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Suicidal Thinking as Affect Regulation

Daniel D. L. Coppersmith¹, Yael Millgram¹, Evan M. Kleiman², Rebecca G. Fortgang^{1, 3}, Alexander J. Millner^{1, 4},
Madelyn R. Frumkin⁵, Kate H. Bentley^{1, 3}, and Matthew K. Nock^{1, 3, 4}

¹ Department of Psychology, Harvard University

² Department of Psychology, Rutgers the State University of New Jersey

³ Department of Psychiatry, Massachusetts General Hospital, Boston, Massachusetts, United States

⁴ Mental Health Research, Franciscan Children's, Boston, Massachusetts, United States

⁵ Department of Psychological and Brain Sciences, Washington University in St. Louis

Nine percent of people worldwide report thinking about suicide at some point during their lives. A fundamental question we currently lack a clear answer to is: why do suicidal thoughts persist over time? One possibility is that suicidal thoughts serve adaptive functions for people who experience them. We tested whether suicidal thinking may serve as a form of affect regulation. In a real-time monitoring study among adults with recent suicidal thoughts ($N = 105$), we found that participants often endorsed using suicidal thinking as a form of affect regulation. The occurrence of suicidal thinking was followed by decreased negative affect. However, when assessing the direction of the relationship between suicidal thinking and negative affect, we also found positive bidirectional associations between them. Finally, using suicidal thinking as a form of affect regulation predicted the frequency and severity of suicidal thinking at later time points. These findings may help explain the persistence of suicidal thoughts.

General Scientific Summary

Suicidal thinking persists over time for many people. This study suggests that suicidal thoughts may persist because people use them to decrease negative affect. Specifically, people endorsed using suicidal thoughts to regulate negative affect, which in turn, predicted more frequent and severe suicidal thoughts.

Keywords: suicide, suicidal thinking, emotion regulation, negative affect

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Daniel D. L. Coppersmith <https://orcid.org/0000-0002-9397-3228>

Yael Millgram <https://orcid.org/0000-0001-9665-222X>

Evan M. Kleiman <https://orcid.org/0000-0001-8002-1167>

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Daniel D. L. Coppersmith served as lead for conceptualization, data curation, formal analysis, investigation, methodology, project administration, visualization, writing—original draft, and writing—review and editing and served in a supporting role for funding acquisition. Yael Millgram served in a supporting role for conceptualization, writing—original draft, and writing—review and editing. Evan M. Kleiman served in a supporting role for conceptualization, data curation, formal analysis, investigation, methodology, project administration, and writing—review and editing. Rebecca G. Fortgang served in a supporting role for data curation, investigation, methodology, project administration, writing—review and editing, supervision, and funding acquisition. Alexander J. Millner served in a supporting role for data curation, investigation, methodology, project administration, and writing—review and editing. Madelyn R. Frumkin served in a supporting role for formal analysis, visualization, and writing—review and editing. Kate H. Bentley served in a supporting role for writing—review and editing. Matthew K. Nock served as lead for supervision and funding acquisition and served in a supporting role for conceptualization, data curation, investigation, methodology, project administration, writing—original draft, and writing—review and editing.

Correspondence concerning this article should be addressed to Daniel D. L. Coppersmith, Department of Psychology, Harvard University, 33 Kirkland Street, Cambridge, MA 02138, United States. Email: dcoppersmith@g.harvard.edu

Approximately 9.2% of people have suicidal thoughts at some point in their life (Nock, Borges, Bromet, Alonso, et al., 2008; Nock, Borges, Bromet, Cha, et al., 2008). For more than half of those who experience such thoughts, they persist for longer than 1 year (Nock et al., 2018). This is puzzling because most people report that the idea of death is aversive (Neimeyer et al., 2004) and people generally strive to avoid aversive experiences (Chawla & Ostafin, 2007). One explanation for why suicidal thoughts persist for many individuals is that suicidal thinking provides relief from negative affect.

According to this account, suicide promises a means of escaping intolerable internal affective states (Baumeister, 1990; O'Connor & Kirtley, 2018). Therefore, suicidal thoughts provide comfort because they evoke an imagined state of relief from this aversive state (Crane et al., 2014; Selby et al., 2007) leading to reductions in negative affect. Affect regulation involves attempts to change one's affective state by influencing its intensity, duration, or quality (Gross, 2015). One form of emotion regulation is imagining desired future events (Ochsner & Gross, 2005) or, in the case of suicidal thinking, imagining a circumstance without intense aversive affect. Over time, people may learn to employ suicidal thinking to regulate aversive affect.

To the extent that suicidal thinking leads to decreases in negative affect, the relief provided by suicidal thinking may also result in Pavlovian-like conditioning, where the presence of such thoughts is elicited via negative reinforcement (i.e., their occurrence is promoted by the reduction of negative affect). Over time, highly aversive affective states may come to more automatically elicit suicidal thinking as a means of relief. Thus, either through the volitional, conscious production of suicidal thoughts, or via unconscious conditioning, suicidal thinking may serve to regulate negative affect, which may at least partially explain why suicidal thoughts persist over time.

Do People Report Using Suicidal Thinking as Affect Regulation?

Several lines of clinical and anecdotal experiences suggest that suicidal thinking functions as a form of affect regulation. Clinicians have written about the affect regulation function of suicidal thinking (Fowler, 2013; Maltsberger et al., 2010) and used clinical tools, such as functional analysis and chain analysis to try to understand suicidal thinking in their patients (Borges et al., 2019). Anecdotal information, such as online posts, also suggests that suicidal thoughts might provide people with comfort in difficult times. People report in online posts that their suicidal thoughts are comforting (r/SuicideWatch—Suicidal Thoughts Comfort Me, n.d.; r/SuicideWatch—The Thought of Killing Myself Gives Me Comfort, n.d.) and calming (r/SuicideWatch—Planning My Death Is the Only Thing That Comforts Me, n.d.). Hundreds of users on the social media platform of Reddit have been upvoting (i.e., expressing their approval of) these messages.

Although clinical and anecdotal data exist to support the notion of suicidal thinking as a form of affect regulation, little empirical work has been conducted on this phenomenon. Crane et al. (2014) were the first to formally address it by developing the Comfort from Suicidal Thoughts Scale. They found that 15% of patients with recurrent depression reported experiencing comfort from suicidal thoughts. A limitation of this study is that participants were asked to retroactively report, in a single assessment, the degree to which suicidal

thoughts were comforting. Yet, suicidal thinking is dynamic (Bryan & Rudd, 2016; Kleiman et al., 2017; Kleiman, Turner, et al., 2018), and the degree to which suicidal thoughts are comforting may be dynamic as well. Recent research suggests that retrospective reporting of suicidal thinking may be biased and miss instances of suicidal thoughts (Gratch et al., 2021). Therefore, the ecological validity of these findings is unknown. The current study sought to examine whether and how often people report using suicidal thinking as an affect regulation in their daily life. Assessing people's reports every day for a long period of time allows for a more ecologically valid assessment of this phenomenon as it manifests in daily life.

Is the Occurrence of Suicidal Thinking Associated With Changes in Affect?

Prior research suggests that self-injurious thoughts and behaviors may be associated with shifts in affect. People with recent suicidal thoughts and behaviors report lower aversion, arousal, and threat to suicide-related images than people with no history of suicidal thoughts and behaviors (Jaroszewski et al., 2020). Among adults with a history of borderline personality disorder, which is associated with elevated rates of suicidal thoughts and behaviors (Gunderson, 2011), imagining engaging in nonsuicidal self-injury (NSSI) was associated with decreases in negative affect and physiological arousal (Welch et al., 2008). Imagining a suicide attempt, however, was not associated with any changes in affect or arousal.

Kleiman, Coppersmith et al. (2018) used real-time monitoring, which involves data collection in an individual's natural environment, intensively and repeatedly over time (Kleiman & Nock, 2018; Shiffman et al., 2008), to examine how negative and positive affect change with the occurrence of suicidal thoughts. Negative affect decreased and positive affect increased following the presence of suicidal thoughts. This was the case when suicidal thinking and affect were measured together and when suicidal thinking was assessed between measurements of affect. These reductions in negative affect following the presence of suicidal thoughts support the idea that such thoughts could be reinforced and maintained by providing relief. In the current study, we sought to replicate this finding in a larger sample of people and expand upon this initial finding by addressing some of its limitations.

Does Using Suicidal Thinking as Affect Regulation Predict Future Suicidal Thinking?

If people use suicidal thoughts to regulate their affect, then we might expect that the more people use suicidal thoughts for this purpose, the more suicidal thoughts would persist. Recent work suggests that engaging in NSSI to decrease negative affect predicted future NSSI thoughts and behaviors (Pollak et al., 2020). No work to date has examined whether using suicidal thinking as affect regulation predicts the severity and frequency of suicidal thinking at later time points. The current study sought to test, across multiple timescales, if using suicidal thinking as affect regulation predicts future suicidal thinking.

The Current Study

The current study sought to replicate and extend previous work by addressing three key questions. First, do people who think about

suicide report using it as means to regulate their affect? We hypothesize that people would endorse using suicidal thinking to regulate their affect. Second, is the occurrence of suicidal thinking associated with actual changes in affect? We hypothesize that suicidal thinking would be associated with decreased negative affect. Third, does using suicidal thinking as affect regulation predict future suicidal thinking? We hypothesize that using suicidal thinking as affect regulation will predict more severe and frequent suicidal thinking at future time points. The latter two possibilities could result from either a more volitional, conscious choice to gain relief from suicidal thinking, or more automatic processes. The current study is unable to tease apart these differences, however, together, these questions have the potential of advancing our understanding of why suicidal thinking persists over time.

Method

Participants

Participants were 105 adults recruited through online advertisements. The average age of the sample was 29.22 ($SD = 9.10$, range = 18–60). For birth sex, 68.57% of participants were assigned female sex at birth ($n = 72$), 30.48% were assigned male sex ($n = 32$), and 0.95% were not known ($n = 1$). For gender, 56.19% identified as women ($n = 59$), 33.33% identified as men ($n = 35$), 1.90% identified as transgender ($n = 2$), 7.62% identified as nonbinary ($n = 8$), and 0.95% person did not report ($n = 1$). The racial identities within the sample were 57.14% White ($n = 60$), 21.90% multiracial ($n = 23$), 8.57% Black ($n = 9$), 6.66% Hispanic ($n = 7$), 4.76% Asian ($n = 5$), and 0.01% were Middle Eastern ($n = 1$). Inclusion criteria were active suicidal thoughts in the past week. The median number of lifetime days with suicidal thoughts was 1,825 (range = 30–8,000 days). More than two-thirds of participants (65.71%) reported a prior suicide attempt ($n = 69$).

Procedure

The study included a baseline survey, a 42-day real-time and daily monitoring period, and 4-week follow-up survey. Participant compensation (via Amazon gift cards) was as follows: \$5 for the baseline survey, \$5 for the follow-up survey, \$0.25 for each real-time survey, and a \$1 bonus for completing more than four real-time surveys in 1 day (maximum amount: \$190). After providing informed consent, participants completed a battery of demographic and self-report measures on a secure study website. We used Metricwire to collect real-time monitoring data. For the real-time monitoring period, the app sent three types of surveys over a 6-week period: daily surveys (1 time/day, available for 6 hr), momentary surveys (5 times/day, at least 90 min apart, available for 1 hr), and burst surveys (6 times an hour, 2/day, 4 days/week). The current study used only momentary and daily surveys (for more details on the burst surveys see Coppersmith et al., 2022). In each survey, participants were provided with resources for treatment and safety (e.g., suicide prevention hotlines). Participants were paid every 2 weeks during the 42-day real-time monitoring period to increase compliance. The follow-up survey was sent 28 days after participants completed the real-time monitoring period. The study was approved by the Harvard University-Area Institutional Review Board (IRB# 19-1819; “High-Resolution Real-Time Capture of Suicidal Thoughts and Urges”). Informed consent was obtained from all participants.

Recruitment

Inclusion criteria were active suicidal thoughts in the past week, fluency in English, >17 years of age, and regular access to an Android or iPhone smartphone. An exclusion criterion was living in Europe (due to General Data Protection Regulation restrictions) or providing inconsistent or illogical responses to questions about suicidal thoughts or behaviors (e.g., reporting multiple past year suicide attempts but no lifetime attempts, reporting more suicide attempts in the past month than in past year, reporting more lifetime days with a suicide plan than lifetime days with suicidal thoughts). Active suicidal thoughts in the past week were measured with the following item, “When was the last time you seriously thought about killing yourself?”

Participants were recruited online (e.g., Reddit, Craigslist), with postings seeking “people who have experienced difficult emotions.” Participants completed an eligibility screener that assessed self-injurious thoughts and behaviors. We emailed participants who qualified a consent form and the baseline assessment, followed by information for installing the real-time monitoring application.

A total of 8,035 individuals completed the recruitment screener, 279 of whom qualified. Of the 279 who were emailed the baseline assessment, 161 completed it. Thirty were removed for no longer meeting inclusion criteria (e.g., active suicidal thoughts) or providing illogical responses. Of the 131 who qualified for the study, 115 downloaded the application. Five participants’ data were not included because we were testing feasibility. Three participants failed to complete a single momentary or daily assessment and two more were excluded for providing illogical responses. A total of 105 participants were included in the final sample.

Measures

Comfort From Suicidal Thinking Scale

In the baseline survey, participants completed the Comfort from Suicidal Thoughts Scale (Crane et al., 2014). The Comfort from Suicidal Thoughts Scale is a five-item measure where each item is rated on 1 (*strongly disagree*) to 5 (*strongly agree*). For purposes of visualization and interpretation, we rescaled the items to 0 (*strongly disagree*) to 4 (*strongly agree*). The specific items are: “Suicidal thoughts come into my mind but do not bother me,” “I take comfort from thoughts of suicide,” “Thinking about suicide makes me feel calm,” “Thinking about suicide makes me feel better,” and “I think about suicide to help myself cope.” Similar to Crane et al. (2014), we found that removing the item “Suicidal thoughts come into my mind but do not bother me” improved Cronbach’s alpha (α without = .90, α with = .84). Therefore, we removed this item from the scale for all analyses. Following recommendations (Revelle & Condon, 2019), we report three estimates of internal consistency: omega hierarchical (ω_h), Cronbach’s alpha (α), and omega (ω). All measures of internal consistency were estimated with the *psych* package (Revelle, 2019). The four-item Comfort from Suicidal Thoughts Scale showed strong internal consistency ($\omega_h = 0.87$, $\alpha = .90$, $\omega = 0.93$).

Self-Injurious Thoughts and Behaviors Interview

In the baseline survey, participants completed a self-report version of the Self-Injurious Thoughts and Behaviors Interview (SITBI; Fox

et al., 2020). The SITBI assesses the lifetime presence and frequency of self-injurious thoughts and behaviors. The SITBI has good test-retest reliability, shown convergent validity, and is widely used in research studies (Fischer et al., 2014; Fox et al., 2020; Nock et al., 2007).

Daily Measures

In the daily survey, various aspects of suicidal thinking were measured. The extent to which participants used suicidal thinking as an affect regulation strategy that day was measured with the single item “Today, how much did thinking about killing yourself help you cope with difficult emotions?” Participants rated this item on a 0 (*not at all*) to 10 (*very much*) scale. The severity of suicidal thoughts was measured with items assessing the desire, urge, and intent to kill oneself. Each item was rated on a 0 (*not at all*) to 10 (*very much*) scale, which was combined to create a suicidal thinking severity score. Desire was defined for participants as “how much do you want to kill yourself.” Urge was defined for participants “how much do you feel like actually killing yourself.” Intent was defined for participants as “to what extent are you actually going to kill yourself.” The three suicidal thinking items were selected based on the Beck Scale for Suicidal Ideation (Beck et al., 1979), a widely used measure of suicidal thinking. Questions pertaining to desire, urge, and intent are similar to momentary measures of suicidal thinking used in other real-time monitoring studies (Gee et al., 2020; Kleiman et al., 2017). Items such as the ones in the current study have shown predictive validity of suicidal behavior (Wang et al., 2021) and convergent validity (Forkmann et al., 2018). To assess the psychometric properties of the suicidal thinking items, we computed multilevel coefficient omega with the R package *multilevel tools* (Wiley, 2020). The three daily suicidal thinking items showed excellent reliability (within $\omega = 0.85$, between $\omega = 0.96$).

Momentary Measures

We assessed suicidal thinking and negative affect in the momentary measures. The severity of suicidal thoughts was measured with items assessing the desire, urge, and intent to kill oneself right now. Items were each on 0 (*not at all*) to 10 (*very much*) point scale (except for momentary suicidal urges, which was accidentally assessed on a 0–9 scale). The three items were combined to create a suicidal thinking severity score. The definitions for desire, urge, and intent were the same as the definitions provided in the daily measures. The three suicidal momentary thinking items showed excellent reliability (within $\omega = 0.85$, between $\omega = 0.95$).

Suicidal thinking at the momentary level was also assessed with an item on verbal suicidal thoughts, which were assessed on every survey by asking, “What best describes the thoughts that you are having right now?” Participants could select one of eight possible responses adopted from (Millner et al., 2015): “I am not having any of these thoughts”; “I wish I could disappear and not exist”; “I wish I was never born”; “My life is not worth living”; “I would be better off dead”; “I wish I was dead”; “Maybe I should kill myself”; and “I should kill myself.”

In the momentary measure, we assessed negative affect with seven affect items: stress, fatigue, self-hatred, anger, agitation, loneliness, and psychological pain. Participants rated how much they felt each affect item on a 0 (*not at all*) to 10 (*very much*) scale. To create

an overall measure of negative affect, we applied a principal components analysis to these seven items. We found that one principal component accounted for 60% of the variance. Although “loneliness” loaded on the first principal component in the same direction as the other items, it loaded in the opposite direction on the second principal component. Therefore, we removed loneliness from the rest of the analyses. We then fit a multilevel confirmatory factor analysis with the R package *lavaan* (Rosseel, 2012). We fit a one-factor model with six affect items as indicator variables. The one factor (at within- and between-person levels) solution showed good model fit (CFI = 0.96, RMSEA = 0.06, 90% CI [0.056, 0.064], SRMR_{within} = 0.03, SRMR_{between} = 0.05). We also computed multilevel coefficient omega for the six negative affect items and they showed excellent reliability (within $\omega = 0.80$, between $\omega = 0.93$). We created a composite negative affect item by summing the six negative affect items.

Follow-Up Measures

In the follow-up survey participants were asked, “how many days in the past 28 days did you have suicidal thoughts?” Participants provided a numeric value ranging from 0 to 28.

Analytic Approach

Do People Report Using Suicidal Thinking as Affect Regulation?

For Aim 1, we computed descriptive statistics of the Comfort from Suicidal Thoughts Scale. We operationalized endorsement of items on the scale as reporting a three or four (out of four). To examine endorsement on the daily measure of using suicidal thinking to cope with difficult emotions, we limited our analysis to days during which participants provided a daily nonzero rating for the desire to kill oneself and the desire to die (total number of days = 1,386).

To examine how endorsement on the daily measure of using suicidal thinking to cope with difficult emotions varies over time, we computed between-person intraclass correlations (ICC). The ICC is an index of the proportion of variance due to between-person versus within-person differences. A higher ICC value indicates less within-person variability and more between-person variability. We estimated the ICC with the *rptR* (Stoffel et al., 2017) with 1,000 parametric bootstraps.

Is the Occurrence of Suicidal Thinking Associated With Changes in Affect?

For Aim 2, we first followed the same analysis as Kleiman, Coppersmith et al. (2018), which was since used in a comprehensive meta-analysis on this topic (Kuehn et al., 2022). We selected pairs of consecutive responses where participants reported suicidal thinking (as operationalized as a nonzero on the sum of desire, urge, and intent to kill self) and then no suicidal thinking (as operationalized as a zero on the sum of desire, urge, and intent to kill self). We only included responses that were within 8 hr of each other. We then ran a multilevel model where time of response, that is, during suicidal thinking [*T*] versus after suicidal thinking [*T* + 1], was a dichotomous predictor and negative affect was the outcome. The model was a three-level model with response pairs nested within

events nested within people. We fit both models with the *lme4* package (Bates et al., 2015).

There are several limitations with this original analysis that we sought to address in the current study. These limitations include timing, generality, and directionality. First, the time lag of 8 hr is a relatively long time window for the effects of suicidal thinking on affect. This window was selected due to the sampling design of the original study (Kleiman, Coppersmith, et al., 2018). We used a data-driven approach for selecting a lag window for the next analysis. Specifically, we used the Differential Time-Varying Effect Model (DTVEM), which is a tool for identifying optimal time lags in intensive longitudinal data (Jacobson et al., 2019). This model explores a range of time lags to identify the lags over which the maximal effects occur. We ran DTVEM with the suicidal thinking sum score predicting the negative affect sum score. The detailed results of the model are presented in the online supplemental material. The model suggested that the largest effects are seen at lags of 2, 4, and 6 hr. The largest effect was at 2 hr ($\alpha = .18$) with effects decreasing at 4 hr ($\alpha = .07$) and 6 hr ($\alpha = .04$). We wanted to balance the magnitude of effects and the availability of the data. We, therefore, examined the number of paired observations where participants went from experiencing suicidal thoughts to not experiencing suicidal thoughts. The number of episodes (i.e., paired observations) and participants in the dataset restricted to less than 4-hr lag was 276 and 66. The number of episodes and participants in the dataset restricted to less than 2-hr lag number of observations and participants was 78 and 33. Therefore, we selected a lag of less than 4 hr as an optimal time lag. To address the issue of timing, we ran the same analysis as Kleiman, Coppersmith, et al. (2018), but only included responses that were within 4 hr of each other.

Another limitation of the original analysis is that it only focused on instances where participants went from having suicidal thoughts to not having suicidal thoughts. Therefore, a possible interpretation of the results is that when suicidal thinking subsides, negative affect subsides as well. To address this limitation, we ran a new analysis.

First, we restricted the dataset to assessments with a lag of 4 hr or less based on the results of DTVEM. We then computed a difference score between negative affect at $t + 1$ and negative affect at t . Higher negative affect at $t + 1$ corresponds to a positive difference score. Lower negative affect at $t + 1$ corresponds to a negative difference score. We then used the verbal suicidal thoughts item (i.e., “What best describes the thoughts that you are having right now?”) to create a dichotomous suicidal thinking variable. If participants endorsed “I am not having any of these thoughts” it was categorized as suicidal thoughts not being present. If participants endorsed any of the seven verbal thoughts, it was categorized as suicidal thoughts being present.

We then ran a multilevel model where difference in negative affect was the outcome and suicidal thoughts (not present vs. present) at t was the predictor. We expected that suicidal thoughts being present at t would result in a larger negative difference score (indicating a reduction in negative affect from t to $t + 1$) than when suicidal thoughts were not present. A limitation of this analysis is that suicidal thinking being present could be confounded with high negative affect. Therefore, a larger reduction when suicidal thinking is present could be due to starting negative affect being higher when suicidal thinking is present at t versus when it is not at t . To address this limitation, we also ran the same analysis selecting only cases where participants experienced elevated negative affect at t . Negative affect

being high at t cannot be the sole explanation of any effects found, because negative affect was high for all participants in this analysis at t . We operationalized elevated negative affect using a median split approach. The median of the negative affect sum score was 23. Therefore, we selected observations where participants initially at t reported negative affect above 22. Once again, we expected that suicidal thoughts being present at t would result in a larger decrease in negative affect than when suicidal thoughts were not present at t .

Finally, the original analysis did not address the issue of directionality. The original analysis only examined how suicidal thoughts are related to negative affect, but it is quite possible that negative affect could affect suicidal thoughts. To understand the bidirectional relationship between suicidal thinking and negative affect, we used multilevel residual dynamic structural equation modeling (ML-RDSEM) in Mplus Version 8.8 (Asparouhov et al., 2018; McNeish & Hamaker, 2020). There are several advantages of ML-RDSEM. First, as an extension of structural equation modeling, ML-RDSEM can be used to estimate reciprocal effects (e.g., the effect of suicidal thinking on negative affect and the effect of negative affect on suicidal thinking) in a single model. Second, ML-RDSEM allows for precise modeling of temporal effects. For example, one can specify the time interval of interest to model in lagged relationships. ML-RDSEM also decreases concerns about stationarity, a common assumption of time-series analysis, by partialing out time trends before modeling other relationships on remaining residuals. Finally, ML-RDSEM uses Bayesian estimation to provide both group- and individual-level model results, including estimates of uncertainty. This estimation provides rich information regarding individual differences and allows for examining between-person heterogeneity in estimates.

Given these advantages, we fit an ML-RDSEM to examine reciprocal relationships between the suicidal thinking sum score and the negative affect sum score. Based on the results of the DTVEM analysis, we modeled lagged relationships over a 4-hr interval. To account for temporal trends, we also included variables indexing day in the study and time of day as predictors of suicidal thinking and negative affect. Suicidal thinking and negative affect were each predicted by themselves (autoregressive effects) and each other (cross-lagged effects) at the previous lag. Suicidal thinking and negative affect were also allowed to correlate with one another at the same time point. All model components were specified as random, meaning they could vary between individuals. The outcomes of interest were the group-level estimates of average within-person relationships, and the proportion of participants with significant paths (indicated by a 95% credible interval that does not contain zero). We hypothesized that there would be a *positive* cross-lagged relationship from negative affect to suicidal thinking, meaning that elevations in negative affect would predict increased suicidal thinking. We also hypothesized that there would be a *negative* cross-lagged relationship from suicidal thinking to negative affect, such that elevations in suicidal thinking would predict decreased negative affect 4 hr later.

Does Using Suicidal Thinking as Affect Regulation Predict Future Suicidal Thinking?

For Aim 3, we ran a series of multilevel models to test whether reports of comfort from suicidal thinking, or using suicidal thoughts

to cope, were associated with higher likelihood or severity of subsequent suicidal thoughts. First, we ran a multilevel model where the Comfort from Suicidal Thoughts sum score from the baseline assessment was a time-invariant (i.e., person-level) predictor of the severity of suicidal thinking in the momentary surveys. Second, we ran the same model except the outcome was the severity of suicidal thinking in the daily surveys. Third, we ran a multilevel model where daily ratings of using suicidal thinking to cope with difficult emotions were the predictor and severity of suicidal thinking the next day was the outcome. Fourth, to test whether using suicidal thoughts to cope predicts increases in suicidal thoughts from 1 day to the next, we ran a multilevel model where using suicidal thinking to cope with difficult emotions and severity of suicidal thinking that day were the predictors and severity of suicidal thinking the next day was the outcome. In all models, the daily ratings of using suicidal thoughts as affect regulation were within-person centered. All multilevel models fit with the *ordinal* package (Christensen, 2019). We used ordinal models because the ordinal nature and skewed distribution of the suicidal thinking severity score violated assumptions of linear regression (Bürkner & Vuorre, 2019; Jacobucci et al., 2021). We used ordinal models with an equidistant threshold and report coefficients in terms of odds ratios.

Finally, we fit a beta regression model where mean ratings of using suicidal thinking to cope with difficult emotions were the predictor and the number of days with suicidal thoughts in the follow-up period (a proportion variable) was the outcome. We also fit the same model with the mean severity of suicidal thinking and number of observations were added as predictors to see if the relationship held when accounting for severity of suicidal thinking and EMA compliance. These models were fit with the *betareg* package (Cribari-Neto & Zeileis, 2010).

Transparency and Openness

The study was not preregistered. All study analysis code and study materials are available on the Open Science Framework at: https://osf.io/9ax5k/?view_only=03cdc180594f4111adce9d3809ca1958. The analysis code provides detailed results for all analyses. The data that study conclusions are based on are not publicly available because the authors do not have IRB permission to publicly post the data. The deidentified data are available from the corresponding author.

Results

Descriptive Statistics

Participants completed, on average, 43.81% of momentary surveys, amounting to 93.05 ($SD = 61.52$) surveys per participant (9,771 total), and 52.92% of daily surveys, amounting to 22.23 ($SD = 14.19$) surveys per participant (2,334 total). The total number of follow-up surveys completed was 63 (60%).

Do People Report Using Suicidal Thinking as Affect Regulation?

The descriptive statistics for the Comfort from Suicidal Thoughts Scale are presented in Table 1. The distributions of each item are presented in the online supplemental material. Nearly half of the participants endorsed “I think about suicide to help myself cope” or “I take

comfort from thoughts of suicide,” whereas more than a quarter endorsed “Thinking about suicide makes me feel better” and “Thinking about suicide makes me feel calm.” In the daily data on days with nonzero suicidal thinking ($n = 1,571$), 77.7% of the time participants endorsed (i.e., nonzero response) that suicidal thinking helped them cope with difficult emotions. Overall, these results suggest that people do report using suicidal thinking as affect regulation.

For understanding variability in using suicidal thinking to cope with difficult emotions, the ICC was 0.59, 95% CI [0.50–0.65]. Thus, 41% of the variability in daily ratings was due to within-person variability. The ICC shows a fair amount of within-person variability. This suggests that the extent that people report using suicidal thinking to help them cope with difficult emotions fluctuates over time.

Is the Occurrence of Suicidal Thinking Associated With Changes in Affect?

Instances of suicidal thinking were followed by decreases in negative affect ($\beta = -6.45, p < .001$) with lags of less than 8 hr. Results are shown in Figure 1. When restricted to lags of less than 4 hr, instances of suicidal thinking were similarly followed by decreases in negative affect ($\beta = -6.29, p < .001$).

Suicidal thoughts being present were associated with larger reductions in negative affect than when suicidal thoughts were not present ($\beta = -2.88, p < .001$). When only examining times when participants started with elevated negative affect, suicidal thoughts being present were still associated with larger reductions in negative affect than when suicidal thoughts were not present ($\beta = -1.38, p = .024$).

Results of the ML-RDSEM model are provided in Table 2 and Figure 2. Supporting our hypothesis, increased negative affect predicted increased suicidal thinking 4 hr later ($\beta = 0.177, p < .001$). The percent of participants in the sample with a significant path for this relationship was 48.6%. However, counter to our hypothesis, increased suicidal thinking predicted increased negative affect 4 hr later ($\beta = 0.207, p < .001$). The percent of participants in the sample with a significant path for this relationship was 61.9%. We also found significant autoregressive effects of negative affect and suicidal thinking. The only significant temporal trend was that negative affect decreased over the study. More detailed information on individual participant estimates are presented in the online supplemental material.

Does Using Suicidal Thinking as Affect Regulation Predict Future Suicidal Thinking?

The Comfort from Suicidal Thoughts sum score predicted both the severity of suicidal thinking in the momentary surveys ($OR = 1.23, p = .002$) and daily surveys ($OR = 1.19, p = .009$), such that higher comfort from suicidal thinking at the beginning of the study predicted more severe suicidal thoughts in the following 6 weeks.

In the daily data, the extent to which participants endorsed using suicidal thinking to cope with negative emotions predicted the severity of their suicidal thinking the next day ($OR = 1.08, p < .001$). There was no significant association with next day suicidal thinking, however, when previous day suicidal thinking was included in the model ($OR = 0.98, p = .424$). Thus, although the

Table 1*Descriptive Statistics of the Comfort From Suicidal Thoughts Scale*

Item	% Endorsed	<i>M</i>	<i>SD</i>	Skew	Range
I think about suicide to help myself cope	45.7	2.1	1.4	−0.24	0–4
I take comfort from thoughts of suicide	40.0	1.9	1.28	−0.28	0–4
Thinking about suicide makes me feel better	31.4	1.7	1.26	0.02	0–4
Thinking about suicide makes me feel calm	26.7	1.6	1.28	0.14	0–4

extent to which participants endorsed using suicidal thinking as affect regulation predicted the absolute severity of next day suicidal thinking, it did not predict changes in the severity of next day suicidal thinking.

Finally, mean daily ratings of using suicidal thinking to cope with negative emotions predicted the number of days with suicidal thoughts in the 1-month follow-up period ($OR = 1.19, p = .006$). Mean daily ratings of using suicidal thoughts as affect regulation, however, did not predict the number of days with suicidal thoughts in the 1-month follow-up period when accounting for severity of suicidal thinking and compliance ($OR = 0.99, p = .924$).

Discussion

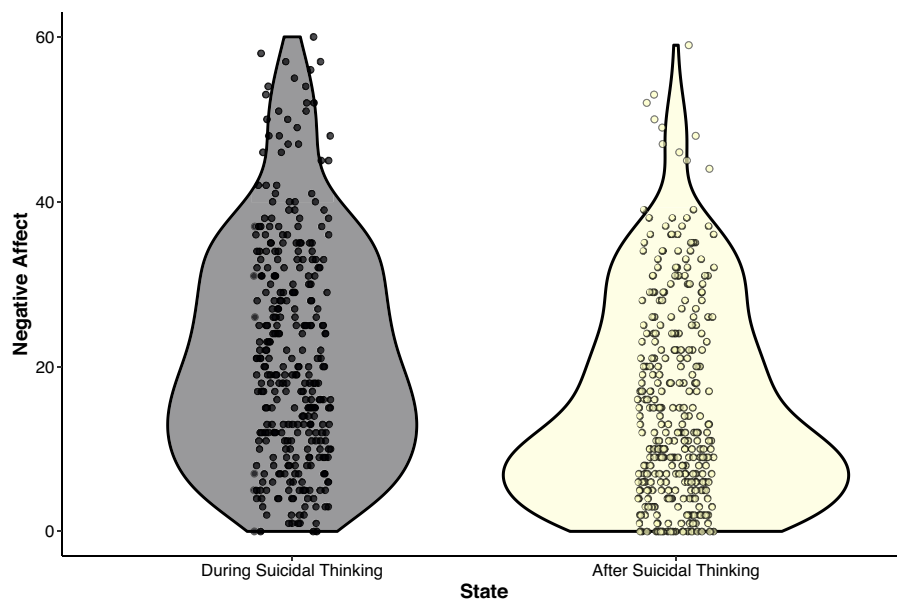
This paper provides new insight into and confirms existing work about the functions of suicidal thinking. There were three key findings. First, participants frequently endorsed suicidal thinking as a form of affect regulation. Second, the occurrence of suicidal thinking was followed by decreased negative affect and negative affect decreased more when suicidal thinking was present versus when it was not—a pattern supporting the possibility that suicidal thinking is reinforcing as seen in prior work (Kleiman, Coppersmith, et al., 2018; Kuehn et al., 2022).

However, the results were not conclusive, as we also found a positive temporal association between severity of suicidal thinking and subsequent negative affect when controlling for temporal and autoregressive effects. Third, self-reported using suicidal thinking as a form of affect regulation predicted the severity and frequency of subsequent suicidal thinking (but not increases in suicidal thinking) across multiple timescales. Each of these findings warrants additional comment.

Across multiple types of measurements, we found evidence that participants endorse using suicidal thinking as a form of affect regulation. The levels of endorsements in both the Comfort from Suicidal Thoughts Scale and daily reports are higher than in previous research (Crane et al., 2014). The difference may be due to prior research being conducted among depressed patients whereas the current sample was not based on diagnosis but on the presence of suicidal thinking. We also found, however, a fair amount of between- and within-person heterogeneity in the endorsement of using suicidal thinking as a form of affect regulation. Questions for future research are why suicidal thinking can be comforting and reinforcing for some people, but not for others or at certain times but not others.

We replicated previous research that found that the occurrence of suicidal thinking was followed by decreased negative affect (Kleiman, Coppersmith, et al., 2018; Kuehn et al., 2022). Additionally, the initial

Figure 1
Changes in Affect During and After Suicidal Thinking



Note. See the online article for the color version of this figure.

Table 2
Results of the ML-RDSEM Examining Reciprocal Relationships Between Suicidal Thinking and Negative Affect

Predictor	Estimate	Posterior SD	95% Credible interval	<i>p</i>	<i>n</i>	%
Outcome: negative affect						
Day	−0.151	0.020	−0.19 to −0.112	0.000	67	63.81
Survey	−0.004	0.008	−0.022 to 0.011	0.327	4	3.81
Negative affect	0.482	0.019	0.44 to 0.515	0.000	93	88.57
Suicidal thinking	0.207	0.014	0.179 to 0.238	0.000	65	61.90
Outcome: suicidal thinking						
Day	0.022	0.022	−0.025 to 0.067	0.137	65	61.90
Survey	−0.006	0.006	−0.021 to 0.002	0.070	0	0.00
Suicidal thinking	0.571	0.020	0.531 to 0.612	0.000	90	85.71
Negative affect	0.177	0.014	0.146 to 0.202	0.000	51	48.57

Note. Estimates are within-level standardized estimates averaged over clusters. *p* = Bayesian *p*-value; *n* = number of participants with a significant path; % = percent of participants with a significant path (positive or negative direction); ML-RDSEM = Multilevel Residual Dynamic Structural Equation Model.

finding persisted when examining a shorter time lag than in previous research. A limitation, however, is that we were only able to attempt to replicate one of the original study's analyses because our study did not include event-contingent reporting (e.g., participants initiating a survey when they are experiencing suicidal thoughts). We also expanded upon the initial findings with additional analyses. We found evidence that negative affect decreases more when suicidal thinking is initially present compared to when it is not, even when focusing on times during which all participants experienced initial elevated negative affect. However, when testing the directionality of the relationship between suicidal thinking and negative affect by accounting for the autocorrelations of suicidal thoughts and negative affect across time, we found a different pattern of results. Specifically, contrary to expectations, we found a positive temporal relationship from suicidal thinking to negative affect. This finding suggests that suicidal thinking may predict increased negative affect, at least across a 4-hr period.

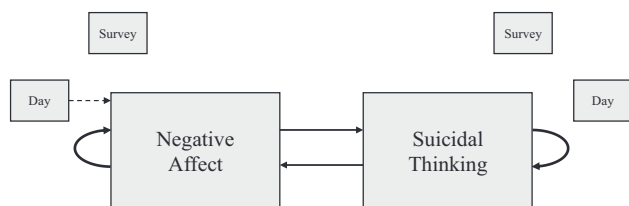
There are several possible reasons for these mixed findings, which also stand in contrast with previous findings in other samples (Kleiman, Coppersmith, et al., 2018; Kuehn et al., 2022). First, the ML-RDSEM analysis focused on a fixed lag of 4 hr, whereas prior analyses in this and other studies largely used unevenly spaced lags. Given what is known about the highly fluctuating nature of suicidal thoughts (Czyz et al., 2019; Kleiman et al., 2017), it is likely that the size and direction of relationships between suicidal thinking and affect will be highly influenced by the frequency at which they are assessed. For example, suicidal thinking might relieve negative

affect in the short term (e.g., over minutes), but not 4 hr later. Additionally, the ML-RDSEM analysis focused on severity of suicidal thinking, rather than presence/absence. Finally, only the ML-RDSEM analysis accounted for time trends and autoregressive effects. Given that we did see small but significant temporal effects (e.g., a tendency for negative affect to improve over the course of the study) and relatively large autoregressive effects, variance in negative affect could be incorrectly attributed to suicidal thinking when these effects are not included. Future research should replicate this analysis and focus on better understanding the directionality and time-scale of the relationship between suicidal thinking and affect using novel designs (e.g., event-contingent reporting) and statistical models (e.g., continuous-time approaches).

Finally, we found that self-reports of using suicidal thinking as a form of affect regulation predicted the severity and frequency of suicidal thinking across multiple measurements and timescales. This supports the idea that the more people regard suicidal thinking as a way to reduce negative affect, the more likely they are to think about suicide in the future. Although some of the effects were small in magnitude, this is a valuable extension of prior work on the functions of suicidal thinking (Crane et al., 2014; Kleiman, Coppersmith, et al., 2018) because it suggests that affect regulation could be one mechanism through which suicidal thinking is maintained. However, two of the associations between the function of suicidal thinking and future suicidal thinking were no longer significant once the severity of past suicidal thinking was accounted for. This indicates that the use of suicidal thinking to regulate affect does not predict increases in suicidal thoughts, but rather indicates the presence of more severe and prolonged suicidal thinking. Further research is needed to better distinguish measures of the functions of suicidal thinking and measures of severity as well as people's own awareness of such functions. Further studies are also required to test whether taking comfort in suicidal thoughts causally leads to more suicidal thoughts, or whether experiencing severe suicidal thinking leads to regarding them as more comforting.

Our research suggests that assessing the functions of suicidal thinking could be a valuable addition to risk assessments (Borges et al., 2019). Currently, functional analysis is often overlooked in assessments in favor of features of suicidal thinking such as the frequency (e.g., number of days) and intent of thoughts (Carter et al., 2017). Furthermore, interventions that target the affect regulation function of suicidal thinking may aid in reducing suicidal thinking

Figure 2
ML-RDSEM Within-Level Standardized Estimates Averaged Over Clusters



Note. Paths for which the 95% credible interval does not contain zero are shown. Solid indicates a positive prospective effect, dashed indicates a negative prospective effect; day = day in the study; survey = survey of the day; ML-RDSEM = Multilevel Residual Dynamic Structural Equation Model.

(Bentley et al., 2017; McCauley et al., 2018). For instance, interventions could specifically focus on offering alternative regulatory strategies, that yield the same effects, as a way to replace suicidal thoughts with more adaptive coping.

There are several notable limitations of this study. First, we only assessed the affect regulation function of suicidal thinking. Similar to other forms of self-injury (Bentley et al., 2014; Coppersmith et al., 2021; Hepp et al., 2020), suicidal thinking may have multiple functions and multiple functions could occur at the same time point. Exploring if there are other functions of suicidal thinking may help explain the between-person heterogeneity observed in the current study. More in-depth momentary functional assessments are a needed area of future research. Another measurement limitation is that only one of the four items in the Comfort from Suicidal Thoughts Scale directly measured intentionally thinking about suicide to regulate affect. Finally, we did not measure other regulation strategies. Assessing other regulation strategies would allow us to test whether suicidal thoughts change affect more (or less) than other strategies.

There are several lines of research that could build on these findings to provide greater specificity and clinical utility. First, it is unclear how this function of suicidal thoughts develops within people. The use of developmental samples and longitudinal designs would be helpful for understanding if and when suicidal thinking begins to serve an affect regulation function. Furthermore, these types of longitudinal studies would be one way to understand if affect regulation is one mechanism that causes suicidal thinking to persist once it onsets (Nock et al., 2018). Second, it is unclear if using suicidal thinking as affect regulation is helpful or harmful. Some researchers have argued that this could be life-saving, such that, ironically, using thoughts about suicide to regulate affect might reduce the likelihood of actual suicidal behaviors (Maltzberger et al., 2010). Others have argued that it could be harmful by facilitating the attribution of positive qualities to suicide (Selby et al., 2007). Future research with large samples should explore if using suicidal thinking as affect regulation increases risk of future suicidal behavior (e.g., suicide attempts). Third, the current study was unable to tease apart the differences between the volitional versus automatic reduction of negative affect. Future research could directly focus on whether suicidal thinking may serve to regulate negative affect through volitional conscious processes or automatic unconscious conditioning.

Suicide is one of the most perplexing aspects of human behavior. The current study highlights the importance of not merely identifying who is at risk for dying by suicide, but also studying what functions suicidal thinking may serve. Better understanding why people think about killing themselves—and more specifically, why suicidal thinking persists—may ultimately advance the prevention of suicidal behavior.

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