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Engaging with digital tool to help detect early signs of anxiety, depression and borderline personality disorder in adolescents and young adults

Submission date
24/02/2026

Recruitment status
Recruiting

Registration date
09/03/2026

Overall study status
Ongoing

Last Edited
09/03/2026

Condition category
Mental and Behavioural Disorders

[ ] Prospectively registered
[ ] Protocol
[ ] Statistical analysis plan
[ ] Results
[ ] Individual participant data
[X] Record updated in last year

Plain English summary of protocol
Background and study aims
Many children and teenagers experience mental health difficulties, but specialist services often have long waiting lists and limited staff, which can delay support. This study aims to test a new screening interview that can be used by a psychiatrist, a tablet-based chatbot, or a humanoid robot to see whether all three options can help identify mental health problems in young people in a clear, age-appropriate, and clinically useful way. The study also explores how young people feel about each type of interview and how mental health professionals rate the usefulness of the information they provide.

Who can participate?
Young people aged 12 to 20 years can take part. This includes those who are being seen by child and adolescent mental health services for anxiety, depression or borderline personality disorder, as well as young people without mental health diagnoses from schools and the community. All participants must speak Slovenian, be able to understand the questions and give informed consent or assent (with parent or guardian consent for those under 15).

What does the study involve?
Each participant attends a single study visit in a quiet room at University Medical Centre Maribor. Participants in both the clinical (with diagnoses of anxiety, depression and/or borderline personality disorder) and control (without mental health diagnoses) groups will be randomly allocated to one of two interview modes (chatbot or virtual agent). Randomisation will be performed at the individual level using a computergenerated allocation list, with a 1:1 ratio between conditions. They sit in front of a tablet and complete a structured conversation led either by a text-based chatbot or a virtual agent. The session is video-recorded and sensors measure breathing, heart-related signals and the quality of the air they breathe out. Participants also complete short questionnaires about their mood, anxiety, personality traits, affinity to

technology and how satisfied they were with the interview. A psychiatrist oversees the session, and at the end explains the true aims of the study and offers information on support services if needed.

What are the possible benefits and risks of participating?
Participants may benefit from reflecting on their feelings and from having contact with a mental health professional, but there is no direct medical benefit expected. The main risk is temporary emotional discomfort when answering questions about mood, anxiety or personal experiences, but participants can pause or stop at any time, and immediate psychiatric support is available if distress occurs. There are no invasive procedures: the study uses non-contact sensors and room air monitors, and all data are pseudonymised and handled under strict data protection rules.

Where is the study run from?
The study is run from the Child and Adolescent Psychiatry Unit, Clinic for Paediatrics, at University Medical Centre Maribor, Slovenia, in collaboration with the University of Maribor and international technology partners.

When is the study starting and how long is it expected to run for?
The broader CERTAIN project started in January 2025. This specific study is planned to start after ethics approval in late 2025 and is expected to run for around 6 months, or until about 120–240 participants have taken part.

Who is funding the study?
This research is funded by the European Commission's Horizon Europe research and innovation programme, project SMILE (Supporting Mental Health in Young People: Integrated Methodology for cLinical dEcisions and evidence-based interventions) , GA. 101080923 , and project CERTAIN (Certification for Ethical and Regulatory Transparency in Artificial Intelligence), GA. 101189650.

Who is the main contact?
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Study information

Scientific Title
Multimodal pre-screening interviews with adolescents and young adults for developing an explainable artificial intelligence model and privacy-preserving synthetic data to assess risk of anxiety, depression and borderline personality disorder

Acronym
SYN-MIND

Study objectives
This observational study is being conducted to understand whether structured, tablet-based pre-screening interviews with a chatbot or virtual agent can capture reliable digital signals of mental health problems in young people and support the safe development of explainable AI and synthetic data for psychiatry.

Primary objective
O1: To collect a high-quality, multimodal dataset of digital biomarkers (speech and language features, facial expressions, physiological signals and exhaled-air–related markers) from adolescents and young adults with and without anxiety, depression and borderline personality disorder, in order to enable the development and validation of explainable AI models for risk assessment and digital phenotyping.

Secondary objectives
O2: To compare interview acceptability (overall satisfaction, perceived communication quality and willingness to repeat) between chatbotled and virtualagentled pre-screening interviews.
O3: To examine how interview acceptability differs by mental health status (anxiety, depression,

borderline personality disorder, no diagnosis) and by personality traits and affinity to technology.
O4: To explore associations between specific symptom dimensions (for example emotional dysregulation, identity disturbance, impulsivity, dissociation) and profiles of digital biomarkers.
O5: To assess whether indoor air quality indicators, including volatile organic compounds related to exhaled breath, differ between diagnostic groups and are associated with mental health status.
O6: To develop and evaluate methods for generating privacy-preserving synthetic data from the collected multimodal dataset while maintaining sufficient utility for model training and validation.

Ethics approval required
Ethics approval required

Ethics approval(s)
approved 13/10/2025, National Medical Ethics Committee of the Republic of Slovenia (Komisija za medicinsko etiko Republike Slovenije) (Štefanova ulica 5, Ljubljana, 1000, Slovenia; +386 1 478 60 01; gp.mz@gov.si), ref: 0120-466/2025-2711-3

Primary study design
Observational

Secondary study design
Cohort study

Study type(s)

Health condition(s) or problem(s) studied
Early identification of anxiety, depression and borderline personality disorder in adolescents and young adults receiving outpatient and community mental health care

Interventions
Adolescents and young adults aged 12–20 years, with anxiety, depression, borderline personality disorder or no mental disorder (controls), will be recruited from child and adolescent mental health services and the community.

Each participant will attend a single visit in a quiet clinical room and complete a structured prescreening interview on a tablet, led either by a chatbot or a virtual agent. The digital interview framework was designed under ISRCTN68006163 (https://doi.org/10.1186 /ISRCTN68006163) and described in the medRxiv preprint (https://www.medrxiv.org/content/10.1101/2025.10.13.25337952v1). The interview will be videorecorded to capture speech, language and facial expressions. At the same time contactless sensors will passively record physiological signals (for example breathing and heartrelated signals) and devices will measure indoor air quality and exhaledairrelated markers during the session.

Participants will, at the end, complete validated selfreport questionnaires on anxiety, depression, borderline personality features, personality traits, affinity to technology and satisfaction with the interview and communication, and the resulting multimodal dataset will be analysed to compare interview acceptability across modes and diagnostic groups, to explore associations between symptom dimensions, personality and digital/airquality biomarkers, and to train, validate and augment explainable AI models, including the development and evaluation of privacypreserving synthetic data.

Intervention Type
Other

Primary outcome(s)
1. Multimodal digital marker profiles (speech and language features, facial expressions, physiological signals and exhaledair–related markers) measured using video recording and measured contactless physiological sensors and indoor air quality sensors at the prescreening interview

Key secondary outcome(s))
1. Satisfaction with communication during the interview measured using Global Medical Interview Satisfaction Scale (GMISS) at the end of the interview

2. Willingness to repeat a similar interview measured using single selfreport Likert item at the end of the interview

3. Anxiety symptom severity measured using Generalized Anxiety Disorder 7item scale (GAD7) at the end of the interview

4. Depressive symptom severity measured using Patient Health Questionnaire 9item scale (PHQ9) at the end of the interview

5. Borderline personality pathology measured using Levels of Personality Functioning Questionnaire 12–18 short form (LoPFQ 12–18SF) at the end of the interview

6. Borderline personality features measured using Borderline Personality Features Scale for Children 11item version (BPFSC11) at the end of the interview

7. Personality traits measured using Big Five Inventory2 Short Form (BFI2S) at the end of the interview

8. Affinity to technology measured using Information Technology Affinity Scale (ITAS) at the end of the interview

Completion date
31/07/2026

Eligibility

Key inclusion criteria
Clinical group:
1. Adolescents and young adults aged 12–20 years at the time of consent/assent.
2. Currently in outpatient or inpatient care at University Medical Centre Maribor or in a collaborating child and adolescent psychiatry service.
2. Presence of symptoms consistent with at least one target condition: anxiety disorder, depressive disorder or borderline personality disorder, as determined by the treating clinician and/or clinical records.
3. Sufficient cognitive abilities to understand questions and provide meaningful answers.
4. Fluent in Slovenian.

5. Able and willing to complete the full study visit (interview, recordings and questionnaires).
6. Provision of informed consent by the participant (from age 15) and/or parent/legal guardian with assent from younger participants.

Control group:
1. Adolescents and young adults aged 12–20 years at the time of consent/assent.
2. Recruited from schools, universities, community settings or paediatric services where they are being seen for nonpsychiatric reasons.
3. No history of formally diagnosed mental disorder and no clinically significant indication of mental disorder on screening questionnaires (borderline scores assessed casebycase by the research psychiatrist).
4. Sufficient cognitive abilities to understand questions and provide meaningful answers.
5. Fluent in Slovenian.
6. Able and willing to complete the full study visit (interview, recordings and questionnaires).
7. Provision of informed consent by the participant (from age 15) and/or parent/legal guardian with assent from younger participants.

Healthy volunteers allowed
Yes

Age group
Mixed

Lower age limit
12 years

Upper age limit
20 years

Sex
All

Total final enrolment
0

Key exclusion criteria
Clinical group:
1. Intellectual disability or developmental/behavioural disorder that prevents understanding or meaningful participation in the interview.
2. Acute, lifethreatening psychiatric condition or need for emergency intervention (for example severe agitation, aggression, acute psychosis).
3. Severe sensory or motor impairment (for example profound visual, hearing or speech impairment) that prevents effective interaction with the tabletbased system and cannot be reasonably accommodated.
4. Severe unstable physical illness or acute/chronic pain that would interfere with participation or reliability of responses.
5. Acute intoxication with or withdrawal from psychoactive substances at the time of assessment.

Control group
1. Any formally diagnosed mental disorder.

2. Clinically significant suspicion of mental disorder based on validated selfreport screening instruments, confirmed by the study psychiatrist.
3. Intellectual disability or developmental/behavioural disorder that prevents understanding or meaningful participation.
4. Acute psychiatric crisis or high current suicide risk requiring urgent care.
5. Severe sensory or motor impairment, severe unstable physical illness or acute intoxication /withdrawal, as above.

Date of first enrolment
12/01/2026

Date of final enrolment
24/04/2026

Locations

Countries of recruitment
Slovenia

Study participating centre
University Medical Centre Maribor, Child and Adolescent Psychiatry Unit
Ljubljanska ulica 5, 2000 Maribor
Maribor
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Sponsor information

Organisation
University Medical Centre Maribor, Unit for pediatric and adolescent psychiatry

Funder(s)

Funder type

Funder Name
HORIZON EUROPE Framework Programme

Alternative Name(s)
Horizon Europe, Horizon Europe Programme, Framework Programme, Horizon Europe, EU Framework Programme, Horizon, Horizonte Europa

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Not expected to be made available

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Other files	Consent form in Slovenian		24/02/2026	No	No
Participant information sheet	in Slovenian		24/02/2026	No	Yes