Case Report

A Case Series of Virtual Reality-Based Social Interactions for Adolescents with Psychiatric Disorders in a Television Program: Insights from NHK's Project Alien

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Background: Virtual reality (VR) technology is emerging as a tool in mental health care, providing a safe space for social interaction and therapeutic engagement. A social VR-based TV program broadcast on Japanese public television offers a virtual environment where adolescents with mental health challenges can engage in peer support using alien avatars, reducing barriers to communication and encouraging emotional expression.

Objective: This case series aimed to document the psychological trajectories of adolescents with psychiatric disorders participating in a social VR-based television program.

Methods: A single-center case series was conducted with three adolescents with psychiatric disorders (aged 15, 18, 19 years) who participated in the social VR-based TV program. The study focused on examining both patient-reported outcomes (including psychological measures and qualitative experiences) and clinical observations across program participation and broadcast viewing. Psychological measures, including the Japanese versions of the UCLA Loneliness Scale, the Resilience Scale, and the Patient Health Questionnaire-9, were assessed at three time points: baseline, pre-broadcast, and post-broadcast. Qualitative analysis of participant dialogue explored themes of self-disclosure, emotional expression, and social dynamics.

Results: Participants showed improvements in loneliness, resilience, and depressive symptoms after experiencing the social VR program, as indicated by both psychological measures and patient-

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reported outcomes. Qualitative analysis suggested that the structured facilitation embedded in the program enabled participants to express both positive and negative emotions, promoting self-reflection and mutual support.

Conclusions: This case series suggests that structured social VR programs can provide a supportive platform for emotional exploration and psychological growth among adolescents with psychiatric disorders. The combination of avatar-based interaction and therapeutic facilitation may offer a novel approach to engaging young people in mental health care, particularly during waiting periods for traditional psychiatric services.

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Introduction

Virtual reality (VR) technology has emerged as an innovative therapeutic tool in mental health care, particularly for individuals with social anxiety, depression, and related conditions[1]. While VR-based exposure therapy and cognitive behavioral interventions have been well-documented[2], VR environments are increasingly being utilized as therapeutic spaces that provide safe gathering places and group therapy settings, or social skill trainings for individuals with mental health challenges. The therapeutic potential of social VR environments—spaces where users can interact through avatars—remains largely unexplored[3][4]. In Japan, various VR-based social participation programs have been implemented, notably addressing school refusal—a significant educational challenge affecting more than 240,000 students in 2021[5].

Building on these developments, Japan's public broadcaster (NHK) developed "*Project Aliens*," an innovative television program that provides a VR environment where adolescents interact through alien avatars[6]. Participants communicate in a virtual space using alien avatars, providing them with a psychologically safe medium for self-disclosure and fostering connections based on shared experience. Therefore, the *Project Aliens* series offers a compelling model for VR-based social experiments with clinical relevance. By minimizing the barriers to self-expression and providing a supportive VR environment, the series intended to encourage participants to confront personal and interpersonal challenges in ways that may be less achievable in conventional therapeutic settings. This social VR-based approach aligns with broader explorations into the metaverse's potential for

mental health care, where users can interact within a customizable, immersive environment that offers emotional safety and flexibility, critical for therapeutic engagement among young people. Each episode of *Project Aliens* explores a unique theme, including social stigma, family dynamics, and self-identity issues. This can be recommended as a tool for fostering emotional growth and social connection.

Among children and adolescents, barriers to seeking and accessing mental health services remain significant challenges, with the most prominent barriers being social stigma and individual factors such as limited mental health knowledge[7]. While peer support has shown promise in promoting recovery among young people with mental health conditions[8][9][10], traditional face-to-face interventions often face barriers related to social anxiety and stigma[11]. Social VR platforms may address these challenges by enabling anonymous, avatar-based participation[12]. However, the psychological impact of structured, VR-based peer support programs for adolescent psychiatric patients remains poorly understood. To address this gap, this case series investigates the impact of *Project Aliens* participation on adolescents' psychological well-being, specifically examining changes in loneliness, depression, resilience, and patterns of emotional expression during VR-based interactions.

Methods

Study Design

This single-center, observational case series evaluated the psychological effects of participation in *Project Aliens*, a Japanese public television program utilizing social VR-based peer dialogue among adolescents with psychiatric disorders.

Participants meeting the inclusion and exclusion criteria were enrolled after providing consent for both program participation and study involvement. Changes in psychological indicators were assessed through data collection before recording and after broadcast.

Participants

Eligible participants are child and adolescent psychiatric patients receiving care who meet the following criteria:

Inclusion Criteria

1. Patients receiving care at the Department of Child Psychiatry, Yokohama City University Hospital
2. Aged 11-19 years at the time of consent
3. In a stable mental health condition as assessed by their primary care physician
4. No restrictions based on gender
5. Both the participant and their family must fully understand the purpose of the NHK program *Project Aliens* and agree to appear on the show
6. Written consent for participation in the study must be obtained

Exclusion Criteria

1. Presence of intellectual disabilities that may interfere with understanding the program or study
2. Imminent risk of self-harm or suicide
3. Suspected cases of abuse by family members
4. Severe depression as indicated by a PHQ-9 score $\geq$21
5. Deemed unsuitable for participation based on clinical judgment by the primary care physician

Recruitment

Participants were recruited from the Department of Child Psychiatry at Yokohama City University Hospital. Between March 14 and April 12, 2024, 15 adolescent patients receiving outpatient care were invited to participate. After follow-up reminders, 10 patients expressed interest, and 3 were selected by NHK producers to align with the program's thematic and logistical needs. The selected participants included one male and two females, aged 15, 18, and 19 years at the time of filming.

Program Description

This study documented participant experiences during their involvement in *Project Aliens*, a 45-minute late-night special program on Japanese public television. Episode 8 of the series, titled "A Healing Field Trip," was recorded July 13-14, 2024, and broadcast October 27, 2024.

The program offered a VR-based journey through three distinct stages: a) Cityscape, b) Spaceship and Spaceport, and c) Moon, as shown in Figure 1. Each stage was designed to encourage self-reflection, interpersonal connection, and emotional exploration. The virtual environment was designed by an artist renowned for distinctive illustrations, three-dimensional artwork, and youth-oriented video

projects that have received both national and international recognition (https://www.hikarucho.com/). Throughout the program, the journey was facilitated by a virtual navigator called the *Moon Rabbit*, who guided the three participants on their virtual trip to the moon. The Moon Rabbit served as a virtual navigator, guiding participants through each stage of the journey. Its role was carefully designed to create psychological safety, manage transitions, and encourage peer support and self-reflection. This facilitation approach was developed in collaboration with mental health professionals to ensure it aligned with therapeutic principles. The *Moon Rabbit* is the white character shown in Figure 1.

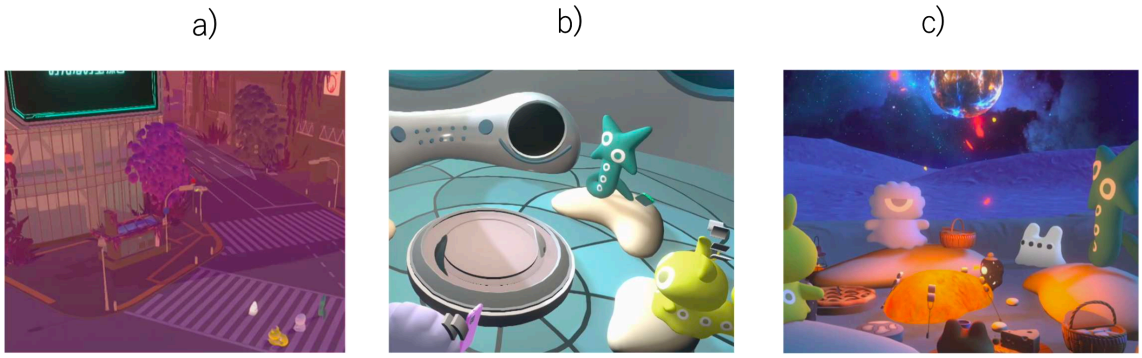

Figure 1. Sequential Stages of the VR-Based Therapeutic Journey. The Figure depicts three sequential therapeutic environments: (A) Cityscape: designed to facilitate initial collaboration and trust formation; (B) Spaceship and Spaceport: structured for deep reflection through narrative sharing; and (C) Moon: focused on personal growth and future orientation. The Moon Rabbit (white Figure) functions as the therapeutic facilitator, guiding structured activities and maintaining psychological safety throughout the program. This facilitation was crucial in creating a supportive environment that enabled meaningful participant interaction and emotional expression. Alien 1 is named Ramune, colored green, Alien 2 is named Puchi, colored purple, and Alien 3 is named Maruhachi, colored yellow.

1) Scene a: Cityscape, *"Discovering Life Through Each Other's Treasures"*

The journey begins in a virtual recreation of Shibuya city in Tokyo, a lively urban environment attracting young people. Participants collaborate in a treasure hunt to locate hidden “treasures” within the city. This activity encourages teamwork and provides an initial opportunity for participants to share personal insights, building trust and familiarity among the group.

2) Scene b: Spaceship and spaceport, *"Discovering We're Not Alone: Sharing Worries and Finding Connection" and "A Letter to Myself: Embracing the Past, Encouraging the Future":*

In the next stage in the spaceship, participants board a spaceship heading to the moon. Here, they encounter narratives from former participants, or "senior aliens," who share their transformative journeys. Participants also share personal photos and discuss their daily struggles, fostering deeper self-reflection and mutual understanding.

At the spaceport, participants undertake the final task of the journey: writing letters to themselves. These self-reflective letters explore past challenges, present struggles, and aspirations for the future. Reading these letters aloud allows participants to express self-compassion and gain closure.

3) Scene c: Moon, *"Sharing Painful Pasts, Stepping Toward the Future":*

The final stage takes place on the Moon, representing a safe space for introspection and transformation. Participants reflect on their experiences, shifting the focus from their past to envisioning their future. This phase highlights the progress they have made throughout the journey.

Case Presentations

- **Case 1**

Alien 1: Ramune

A 19-year-old male ("Ramune") grew up in a socioeconomically disadvantaged family with significant mental health comorbidity. His father had bipolar disorder, his mother experienced depression and asthma, and his sister was diagnosed with autism spectrum disorder (ASD) and bipolar disorder. Diagnosed with ASD and a learning disability at age 8, the patient demonstrated communication difficulties, experienced persistent bullying, and subsequently developed severe social anxiety disorder, leading to extended periods of social withdrawal. Prolonged periods of housebound behavior further isolated him. Telemedicine during the COVID-19 pandemic enabled him to reconnect with psychiatric care, leading to improvements in his emotional stability. By the time of his participation, Ramune was attending a vocational training facility and a youth support center but remained hesitant about interpersonal interactions. Ramune is the green one in Figure 1.

- **Case 2**

Alien 2: Puchi

A 15-year-old female ("Puchi") presented with a history of exposure to high academic pressure. The patient developed major depressive disorder with psychotic features at age 11, coinciding with preparation for private school entrance examinations. Subsequently, she developed body dysmorphic disorder, exacerbated by social media exposure, which led to familial discord and suicidal behavior. Despite progress, Puchi continued to experience fatigue and emotional fragility. Puchi is the purple one in Figure 1 .

- **Case 3**

Alien 3: Maruhachi

An 18-year-old female ("Maruhachi") presented with a history of severe academic and familial stressors. By age 15, her rigorous schedule led to severe weight loss, panic attacks, and eventually hospitalization for generalized anxiety disorder and an eating disorder. After one month of inpatient nutritional rehabilitation and antidepressant treatment, she regained physical health but continued to struggle with social isolation and reintegration into school life. Maruhachi is the yellow one in Figure 1.

Outcome Measures

Primary Outcome Measures

The primary outcome measure of this study was the longitudinal progression of each participant, assessed from baseline (study registration) through pre-broadcast and post-broadcast evaluations. This case series aimed to document individual trajectories by examining changes in self-reported experiences (Patient-Reported Outcomes; PROs) and clinical observations.

To capture subjective experiences, PROs included self-reported loneliness, resilience, and depressive symptoms, as well as open-ended reflections on interpersonal relationships, emotional states, and coping strategies. This qualitative data was supplemented with psychiatrist assessments, based on routine consultations and medical records, to provide a clinical perspective on participants' psychological status.

Secondary Outcome Measures

1. Psychological Measures:

1. The Japanese version of the 3-item Short-form UCLA Loneliness Scale (UCLA-LS3-J SF-3): The UCLA-LS3-J SF-3 is a concise tool developed for the rapid assessment of loneliness. This scale has been validated in various contexts, including use among mothers with infants and toddlers, demonstrating its versatility and robustness in capturing loneliness across different populations. The 3-item version is derived from the 10-item version, with a high correlation to the original UCLA Loneliness Scale Version 3. It has shown adequate reliability and validity in Japanese studies, making it particularly suitable for brief interventions[13]. The total UCLA-LS3-J SF-3 score ranges from 3 to 9.
2. Resilience Scale, short form (RS-14): The RS-14 is a validated tool for assessing resilience, which is conceptualized as the capacity to recover from adversity. Its reliability and validity have been established in Japanese populations, including its psychometric equivalence to the original RS, as demonstrated. The short form reduces respondent burden while maintaining robust internal consistency and test-retest reliability[14]. The total RS-14 score ranges from 14 to 98.
3. The Patient Health Questionnaire-9 (PHQ-9): This measure was selected because assessing treatment efficacy through PHQ-9 score changes is commonly recommended and widely accepted in clinical research, including in Japan[15]. The PHQ-9, a self-administered questionnaire consisting of nine items, evaluates the presence and severity of depressive symptoms based on DSM-IV criteria for major depressive disorder within the past two weeks. The total PHQ-9 score ranges from 0 to 27, with higher scores indicating more severe depressive symptoms.

   Assessments were conducted at three time points: baseline (study enrollment), interim (4-10 days pre-recording), and final (4-10 days post-broadcast). For all evaluations, participants completed the questionnaires at home on paper. The completed questionnaires were then either returned during their next outpatient visit or sent back by mail. This schedule was consistently applied for all three measures to ensure data reliability and consistency.

2. Speech data: Speech data was collected from participants during the program's metaverse-based interactions.

Data Analysis

To analyze the primary outcomes, we created a structured summary table outlining the longitudinal progression of each participant from baseline (study registration) to post-broadcast. This table

summarizes participants' qualitative self-reports at three time points (baseline, pre-broadcast, and post-broadcast), capturing their experiences of loneliness, emotional responses, and coping strategies. As an ad-hoc analysis, a case-by-case qualitative analysis was conducted to further explore these individual trajectories. This analysis focused on participants' self-reported reflections on loneliness, emotional states, and coping strategies, based on responses to the following open-ended questions: 1) "During the past 10 days, have you felt lonely in your relationships with friends, family, or society? ", 2) "How did you feel at that moment?" and 3) "How did you cope with it?" Thematic patterns were categorized based on predefined domains aligned with psychological scales, such as UCLA-LS3-J SF-3, RS-14, and PHQ-9. The identified themes included: 1) Changes in perceived loneliness (e.g., descriptions of social isolation or re-engagement with peers), 2) Changes in resilience, shifts in coping strategies (e.g., engagement in self-reflection, use of peer support). 3) Emotional responses to program participation** (e.g., depressive state, expressions of hope, anxiety, or relief). These thematic categories were aligned with predefined psychological constructs measured by the 1) UCLA-LS3-J SF-3 (loneliness), 2) RS-14 (resilience), and 3) PHQ-9 (depressive symptoms). This alignment was achieved by examining the semantic content of participant narratives in relation to established dimensions of the respective psychological scales. Two independent researchers performed coding, and discrepancies were resolved through discussion. In addition, clinical observations from psychiatrists' records were reviewed to assess changes in participants' social engagement and emotional regulation. The goal was to identify patterns of psychological adaptation throughout the program.

To analyze secondary outcome measures, changes in pre- and post-intervention scores were calculated for psychological measures, including the UCLA-LS3-J SF-3 (loneliness), RS-14 (resilience), and PHQ-9 (depressive symptoms). Descriptive statistics were used to summarize individual trajectories and group-level trends across the three assessment points: baseline, pre-broadcast, and post-broadcast. Given the small sample size, statistical significance testing was not performed, and results were interpreted based on individual-level changes rather than inferential statistics.

Exploratory sentiment analysis of participants' utterances was conducted to capture patterns of emotional expression. Words were categorized into positive and negative terms, and their frequencies were counted to assess emotional dynamics across different stages of the program (Cityscape, Spaceship/Spaceport, Moon). Initially, text segmentation and morphological analysis were attempted

using MeCab (https://taku910.github.io/mecab/), a widely used Japanese text analysis tool. However, existing sentiment dictionaries did not adequately capture the context-specific emotional expressions in this study. Therefore, a custom lexicon was developed to classify words into sentiment categories. The distribution of emotional expressions was analyzed across different program stages (Cityscape, Spaceship/Spaceport, and Moon) to identify shifts in emotional dynamics.

The frequency of positive and negative words was calculated, and sentiment distributions were aggregated for each scene to illustrate emotional transitions across the program's stages. The analysis was performed using R version 4.4.2, with custom scripts utilizing the *dplyr, ggplot2*, and *stringr* packages for text processing and visualization.

All available data were analyzed without imputation. No missing responses were reported for psychological measures, as participants completed and returned all self-reported questionnaires as instructed. For qualitative responses, minor transcription gaps were resolved through researcher consensus, ensuring accurate thematic analysis.

Ethical Issues

This study complies with the Declaration of Helsinki. Ethical approval was obtained from the Yokohama City University Ethics Committee (Approval No F240600003). Detailed explanations of the study's purpose, methods, potential risks, and benefits were provided to participants and their legal guardians. Written informed consent was obtained from all participants, and for minors aged 16 or older with sufficient capacity for independent decision-making, their assent was also obtained.

Personal data were anonymized using unique identification codes, ensuring confidentiality. The correspondence table linking codes to individual identities was securely stored at the research institution and was inaccessible to unauthorized personnel. Both digital and physical data were stored securely with restricted access and will be destroyed responsibly after the retention period.

Qualitative data derived from participant utterances during the metaverse interactions were also anonymized to protect privacy. Participants were informed of their right to withdraw from the study at any time without consequences, and their data would be excluded unless anonymized and aggregated. These measures ensure the protection of participant privacy, the confidentiality of data, and compliance with ethical standards throughout the study.

Results

Primary Outcome Measures

Case-by-case analysis of patient trajectories, based on structured evaluation as shown in Table 1, revealed key psychological and social changes.

Participant	Timepoint	Loneliness (PRO)	Resilience (PRO)	Depression (PRO)	Psychiatrist Observation
Alien1	**Baseline**	Feeling disconnected when unable to talk to online friends	Distracts self with videos and games	No specific episode	Limited social engagement
	Pre	Feeling excluded when unable to join conversations	Watches videos to change mood	No specific episode	Limited social interaction skills
	Post	No specific episode	Interacting with various people was meaningful and enriching	No specific episode	Developed better coping strategies and became more socially engaged
Alien2	**Baseline**	Felt abandoned and lonely when a classmate stopped interacting after a seating change	No specific episode	I felt overwhelmed by loneliness and sadness	Emotional distress, avoidance tendencies, and negative thought patterns
	Pre	No specific episode	No specific episode	Felt anxious about participating in the program	Anxiety about social interaction
	Post	Talking with other participants who shared similar struggles helped me realize that I was not alone	Expressing sadness and loneliness to others provided relief to myself	Felt warmth from kind program staff, reducing isolation	Reduction of loneliness, improvement in coping skills, and alleviation of interpersonal distrust
Alien3	**Baseline**	After missing school, pressure from my family to return caused tension, and I also became isolated from my friends	Retreating to my room provided me with a sense of comfort	However, I still felt distressed, as if I had no place to belong	Social isolation, depressive state, and avoidance behavior
	Pre	Continued school absence has resulted in prolonged feelings of isolation	I tried going outside	Feelings of depression and hopelessness persisted	Despite improvements in proactive coping strategies, the depressive symptoms remained
	Post	I started spending time and chatting with my friends after school	I stopped avoiding tasks due to perfectionism and realized that taking-action matters. Now, I've learned to accept my imperfections	At first, I struggled to connect with my new classmates. Now I feel sad to part ways with them	Enhanced coping strategies, relief from depressive symptoms, and reduced feelings of isolation

Table 1. Longitudinal Psychological Changes in *Project Aliens* Participants. The table presents longitudinal changes in psychological status for three adolescent participants. Data were collected at three time points: baseline (study registration), pre-broadcast, and post-broadcast. Each participant's subjective experiences and clinical observations are categorized into four domains: loneliness, resilience, depression (PRO: Patient-Reported Outcome), and psychiatrist observation. Psychiatrist observations were documented during routine clinical consultations at each time point.

1. Patient Reported Outcomes (PROs)

Participants described changes in their experiences of loneliness, emotional responses, and coping mechanisms across the three time points (baseline, pre-broadcast, post-broadcast).

- Alien 1: Initially, he reported feeling left out in social communication. Post-broadcast, he found the experience of talking to various people meaningful and enriching. From a psychiatrist's observation, his social engagement increased.

- Alien 2: Initially, she felt isolated, and experienced sadness, Post-broadcast, she was able to express her feelings directly to the friend, which provided relief. From a psychiatrist's observation, her loneliness decreased, coping skills improved, and interpersonal distrust was alleviated post-broadcast.
- Alien 3: Initially, she described severe loneliness due to being unable to attend school and lacking communication with family. Post-broadcast, she reported positive social interactions, noting that she had been spending more time with friends. From a psychiatrist's observation, her coping strategies improved, depressive symptoms were alleviated, and feelings of isolation decreased.

Secondary Outcome Measures

1. Psychological Measures:

Figure 2 demonstrates changes in individual scores and group means across three psychological domains:

- Loneliness (UCLA-LS3-J SF-3): Scores increased slightly for Alien 1 (+2) and Alien 2 (+1), while Alien 3 remained stable.
- Resilience (RS-14): Resilience improved across participants, with the largest increase observed in Alien 3 (+24).
- Depression (PHQ-9): Depression scores decreased for all participants, with Alien 3 showing the most significant reduction (-7).

Each psychological measures exhibited different patterns of change across the three time points as shown in Figure 2:

- Loneliness (UCLA-LS3-J SF-3): The group mean increased from 6.3 at registration to 7.0 pre-broadcast, then remained stable at 7.3 post-broadcast.
- Resilience (RS-14): The group mean increased from 56.0 at registration to 58.7 pre-broadcast, followed by a more substantial rise to 70.7 post-broadcast.
- Depression (PHQ-9): The group mean decreased from 7.7 at registration to 6.3 pre-broadcast, then further dropped to 4.0 post-broadcast.

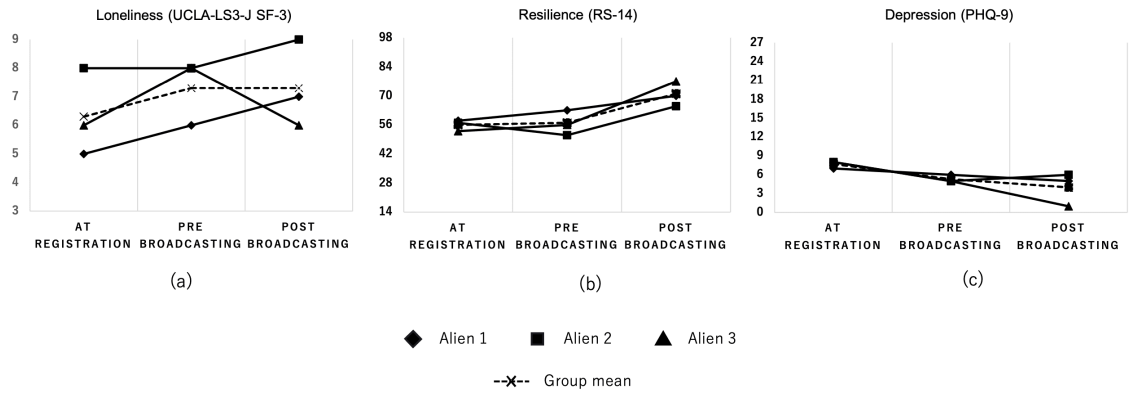

Figure 2. Longitudinal Changes in Psychological Outcome Measures. Visualization of individual trajectories and group means across three time points for: (A) Loneliness (UCLA-LS3-J SF-3, range 3-9), (B) Resilience (RS-14, range 14-98), and (C) Depression (PHQ-9, range 0-27). Each participant's scores were measured at three points: at registration, pre-broadcasting, and post-broadcasting. Alien 1 (diamond), Alien 2 (square), and Alien 3 (triangle) are represented by different markers. Group mean trends, indicated by the × markers and dashed lines, illustrate the overall trajectory of changes in loneliness, resilience, and depressive symptoms among participants.

2．Sentiment Analysis of Speech:

The sentiment analysis, conducted as a secondary outcome measure, revealed distinct emotional dynamics across the program's stages. Positive expressions dominated Scene a (Cityscape), while Scenes b and c reflected more balanced emotional expressions, indicating deeper emotional engagement.

Figure 3 illustrates the sentiment distribution across different scenes, providing a visual representation of how participant emotions varied during each scene of the *Project Aliens*. Scene a contained 48 total emotional expressions: 18 negative (37.5%) and 30 positive (62.5%), scene b contained 115 total emotional expressions: 64 negative (55.7%) and 51 positive (44.3%), and scene c contained 68 total emotional expressions: 29 negative (42.6%) and 39 positive (57.4%).

In scene a, participants frequently expressed positive emotions, such as excitement and curiosity, using terms like “cute”, or “fun”. These findings suggest that the design of the initial VR environment successfully engaged participants and reduced their apprehension. However, as the journey progressed to Scene b, more complex emotional responses emerged. Participants used words such as “painful” and “anxious” while also mentioning “courage” and “challenge”, indicating both the

difficulties they faced and their ability to confront them. By Scene c, the focus shifted to closure as reflected in expressions like “finish”, or “miss you”, and also with optimism as reflected in expressions like “hope”, or “wish”.

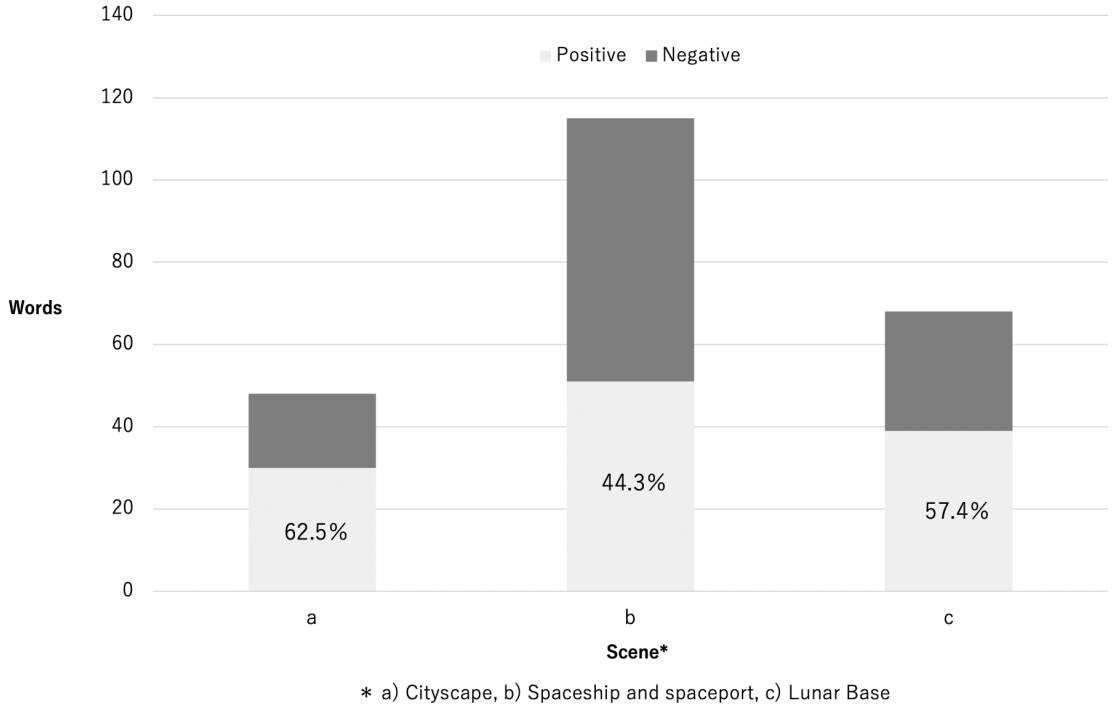

Figure 3. Quantitative Analysis of Emotional Expression Patterns. Temporal distribution of emotional expressions categorized by valence (positive/negative) across program stages. Frequencies represent word-level sentiment analysis of participant utterances. Scene a) Cityscape shows predominantly positive expressions during initial interactions, Scene b) Spaceship and spaceport demonstrates increased emotional complexity with both positive and negative expressions, and Scene c) Moon reflects a shift toward resolution and hope. *Numbers indicate word frequency counts.

Discussion

This case series examined the psychological impact of *Project Aliens*, an innovative VR-based television program on Japanese public broadcasting, demonstrating therapeutic potential for adolescents with mental health challenges. The program provided a unique social VR-based experience, offering adolescents a safe space for emotional expression and peer support through structured facilitation and immersive virtual environments. The findings highlight the program's

potential to improve multiple aspects of psychological well-being, including reduced loneliness and depressive symptoms, and enhanced resilience. These improvements were observed both in psychological measures and patient-reported outcomes throughout the program participation process, from recording through broadcast viewing. Social VR based programs like *Project Aliens* creating immersive spaces for dialogue, peer support, and emotional processing, may pave the way for new approaches to mental health care. Within a psychologically safe social VR environment, participants were able to express both positive and negative emotions in a balanced way while sharing their recovery journeys and adverse experiences through mutual empathy[12][16].

A critical factor in program efficacy was the structured facilitation of participant engagement and interaction within the VR environment. The program design—featuring warm colors, relatable visual elements, and cutely designed alien avatars—fostered a sense of safety and accessibility, reducing barriers to communication. While another study emphasizes the benefits of realistic avatars in fostering trust and attentional focus in virtual environments[17], research on non-humanoid avatars, such as animal avatars, suggests that dissimilar appearances can promote self-disclosure and enhance intimacy between users by reducing self-presentation anxiety and encouraging more open communication[18]. This aligns with *Project Aliens*' approach, where the playful design of alien avatars may create a similar effect, encouraging participants to share their experiences more freely and engage in deeper emotional dialogue. Prior research has established associations between self-disclosure and enhanced relationship quality and well-being, while noting potential limitations of online compared to face-to-face disclosure. However, online self-disclosure can serve as a valuable first step before transitioning to offline interactions for certain populations, such as highly anxious adolescents[19].

This social VR program actively encouraged participant-led interactions while providing sufficient structure to ensure psychological safety. Previous studies found that online or virtual peer support groups significantly enhanced participants' emotional regulation and adaptive coping strategies. Another previous study demonstrated how online peer support can foster group cohesion and build resilience among adolescent cancer survivors[20]. Similarly, research on a VR-based language learning program using a progressive question prompt approach showed that structured peer-tutoring activities can boost engagement, improve self-efficacy, and promote emotional expression[21]. These findings suggest that *Project Aliens*' immersive VR environment has the potential to offer not only

emotional support but also opportunities for personal growth, providing participants with a safe space for self-expression, mutual empathy, and adaptive coping.

The immersive nature and anonymity provided by social VR environments have the potential to enhance social skills training and promote self-disclosure. However, structured facilitation is crucial for maximizing these benefits and maintaining meaningful engagement for young people[22], and is also crucial in virtual therapeutic spaces[23]. Without proper guidance, communication may stagnate, and participants may not fully express themselves. In *Project Aliens*, facilitation was embedded into the program's design, enabling young participants to build trust and develop communication skills.

In such an environment, participants may be encouraged to be more open, playful, and emotionally expressive. Each participant was encouraged to express their thoughts and emotions, and experiences engaging in mutual support within *Project Aliens*. They shared their adverse experiences and also their recovery process during the program. Actually, the analysis of participant utterances revealed distinct emotional dynamics across the program's stages. These emotional transitions may illustrate the program’s capacity to guide participants through self-reflection and emotional growth. This process can be understood through the *Proteus Effect*[24], where users' self-perception and behavior begin to align with the traits of their avatars. In *Project Aliens*, the dialogue facilitated through these playful and non-human avatars may have helped participants adopt new perspectives, allowing them to practice emotional openness and resilience in ways that could extend beyond the virtual world, ultimately contributing to their personal growth and recovery.

The quantitative findings suggest improvements in resilience and reductions in depressive symptoms among participants. In addition to these quantitative improvements, participants’ reflections provided valuable insights into their subjective experiences. Several participants mentioned that the program helped them feel less isolated and encouraged them to face challenges more positively. While these reflections were not part of the formal outcome measures, they complement the quantitative data and offer a broader understanding of the program’s impact.

In this study, several limitations warrant consideration. Primary study limitations include the small sample size and brief follow-up period, which constrain generalizability and long-term outcome assessment. Additionally, the subjective reflections provided by participants may introduce recall bias and may not accurately represent long-term changes. The findings may not be generalizable to all adolescent psychiatric patients due to the small sample size and the unique nature of the television-based intervention. Future research should employ larger, more diverse samples and longitudinal

designs to validate these preliminary findings and examine long-term therapeutic effects. Second, this study focused on short-term outcomes, leaving the long-term impacts of the program unexplored. Longitudinal research is needed to assess the sustainability of the psychological changes observed in participants. Furthermore, the positive effects observed in *Project Aliens* may not be solely attributable to the social VR program structure. The unique experience of participating in a television program during summer vacation, along with the empowering interactions with production staff throughout the filming and broadcasting process, may have contributed to the participants' increased confidence. Future research using appropriate experimental designs is needed to verify the therapeutic effectiveness of social VR programs structured similarly to *Project Aliens*.

This case series demonstrates the potential efficacy of structured social VR interventions that integrate innovative design, therapeutic facilitation, and peer support in promoting emotional exploration, resilience, and recovery among adolescents with psychiatric disorders. The findings of the present study lay the groundwork for future investigations of social VR therapeutic contents, offering new possibilities for accessible and effective mental health care.

Statements and Declarations

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Conflicts of interest

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