0.15**	**.06**	-0.03	0.21	.00	0.16	0.13	1.17	**-0.12**	**0.12**	**0.89**
Alcohol Withdrawal	**-0.63**	**0.15**	**-.20**	19.28	24.05	.03	**6.88**	**2.40**	**.11**	6.25	3.39	.08	**2.05**	**0.39**	**.16**	**2.16**	**0.30**	**.24**	**1.78**	**0.42**	**.15**	**1.01**	**0.27**	**2.75**	**1.36**	**0.25**	**3.88**
Alcohol Sensitivity	**-0.55**	**0.13**	**-.17**	**177.57**	**21.00**	**.29**	**11.21**	**2.10**	**.18**	**18.50**	**2.96**	**.22**	**6.48**	**0.35**	**.50**	**1.92**	**0.26**	**.21**	0.17	0.39	.01	**1.21**	**0.25**	**3.35**	0.30	0.22	1.35
Risk Propensity	**-0.72**	**0.25**	**-.13**	6.04	39.7	.01	0.56	3.97	.00	1.13	5.60	.01	**1.82**	**0.65**	**.08**	-0.08	0.50	.00	**1.61**	**0.69**	**.08**	-0.71	0.42	0.49	0.28	0.38	1.32
Executive Functions	-0.04	0.05	-.04	3.49	8.37	.02	0.02	0.84	.00	-0.36	1.18	-.01	**0.28**	**0.14**	**.07**	0.02	0.10	.01	0.00	0.15	.00	0.00	0.09	1.00	-0.11	0.08	0.90
Incentive Salience/Crav.	-0.04	0.05	-.04	**68.63**	**7.34**	**.39**	**7.79**	**0.73**	**.45**	**9.27**	**1.04**	**.39**	**0.54**	**0.12**	**.15**	**1.19**	**0.09**	**.45**	**1.22**	**0.14**	**.35**	**0.69**	**0.09**	**2.00**	**0.66**	**0.09**	**1.94**
Negative Emotionality	0.11	0.16	.03	**-90.58**	**25.55**	**-.14**	**-9.72**	**2.55**	**-.15**	**-9.27**	**3.61**	**-.10**	-0.32	0.42	-.02	**-0.79**	**0.32**	**-.08**	**1.26**	**0.45**	**.10**	**-0.57**	**0.28**	**0.56**	-0.22	0.25	0.81
Self-Control/Disinh.	**0.04**	**0.01**	**.16**	**-7.07**	**2.26**	**-.15**	**-0.46**	**0.23**	**-.10**	**-0.73**	**0.32**	**-.12**	-0.06	0.04	-.06	**-0.10**	**0.03**	**-.14**	**-0.11**	**0.04**	**-.12**	**-0.07**	**0.02**	**0.94**	0.00	0.02	1.00
Alcohol Use																			**0.01**	**0.00**	**.28**						

Note. Bold coefficients are significant at $p < .05$. Sex (1 = Female and 0 = Male); Race (1 = White and 0 = non-White); SES = socioeconomic status; Risk (1 = total AUDIT score greater or equal than 8 and 0 = total AUDIT score less than 8); AUD = alcohol use disorder (two or more DSM-5 symptoms).

Associations of Hypothesized Functional Domains

Table 8. Summary of Regression Analyses Predicting Alcohol-Related Outcomes from *Hypothesized Functional Domains, Controlling for Age, Sex, Race, and SES.*

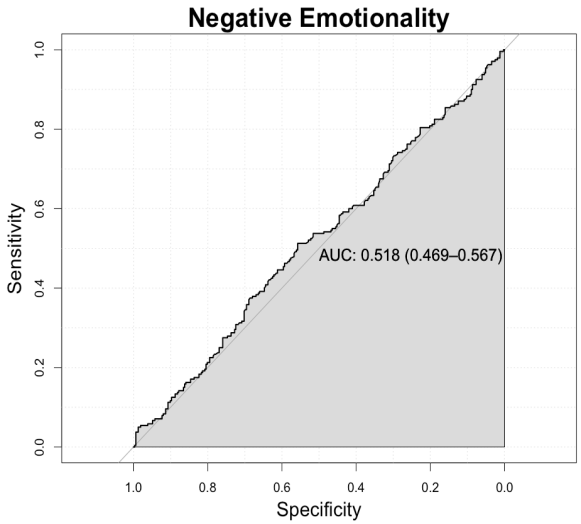
Predictor	Age of Onset Drinking			Alcohol Use			Heavy Drinking			Binge Drinking			Max. Drinks 24h			Harmful and Hazardous Drinking			Alcohol Problems			Risk			AUD		
	Adj. R^2 = .19			Adj. R^2 = .43			Adj. R^2 = .43			Adj. R^2 = .37			Adj. R^2 = .66			Adj. R^2 = .61			Adj. R^2 = .56			AIC = 483.78			AIC =544.75		
	b	SE *b*	β	*b*	SE *b*	β	*b*	SE *b*	β	*b*	SE *b*	β	*b*	SE *b*	β	*b*	SE *b*	β	*b*	SE *b*	β	*b*	SE *b*	OR	*b*	SE *b*	OR
Age	**0.13**	**0.04**	**.12**	1.88	7.06	.01	0.47	0.71	.02	-1.26	1.00	-.04	**0.61**	**0.12**	**.14**	-0.01	0.09	.00	**0.32**	**0.12**	**.07**	-0.02	0.07	0.98	**0.03**	**0.07**	**1.03**
Sex	0.01	0.15	.00	**-90.89**	**24.23**	**-.13**	**-7.60**	**2.42**	**-.11**	-6.7	3.42	-.07	**-5.26**	**0.4**	**-.36**	**-1.21**	**0.30**	**-.12**	0.31	0.43	.02	**-1.00**	**0.26**	**0.37**	0.08	0.24	1.09
Race	-0.34	0.18	-.08	4.66	29.50	.01	0.38	2.95	.00	-4.94	4.16	-.04	**1.21**	**0.48**	**.07**	0.35	0.37	.03	0.28	0.51	.02	0.32	0.33	1.38	-0.30	0.29	0.74
SES	-0.09	0.07	-.05	**26.09**	**11.83**	**.08**	1.93	1.18	.06	2.66	1.67	.06	**0.41**	**0.19**	**.06**	**0.31**	**0.15**	**.06**	-0.03	0.21	.00	0.16	0.13	1.17	**-0.12**	**0.12**	**0.89**
Alcohol Withdrawal	**-0.63**	**0.15**	**-.20**	19.28	24.05	.03	**6.88**	**2.40**	**.11**	6.25	3.39	.08	**2.05**	**0.39**	**.16**	**2.16**	**0.30**	**.24**	**1.78**	**0.42**	**.15**	**1.01**	**0.27**	**2.75**	**1.36**	**0.25**	**3.88**
Alcohol Sensitivity	**-0.55**	**0.13**	**-.17**	**177.57**	**21.00**	**.29**	**11.21**	**2.10**	**.18**	**18.50**	**2.96**	**.22**	**6.48**	**0.35**	**.50**	**1.92**	**0.26**	**.21**	0.17	0.39	.01	**1.21**	**0.25**	**3.35**	0.30	0.22	1.35
Risk Propensity	**-0.72**	**0.25**	**-.13**	6.04	39.7	.01	0.56	3.97	.00	1.13	5.60	.01	**1.82**	**0.65**	**.08**	-0.08	0.50	.00	**1.61**	**0.69**	**.08**	-0.71	0.42	0.49	0.28	0.38	1.32
Executive Functions	-0.04	0.05	-.04	3.49	8.37	.02	0.02	0.84	.00	-0.36	1.18	-.01	**0.28**	**0.14**	**.07**	0.02	0.10	.01	0.00	0.15	.00	0.00	0.09	1.00	-0.11	0.08	0.90
Incentive Salience/Crav.	-0.04	0.05	-.04	**68.63**	**7.34**	**.39**	**7.79**	**0.73**	**.45**	**9.27**	**1.04**	**.39**	**0.54**	**0.12**	**.15**	**1.19**	**0.09**	**.45**	**1.22**	**0.14**	**.35**	**0.69**	**0.09**	**2.00**	**0.66**	**0.09**	**1.94**
Negative Emotionality	0.11	0.16	.03	**-90.58**	**25.55**	**-.14**	**-9.72**	**2.55**	**-.15**	**-9.27**	**3.61**	**-.10**	-0.32	0.42	-.02	**-0.79**	**0.32**	**-.08**	**1.26**	**0.45**	**.10**	**-0.57**	**0.28**	**0.56**	-0.22	0.25	0.81
Self-Control/Disinh.	**0.04**	**0.01**	**.16**	**-7.07**	**2.26**	**-.15**	**-0.46**	**0.23**	**-.10**	**-0.73**	**0.32**	**-.12**	-0.06	0.04	-.06	**-0.10**	**0.03**	**-.14**	**-0.11**	**0.04**	**-.12**	**-0.07**	**0.02**	**0.94**	0.00	0.02	1.00
Alcohol Use																			**0.01**	**0.00**	**.28**						

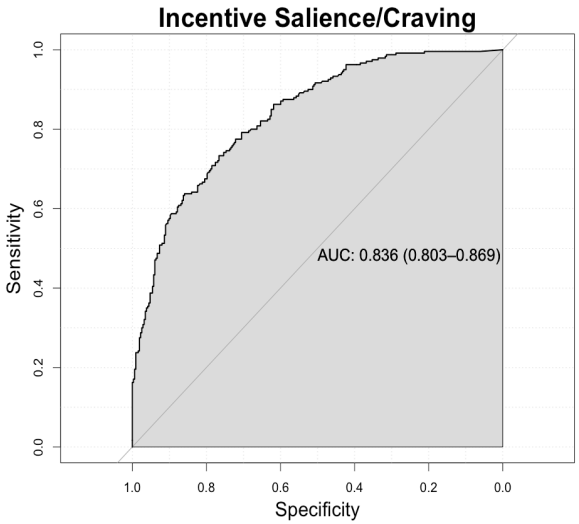
Note. Bold coefficients are significant at $p < .05$. Sex (1 = Female and 0 = Male); Race (1 = White and 0 = non-White); SES = socioeconomic status; Risk (1 = total AUDIT score greater or equal than 8 and 0 = total AUDIT score less than 8); AUD = alcohol use disorder (two or more DSM-5 symptoms).

Aim 2: To determine the classification utility of varying combinations of functional domains in discriminating risk for problematic drinking

Classification Performance & Predictive Utility

Risk status = total AUDIT score ≥ 8

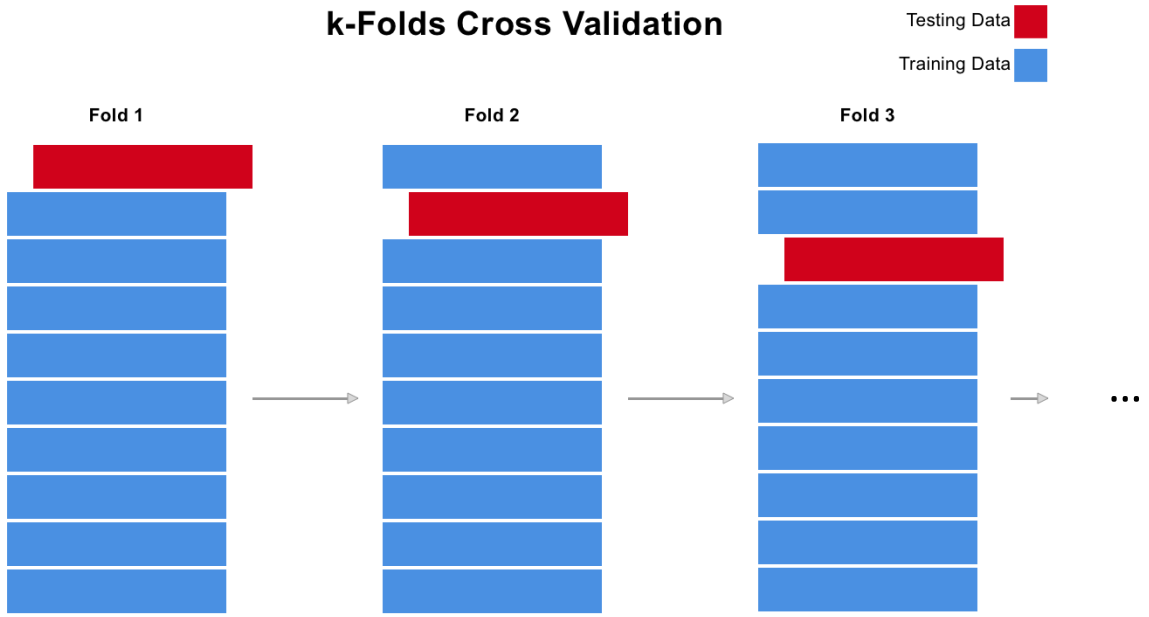




Classification Performance & Predictive Utility

What is the classification utility of different combinations of domains?

- **<u>Risk status = total AUDIT score ≥ 8</u>**
- 7 functional domains = 128 models (2^7 = 128 possible combinations)
- Models raked by AUC (↑ AUC = better classification performance)
- Problem: overfitting -> solution: *k*-fold cross-validation



Classification Performance & Prediction Utility

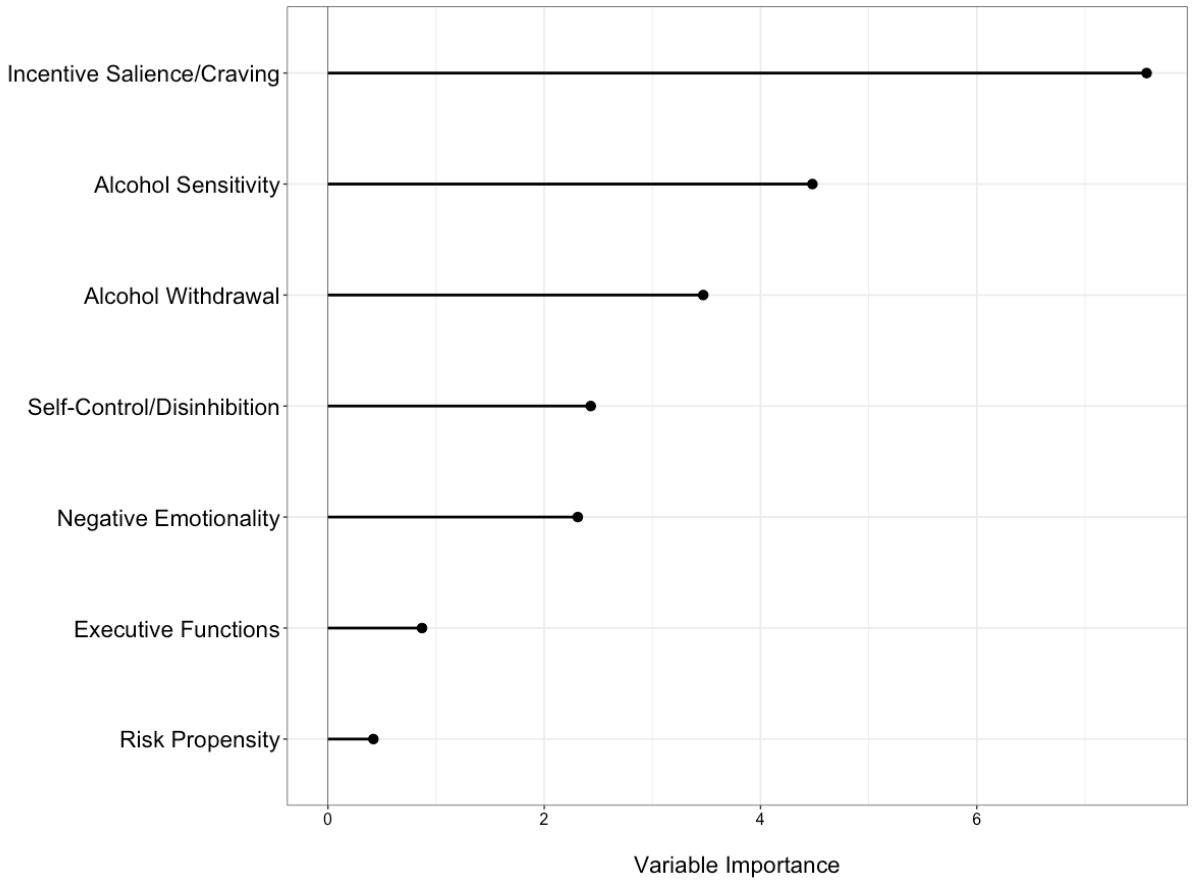
Table 8. *Classification Performance for 5-fold Cross Validated Logistic Regressions Predicting Risk for Harmful and Hazardous Drinking*

Models[b]	Total Sample (N = 541)[a]																
	Out-of-Sample Model Evaluation Metrics										Variable Importance[c]						
	AUC	Accuracy	Sensitivity	Specificity	Precision	Recall	F1 Score	Kappa	Concordance	Somers *D*	IS	AS	NE	AW	EF	DM	SC
AS+AW+IS+NE+SC	.867	.758	.802	.708	.774	.802	.786	.510	.866	.734	7.036	4.342	2.698	3.546	–	–	2.762
AS+AW+DM+IS+NE+SC	.865	.758	.800	.712	.776	.800	.786	.510	.866	.730	7.052	4.352	2.756	3.574	–	0.626	2.834
AS+AW+IS+SC	.864	.750	.802	.688	.764	.802	.780	.492	.862	.730	7.09	4.608	–	3.194	–	–	1.754
AS+AW+EF+IS+NE+SC	.862	.756	.796	.712	.774	.796	.784	.506	.864	.724	7.058	4.362	2.566	3.53	0.85	–	2.682
AS+AW+DM+EF+IS+NE+SC	.862	.764	.802	.720	.780	.802	.790	.520	.862	.724	7.056	4.592	–	3.204	–	0.326	1.774
AS+AW+DM+IS+SC	.862	.756	.806	.696	.770	.806	.784	.502	.860	.726	7.072	4.374	2.624	3.554	0.824	0.596	2.742
AS+AW+IS+NE	.862	.746	.800	.680	.754	.800	.776	.480	.864	.724	8.012	4.322	1.676	3.652	–	–	–
AS+AW+EF+IS+SC	.861	.754	.798	.698	.768	.798	.782	.494	.860	.722	7.128	4.612	–	3.192	1.08	–	2.052
AS+AW+IS	.860	.754	.802	.700	.770	.802	.782	.500	.858	.720	7.932	4.524	–	3.414	–	–	–
AS+AW+DM+IS	.859	.758	.804	.704	.772	.804	.786	.508	.858	.720	7.764	4.49	–	3.404	–	0.436	–
AS+AW+DM+IS+NE	.859	.746	.802	.676	.754	.802	.778	.480	.858	.718	7.862	4.298	1.676	3.644	–	0.43	–
AS+AW+DM+EF+IS+SC	.859	.752	.798	.694	.764	.798	.780	.490	.858	.720	7.094	4.596	–	3.198	1.076	0.308	2.068
AS+AW+EF+IS	.858	.756	.802	.706	.772	.802	.786	.506	.858	.718	7.69	4.538	–	3.388	0.576	–	–
AS+AW+DM+EF+IS	.857	.756	.804	.702	.768	.804	.786	.506	.856	.716	7.58	4.5	–	3.382	0.54	0.348	–
AS+AW+EF+IS+NE	.857	.748	.794	.694	.762	.794	.774	.486	.860	.712	7.714	4.342	1.904	3.644	1.024	–	–
AS+IS+NE+SC	.856	.784	.838	.712	.786	.838	.812	.560	.856	.714	8.22	4.516	2.192	–	–	–	2.904
AS+AW+DM+EF+IS+NE	.856	.746	.788	.694	.764	.788	.772	.482	.856	.712	7.632	4.326	1.908	3.642	0.968	0.3	–
AS+DM+IS+NE+SC	.855	.782	.836	.716	.788	.836	.812	.560	.854	.710	8.196	4.52	2.232	–	–	0.466	2.93
AS+IS+SC	.854	.766	.814	.704	.774	.814	.794	.520	.852	.706	8.184	4.712	–	–	–	–	2.148
AS+DM+IS+SC	.853	.766	.814	.700	.772	.814	.792	.516	.850	.704	8.124	4.702	–	–	–	0.344	2.136
AW+IS+NE+SC	.852	.760	.816	.692	.768	.816	.790	.508	.852	.706	7.468	–	3.19	3.85	–	–	2.746
AS+IS	.852	.772	.830	.698	.776	.830	.802	.532	.850	.704	9.28	4.62	–	–	–	–	–
AS+DM+IS	.851	.768	.828	.694	.774	.828	.800	.528	.852	.704	9.03	4.59	–	–	–	0.484	–
AS+IS+NE	.851	.772	.832	.704	.776	.832	.802	.538	.850	.700	9.274	4.5	0.986	–	–	–	–
AS+EF+IS+NE+SC	.851	.788	.834	.728	.794	.834	.814	.568	.850	.702	8.234	4.532	2.056	–	0.92	–	2.834
AS+EF+IS+SC	.850	.766	.812	.708	.776	.812	.792	.520	.852	.702	8.212	4.716	–	–	1.054	–	2.348
AS+DM+EF+IS+SC	.850	.764	.812	.704	.774	.812	.790	.516	.848	.700	8.152	4.702	–	–	1.05	0.336	2.344
AW+DM+IS+NE+SC	.849	.762	.820	.692	.768	.820	.794	.512	.850	.698	7.424	–	3.178	3.86	–	0.398	2.72
AS+DM+EF+IS+NE+SC	.849	.786	.838	.720	.790	.838	.814	.562	.848	.698	8.208	4.536	2.094	–	0.906	0.44	2.862
AS+DM+IS+NE	.849	.768	.834	.692	.772	.834	.800	.530	.848	.698	9.042	4.474	0.986	–	–	0.484	–
AS+EF+IS	.849	.766	.826	.698	.776	.826	.800	.526	.848	.698	8.918	4.636	–	–	0.718	–	–
AS+DM+EF+IS	.849	.766	.828	.696	.772	.828	.800	.528	.848	.698	8.766	4.606	–	–	0.646	0.372	–
AW+EF+IS+NE+SC	.848	.754	.810	.688	.762	.810	.784	.496	.848	.696	7.486	–	3.05	3.83	0.79	–	2.694
AS+EF+IS+NE	.847	.768	.832	.688	.770	.832	.798	.524	.848	.694	8.972	4.516	1.3	–	1.038	–	–
AS+DM+EF+IS+NE	.846	.766	.830	.688	.768	.830	.796	.522	.846	.692	8.83	4.496	1.286	–	0.964	0.338	–
AW+IS+NE	.845	.748	.806	.680	.758	.806	.778	.488	.844	.690	8.334	–	2.24	3.946	–	–	–
AW+DM+EF+IS+NE+SC	.845	.758	.812	.692	.764	.812	.788	.502	.846	.688	7.436	–	3.03	3.838	0.792	0.4	2.684
AW+DM+IS+NE	.844	.746	.798	.684	.76	.798	.776	.486	.844	.690	8.126	–	2.22	3.93	–	0.624	–
AW+IS+SC	.843	.758	.822	.684	.764	.822	.792	.506	.844	.688	7.536	–	–	3.448	–	–	1.46
AW+IS	.842	.758	.810	.694	.766	.810	.788	.506	.842	.684	8.21	–	–	3.624	–	–	–
AW+EF+IS+NE	.842	.750	.810	.680	.758	.810	.782	.494	.840	.684	8.082	–	2.394	3.942	0.938	–	–
AW+DM+IS+SC	.842	.766	.826	.698	.774	.826	.796	.524	.842	.686	7.432	–	–	3.454	–	0.536	1.382

Classification Performance & Prediction Utility

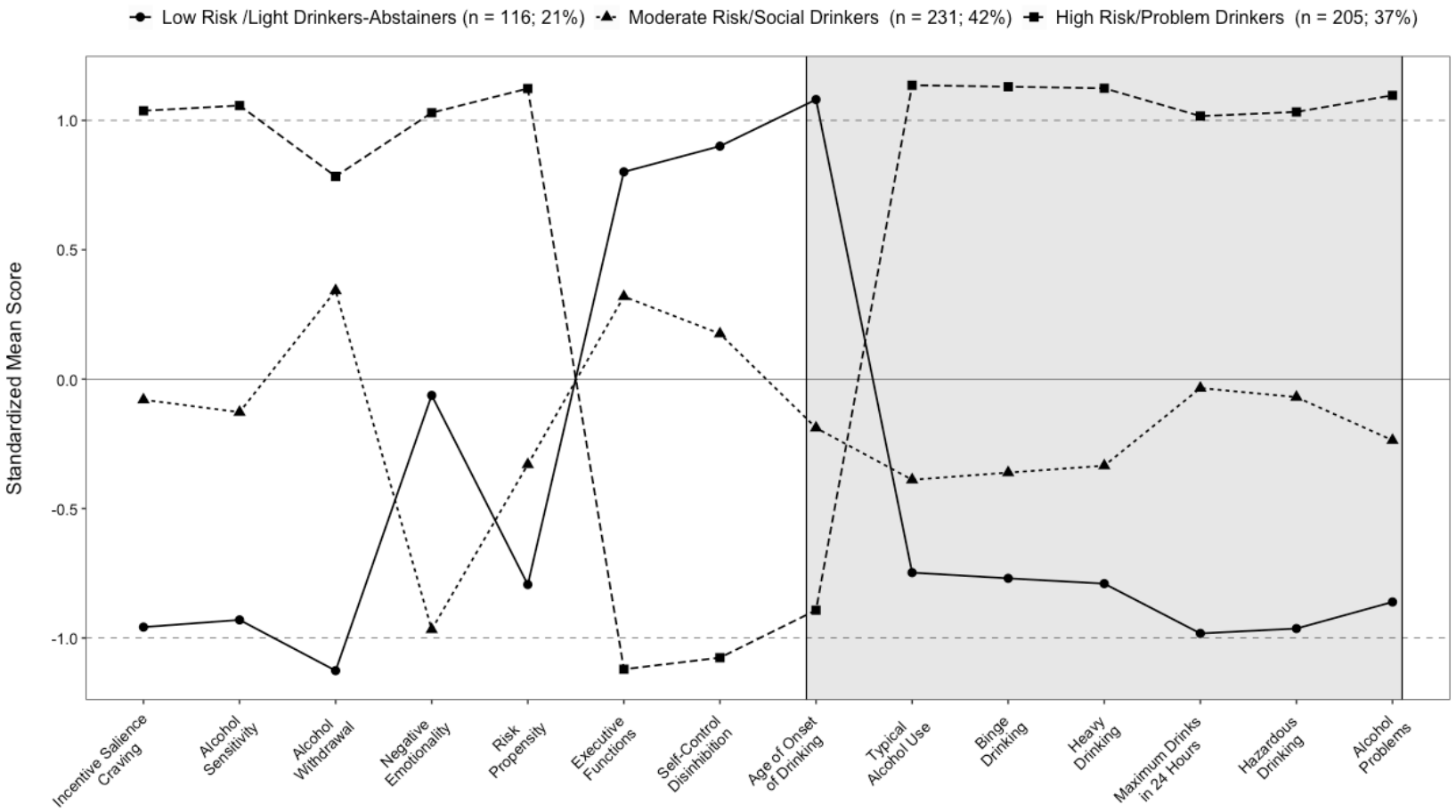
AW+DM+IS	.841	.750	.810	.676	.758	.810	.782	.488	.842	.682	7.988	–	–	3.61	–	0.672	–
AW+DM+EF+IS+NE	.841	.748	.800	.688	.762	.800	.778	.490	.840	.684	7.95	–	2.342	3.93	0.832	0.466	–
AW+EF+IS	.840	.758	.810	.698	.768	.810	.790	.508	.842	.680	8.054	–	–	3.616	0.56	–	–
AW+DM+EF+IS+SC	.840	.756	.812	.690	.764	.812	.784	.504	.840	.676	7.456	–	–	3.448	1.232	0.556	1.84
AW+EF+IS+SC	.840	.756	.810	.690	.764	.810	.786	.502	.840	.678	7.564	–	–	3.442	1.206	–	1.892
AW+DM+EF+IS	.838	.752	.810	.684	.762	.810	.784	.496	.84	.678	7.886	–	–	3.612	0.54	0.622	–
IS+NE+SC	.837	.758	.810	.692	.768	.810	.788	.506	.836	.674	8.822	–	2.662	–	–	–	2.882
DM+IS+NE+SC	.835	.752	.806	.684	.760	.806	.782	.494	.834	.672	8.744	–	2.644	–	–	0.352	2.816
EF+IS+NE+SC	.832	.748	.802	.680	.756	.802	.778	.484	.832	.662	8.834	–	2.518	–	0.874	–	2.856
DM+EF+IS+NE+SC	.831	.748	.802	.680	.758	.802	.778	.484	.832	.664	8.748	–	2.49	–	0.878	0.356	2.814
IS+NE	.831	.750	.814	.666	.754	.814	.786	.488	.832	.662	9.81	–	1.532	–	–	–	–
DM+IS+NE	.830	.746	.812	.662	.750	.812	.782	.480	.832	.658	9.52	–	1.514	–	–	0.692	–
IS+SC	.830	.750	.824	.658	.748	.824	.784	.488	.830	.662	8.806	–	–	–	–	–	1.868
IS	.829	.742	.816	.652	.744	.816	.778	.472	.830	.658	9.768	–	–	–	–	–	–
DM+IS+SC	.829	.752	.826	.662	.750	.826	.784	.492	.830	.658	8.684	–	–	–	–	0.51	1.772
DM+IS	.828	.740	.810	.652	.746	.810	.776	.468	.828	.654	9.466	–	–	–	–	0.712	–
EF+IS+NE	.828	.748	.814	.666	.752	.814	.782	.484	.828	.656	9.552	–	1.76	–	0.942	–	–
EF+IS+SC	.828	.752	.814	.672	.754	.814	.784	.490	.828	.656	8.824	–	–	–	1.188	–	2.21
DM+EF+IS+NE	.827	.742	.810	.658	.746	.810	.778	.472	.828	.654	9.352	–	1.698	–	0.822	0.532	–
DM+EF+IS+SC	.826	.748	.818	.662	.748	.818	.780	.486	.826	.654	8.696	–	–	–	1.214	0.532	2.146
EF+IS	.825	.74	.808	.656	.746	.808	.774	.468	.824	.65	9.486	–	–	–	0.55	–	–
DM+EF+IS	.824	.742	.810	.656	.748	.810	.778	.472	.824	.650	9.278	–	–	–	0.514	0.676	–
AS+AW+NE+SC	.820	.734	.782	.676	.752	.782	.766	.460	.818	.642	–	5.004	2.942	6.284	–	–	5.424
AS+AW+DM+NE+SC	.818	.748	.796	.690	.762	.796	.776	.484	.818	.638	–	4.91	2.844	6.218	–	0.676	5.062
AS+AW+EF+NE+SC	.815	.738	.784	.684	.756	.784	.770	.466	.816	.628	–	5.01	2.874	6.272	0.614	–	4.706
AS+AW+DM+EF+NE+SC	.814	.752	.798	.698	.770	.798	.780	.492	.816	.628	–	4.918	2.766	6.206	0.632	0.696	4.478
AS+AW+DM+SC	.807	.726	.770	.676	.748	.77	.758	.444	.806	.614	–	5.116	–	5.938	–	1.05	4.348
AS+AW+SC	.807	.724	.774	.668	.744	.774	.758	.440	.808	.612	–	5.258	–	6.02	–	–	4.75
AS+AW+DM+EF+SC	.805	.722	.766	.672	.746	.766	.754	.436	.802	.612	–	5.094	–	5.928	0.768	1.076	3.924
AS+AW+EF+SC	.804	.724	.772	.668	.744	.772	.758	.440	.804	.608	–	5.246	–	6.012	0.728	–	4.176
AS+AW+DM+EF+NE	.794	.704	.750	.656	.730	.750	.738	.406	.796	.586	–	4.896	1.598	6.716	2.512	1.724	–
AS+AW+DM+EF	.791	.714	.768	.656	.736	.768	.748	.422	.792	.582	–	5.008	–	6.598	2.07	1.866	–
AS+AW+EF+NE	.791	.708	.752	.656	.732	.752	.740	.410	.790	.580	–	5.05	1.752	6.912	2.936	–	–
AS+AW+DM	.788	.702	.766	.630	.724	.766	.742	.398	.790	.576	–	4.904	–	6.894	–	2.312	–
AS+AW+DM+NE	.788	.708	.768	.638	.728	.768	.746	.410	.788	.576	–	4.832	0.688	6.82	–	2.304	–
AS+AW+EF	.786	.700	.746	.652	.730	.746	.736	.398	.784	.570	–	5.202	–	6.782	2.484	–	–
AW+DM+NE+SC	.785	.728	.774	.672	.750	.774	.760	.446	.786	.570	–	–	3.272	6.85	–	1.256	4.942
AS+AW	.784	.696	.746	.642	.724	.746	.734	.388	.784	.568	–	5.094	–	7.18	–	–	–
AW+NE+SC	.784	.722	.770	.668	.746	.770	.752	.436	.782	.568	–	–	3.466	6.954	–	–	5.424
AS+AW+NE	.783	.704	.756	.646	.728	.756	.740	.404	.784	.566	–	5.018	0.708	7.096	–	–	–
AW+DM+EF+NE+SC	.783	.716	.764	.664	.742	.764	.748	.428	.782	.564	–	–	3.152	6.828	0.622	1.286	4.468
AW+EF+NE+SC	.780	.71	.760	.656	.736	.760	.742	.416	.780	.560	–	–	3.364	6.944	0.566	–	4.772
AS+DM+NE+SC	.777	.716	.804	.618	.722	.804	.758	.420	.776	.556	–	5.69	1.858	–	–	1.282	5.854
AS+DM+SC	.776	.700	.780	.612	.714	.780	.744	.392	.774	.550	–	5.808	–	–	–	1.54	5.724
AW+DM+SC	.776	.702	.764	.626	.718	.764	.738	.390	.778	.552	–	–	–	6.59	–	1.742	4.014
AW+DM+EF+SC	.775	.706	.766	.638	.726	.766	.744	.404	.774	.550	–	–	–	6.572	1.068	1.792	3.814
AS+NE+SC	.774	.716	.806	.612	.722	.806	.758	.420	.776	.548	–	5.83	2.036	–	–	–	6.434
AS+DM+EF+SC	.773	.696	.780	.600	.710	.780	.740	.380	.770	.548	–	5.774	–	–	0.838	1.57	5.01
AS+DM+EF+NE+SC	.773	.706	.788	.610	.716	.788	.750	.398	.772	.544	–	5.678	1.756	–	0.732	1.31	5.258
AW+SC	.771	.702	.772	.618	.720	.772	.742	.392	.770	.546	–	–	–	6.722	–	–	4.526
AW+EF+SC	.771	.698	.770	.618	.716	.770	.740	.388	.768	.544	–	–	–	6.708	0.982	–	4.128

Classification Performance & Prediction Utility



Aim 3: To identify common profiles of the hypothesized functional domains that may either protect or place individuals at higher risk and explore their group-specific etiological relevance for harmful and hazardous drinking

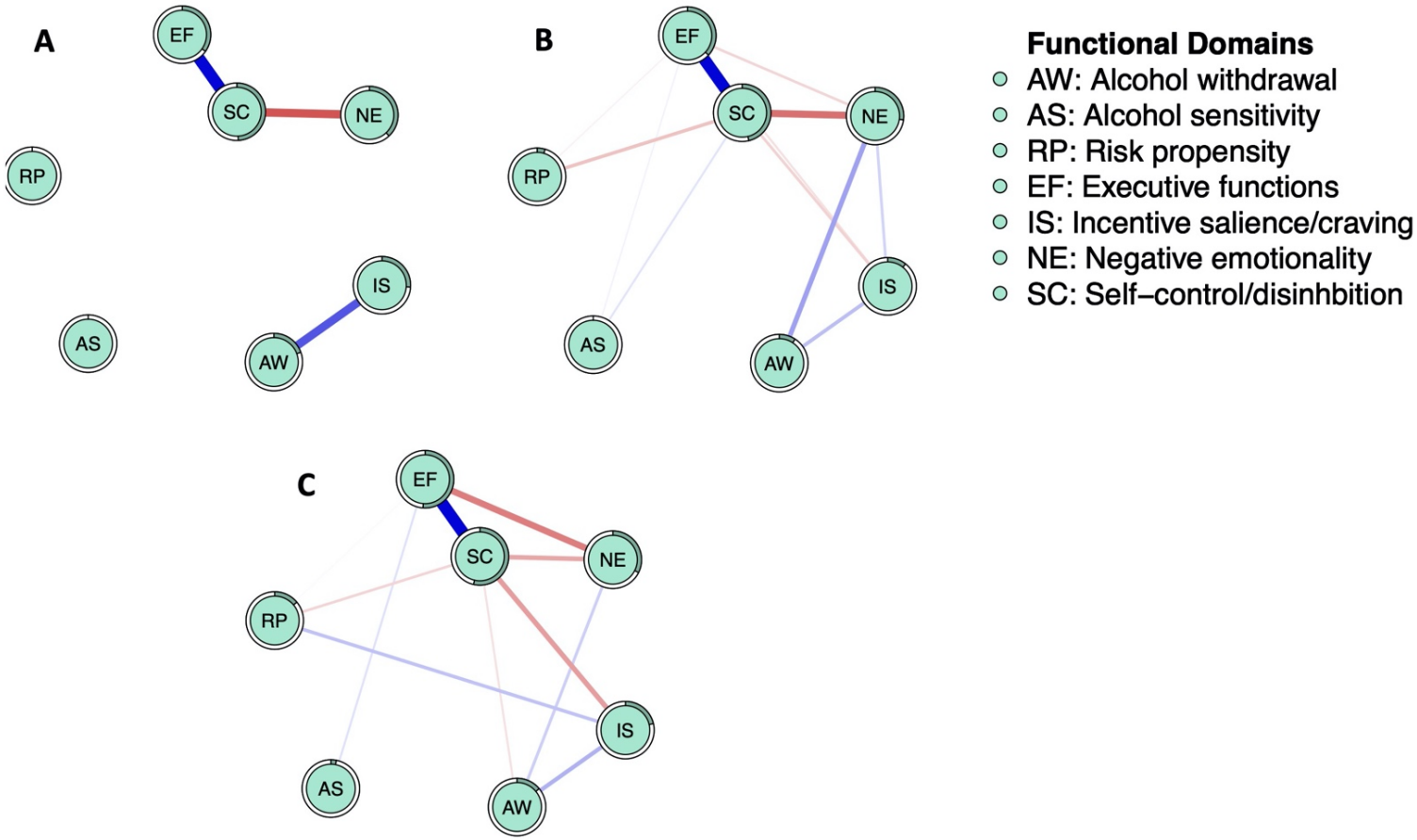
Latent Classes or “Subtypes”



Aim 4: To identify the most "central" domains for the emergence, development, and maintenance of persistent harmful and hazardous drinking

Network Modeling & Centrality Analysis

(A) Low Risk/Light Drinkers-Abstainers
(B) Moderate Risk/Social Drinkers
(C) High Risk/Problem Drinkers



Network Modeling & Centrality Analysis

(A) Low Risk/Light Drinkers-Abstainers
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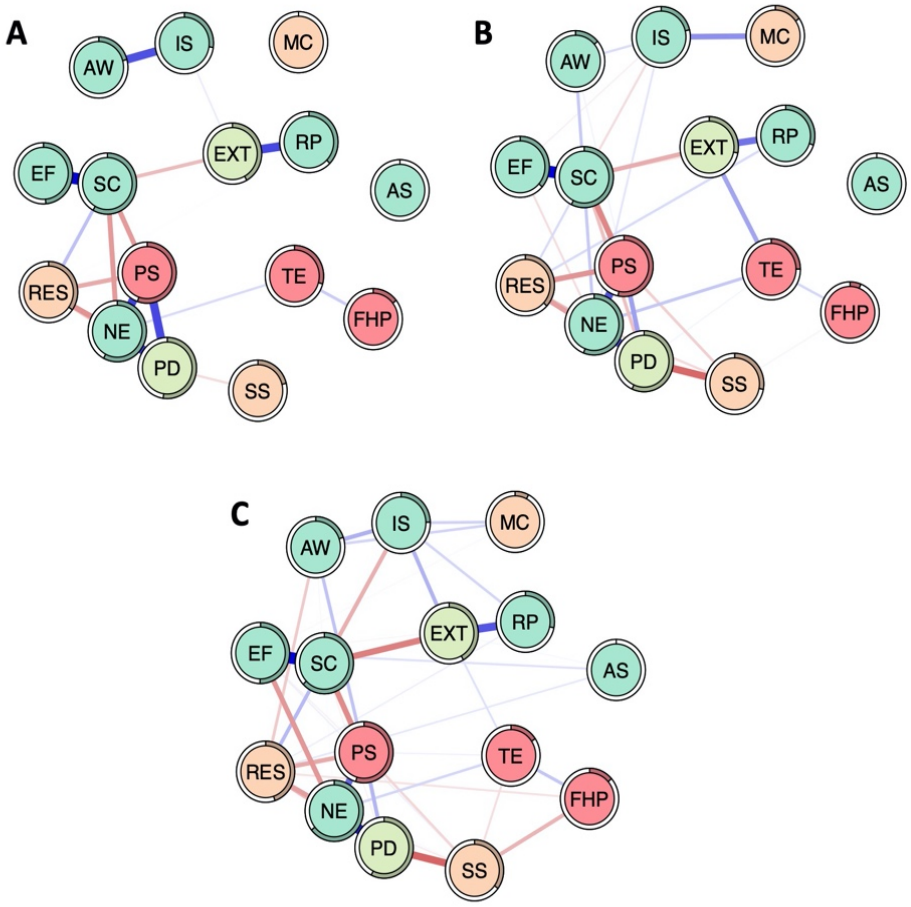


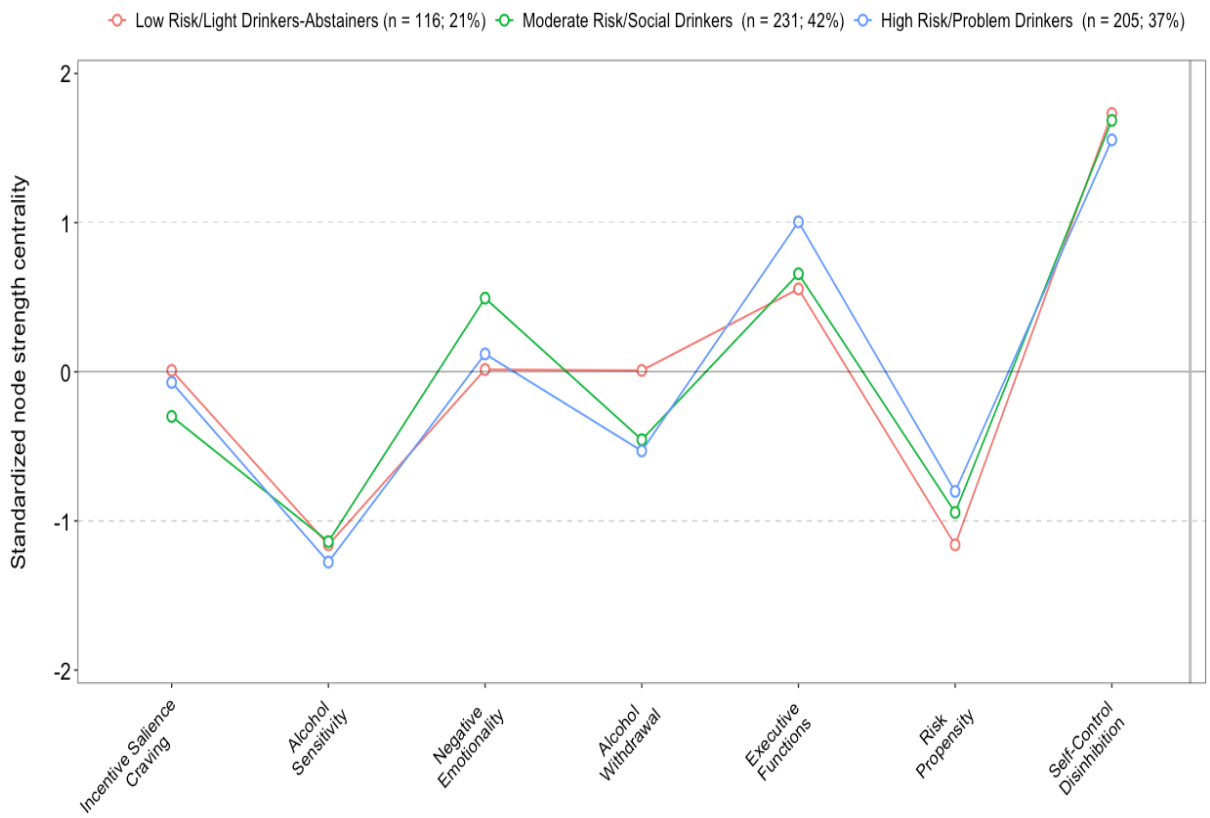
Functional Domains
- AW: Alcohol withdrawal
- AS: Alcohol sensitivity
- RP: Risk propensity
- EF: Executive functions
- IS: Incentive salience/craving
- NE: Negative emotionality
- SC: Self–control/disinhbition

Externalizing and Internalizing Symptomatology
- EXT: Externalizing deviancy
- PD: Psycological distress

Intra & Interpersonal Protective Factors
- RES: Resilience
- MC: Motivation to control drinking
- SS: Social support

Family History & Situational Risk Factors
- PS: Perceived stress
- FHP: Family positive history
- TE: Trauma experiences

Network Modeling & Centrality Analysis



Conclusion

Take Home Messages

- When tested individually, all functional domains were quite robustly and consistently associated with all drinking measures, except for Negative Emotionality that was uniquely associated with alcohol problems, including AUD.

- The functional domains were differentially associated with measures of alcohol use and related experiences and failed to consistently show robust associations with all drinking measures, when tested simultaneously.

- The Incentive Salience/Craving, Alcohol Sensitivity, Alcohol Withdrawal, and Self-Control/Disinhibition domains still showed expected and unique associations with most drinking measures.

Take Home Messages

- Negative Emotionality showed a handful of unexpected negative associations with drinking measures, after controlling for the effects of the other functional domains.
  - Possible explanations:
    - (1) Anxiety-specific (but not depression-specific) indicators of negative emotionality may have a protective role against alcohol use, even more when controlling for externalizing deviancy (Hussong et al., 2017).
    - (2) This negative association could be attributable to a suppression effect, such that after controlling for Executive Functions and Self-Control/Disinhibition (closely related to externalizing deviancy), individuals with higher negative affect are less likely to engage in alcohol use and abuse.

Take Home Messages

- Negative Emotionality showed a handful of unexpected negative associations with drinking measures, after controlling for the effects of the other functional domains.
  - Possible explanations:
    - (3) Negative emotionality does not hold any etiological relevance for problematic drinking but may instead be caused by persistent alcohol use
      - Differential influence of negative emotionality at different stages of the drinking career (e.g., Litten et al., 2015; Kwako et al., 2017)
      - Precipitating factor and a consequence when problematic drinking has been established (see Witkiewitz & Villarroel, 2009)

Take Home Messages

- Incentive Salience/Craving, Alcohol Withdrawal, and Alcohol Sensitivity produced the single most parsimonious and optimal combination with the best classification utility in discriminating problematic drinking.
- Incentive Salience/Craving demonstrated by far the strongest predictive utility and diagnostic value.
  - Incentive-sensitization theory of addiction (Robinson & Berridge, 1993), and its explanation of the mechanisms underlying the development of persistent problematic drinking, including AUD (e.g., Cofresî, Bartholow, & Piasecki, 2019)

Take Home Messages

- We identified three homogeneous and well-separated classes:
  - Low Risk/Light Drinkers-Abstainers (n = 116, 21%)
  - Moderate Risk/Social Drinkers (n = 231, 42%)
  - High Risk/Problem Drinkers (n = 205, 37%)

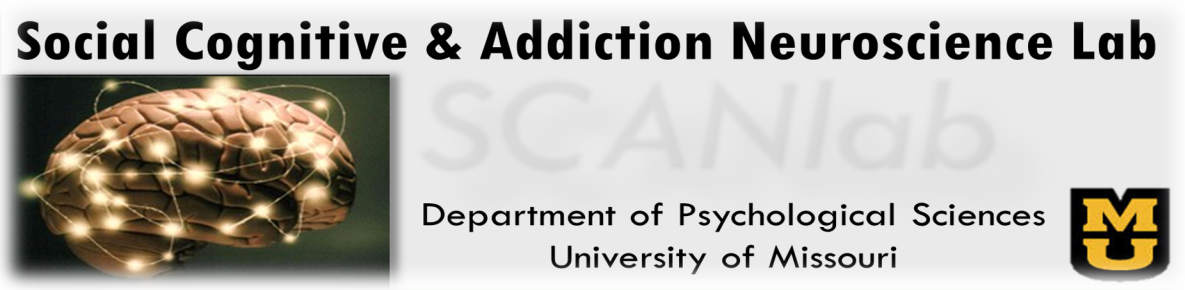
Take Home Messages

- Incentive Salience/Craving, Alcohol Withdrawal, and Alcohol Sensitivity–the domains with the best classification utility–were weakly interconnected with the other nodes in all networks.

- Self-Control/Disinhibition was consistently identified as the most interconnected and highly central domain in all networks -> Self-Control/Disinhibition could prove to be an important and useful target for promoting efficacy of prevention and intervention efforts.
  - Caution: The usefulness of Self-Control/Disinhibition as a target for prevention and intervention efforts depends upon the existing true causal mechanisms and directionality of connections.

Limitations

- The lack of heterogeneity and representativeness of the sample used.
  - College students differ in their patterns of alcohol involvement compared to noncollege peers (e.g., Quinn & Fromme, 2011; Slutske, 2005)
  - The need to replicate findings using heterogeneous and more diverse samples
- The inability to investigate the existence of causal relations:
  - Explore the causal relations and directionality of connections in the networks
  - Explore theoretically plausible reverse causation mechanisms
- We did not explore gender differences in our findings.



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