Ecologically assessed affect and suicidal ideation following psychiatric inpatient hospitalization

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Introduction

Suicide is an increasingly serious public health concern in the United States (U.S.). In just over a decade (2005 - 2016), the U.S. suicide rate has increased from 10.9 to 13.42 per 100,000 (American Foundation for Suicide Prevention, 2017). Suicide ranges from the 2nd to 5th leading cause of death among people between the ages of 18 – 54 (Centers for Disease Control, 2010). Each year, suicidal ideation (SI), suicidal behavior (SB), and suicide attempts (SA) account for approximately 500,000 hospital and emergency room admissions (Pitts, Niska, Xu, & Burt, 2006; Rui & Kang, 2014), representing a significant proportion of the workload in emergency, intensive care, and psychiatric units (Kessel, 1985; Owens et al., 2017; Thibault et al., 1980; Ting, et al., 2012). Further, self-inflicted injuries resulting in suicide account for between \$30 – 69 billion in medical expenses and lost productivity per year (Corso, Mercy, Simon, Finkelstein, & Miller, 2007; AFSP, 2017).

Of particular concern for emergency departments and psychiatric hospitals alike is the elevated risk of suicide following discharge from treatment. Emergency department visits for suicide and deliberate self-harm are common, with many patients (31%) requiring intensive and expensive medical care (Doshi, Boudreaux, Wang, Pelletier, & Camargo, 2005). The suicide rate for patients in the first four weeks following inpatient psychiatric care can be as much as 3 (for women) to 7.1 (for men) times greater than the rate for the other 48 weeks of the year (Goldacre, Seagroatt, & Hawton, 1993), with as many as 55% of completed suicides occurring in the first week and 49% occurring before a patient's first follow-up appointment (Bickley et al., 2013). In one sample (Gairin, House, & Owens, 2003), 39% of patients who later died by suicide had contact with an emergency department in the year prior to death, with most visits occurring shortly before the suicide (median = 38 days). Suicide risk is

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particularly elevated for those who have contact with health care services in the week prior to their deaths (Odds Ratio = 4.0; Yim et al., 2004). Clearly, there is a need to better understand the post-discharge period for these high-risk patients, and to identify treatment modifiable risk factors to reduce the prevalence of SI and SB.

Studies have identified many distal/cross sectional predictors (e.g. age, gender, psychiatric diagnosis, social support deficits) of SI and SB (Moscicki, 1997; Petronis, Samuels, Moscicki, & Anthony, 1990). In hospital settings, long-established predictors include past mental health contacts and history of psychiatric hospitalization, substance use and abuse, as well as recent hospital discharge and loss of contact with service providers (Appleby et al., 1999). Recently, one meta-analysis of suicide research found that our ability predict suicide is only slightly better than chance, and has not improved over the past half century (Franklin et al., 2017). Indeed, this same study reported that even when research yields statistically significant predictors, the size of these effects are modest, generally finding odds ratios of 1.5 or less. In addition, these predictors are of general rather than specific risk, identifying individuals who might someday engage in SB, but unable to predict *when* that risk will manifest. Despite the wealth of cross-sectional research elucidating dispositional and cross-sectional predictors of suicide, little is understood about the phenomenology of SI and SB as it is experienced by patients in the real world. Indeed, one possible reason that existing models of prediction are so limited is due to the temporal separation of traditional predictors (i.e. self-report, epidemiological, and chart data) and SBs.

Emotion reactivity, defined as the “extent to which an individual experiences emotions: 1) in response to a wide array of stimuli (i.e., emotion sensitivity), 2) strongly or intensely (i.e., emotion intensity), and 3) for a prolonged period of time before returning to baseline level of arousal (i.e., emotion persistence)” has been proposed as a key risk factor for SI and SB (Nock, Wedig, Holmberg, & Hooley, 2008, p. 107). Individuals with a past-year history of SI and/or SAs self-report significantly higher emotion reactivity than those with no such history (Nock et al., 2008), and negative affect intensity and reactivity predicts SI in older adults (Lynch, Cheavens, Morse, & Rosenthal, 2004). Emotion reactivity also mediates the relationship between psychopathology and SI (Nock et al., 2008) and SAs (Kleiman, Ammerman, Look, Berman, & McCloskey, 2014). Increased behavioral reactivity to emotions predicts greater odds of a past-month suicide attempt (Auerbach, Stewart, & Johnson, 2016) and affective intensity mediates the relationship between abuse and SAs (Gordon et al., 2015).

Beyond general emotion reactivity, anger is one specific emotion that seems to confer risk for suicide. Yet, while the link between self-reported anger and suicide is well known, the precise manner in which anger confers suicide risk is unclear. Across diagnostic groups and research methodologies, anger-related (Baud, 2005; Hawkins & Cougle, 2013; Hawkins et al., 2014; Horesh et al., 1997; Kotler et al., 1993), and aggressive-impulsive (Angst & Clayton, 1986; Dumais et al., 2005; Gvion & Apter, 2011) traits predict suicide, and anger and impulsivity may combine synergistically to increase suicide risk (Horesh et al., 1997). Anger also differentiates between individuals with a history of single and multiple SAs (Esposito, Spirito, Boergers, & Donaldson, 2003). Among female inmates assessed using retrospective interview, increased anger was described to precipitate SAs (Chapman &

Dixon-Gordon, 2007). Historically, the link between anger and SB was understood as a manifestation of inwardly directed angry impulses; however, research also suggests that both inward and outward-directed anger are associated with SB (Conner, 2003; Dumais et al., 2005; Jameson K. Hirsch, 2012; Painuly, Sharan, & Mattoo, 2007). Problems of anger experience and expression have independent additive effects in conferring risk for SI (Hawkins & Cougle, 2013) beyond other predictors. Among individuals reporting lifetime SI, difficulty with anger expression predicted the presence of a suicide plan, and anger expression and anger experience predicted the progression from SI to SA (Baumeister, 1990). Explosive acts of anger may also reflect the tendency for people to act impulsively when they are dysregulated (Hawkins & Cougle, 2013).

Unfortunately, the vast majority of studies examining emotion reactivity in general and anger reactivity specifically—and all of those reviewed above—have relied on retrospective self-report methodologies, which are prone to social desirability effects and a wide range of cognitive biases (Shiffman, Stone, & Hufford, 2008). Recall of prior events is heavily influenced by systematic bias, wherein individuals generally remember salient experiences, rather than specific events (Bradburn, Rips, & Shevell, 1987). Indeed, prior studies have found that self-reports are heavily influenced by salient experiences, such as peak levels of pain during a medical procedure (Redelmeier, Katz, & Kahneman, 2003), rather than the experience of pain averaged across time. Likewise, individuals are prone to restructure or to reorganize memories to fit a consistent story or script describing how they view themselves or the world, rather than how events actually transpired (Ross, 1989). Given these well documented limitations of retrospective self-report, it's clear that research methodologies better examining the phenomenology of emotion and emotion reactivity in patients at high risk for suicide is merited.

The use of Ecological Momentary Assessment (EMA) methodology permits a better understanding of participants' phenomenological world, in the present moment, while minimizing many of the limitations of traditional, retrospective, self-report. EMA is most effectively employed to identify and to describe the interplay of situational or contextual factors on participants' affect, behavior, and cognition (Bolger, Davis, & Rafaeli, 2003). It has been used to explore a wide variety of processes, such as personality (Rhodewalt, Madrian, & Cheney, 1998), marital interactions (Almeida & Kessler, 1998), medical symptoms (Suls, Wan, & Blanchard, 1994), and physical and mental health concerns (Alloy, Just, & Panzarella, 1997). EMA is also minimally reactive (Hufford, Shields, Shiffman, Paty, & Balabanis, 2002; Shiffman, 2009), meaning that participants tend not to change their responses due to repeatedly completing questionnaires, reducing the impact of social desirability and recall bias on participant responses. For constructs such as suicide, longitudinal or daily assessments may be insufficiently frequent to capture crucial variability in affect, behavior, and cognition relevant to testing study hypotheses. For example, as demonstrated in a recent study, SI measured using EMA often showed great variability from assessment to assessment (Kleiman et al., 2017). Compounding this issue, research consistently shows that people are unreliable informants when asked to retrospectively recall past behavior (Kendall, Butcher, & Holmbeck, 1999; Stone & Shiffman, 1994, 2002), which is likely exacerbated when asked to retrospectively recall and label an experience with great variability. Under such circumstances, we might expect individuals to focus on one or more

particularly salient experiences or to rely on personal biases, beliefs, or self-narratives to describe how they feel, behave, and think.

Prior EMA research in non-suicidal self-injury (NSSI), a behavior hypothesized to confer risk for SB (Franklin et al., 2017; Hamza, Stewart, & Willoughby, 2012), has shown that emotion reactivity predicts episodes of NSSI; however, the causal mechanism, or shared vulnerability, is unclear. Studies have demonstrated clear emotional precipitants (e.g. increased negative affect and anger) to increases in SI and self-harm behavior (Armey, 2012; Armey, Crowther, & Miller, 2011; Armey, Nugent, & Crowther, 2012; Armey, Schatten, Haradhvala, & Miller, 2015; Nock, Prinstein, & Sterba, 2009), with some indication that the inclusion of EMA methods incrementally improves our ability to predict episodes of self-harm above and beyond distal, retrospective, self-reports (Armey, 2012). In addition, this research suggests that changes in negative affect were detectable hours before the event, which has obvious implications for early intervention. Applying and extending these methods to the study of suicide risk among individuals recently discharged from inpatient hospitalization may further our knowledge of the link between emotional experiences and suicide, providing vital information for future intervention as well as shedding light on patients' experiences during the high-risk post-hospitalization period.

Present study

The present investigation sought to explore the phenomenology of ecologically experienced daily emotion and SI and was conducted as part of a large-scale, longitudinal study of emotion reactivity in psychiatric patients at high risk for suicide who completed an intensive inpatient baseline assessment followed by three weeks of EMA post-hospital discharge as well as follow-up assessments after the EMA and at six-months post hospitalization. In the present study, we hypothesized that SI would be tightly coupled to the experience of negative and angry emotions and that this risk would increase over time following hospital discharge. We expected that this same coupling would not be present for positive affect, and any relationship between the two would be protective. Additionally, the interrelation of positive and negative affect is critically important, as the relative contributions of negative affect (as a predictor of suicide risk) and positive affect (as a buffer against suicide risk) operate in opposition to one another. Here, we examined this relationship using a ratio of negative to positive affect.

In an effort to further the science of ecological assessment, analyses were conducted using time varying effects models (TVEM; Shiyko, Lanza, Tan, Li, & Shiffman, 2012; Tan, Shiyko, Li, Li, & Dierker, 2012), which are an extension of linear regression in which coefficients are allowed to vary as a function of time. TVEM is an ideal analytic method for EMA data, given its ability to flexibly handle missing data as well as large datasets with unevenly spaced assessments, as is common in EMA protocols employing random assessment schedules. Using this approach, the strength of a coupled relationship between two variables can be modeled over time to determine whether the relationship is stationary (e.g., constant over time) – a critical assumption of many longitudinal statistics. Furthermore, this methodology does not assume a single functional form of the longitudinal trajectory and flexibly handles unevenly spaced assessments, as is also characteristic of

EMA data. As such, this approach can help to identify especially relevant periods of time where the coupling of protective and/or risk factors to SI are strongest or weakest. Here, we employed TVEM to examine the coupling of several ecologically experienced affects (positive, negative, the ratio of negative to positive, and anger/irritability) to SI.

Method

Participants

Participants were recruited from the psychiatric inpatient units of a New England psychiatric hospital and the data reported here are a subsample of a larger study ($N = 439$). Although all 439 participants were invited to complete the EMA, many found it difficult to do so in the chaotic transition back to their lives following psychiatric hospitalization. The current sample ($n = 151$) of individuals represents all individuals who completed any EMA during the larger study. At recruitment, these participants reported a SA precipitating hospitalization (SA; $n = 24$), SI precipitating hospitalization (SI; $n = 112$), or another psychiatric condition requiring hospitalization, but with no lifetime SAs and no SI in the prior month (non-suicidal psychiatric control; $n = 14$).

Procedures

Upon psychiatric hospitalization, research staff screened patient charts for the presence or absence of current SI or SB. Research staff attended daily inpatient treatment team meetings and obtained physicians' permission to approach patients for recruitment. Participants provided informed consent, completed additional eligibility screening, and those who met all inclusion/exclusion criteria were recruited. General inclusion criteria were psychiatric hospitalization, aged 18 to 70, the ability to speak, read, and understand English sufficiently well to complete study procedures, and comfort with the use of smart-phone technology for EMA. General exclusion criteria included the presence of psychotic or mood symptoms sufficiently severe to prevent completion of study tasks as assessed by the treating physician or observed by research staff. Presence or absence of SI or SAs was verified with the Columbia-Suicide Severity Rating Scale (C-SSRS; Posner et al., 2008) interview conducted by trained research staff.

Following recruitment, participants completed an intensive inpatient assessment including self-report measures, semi-structured interviews, behavior-based laboratory tasks, psychophysiological assessments, and genetic sampling (see Supplemental Materials for more information). Participants were also trained to complete a three-week EMA period immediately following discharge from the hospital. When possible, participants used their own smartphone for sake of convenience; however, in the event that a participant did not have their own smartphone, or did not want to use it, one was provided for the duration of the study. At the end of that three-week EMA period, participants returned to the hospital for a follow-up assessment, and again for a final follow-up six-months post-recruitment. The current study reports data from the baseline assessment and EMA period. Participants were compensated up to a total of \$265 for their participation in all phases of the study, with participants earning \$40 for baseline assessments, \$50 for a three-week post EMA

assessment, \$70 for the six-month assessment, and \$1 for each random EMA assessment completed (up to \$105).

As most participants continued to experience SI and a potential for SB following hospital discharge, it was important to develop strategies to mitigate risk to participants while they completed EMA about these affects, behaviors, and cognitions. First, during training, participants were instructed that researchers would not be monitoring their responses in real time, and that the research team would be unable to respond to identified distress, SI, or SB communicated through EMA. Second, the telephone numbers of at least two emergency contacts, customized for each participant, were programmed into the EMA application, allowing participants to rapidly reach out to others for help. Third, the branching logic of the protocol was designed such that whenever a participant reported an imminent urge to engage in suicidal or non-suicidal self-harm, or had they already engaged in these behaviors, they were instructed to implement their personal post-hospitalization emergency plan, to call their emergency contacts, or to seek help at an emergency room. These procedures were developed in order to permit the collection of potentially high-impact research data with a minimum of outside influence, while at the same time ensuring participant safety. Further, all procedures were approved and continuously monitored by the hospital IRB over the course of the study.

Measures

Demographics.—Demographics for this sample are summarized in Table 1. Participant group at recruitment (SI, SA, or Psychiatric control) was included in models as a dummy coded variable, with Non-suicidal Psychiatric control serving as the reference group.

Columbia Suicide Severity Rating Scale.—Participants completed the C-SSRS (Posner et al., 2008) interview at baseline for the presence of SI and SB for both lifetime and past-month time periods. The C-SSRS is generally considered the “gold standard” measure of SI and SB, and is part of the PhenX Toolkit (Hamilton et al., 2011), a set of measures intended to enhance the development of behavioral phenotypes and recommended to provide consistency between studies. The C-SSRS was used to assess inclusion/exclusion criteria as well as to determine the presence and number of reported lifetime suicide attempts. Lifetime suicide attempts (0 = none, 1 = one or more) was included as a time varying covariate. Interrater reliability for the C-SSRS was conducted by a panel of trained raters who listened to interview recordings (20% of the total sample) and provided independent ratings. Disagreements, when they occurred, were discussed amongst the team to improve future reliability, but independent ratings were not changed. Using these methods, we have obtained excellent interrater reliability in our sample (ICCs > .90).

EMA Measures.—EMA was delivered using mEMA (Illumivu, 2018), a cross-platform (iOS and Android) smartphone application. All participants were prompted to complete five assessments at random times each day, during participant defined regular waking hours (a minimum window of 12 hours). Participants were also trained to complete assessments when they experienced and increase in SI, or engaged in some form of SB or other non-suicidal self-harm.

The EMA measures of affect reported here were drawn from the Positive and Negative Affect Schedule (PANAS-X; Watson & Clark, 1994), with anger divided into both self- and other-directed components. Participants responded on a five-point scale ranging from “Very slightly or not at all” to “Extremely”, reporting how they were feeling “right now”. To examine a range of ways that experienced affect may be associated with SI, several aggregated variables were computed. First, mean scores across Positive Affect (PA; mean of response to items: happy, confident, and excited), Negative Affect (NA; mean of response to items: sad, hopeless, guilty, worried, and shame), and Anger/Irritability (mean of responses to items: angry at self, angry at others, and irritable). These variables were centered around the grand mean of the sample and therefore represented mean levels of EMA-assessed PA, NA, or Anger/Irritability at a given moment relative to the average reported value of all participants (i.e. *between-person* effect). Next, to examine whether increases or decreases relative to each individual person’s “average” level of affect over the three weeks influenced SI, each variable was centered around each person’s mean level (i.e. *within-person* effect). In addition, the between- and within-person ratio of negative to positive affect, to measure the relative contribution of both, simultaneously, was computed.

The binary outcome (i.e., referred to as SI) was determined through a series of two EMA administered items. First participants were asked a screening question: “Since you last completed a questionnaire, have you thought about hurting or killing yourself?” to assess the presence of suicide and self-harm ideation (“yes” or “no”). Participants who reported “yes” were then asked a series of follow-up questions regarding their thoughts and behaviors with regards to SI, SB, and NSSI. Participants who reported any frequency of SI to the following question “Since you last completed a questionnaire, how often have you thought about suicide” were assigned to a value of 1. Participants who reported “Not at all” to that question, or “No” to the screening question were assigned to 0. Our analyses are restricted to SI as SB and NSSI were too infrequent to statistically examine.

Data Analysis

TVEM analyses were performed in SAS 9.4 using the TVEM SAS Macro obtained from methodology.psu.edu (Yang, Tan, Li, & Wagner, 2012). All other analyses were conducted in R and SPSS. TVEM logistic models with SI as a binary outcome were employed using a penalized truncated power spline (p-spline) approach, which uses sandwich standard errors to account for non-independence of the within person repeated measures. Spline regression is semi-parametric approach in which several polynomial functions are constructed and smoothed into a single curve. While several approaches to the estimation of unknown functions exist, we chose to use a p-spline function due to its flexibility and availability in commonly used software (see Tan et al., 2012 for an overview of these methods).

We fit four separate models to investigate the coupled relationship between affect and SI over time (e.g., Model 1 = negative affect, Model 2 = positive affect, Model 3 = anger/irritability, Model 4 = ratio of negative to positive affect). In all models, the effects of group and lifetime history of SA were included as time-invariant covariates. The intercept of each model represents endorsement of SI over the three weeks of assessment for an individual in the non-suicidal psychiatric control group with no lifetime history of SA. For all models,

between- and within-person centered variables were entered to partition variation in affect based on the degree to which people differ from each other or themselves over time.

Results

A total of 151 participants completed the EMA protocol. On average, participants completed 12.65 days of EMA ($SD = 7.35$) and an average of 2.18 assessments per day ($SD = 0.80$) for a total of 3,262 completed assessments, reflecting a compliance rate of roughly 60% for days completed and 44% of assessments completed each day. In general, the subsample reported here was virtually identical to participants who did not complete EMA; however, individuals who completed EMA reported a greater number of lifetime SAs ($M = 2.48$, $SD = 4.49$) than those who did not complete EMA ($M = 1.60$, $SD = 2.75$), $F(1,304) = 4.40$, $p = .04$.

TVEM

Due to the large number of coefficients generated by the fitting of a TVEM, results are presented graphically with confidence bands surrounding the regression curve. Each curve displays the time-varying odds ratios that represent either the time-varying intercept of SI (Model 0) or the time-varying relationship between each affect and SI (Models 1-4). Thus, any region of the graph whose confidence bands do not include 1 represents an increased (above 1) or decreased (below 1) odds of reporting SI during that period of time. For models including time-varying effects, the odds ratios represent increased odds of reporting SI for every one unit change in affect (i.e., as measured on the five-point PANAS scale and centered to either the grand mean or the person mean). It is noted that wider confidence intervals are seen at the beginning and end of the time period, due to local increases in error of estimation, and should be interpreted with caution. Results from each of the models are described in detail below.

Model 0: Variation in SI over time

To explore the variation in SI over the three weeks following discharge, we first fit an intercept-only model that did not contain any affective predictors of SI, but included the time invariant effects of treatment group and lifetime history of SA. Results for this model are presented in Figure 1 (to show differences across treatment groups, we present three graphs in which each treatment group serves as the reference group for the plot). The figure presents the time-varying odds of reporting SI for psychiatric control group participants with no history of SA. Results indicated that overall, there was a low likelihood of endorsing SI during the three weeks. Participants in the SI, but not the SA, group had significantly higher likelihood of endorsing SI, relative to participants in the control group. There was no significant effect for lifetime history of SA. See Table 2 for a summary of time-invariant effects.

Model 1: Influence of Negative Affect

Results for Model 1 are presented in Figure 2. Panel a displays the time-varying effect of between-person NA coupled to SI, revealing that overall, individuals with higher NA relative to others have increased odds of reporting SI. This effect is statistically significant from

discharge until about day 4, then again from days 11-19. The strongest effect ($OR \cong 2.5$) is observed immediately following discharge. The effect then decreases and rises again to peak around day 12 ($OR \cong 2.3$). Panel b displays the time-varying effect of within-person NA coupled to SI, which reveals that when individuals experience NA above their overall average, they are much more likely to endorse SI. Upon discharge, the OR is significant ($OR \cong 2.5$) and this effect steadily increases to a peak around day 15 ($OR \cong 4.9$), then declines steadily.

Model 2: Influence of Positive Affect

Results for Model 2 are presented in Figure 2. Panel c displays the time-varying effect of between-person PA coupled to SI, revealing that overall, individuals with higher PA relative to others have a significantly decreased odds of reporting SI. This effect is fairly stable, with an $OR \cong 0.3$ that stays fairly flat throughout the three-week period. Panel d displays the time-varying effect of within-person PA coupled to SI, which shows a similar pattern. However, from days 5-6 and after day 18 this effect is not significant.

Model 3: Influence of Anger/Irritability

Results for Model 3 are presented in Figure 2. Panel e displays the time-varying effect of between-person Anger/Irritability coupled to SI; however, the confidence band around the effect tends to include 1 across all time points signifying that individuals who report higher Anger/Irritability than others are not at a higher risk for endorsing SI. Panel f displays the time-varying effect of within-person Anger/Irritability coupled to SI, which shows that across time, individuals experiencing higher than the own average level of Anger/Irritability than they normally report are at an increased risk for experiencing SI. This effect fluctuates over time: starting at an $OR \cong 2.5$, then decreasing, and increasing again to peak around day 15 ($OR \cong 2.7$) before decreasing again.

Model 4: Influence of Ratio of Negative to Positive Affect (NA:PA)

Results for Model 4 are presented in Figure 2. Panel g displays the time-varying effect of between-person NA:PA coupled to SI, revealing that overtime, individuals with higher a NA:PA ratio than others are at an increased risk for SI. This effect starts high ($OR \cong 2.5$) and then decreases to stay around $OR \cong 2.0$. Panel h displays time-varying effect of within-person NA:PA coupled to SI, which shows a similar pattern, but at a slightly higher magnitude. Over time, individuals experiencing higher than their own average ratio of NA:PA are at an increased risk for experiencing SI. This effect starts high ($OR \cong 3.0$), then declines around day 16 to become non-significant by day 20.

Discussion

Findings from the present investigation reinforce the challenges often observed in suicide research. Our findings indicate that the odds of endorsing SI, out of context with other ecological measures, was found to be low in this sample and to be stable over time. Participants in the SI hospital admission group showed low, but slightly higher risk, relative to non-suicidal psychiatric controls. However, when the coupled relationship between affect and SI was examined, a consistent pattern of results emerged, suggesting that the presence or

absence of SI or SB at hospital admission alone does not capture the extent of this complex process. This finding might also suggest that the common practice of developing comparison groups of participants based on the presence of SI or SB at hospitalization may have little utility, as it fails to capture the complexity and history of patients' experiences of SI and SB.

The coupled effects of PA to SI were protective and statistically significant. These effects also appeared to be rather stable over the course of the study, as evidenced by the flat and smooth plots, providing a protective effect against SI on a regular basis. There was also little difference between the between-person and within-person results, suggesting that individuals with higher PA relative to others, as well as themselves, are at a reduced risk for co-occurring SI.

In contrast, the coupled effects for NA to SI, for both the between-person and within-person effects, were large, with the largest effects observed in this study found for within-person NA suggesting that individual-level increases in NA are strongly related to increases in endorsed SI. For example, around the 12th to 15th day of the study, the effects for within-person NA on SI exceeded an OR of 4 or even 5, which is substantially greater than the OR of 1.5 or less found in most prior research (Franklin et al., 2017). The implications of this finding suggest that understanding individual level affect may reduce the situational variability, or error, associated with predicting SI from NA. As such, it may be quite important to understand how situational affect differs from how patients generally feel, rather than the absolute magnitude of their NA in the moment, or how they compare to others. This finding is also consistent with the need to build ecologically valid predictive models of suicide risk using idiographic data from individual patients, rather than relying solely on population-level predictors. Past research has already found that EMA measures contribute unique variance above and beyond that of traditional retrospective self-report measures of life history, traits, or personality measures (Armey, 2012). While we believe that these traditional measures are still vitally important, and play a foundational role in suicide prediction, it may be the case that if the ultimate goal is to predict *episodic risk and/or behavior*, it will be essential to employ ecologically valid measures in future research and intervention.

The effects for the ratio of NA:PA were similar to those for the NA models. While the effects were above one (increasing risk) and generally large (OR > 3), they were smaller than the within-person NA model. This points to the possibility that elevations in NA, and not a more qualified pattern of high NA in the presence of low PA, is more highly related to co-occurring SI. This finding might also suggest that the co-occurrence of PA alongside NA may negate the coupled relationship of NA to SI, highlighting the potential role PA may play in the amelioration of SI within an intervention. One risk of treatment is that an over-emphasis on problem solving, or the reduction of short-term problems in a patient's life rather than the cultivation of long-term goals, values, and positive life experiences, may diminish the potential of therapy to reduce SI. In short, it may be important to help patients feel good, rather than just less bad. Consequently, therapeutic approaches such as Acceptance and Commitment Therapy (Hayes, et al. 1999) and suicide-specific interventions leveraging these strategies such as the Coping Long-term with Active Suicide

Program (CLASP; Miller et al., 2017; Miller, Gaudiano, & Weinstock, 2016), may be particularly useful in the treatment of suicide risk.

Finally, the effects for between-person anger/irritability on SI were low and not statistically significant. However, the effect of within-person anger/irritability coupled to SI demonstrated a strong relationship that peaked around day 15. Notably, the pattern of anger experiences differs greatly from those of PA, NA, and the NA:PA ratio, in that this relationship appears to build progressively over time (with the exception of within-person NA, which also increased progressively), with the associated OR reaching its peak towards the end of the study period. This finding suggests that the experience of NA, PA, and anger/irritability as coupled to SI are potentially separate processes with different underlying mechanisms and time courses which may be separately modifiable through treatment. Further, given that the coupled relationship between anger/irritability and SI peaked towards the end of the study period, it is possible that increasing risk would have been identified had EMA continued for a longer period of time.

These findings further support the value of monitoring affect using ecological methods in populations at high-risk for suicide. We found a strong coupling of within-person NA and anger/irritability to SI, and that these processes peaked towards the end of the three-week assessment period. One application of these findings would be the development and implementation of a post-hospitalization smartphone app to regularly monitor mood. Knowing that SI can be strongly predicted from the presence of elevated NA, as well as the gradual buildup of anger/irritability over time (even if it is unclear if NA/anger drive SI, or vice versa), an app developed with this knowledge could alert patients to their (possibly non-conscious) risk levels and/or to contact members of their treatment team or support system. While the idea for an intervention of this type is not particularly novel (Armey, 2012), a practical empirically supported implementation of this approach has not yet been developed. However, with the increased availability of smartphones and improvements in computational techniques for suicide prediction such as machine learning (Choi, Lee, Yoon, Won, & Kim, 2018; Just et al., 2017; Pestian et al., 2017), the gap between the theoretical and the practical continues to narrow.

Despite clinically meaningful findings and the size of the observed effects, this study is limited in a number of ways. The current sample is limited to psychiatric inpatients who, despite being at particularly elevated suicide risk, are not demonstrative of the entire population of individuals at risk for suicide. However, given the high risk of suicide following hospital discharge (Ho, 2003; Large, Sharma, Cannon, Ryan, & Nielssen, 2011), developing improved predictive models even for this sample is of potentially great value.

Compliance and completion rates for the EMA protocol were low compared with other EMA studies. Based on our experiences with participants in this setting and across multiple studies, we believe that this low rate of compliance reflects the psychiatric chronicity and acuity of the sample, and the challenges they experience in the transition back to their lives following hospital discharge. While this high-risk population is of particular importance in the detection and prevention of suicide, the very factors that likely place them at high risk make it difficult for them to engage in research as well as treatment. Given the importance of

better understanding the phenomenology of suicide in this population, as well as the fact that individuals who completed EMA differed very little from those who did not, we believe that while this is a limitation of the study, it does not negate the value of our findings.

Another limitation is that while assessments of affect were done momentarily (i.e., “how do you feel right now?”) assessments of SI included some retrospective recall (i.e. “since the last questionnaire”). We chose this design due to the potentially fleeting nature of SI, and the desire to capture the presence of this experience whenever possible. As such, we are unable to explore causal relationships between affect and SI, and instead must limit our explorations to the coupling of recent SI with current affect. Additionally, while TVEM provides intriguing information about the nature of the coupled relationship between affect and SI for this high-risk population, the directionality of this relationship is undetermined, so it is unclear whether affect drives the relationship with SI, or vice versa.

Given these findings, we consider the ecological examination of affect in this high-risk population to be an important and promising direction towards future interventions. Regardless of the directionality of the relationship, knowledge that episodes of SI are marked by predictable increases in aversive affect, and that these increases over time are consistent with prior research highlighting elevated suicide risk post emergency department and psychiatric hospital discharge, emphasizes the need for additional research in this area, with obvious translational applications. However, it likely that there is more to learn from the examination of ecologically valid data in this, as well as other high-risk populations, and there is an urgent need to continue the transition away from traditional, cross-sectional retrospective self-report studies, to methods which better capture patient experiences.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

- Alloy LB, Just N, & Panzarella C (1997). Attributional style, daily life events, and hopelessness depression: Subtype validation by prospective variability and specificity of symptoms. *Cognitive Therapy and Research*, 21(3), 321–344.
- Almeida DM, & Kessler RC (1998). Everyday stressors and gender differences in daily distress. *Journal of Personality and Social Psychology*, 75(3), 670–680. [PubMed: 9781406]
- Angst J, & Clayton P (1986). Premorbid Personality of Depressive, Bipolar, and Schizophrenic-Patients with Special Reference to Suicidal Issues. *Comprehensive Psychiatry*, 27(6), 511–532. doi:10.1016/0010-440x(86)90055-6 [PubMed: 3780193]
- Appleby L, Shaw J, Amos T, McDonnell R, Harris C, McCann K, ... Parsons R (1999). Suicide within 12 months of contact with mental health services: national clinical survey. *Bmj*, 318(7193), 1235–1239. [PubMed: 10231250]

- Armey MF (2012). Ecological momentary assessment and intervention in nonsuicidal self-injury: A novel approach to treatment. *Journal of Cognitive Psychotherapy*, 26(4), 299–317.
- Armey MF, Crowther JH, & Miller IW (2011). Changes in ecological momentary assessment reported affect associated with episodes of non-suicidal self-injury. *Behavior Therapy*, 42, 579–588. [PubMed: 22035987]
- Armey MF, Nugent NR, & Crowther JH (2012). An Exploratory Analysis of Situational Affect, Early Life Stress, and Nonsuicidal Self-Injury in College Students. *Journal of Child & Adolescent Trauma*, 5(4), 327–343.
- Armey MF, Schatten HT, Haradhvala N, & Miller IW (2015). Ecological momentary assessment (EMA) of depression-related phenomena. *Current opinion in psychology*, 4, 21–25. [PubMed: 25664334]
- Auerbach RP, Stewart JG, & Johnson SL (2016). Impulsivity and Suicidality in Adolescent Inpatients. *Journal of Abnormal Child Psychology*, 1–13. doi:10.1007/s10802-016-0146-8 [PubMed: 26687502]
- Baud P (2005). Personality traits as intermediary phenotypes in suicidal behavior: Genetic issues. *American Journal of Medical Genetics Part C: Seminars in Medical Genetics*, 133C(1), 34–42. doi:10.1002/ajmg.c.30044
- Baumeister RF (1990). Suicide as escape from self. *Psychological review*, 97(1), 90. [PubMed: 2408091]
- Bickley H, Hunt IM, Windfuhr K, Shaw J, Appleby L, & Kapur N (2013). Suicide within two weeks of discharge from psychiatric inpatient care: a case-control study. *Psychiatric Services*, 64(7), 653–659. [PubMed: 23545716]
- Bolger N, Davis A, & Rafaeli E (2003). Diary methods: Capturing life as it is lived. *Annual Review of Psychology*, 54, 579–616.
- Bradburn NM, Rips LJ, & Shevell SK (1987). Answering autobiographical questions: The impact of memory and inference on surveys. *Science*, 236(4798), 157–161. [PubMed: 3563494]
- Chapman AL, & Dixon-Gordon BS (2007). Emotional antecedents and consequences of deliberate self-harm and suicide attempts. *Suicide and Life-Threatening Behavior*, 37(5), 543–552. [PubMed: 17967121]
- Choi SB, Lee W, Yoon J-H, Won J-U, & Kim DW (2018). Ten-year prediction of suicide death using Cox regression and machine learning in a nationwide retrospective cohort study in South Korea. *Journal of affective disorders*, 231, 8–14. [PubMed: 29408160]
- Conner KR, Duberstein PR, Conwell Y, & Caine ED (2003). Reactive aggression and suicide - Theory and evidence. *Aggression and Violent Behavior*, 8, 413–432.
- Corso PS, Mercy JA, Simon TR, Finkelstein EA, & Miller TR (2007). Medical Costs and Productivity Losses Due to Interpersonal and Self-Directed Violence in the United States. *American Journal of Preventive Medicine*, 32(6), 474–482.e472. [PubMed: 17533062]
- Doshi A, Boudreaux ED, Wang N, Pelletier AJ, & Camargo CA (2005). National study of US emergency department visits for attempted suicide and self-inflicted injury, 1997–2001. *Annals of emergency medicine*, 46(4), 369–375. [PubMed: 16183394]
- Dumais A, Lesage AD, Alda M, Rouleau G, Dumont M, Chawky N, ... Turecki G (2005). Risk factors for suicide completion in major depression: a case-control study of impulsive and aggressive behaviors in men. *Am J Psychiatry*, 162(11), 2116–2124. doi: 10.1176/appi.ajp.162.11.2116 [PubMed: 16263852]
- Esposito C, Spirito A, Boergers J, & Donaldson D (2003). Affective, behavioral, and cognitive functioning in adolescents with multiple suicide attempts. *Suicide and Life-Threatening Behavior*, 33(4), 389–399. doi:Doi 10.1521/Suli.33.4.389.25231 [PubMed: 14695054]
- Franklin JC, Ribeiro JD, Fox KR, Bentley KH, Kleiman EM, Huang X, ... Nock MK (2017). Risk factors for suicidal thoughts and behaviors: A meta-analysis of 50 years of research. *Psychological Bulletin*, 143(2), 187. [PubMed: 27841450]
- Gairin I, House A, & Owens D (2003). Attendance at the accident and emergency department in the year before suicide: retrospective study. *The British Journal of Psychiatry*, 183(1), 28–33. [PubMed: 12835240]

- Goldacre M, Seagroatt V, & Hawton K (1993). SUICIDE AFTER-DISCHARGE FROM PSYCHIATRIC INPATIENT CARE. *Lancet*, 342(8866), 283–286. [PubMed: 8101307]
- Gordon KH, Simonich H, Wonderlich SA, Dhankikar S, Crosby RD, Cao L, ... Engel SG (2015). Emotion Dysregulation and Affective Intensity Mediate the Relationship between Childhood Abuse and Suicide-Related Behaviors among Women with Bulimia Nervosa. *Suicide and Life-Threatening Behavior*.
- Gvion Y, & Apter A (2011). Aggression, impulsivity, and suicide behavior: a review of the literature. *Arch Suicide Res*, 15(2), 93–112. doi: 10.1080/13811118.2011.565265 [PubMed: 21541857]
- Hamilton CM, Strader LC, Pratt JG, Maiese D, Hendershot T, Kwok RK, ... Haines J (2011). The PhenX Toolkit: get the most from your measures. *Am J Epidemiol*, 174(3), 253–260. doi: 10.1093/aje/kwr193 [PubMed: 21749974]
- Hamza CA, Stewart SL, & Willoughby T (2012). Examining the link between nonsuicidal self-injury and suicidal behavior: A review of the literature and an integrated model. *Clinical Psychology Review*, 32(6), 482–495. [PubMed: 22717336]
- Hawkins KA, & Coughle JR (2013). A test of the unique and interactive roles of anger experience and expression in suicidality: findings from a population-based study. *J Nerv Ment Dis*, 201(11), 959–963. doi:10.1097/NMD.0000000000000041 [PubMed: 24177483]
- Hawkins KA, Hames JL, Ribeiro JD, Silva C, Joiner TE, & Coughle JR (2014). An examination of the relationship between anger and suicide risk through the lens of the interpersonal theory of suicide. *Journal of Psychiatric Research*, 50, 59–65. doi:10.1016/j.jpsychires.2013.12.005 [PubMed: 24388767]
- Hayes SC, Strosahl KD, & Wilson KG (1999). *Acceptance and commitment therapy*. New York: Guilford Press.
- Ho TP (2003). The suicide risk of discharged psychiatric patients. *Journal of Clinical Psychiatry*, 64(6), 702–707. [PubMed: 12823086]
- Horesh N, Rolnick T, Iancu I, Dannon P, Lepkifker E, Apter A, & Kotler M (1997). Anger, impulsivity and suicide risk. *Psychother Psychosom*, 66(2), 92–96.
- Hufford M, Shields A, Shiffman S, Paty J, & Balabanis M (2002). Reactivity to ecological momentary assessment: An example using undergraduate problem drinkers. *Psychology of addictive behaviors*, 16(3), 205–211. [PubMed: 12236455]
- Ilumivu. (2018). mEMA. Retrieved from <https://ilumivu.com/>
- Hirsch Jameson K., W. JR, Jeglic Elizabeth L.. (2012). Forgiveness as a moderator of the association between anger expression and suicidal behaviour. *Mental Health, Religion & Culture*, 15(3), 279–300.
- Just MA, Pan L, Cherkassky VL, McMakin DL, Cha C, Nock MK, & Brent D (2017). Machine learning of neural representations of suicide and emotion concepts identifies suicidal youth. *Nature Human Behaviour*, 1(12), 911.
- Kendall PC, Butcher JN, & Holmbeck GN (1999). *Handbook of research methods in clinical psychology* (2nd ed.). New York: John Wiley and Sons.
- Kessel N (1985). Patients who take overdoses. *British Medical Journal*, 290, 1297–1298. [PubMed: 3922464]
- Kleiman EM, Ammerman B, Look AE, Berman ME, & McCloskey MS (2014). The role of emotion reactivity and gender in the relationship between psychopathology and self-injurious behavior. *Personality and Individual Differences*, 69, 150–155.
- Kleiman EM, Turner BJ, Fedor S, Beale EE, Huffman JC, & Nock MK (2017). Examination of real-time fluctuations in suicidal ideation and its risk factors: Results from two ecological momentary assessment studies. *Journal of Abnormal Psychology*, 126(6), 726. [PubMed: 28481571]
- Kotler M, Finkelstein G, Molcho A, Botsis AJ, Plutchik R, Brown SL, & Vanpraag HM (1993). Correlates of Suicide and Violence Risk in an Inpatient Population - Coping Styles and Social Support. *Psychiatry Res*, 47(3), 281–290. doi:10.1016/0165-1781(93)90085-U [PubMed: 8372164]
- Large M, Sharma S, Cannon E, Ryan C, & Nielssen O (2011). Risk factors for suicide within a year of discharge from psychiatric hospital: a systematic meta-analysis. *Australian and New Zealand Journal of Psychiatry*, 45(8), 619–628. [PubMed: 21740345]

- Lynch TR, Cheavens JS, Morse JQ, & Rosenthal MZ (2004). A model predicting suicidal ideation and hopelessness in depressed older adults: The impact of emotion inhibition and affect intensity. *Aging & Mental Health*, 8(6), 486–497. [PubMed: 15724830]
- Miller IW, Camargo CA, Arias SA, Sullivan AF, Allen MH, Goldstein AB, ... & Boudreaux ED (2017). Suicide prevention in an emergency department population: the ED-SAFE study. *Jama Psychiatry*, 74(6), 563–570. [PubMed: 28456130]
- Miller IW, Gaudiano BA, & Weinstock LM (2016). The coping long term with active suicide program: description and pilot data. *Suicide and Life-Threatening Behavior*, 46(6), 752–761. [PubMed: 27038050]
- Moscicki EK (1997). Identification of suicide risk factors using epidemiologic studies. *Psychiatric Clinics of North America*, 20(3), 499–517. [PubMed: 9323310]
- Nock MK, Prinstein MJ, & Sterba SK (2009). Revealing the form and function of self-injurious thoughts and behaviors: A real-time ecological assessment study among adolescents and young adults. *Journal of Abnormal Psychology*, In press.
- Nock MK, Wedig MM, Holmberg EB, & Hooley JM (2008). The emotion reactivity scale: development, evaluation, and relation to self-injurious thoughts and behaviors. *Behavior Therapy*, 39(2), 107–116. [PubMed: 18502244]
- Owens P, Fingar K, Heslin K, Mutter R, & Booth C (2017). Emergency Department Visits Related to Suicidal Ideation, 2006–2013: Statistical Brief# 220.
- Painuly N, Sharan P, & Mattoo SK (2007). Antecedents, concomitants and consequences of anger attacks in depression. *Psychiatry Res*, 153(1), 39–45. doi: 10.1016/j.psychres.2006.03.001 [PubMed: 17544515]
- Pestian JP, Sorter M, Connolly B, Bretonnel Cohen K, McCullumsmith C, Gee JT, ... Rohlfs L (2017). A machine learning approach to identifying the thought markers of suicidal subjects: a prospective multicenter trial. *Suicide and Life-Threatening Behavior*, 47(1), 112–121. [PubMed: 27813129]
- Petronis KR, Samuels JF, Moscicki EK, & Anthony JC (1990). An epidemiologic investigation of potential risk factors for suicide attempts. *Social Psychiatry and Psychiatric Epidemiology*, 25(4), 193–199. [PubMed: 2399476]
- Pitts SR, Niska RW, Xu J, & Burt CW (2006). National Hospital Ambulatory Medical Care Survey: 2006 Emergency Department Summary. Retrieved from
- Posner K, Brent D, Lucas C, Gould M, Stanley B, Brown G, ... Oquendo M (2008). Columbia-suicide severity rating scale (C-SSRS). New York, NY: Columbia University Medical Center.
- Posner K, Brown GK, Stanley B, Brent DA, Yershova KV, Oquendo MA, ... Shen S (2011). The Columbia-Suicide Severity Rating Scale: initial validity and internal consistency findings from three multisite studies with adolescents and adults. *American Journal of Psychiatry*, 168(12), 1266–1277. [PubMed: 22193671]
- Prevention, A. F. f. S. (2017). Suicide Statistics. Retrieved from <https://afsp.org/about-suicide/suicide-statistics/>
- Prevention, C. f. D. C. a. (2010). Web-based Injury Statistics Query and Reporting System. Retrieved from <http://www.cdc.gov/iniurv/wisqars/index.html>
- Redelmeier DA, Katz J, & Kahneman D (2003). Memories of colonoscopy: a randomized trial. *Pain*, 104(1-2), 187–194. [PubMed: 12855328]
- Rhodewalt F, Madrian JC, & Cheney S (1998). Narcissism, self-knowledge organization, and emotional reactivity: The effect of daily experiences on self-esteem and affect. *Personality and Social Psychology Bulletin*, 24(1), 75–87.
- Ross M (1989). Relation of implicit theories to the construction of personal histories. *Psychological review*, 96(2), 341.
- Rui P, & Kang K (2014). National Hospital Ambulatory Medical Care Survey: 2014 Emergency Department Summary Tables. Retrieved from http://www.cdc.gov/nchs/data/ahcd/nhamcs_emergency/2014_ed_web_tables.pdf.
- Shiffman S (2009). Ecological Momentary Assessment (EMA) in Studies of Substance Use. *Psychological Assessment*, 21(4), 486–497. doi:10.1037/a0017074 [PubMed: 19947783]
- Shiffman S, Stone AA, & Hufford MR (2008). Ecological momentary assessment. *Annu. Rev. Clin. Psychol*, 4, 1–32. [PubMed: 18509902]

- Shiyko MP, Lanza ST, Tan X, Li R, & Shiffman S (2012). Using the time-varying effect model (TVEM) to examine dynamic associations between negative affect and self confidence on smoking urges: Differences between successful quitters and relapsers. *Prevention Science*, 13(3), 288–299. [PubMed: 22246429]
- Stone A, & Shiffman S (1994). Ecological momentary assessment (EMA) in behavioral medicine. *Annals of Behavioral Medicine*, 16, 199–202.
- Stone A, & Shiffman S (2002). Capturing momentary, self-report data: A proposal for reporting guidelines. *Annals of Behavioral Medicine*, 24(3), 236–243. [PubMed: 12173681]
- Suls J, Wan CK, & Blanchard EB (1994). A multilevel data-analytic approach for evaluation of relationships between daily life stressors and symptomatology: Patients with irritable bowel syndrome. *Health Psychology*, 13(2), 103–113. [PubMed: 8020453]
- Tan X, Shiyko MP, Li R, Li Y, & Dierker L (2012). A time-varying effect model for intensive longitudinal data. *Psychological Methods*, 17(1), 61. [PubMed: 22103434]
- Thibault GE, Mulley AG, Barnett GO, Goldstein RL, Reder VA, Sherman EL, & Skinner ER (1980). MEDICAL INTENSIVE-CARE - INDICATIONS, INTERVENTIONS, AND OUTCOMES. *New England Journal of Medicine*, 302(17), 938–942. [PubMed: 7360200]
- Ting SA, Sullivan AF, Boudreaux ED, Miller I, & Camargo CA Jr (2012). Trends in US emergency department visits for attempted suicide and self-inflicted injury, 1993–2008. *General hospital psychiatry*, 34(5), 557–565. [PubMed: 22554432]
- Watson D, & Clark L (1994). The PANAS-X: Manual for the positive and negative affect schedule – expanded form. Unpublished manuscript.
- Yang J, Tan X, Li R, & Wagner A (2012). TVEM (time-varying effect model) SAS macro suite users' guide (Version 2.0.0): University Park: The methodology center, Penn State Retrieved from <http://methodology.psu.edu>
- Yim PH, Yip PS, Li RH, Dunn EL, Yeung W, & Miao Y (2004). Suicide after discharge from psychiatric inpatient care: a case-control study in Hong Kong. *Australian and New Zealand Journal of Psychiatry*, 38(1-2), 65–72. [PubMed: 14731196]

Figure 1. Time varying effects of the intercept with Psychiatric Controls as reference group (panel a), SI group as reference group (panel b), SA as reference group (panel c).

Figure 2.

Time varying effects of between-person and within-person NA (panels a,b), PA (panel c,d), anger/irritability (A/I; panel e,f), and ratio of NA:PA (panels g,h) with SI over the three weeks following discharge.

Table 1.

Descriptive Statistics for Study Demographics of Analytic Sample

Variable	N (%)
Group	
Non-suicidal Psychiatric control	14 (9.33%)
Suicide Attempt	24 (16.00%)
Suicidal Ideation	112 (74.67%)
Lifetime attempts at baseline	
None	41 (27.15%)
One or more	110 (72.85%)
Gender	
Female	93 (62.00%)
Male	57 (38.00%)
Race	
White	135 (90.60%)
Black or African American	11 (7.38%)
Asian	2 (1.34%)
American Indian/ Alaska Native	1 (0.67%)
Native Hawaiian or Other Pacific Islander	0 (0.00%)
Ethnicity	
Hispanic or Latino	11 (7.33%)
Not Hispanic or Latino	139 (92.67%)
Age M (SD)	40.88 (12.49)

Table 2.

Time-invariant effects of covariates on Suicidal Ideation.

Variable	Estimate	SE	Z	p
Suicidal Attempt *	1.54	0.99	1.55	0.122
Suicide Ideation *	2.60	0.89	2.92	0.003
Lifetime attempts at baseline	0.77	0.58	1.33	0.184

*
Reference group is Non-suicidal Psychiatric Control