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The longitudinal association between cognitive control capacities, suicidality, and depression during late adolescence and young adulthood



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ABSTRACT

This study examined the association between cognitive control capacities, suicidal thoughts and attempts, and depressive symptoms during late adolescence and young adulthood. The sample included 4192 participants (55.5% female) from the United States who participated in Waves III (2001–2002; respondent age 18–26 years) and IV (2007–2008; respondent age 24–33 years) of the National Longitudinal Study of Adolescent to Adult Health. Data were analyzed using structural equation modeling. Suicidality in late adolescence predicted depressive symptoms in young adulthood. Depressive symptoms were not predictive of later suicide ideation nor attempts. Working memory was associated with lower depressive symptoms. Higher verbal ability was associated with more suicidal thoughts but not attempts. Internal locus of control was associated with decreased depressive symptoms and suicidal thoughts/attempts in young adulthood. Findings suggest that cognitive control capacities developed in adolescence differentially predict depressive symptoms, suicidal thoughts, and suicide attempts in young adulthood.

Young adult mental health issues are national and global health priorities. Globally, unipolar depressive disorders rank first in causes of years lived with a disability ([World Health Organization \(WHO\)](https://www.who.int), 2014). In the United States, neuropsychiatric disorders, with major depressive disorder being the biggest contributor, are the leading cause of disability ([Murray et al.](https://doi.org/10.1016/j.jadolescence.2018.03.009), 2013). Suicide is the second leading cause of death in adults ages 18–34 years ([Centers for Disease Control and Prevention \(CDC\)](https://www.cdc.gov), 2015, p. 10). In the overwhelming majority of cases where people suffer death by suicide, depression or other mood disorders are a contributing factor ([Substance Abuse and Mental Health Services Administration \(SAMHSA\)](https://www.samhsa.gov), 2015). The age-adjusted suicide rate in the United States increased from 10.5 per 100,000 in 1999 to 13.0 per 100,000 in 2014, an increase of 24% ([Curtin, Warner, & Hedegaard](https://doi.org/10.1016/j.jadolescence.2018.03.009), 2016). For each completed suicide in the United States, there are more than 25 suicide attempts ([SAMHSA](https://www.samhsa.gov), 2015). Given the magnitude of depression and suicide in young adults, understanding the factors that influence depressive symptoms and suicidality in young adults is crucial.

Cognitive control capacities are a family of skills that include the ability to resist reflexive or salient behaviors, thoughts, and attention in favor of making choices that lead to goal achievement ([Diamond](https://doi.org/10.1016/j.jadolescence.2018.03.009), 2016). Cognitive control capacity is an umbrella term for executive functions and related higher-order cognitive skills ([Crandall, Deater-Deckard, & Riley](https://doi.org/10.1016/j.jadolescence.2018.03.009), 2015). Many researchers categorize executive functions into the domains of working memory, inhibitory control, and attentional or cognitive shifting (not measured in this study), and the resulting higher order capacities such as reasoning, problem-solving, and planning ([Diamond](https://doi.org/10.1016/j.jadolescence.2018.03.009), 2013). Although cognitive control capacities are comprised of a series of components, brain imaging studies have demonstrated a

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superordinate cognitive control network that supports these various capacities (Niendam et al., 2012). Housed primarily in the prefrontal cortex, which develops over the first three decades of life, cognitive control capacities reach maturity in the mid-to late-20s (Niendam et al., 2012).

In the current study, we include components of three of these four primary categories of executive functioning (inhibitory control, working memory, and higher-order capacities). Additionally, we have included the cognitive capacity of locus of control. Inhibitory control includes the ability to regulate prevailing behavioral, cognitive, and emotional responses in favor of later greater rewards. We included one aspect only of inhibitory control: self-control, which is the ability to inhibit prepotent responses when a behavior is at odds with one's primary goal (Broadway, Redick, & Engle, 2010). People with low levels of self-control are characterized as being more impulsive and risk-seeking (Beaver, Ratchford, & Ferguson, 2009; Broadway et al., 2010). Sometimes used as a proxy for higher order executive functioning (Converse et al., 2015), verbal ability includes the ability to reason, plan, problem solve, and think abstractly (Gottfredson, 1997). Working memory is a system for selecting and keeping goal-relevant information accessible (Broadway et al., 2010). Finally, internal locus of control refers to the degree that one believes they have control over their life rather than being controlled by external forces. Although traditionally thought of as a product of social learning, research suggests that locus of control is connected with the brain's cognitive control network (Declerck, Boone, & De Brabander, 2006). Those with executive function impairments have been found to have a greater external locus of control (Rucklidge & Tannock, 2001). Conversely, impulse control, working memory, planning, and other cognitive control capacities have been shown to positively correlate with internal locus of control (De Brabander & Declerck, 2004; Stevens, Kaplan, Ponds, & Jolles, 2001). United, these capacities are highly relevant to helping young people to successfully manage the life changes and new relationships that come as they transition from adolescence to adulthood.

As individuals move from young adulthood to middle adulthood, many are transitioning into marriage and parenthood and launching into careers and further education. Changing physical and social environments require individuals to learn to manage increasingly complex relationships (e.g., romantic, marital, coworkers, and peers), which can be a source of both satisfaction and stress. At this stage, their cognitive control capacities are mature, or nearly mature, and they must learn to select life paths, adjust goals and plans to account for various challenges and successes, and reflect on decisions made (Nurmi, 2004). Deficits in cognitive control capacities may impact their ability and confidence to manage depression and stress, especially in relation to these new, critical relationships and key reflective periods. Well-developed cognitive control capacities provide many of the tools necessary to properly reflect on and cope with changes, leading to more fulfilling, healthy relationships and quality of life (Coban, 2013; Mansfield & Diamond, 2017).

1. Research Domain Criteria of mental health and suicidality

A number of psychosocial theories provide explanations for suicide. For example, Shneidman (1998) suggests that suicide is caused by psychoache or intolerable emotional pain. Joiner (2007) on the other hand purports that suicide is the result of individuals experiencing perceived burden, someness, social alienation, increased pain tolerance and reduced fear of death. Finally, Baumeister (1990) posits that suicide results from the need to escape from awareness of personal inadequacies that generate negative emotion. Despite these psychosocial theories, much of the research on suicide has focused on sociodemographic (e.g., gender) and psychiatric risk factors (e.g., major depression), rather than on more proximal factors to suicidal behavior (Glenn, Cha, Kleiman, & Nock, 2017).

In order to provide a new conceptual framework for guiding research on more proximal factors related to mental disorders, the National Institute of Mental Health (NIMH) has developed a classification system called the Research Domain Criteria (RDoC) (Kozak & Cuthbert, 2016). Domains within the criteria include negative valence systems; positive valence systems; cognitive systems; social processes, and; arousal and regulatory systems. Unit of analysis for each domain consists of genes, molecules, cells, circuits, physiology, behavior, and self-report.

Cognitive control is one construct within the RDoC cognitive systems domain. Research relative to cognitive control and suicide has been summarized by Glenn et al. (2017) and focuses on executive attention and attention control deficits (Keilp et al., 2013), making disadvantageous choices (Jollant et al., 2007), difficulty inhibiting poor responses (Westheide et al., 2008), and decreased activation for disadvantageous choices in the lateral orbitofrontal and occipital cortices (Jollant et al., 2010).

2. Cognitive control capacities, depressive symptoms, and suicidality

Prior research has found a relationship between some cognitive control capacities and depressive symptoms. In a meta-analysis assessing locus of control and psychological symptoms using 152 independent samples comprised of over 33,000 adults, it was found that there was a moderately strong relationship between external locus of control and depression and anxiety symptoms (Cheng, Cheung, Chio, & Chan, 2013). Andreotti et al. (2013) found that better working memory and cognitive reappraisal were associated with decreased depressive symptoms among adults. Shields, Kuchenbecker, Pressman, Sumida, and Slavich (2016) found that adults who exhibited better cognitive control while feeling emotional stress experienced less adverse bodily reactions typically caused by stress.

Based on extant literature, the relationship between cognitive control capacities and suicidality is complex, and cognitive control capacity may differentially affect suicide ideators versus those who have attempted suicide. Across studies on suicidality, a link has been found between executive functioning deficits and suicidality (ideation and attempts), with a more pronounced relationship in depressive disorder samples compared to samples with mixed diagnoses (Bredemeier & Miller, 2015; Saffer & Klonsky, 2016). Low cognitive flexibility appears to be a risk factor for suicide ideation among young adults (Miranda, Valderrama, Tsypes, Gadol, &

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