Original article

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Promoting health among adolescents with and without chronic illness through a serious game (emoTIChealth): An intervention and evaluation protocol

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ABSTRACT

Introduction. Adolescence is a stage characterized by significant emotional, cognitive, and social changes. The presence of chronic physical illness during this period can increase the risk of psychological distress and negatively affect quality of life and the adoption of healthy habits. In this context, digital interventions based on serious games represent an innovative strategy for promoting health among adolescents.

Objective: To describe the design and implementation protocol for emoTIChealth, *a* psychoeducational serious game aimed at adolescents aged 12-16, with and without chronic physical illnesses, designed to promote physical and emotional health, social-emotional skills, and healthy habits.

Population and methods. A quasi-experimental, longitudinal, within-subject design with repeated measures at three time points. The intervention is structured around six areas: emotional awareness and regulation, cognitive coping, identity, social relationships and communication, and physical well-being. Psychological variables (such as health-related quality of life, self-concept, and resilience) will be assessed using validated instruments. Following the completion of emoTIChealth, we plan to evaluate pre- and post-intervention changes in indicators of health-related quality of life, socio-emotional skills, self-concept, resilience, and healthy habits, as well as a reduction in psychological symptoms.

Conclusion. EmoTIChealth is an innovative digital intervention designed for educational and healthcare settings that holistically promotes adolescent health, regardless of whether the adolescent has a chronic illness or not, and its impact will be evaluated in a longitudinal quasi-experimental study currently in the implementation phase.

Keywords: *adolescent; quality of life; chronic illness; psychological intervention; serious games.*

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INTRODUCTION

Adolescence is a stage marked by profound physiological, psychological, and social changes that can significantly influence personal adjustment and quality of life.[1] Depressive and anxiety symptoms are common during this stage; high rates of social anxiety, risky behaviors, and generalized anxiety are found among adolescents.[2,3]

The presence of a chronic disease (CD) during this period imposes additional demands, making adaptation more difficult.[4] Diseases such as asthma, the most common CD in children,[5] and type 1 diabetes *mellitus* (T1DM), with approximately 2 million cases worldwide among those under 20 years of age,[6] are particularly relevant. Although it is more difficult to estimate due to underdiagnosis, allergic rhinitis and food allergies are also highly prevalent in this population, with a symptom prevalence of 14% in the former,[7] and an increasing prevalence in the latter.[8]

Several studies have shown that adolescents with chronic conditions have a higher prevalence of social, emotional, and mental health problems compared to their peers without chronic conditions.[9] These issues have a negative impact on this population's quality of life.[10] For this reason, the literature emphasizes the importance of addressing health-related quality of life and its protective factors.[11]

Nowadays, serious games are emerging as an innovative technological tool whose primary objective goes beyond mere entertainment, integrating playful elements with educational and therapeutic purposes. These tools are particularly well-suited for addressing educational and psychosocial content with adolescents, given their affinity for digital environments.[12]

OBJECTIVES

1. Develop and implement a serious game called "emoTIChealth," designed to promote physical and emotional health, socio-emotional skills, and healthy habits among adolescents with or without chronic conditions.
2. Examine pre- and post-intervention changes in various psychological indicators, such as health-related quality of life and socio-emotional skills, self-concept, and the importance and adoption of healthy habits.

Hypothesis

Before the intervention, adolescents with and without chronic illness will maintain or see a decline in their health indicators. In contrast, following the use of emoTIChealth, a significant improvement (p <0.05) is expected in quality of life, social and communication skills, emotional awareness, resilience, self-concept, and healthy habits. For those with chronic illness, a significant reduction in the perceived threat of the illness is anticipated.

POPULATION AND METHODS

Study design and timeline

The study employs a quasi-experimental, longitudinal, within-subject design with repeated measures and convenience sampling, in which each participant serves as their own control. This type of design was chosen because the intervention takes place in a real educational setting, where random assignment and the inclusion of external control groups would introduce several ethical and logistical limitations.

Three assessments will be conducted: an initial assessment (T1), a second assessment four weeks later, before the intervention (T2), and a post-intervention assessment after the game ends (T3).

The intervention will take place during homeroom periods at participating schools (50-60 minutes per week), with groups of 20-30 students under the supervision of the homeroom teacher and remote support from the research team. Informed consent will be required from the adolescent and their parents or legal guardians, and will be obtained by homeroom teachers at participating schools.

Following an initial online meeting to explain the study in detail, the research team will provide training materials to the school tutors at participating schools: a program implementation manual, practical guides for each game area, instructional videos on using the platform, and a troubleshooting protocol. The assessment instruments will be administered separately from the gaming experience, via an external platform called LimeSurvey, to ensure standardized conditions for anonymous assessment.

Each participant is assigned a unique alphanumeric code, issued and managed exclusively by the tutor, who will distribute it to each participant to ensure confidentiality. This code serves as the student's identifier and allows researchers to track their progress; researchers will only have access to this coded information. Adherence will be monitored through automatic logs of platform access and progress using these

identification codes. *Table 1* provides a detailed overview of the assessment design and the intervention timeline.

Sample characteristics and inclusion criteria

The intervention will take place at 19 schools in the province of Valencia (Spain). The inclusion criteria are: a) being between 12 and 16 years of age, and b) having informed consent from a parent or legal guardian. Participants will be excluded if they a) do not understand Spanish or b) are unable to access an electronic device with an internet connection during the school hours set aside for the intervention.

The study will include adolescents with and without chronic physical illness, enabling a comprehensive and rigorous characterization of the main chronic conditions in adolescence. The chronic conditions included in the study will be asthma, type 1 diabetes *mellitus*, food allergies, and allergic rhinitis. Other chronic conditions that require highly specific interventions not covered by the game's design will be excluded.

A 95% confidence level and a 5% margin of error were established, which resulted in a minimum sample size of 385 participants after adjusting for a finite population, given that in 2022 the adolescent population aged 11 to 16 in Spain numbered 2 749 134 individuals.[13] In addition, the prevalence of chronic conditions common in adolescence was taken into account, such as pneumallergic diseases (prevalence exceeding 10%)[14] and type 1 diabetes *mellitus*, with an estimated annual incidence of 11–24 cases per 100 000 children under 15 years of age.[15] For this subgroup, a sample size of 372 participants was estimated.

Intervention

EmoTIChealth is a serious game designed as a digital intervention that adapts part of its content based on the presence of a chronic condition. At the start of the game, the adolescent indicates whether they have asthma, type 1 diabetes, food allergy, another illness, or none at all. The narrative remains consistent, but some content in Area 1 is tailored to the specific condition, incorporating relevant information and recommendations. For example, in the case of diabetes, the game addresses nutritional aspects related to the glycemic index, while in all other cases it focuses on macronutrients. In this way, the game promotes healthy habits tailored to the condition when it is present and general guidelines when it is not.

Its design is based on the disease-adjustment model from an integrative perspective (DAMIP),[16] an integrative conceptual framework that

Table 1. Study timeline

	Study period			
	Recruitment	Post-recruitment		
TIME PERIOD	**-T1**	**T1**	**T2**	**T3**
Inclusion criteria	X			
Informed consent	X			
INTERVENTION				
[emoTIChealth]			⟷	
MEASUREMENTS				
Clinical and sociodemographic variables		X		
Primary outcome variables				
Health-related quality of life (KIDSCREEN)		X	X	X
Presence of psychopathology (SDQ)		X	X	X
Emotional awareness (EAQ-30)		X	X	X
Self-concept (CAG)		X	X	X
Problem solving (SPSI-R)		X	X	X
Social skills (CHASO)		X	X	X
Secondary outcome variables				
Perceived risk of illness (BIPQ)		X	X	X
Resilience (CD-RISC)		X	X	X
Healthy habits scale		X	X	X
Perception of emotional state		X	X	X

combines contributions from various established theoretical models.[17] This model identifies five key areas to focus on, corresponding to the areas of play: physical well-being, emotional well-being, cognitive coping strategies, identity development and social relationships, and support systems.

EmoTIChealth runs as a web application, accessible on a PC, tablet, or smartphone without installation. The story unfolds as an adventure through time, a concept developed following consultation with the target audience, and its gameplay is based on a first-person "point-and-click" graphic adventure that combines exploration, mini-games, decision-making, and immediate feedback to convey psychoeducational content. The duration varies, although initial tests estimate that it takes at least 4 hours to complete the story. In addition, the design adopts a flexible

Figure 1. In-game image: mini-game on regulation techniques

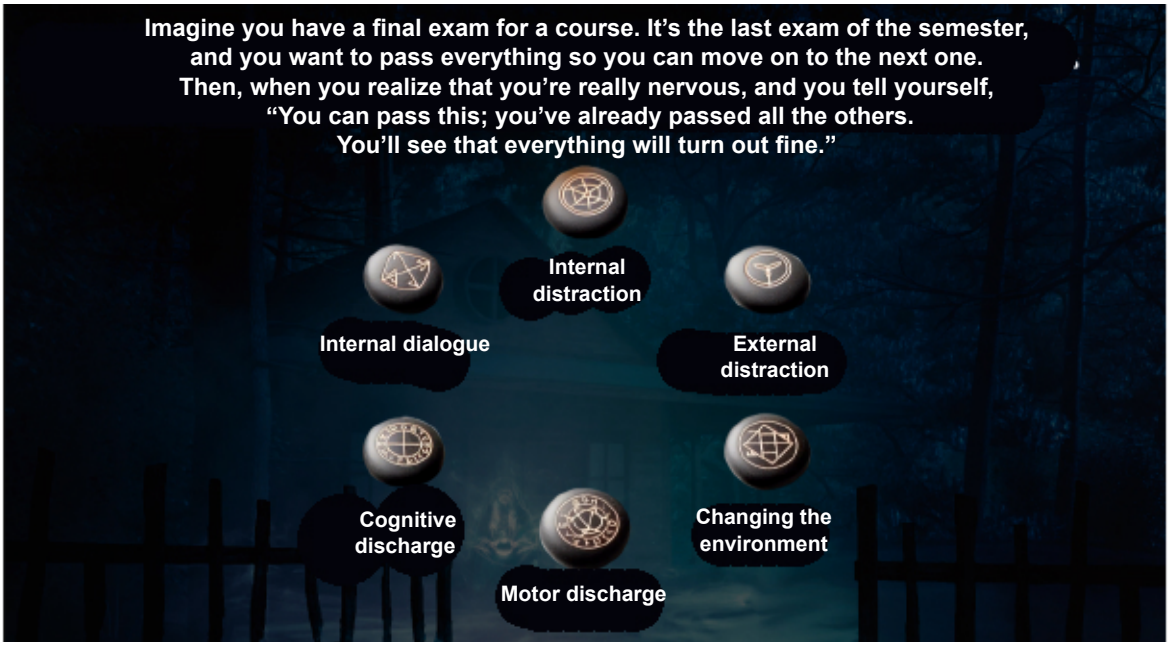

Figure 2. In-game image: Portal room

structure that integrates narrative, cognitive challenges, and immediate feedback to adapt to adolescents' diverse motivational profiles, whether or not they have a chronic illness.

Table 2 provides a breakdown of the topics and tasks that the adolescents will work on in each area.

Variables analyzed

Through an *ad hoc* registry, sociodemographic data will be collected: gender, age, identification code, nationality, school, grade level, presence of chronic illness, and diagnosis of a psychological disorder. For participants with chronic illness, clinical variables will also be recorded, including treatment type, number of hospitalizations, time since diagnosis, illness severity, presence of physical comorbidities, physical consequences of the illness, and frequency of visits to a specialist.

Variables will be categorized as primary

Figure 3. In-game image: Knowledge about healthy eating

Figure 4. In-game image: Dialogue system

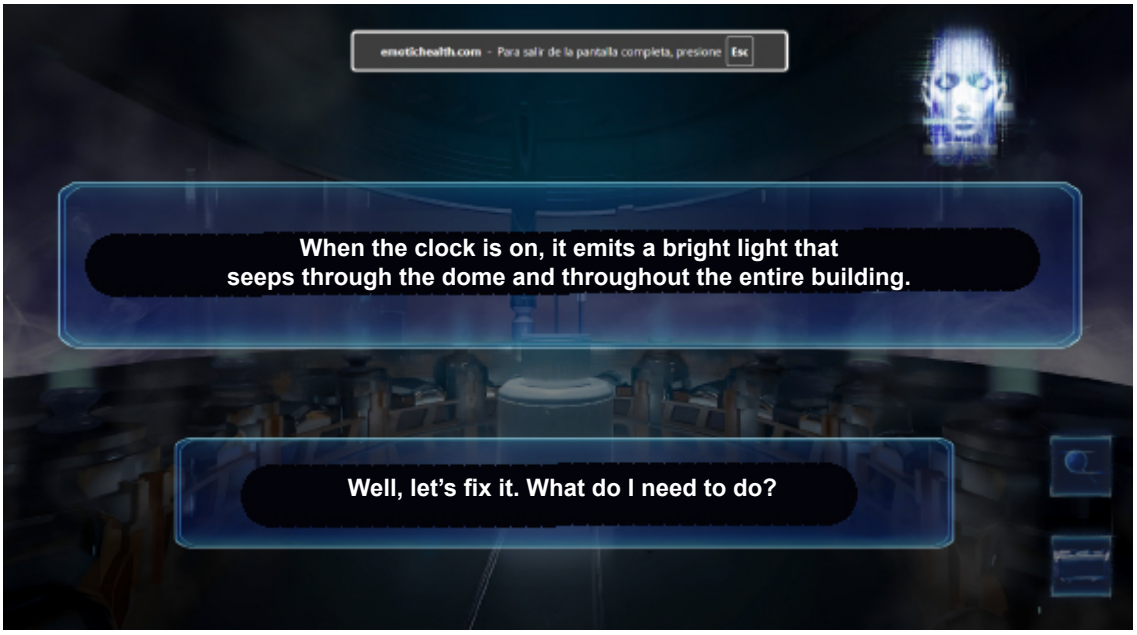

Table 2. Areas of emoTIChealth

Area	Description of the area	Objectives
Area 1. Psychoeducation and physical well-being	Introduces adolescents to understanding chronic illness and adopting healthy lifestyle habits.	• Sleep habits. • Diet management. • Physical exercise. • Basic knowledge of chronic disease healthy habits. • Hygiene habits. • Coping with feared situations.
Area 2. Emotional awareness	It focuses on laying the foundation for adolescents' emotional well-being by helping them become aware of their own emotions and those of others. It works on understanding, Identification and recognition of basic and complex emotions.	• Understand the definition, purpose, and expressions of basic emotions. • Identify basic emotions based on facial expressions. • Identify and define complex emotions. • Expand emotional vocabulary and recognize different levels of emotional intensity. • Recognize emotions in different contexts and social situations.
Area 3. Emotional regulation	Work on emotional well-being continues, providing tools to regulate and manage emotions. It focuses on stress management and reducing emotional distress.	• Learn and apply short-term stress management strategies in various situations. • Practice cognitive relaxation or mindfulness techniques. • Practice guided muscle relaxation techniques.
Area 4. Cognitive coping	It focuses on developing cognitive strategies for coping with stressful situations and solving problems effectively.	• Learn and apply the steps of problem-solving. • Practice using self-instructions to improve planning and cognitive control. • Identify and stop intrusive negative thoughts. • Restructure irrational thoughts and transform them into more adaptive ones.
Area 5. Identity	It focuses on the development of adolescents' personal identity, encouraging reflection on self-concept, self-esteem, values, and self-image. It aims to foster a positive and realistic self-perception.	• Identify and reflect on one's own personal qualities • Recognize and prioritize meaningful personal and social values. • Reflect on desires, concerns, and relevant personal aspects. • Integrate thoughts, emotions, values, skills, interests, and goals into a visual representation of one's own identity.
Area 6. Social relationships and communication	It addresses social interactions and interpersonal communication, providing tools to improve social skills, emotional expression, and managing conflicts with others.	• Understand and apply the principles of positive communication. • Develop active and empathetic listening skills. • Distinguish between and use appropriate communication styles, especially assertive communication. • Recognize and apply effective conflict resolution strategies.

and secondary to prioritize the main outcomes and facilitate clinical interpretation. Additionally, participants' fatigue will be monitored, and if adherence becomes an issue, the exclusion of secondary measures will be considered.

Primary psychological variables

- **Health-related quality of life**: This will be assessed using the KIDSCREEN-27 questionnaire, in the version adapted and validated in Spanish by the KIDSCREEN group.[18] The instrument consists of 27 items on a Likert scale (1-5) distributed across five dimensions.
- **Presence of psychopathology**
  The Strengths and Difficulties Questionnaire (SDQ) will be used in its Spanish version, validated by Ortuño-Sierra *et al*.[19] It consists of 25 items with Likert-type responses (0–2), grouped into five scales.
- **Social and communication skills**: These will be assessed using the Social Skills Questionnaire (CHASO), in the version validated for the Spanish-speaking population by Caballo *et al*.[20] The instrument consists of 40 items on a five-point Likert scale and assesses ten specific dimensions of social functioning.
- **Emotional awareness**
  It will be assessed using the Emotion Awareness Questionnaire (EAQ-30), adapted into Spanish by Samper-García et al.[21] The questionnaire comprises 30 items on a three-point Likert-type scale and assesses six dimensions related to both emotional awareness and emotional expression.
- **Coping and problem-solving skills**
  It will be assessed using the Spanish-adapted short form of the Social Problem-Solving Inventory–Revised (SPSI-R),[22] developed by Maydeu-Olivares *et al*.[23] The instrument consists of 25 items with Likert-scale responses (0–4) and five subdimensions.
- **Self-concept**
  It will be assessed using the Garley Self-Concept Questionnaire (CAG).[24] This instrument consists of 48 items on a Likert scale (1-5) and provides an overall self-concept score, as well as six subdimensions.

Secondary psychological variables

- **Resilience**
  Resilience will be assessed using the 10-item short form of the Connor-Davidson Resilience Scale (CD-RISC-10),[25] in its Spanish version validated by Notario-Pacheco *et al*.[26] The items are rated on a Likert scale from 0 to 4.
- **Perception of illness threat**
  The Brief Illness Perception Questionnaire (BIP-Q)[27] will be used in its abbreviated version, validated for Spanish-speaking adolescents.[28] It consists of 5 items with Likert-scale responses (0–10) and one open-ended item. Higher scores on the scale indicate a greater perception of threat.
- **Healthy Habits Scale (self-developed)**
  It consists of 16 items on a 0 to 10 scale and provides an overall score, as well as specific scores for four areas: nutrition, personal hygiene, physical exercise, and sleep hygiene.
- **Perception of emotional state and problems in daily life**
  The assessment will be conducted using self-developed items on a 0-to-10 Likert scale. It includes one item to assess current emotional state and five items to assess perceived difficulties in various areas of daily life (family, friends, peers, studies, and overall situation).

Finally, we have included the Oviedo infrequency scale, developed by Fonseca-Pedrero *et al*.,[29] which comprises 12 items, ensuring that participants' responses were not selected at random.

Statistical analysis

Using SPSS (version 30.0.0), descriptive and correlational analyses will be conducted to characterize the sample. To evaluate the effect of the intervention, repeated-measures analysis of variance (ANOVA) or nonparametric tests (depending on the assumptions) will be applied. Additionally, the moderating role of chronic disease will be examined using mixed models with within- and between-subject factors.

Ethics and documentation of the intervention

This study complies with the ethical guidelines of the World Medical Association's 2013 Declaration of Helsinki and has been approved by the Human Research Ethics Committee of the University of Valencia (Reference 2024-PSILOG-3310629 UVINV_ETICA-3310629). Confidentiality is guaranteed in accordance with Organic Law 3/2018 of December 5 on the Protection of Personal Data (LOPD).

This study and its protocol have been approved and registered as a clinical trial in the ClinicalTrials.gov Protocol Registration and

Results System (Reference ID: EmoTIChealth: NCT07212530). Copyright: ©emoTIChealth registration number: UV-SW-202481R © University of Valencia & Polytechnic University of Valencia, 2025. All rights reserved.

DISCUSSION

This protocol describes the design of a psychological intervention using a serious game called emoTIChealth, which aims to promote physical and emotional health, socio-emotional skills, and healthy habits.

Serious games are educational tools designed for a specific learning purpose; their interactive nature makes them particularly useful for adolescents, for whom this engagement can be key to the effectiveness of educational interventions aimed at teaching or enhancing certain socio-emotional skills.[30]

There is evidence that serious games have improved knowledge of the disease and adaptive capacity, as well as enhanced related skills and competencies, such as emotional intelligence, active listening, internal locus of control, and other behavioral aspects, such as actively avoiding behaviors that could pose risks to the individual.[31,32]

We expect that this intervention using emoTIChealth will lead to significant improvements in variables such as health-related quality of life, emotional awareness, and emotional regulation, as other interventions focused on these characteristics have.[33,34] In adolescents with chronic illness, we also anticipate a reduction in the perceived threat of the illness, consistent with previous studies.[35]

The main strength of this study is the inclusion of adolescents with and without physical conditions, which will allow us to explore the moderating role of chronic illness in response to the intervention. However, the design of this intervention has several limitations. As this is a quasi-experimental design without an external control group, we cannot control all external influences, making it difficult to draw robust causal inferences. Furthermore, the use of self-report measures and the potential test-retest effect are limitations to consider when interpreting the results. Nevertheless, the longitudinal approach and the planned sample size provide relevant information regarding the feasibility and acceptability of the protocol's intervention.

CONCLUSION

EmoTIChealth represents an innovative approach to promoting emotional and psychosocial health among adolescents, combining a robust theoretical framework with an engaging, accessible digital format. The results of this protocol may lay the groundwork for future controlled studies and for the implementation of serious games as complementary tools in educational and healthcare settings, both among the general population and among adolescents with chronic illnesses. ■

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