

## Just In Time Adaptive Interventions for Promoting Mental Health Among College Students

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**Background:** The college years are a high-risk period for a variety of mental health concerns. Comorbid hazardous drinking and depressed mood is one example. Hazardous drinking (“drinking that confers the risk of dysfunction or harmful consequences”; Kypri et al., 2002) among college students is a widespread and problematic phenomenon, associated with severe educational, health, psychological, interpersonal, and behavioral consequences (Saunders et al., 2004). Additionally, college students often experience depressed mood, namely symptoms of depression, such as feelings of sadness, unhappiness, and hopelessness, which fail to meet diagnostic criteria for a major depressive episode (Geisner et al., 2007). Empirical evidence suggests that students who experience depressed mood are an at-risk group for alcohol misuse and related problems (see Geisner et al., 2007 for review). Despite the availability of effective treatments, most students in need do not receive mental health or substance abuse services (Blanco et al., 2008; Eisenberg et al., 2007). In light of these challenges, *innovative approaches are needed to attenuate problematic alcohol use and depressive symptoms for college-aged populations.*

Advances in wireless devices and mobile technology offer an opportunity for the delivery of *just-in-time adaptive interventions* (JITAs). JITAs are a treatment design in which intervention options are delivered in real-time, and are adapted to address the immediate and changing needs of individuals as they go about their daily lives. Below we clarify the motivation for this intervention design and discuss our vision for using JITAs in the context of college students’ mental health in general, and comorbid hazardous drinking and depressed mood in particular.

**Just-In-Time (JIT)** The concept JIT has long traditions in various fields. Overall, these traditions conceptualize JIT as the effective provision of timely support, operationalized by offering the type of support needed, precisely when needed, in a way that minimizes waste (i.e., anything that does not benefit the person). Building on these traditions we (Nahum-Shani et al., 2015) define the JIT approach in the context of health behavior interventions as the precise provision of support whenever the person is (a) vulnerable and/or open to positive changes, and (b) receptive.

**State of vulnerability/opportunity.** A vulnerable state is defined as the person’s transient tendency to experience adverse health outcomes or to engage in maladaptive behaviors. A state of opportunity is defined as the person’s transient openness for learning and/or making positive changes (e.g., “a teachable moment”). Both states are a function of the interplay between relatively stable factors (e.g., socio-economic status) and more dynamic factors (e.g., mood, location, social interactions).

**State of receptivity.** A state of receptivity is defined as the conditions in which the person can receive, process, and use the support provided. A variety of facets can impact receptivity. This includes (a) the nature of support, particularly the demands it imposes on the individual; this is influenced by aspects related to the type and the design of support, including the content (e.g., complicated messages would be more demanding), the media deployed (e.g., text, video, audio; see Mohr et al., 2014) and the use of paraverbal and/or nonverbal cues that are less cognitively demanding (e.g., images or colors that trigger specific associations or heuristics; see Castelo et al., 2012); and (b) the recipient’s ability or motivation to receive, process and use the support. This can be influenced by stable (e.g., personality, working memory capacity) and dynamic factors (e.g., emotions, presence of distracters; Bureson, 2009).

**Adaptation.** To offer the right type of support only when the person is (a) vulnerable or open to positive changes, and (b) receptive to support, a strategy for adapting support provision is required. Adaptation is defined as a dynamic form of individualizations, namely one that uses time-varying information in the course of the intervention (e.g., changes in depressive mood, location and response to an intervention) to make decisions about the type, amount and timing of support provision.

**Just-In-Time Adaptive Interventions.** Building on the above terminology, we conceptualize the JITAI as an intervention design that uses a dynamic form of individualization to operationalize the provision of JIT support. JITAs operationalize the individualization of support provision based on ongoing assessments of the individual’s state and ecological context. The goal is to offer the right type of support precisely when, and only when, the person is in a state of vulnerability/opportunity and receptivity. The detection of such states, and hence the feasibility of JITAs, becomes increasingly possible with the growing availability of technology such as wearable and ubiquitous computing sensors (e.g., wearable activity monitors, home

automation systems such as a smart thermometer), mobile-phone-based sensing (e.g., GPS, light sensors, microphones), digital footprints (e.g., social media interactions, email, digital calendars), and low-effort self-reporting (e.g., ecological momentary assessment [EMA]) (Hekler et al., 2013).

Our vision for JITAI in the context of college students' mental health: Our goal is to construct a JITAI to reduce drinking and depressive symptoms among college-aged populations with comorbid hazardous drinking and mild depression. We seek to develop a JITAI that integrates a novel and engaging video-based approach, building on our recent work on developing and disseminating brief videos (see [www.inkblots.tv](http://www.inkblots.tv)). Specifically, *inkblots* is a series of brief (4-6-minute) online videos designed to (a) normalize negative feelings and experiences; (b) illustrate resilience and coping skills using evidence-based principles such as Cognitive Behavioral Therapy and Acceptance and Commitment Therapy; and (c) promote help-seeking behaviors for conditions that are highly prevalent among adolescents and young adults, such as depression and drinking. The central theme is that “tiny shifts can lead to big changes”—i.e., subtle changes in how we approach life can yield large and lasting benefits. The videos have received very favorable feedback from college students and other audiences (e.g., when presented with the videos in classrooms, over 90% of students reported in anonymous surveys that the videos were relevant, useful, and engaging). Simple randomized trials are underway to understand the effects of the videos on short-term outcomes such as the use of coping skills and intentions to seek help.

Despite the great potential of this video-based intervention approach, it is currently implemented as an “on-demand” intervention, or in other words, as a “pull” intervention, where various videos are made available for the person and he/she can access them online whenever and wherever needed.

Recognizing that some individuals may not access or utilize available therapeutic resources as needed (e.g., Klein et al., 2012; Simpson et al., 2012; McTavish et al., 2012); our goal is to construct a JITAI that uses a “push” approach, where small chunks of intervention content and/or brief reminders are sent to prompt/encourage the person to access the videos or apply a coping skill.

**Open scientific questions:** There are many open questions concerning the optimal construction of a JITAI that employs such a “push” approach.

Scientific questions concerning states of vulnerability/opportunity include (a) what are the situational and contextual conditions that define a state of vulnerability for (i.e., that predict) depressive symptoms and hazardous drinking; (b) can a “push” intervention break the link between the vulnerable state and depressive symptoms and/or hazardous drinking; (c) what type (e.g., content, media deployed for delivery) of a “push” intervention can be most useful in breaking this link?; and (d) in what conditions providing a “push” intervention is more likely to facilitate learning of a coping skill.

Scientific questions concerning states of receptivity include: (a) what are the situational and contextual conditions in which providing a “push” intervention will facilitate participant engagement in the videos (i.e., will lead to participants accessing the videos, watching the videos, and using recommended coping strategies); (b) in what conditions providing a “push” intervention might lead to iatrogenic effects such as irritation, boredom and cognitive overload; and (c) what strategies can be used (in terms of the type, amount and timing of intervention provision) in order to reduce these possible iatrogenic effects.

Answering these questions requires expertise in several areas, including the application area (mental health and drinking in young people), Human-Computer interaction (to design usable and enjoyable “push” intervention options), the design of studies that involve immediate reporting of experiences in the everyday life of individuals, the use of mobile and wearable sensors for non-intrusive monitoring of situational and contextual factors, machine learning analytics for high volume data, and experimental designs that enable causal inference about the immediate and long-term effect of just-in-time interventions. Hence, our vision includes the establishment of a new collaboration between researchers working in these various domains, with the goal to answer scientific questions that will inform the development of high-quality video-based JITAI for comorbid hazardous drinking and depressive symptoms in college students. We hope that this collaborative research will also contribute to the development of JITAI for addressing other mental health concerns among college-aged populations.

\*\*\* References are available from the author; this statement is based on my work with Daniel Eisenberg, Eric Hekler, Donna Spruijt-Metz and Susan Murphy\*\*\*