Six-Month Clinical and Ecological Momentary Assessment Follow-Up of Patients at High Risk of Suicide:
A Survival Analysis

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ABSTRACT

Objective: In this study, we combined ecological momentary assessment (EMA) with traditional clinical follow-up to explore correlates of suicidal relapse in patients with a history of suicidal behavior.

Methods: Over 6 months, we followed up with 393 patients who completed baseline and follow-up interviews and were monitored through smartphone-based EMA via the MEmind app. Recruitment was conducted between February 2018 and March 2020. We recorded the occurrence of clinical suicidal events and EMA suicidal events, the latter defined as extreme scores on questions on passive suicide ideation.

Results: Fifteen percent of participants had a new clinical suicidal event during follow-up (9.2% suicide attempt [SA]; 5.9% emergency referral for suicidal ideation [SI]). Of the 319 participants who installed the MEmind app, 20.7% presented with EMA suicidal events. EMA suicidal events were statistically significantly associated with clinical suicidal events at 2-month follow-up but not at 6-month follow-up. In the Cox multivariate regression model, 5 factors were independently associated with clinical suicidal events: number of previous SAs, SA in the past year, SA in the past month (risk factors), female gender, and age (protective factors).

Conclusions: Our study confirms some of the risk factors classically associated with risk of suicide reattempt, such as history of suicidal behavior, while questioning others, such as female gender. Risk factors associated with EMA events differed from risk factors associated with traditional clinical suicide events, supporting the existence of distinct suicidal phenotypes.

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Suicide is one of the leading public health problems worldwide.[1] In 2018, suicide caused nearly as many years of life potentially lost in the United States as COVID-19 caused in 2020.[2] Similar figures are repeated every year, and efforts to reduce mortality have not achieved significant results in most countries.[3] Monitoring people with a history of suicidal thoughts and behaviors (STB) is crucial for suicide prevention.[4,5]

Several cohort studies[6–11] have explored precipitating factors for suicidal relapses, with follow-up times ranging from 6 months to 10 years. Factors associated with lower survival (time until next event) include personality disorders,[7,8] alcohol abuse,[7,11] poor treatment adherence,[8] number of previous suicide attempts (SA),[9,10] childhood trauma,[9,12] S and S/S allele 5-HTTLPR polymorphism,[13] and suicide ideation (SI) at baseline.[14,15]

Since death by suicide and SAs are infrequent phenomena,[16] suicide research usually focuses on SI, which has clinical value in its own right, as it decreases quality of life[17] and increases hospital admissions.[18]

Some authors understand SI as a continuum in which passive SI represents the first step for a SA,[19] while other authors argue that active and passive SI are overlapping constructs. For instance, a recent meta-analysis[4] showed that active and passive SI shared the same psychological correlates and that both were strongly associated with SAs. In contrast, other authors[20–22] claim that there are notable differences between subtypes of SI and advocate for more nuanced distinctions.

Assessing SI is a challenging task due to its fluctuations in intensity and frequency.[23] For some years now, ecological momentary assessment (EMA) has been increasingly used to detect SI in real time.[24] EMA consists of asking patients daily questions, usually through their smartphones. This allows for an assessment in real time, in patients' usual environment, decreasing recall bias and increasing ecological validity.[24–26]

EMA studies in suicide research typically employ follow-up times of less than 2 months. A recent

Clinical Points

- Ecological momentary assessment (EMA) may help characterize suicidal ideation in high-risk patients, using daily questionnaires that are completed in patients' smartphones.
- This study found that the information provided by EMA correlated with recorded clinical events, but only in the short term (2 months of follow-up), while at 6 months this association was not clear, probably because patients did not continue to respond to the daily questions after several months.
- Given that the first 2 months after a suicide attempt are the ones with the highest risk, EMA technology may be useful for monitoring patients during this period, and it could complement traditional clinical follow-up.

systematic review[26] showed that the median number of follow-up days of EMA studies was 13. Also, sample sizes of previous EMA studies are usually of fewer than 100 participants.[26]

In this study, we combine EMA's advantages with a traditional clinical assessment to explore correlates of suicidal relapses among patients with a history of STB.

METHODS

Settings and Design

This prospective cohort multicenter study was carried out at 5 hospitals in Spain (3 sites, Madrid) and France (2 sites, Nîmes and Montpellier). The study complied with the principles outlined in the Declaration of Helsinki[27] and was approved by the research ethics committees of the University Hospital Fundación Jiménez Díaz and the Comité de protection des personnes oust IV—Nantes Montpellier. Patients gave written informed consent to participate.

Sample

Participants were recruited at emergency departments, inpatient facilities, and outpatient psychiatric mental health clinics. Inclusion criteria were age ≥18 years, history of SAs and/or emergency referral for SI, having the capacity to provide informed consent, and being fluent in Spanish (in Spanish sites) or French (in French sites).

Procedure

Recruitment took place between February 2018 and March 2020. After enrollment, participants completed a face-to-face baseline interview, during which the smartphone applications were installed. Patients were followed for 6 months, after which they completed a second interview. Interviews were carried out by trained psychologists.

Smartphone-Based Measures

The EMA questionnaire was deployed through the MEmind mobile application,[28,29] available for Android and iOS. A 32-item questionnaire was used, including 2 questions about passive SI ("wish to die" and "wish to live"), 13 about negative feelings, 10 about sleep quality, and 7 about appetite. Questions were based on the Salzburg Suicide Questionnaire,[30] the Insomnia Severity Index (ISI),[31] and the Council on Nutrition Appetite Questionnaire (CNAQ).[32]

To avoid constant repetition of questions, one prompt was delivered to the user every day containing 1–4 random questions from the pool of 32 questions, at random intervals during the day, respecting sleep hours. Every question is answered in a 7-point Likert scale; for instance, for wish to live, the scale goes from no wish to live (1) to maximum wish to live (7).

Data Protection

Answers to EMA questions were uploaded to a secure web server. Usernames and personal data were pseudonymized with a code. Data were encrypted using AES-256 algorithms and 256-bit keys protected by a professional key management infrastructure externally audited.

Measures

At the baseline interview and the 6-month follow-up, we assessed suicidality with the Spanish version of the Columbia Suicide Severity Rating Scale (C-SSRS),[33] depression with the 30-item Inventory of Depressive Symptomatology (IDSC-30),[34] and functionality with the World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0).[35]

We verified the occurrence of clinical suicidal events through digital medical records, which integrate information from the emergency department and inpatient and outpatient clinics. SAs that did not reach the emergency department, or which were attended at a different hospital, were verified through the C-SSRS at the follow-up interview.

Sociodemographic variables collected were age, gender, marital status, and employment status. *International Classification of Diseases, Tenth Revision* (*ICD-10*),[36] diagnosis was established by each patient's attendant psychiatrist and obtained from the electronic medical record.

Outcomes

Our main outcome was the occurrence of clinical suicidal events. We used 2 suicidal events listed in the Columbia Classification Algorithm of Suicide Assessment (C-CASA)[37]: SA and emergency referral for SI. The events followed a hierarchical order, registering the most severe event that took place first. Thus, if a person attended the emergency department on day 10 for SI and later committed a SA on day 100, the latter and not the former event was recorded.

Our secondary outcome was the occurrence of EMA suicidal events, defined as extreme scores on the EMA questions on passive SI (score of 7/7 in wish to die or score of 1/7 in wish to live). Extreme scores were chosen to increase specificity.[38]

Statistical Analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version

Table 1. Sample Characteristics (N = 393)

Variable	n	%	Mean (SD)
Gender			
Male	134	34.1	
Female	259	65.9	
Age, y			43.2 (15.2)
Recruitment site			
Spain	330	84.0	
France	63	16.0	
Country of birth			
Spain	252	64.1	
France	62	15.8	
Other European countries	13	3.3	
Latin American countries	57	14.5	
African countries	5	1.3	
Other countries	4	1.0	
Marital status			
Married/coupled	157	39.9	
Single	168	42.7	
Separated/divorced	73	18.6	
Widowed	10	2.5	
Employment status			
Employed/student	157	39.9	
Unemployed	80	20.4	
Retired	26	6.6	
Leave	117	29.8	
Homemaker	3	0.8	
Psychiatric diagnosis (some patients had more than 1 diagnosis)			
Mood disorders	234	59.5	
Anxiety disorders	108	27.5	
Psychotic disorders	8	2.0	
Personality disorders	137	34.9	
Drug abuse	33	8.4	
Eating disorders	12	3.1	
Physical disease	13	3.3	
Other	8	2.0	
Psychiatric comorbidity (2 or more diagnoses)	166	42.2	
Index event (reason for inclusion)			
Attempted suicide in the past month (yes/no)	91	23.2	
Attempted suicide in the past year, excluding past month (yes/no)	86	21.9	
Attempted suicide in the lifetime, excluding past year (yes/no)	138	35.1	
Lifetime suicide ideation, no suicide attempt (yes/no)	78	19.8	
No. of lifetime suicide attempts, including index event			1.9 (3.1)
C-SSRS SI subscale score (range, 0–5), past month			2.8 (1.8)
C-SSRS SI subscale score (range, 0–5), lifetime			4.0 (2.2)
Depressive symptomatology (IDS score)			25.4 (12.7)
Depressed (IDS score ≥ 13)	331	84.2	
Functionality (WHODAS score)			35.4 (22.8)
Suicidal events at 6-month follow-up			
Total	59	15.0	
In participants with index event ≤ 1 month ago	19	4.8	
In participants with index event > 1 month ago ≤ 1 year ago	24	6.1	
In participants with index event > 1 year ago	9	2.3	
In participants with history of emergency referral for SI and no previous SAs	7	1.8	
Emergency referral for SI	23	6.1	
SA	36	9.2	
Death by suicide	0	0	
Maximum wish to die/minimum wish to live (EMA-measured)	66	16.8	
Other events at 6-month follow-up			
NSSI	6	1.5	
Emergency department visits for other psychiatric issues	19	4.8	
EMA mean scores (range, 1–7)			
Wish to die			2.37 (1.46)
Wish to live			3.83 (1.62)

Abbreviations: C-SSRS = Columbia Suicide Severity Rating Scale, EMA = ecological momentary assessment, IDS = Inventory of Depressive Symptomatology, NSSI = non-suicidal self-injury, SA = suicide attempt, SI = suicidal ideation, WHODAS 2.0 = World Health Organization Disability Assessment Schedule 2.0.

Figure 1. Survival Curves for (A) Clinical Suicidal Events and (B) Ecological Momentary Assessment (EMA)–Measured Passive Suicidal Ideation

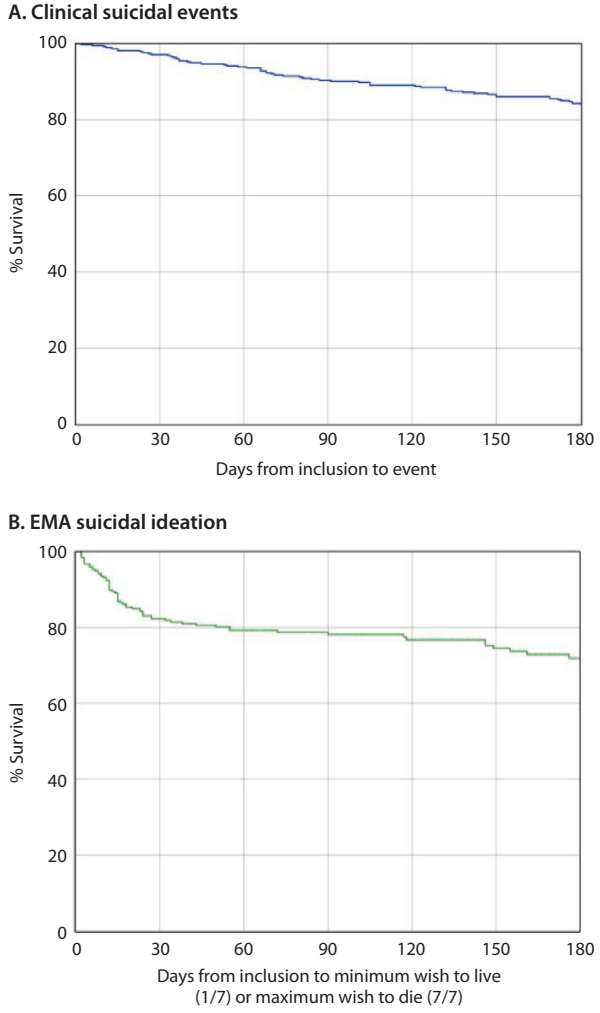
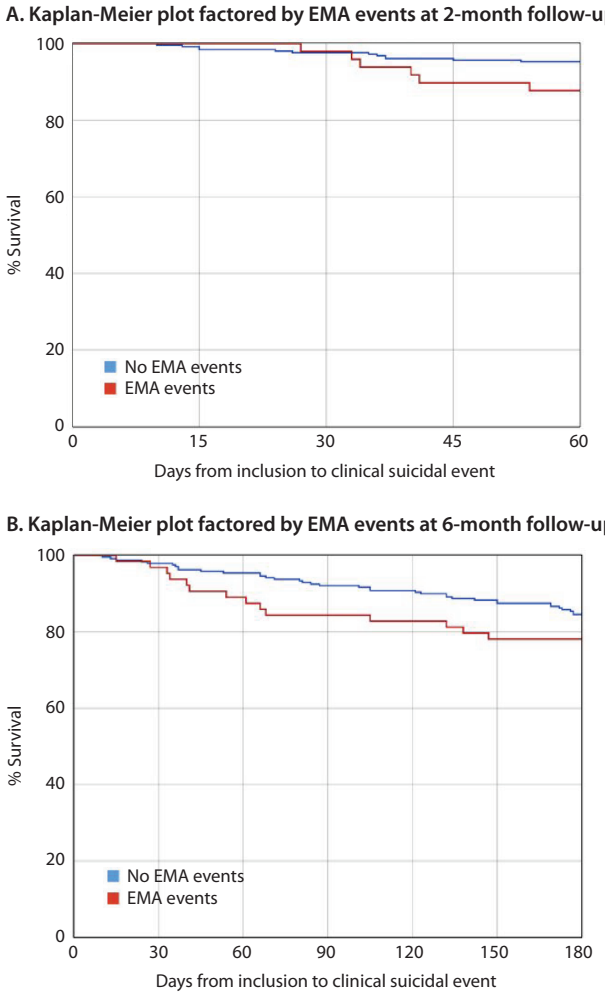


Figure 2. Survival Curves for Clinical Suicidal Events Factored by Ecological Momentary Assessment (EMA) Events at (A) 2-Month and (B) 6-Month Follow-Up



	X^2	*df*	*P* value
Log rank, 2 mo	4.112	1	.043
Log rank, 6 mo	1.811	1	.478

24.0 software (IBM SPSS Statistics). We conducted a Kaplan-Meier survival analysis to estimate the occurrence of clinical and EMA suicidal events after 2 and 6 months of follow-up and a Cox regression to explore the correlates of such events. We built a multivariant Cox regression model with variables that resulted statistically significant at the univariate Cox regression. Statistical significance was established at *P* values < .05, using 2-sided tests and 95% confidence intervals.

RESULTS

Sample Description

Our sample consisted of 393 patients, 66% women, with a mean age of 43 years. The most frequent diagnosis was mood disorders, followed by personality disorders. Twenty-three percent of patients had attempted suicide in the month before inclusion, 22% had attempted suicide in the past year (excluding past month), and 35% had attempted suicide over a year before. Table 1 shows the full description of the sample.

Clinical Follow-Up

Of the 393 participants, the status of 374 (95.2%) of them was known at the end of follow-up through the different methods of verification. Fifty-nine events (15.8% of participants with known status) were observed in 6 months (9.2% SAs; 6.1% emergency referrals for SI), with a mean (SD) survival time (time to clinical event) of 161.8 (44.8) days. Most events took place during the first 90 days: 18.6% of the events in the first month, 39.0% in the first 2 months, and 61.0% in the first 3 months. There were no fatal outcomes during the follow-up.

Comparing our Spanish and French samples, 14.5% of the participants recruited in the Spanish sites had a clinical suicidal event during the follow-up (8.2% SAs; 6.4% emergency referral for SI), compared with 25.0% of participants recruited in the French sites (20.5% SAs;

Table 2. Variables Associated With Clinical Suicidal Events and EMA Suicidal Events in Cox Regression

Variable	Clinical Suicidal Events, OR (95% CI)	EMA Suicidal Events, OR (95% CI)
Gender		
Female	0.59 (0.35–0.98)*	1.24 (0.72–2.11)
Male	1.0 (ref)	1.0 (ref)
Age, y	0.97 (0.95–0.99)**	1 (0.98–1.01)
Recruitment site		
Spain	1.0 (ref)	…
France	1.79 (0.93–3.50)	…
Marital Status		
Married/coupled	1.0 (ref)	1.0 (ref)
Single	0.75 (0.43–1.28)	0.89 (0.51–1.54)
Separated/divorced	0.43 (0.19–0.99)*	1.18 (0.64–2.16)
Widowed	0.47 (0.06–3.49)	1.41 (0.33–5.95)
Employment status		
Active	1.0 (ref)	1.0 (ref)
Disabled	1.29 (0.72–2.31)	0.87 (0.49–1.56)
Unemployed	1.4 (0.7–2.8)	1.04 (0.53–2.04)
Retired	0.50 (0.12–2.10)	1.97 (0.76–5.12)
Psychiatric diagnosis (some patients had more than one diagnosis)		
Mood disorders	0.52 (0.30–0.92)*	0.99 (0.56–1.75)
Anxiety disorders	1.32 (0.74–2.35)	0.92 (0.53–1.60)
Psychotic disorders	0.05 (0.00–120.29)	1.58 (0.38–6.50)
Personality disorders	2.01 (1.14–3.53)*	1.28 (0.76–2.16)
Drug abuse	1.59 (0.71–3.52)	0.48 (0.15–1.55)
Eating disorders	0.54 (0.07–3.90)	1.62 (0.39–6.70)
Psychiatric comorbidity (2 or more diagnoses)	0.98 (0.59–1.65)	1.10 (0.68–1.78)
History of suicidal thoughts and behavior		
Attempted suicide > 1 year ago	0.32 (0.16–0.64)**	1.10 (0.67–1.81)
Attempted suicide in the last year	2.30 (1.38–3.84)**	0.87 (0.48–1.56)
Attempted suicide in the past month	1.75 (1.03–2.99)*	1.06 (0.59–1.92)
Emergency referral for SI (no SA)	0.60 (0.28–1.26)	0.95 (0.51–1.77)
No. of lifetime SAs	1.08 (1.04–1.11)**	0.98 (0.90–1.06)
Depressive symptomatology at baseline (IDS score)	2.14 (0.86–5.35)	1.20 (0.57–2.51)
Depressed at baseline (IDS score ≥ 13)	2.14 (0.86–5.35)	1.03 (1.01–1.04)**
Functionality at baseline (WHODAS 2.0 score)	1.01 (0.99–1.03)	1.01 (0.99–1.03)
Mean score in EMA wish to live	0.83 (0.69–1.00)	…
Mean score in EMA wish to die	1.24 (1.02–1.50)*	…

*Statistically significant association, $P < .05$.
**Statistically significant association, $P < .01$.
Abbreviations: EMA = ecological momentary assessment, IDS = Inventory of Depressive Symptomatology, OR = odds ratio, ref = reference, SA = suicide attempt, SI = suicidal ideation, WHODAS 2.0 = World Health Organization Disability Assessment Schedule 2.0.

Table 3. Statistically Significant Variables in Multivariant Cox Regression Model for Clinical Suicidal Events

Variable	B	SE	Wald	*df*	OR	95% CI, Lower Bound	95% CI, Upper Bound	*P* Value
Female	−1.03	0.30	11.62	1	0.36	0.20	0.65	.001
Age	−0.02	0.01	4.48	1	0.98	0.96	1	.034
No. of previous SAs	0.07	0.02	11.73	1	1.07	1.03	1.12	.001
SA in the past year	1.11	0.35	9.94	1	3.04	1.52	6.06	.002
SA in the past month	0.83	0.38	4.63	1	2.29	1.08	4.86	.031

Abbreviations: OR = odds ratio, SA = suicide attempt, SE = standard error.

4.5% emergency referrals for SI). This difference was not statistically significant (χ^2_1=3.19, P = .074).

Figure 1 shows the survival curve for clinical suicide events. Significant results were obtained when factoring the survival curve by age group and number of suicide attempts, as shown in Figure 2.

In the Cox regression, variables associated with clinical suicidal events were younger age, male gender, diagnosis of personality disorders, SA in the past year excluding the past month, SA in the past month, number of lifetime SAs, and mean score in EMA-measured wish to die. Variables associated with fewer clinical suicidal events (protective factors) were older age, female gender, diagnosis of mood disorders, separated/divorced marital status, and history of SA over a year ago. Table 2 shows the complete Cox regression results.

In the multivariate Cox model, 5 factors were independently associated with survival: number of previous SAs, SA in the past month, SA in the past year excluding the past month (risk factors), age, and female gender (protective factors) (see Table 3).

EMA Follow-Up

The MEmind app was installed by 319 participants (81.2%). Mean (SD) days of application use were 104.5 (68.1). Retention with the application—ie, continuing to answer the EMA questions—was 79.3% at 30 days, 66.0% at 60 days, 55.5% at 90 days, and 22.6% at 180 days. The EMA questionnaire data concerning passive SI consist of 5,555 responses (1,967 responses on wish to die and 3,588 responses on wish to live), with a mean of 17.4 responses by patient.

Patients' mean (SD) wish to live score was 3.83 (1.62) out of 7, while mean (SD) wish to die score was 2.37 (1.46) out of 7. The mean score on the C-SSRS subscale of SI severity at baseline (last month) correlated with mean wish to live score (negative correlation: B = −0.16; P = .024), but not with mean wish to die score. Mean score on the C-SSRS subscale of SI severity at 6-month follow-up correlated with mean wish to live score (negative correlation: B = −0.16; P = .010) and mean wish to die score (positive correlation: B = 0.17; P = .011).

Sixty-six participants—20.7% of the patients who installed the app—presented EMA suicidal events, defined as extreme scores on the passive SI questions.

The mean (SD) survival time—time to EMA event—was 84.61 (70.5) days. Most events occurred during the first 2 months (56 events, 84.8% of the total events). Figure 1 shows the Kaplan-Meier survival curve for EMA suicidal events.

In the Cox regression, severity of depressive symptoms at baseline (higher scores on the IDS) was associated with EMA suicidal events (see Table 2).

People who experienced EMA suicidal events also had more clinical suicidal events at 6-month follow-up, but the association was not statistically significant. We explored this association during the first 2 months of follow-up, at which the retention with the EMA questions was still moderate, and found that the difference was statistically significant—people who experienced EMA suicidal events were more likely to present clinical suicidal events at 2-month follow-up, as shown in Figure 2.

DISCUSSION

Clinical Suicidal Events

EMA passive SI was associated with clinical suicidal events at 2-month follow-up but not at 6-month follow-up. We found that recent previous suicide attempts were associated with presenting a clinical suicidal event during follow-up.

Just over 9.0% of our patients re-attempted suicide at 6-month follow-up, while just over 6% of them had an emergency referral for SI. A previous Spanish suicide cohort study[8] showed similar results, with a suicide reattempt rate of 11.3% at 6 months. In a previous French suicide cohort study,[13] reattempt rate was 26.3%, similar to what we found for participants from French sites. Different reattempt rates have been observed for different populations, which is the result of several factors. For instance, a higher prevalence of depression has been found in France compared with Spain and other European countries.[39]

Regarding risk factors associated with suicidal events, we found that previous SAs were among the most important factors. Both a recent history and a higher number of attempts were associated with lower survival. Personality disorders, which were found to be associated with suicidal events in the binary Cox regression, lost significance in the multivariate model when adjusting for previous SAs. People with personality disorders, particularly borderline personality disorder (BPD), present with a higher number of SAs throughout their lifetime and are more likely to belong to the suicide phenotype known as "major repeaters."[40]

In our study we found that female gender was a protective factor for suicide reattempt. Some previous studies found that female gender was associated with suicide reattempts,[6,9] others found that male gender was associated with reattempts,[41] and others found no significant association.[8,19]

EMA for the Prediction of Clinical Suicide Events

The occurrence of EMA suicidal events during the follow-up was statistically significantly associated with clinical suicidal events at 2-month follow-up, but not at 6-month follow-up. At 6-month follow-up, people with EMA events also had a lower clinical survival, but the differences were not significant. In its current state, EMA could be useful for short-term risk, but not midterm prediction. A recent study[42] also found that EMA could be useful for short-term suicide risk prediction, specifically for prediction of SAs at 1 month post-discharge.

The lack of statistical significance at 6 months is probably caused by the decrease in retention over time, even though our retention rates are higher than those found for other mental health trackers.[43] Nevertheless, short-term prediction is highly important for suicide prevention, as the highest risk of suicide reattempt occurs during the first 2 months.[8,44]

Retention and compliance issues are intrinsic to EMA methodology. A possible strategy to increase EMA retention and compliance is to combine it with its therapeutic variant: ecological momentary intervention (EMI). EMIs are interventions administered longitudinally through smartphones, offering a tool of continuous support.[45] Providing patients with a therapeutic element might increase their perception of the usefulness of the application, which might increase retention.

Suicidal Phenotypes

Our results show that EMA-measured passive SI had different correlates than clinical suicidal events. Thus, passive SI was associated with greater severity of depressive symptoms, whereas this association was not observed for clinical suicidal events. In fact, having a mood disorder was a protective factor for clinical suicidal events. In a previous EMA study, Hadzic et al[46] found that the correlates of passive SI were different from those of active SI. Thus, daily passive SI

was associated with trait impulsivity, whereas active SI was not. Furthermore, daily passive SI was not associated with daily active SI in this study.[46]

In our case, the differences found are not directly comparable, since passive SI was measured with EMA, and suicidal events included both SAs and emergency referrals for SI. Even so, our findings and those of other EMA studies point in the direction that there are different suicidal phenotypes. This concept has been advocated by many authors,[21,22] who argue for the need to make nuanced distinctions between different types of SI, as well as between different types of suicidal behavior. Although very often associated with each other, the different manifestations of suicidal thoughts and behaviors are not interchangeable and could be translating distinct psychopathological and neurobiological alterations,[20] as well as calling for distinct therapeutic approaches.[47]

New Lines of Research: Indirect Assessment of Suicidal Risk

In addition to EMA, other approaches to non-traditional suicide risk assessment are emerging. One such approach is smartphone-based passive monitoring, also known as passive EMA, which has been scarcely exploited in suicide research.[48,49] Instead of directly observing SI, passive EMA collects indirect information through the cell phone's native sensors, such as sleep habits, physical activity, location, or smartphone usage. From this information, typical behavioral patterns can be described for each participant. Changes in these patterns could be associated with clinical decompensation.

To design new and better assessment systems, we must also consider the different diagnoses and how these may affect engagement with EMA systems. Some studies show that the use of EMAs in certain populations, such as patients with psychosis, can be problematic.[50] Regarding our EMA system in particular, a previous study[51] assessing its feasibility showed that people with eating disorders were more likely to uninstall the application.

Strengths and Limitations

To our knowledge, this suicide cohort study is the first combining traditional follow-up with EMA monitoring in a large sample for a period of 6 months. Among the limitations of the study, retention with the MEmind application decreased to 25% at 6 months, with the resulting missing data and decrease in statistical power. Added to this is the limitation of asking for passive and not active SI. Including active SI assessment was considered during the design of the study, but it was rejected by the Ethics Committee. As per suggestion of the Ethics Committee, "wish to live" was asked about more frequently than "wish to die," as it was considered less intrusive. Moreover, our sample of patients was somewhat heterogeneous given that, although all of them had a history of suicidal thoughts and behavior, some had a history of SI with no SA, while SAs had different dating at recruitment. Another limitation is that the electronic health records from which we extracted our diagnoses allow for only one box for main diagnosis. Therefore, patients were only grouped into a diagnostic category. Finally, given that wish to die and wish to live are highly subjective measurements, a risk of classification bias exists.

CONCLUSIONS

Our study confirms some of the risk factors classically associated with risk of suicidal reattempt while contradicting others. The risk factors associated with EMA events differed from those associated with clinical suicide events. This finding supports the thesis of authors who advocate making nuanced distinctions between different suicidal phenotypes.

EMA events were significantly associated with clinical events at 2-month follow-up but not at 6-month follow-up, a difference that may be associated with the decrease in retention. Future lines of research include implementing strategies to increase retention, increasing the accuracy of risk detection using machine learning techniques, optimizing the formulation of EMA questions, and combining EMA with EMI.

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