

# CLEARINGHOUSE FOR MILITARY FAMILY READINESS

## Just-in-Time Adaptive Interventions

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Clearinghouse Technical Assistance Team

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## Background

In the mid-1970s, Taiichi Ohno, Vice-President of Toyota Motor Company developed a system of manufacturing called ‘just-in-time production’ which limited inventories to carrying only necessary parts and restricted the manufacturing of products to only the necessary quantities at the time they were needed (Sugimori, Kusunoki, Cho, & Uchikawa, 1977). The result of this streamlined manufacturing system was an elimination of excess waste: saving time, money, and other resources.

Since the advent of the just-in-time concept in the 70’s, other fields such as education and computer programming have integrated principles from *just-in-time (JIT)* production into developing their own systems and processes to produce the right programs, products, and services, all within a timeframe that is delivered neither too early nor too late and with the same end-goal in mind, to eliminate waste and conserve resources (Nahum-Shani et al., 2017).

## Just-in-Time Adaptive Interventions

The field of Behavioral Healthcare is another discipline that has adopted the concept of JIT into its programming and interventions. Using the JIT framework, the behavioral health field has focused on developing a byproduct of JIT programs called just-in-time adaptive interventions (JITAs) to improve behavioral health outcomes in areas such as smoking, weight management, and alcohol abuse.

The just-in-time adaptive intervention is defined as an intervention design aimed at “provid[ing] the right type/amount of support, at the right time, by *adapting* to an individual’s changing internal and contextual state” (Nahum-Shani et al., 2017, p. 1). JITAs rely upon mobile sensing technologies (e.g., smart phones, Fitbits, smart watches) to monitor conditions which can change rapidly (e.g., over hours, minutes, or even seconds), irregularly (e.g., in an unexpected manner), and outside of a traditional treatment setting (Nahum-Shani et al., 2017). The incorporation of mobile devices into behavioral health interventions has become more feasible as devices such as smart phones, GPS tracking, and heart rate monitors now offer greater functionality and promise to deliver reliable information to researchers outside of a traditional primary care setting.

Technology provides researchers the opportunity to tailor (i.e., adapt) the intervention supports to the unique needs of a person in optimal moments when he or she needs support and will be most receptive to receive it. For example, researchers are increasingly able to provide interventions (e.g., a text message encouraging a sedentary person who has been sitting for an hour to get up and take a walk outside for 10 minutes) in real-time in the context of everyday life settings such as at home or at work.

JITAs are identified by three main characteristics:

1. Behavioral supports correspond to a need in real-time (i.e., when a person needs support or would be most receptive to receiving support);
2. The content and timing of support are modified and adapt to ongoing data collected by the system including before, during, and after support is delivered; and
3. Delivery of support (i.e., timing, type) is initiated by the intervention protocol rather than by the user (Naughton, 2017; Hardeman, Houghton, Lane, Jones, & Naughton, 2019).

## Examples of Behavioral Health Needs Addressed by JITAls

- Eating Disorders (Juarascio, Parker, Lagacey, & Godfrey, 2018)
- Smoking Cessation (Cerrada et al., 2017; Naughton, 2017).
- Physical Activity (Feter, dos Santos, Caputo, & da Silva, 2019)
- Obesity and Weight Management (Thomas & Bond, 2015)
- Alcohol Use Disorders (Bae, Chung, Ferreira, Dey, & Suffoletto, 2018; Gustafson et al., 2014)
- Pain Management (Kristjánisdóttir et al., 2013)
- Mental Illness (Ben Zeev et. al., 2013)
- Sleep Disorders (Pulantara, Parmanto, & Germain, 2018)

## Examples of JITAls in Development

1. **iREST (interactive Resilience Enhancing Sleep Tactics)**
  - Developed to be integrated into behavioral insomnia sleep interventions and to be accessed by both clinicians and patients. The iREST system includes a smartphone app, a clinician portal and a secured communication platform connecting the clinician's portal directly to the app. The app tracks both wake and sleep times, sends patients a weekly assessment when approved by the clinician, and offers sleep education and personalized sleep tips which are always available on the app. The clinician portal allows clinicians to monitor patient progress and offer input as to which prompts clients receive the next steps clients should follow. The participants of the usability study to investigate the iREST intervention were Active Duty Service Members and Veterans. (Pulantara et al., 2018).
2. **Sense2Stop for Stress Management**
  - Created as an intervention to support smokers who have recently quit smoking. The app is designed to prompt users to perform stress-reduction exercises when under stress, assuming that stressful situations and experiences may cause an abstinent smoker to relapse. Through the use of an electronic wristband and chest band, participant stress levels are monitored. When the bands detect stress, participants are prompted with

stress management exercises more frequently. The app also assigns 1 of 3 possible stress regulation exercises for practice at periods throughout the day even if stress is not detected (The Methodology Center at Penn State's College of Health and Human Development, 2019).

## Recommendations

While JITAIs hold enormous potential for positively impacting behavioral health concerns, there is also a need for further research and evidence to direct their design and implementation and to then substantiate evidence that these programs can affect positive outcomes (Thomas & Bond, 2015). Given the growing body of research around JITAIs, more time is needed for researchers to respond to this new field of study, growth in mobile technological capabilities, and the increasing body of evidence in best practices around JITAIs. In the meantime, decisionmakers should be aware that although early evidence around JITAIs suggests promise for use in behavioral health, strong evidence of positive outcomes demonstrated over time is currently unavailable.

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