Development of a Mobile App for the Mental Health Improvement of Youth in Out-of-Home Care: An Intervention Mapping Approach

Jinyoung Park, Jungeun Lee, Dabok Noh

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Abstract

Background: Youth in out-of-home care encounter substantial mental health challenges because of the absence of stable family and social support systems. Their vulnerability is heightened by trauma, neglect, and abuse. They struggle, especially when transitioning to independent living, coping with loneliness, anxiety, and pressure.

Objective: This study aimed to develop a mobile app with high accessibility and long-term continuous effects to support independent living and improve mental health among youths in out-of-home care. The approach used was the systematic and step-by-step intervention mapping protocol (IMP).

Methods: The program was created using IMP and had six steps. Drawing from data from individual and focus group interviews and literature reviews, we developed a logical model of the problem. We established program outcomes and objectives, defining performance objectives and variable determinants. We identified theoretical and evidence-based methods that influence determinants. The app design integrated these methods into practical applications, allowing for the creation of self-management and emotional support tools. The development process included ongoing discussions between app designers and the research team to ensure that user needs and preferences were addressed.

Results: Individual interviews and focus group discussions revealed challenges in managing daily routines and regulating emotions. The program design was based on the transtheoretical model, social cognitive theory, and elaboration likelihood model. Key features included goal setting, structured routines, emotion recognition flashcards, character models demonstrating emotion regulation strategies, verbal persuasion, and self-monitoring tools to support habit formation and emotion regulation. An implementation plan was developed to facilitate the app's adoption, execution, and maintenance, while an evaluation plan was established, including app usage analytics, user logs, and feedback surveys. A randomised controlled trial will be conducted to assess the app's impact on mental health outcomes, focusing on reducing anxiety and depressive symptoms, improving emotion regulation, and enhancing daily living skills.

Conclusions: The IMP framework was beneficial in developing a mobile app to enhance the mental health of youths in out-of-home care. The study produced a program grounded in theory and evidence which caters to the needs of these individuals. Further research should aim to verify the app's effectiveness in real-world settings and refine it continuously based on user input. Clinical Trial: Not applicable

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Keywords: out-of-home youth; mental health intervention; mobile application; intervention mapping

Introduction

In South Korea, 'out-of-home youth' refers to individuals aged 9–24 years who have been separated from their guardians due to family conflicts, abuse, violence, neglect, family

dissolution, or elopement, and thus require social protection and support [1]. In 2019, the Korea Youth Policy Institute reported that there were about 56,000 out-of-home youths [2].

Youth in out-of-home care settings, such as child welfare facilities, orphanages, group homes, and youth shelters, are vulnerable to mental health issues due to the absence of stable family and social support systems [3,4]. This vulnerability is worsened by trauma, neglect, and abuse, which are prevalent among these youths [5-7].

A 2021 survey on support facilities for at-risk youths aged 9–18 years found that youths living in shelters were more prone to social support deficiencies and mental health issues compared to those in other accommodations [2]. These youths perceived their parent-child relationships most negatively and had the highest response rate of 'no one to turn to' when asked if they had someone to seek help from during difficult times, indicating that these youths had the weakest social support system among all out-of-home youths [2]. The main reason for running away was family conflict; 74.8% of respondents reported conflict, while 72.1% experienced violence at home [2]. This suggests that families, who should have been their primary support system, did not adequately protect them. Furthermore, 44.1% of youths living in shelters reported experiencing negative emotions like depression, anxiety, frustration, fear, and loneliness; this rate is higher than what has been reported among residents of other institutions, like child welfare facilities and orphanages [2].

These youths are especially vulnerable when transitioning from out-of-home care to living independently [8]. Youths residing in shelters may be less prepared for independence due to their shorter stays compared to those in child welfare facilities, orphanages, and similar settings [9]. They often fail to make realistic and specific plans for independence, resulting in anxiety and pressure [10]. When individuals leave shelters, they face a sudden lack of support leading to economic challenges such as housing instability, inadequate job opportunities, and financial hardship [11,12]. They are at a high risk of becoming involved in or becoming victims of crime [13]. During the transition from youth to adulthood, individuals often face various crises, and the lack of a social support system can intensify feelings of isolation, loneliness, and despair, ultimately impacting their mental health [5,6].

Several policies have been proposed and implemented to address these issues. However, most of them focus on providing economic support, with very few programs specifically targeting the mental health of youths in out-of-home care [14]. Some studies have attempted interventions for mental health, such as art therapy [15], cognitive behaviour therapy [16,17], and family therapy [18], and reported these interventions' positive effects on youths in out-of-home care [19]. These studies primarily focused on face-to-face counselling [16,17,19]. Additionally, according to a meta-analysis by Macdonald et al. [20], interventions aimed at improving the mental health of children and young people in out-of-home care showed significant positive effects on depression, anxiety, and social functioning difficulties in the short term (0–6 months); however, there was no evidence of effectiveness for long-term outcomes (>6 months) [20]. Furthermore, youths in out-of-home care often lose contact with the facilities when they become independent, leading to inconsistent management and heightened vulnerability [8,9] Hence, youths living independently should receive ongoing and structured assistance.

In this study, we created a mobile app to enhance independent living, accessibility, and long-term mental health benefits for youths in out-of-home care. The app was developed using intervention mapping (IM), a systematic framework for designing evidence-based health promotion programs [21].

Methods

A mobile app was developed from October 2023 to June 2024 to enhance the mental health of youths in out-of-home care. The app was created using the IM approach, which is a systematic method that integrates theoretical and empirical evidence to create impactful health promotion programs tailored to the needs of youths in out-of-home care [21]. It involves engaging stakeholders throughout the program development process to ensure that their perspectives and needs are considered [22]. It consists of six steps: (1) a logical model of the problem, (2) program outcomes and objectives (logical model of change), (3) program design, (4) program production, (5) program implementation plan, and (6) evaluation [21].

Step 1. Logical Model of the Problem

Initially, we formed a planning group with various stakeholders. The group comprised a psychiatric and mental health nurse with a PhD, a PhD graduate in child and family studies, two social workers serving as directors at youth shelters, a social worker employed at a youth shelter, and app designers.

Next, we conducted a needs assessment to analyse respondents' mental health and quality of life issues, as well as their underlying causes. The methods used for this assessment included conducting a literature review, holding individual interviews with youths living in youth shelters, and organising focus group interviews with shelter workers.

The target population for this intervention was youths aged 18–25 years who receive out-of-home care at youth shelters and are preparing for independent living after leaving such care. This focus was motivated by two main reasons. First, previous research indicated that young people in youth shelters are more likely to have mental health vulnerabilities compared to those in group homes or child welfare facilities [2,9]. Thus, we focused on young individuals living in youth shelters. Second, youths in out-of-home care in South Korea must transition to independent living between the ages of 18 and 25. Thus, our target population consisted of individuals aged 18 to 25 who are in the process of transitioning to independence. The participants were chosen purposefully to include those who could share their experiences living away from family and preparing for independence. They talked about their mental health struggles, coping strategies during tough times, when they sought help, and the importance of intervention programs. The interviews, conducted in the counselling rooms of the shelters, lasted around 1 hour.

We also conducted two focus group interviews with 10 shelter workers from two youth shelters. These workers were selected based on their experience of working at youth shelters for one year or more and their deep understanding of the experiences of out-of-home youths. The interviews focused on discussing the mental health challenges faced by these youths, instances where assistance was sought, and the need for intervention programs. Each interview lasted about 1 hour and took place in the meeting rooms of the two youth shelters.

Finally, we outlined the intervention's context, which includes the population, community, and setting. In the final step of Phase 1, we defined the program's goals.

Step 2. Program Outcomes and Objectives: Logical Model of Change

In the second step, we identified the expected outcomes from the results of Step 1. We defined

the performance objectives for these outcomes and chose their determinants. A matrix was created to outline the change objectives that would impact the determinants and help achieve the performance objectives.

Step 3. Program Design

In Step 3, we conceptualised and designed the program, selecting theory- and evidence-based change methods to achieve the change objectives determined in Step 2. Theoretically grounded change methods were translated into practical applications. This phase focused on ensuring that each component of the program was based on evidence-based methods and tailored to meet the specific needs of youths in out-of-home care. Key tasks included identifying and selecting appropriate change methods based on established theories like the transtheoretical model (TTM), social cognitive theory (SCT), and elaboration likelihood model (ELM). These theoretical methods were then translated into practical applications by designing specific features within the mobile app to deliver the selected change methods effectively. The practical applications were developed to be user-friendly and engaging, allowing users to easily interact with the app and incorporate desired behaviours into their daily routines. The aim was to create a structured theoretical framework to help youths in out-of-home care manage their daily lives independently and improve their emotion regulation abilities.

Step 4. Program Production

Each component of the intervention app was developed systematically by integrating theoretical foundations, designing the user interface, and implementing functionalities. This step aimed to ensure the app's practical applicability and functionality. Educational content, messages, and images depicting characters and emotions were also developed in a structured manner. A programmer was hired to develop the app, engaging in an iterative process to check and revise the prototype, ensuring that all specified conditions and features were met. Throughout the development process, we conducted meetings with the programmer to communicate requirements and review screen designs. Zoom meetings were organised to discuss and finalise modifications, ensuring that the app met our standards.

Step 5. Program Implementation Plan

The fifth step involved creating a comprehensive program implementation plan. This plan included strategies to ensure that the mobile app, which was designed to improve the mental health of youths in out-of-home care, was effectively adopted, utilised, and maintained over time.

Step 6. Evaluation Plan

The sixth step was to develop a plan to evaluate if the app had achieved its goals and objectives. This plan focused on conducting a thorough assessment of the app's effectiveness, covering both process and outcome evaluations.

Results

Step 1. Logical Model of the Problem

Our literature review revealed that young people living in youth shelters often experience a high prevalence of mental health issues, like anxiety, depression, suicidal thoughts, and a poor quality of life [5]. After leaving youth shelters, they often experience isolation, loneliness, despair, and suicidal thoughts as they navigate the challenges of independent living [8].

Individual interviews were conducted with five adolescents aged 18-23 years who had been living in shelters for 5 months to 5 years. Most of them spent most of their time lethargically in their shelters, waking up late, and working part-time jobs. One of them had initially become independent but later returned to the shelter. While living independently, she mostly stayed at home, invited friends over in the evening, and stayed up all night. After her friends left, she rested until the evening and ate instant food, leading her to avoid sunlight for several months. These habits contributed to her return to the shelter. Most of them were either overweight or obese and expressed feelings of loneliness, depression, and suicidal thoughts.

Focus group interviews were conducted with shelter staff between the ages of 29 and 59, who had 1 year to 9 years and 11 months of work experience. They specialised in counselling psychology, social welfare, youth education, counselling, and youth studies. The staff explained that the mental health of adolescents entering shelters recently was worse compared to those in the past, with many experiencing higher levels of depression and anxiety. Most adolescents spend the majority of their day on their phones, engaging in social media, calls, YouTube videos, and games. During their days off, they often wake up around 1-2 PM, have meals at the shelter, socialise with friends, and return just before bedtime.

The staff observed that some adolescents at the shelter have difficulties with emotional regulation, including depression and anxiety, and actively seek counselling. At times, some adolescents stay up past bedtime due to self-harm urges and turn to teachers for assistance. They also discussed how adolescents struggle to regulate their emotions even in the presence of peers and teachers. Furthermore, when these adolescents transition to living independently, they experience loneliness and depression, prompting them to seek support.

The staff mentioned that some adolescents struggle to manage their daily lives and emotions even after becoming independent. In some cases, they choose to return to the shelter. Additionally, some adolescents do not maintain contact after leaving. Therefore, the staff suggested that a mobile app could assist youths in managing their daily lives and emotions post-independence.

Out-of-home youths living in shelters encounter challenges due to lack of support from family and caregivers, resulting in feelings of anxiety, depression, and a tendency to engage in self-injury. In their transition to independent living, many youths face loneliness, leading to feelings of powerlessness, difficulties in daily life management, and struggles with emotional regulation. The proposed program aims to empower youths in out-of-home care to address these challenges by effectively managing their daily lives, regulating their emotions, and improving their stability and emotional well-being.

Step 2. Program Outcomes and Objectives: Logical Model of Change

Based on the findings of the initial phase, the expected program outcomes were: (1) young people managing their daily lives independently and (2) young people enhancing their emotion regulation. Specific performance objectives for independently managing daily lives included

structuring and maintaining daily routines, as well as developing healthy habits. Additionally, performance objectives for enhancing emotion regulation in young people involved expressing their emotions and implementing strategies for emotion regulation.

There is evidence that knowledge influences attitude, leading to behavioural changes. Habit formation is crucial for lasting behavioural change, especially when dealing with changing attitudes and temptations [23]. In this study, knowledge, attitude, and habits were chosen as determinants. For out-of-home youths with little family and adult support, forming habits is a key factor in being able to manage daily life and emotions independently. The change objectives are outlined for each of the four performance objectives in the three determinant areas (Table 1).

Step 3. Program Design

The theory-based program design and practical applications to achieve change objectives are detailed in Table 2. Core components of the program were determined to be structuring and maintaining routines and regulating emotions. The delivery mode was a smartphone app. Methods to achieve the change objectives were identified by considering the methods used for determinants. The program was designed to provide users with the necessary functions to independently manage their daily lives and improve their emotion regulation abilities.

The program used the TTM's consciousness-raising method [24] to help users understand the benefits of organising their daily lives and the importance of fostering healthy behaviours. Upon logging into the app, the introductory session explained the purpose and content of the program. Following that, emotion flashcards were utilised for recognising and labelling emotions. This method, inspired by the ELM's use of repeated messages [25], aimed to expose users to a variety of emotions repeatedly, helping them identify and label the emotions to improve their recognition and expression of emotions. The program utilised observational learning methods based on SCT [26], and also used character models to demonstrate emotion regulation strategies. Users could learn emotion regulation methods by observing how characters handle their emotions.

To enhance attitudes and motivation, the program utilised goal setting principles from SCT [26]. This process allowed users to set and achieve their goals. Users were encouraged to establish structured routines and healthy behaviours on their own. Verbal persuasion techniques were also used to help users reach their goals and increase their confidence in regulating emotions. Emotion flashcards were created based on the repeated-message method of the ELM [25] to encourage a positive attitude towards acknowledging one's emotions. Additionally, character models in the flashcards showed empathy towards users' emotions using observational learning methods from SCT [26], which helped to cultivate a supportive environment that boosts motivation.

The program included a self-monitoring method from SCT [26] to encourage habit formation. This method emphasised users tracking their daily routines and accomplishments. Calendar functions and pop-up notifications assisted users in visualising their daily accomplishments and monitoring progress independently. The program also utilised the reinforcement management method from the TTM [24], rewarding points for meeting self-set routines and embracing healthy behaviours to encourage positive changes. Additionally, the program incorporated an emotion journal feature inspired by reflective techniques [27]. An emotion journal aided users in recognising and reflecting on their emotional changes, improving their

ability to manage emotions. Users earned points for consistent journaling to encourage self-reflection and habit-building. Additionally, emotional states were visualised through statistical graphs to help users track changes, spot patterns, and highlight areas for improvement.

Table 1. Matrix of change objectives.

Outcome	Performance objective (PO)	Determinant		
		Knowledge/ cognition	Attitude/ motivation	Habit
Young people manage their daily lives independently	PO 1. Young people structure and maintain their daily routines	K.1. Identify the advantages of structuring daily routines	A.1. Recognise the advantages of structuring daily routines	H.1.a. Monitor the progress of achievement of daily routines H.1.b. Stick to routines to turn them into habits
	PO 2. Young people develop healthy behaviours	K.2. Identify the importance of healthy behaviors	A.2. Recognise the importance of healthy behaviors	H.2.a. Monitor the progress of achievement of healthy behaviors H.2.b. Stick to healthy behaviors to turn them into habits
Young people enhance their emotion regulation abilities	PO 3. Young people express their emotions	K.3. Identify and name a range of emotions	A.3. Express an accepting attitude towards one's own emotions	H.3.a. Incorporate emotional expression into daily routines H.3.b. Track one's own emotions
	PO 4. Young people implement strategies to regulate emotions	K.4. Identify the strategies to regulate one's own emotions	A.4. Express an attitude of openness to regulate emotions	H.4. Incorporate emotion regulation into daily routines

Table 2. Explanations of changeable determinants, theory-, and evidence-based change methods, and practical applications.

Determinant	Change objective	Theory	Method	Practical application
Knowledge/ cognition	K.1. Identify the advantages of structuring daily routines K.2. Identify the importance of healthy behaviors	Transtheoretical model	Consciousness raising	Intro session with educational messages on app content, daily routines, and healthy behaviors; shown after first login
	K.3. Identify and name a range of emotions	Elaboration likelihood model	Message repetition	Emotion flashcards
	K.4. Identify strategies to regulate one's own emotions	Social cognitive theory	Observational learning	Observing a character model regulating their emotions
Attitude/ motivation	A.1. Recognise the advantages of structured daily routines A.2. Recognise the importance of healthy behaviors	Social cognitive theory	Goal setting	Setting daily routines including healthy behaviors
	A.3. Express an accepting attitude towards one's own emotions	Elaboration likelihood model	Message repetition	Selecting an emotion flashcard and choosing the corresponding word for the emotion
		Social cognitive theory	Observational learning	Character showing empathy towards their emotions
	A.4. Express an attitude of openness to regulate emotions	Social cognitive theory	Verbal persuasion	Uttering encouraging words such as 'you can do it' to boost confidence and induce initial efforts
Habit	H.1.a. Monitor the progress of achievement of daily routines H.1.b. Stick to routines to turn them into habits	Social cognitive theory	Self-monitoring	Tracking daily achievements using a calendar function
			Feedback	Informing and displaying routine accomplishments
		Transtheoretical	Reinforcement	Rewards for maintaining routines; points for achievements

	H.2.a. Monitor the progress of achievement of healthy behaviors H.2.b. Stick to healthy behaviors to turn them into habits	model	management	
	H.3.a. Incorporate emotional expression into daily routines H.3.b. Track one's own emotions	Social cognitive theory	Feedback	Notifications to encourage the expression of emotions
			Self-monitoring	Visualising weekly emotions in a graph
	H.4. Incorporate regulating emotions into daily routines	Transtheoretical model	Reflection	Keeping an emotion diary
		Transtheoretical model	Reinforcement management	Points for completing each routine task and diary entry

Step 4. Program Production

The fourth step involved developing the specific components of the program to give it a viable form. To create an app for youths in out-of-home care, the program was designed by incorporating information gathered in Steps 1 to 3. Prototypes were utilised in designing the app's structure and main features, focusing on making the interface intuitive and visually appealing for easy use by the youth. The app development team and research team convened numerous online and offline meetings to visually craft the user experience. All program stages were continuously reviewed, with various features added to improve its comprehensiveness and quality. Figure 1 offers an overview of the mobile app's user interface, showcasing the main components and navigation elements. It presents the home screen comprehensively, including the dashboard, navigation menu, and key interactive features like touchable buttons and icons.

Once users sign in and provide their information, they can use the app after obtaining approval from the administrator. Approved users receive guidance on using the app, including details regarding the importance of daily routines and healthy behaviors. Users then select a character to represent themselves and another character to act as their counsellor. Subsequently, they set their daily routines, which includes wakeup time, bedtime, number of outings per day, number of meals per day (at least two), personal development activities (e.g. reading, exercising, and studying), and household chores (e.g. cleaning and washing dishes). The default home screen displayed the current date and provides visual feedback, showing a cake image that is filled in based on routine completion. Additionally, the calendar function allows users to visually track their daily achievements and served as a self-monitoring tool to easily observe their progress.

During the day, users can input whether they completed their routines and the time spent doing so. They can then select their emotions from a list of 12 emoticons, along with appropriate verbal expressions. The counsellor character provides messages based on the selected emotions to create an emotionally supportive environment. For instance, if a user chooses 'anxious', they receive advice such as, 'Something is making you anxious. Consider the causes and prioritise tasks to write down. Talking or writing about your problems can help calm your negative emotions'. This can aid users in recognising and managing their emotions.

The Emotion Regulation tab shows facial images gathered over a week in a graph, allowing users to visually monitor their emotional changes. Additionally, users can write emotion diaries to document and analyse their feelings, aiding in improved understanding and management of emotions.

In the My Info tab, users can view basic information such as their characters, accumulated points, and set routines. They can also check and modify their routines at any time. The Settings tab offers options to change passwords, set notifications, and log out or reset accounts.
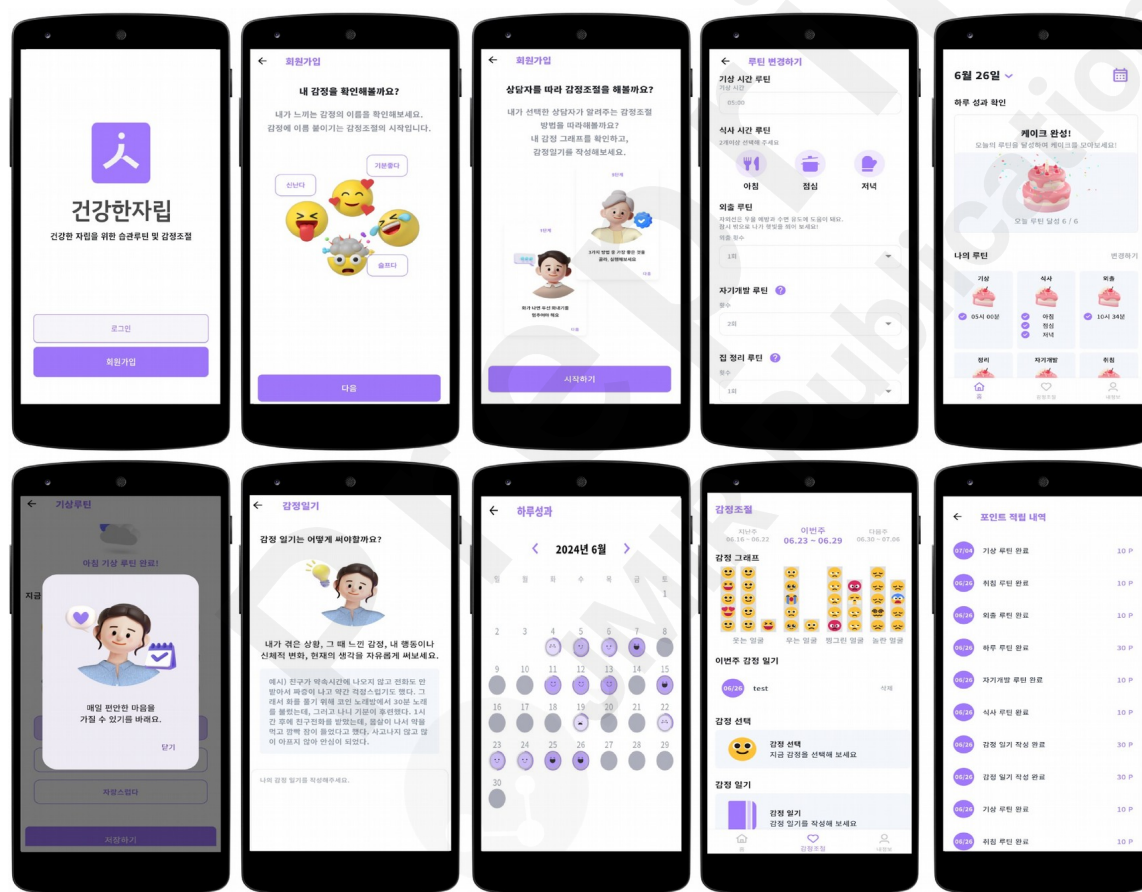

Figure 1. APP user interface overview

Step 5. Program Implementation Plan

The fifth step's objective, not yet executed, is to facilitate the adoption, execution, and maintenance of the program. During this phase, we will identify potential program executors, describe outcomes and performance, and plan discussions regarding ongoing maintenance. To

implement the app successfully, it is essential to educate and engage youth in shelters. Both shelter staff and youth will receive training on the app's features, usage, and basic mental health management for effective utilisation. Promotional materials like posters and social media content will be developed and distributed to encourage app adoption. Furthermore, peer ambassadors from shelters, trained to use the app, will be recruited to share personal experiences and success stories with their peers to promote the app's benefits. For maintenance, regular updates and improvements will be based on user feedback, and user experience will be continuously monitored to enhance the app's features and usability.

Step 6. Evaluation Plan

The sixth step involved creating a detailed and comprehensive plan to evaluate the designed mobile app. This evaluation plan aims to systematically analyse the implementation process, effectiveness, and identify areas for improvement, if necessary.

Process evaluation

Process evaluation confirms whether the app is being implemented as planned and assesses the fidelity of its implementation. Key indicators include the number of youths using the app, frequency of app usage, levels of user engagement, and the frequency with which users utilise the key features of the app. These data will be collected through various methods, including app usage analytics software, user logs, and feedback surveys from youths residing in shelters. Real-time data collection will be implemented to analyse usage patterns and engagement levels. User logs will track individual user activities to help identify the most and least used features. Regular feedback surveys will assess subjective user experiences and satisfaction, covering aspects such as ease of use, usefulness of features, and overall satisfaction. Additionally, in-depth interviews will be conducted to gain a more detailed understanding of user experiences, focusing on the strengths, weaknesses, and areas for improvement of the app. This comprehensive data collection will help determine if the app is being implemented as planned, identify any unforeseen issues, and understand the most beneficial features to users.

Effectiveness evaluation

The program's effectiveness will be assessed through a randomised controlled trial. Participants will be assigned randomly to either the experimental or control group using computer-generated random allocation. The evaluation will focus on the app's effects on youths' mental health, daily living skills, and emotion regulation. Key measures will include decreases in anxiety and depressive symptoms, better emotion regulation, and improved daily living skills. Data collection methods will include pre- and post-surveys, standardised mental health assessment tools (such as the Beck Depression Inventory and Generalised Anxiety Disorder Scale), and user interviews.

Quantitative data analysis will be conducted using IBM SPSS version 26 (Armonk, NY, USA). The one-way repeated-measures multivariate analysis of variance will be employed to assess the intervention effects. Qualitative data from interviews and open-ended survey responses will undergo thematic analysis to gain deep insights into user experience and app effectiveness. This thorough evaluation plan aims to systematically evaluate the app's implementation process and outcomes, aiming to enhance youths' mental health. Our goal is to optimise the app's effectiveness and promptly make any necessary improvements.

Discussion

Principal Results and Comparisons with Prior Work

A mobile app was developed in this study to enhance the mental health of youths in out-of-home care using the IM approach. The app was created through a systematic and step-by-step development process.

Earlier studies have utilised the IM approach to create successful health promotion programs for different health concerns. Nonetheless, IM-based mental health promotion initiatives aimed at youth residing in shelters are scarce. Furthermore, programs developed in previous studies frequently depend on brief interventions centred on in-person counselling, posing challenges in maintaining lasting impacts [18,20]. The mobile app developed in this study was created to overcome these limitations by providing accessible emotional support and daily management functions to youth. Emotion flashcards and self-monitoring tools assist users in recognising and regulating their emotions independently, helping them cultivate their ability to self-manage even after leaving the shelter.

Our program was designed after conducting a comprehensive needs assessment of youth living in shelters. Previous study has emphasised the importance of a thorough needs assessment to improve program effectiveness [28]. This study investigated the behavioural and environmental factors influencing mental health issues by reviewing literature and interviewing youths in out-of-home care and shelter staff with the aim of providing tailored interventions.

We designed a program utilising theories like TTM, SCT, and ELM to improve the scientific validity of the program's mental health promotion program. By integrating these theories, our program identified knowledge, attitudes, and habit formation as key determinants, applying each theory's methods to enhance the app's effectiveness. Previous studies that incorporated these theories have shown positive outcomes

For example, Liu et al. [29] showed that interventions based on the Transtheoretical Model (TTM) effectively managed depression in hospitalised patients with coronary artery disease. Their study offered interventions to help patients identify depression and sustain positive behavioural changes using TTM's methods of raising consciousness and reinforcing management [29]. Using TTM's consciousness-raising method, our app helps users understand the benefits of structuring daily routines and the importance of healthy behaviors. The reinforcement management method visualizes routine achievements and provides reward points to maintain positive behavioral changes.

Li et al. [30] examined the effects of stress management programs utilising SCT and found that self-efficacy and goal setting are crucial for promoting successful behavioural changes in stress management. Our program applies SCT's observational learning method, enabling users to learn emotion regulation strategies by observing character models.

According to Petty and Cacioppo [25], repeated messages and emotional stimuli significantly influence individuals' attitudes and behavioural changes. ELM enhanced emotion recognition by repeatedly emphasising messages and using emotion flashcards [25]. Morris et al. [31] demonstrated that the emotional aspect of ELM is as important as the cognitive aspect, leading

to attitude changes through eliciting emotions. Our program uses the ELM message repetition method to provide emotion flashcards, helping users identify and name various emotions.

We prioritised a user-centred design approach, as recommended by Johnson et al. [32] and Bakker et al. [33], for enhancing the app's usage and effectiveness. To increase youths' engagement and persistence, we implemented various strategies. For instance, users have the option to personalise their experience by selecting both their own character and their counsellor's character. The app's user-friendly design, combined with a visual reward system for completing daily tasks, sparks interest and boosts engagement, encouraging continuous use. Users can establish their daily routines and receive visual cues indicating progress, such as a cake image that fills up as they complete tasks, providing a sense of achievement. When users choose an emotion from a list, the counsellor responds with appropriate messages to foster emotional support. For example, if a user selects 'anxious', the counsellor character might suggest, 'Identify what's causing your anxiety and focus on tackling simple tasks first. Acknowledging and addressing your problems can help alleviate negative feelings.' This feature enhances emotional support and equips users with tools to manage their emotions effectively. The Emotion Regulation section displays facial expressions accumulated over a week, allowing users to monitor changes in their emotions. By keeping emotion diaries, users can record and reflect on their feelings, which enhances their emotional awareness and regulation skills.

Limitations

This study focused on developing a mobile app but did not confirm its effectiveness through application and evaluation. This limitation hinders the assessment of the app's effectiveness and user satisfaction. Future research should validate the app's long-term effectiveness in real-world scenarios. The study specifically targeted youths living in shelters in a specific region, limiting the generalisability of the findings to youths in other regions and cultural contexts. Further research is necessary to evaluate the app's use among youths from various regions and cultural backgrounds.

Conclusions

This study outlines the development process of a mobile app aimed at enhancing the mental health of youths in out-of-home care using the intervention mapping approach. The app was created to assist youths in managing their daily lives and regulating their emotions independently, offering high accessibility and continuous support. The systematic development process and theoretical foundations for designing the app's structure and features are described, along with plans for evaluating its process and effectiveness.

Although real-world use of the app was not evaluated in this study, the systematic approach and substantial stakeholder involvement in the development phase indicate its potential effectiveness. Future research should focus on assessing the app's real-world usage and incorporating user feedback for continuous improvement. Additional studies are anticipated to establish a strong foundation for developing and implementing digital health interventions that can significantly improve the mental health and well-being of youths in out-of-home care.

Ethical Approval
This study was approved by the Eulji University Institutional Review Board (approval number:

EU23-43).

Author Contributions

Funding

Conflicts of Interest

None declared.

Abbreviations

ELM: elaboration likelihood model
IMP: intervention mapping protocol
SCT: social cognitive theory
TTM: transtheoretical model

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Supplementary Files

Figures

APP user interface overview.