

The association between suicidal ideation and negative affect: A 6-month ecological momentary assessment study

Alejandro Porras-Segovia, Ana Pérez-Balaguer, Adrián Alacreu-Crespo, Maria Luisa Barrigón, Paula García-Barja, Philippe Courtet, Jorge López-Castroman, Inmaculada Peñuelas-Calvo, Enrique Baca-García

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Abstract

Background: Suicide is a major public health challenge. Ecological Momentary Assessment (EMA) can improve suicide risk assessment, but EMA burden often results in short follow-up periods.

Objective: In this study, we explore the association between suicidal ideation and multiple variables collected in real time using smartphone-based EMA for 6 months.

Methods: This is a prospective EMA-based study carried out among outpatients at high risk of suicide, attended at Madrid (Spain). At baseline, depression, suicidality and psychological and physical pain were explored using traditional questionnaires. During the 6-month follow-up, patients answered daily EMA questions covering suicidal ideation, non-suicidal self-injuries, negative affect, interpersonal experiences, sleep, and eating habits in their smartphones. We explored the association between baseline variables and EMA variables, as well as the association between different EMA variables.

Results: : N=99 participants were included in the final analysis, and 13,900 EMA answers were obtained. The slope of suicidal ideation showed no significant changes over the follow-up. Similar results were obtained for negative affect, interpersonal difficulties, sleep problems, and appetite. The variables statistically significantly associated with suicidal ideation were negative affect (b (SE)=0.193 (0.03), t=6.21, p<0.001) and interpersonal difficulties (b (SE) =0.168 (0.03), t=5.96, p=0.001).

Conclusions: This study provides novel insights into the real-time relationship between suicidal ideation and several psychological and behavioural variables using EMA in a high-risk clinical population. Future studies should aim to translate EMA-based monitoring into actionable interventions to provide real-time support for individuals at high risk of suicide.

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Original Manuscript

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Abstract

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Conclusions: This study provides novel insights into the real-time relationship between suicidal ideation and several psychological and behavioural variables using EMA in a high-risk clinical population. Future studies should aim to translate EMA-based monitoring into actionable interventions to provide real-time support for individuals at high risk of suicide.

Keywords: suicide ideation, suicide attempt, Ecological Momentary Assessment, eHealth, mHealth, new technologies, mobile health, psychological pain.

Introduction

Suicide is a significant global public health concern, accounting for over 700,000 deaths worldwide each year [1]. Years of potential life lost (YPLL) due to suicide have declined by less than those associated with other external causes, and have even increased in some regions [2]. For example, in 2020 suicide accounted for almost as many YPLL as the novel coronavirus (SARS-CoV-2) in the United States [3], and even surpassed it in Spain [4]. Nevertheless, suicide continues to receive far less public health attention than physical illnesses.

Traditionally, suicidal thoughts and behaviours (STBs) have been assessed through clinical interviews and self-report questionnaires. However, these methods face notable limitations, including limited predictive accuracy, insufficient consideration of contextual influences and susceptibility to recall bias [5]. Furthermore, much of the research has emphasised long-term rather than immediate (proximal) risk factors for STB [6].

Ecological Momentary Assessment (EMA) has emerged as a promising tool to address some of these limitations. EMA involves repeatedly assessing participants in real time, typically through daily prompts delivered in their natural environments [7]. While EMA was originally administered via paper diaries, it is now predominantly conducted through smartphones [8]. This approach reduces recall bias, enables tracking of dynamic changes over time and captures subtle variations that traditional methods often overlook [9].

Systematic reviews have highlighted the potential of EMA for real-time monitoring of STB [8, 10]. Studies have demonstrated the feasibility and acceptability of EMA across various populations [11, 12] and its potential for examining psychological mechanisms. For example, Herzog et al. identified a correlation between suicidal ideation (SI) and deficits in attentional control [13]. Other studies suggest that previous SI and shifts in emotional or cognitive states may predict SI the following day [14]. Furthermore, individuals who report SI demonstrate higher levels of perceived burdensomeness and a lower sense of belonging [15], while feelings of entrapment appear to be associated with short-term SI in both directions [16]. However, challenges remain, particularly with regard to the burden of EMA, which refers to participant fatigue due to frequent prompts. This can reduce adherence and limit the duration of data collection to just a few weeks [8, 17].

In recent years, our research group has sought to mitigate some of these limitations through the SmartCrisis 1.0 project [18]. By implementing a rotating system of questions to reduce repetition, we achieved a higher level of feasibility than in previous EMA studies conducted in real-world clinical settings, even in the absence of financial incentives [19, 20].

However, SmartCrisis 1.0 had some significant limitations. For example, it focused solely on passive suicide ideation (SI), which restricted the scope and applicability of its findings. To address this issue, we developed SmartCrisis 2.0 — an enhanced version that incorporates

active suicide intervention (SI) measures and integrates a safety plan for managing suicide risk. Initial results suggest high user satisfaction, as evidenced by strong ratings in user surveys. The current study aims to investigate the association between suicidal behaviour (STB) and various variables measured in real time via smartphone-based ecological momentary assessment (EMA), with the goal of identifying short-term predictors of suicide risk in a clinical population. A secondary aim is to examine how baseline levels of depression and psychological distress influence variability in EMA-reported suicidal ideation (SI).

Methods

Setting and Design

This prospective study used Ecological Momentary Assessment (EMA) and focused on psychiatric outpatients who were identified as being at high risk of suicide. Participants were recruited from four hospitals in the Community of Madrid (Spain). The study adhered to the ethical principles set out in the Declaration of Helsinki and was approved by the Research Ethics Committee of Fundación Jiménez Díaz. Written informed consent was obtained from all participants. Full details of the SmartCrisis 2.0 randomised controlled trial (RCT) protocol are available in a separate publication [7].

Data Protection

To ensure confidentiality, the usernames and personal information of participants were pseudonymised using coded identifiers. All data was encrypted using AES-256 with 256-bit keys and was managed within a professional key management system which underwent external security compliance audits.

Sample

The study sample comprised psychiatric outpatients who had recently experienced suicidal thoughts or behaviours.

Inclusion Criteria:

1. Age 18 years or older.
2. A suicide attempt or emergency intervention for suicidal ideation within the previous month.
3. Capacity to understand the study and provide informed consent.
4. Fluency in Spanish.
5. Access to a personal smartphone with internet connectivity.

Exclusion Criteria:

1. Refusal to install the mobile application.
2. Inability to understand or sign the informed consent.
3. No regular access to a compatible smartphone.

For the final analysis, only those participants who responded to at least three EMA prompts related to STB were included.

Measures and Procedure

Psychiatrists conducting routine clinical care were responsible for recruitment. They evaluated patients for eligibility, explained the study objectives and invited those who met the criteria to participate. Those who agreed were asked to sign a written informed consent form. No financial incentives were provided for participation.

Clinical (Face-to-Face) Measures:

A trained psychologist conducted a baseline clinical interview, during which demographic and clinical data were collected. Standardized instruments were used to assess the following dimensions:

- Depression: Inventory of Depressive Symptomatology – Clinician-Rated (IDS-C) (22).
- Suicidal thoughts and behaviors: Columbia Suicide Severity Rating Scale (CSSRS) (23).
- Psychological and physical pain: Visual Analog Scales (VAS) [24].

Additional demographic details, including date of birth and gender identity, were obtained from electronic health records.

EMA Measures:

During the baseline interview, the MEmind mobile app was installed on participants' smartphones. This app delivers brief, daily surveys directly to the device. Each day, between 9:00 AM and 9:00 PM, a prompt containing 2 to 4 randomly selected questions (4 in the first two months, and 2 thereafter) was presented. These questions were drawn from a pool of 34 items, based on validated instruments including:

- Salzburg Suicide Process Questionnaire [25]
- Patient Health Questionnaire-9 (PHQ-9) [26]

- Positive and Negative Affect Schedule (PANAS) [27]
- Interpersonal Needs Questionnaire [28]
- Prior EMA research on suicidality

The EMA questions were grouped into the following categories:

- Suicidal Ideation (SI): 5 items
- Non-suicidal Self-Injury (NSSI): 2 items
- Negative Affect: 9 items
- Interpersonal Experiences: 11 items
- Sleep: 4 items
- Eating Habits: 3 items

[Table 1 approximately here]

This random and varied delivery of items was specifically designed to minimise the burden typically associated with EMA, which often leads to participant fatigue and high dropout rates. While this approach reduces redundancy, it requires questions to be grouped into broader categories for statistical analysis. Items that were positively worded (e.g. 'I feel full of hope') were reverse-coded to align with their category.

Participants were observed over a six-month period.

Statistical Analysis

All statistical analyses were performed using the R software package. The intra-individual mean and variability of responses were calculated for each participant. Variability was assessed using the root mean squared of successive differences (RMSSD).

Mixed-effects models were employed to evaluate within-person variability and temporal trends. Time was entered as a fixed effect, participants as random effects and each EMA category (e.g. negative affect or sleep) as a dependent variable. Intraclass correlation coefficients (ICCs) were derived from these models to quantify within-person variability.

Mixed-effects models were also used to examine the effect of EMA categories (e.g. negative affect, interpersonal difficulties, sleep and eating behaviour) on suicidal ideation over time. Each model included fixed effects for the EMA category, time, and their interaction. Random intercepts were specified for participants, with random slopes for time. An additional model was run that included all significant EMA categories together.

Multiple linear regression analyses were conducted to assess the association between EMA variables and demographic covariates (age and gender). Further regressions examined whether baseline levels of depression and psychological distress predicted the mean and variability of

suicidal ideation (SI) and negative affect throughout the EMA follow-up period. Where appropriate, post hoc simple slope analyses were performed.

All tests were two-tailed and significance was set at $p < 0.05$, with 95% confidence intervals.

Results

Characteristics of the sample

A total of 115 participants were recruited. From the initial sample, $n=99$ had sufficient data (at least 3 EMA answers) and were included in the final analysis. Mean age was 39.5 ± 0.05 years (43.4 ± 2.24 for men and 37.1 ± 1.74 for women), and there was a majority of females (62.6% females vs. 37.4% males)

Description of EMA variables

A total of 13,900 EMA answers were obtained. Of them, 5,638 belonged to the suicidal ideation category. The slope of SI over time was not statistically significant (b (SE) = -0.006 (0.014), $p < 0.679$), showing no significant changes over follow-up. Similar results were obtained for the slopes of negative affect (b (SE) = -0.019 (0.017), $p = 0.243$), interpersonal difficulties (b (SE) = -0.027 (0.019), $p = 0.151$), sleep problems (b (SE) = 0.007 (0.011), $p = 0.518$), and appetite (b (SE) = 0.001 (0.018), $p = 0.985$).

We found a high within-person variance for all variables, with an ICC of 0.17 for SI, ICC=0.24 for negative affect, ICC=0.26 for interpersonal difficulties, ICC=0.29 for sleep problems, and ICC=0.45 for appetite.

Figure 1 shows the evolution of the EMA answers over time.

[Figure 1 approximately here]

Association between EMA variables and SI

The variables statistically significantly associated with SI were negative affect (b (SE) = 0.193 (0.03), $t = 6.21$, $p < 0.001$) and interpersonal difficulties (b (SE) = 0.168 (0.03), $t = 5.96$, $p = 0.001$).

The association was positive: the greater the negative affect and the interpersonal difficulties, the greater the SI. When negative affect and interpersonal difficulties were put together in the same model, both predictors maintained their significance ($p < 0.001$).

The effect of time and the interactions negative affect*time and interpersonal difficulties*time were not statistically significant ($p > 0.050$). There were also no statistically significant effects on appetite and sleep models ($p > 0.050$).

Greater intra-individual means of negative affect ($R^2 = 0.39$, b (SE) = 0.502 (0.08), $t = 6.65$, $p < 0.001$) and interpersonal difficulties ($R^2 = 0.182$, b (SE) = 0.359 (0.07), $t = 5.03$, $p < 0.001$) were associated with greater intra-individual mean of SI. No significant differences were found for sleep problems and appetite. None of the intra-individual variability indexes were associated

with the intra-individual mean of SI.

Intra-individual variability of SI was directly associated with intra-individual variability in the rest of the EMA variables: the greater the SI variability, the greater the variability of negative affect ($R^2=0.15$, $b(SE)=0.477(0.12)$, $t=4.04$, $p=0.001$), interpersonal difficulties ($R^2=0.15$, $b(SE)=0.323(0.07)$, $t=4.49$, $p=0.001$), sleep problems ($R^2=0.12$, $b(SE)=0.259(0.09)$, $t=2.96$, $p=0.004$) and eating habits ($R^2=0.23$, $b(SE)=0.318(0.09)$, $t=3.54$, $p<0.001$).

Baseline psychological pain as a predictor of intra-individual mean and variability

A sub-sample of $N=37$ (48.6 % females, mean age = 40.6 ± 2.41 years) participants had information about baseline psychological pain and depression. The mean baseline IDS-C score of the participants was 26.2 ± 1.59 . Their current and maximum psychological pain at inclusion was 6.76 ± 0.48 and 7.36 ± 0.59 , respectively. Participants answered EMA questions for a mean of 146 ± 21.2 days.

There was a negative association between baseline maximum psychological pain and variability of negative affect ($R^2=0.12$, $b(SE)=-1.40(0.65)$, $t=-2.16$, $p=0.040$). Thus, the greater the psychological pain, the lower the variability. The interaction psychological pain*days of follow up significantly predicted intra-individual negative affect mean ($R^2=0.24$, $b(SE)=0.019(0.007)$, $t=2.58$, $p=0.017$). Simple slopes showed significant results for the -1SD psychological pain ($b(SE)=-0.08(0.037)$, $p=0.031$) but not for the +1SD of psychological pain ($b(SE)=0.04(0.039)$, $p=0.189$); showing patients with lower psychological pain and longer follow up experiment less negative affect (see Figure 2).

[Figure 2 approximately here]

The interaction psychological pain*days of follow up predicted the intra-individual mean of SI ($R^2=0.34$, $b(SE)=0.024(0.001)$, $t=3.95$, $p<0.001$). Simple slopes showed significant results for the -1SD psychological pain ($b(SE)=-0.12(0.030)$, $p<0.001$) but not for the +1SD of psychological pain ($b(SE)=0.04(0.023)$, $p=0.101$), showing that patients with lower psychological pain and longer follow up experiment less SI (see Figure 3).

[Figure 3 approximately here]

Regarding depression, the interaction depression*days of follow up predicted the intra-individual mean of negative affect ($R^2=0.17$, $b(SE)=0.006(0.003)$, $t=2.35$, $p=0.026$). Simple slopes showed as a significant trend results for the +1SD of psychological pain ($b(SE)=0.06(0.03)$, $p=0.055$) but not significant results for the -1SD psychological pain ($b(SE)=-0.06(0.04)$, $p=0.182$). Thus, patients with higher depression and longer follow up experience greater negative affect (see Figure 4).

[Figure 4 approximately here]

Results for the rest of depression models did not show statistically significant results.

Discussion

Summary of Results

This study examined suicidal ideation (SI) and its associations with other psychological and behavioural variables in a sample of almost 100 high-risk outpatients who were monitored for six months. Trajectories (slopes) of SI, negative affect, interpersonal difficulties, sleep disturbances and appetite issues did not demonstrate significant change over time. However, SI was significantly associated with negative affect and interpersonal difficulties. Additionally, substantial within-person variability in SI was observed. Notably, individuals who reported higher levels of psychological distress at the beginning of the study exhibited increased levels of negative affect and suicidal ideation throughout the follow-up period.

Fluctuations in EMA Variables Over Time

Considerable within-person variability was observed for all EMA-tracked variables. Relatively low intraclass correlation coefficients (ICCs) suggest that these constructs reflect dynamic, state-like fluctuations rather than stable traits [29]. The pronounced variability in SI and its related factors emphasises the fluctuating nature of suicide risk. Bernanke et al [30] have proposed two subtypes of SI: one that is reactive to stress and tends to spike following acute stressors, and another that is more chronic and associated with persistent depressive states. This distinction may partly account for the variability observed in our data, as individual emotional responses are likely shaped by personal experiences.

Consistent with this, Bonilla-Escribano et al [31] conducted an EMA study involving 275 psychiatric outpatients and almost 50,000 responses. Their findings indicated that high SI variability was associated with greater instability in social withdrawal, sleep, and perceived social support.

The dynamic interplay between negative affect, interpersonal difficulties and SI, as observed in our study, supports the need for personalised, real-time monitoring strategies [10]. This reinforces recent critiques of traditional clinical assessments, which often fail to capture moment-to-moment fluctuations in suicide risk [6]. Our results emphasise the value of EMA in capturing these rapid shifts, which standard tools may overlook.

Associations Between EMA-Measured Variables

One of the key findings was the significant association between suicidal ideation (SI) and negative affect and interpersonal difficulties, as measured via ecological momentary assessment (EMA). These results are consistent with prior research identifying these variables as critical components in the development of suicidal thoughts. In particular, our findings align with existing literature linking SI to interpersonal distress, including feelings of loneliness and of

being a burden to others [32,33]. Similarly, Bentley et al [34] identified emotions such as anxiety, shame and self-hatred as predictors of subsequent SI using EMA. These results echo the core tenets of the Interpersonal Theory of Suicide, which posits that a lack of belonging and the perception of being a burden are fundamental drivers of SI [35].

However, sleep and appetite disturbances were not significantly associated with increased SI in this sample. This diverges from earlier studies conducted by our group [36] which focused specifically on passive SI. Differences in sample size and the more pronounced role of negative affect may explain these inconsistencies.

We also found that greater variability in negative affect, interpersonal experiences, sleep and appetite within individuals corresponded with greater variability in SI. Whether such fluctuation in SI translates into an increased risk of suicide attempts remains an open question. However, evidence from studies such as that of Oquendo et al [37], which followed 51 patients with depression for two years, suggests that higher SI variability may increase reactivity to stressors and elevate the risk of impulsive suicidal behaviour.

Baseline Clinical Predictors of EMA-Measured Variables

Baseline psychological pain was found to have a significant influence on suicidal ideation (SI) throughout the EMA follow-up. The relationship between psychological distress and suicidal thoughts can be explained by several theoretical models. For example, Shneidman identified unbearable psychological pain as a key factor in suicidal behaviour, while Baumeister proposed that suicide may be an attempt to escape distress caused by perceived failure or unmet expectations. More recently, Klonsky and May's three-step theory emphasised the role of psychological pain and hopelessness in the development of suicidal ideation (SI) [40].

Regarding depression, we found that baseline severity was associated with increased negative affect over time. However, no significant association was found between depression and SI. Since negative affect includes components such as hopelessness, anxiety, sadness, anger and restlessness — many of which overlap with depressive symptomatology — this association is expected. Nevertheless, our findings suggest that SI is a more multifaceted construct that is not exclusively linked to depressive disorders. This highlights the importance of considering other psychiatric conditions, particularly those characterised by emotional dysregulation, when assessing suicide risk.

Future Research Directions

Future studies should explore integrating EMA into routine clinical practice. One promising approach is the use of ecological momentary interventions (EMIs), which can deliver personalised, context-aware feedback based on momentary risk profiles. Furthermore, research should aim to identify patient subgroups who may benefit from specific therapeutic strategies.

For instance, individuals with heightened emotional variability may respond better to interventions based on emotion regulation, while those facing ongoing interpersonal difficulties could benefit from targeted social support programmes [17].

Conclusions

This study is one of the few to use smartphone-based ecological momentary assessment (EMA) to monitor self-injury (SI) over an extended period [13]. EMA is a useful method for capturing short-term suicide risk factors. It is particularly important to consider negative emotions and interpersonal issues in suicide prevention. The high within-person variability observed in SI and its correlates emphasises the dynamic and fluctuating nature of suicide risk. Moving forward, integrating EMA-based monitoring into clinical care could facilitate real-time, personalised interventions aimed at mitigating suicide risk in vulnerable populations

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Conflicts of interest: EBG has been a consultant to or has received honoraria or grants from Janssen Cilag, Lundbeck, Otsuka, Pziffer, Servier and Sanofi. EBG designed the MEmind application. The other authors confirm they have no conflict of interest.

Data availability statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Authors' contributions: APS: Conceptualization and Writing of the Original Draft; APB: Writing of the Original Draft; AAC: Methodology, Formal analysis, Resources, Data Curation; MLB: Methodology, Resources and Writing (Review & Editing); PGB: Writing of the Original Draft; PC: Writing (Review & Editing) and Supervision; JLC: Writing (Review & Editing) and Supervision; IPC: Writing (Review & Editing) and Supervision

EBG: Writing (Review & Editing) and Supervision.

Ethics approval statement: The study adhered to the ethical principles set out in the Declaration of Helsinki and was approved by the Research Ethics Committee of Fundación

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Patient consent statement: Written informed consent was obtained from all participants

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Figure caption

Figure 1 Fluctuation of EMA variables over time

A: Suicidal Ideation. **B:** Negative Affect. **C:** Interpersonal Relationship. **D:** Sleep. **E:** Eating habits

Figure 2 Association between baseline psychological pain and EMA-measured negative affect

Figure 3 Association between baseline depression and EMA-measured negative affect

Figure 4 Association between baseline psychological pain and EMA-measured Suicidal Ideation

Tables

Table 1. Ecological Momentary Assessment (EMA) questionnaire

Area	Variable	Question	Minimum value	Maximum value	Scoring	Source
Suicidal Ideation (5 questions)	Passive SI	My wish to live is	No wish to die	Maximum wish to die	1-7	SSPQ [36]
		My wish to live is	No wish to live	Maximum wish to live	1-7	
	Active SI	Do you have thoughts that you would be better off dead or of hurting yourself in some way?	Not at all	Nearly every day	0-3	PHQ-9 [37]
		How intense is your desire to kill yourself right now?	Absent/no desire	Extremely intense	0-5	Based on prior EMA studies [15,20]
		How able are you to keep yourself safe right now?	I definitely can keep myself safe	I definitely cannot keep myself safe	1-5	
Non-suicidal self-injury (2 questions)	Non-suicidal self-injury	At any point in the last 24 hours, did you harm yourself on purpose without the intention to die?	Yes	No	Y/N	Based on prior EMA studies [17]
		Since the last prompt, have you felt an urge or wanted to harm or injure yourself on purpose, without wanting to die?	Not at all	Extremely	1-5	Based on prior EMA studies [21]
Affect (9 questions)	Psychological pain	I feel psychological pain	No pain	Maximum pain	1-7	SSPQ [36]
	Stress	I feel stressed out today (with pressure, overwhelmed)	No stress	Maximum stress	1-7	
	Restlessness	I feel restless (agitated), with the need to keep moving	No restlessness	Maximum restlessness	1-7	
	Hopelessness	I feel full of hope	No hope	Maximum hope	1-7	
	Anger towards self	I feel hatred or anger towards myself	No hatred	Maximum hatred	1-7	
	Anger towards others	I feel hatred or anger towards others	No hatred	Maximum hatred	1-7	PANA [38]
	Anxiety	At this moment I feel nervous	Very slightly or not at all	Extremely	1-5	
	Depression	At this moment I feel sad	Very slightly or not at all	Extremely	1-5	
	Happiness	At this moment I feel happy	Very slightly or not at all	Extremely	1-5	
Interpersonal experiences (11 questions)	Thwarted belongingness	I wish there was a trusted person with whom I can talk about all my personal issues	Not at all	Absolutely	1-7	SSPQ [36]
	Thwarted belongingness	I feel like an outsider	Not at all	Absolutely	1-7	
	Lack of recognition	I wish I received more recognition and love from others	Not at all	Absolutely	1-7	
	Lack of independence	I have the impression that important people around me want to decide for me what I should think and do	Not at all	Absolutely	1-7	
	Criticism	Since the last prompt have you felt insulted or criticized?	Not at all	Extremely	1-5	Based on prior EMA studies [21]
	Thwarted belongingness	Since the last prompt have you felt rejected, abandoned, excluded, or left out?	Not at all	Extremely	1-5	
	Perceived burdensomeness	I believe I'm contributing to the well-being of my family/friends	Not at all	Absolutely	1-7	SSPQ [36]
	Perceived burdensomeness	I believe I'm contributing to the well-being of the people around me	Not at all	Absolutely	1-7	
	Thwarted belongingness	I feel disconnected from other people	Not at all	Absolutely	1-7	INQ [39]
	Perceived burdensomeness	I feel like a burden to others	Not at all true for me	Very true for me	1-7	
	Perceived burdensomeness	I feel useless	Not at all true for me	Very true for me	1-7	
Sleep (4 questions)	Sleep maintenance	Last night I had trouble staying asleep	None	Very severe	0-4	SSPQ [36]
	Sleep-derived quality of life	Others think that sleep problems affect my quality of life	Not at all	Absolutely	1-7	
	Sleep dissatisfaction	Today I am satisfied with my sleep	Very unsatisfied	Very satisfied	1-7	

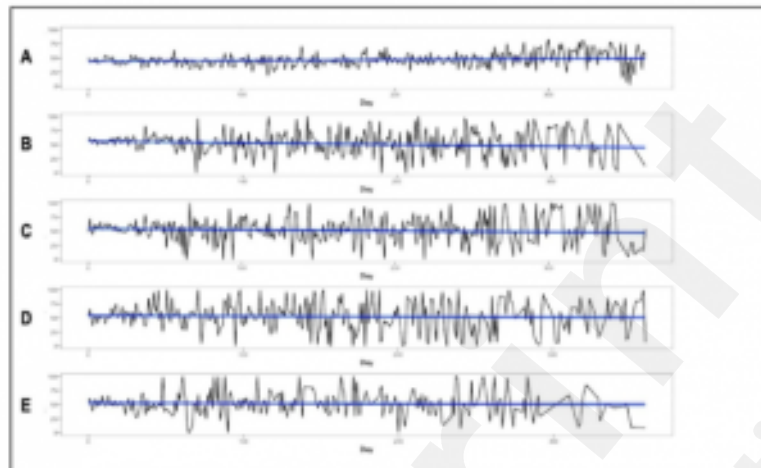
	Sleep-derived interference with daily activity	My sleep problems are interfering with my daily activity	Not at all	Very much	0-4	
Eating (3 questions)	Appetite	In the last few days, I have been hungry...	Never	All the time	0-4	SSPQ [36]
	Taste	In the last days when I eat, the food tastes...	Very bad	Very good	0-4	
	Number of meals	In the last few days, I usually do...	Less than one meal a day	More than three meals a day	0-4	

INQ=Interpersonal Needs Questionnaire; PANA= Positive and Negative Affect Schedule; PHQ-9=Patient Health Questionnaire-9; SI=Suicidal Ideation; SSPQ=Salzburg Suicide Process Questionnaire

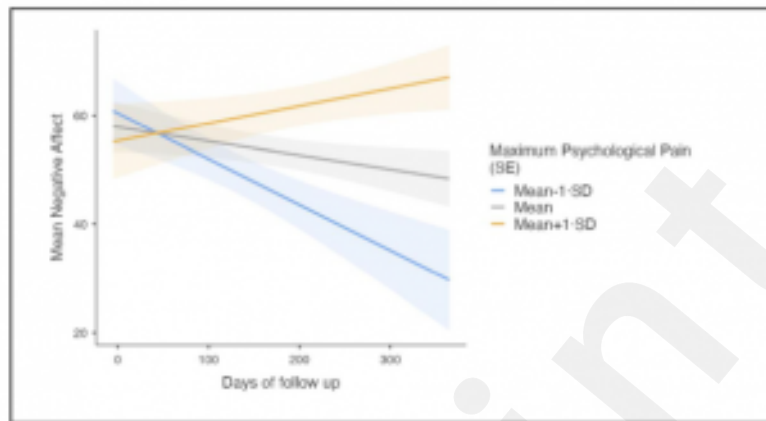
Supplementary Files

Figures

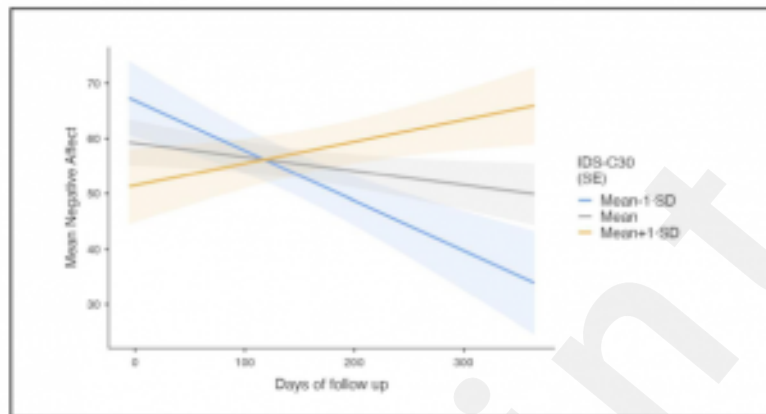
Fluctuation of EMA variables over time. A: Suicidal Ideation. B: Negative Affect. C: Interpersonal Relationship. D: Sleep. E: Eating habits.



Association between baseline psychological pain and EMA-measured negative affect.



Association between baseline depression and EMA-measured negative affect.



Association between baseline psychological pain and EMA-measured Suicidal Ideation.

