Utilizing AI for Predicting and Intervening in Adolescent Suicide and Self-injury through a mobile-based EMA and EMI Application*

Dong Hun Lee[1], Hwa Jung Lee[1], Nattasuda Taephant[2]
[1]Traumatic Stress Center, Department of Education, Sungkyunkwan University, South Korea
[2]Faculty of Psychology, Chulalongkorn University, Bangkok, Thailand

Background

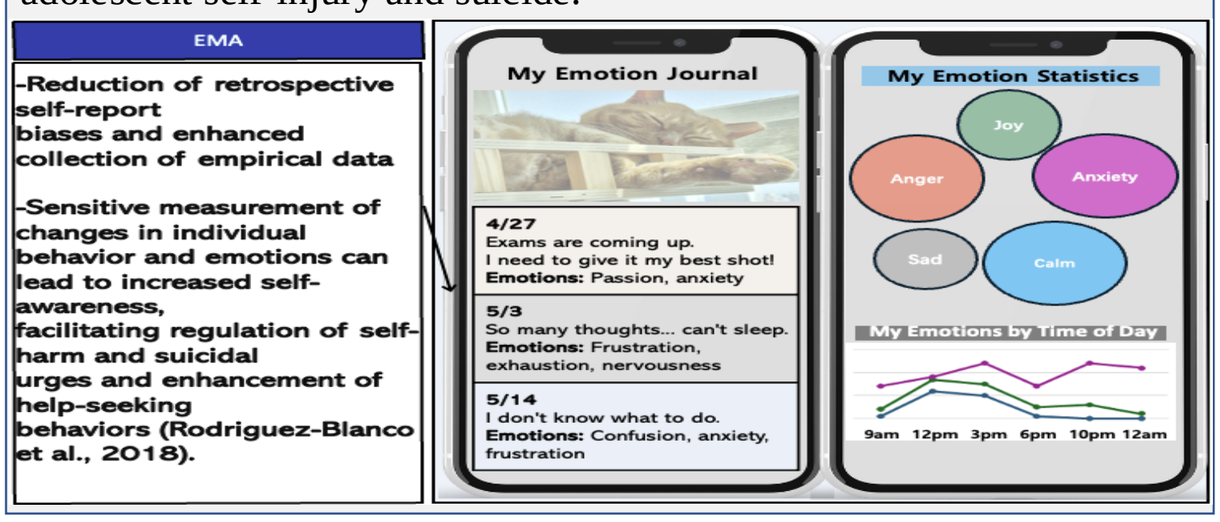
Despite increased awareness and interest in mental health, limitation and inefficiencies pose challenges to effective management. Especially, adolescents facing suicidal and self-injurious behaviors encounter barriers to timely mental health support due to time, spatial, and economic limitations. Traditional services often fall short for tech-savvy adolescents, necessitating innovative, mobile-based strategies. Real-time assessment and intervention applications integrating Ecological Momentary Assessment (EMA) and Ecological Momentary Intervention (EMI) are essential for enabling precise, context-specific monitoring and timely interventions to predict and address self-injury and suicide risks effectively.

Objectives

This study aims to design a mobile application utilizing EMA and EMI algorithms to assess suicide and self-injury risk in adolescents and deliver personalized interventions based on the biopsychosocial-pathway model which emphasizes the importance of the interaction between biological, psychological, and social factors in understanding self-injury and suicide.

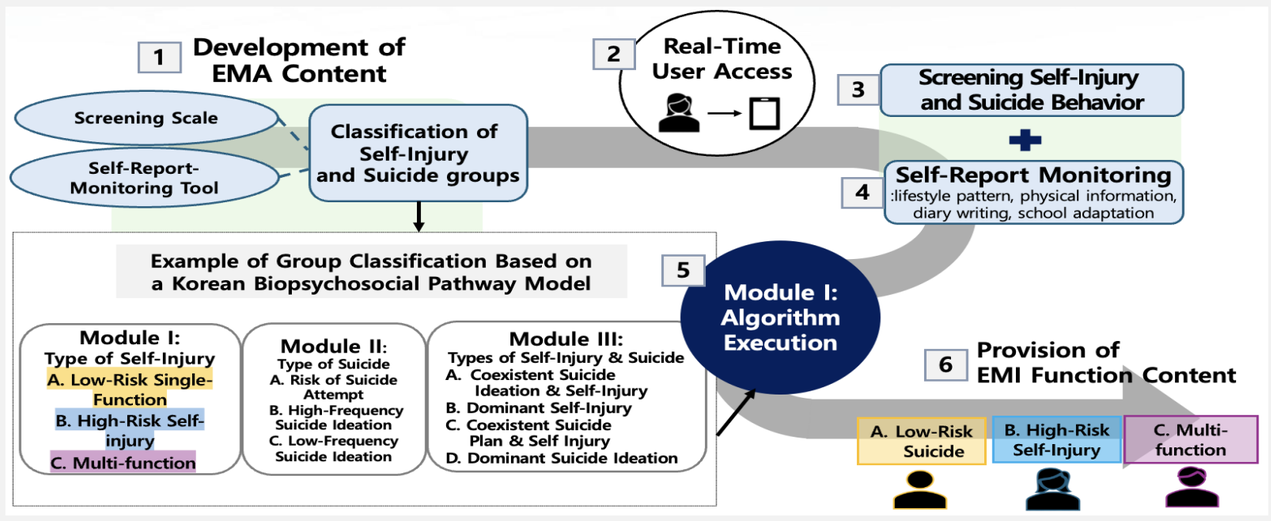
Methodology

To develop an application integrating EMA and EMI for the evaluation and intervention, a mixed-method approach was employed using qualitative and quantitative cross-sectional and longitudinal data to establish a comprehensive biopsychosocial pathway model. A brief scale for screening self-injurious and suicidal behaviors based on Item Response Theory (IRT) was developed and will be embedded in the app. Using longitudinal data, a biopsychosocial pathway model was constructed to classify behavior patterns into subgroups through Latent Class Analysis (LCA) and Latent Transition Analysis (LTA).
Qualitative research and psychological autopsy identified biopsychosocial risk and protective factors for each group, informing predictive models that enabled tailored interventions. Additionally, self-report monitoring items, including lifestyle patterns, physiological data, and school-related activities, were created based on literature reviews and mental health app evaluations.
The algorithm based on all these findings from studies on self-injury, suicide, and mental health will be integrated into the application, providing a learning database to upgrade predictive models and develop data augmentation techniques. Further data expansion will be used to incorporate AI technology, enabling the development of an AI-driven algorithm and solution for the assessment and intervention of adolescent self-injury and suicide.

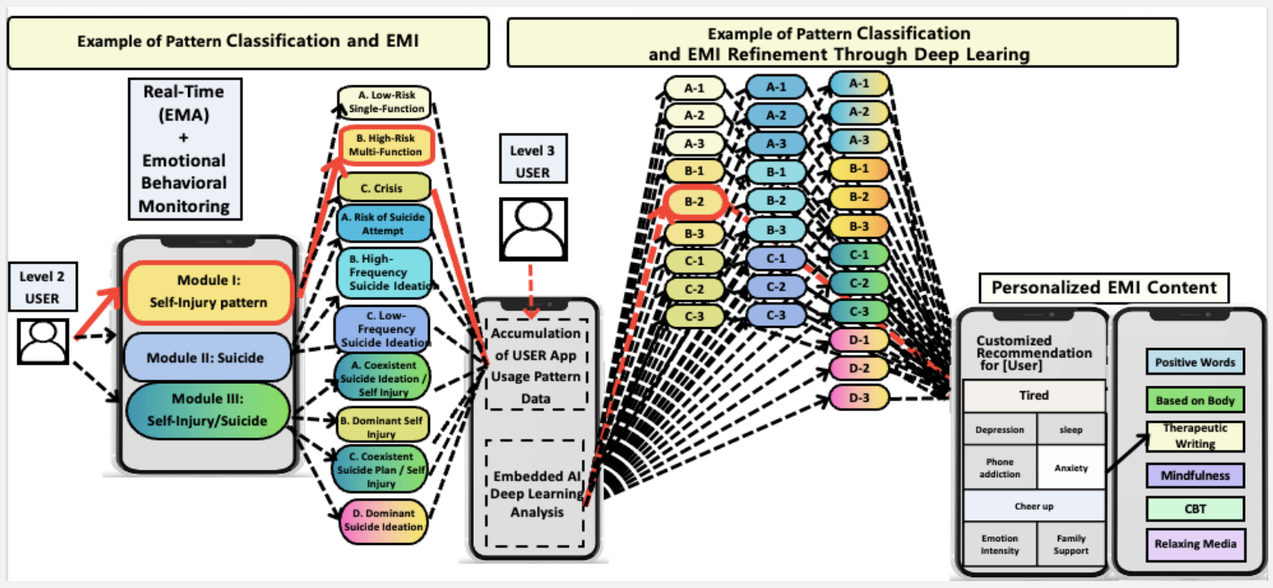


Results

EMA is implemented by utilizing a self-injury and suicide risk scale and self-report mental health monitoring items, including physical information, lifestyle patterns, and diary methods. Additionally, digital biomarkers and comparable devices enable the real-time collection of user information, such as heart rate, oxygen levels, and sleep patterns. By leveraging real-time response data from users, an algorithm is established that predicts the risk of self-injury and suicide and classifies behavior patterns into distinct groups (e.g., high-risk multifunction self-injury group, suicide planning group, co-occurrence of suicidal ideation and self-injury group, etc.).



Then, based on the biopsychosocial-pathway model, an AI deep learning algorithm is employed to provide evidence-based EMI based on each group's identified risk and protective factors. EMI encompasses delivering interventions (e.g., body-based therapies and cognitive behavioral therapies, etc.) in real-time during individuals' daily lives. Furthermore, the algorithm is continuously refined by accumulating big data to offer personalized intervention.



Conclusion

Although such support via mobile application may come with limitations in methodological, technical, and ethical aspects, it may be especially effective for younger populations at risk of suicide and self-injury. Mobile applications using EMA, EMI, and Integration with AI can support early intervention and personalized care for adolescents, offering scalable solutions for global mental health needs. The biopsychosocial pathway model underpins the customization of EMI content, ensuring that interventions are both evidence-based and tailored to individual needs. Digital biomarkers and AI predictive modeling also provide a new avenue for effective, accessible mental health interventions. Given the increasing global prevalence of self-injury and suicide, this approach can be seen as a promising solution to address these critical issues, with potential for future implementation in educational, clinical, and governmental institutions to enhance outreach and effectiveness."

Contact Information
Prof. Dr. Dong Hun Lee, Full Professor, Director, Traumatic Stress Center, Department of Education, Sungkyunkwan University, South Korea
Email: dhlee8@skku.edu
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