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Review on the Integration of Just-in-time Adaptive Intervention and Internet-based Cognitive Behavioral Therapy in Reducing Suicidal Thoughts and Behavior

Zekai Chen[1,*]

[1]Department of Psychology, Pepperdine University, California, US
*Corresponding author: zekai.chen@pepperdine.edu

Abstract:

Suicide remains a major public health challenge in the world. The current suicide prevention approaches face challenges in timing mismatch, access barriers, and lack of personalization, complicating the environment for successfully reducing suicidal thoughts and behaviors (STBs). Mobile health has been an emerging but effective approach to supporting and treating mental illnesses. The strengths of Just-in-Time Adaptive Interventions (JITAI) and Internet-based Cognitive Behavioral Therapy(iCBT) are potential approaches to resolving the current challenges of suicide prevention. This paper examines the definitions of JITAIs and iCBT and explores their use in mitigating suicidal thoughts and behaviors. It is proposed that the integration of JITAIs and iCBT could address the current obstacles in preventing suicidal thoughts and behaviors due to their advantages in availability, accessibility, and personalization. However, this integration also has its limitations, necessitating further research. The paper underscores the necessity of future empirical studies on the combined use of JITAIs and iCBT to reduce suicidal thoughts and behaviors.

Keywords: JITAIs, iCBT, Suicide Prevention, Multimodality Treatment, mHealth

1. Introduction

1.1 Research Background

Suicide is an imperative public health issue and remains an imperative contributor to mortality around the world. It is the leading cause of death and affects people of all ages [1]. In the year 2021, over 48,000 individuals in the United States lost their lives to suicide, equating to one death every 11 minutes. Moreover, 12.3 million adults in the US contemplated suicide, 3.5 million devised a plan for it, and 1.7 million made attempts [2].

Research has suggested that suicide is a multidetermined phenomenon, and the current suicide prevention strategies do not align with the complex and dynamic nature of suicide risk. The three major challenges of the existing suicide prevention approaches are timing, accessibility, and personalization. The issue of timing regards the mismatch between the current treatment and the dynamic of suicidal thoughts and behavior (STBs) [3]. Studies have shown that suicidal ideations fluctuate rapidly over short periods, usually within a few hours [4]. Due to the nature of rapid changes in STBs, many current treatments end up providing no support during mild periods of STBs and intensive care during elevated periods of STBs [3]. The issue in accessibility responds to the fact that the majority of people with STBs do not receive any treatment, with the potentially high barriers of financial cost, availabilities of providers, and individual's attitudes towards treatment. The current treatment approaches ask people with STBs to actively bring themselves to help instead of interventions and treatments presented to STB individuals. Finally, the personalization issue regards the complexity and heterogeneity of suicide risk that can be changed rapidly in a short period of time. Yet, the current interventions tend to follow a general rule of thumb and provide similar interventions with individuals in unique contexts, which results in poor response [3].

1.2 The Purpose of the Article

To explore the solution to the current barriers to STB prevention, this article suggests the integration use of JITAI and iCBT in reducing suicidal thoughts and behaviors (STBs). It is proposed that integrating JITAI and iCBT tackle the current timing mismatch, access barriers, and lack of personalization in STB prevention. This paper will

review the definition of JITAI and iCBT and discuss the strengths and potential limitations of the integration in reducing STBs.

2. JITAI

2.1 Just-in-Time Adaptive Interventions (JITAI) and its Application in Health Behavior Change

Just-in-Time Adaptive Intervention (JITAI) is a digital intervention design that delivers daily and at-the-moment support to individuals in the context of what the person needs the most and is most prone to be receptive by determining the type, amount, and intensity of the support. JIETAIs use smartphones and wearables to monitor the internal (e.g., Mood, feelings) and external (e.g., physical location) state to identify when and how to provide interventions to eliminate non-beneficial support provision. The determined interventions are based on empirical intervention protocol rather than the target individuals themselves; it adapts to individuals' unique and dynamic needs and attempts to achieve the best outcome possible for them. JITAI, as an intervention design, has been applied to smartphone applications for health behavior change. While JIETAI is not a treatment, it determines the best interventions from a pool of intervention options and delivers at the right time possible [5].

The Key components of JIETAI include decision points, decision rules, tailoring variables, and intervention options. At the time that an intervention decision is made (decision points), Decision rules specify the type, approach, provider, and contexts of the intervention by using the information regarding the individual to make personalized intervention (tailoring variables) and select from an array of possible treatment/actions that is to be made (intervention options) at the given decision point. With the selected intervention, JIETAI intends to achieve a measurable short-term goal (proximal outcomes) that is used to gauge the effectiveness of the intervention. The short-term goals usually mediate the intervention's ultimate goal (distal outcome). Specifically, there are two types of proximal outcomes. The proximal outcomes regarding intervention adherence and retention revolve around averting inadequate adherence to or abandonment of JITAIs. The proximal outcomes related to health conditions concern the actual short-term outcome of the intervention. For example, the overall goal of JITAIs is to promote healthy behaviors, and the proximal outcome would be increasing the daily step count (a healthy behavior) [5].

To make personalized optimal decisions for individuals for the decision rules, a micro-randomized trial (MRT) is used to collect and analyze empirical data to help develop more effective JITAIs. It is a factorial design that addresses the effectiveness of different interventions delivered to individuals in JITAI. MRT provides an understanding of whether the intervention achieves the desired outcome, identifies when and for whom the intervention is effective, and studies the factors that influence these effects [6]. JITAIs are promising approaches to the treatment of several mental health issues, such as depression and anxiety symptoms [7-9].

2.2 JITAI Application in Suicide Prevention

JITAI may increase the effectiveness of suicide prevention and provide treatment for STBs. Even though JITAIs have not been utilized for suicide prevention thus far, research indicates that other mobile health or internet-based interventions have demonstrated beneficial effects on reducing suicidal thoughts [3,10]. JITAIs' characteristics in the digital and technological monitoring and empirical-based intervention selection process hold promise to resolve the issues with current treatments and supports on STBs. First, digital technology provides 24/7 monitoring of the rapid wax and wane of the target individual's STBs. Second, the intervention is constantly available to target individuals requiring compatible mobile phones and wearables, significantly reducing the financial barrier. In the meantime, the intervention service is constantly ready and accessible to individuals, and the communication experience with the application and AI is as simple as taping and typing, which mitigates the potential stigma and personal attitudinal issues. Finally, JITAIs' capability of personalized intervention provision has a high potential to increase the effectiveness of the intervention [3].

Coppersmith et al. suggested an example of applying JITAIs in STBs [3]. The decision point occurs after a certain amount of time of self-reported suicidal thoughts. The suggested intervention options include phone calls by trained professionals, automated intervention, and local crisis service resources, but no action has been taken. The tailoring variable is suggested to be the risk score of STBs that are constructed from self-reported scales. Finally, the decision rules connect the intervention options and the tailoring variables to make the individualized optimal approaches for the target individual. With the ultimate (distal outcome) of stopping STBs, the short-term (proximal) outcome would be the target individuals actively seeking support from social services and crisis hotlines.

It is important to note that the framework of JITAI provides personalized, adapting interventions to promote

healthy behaviors in general. Its application in suicidal prevention is promising in resolving the current major dilemmas in suicidal prevention. Yet, there is room for improvement in establishing suitable interventions and mechanisms specifically for individuals in their fluctuating condition in STBs [3].

3. iCBT

3.1 Introduction of iCBT

Internet-based Cognitive Behavioral Therapy (iCBT) can be effectively integrated with JITAIs to reduce suicidal thoughts and behaviors. Research indicates that iCBT is as effective as in-person CBT in reducing symptoms such as social anxiety disorder, panic disorder, and depressive symptoms [11]. Studies have also shown the effectiveness of iCBT in reducing suicide ideation, depressive symptoms, and hopelessness [12].

iCBT is a psychotherapeutic treatment designed to reproduce the traditional in-person Cognitive Behavioral Therapy that focuses on helping individuals alternate their negative thoughts, behaviors, and emotional responses by promoting balanced thinking and improving coping abilities under stressful conditions [13,14]. The materials of iCBT are delivered digitally and often in online text, videos, audio files, infographics, and interactive elements. It is accessible online or through mobile devices. Based on their preliminary diagnosis, individuals participating in the iCBT programs will be assigned to designated programs. iCBT is highly personalized to individuals. The specific programs are designed to support individuals with their particular problems. Individuals will be self-guided or introduced to the program by their assigned therapist, who communicates with individuals via encrypted asynchronous messages. Depending on the program, individuals will be introduced to different modules with contents such as psychoeducation and exercises [13].

iCBT is flexible, accessible, and relatively cost-effective compared to traditional in-person CBT [15]. The content of iCBT is targeted to mirror in-person CBT. The CBT modules are usually presented as text in the chapters and modules in iCBT; the individual using the iCBT program can fully or partially self-direct and pace their own progress. In addition, with the nature of the digital delivery format, individuals can access the program at any location and time. Since iCBT involves relatively low therapist support and the support is asynchronous, it is considerably cost-effective. Moreover, since iCBT can be accessed anonymously, Individuals with stigmas seeking support can be encouraged to participate in the program [16].

3.2 iCBT Application in Suicide Prevention

iCBT can be a feasible approach to reducing suicidal thoughts and behavior (STBs) with the strength of its goal-orientated and problem-focused interventions in alternating individual's negative thoughts [14]. In addition, iCBT, similar to JITAIs, has strength in flexibility, accessibility, anonymity, and cost-effectivity, which present the possibility of resolving the current dilemmas (timing, accessibility, and personalization) that suicide prevention faces [3,12,15]. iCBT, mirroring the target of in-person CBT, aims to enhance problem-solving skills and coping methods to help individuals modify negative problems and cognitions [17]. Individuals educated and trained with enhanced problem-solving skills and coping abilities are better prepared to deal with the dynamically changing STBs at different times and environments. Büscher et al.found that iCBT demonstrated notable efficacy in reducing suicidal ideation compared to control conditions regardless of age, gender, and prior suicide attempts in their meta-analysis of individual participant data (N=2037) [12]. iCBT consistently showed reductions in suicidal ideation in various measures, including severity, reliable changes, and treatment responses. Specifically, the reliable improvement was 40.5%, with a low % deterioration rate of 2.8%.

4. Integrating JITAIs with iCBT in Reducing STBs

4.1 Impact of the Integration

It is suggested to integrate JITAIs and iCBT in reducing suicidal thoughts and behaviors (STBs) due to their similarity in strength and complementary nature in reducing STBs. Integrating JITAIs and iCBT provides timely, accessible, and personalized intervention and treatment for STBs, which is promising in overcoming the current barriers in suicide prevention. While iCBT delivers structured and scheduled therapeutic support to vulnerable individuals with STBs, JITAIs provide dynamic and all-time monitoring services to individuals that identify the optimum time to provide interventions, especially during a crisis. Responding to the complexity and dynamic nature of the mechanism of STBs, iCBT provides support in enhancing problem-solving and coping skills through regular psychoeducation, interactive exercises, and personalized feedback, which increase the likelihood of individuals in crisis making the best decision possible and provide accurate self-analysis allowing JITAI to promote the best intervention for the individual [11]. While iCBT provides promising distal outcomes for individuals with

STBs to make the best decision in crisis and fulfill the proximal outcome of JITAI suggested by Coppersmith et al., the structured and interactive format of iCBT may increase the achievement in the distal outcome of reducing STBs in individuals [3].

Wang & Miller conducted a pilot study on the integration of JITAI and mobile-rumination-focused CBT (MRFCBT) on identifying and blocking depressive rumination [9]. They found the integrated approach is strongly promising in identifying and blocking depressive rumination due to the interventions and treatment being promptly and appropriately delivered to users. The integration of JITAI features and MRFCBT has the advantage of detecting vulnerabilities at the right time by both active and passive multi-time assessments; in the meantime, the ample knowledge from the MRFCBT can be selected by the JITAI algorithm and delivered to the user at the right time.

4.2 Potential Limitation of Integrating JITAI and iCBT

Potential limitations of the integration of JITAI and iCBT exist. JITAI provides interventions for individuals in dynamic conditions, with intervention theories of a static nature that remain a potential challenge that hinders the efficacious development of JITAI [5]. Although iCBT may help provide the solution to the dynamic nature of STBs, iCBT is still a structured therapy that aims to resolve specific problems of individuals. Since suicide ideation fluctuates and is usually dynamic and complex, even if iCBT accurately identifies individuals' constantly changing problems with the features of JITAI, the effectiveness of iCBT on dynamically changing problems of individuals remains a challenge. Future studies are suggested to focus on the effectiveness of iCBT in the dynamic goal of solution or short-term programs that accommodate the dynamic nature of JITAIs.

5. Conclusions

Suicide is a critical issue in public health, and issues in timing, accessibility, and personalization complicate the implementation and effectiveness of interventions. This paper reviewed the definition of JITAIs and iCBT and their application in reducing suicidal thoughts and behaviors. It is suggested that JITAIs and iCBT be integrated to reduce STBs because the integration of JITAI and iCBT has strengths in availability, accessibility, and personalization, which can provide the solution to the current barriers in STB prevention. Yet, integrating JITAI and iCBT still has limitations, and future research is needed. This paper emphasizes the importance of future empirical study of the integration of JITAI and iCBT in reducing suicidal thoughts and behaviors.

References

[1] Naghavi, M., & Global Burden of Disease Self-Harm Collaborators. (2019). Global, regional, and national burden of suicide mortality 1990 to 2016: Systematic analysis for the Global Burden of Disease Study 2016. *BMJ (Clinical Research Ed.)*, *364*, l94.

[2] CDC.2018, Suicide Data and Statistics. Available online at https://www.cdc.gov/suicide/facts/data.html

[3] Coppersmith, D. D. L., Dempsey, W., Kleiman, E. M., Bentley, K. H., Murphy, S. A., & Nock, M. K. (2022). Just-in-time adaptive interventions for suicide prevention: Promise, challenges, and future directions. *Psychiatry*, *85*(4), 317–333.

[4] Kleiman, E. M., & Nock, M. K. (2018). Real-time assessment of suicidal thoughts and behaviors. *Current Opinion in Psychology*, *22*, 33–37.

[5] Nahum-Shani, I., Smith, S. N., Spring, B. J., Collins, L. M., Witkiewitz, K., Tewari, A., & Murphy, S. A. (2018). Just-in-time adaptive interventions (JITAIs) in mobile health: Key components and design principles for ongoing health behavior support. *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine*, *52*(6), 446–462.

[6] Klasnja, P., Hekler, E. B., Shiffman, S., Boruvka, A., Almirall, D., Tewari, A., & Murphy, S. A. (2015). Microrandomized trials: An experimental design for developing just-in-time adaptive interventions. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*, *34*(S), 1220–1228.

[7] Teepe, G. W., Da Fonseca, A., Kleim, B., Jacobson, N. C., Salamanca Sanabria, A., Tudor Car, L., Fleisch, E., & Kowatsch, T. (2021). Just-in-time adaptive mechanisms of popular mobile apps for individuals with depression: Systematic app search and literature review. *Journal of Medical Internet Research*, *23*(9), e29412.

[8] Lu, S. C., Xu, M., Wang, M., Hardi, A., Cheng, A. L., Chang, S. H., & Yen, P. Y. (2022). Effectiveness and minimum effective dose of app-based mobile health interventions for anxiety and depression symptom reduction: Systematic review and meta-analysis. *JMIR Mental Health*, *9*(9), e39454.

[9] Wang, L., & Miller, L. (2023). Assessment and disruption of ruminative episodes to enhance mobile cognitive behavioral therapy just-in-time adaptive interventions in clinical depression: Pilot randomized controlled trial. *JMIR Formative Research*, *7*, e37270.

[10] Meyer, B. (2021). Online treatment programmes for suicidal persons: Current evidence and future directions. In D. Wasserman (Ed.), *Oxford Textbook of Suicidology and Suicide Prevention* (2nd ed., pp. 497–503). Oxford University Press.

[11] Mamukashvili-Delau, M., Koburger, N., Dietrich, S., & Rummel-Kluge, C. (2022). Efficacy of computer- and/or internet-based cognitive-behavioral guided self-management for depression in adults: A systematic review and meta-analysis of randomized controlled trials. *BMC Psychiatry, 22*(1), 1–18.

[12] Büscher, R., Beisemann, M., Doebler, P., Micklitz, H. M., Kerkhof, A., Cuijpers, P., Batterham, P. J., Calear, A. L., Christensen, H., De Jaegere, E., Domhardt, M., Erlangsen, A., Eylem van Bergeijk, O., Hill, R., Lungu, A., Mühlmann, C., Pettit, J. W., Portzky, G., Steubl, L. S., van Spijker, B. A. J., … Sander, L. B. (2022). Digital cognitive-behavioural therapy to reduce suicidal ideation and behaviours: A systematic review and meta-analysis of individual participant data. *Evidence-Based Mental Health, 25*(e1), e8–e17.

[13] Carlbring, P., Andersson, G., Cuijpers, P., Riper, H., & Hedman-Lagerlöf, E. (2018). Internet-based vs. face-to-face cognitive behavior therapy for psychiatric and somatic disorders: An updated systematic review and meta-analysis. *Cognitive Behaviour Therapy, 47*(1), 1–18.

[14] Nakao, M., Shirotsuki, K., & Sugaya, N. (2021). Cognitive–behavioral therapy for management of mental health and stress-related disorders: Recent advances in techniques and technologies. *BioPsychoSocial Medicine, 15*, 16.

[15] Weiner, L., Berna, F., Nourry, N., et al. (2020). Efficacy of an online cognitive behavioral therapy program developed for healthcare workers during the COVID-19 pandemic: The Reduction of Stress (REST) study protocol for a randomized controlled trial. *Trials, 21*, 870.

[16] Stjerneklar, S., Hougaard, E., McLellan, L. F., & Thastum, M. (2019). A randomized controlled trial examining the efficacy of an internet-based cognitive behavioral therapy program for adolescents with anxiety disorders. *PLoS ONE, 14*(9), 1–26.

[17] Hetrick, S., Yuen, H. P., Cox, G., Bendall, S., Yung, A., Pirkis, J., & Robinson, J. (2014). Does cognitive behavioural therapy have a role in improving problem solving and coping in adolescents with suicidal ideation? Cognitive Behaviour Therapist, 7, 1–15.