

# Cognitive Control and Negative and Positive Valence Systems in the Development of an NIMH RDoC-Based Model for Alcohol Use Disorder

Edén Sánchez and Carlos Cruz-Fuentes

To the Editor:

THE MAIN GOAL of the current research on alcohol use disorder (AUD) (e.g., studies sponsored by the National Institute of Alcohol Abuse and Alcoholism) and of utmost interest for shaping the future of international mental health diagnostic classifications (e.g., American Psychiatric Association, World Health Organization) is the identification of the psycho-neurobiological factors that explain the gradual transition from occasional and limited alcohol use to heavy and problematic consumption culminating in AUD (Koob, 2014). Thus, the recent position paper by Litten and colleagues (2015) outlining the effort to develop a National Institute of Mental Health (NIMH) Research Domain Criteria (RDoC)-based model (Cuthber, 2014) for AUD represents a timely and appealing proposal.

While recognizing the virtues of the holistic and multifaceted approach of Litten and colleagues (2015), we also consider the utility of other theoretical frameworks. Examples of alternative approaches include that of Belcher and colleagues (2014), who proposed 3 major functional domains (positive emotionality, negative emotionality, and constraint) that represent complementary approaches of reinforcement and impulsive-compulsive behavior associated with the development of AUD. Likewise, Volkow and Baler (2014) put forward a heuristic model in which the behavioral continuum between inhibition or urge to substance use reflects competing cognitive processes and visceral influences.

Consistent with the dimensional approaches to understanding the complexity of AUD, we are currently working to develop a dimensional RDoC-based model focused on the cognitive control of drinking that we have called Research Domain Criteria for Abstinence,

*From the Instituto Nacional de Psiquiatría (ES, CC-F), Ramón de la Fuente Muñiz, Departamento de Genética, México, DF, México.*

*Reprint requests: Carlos Cruz-Fuentes, Instituto Nacional de Psiquiatría, Ramón de la Fuente Muñiz, Departamento de Genética, México, DF 14370, México; Tel.: (55) 41605074; Fax: (55) 133722; E-mail: cruz@imp.edu.mx*

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DOI: 10.1111/acer.12920

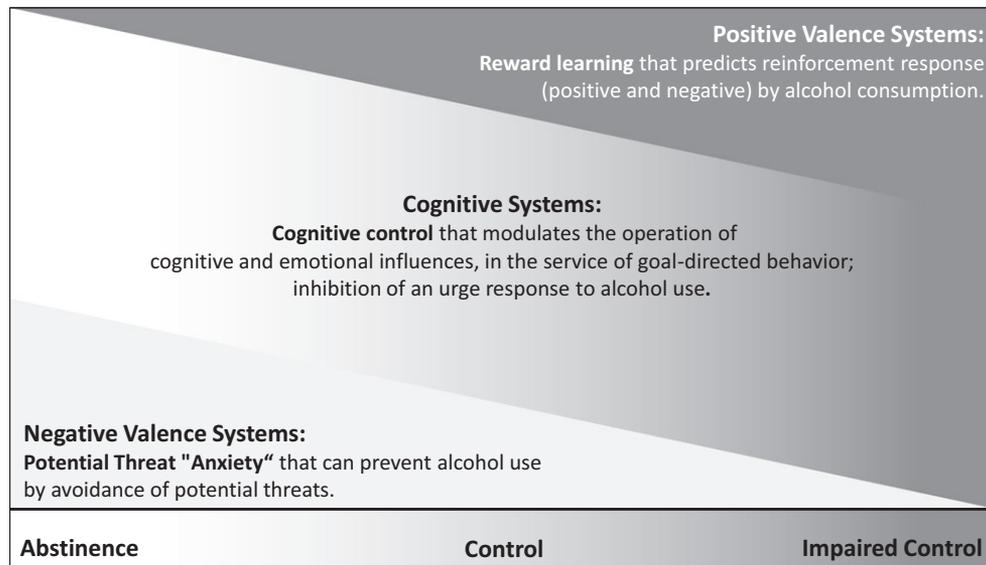
**Table 1.** Matrix of RDoC-NIMH Based Model of Alcohol Use Disorder

Domain	Unit of analysis	
	Behavior	Self-report
• Construct		
○ Subconstruct		
Positive Valence Systems (PVS):	Iowa Gambling Task	
• Reward learning		
Cognitive Systems (CS):	NIH Toolbox Dimensional Change Card Sort Test	Obsessive-Compulsive Drinking Scale
• Cognitive control		
○ Performance Monitoring		
○ Response Selection, Inhibition, or Suppression		
Negative Valence Systems (NVS):		State-Trait Anxiety Inventory
• Potential Threat "Anxiety"		

Source: Research Domain Criteria from National Institute of Mental Health: Development of the RDoC Framework. Available at: <http://www.nimh.nih.gov/researchpriorities/rdoc/detailed-description-of-the-rdoc-project.shtml>. Accessed April 28, 2015.

Control, and Impaired Control over Alcohol Use. Our model includes elements that resemble Koob and Le Moal's (2001) view of positive and negative reinforcement. The model is based on constructs/subconstructs from the domains of the original RDoC Matrix: the Negative Valence Systems (NVS) and the Positive Valence Systems (PVS) act to modulate/regulate nonautomatic cognitive process activated by blocking the automated execution of drinking behavior (craving as defined by Tiffany and Conklin (2000)). This is described in more detail in Table 1. We hypothesize that these domains act simultaneously, are intermingled, and together are responsible for the phenotypic/behavioral expression of drinking, ranging from no consumption to the impaired control over alcohol use (see Fig. 1).

It should be underscored that the successful elaboration of the RDoC-based models depends on an intimate knowledge of the interaction between biological systems and psychological constructs. By emphasizing the use of measurable variables of drinking behavior and cognition, in addition to the evaluation of symptoms that cannot be clearly defined by the subjects (e.g., positive or negative reinforcement), our model aims to explain the individual heterogeneity and complexity of the acute and chronic responses to the effects of alcohol.



**Fig. 1.** Dimensional approach using a National Institute of Mental Health (NIMH) Research Domain Criteria (RDoC)-based model of alcohol use disorder. Graphical RDoC-based model of abstinence, control, and impaired control over alcohol use. This includes the intermingled and simultaneous action of 3 domains: Negative Valence Systems (NVS), Positive Valence Systems (PVS), and Cognitive Systems (CS). In our model, the influence of the different constructs/subconstructs of NVS and PVS domains (opposing one another, but not necessarily mutually exclusive) modulate/regulate craving (CS), which changes the behavioral response from abstinence to drinking to the loss of behavioral control over drinking (shown in the graph as different shades of gray).

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