

SERO – A New Mobile App for Suicide Prevention

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Abstract. Mobile apps indicate a positive effect on suicidal ideation and potential impact on suicide attempts. As part of the SERO suicide prevention program, Lucerne Psychiatry in collaboration with partner organizations aims to reduce suicides and suicide attempts in its service area, and to improve the self-management of suicidal individuals with a mobile app. The concept for such an app was developed in a dialog with health professionals, persons at risk and their relatives and its functions were compared to six known essential app-based strategies for suicide prevention, such as the development of a safety plan, access to support networks and tracking of mood. We present the concept and architecture for the app and discuss potential added value, which may result from the intertwining of the strategies within the app, which will be available in its first version in late 2022.

Keywords. mental health, suicide prevention, self-management, self-monitoring, mobile app.

1. Introduction

Suicide causes more than 700'000 annual deaths worldwide and is the fourth leading cause of death among 15-29 year olds [1]. In Switzerland, two to three people a day end their lives by suicide [2] and due to Corona, emergency interventions at the University Hospital Zurich went up from 321 in the first 6 months of 2019 to 450 in the same time period in 2021 [3]. Management of patients at risk for suicide may involve combined modular approaches for prevention, treatment and follow-up, including hospitalization, pharmacotherapy and psychotherapy [4]. Algorithms exist listing recommendations for securing patient's safety, including limited access to lethal means, education and a safety plan [4].

Hundreds of mobile apps for depression and suicide prevention can be found [5,6] and some have been systematically evaluated [7,8]. Results suggest a positive effect on suicidal ideation [8] and potential effects on the prevention of suicide attempts, although not statistically significant [7]. Martinengo et al. [5] identified six essential app-based strategies for suicide prevention, namely 1) tracking of mood and suicidal thoughts, 2) development of a safety plan, 3) recommendation of activities to deter suicidal thoughts, 4) information and education, 5) access to support networks and 6) access to emergency

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counselling and found only 5 of 69 apps covering all six strategies. Most apps included only three strategies [5], with the most common being: Emergency contact information (65/69), direct access to a crisis helpline (46/69) and suicide-related education (35/69).

Lucerne Psychiatry with three psychiatric hospitals and numerous outpatient clinics, including two home treatment teams in Central Switzerland wishes to improve the self-management of suicidal individuals as the shortage of mental health professional is an immediate issue. The project “SERO: Suizidprävention Einheitlich Regional Organisiert²” (www.sero-suizidpraevention.ch) is a co-operative initiative with the goal to reduce suicides, suicide attempts and re-/hospitalizations due to suicide risk [9]. SERO is one of five suicide prevention projects funded by Health Promotion Switzerland’s “Prevention in Healthcare” project grant [10]. Within this project, Lucerne Psychiatry collaborates with Health Promotion Switzerland and other partner organizations. As part of it, a mobile suicide prevention SERO-app is under development that strives to combine the above-mentioned six strategies within one single app and comprises the PRISM-S³ instrument [11] for rapid self-assessment of suicidality.

2. Methodology

Literature research was conducted using the PubMed database. We were only interested in studies that focused on strategies implemented in apps for suicide prevention and its impact. Combination of keywords such as the following were used: (mobile app) AND ((suicide prevention) OR (suicide risk assessment)).

User requirements were collected in focus group discussions with health professionals, people with illness experience (suicidality) and relatives. A pilot study for the adaption of the PRISM-S assessment, which is usually performed with a mental health professional, was conducted in the inpatient setting. The aim was to develop a guidance for the patients in order to use the PRISM-S without being instructed by a mental health professional. To validate requirements and design, a formative usability test in a real-life setting with eleven psychiatric inpatients was performed within two focus groups and three individual sessions using a detailed clickable mock-up.

Implementation will be done cross-platform and in parallel for iOS and Android devices with React Native (www.reactnative.dev). The app will be available to download for free in the respective stores in German, French and Italian language.

3. Results

3.1. *The Whole May Be More than the Sum of Its Parts*

When designing the SERO-app, we extensively analyzed the work of Martinengo et al. [5]. Our goal was to implement all six potential strategies for suicide prevention with analogue functions of the SERO-app. Fig. 1 illustrates the approach: Tracking of mood or suicidal thoughts is covered with the two functions “Suicide risk assessment” by means of the PRISM-S instrument [12] and a follow-up questionnaire to assess self-

² engl. “Suicide Prevention Unified Regionally Organized”

³ “pictorial representation of illness and self management – suicidality”

reflection. Activities to deter suicidal thoughts are covered with the SERO-app functions to record own coping strategies and own distraction strategies.

The interesting point however is the desired interaction among those different strategies. Thus, the following added values are expected:

1. When tracking of mood or suicidal thoughts is completed, SERO suggests consulting the strategies recorded in the safety plan, e.g., coping or distraction strategies, or to consider talking to someone in the support network or an emergency number.
2. The tracking module and the safety plan development function are connected to the information screen function, which describes also intention and usage of both functions. Furthermore, the safety plan has outsourced its element “my personal helpers” to an own module to increase its accessibility.
3. Activities to deter suicidal thoughts are offered by suggesting emergency counselling and are proposed when creating the safety plan.

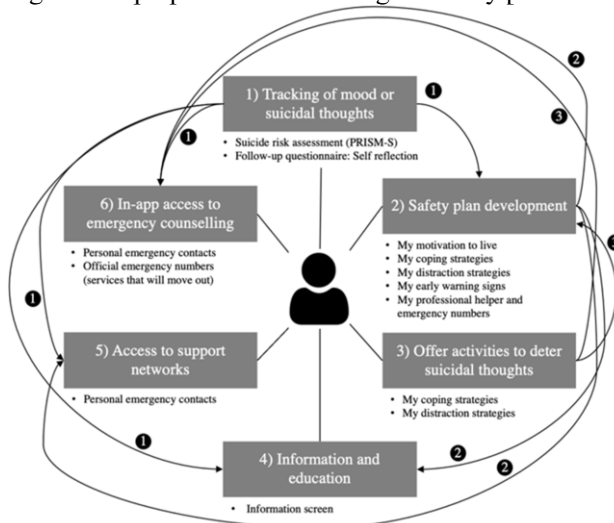


Figure 1. The six strategies for suicide prevention and the corresponding SERO-app functions. Numbered connections indicate interactions among strategies.

3.2. Conceptual Overview and Development Path

To enable the SERO-app to be distributed throughout Switzerland and to support later data analysis for research, secure data storage and access must be provided. Therefore, SERO-app uses MIDATA (www.midata.coop), a GDPR-compliant and citizen-owned health data platform, where each user has individual control over their personal data stored in their account [13]. Patient data is stored within FHIR-resources (www.hl7.org/fhir) in the secured MIDATA server environment under the personal account of the user. Data transmission between the SERO-app and MIDATA is encrypted, and further security aspects will be implemented, such as the app can only be used if the mobile phone is protected with a pin, fingerprint, or Face ID. App development is planned in two versions in order to rapidly provide a minimum viable product. SERO-app V1.0 will be released in 2022 and is limited to data and functionality for the suicidal person only. SERO-app V2.0 planned for 2023 will assist interaction of the suicidal person with his relatives and beloved ones and will permit data sharing for

parts of the safety plan and the suicide risk assessment. The MIDATA platform is able to support such interaction by means of an advanced consent management mechanism, where users can give third parties access to certain personal data. Fig. 2 shows the overall conceptual architecture for both versions.

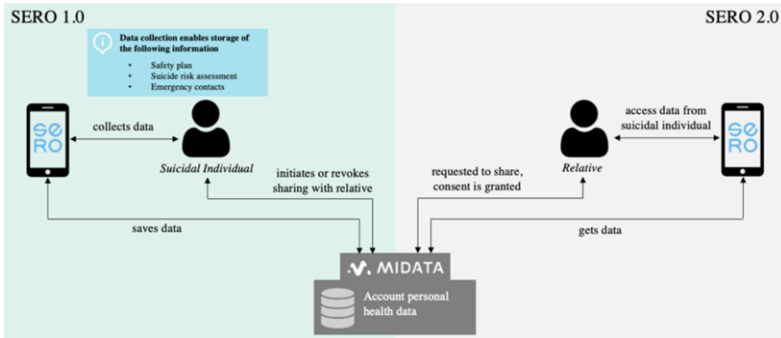


Figure 2. Conceptual architecture of SERO-app 1.0 and 2.0, and the MIDATA database and server.

3.3. Planned Architecture and features of SERO-App 1.0

SERO-app 1.0 will comprise four main modules which cover the app functions described in Fig. 1. The main modules “home”, “safety plan”, “suicide risk assessment” and “emergency contacts” comprise between one and six different app functions and support the suicidal individual in preventing, coping and reflecting on the crisis (see Fig. 3). In addition, SERO-app 1.0 will have two supporting modules which provide a) baseline information and education related to suicidality (information screen) and permit to b) personalize the app with the respective settings. The app will also have a function for onboarding and registration on the MIDATA server platform.

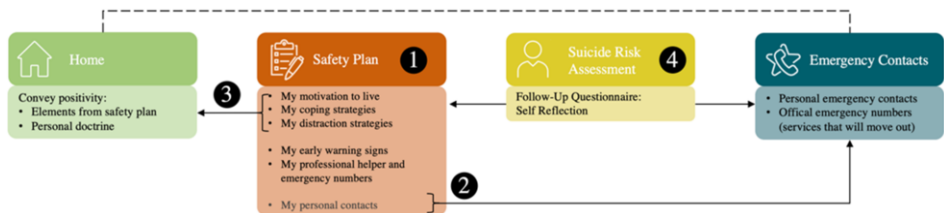


Figure 3. SERO-app modules, and their dependencies and interfaces.

The safety plan (Fig. 3, no. 1) is based on the plan developed within the SERO project on the basis of scientific findings, expert knowledge and the involvement of affected persons and their relatives [9]. The goal is to empower affected individuals and family members to use and reflect on their strengths and coping strategies. The plan is subdivided in the following sections: 1. My motivation to live, 2. My coping strategies, 3. My distraction strategies, 4. My early warning signs, 5. My personal contacts, and 6. My professional helper and emergency numbers. The plan will be implemented with a modular approach, meaning the sequence can be adapted individually to the needs of the users. While sections 1-4 and 6 are illustrated in the safety plan itself, a separate module has been created for section 5 (Fig. 3., no. 2). These emergency contacts are integrated

on the main screen; official emergency numbers can be accessed from any screen. Both can be directly called from within the app. While personal emergency contacts can be added individually by the user (incl. profile picture) and bring a personal touch to the app, official emergency numbers are predefined by the app. The latter are services that move out in emergencies around the clock, e.g., ambulance or police.

In addition to the emergency numbers, the home screen will always present a subsection of the safety plan (Fig. 3, no. 3) for the user to memorize his/her personal strategies. An example might be, “One of your distraction strategies is ‘do relaxation exercises’”. You should give this a try soon.” Furthermore, push-notifications of subsections of the safety plan are being considered.

3.4. PRISM-S and Its Realization in SERO-App 1.0

Most current digital interventions [8] use the PHQ-9 (“Patient Health Questionnaire”) [14] for risk documentation of suicidal ideation or self-harm, which is a self-administered diagnostic instrument for depression. However, in the SERO-app, we use the PRISM-S [12] for suicide risk assessment (Fig. 3, no. 4). It is a valid instrument for the visual clinical assessment of suicide risk [11] and can be used to assess how far a person is away from suicide (Fig. 4). The assessment is normally carried out together with a mental health professional on a physical board and was adapted for the app for self-application. Results of the conducted pilot study have shown that post-assessment self-reflection and access to emergency contacts are key aspects for successful realization. Therefore, the assessment is followed by a questionnaire and after completion, the consultation of the safety plan or to contact a relative is suggested. The usability test demonstrated that patients in treatment for acute suicidality feel supported by such a mobile app. Participants were able to use the mockup without experiencing panic attacks, but desired an emergency button to call relatives nearby.

The assessments performed are stored and the distance between the two circles is saved on MIDATA. Thus, the individual self-experience and progress can be discussed with a mental health professional during a therapy session.

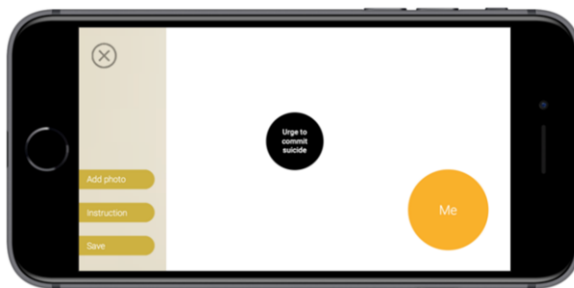


Figure 4. PRISM-S suicide risk assessment in the SERO-app. The user may move the black disc (Urge to commit suicide) towards or away from his “self” (Me). If the black disc overlaps the yellow one, this indicates the highest risk level.

4. Discussion/Conclusion

Our approach combining multiple suicide prevention strategies provides a simple and user-friendly mobile app and has been developed in close interaction with healthcare

professionals and persons in treatment for suicidality. Current studies indicate little knowledge about the effect of an app on suicidal behavior and thoughts [7,8], although an effect on suicidal ideation may be expected. Tracking and documentation of the person's status is recommended [4] and will be provided by means of the PRISM-S and questionnaire. Other recommended strategies include limiting access to lethal means, as well as appropriate pharmacological support [4].

Legal requirements have limited the functional scope of the SERO-app. For example, the PRISM-S does not provide feedback as this would fall within the scope of the Medical Device Regulation (REGULATION (EU) 2017/745) requiring financial resources not currently available. Nevertheless, we managed to avoid these limitations by adapting the methodology for self-assessment and adding elements for self-reflection.

We think that our combination of the six suicide prevention strategies from Martinengo et al. [5] and their interaction has the potential to support self-management of suicidality, but we will need to wait and see if SERO V1.0, planned for late 2022, will come up to our expectations and will be used on a continuous base, which is the utmost prerequisite for any positive effects.

References

- [1] Suicide worldwide in 2019: global health estimates. World Health Organization; 2021.
- [2] Schweizerisches Gesundheitsobservatorium. Suizid und Suizidhilfe [Internet]. 2021 [cited 2021 Mar 22]. Available from: <https://www.obsan.admin.ch/de/indikatoren/suizid>
- [3] Wegen Corona leiden mehr Jugendliche an Suizidgedanken [Internet], watson.ch. 2022 [cited 2022 Jan 24]. Available from: <https://www.watson.ch/!161738841>
- [4] The Assessment and Management of Risk for Suicide Working Group. VA/DoD clinical practice guideline for assessment and management of patients at risk for suicide. Washington: Department of Veterans Affairs, Department of Defense; 2013.
- [5] Martinengo L, Van Galen L, Lum E, Kowalski M, Subramaniam M, Car J. Suicide prevention and depression apps' suicide risk assessment and management: a systematic assessment of adherence to clinical guidelines, *BMC Med.* 2019 Dec 19;17(1):231.
- [6] Larsen ME, Nicholas J, Christensen H. A Systematic Assessment of Smartphone Tools for Suicide Prevention. *PLoS ONE.* 2016 Apr 13;11(4).
- [7] Kennard BD, Goldstein T, Foxwell AA, McMakin DL, Wolfe K, Biernesser C, et al. As Safe as Possible (ASAP): A Brief App-Supported Inpatient Intervention to Prevent Postdischarge Suicidal Behavior in Hospitalized, Suicidal Adolescents. *Am. J. Psychiatry.* 2018 Sep 1;175(9):864–72.
- [8] Witt K, Spittal MJ, Carter G, Pirkis J, Hetrick S, Currier D, et al. Effectiveness of online and mobile telephone applications ('apps') for the self-management of suicidal ideation and self-harm: a systematic review and meta-analysis. *BMC Psychiatry.* 2017 Aug 15;17(1):297.
- [9] Durrer M, Fluder M, Fringeli J, Lerch M, Meinhof J, Maeck L, et al. Projekt SERO – Suizidprävention Einheitlich Regional Organisiert. *Lead Opin Neurol Psychiatr.* 2021 Jun;55–7.
- [10] Gesundheitsförderung Schweiz. Projektförderung Prävention in der Gesundheitsversorgung [Internet]. 2021 [cited 2022 Jan 30]. Available from: <https://gesundheitsfoerderung.ch/pgv/grundlagen-der-projektfoerderung/konzept.html>
- [11] Ring M, Harbauer G, Haas S, Schuetz C, Andreae A, Maercker A et al. Validierung des Suizidalitätseinschätzungsinstrumentes PRISM-S (Pictorial Representation of Illness Self Measure – Suicidality). *Neuropsychiatrie.* 2014 Dec 1;28(4):192–197.
- [12] Harbauer G, Ring M, Schuetz C, Andreae A, Haas S. Suicidality assessment with PRISM-S - simple, fast, and visual: a brief nonverbal method to assess suicidality in adolescent and adult patients. *Crisis.* 2013;34(2):131–6.
- [13] Hafen E, Personal Data Cooperatives – A New Data Governance Framework for Data Donations and Precision Health. In: J. Krutzinna, and L. Floridi, editors. *The Ethics of Medical Data Donation.* Cham: Springer International Publishing; 2019. p. 141–9. (Philosophical Studies Series).
- [14] Kroenke K, Spitzer RL, Williams JBW. The PHQ-9: validity of a brief depression severity measure. *J. Gen. Intern. Med.* 2001 Sep;16(9):606–13.