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Dynamics of despair: examining suicidal ideation using real-time methodologies

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CHAPTER 01:

Introduction

Introduction

In past times, the act of suicide was often seen as a societal or political statement, unrelated to any internal struggles of the mind. In ancient Rome, *Romana mors*, or “Roman death”, gave people the chance to choose between an honorable and dishonorable death. This path was chosen by army officials facing defeat, aristocrats faced with the prospect of public humiliation, and political opponents facing death or imprisonment (Hill, 2004). How suicide was viewed among commoners is unknown. In this context, suicide was seen as a direct, rational response to external events, and an act that was rarely executed “*while the balance of mind was disturbed*”(Hill, 2004, p. 2). As such, the perception at the time was that the contemplation of suicide was marked by dispassion rather than mental anguish, and that the path to suicide was characteristically direct and straightforward, with a distinctive cause behind it. This conceptualization persisted into the 19th century, with the French philosopher Émile Durkheim in his writings depicting the causes behind suicide to be societal, rather than individual (Berkman et al., 2000; Stack, 2000).

Although honor suicides still exist in certain cultures (see e.g., Russell et al., 2017), in contemporary Western society, suicide is rather understood to arise from a complex interplay of not only societal, but also biological and psychological influences. Meanwhile, the continuum from initial *suicidal ideation* (i.e., thoughts or contemplations of death and suicide (Harmer et al., 2024)) to the final act of suicide is considered to be much broader than depicted in many historical accounts. This complexity and continuity are reflected in many theoretical frameworks of suicidal ideation and behavior, including Rubinstein’s *Diathesis-Stress Model* (Rubinstein, 1986) and Mann’s *Psychobiological Model* (Mann & Arango, 1992), both of which posit that underlying vulnerability (such as genetics, childhood trauma, or maladaptive personality traits) may be activated by current stressors (such as adversity or illness) to produce suicidal ideation. Further psychological and physiological processes, still, are needed to understand how an individual may experience the transition from suicidal ideation to behavior, as depicted by the *Interpersonal Psychological Theory of Suicide (IPTS)* (Van Orden et al., 2010). These processes may include, for example, reduced fear of death and increased physical pain tolerance. The necessity for such *capability for suicide* is also highlighted by the *Integrated Motivational-Volitional (IMV) Model of Suicidal Behavior* (O’Connor & Kirtley, 2018). This model details that access to means and planning of the suicidal act are necessary prerequisites to suicidal behavior. As such, determinants of suicidal ideation and behavior may be dependent on the stage of the suicidal process.

As depicted above, stressful life events (Choi et al., 2023; Classen & Dunn, 2012; Næss et al., 2021) and psychiatric illness (Bostwick & Pankratz, 2000; Isometsä, 2014; Lynch et al., 2020; Paris, 2019) are predictors of suicidal ideation and behavior. While these predictors may increase the risk of suicidal ideation in general, more proximal experiences determine changes in the level of ideation in the present. These experiences include, for example, maladaptive cognitions such as hopelessness, loneliness and burdensomeness (Ribeiro & Joiner, 2009; Van Orden et al., 2010). Hopelessness, specifically, has a characteristically central role in the suicidal mind (Beck, 1990; Ribeiro et al., 2018). Such maladaptive cognitions also form the crux of the IPTS (Ribeiro & Joiner, 2009; Van Orden et al., 2010), which describes how feelings of disconnection, loneliness and burdensomeness may stem, for example, from recent negative life events such as the loss of employment, important relationships, or health. More distal forces (such as traumatic life events) therefore interact with current cognitive and psychological processes in the emergence of suicidal thought (Bryan & Rudd, 2016; Rudd, 2006; Rudd et al., 2006).

More recently, dynamic cognitive-emotional and behavioral processes, such as emotional dysregulation (Turton et al., 2021), insufficient or maladaptive coping (Ong & Thompson, 2019), and dysregulated sleep (Allen et al., 2019; Bernert et al., 2007, 2017), have also been implicated in suicidal crises. These disturbances may again be caused by external events (Baumeister et al., 2002; Dvir et al., 2014) as well as by existing psychopathology (Franzen & Buysse, 2008; Sansone & Sansone, 2010; Turton et al., 2021). Models of the transition from ideation to action also highlight the influence of dynamic and proximal, rather than static and distal risk factors. Such a division is made in the *Fluid Vulnerability Theory* (Rudd, 2008), which states that it is this distinction that differentiates between chronic and acute suicide risk. That is, as one moves closer to the act of suicide, more dynamic and proximal processes (such as ongoing disturbances in cognition, affect, or behavior) become increasingly important, instead of more static and chronic risk factors, such as history of trauma or long-term psychiatric illness (Berman, 2018; Bryan & Rudd, 2016). Considering the low base rate of suicide among individuals with these chronic risk factors, increased focus on proximal determinants within these populations may be necessary to differentiate those most at risk in the near term (Rudd et al., 2006). Taken all together, suicidal ideation may arise from a combination of dynamically interactive influences stemming from early vulnerability, recent stressors, and ongoing cognitive-psycho-behavioral processes. For example, when daily life stressors overwhelm someone with neurodevelopmental vulnerability and current mental

health struggles (see **Case Study 1**), or when a series of recent adverse events chips away at the resilience of someone with a history of early trauma (see **Case Study 2**).

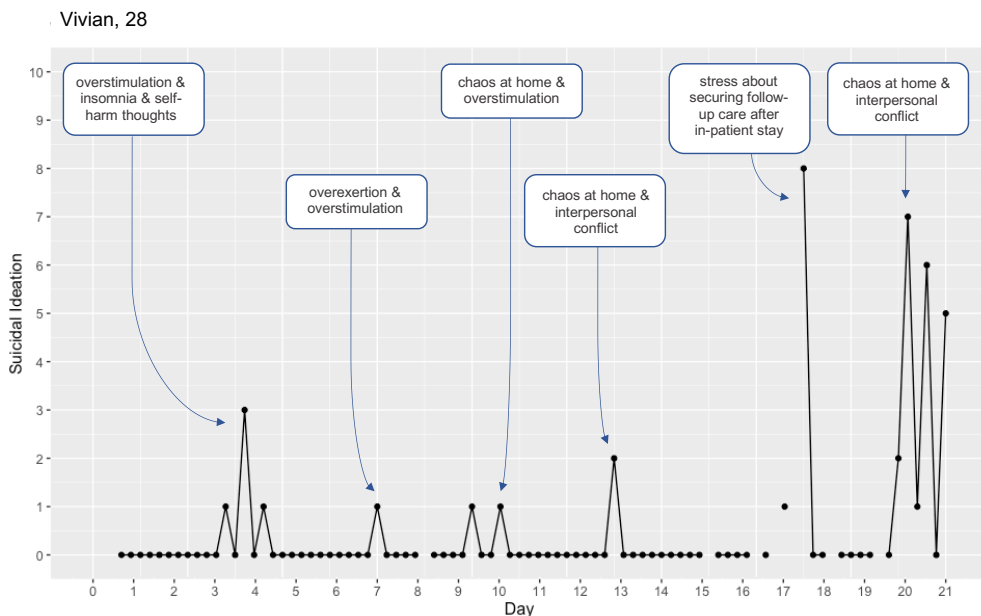
Meanwhile, the progression from ideation to action is far from a quick jump (Anestis et al., 2014) (see **Case Study 3**), and further includes the transition from more passive suicidal ideation (“I don’t want to be alive anymore”), to more active suicidal thoughts (“I want to kill myself”), and intent (“I *will* kill myself”). The final stages of suicidal ideation further require additional steps including the planning of the exact suicidal act (Wastler et al., 2023; Witte et al., 2006), and other preparations thereafter (O’Connor & Kirtley, 2018). Still, most individuals experiencing suicidal ideation will ultimately not attempt or die by suicide (Nock et al., 2008), even after progressing to the later stages of ideation. Instead, individuals may continue to experience thoughts of death or suicide over months, years, or even decades (Borges et al., 2008), severely affecting quality of life. This makes suicidal ideation, in itself, a distinct and pervasive disturbance, and one worthy of continued research attention.

Case Study 1: Vivian, 28

Vivian, 28, lives in a large city in the Netherlands. Typically, she lives together with her husband and two children, but currently she is completing a 6-month in-patient treatment program following a recent diagnosis of Autism Spectrum Disorder (ASD). While she has trained as an executive assistant, she is currently on occupational disability. In addition to her ASD diagnosis two years prior, she was also more recently diagnosed with Attention Deficit Hyperactivity Disorder (ADHD). In her teens, she was misdiagnosed with Borderline Personality Disorder (BPD) due to her frequent emotional outbursts resulting from ASD-related overstimulation, as well as history of chronic suicidal ideation. A diagnostic clinical interview further indicated that Vivian met criteria for both current and past Major Depressive Disorder (MDD), and confirmed the absence of BPD. Currently, Vivian is taking selective norepinephrine reuptake inhibitor (SNRI) medication for her ADHD, as well as benzodiazepines and quetiapine (an anti-psychotic) for sleep issues. Vivian reports having struggled with suicidal thoughts “her whole life – I always thought that if things get really bad, I can always kill myself.” She describes engaging in suicidal ideation as a form of coping and escapism. She also has a history of three prior suicide attempts that resulted in hospital admissions. Previously, her attempts to seek help for

her suicidal crises often went unaddressed by mental health professionals who labeled her behavior as attention seeking due to her previous BPD diagnosis.

As part of the SAFE study, Vivian records her suicidal ideation and associated mood, thoughts, and behaviors for three weeks using a mobile phone application. Following the assessment period, Vivian attends a meeting during which she receives a summary report of her data. The report indicates that Vivian predominantly experienced mild and infrequent suicidal ideation. Correspondingly, Vivian indicates that her suicidal ideation has substantially improved after starting treatment. Lately, her suicidal ideation predominantly consists of fleeting thoughts, whereas previously her ideation was obsessive and pervasive. Most of these momentary instances occurring at the treatment facility typically happened late at night when Vivian was unable to sleep. These sleepless moments usually followed a day of being overstimulated due to high external demands and sensory input, which made Vivian feel overwhelmed. In these moments, Vivian reported “getting stuck --- stuck in my head”, and falling back into old patterns of thoughts of self-harm and suicide. In these moments, she relied on her medication as well as coping strategies acquired as part of Dialectical Behavioral Therapy (DBT) to prevent her ideation from intensifying or escalating.



While at home, Vivian's suicidal ideation was often triggered by chaotic environments and changing plans, which further lead to conflict with her husband, and outbursts by her children. When Vivian received her own ASD diagnosis two years prior, her two children also received the same diagnosis. Now, in instances where her children struggle with their triggers, Vivian's own related difficulties hinder her ability to optimally respond to her children. These instances make her feel increasingly overwhelmed, overstimulated, and further escalate chaos at the family home. After these instances, Vivian frequently finds herself lying in bed late at night, unable to sleep, stuck in negative thoughts.

Lately, Vivian has been increasingly worried about the end of her in-patient treatment program and securing follow-up care, and concerned about her return to the family home full time. She is especially worried about the family's financial status, and is currently waiting on a decision from social services regarding the extension of her disability leave and benefits – a process that is both slow, and discouraging.

Note: Certain identifiable characteristics have been changed to protect the anonymity of the individuals depicted in the case studies.

Temporal Dynamics of Suicidal Ideation

Long-Term Course Suicidal ideation can be highly persistent, but also substantially variable over time. Approximately 30% of individuals with significant suicidal ideation can be characterized as having persistent suicidal ideation (Kivelä et al., 2019; Smith et al., 2020; Wilcox et al., 2010), and may continue to experience ideation over a decade (Borges et al., 2008), or beyond. However, even when persistent, the level of ideation can vary over time, and be separated by periods marked by the absence of suicidal desire (Borges et al., 2008). Suicidal ideation has been characterized as varying in a “waxing and waning manner” (Oquendo & Baca-Garcia, 2014), fluctuating in both intensity and changing in composition (i.e., the degree of passive vs. active ideation or intent). Indeed, most people (>75%) with chronic suicidal ideation tend to report ideation intermittently rather than consistently, when followed over many years (Handley et al., 2013). Suicidal ideation characteristically tends to re-emerge at times of psychological pain or hardship (Handley et al., 2013), and may be accompanied by relapses in other psychiatric conditions, such as depression (Kivelä et al., 2019; Williams et al., 2006).

However, people may also continue to struggle with suicidal thoughts throughout remission from other mental health conditions (Heuschen et al., 2022), and not all people reporting suicidal ideation or behavior present with a diagnosable mental disorder (Milner et al., 2013). For example, remitted depressed patients with a history of suicidal ideation during a previous depressive episode present with a cognitive profile characterized by hopelessness and a heightened likelihood of experiencing suicidal thoughts when experiencing low mood, even during times of recovery (Antypa et al., 2010).

Predicting Risk Due to the diversity in risk factors and the multitude of potential pathways to eventual suicide, making assessments of an individuals' risk status remains a challenge to both mental health professionals as well as researchers. Based on two meta-analyses of longitudinal cohort studies of suicide risk published in 2017 and 2016, respectively, the authors of the two studies conclude that little improvement in prediction accuracy has been achieved over the past five decades of research (Franklin et al., 2017; Large et al., 2016). Further, they estimate that based on risk assessments performed in accordance with the currently established risk factors, 95% of individuals labelled as high-risk will eventually not die by suicide, whereas up to 50% of suicide mortality emerges from populations thought to be low-risk (Large et al., 2016). The authors propose that one reason for this poor predictive value of established risk factors is the lack of knowledge about the short-term dynamics of suicidal ideation, as less than 1% of the reviewed literature had focused on a timeframe of a month or less (Franklin et al., 2017). Therefore, our understanding of the days and hours leading up to suicidal crises has largely remained in the dark, at least with regard to the evidence provided by systematic empirical research, even though clinicians have long recognized the importance of this time period. A third review at the time concluded that *"the current state of affairs [in suicide research] is the consequence of our failure to explicitly consider the temporal dynamics that characterize various risk factors"* (Bryan & Rudd, 2016) (p. 22). That is, what exactly leads to the emergence or heightening of suicidal ideation in critical moments? And to what extent do these *warnings signs* – that is, factors indicating imminent changes in someone's risk status (Rudd, 2008; Rudd et al., 2006) – differ from the well-known, chronic risk-factors identified through the vast literature of past longitudinal studies? A better understanding of these more immediate, temporal indicators requires a switch in perspective from the distal to the proximal.

Short-Term Variability Although much neglected until recent years, initial reports about the short-term dynamics of suicidal ideation exist from two decades ago. Witte and colleagues (2006) were among the first to describe such patterns, reporting

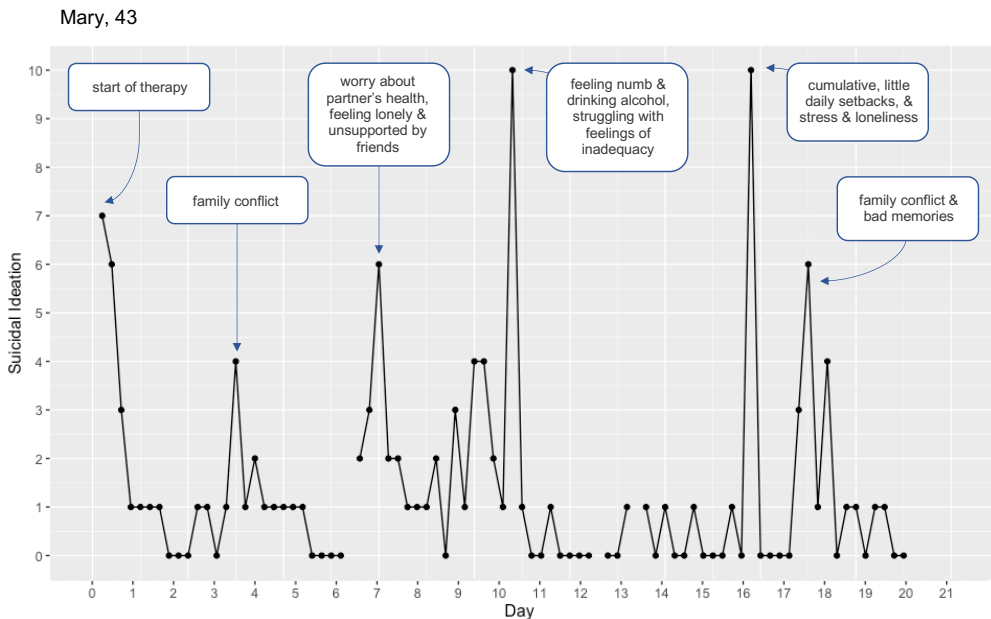
that the short-term course of suicidal ideation was neither stable nor linear, rather exhibiting a significant amount of variation from one day to the next. Prior to this, suicidal ideation had been thought to remain rather stable over the short-term period (days, weeks, and even months). This was based on findings such as that the test-retest reliability of widely used suicidal ideation measures (incl. the Suicide Probability Scale, SPS) is rather high (ranging from $\alpha = .94$ after 10 days to $\alpha = .70$ after 6 months) (Cull & Gill, 1995). However, such measures will invariably *remove* any evidence of short-term variability, focusing instead on average scores over extended time periods (i.e., typically a week or more) (Witte et al., 2006). Instead, since then it has been found that *“daily variability in suicidal ideation appears the norm, rather than the exception”* (Witte et al., 2006, p. 1038). Further, it has been demonstrated that variability in suicidal ideation is higher in suicide attempters than non-attempters – and *highest* in those with a history of multiple attempts (Witte et al., 2006). Subsequently, it has been proposed that suicidal ideation variability may represent a distinctive risk factor for future suicidal behavior (Witte et al., 2006). Although such declarations still warrant further research, it appears that suicidal ideation variability is a potentially relevant, and until recently largely unexplored, characteristic of ideation. As such, it may be relevant to consider variability alongside other suicidal ideation characteristics, such as its overall severity. Highly variable suicidal ideation, it is argued, may be perceived as more distressing by individuals than a chronically high level of ideation (Witte et al., 2005, 2006). Indeed, highly labile emotions tend to be perceived as more intense, and more frequent, than emotions that are more stable over time (Diener et al., 1991; Diener & Larsen, 1984). Finally, similar variability has been observed in the two best-known correlates of suicidal ideation: depressive symptoms and hopelessness (Witte et al., 2006). These findings represent the first indicators that known longitudinal suicide risk factors may also be synergistically involved in the short-term occurrence of suicidal ideation.

Case Study 2: Mary, 43

Mary, 43, grew up in France, but now lives alone in a Dutch town. She has recently experienced a number of significant adverse life events: she was let go from her long-term job and is currently unemployed, and a year prior, her husband suffered a stroke that left him hospital-bound and with limited communicational capabilities. Following these stressful events, Mary sought therapy for her trauma and associated depression. However, this experience has left her increasingly distressed, as she felt like the therapist that she saw was frightened by her experiences and emotions. This has left Mary feeling increasingly helpless. Furthermore, in conversations with her previous therapist, Mary had disclosed of her suicide plan. She describes this as a backup plan, one to be put into action in the future if the situation called for it, but one that she had no immediate plans to enact. However, after sharing these thoughts with her therapist, she now feels like that plan is no longer available to her, making her feel even more hopeless, trapped, and without the possibility of escape. Mary reports that her therapist had diagnosed her with Complex Post-Traumatic Stress Disorder (C-PTSD) and Major Depressive Disorder (MDD). She had also previously been diagnosed with PTSD in her teens due to childhood trauma, and has struggled with problematic alcohol use in recent years.

As part of the SAFE study, Mary records her suicidal ideation and associated mood, thoughts, and behaviors for three weeks using a mobile phone application. Following the assessment period, Mary attends a meeting during which she receives a summary report of her data. The report indicates that Mary, on average, experienced frequent mild-to-moderate suicidal ideation, with a few distinctive peak moments. Her experiences of suicidal ideation were characterized by increased feelings of loneliness and hopelessness, and decreased optimism, such as following her recent experience with her previous therapist. However, Mary also reported feeling numb and disconnected from her emotions: “I know I am sad, I have an indescribable grief with me every minute of the day. And I am also well aware of my loneliness. But I barely feel it.” Following her husband’s stroke, Mary is also cognizant that she has been secluding herself and struggles to reach out to friends, after feeling like her friends were initially unsupportive following the stroke.

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During the assessment period, Mary also reports a number of stressful life events, including a medical setback concerning her husband, as well as reconnecting with her family. She calls her family dynamics “disturbing”. However, Mary’s peak suicidal ideation moments appeared to occur following multiple, compounding, but relatively lower-level stressors during the day, such as small daily setbacks, reminders of painful past experiences, and discouraging news about her husband’s situation. In these moments, Mary was also more likely to reach for alcohol and cigarettes to regulate her mood, although she had recently stopped using both substances.

Note: Certain identifiable characteristics have been changed to protect the anonymity of the individuals depicted in the case studies.

Technological Advancements in the Study of Suicidal Ideation

Ecological Momentary Assessment (EMA) Since the initial studies using daily symptom measures on paper-and-pen diaries (Witte et al., 2005, 2006), the expansion of consumer-based technology (mobiles phones, tablets, and wearables such as

smartwatches) has provided new avenues for the naturalistic collection of data related to suicidal ideation in daily life (Gratch et al., 2021; Myin-Germeys et al., 2009; van Berkel et al., 2018). What was once referred to as “diary studies” is now called *Ecological Momentary Assessment (EMA)*, comprising research methods where participants provide data on their experiences as part of their everyday lives, in real-time, and most frequently via the help of a mobile phone app (Shiffman et al., 2008). In addition to having increased convenience to the user (who does not need to carry additional paper diaries with them) such sampling methods also work to reduce retrospective completion of entries, instead focusing fully on the participant’s immediate, momentary experiences. As such, EMA has the potential to provide data characterized by both high reliability as well as ecological validity (Bos, 2021; Myin-Germeys et al., 2009; Shiffman et al., 2008). Through such mobile phone apps, participants may track their suicidal ideation, and input data on related risk and protective factors and other daily occurrences as they happen. This mode of data collection is especially relevant for examining the types of proximal and/or dynamic predictors that may either be forgotten in the retrospect (if present only momentarily), or under- or overreported (if highly variable). Such predictors may include, for example, affect dynamics (Gross, 2002; Trull et al., 2015), cognitive appraisal (Van Orden et al., 2010), or changes in sleep (Bernert et al., 2017).

While a more comprehensive review of the literature on EMA in suicide research is provided in **Chapter 2**, a few pioneering studies are described here. Prior to the broader application of EMA in suicide research, the feasibility and safety of using EMA in populations with suicidal ideation were first examined (Husky et al., 2014). This revealed high compliance and agreement to participate, signaling that EMA is well-accepted and -tolerated in this population. EMA was also declared safe, after no reactive effects on either negative affect or suicidal ideation were found in response to the measures. While the application of EMA is growing rapidly, however, a closer examination of potential *iatrogenic* (i.e., negative reactive) effects is warranted. As an extension to these findings, we examine the acceptability, feasibility and safety of EMA, as well as participants’ subjective experiences as relating to completing such assessments, in **Chapter 3**.

The short-term dynamics of suicidal ideation and its risk factors hopelessness, loneliness and burdensomeness were also examined through EMA (Kleiman et al., 2017). In line with the early findings reporting substantial day-to-day variability in suicidal ideation (Witte et al., 2006), similar variability was also found within-days (Kleiman et al., 2017). Further, the finding that known suicidal ideation risk factors exhibit similar variability in tandem with suicidal ideation was replicated (Kleiman et al., 2017). Subsequent studies have replicated findings on these temporal patterns both between- (Czyz et al., 2019) and

within-days (Hallensleben et al., 2018; Rizk et al., 2019), and have examined the role of additional suicidal ideation risk factors, such as anger (Armey et al., 2020) and aggression (Ben-Zeev et al., 2017), emotion regulation (Rizk et al., 2019; Victor et al., 2019), and coping (Czyz et al., 2020; Stanley et al., 2021). Due to the multitude of suicide risk and protective factors, as well as the need to consider multiple, interacting risk factors in predicting suicidal ideation, studies examining broader arrays of such factors concomitantly are needed. In **Chapter 4**, we contribute to this literature by examining the cognitive-affective antecedents and consequences of real-time suicidal ideation, and model these interconnections using network analysis (Borsboom et al., 2021). Further, in **Chapter 5**, we extend these predictors to include sleep parameters.

More recently, increased temporal variability in suicidal ideation was found to increase future suicide risk, similar to the early findings indicating heightened suicidal ideation variability among those with a history of suicidal behavior (Witte et al., 2006). Specifically, higher variability in suicidal ideation (as measured with EMA during hospitalization) was found to associate with an increased risk of suicide attempt in the month post-discharge (Wang et al., 2021). While promising, these early findings warrant replication, especially over longer time intervals. In **Chapter 6**, we examine subtypes (i.e., *digital phenotypes*) of suicidal ideation based on momentary suicidal ideation dynamics (including intensity, frequency, and variability of ideation), and further examine if these characteristics can be used to predict the risk of suicide attempt over 12-months.

Actigraphy Together with the growing use of EMA in suicide research, further strides have been made to employ additional real-time monitoring techniques, especially those able to obtain objective data on suicide warning signs. Specifically, *actigraphy*, used to collect real-time data on sleep, activity patterns, and light exposure (Ancoli-Israel et al., 2015; Sadeh, 2011), has recently been implemented in suicide research. Sleep specifically has relevance as a potential warning sign for suicide, as prior studies have demonstrated that sleep disturbances outperform depressive symptoms in explaining current suicidal ideation (Bernert et al., 2007), as well as in predicting ideation in the short-term (Bernert et al., 2017). The identification of overt and objective indices of suicide risk also provides opportunities for outside intervention if such signs are noticed by mental health professionals or close others. This is especially relevant as those planning suicide in the near-term may often explicitly deny having suicidal intent (Berman, 2018), making it crucial to understand external signs that may signal imminent risk. Current sleep problems, which may be present in over 75% of cases of recent suicide deaths (Berman, 2018), may represent such a sign. To test this hypothesis, we examine the value of

actigraphic sleep registration in predicting short-term changes in suicidal ideation in
Chapter 5.

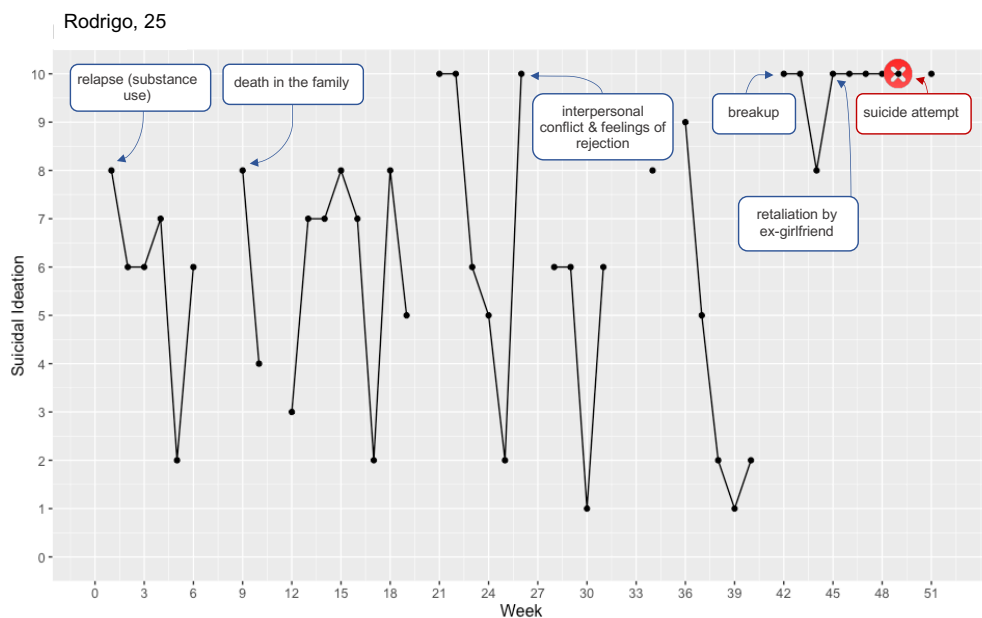
Case Study 3: Rodrigo, 25

Rodrigo, 25, is from Southern Europe and is currently completing an internship in the Netherlands. Throughout his life, he has struggled with emotional dysregulation, and in his early twenties, received diagnoses for both Borderline Personality Disorder (BPD) and Bulimia Nervosa (BN). A diagnostic clinical interview further indicated the presence of current Post-Traumatic Stress Disorder (PTSD), and past substance dependence issues. For his symptoms, Rodrigo is currently prescribed with anti-psychotic medication and antidepressants (a selective serotonin reuptake inhibitor, SSRI). Rodrigo also reports four prior suicide attempts, with the latest occurring approximately 12 months ago.

As part of the SAFE study, Rodrigo records his suicidal ideation and associated mood, thoughts, and behaviors for three weeks using a mobile phone application. Following the assessment period, Rodrigo attends a meeting during which he receives a summary report of his data. The report indicates that Rodrigo experienced frequent suicidal ideation that varied in intensity from mild to severe, often changing drastically from once assessment point to the next. During this time period, Rodrigo was impacted by disagreements with his girlfriend and family, and specifically struggled with feelings of rejection and fears of abandonment when he felt growing disconnection from his girlfriend. These events also corresponded with Rodrigo's peak-intensity suicidal ideation moments, and were associated with feelings of sadness and hopelessness, and to a lesser degree, anger and shame. Rodrigo also reported struggling with overeating and overspending.

Following the three-week daily assessment period, Rodrigo continues to log his experiences through the app once per week over the following 12 months. Over the course of the year, Rodrigo reports a number of additional stressors, including the death of a close family member, experiences of discrimination, dysfunctional dynamics with his girlfriend, and conflict with family members. During this time, he also experiences a relapse with his substance use, receives a diagnosis of Major Depressive Disorder (MDD), and gets prescribed sedative-hypnotic medication for his struggles with insomnia. Additionally, in his app entries he reports using other prescription and recreational

substances, such as benzodiazepines, amphetamines, and cannabis. At the time, he writes: “I bought [dextroamphetamine pills] just for fun to have. I don’t have any intentions of killing myself with it. I just like to feel the control of knowing I can do whatever I want if I want to”. Rodrigo meets regularly with his psychologist and psychiatrist during this time.



In the following months, Rodrigo undergoes a breakup with his girlfriend. Afterwards, he professes fears about his ex-girlfriend breaking into his apartment to damage his property, and reports that his ex-girlfriend was spreading rumors about him to his friends and family. This led Rodrigo to feel increasingly isolated from people close to him. Rodrigo also discloses a past history of his girlfriend being violent, further fueling his fears of potential retaliation following the breakup. Subsequently, Rodrigo grows increasingly reliant on substances, and reports turning to food, cigarettes, and sex as forms of coping with his increasing distress. He also reports feeling increasingly manic and obsessive. Two weeks later, Rodrigo attempts suicide and spends a period of time in an intensive care unit, and subsequently in an in-patient treatment facility.

Note: Certain identifiable characteristics have been changed to protect the anonymity of the individuals depicted in the case studies.

The SAFE Study – Suicidal ideation Assessment: Fluctuation monitoring with Ecological momentary assessment

The SAFE study (Suicidal ideation Assessment: Fluctuation monitoring with Ecological momentary assessment) was designed to 1) examine the short-term (hourly, daily) course of suicidal ideation and its associated predictors, and to 2) study the long-term (weekly, monthly) trajectory of ideation, and risk factors precipitating suicide attempts in the prospective. *Figure 1* presents a graphical overview of the SAFE study.

The target population for the study comprised individuals with a past-year history of active suicidal ideation (Columbia Suicide Severity Rating Scale (CSSRS) (Posner et al., 2011) score of ≥ 3 , or ≥ 2 if symptoms were present in the past two months) and/or a suicide attempt, therefore capturing individuals with varying levels of severity of ideation. During initial intake proceedings, participants completed in-depth clinical interviews and symptom questionnaire measures of current psychopathology and past history of suicidal ideation and behavior. During the first part of the study, a **21-day assessment period** with EMA and actigraphy, participants completed four daily prompts on their mobile phone (*Figure 2a*), capturing reports of suicidal ideation, as well as associated behavioral (activity, social contact, coping, substance use, sleep), affective (positive and negative affective states) and cognitive (positive and negative thoughts) risk factors. Additionally, participants wore an actigraphy watch (*Figure 2b*) that measured their sleep and activity levels throughout the day and night. After the daily assessment period, participants could receive a summary report of their data, detailing observed patterns with regard to high/low-risk suicidal ideation moments in their daily life, aimed at increasing the individual's insights about the dynamics of their ideation (as described in *Case Studies 1-3*). Following the daily assessment period, participants continued into a **1-year monitoring period**, during which they continued to report on their suicidal ideation and associated experiences through the mobile phone app, now additionally including reports of depressive symptoms as well as the occurrence of suicide attempts. An overview of all measures completed by the participants over the course of the study is included in the Appendix.

Following the introductory **Chapter 1** and a systematic review of the literature in **Chapter 2**, **Chapters 3-6** in the dissertation present findings from the SAFE study: **Chapters 3, 4 and 5** report findings from the 21-day assessment period, and **Chapter 6** also includes data from the 1-year monitoring period. Finally, **Chapter 7** provides a discussion of the works presented, the strengths and limitations of the methodologies used, as well as directions for future research and clinical practice. *Figure 3* presents a

graphical depiction of the contents of the dissertation and themes discussed in each chapter.

Figure 1. A Graphical Overview of the SAFE Study (Suicidal ideation Assessment: Fluctuation monitoring with Ecological Momentary Assessment)

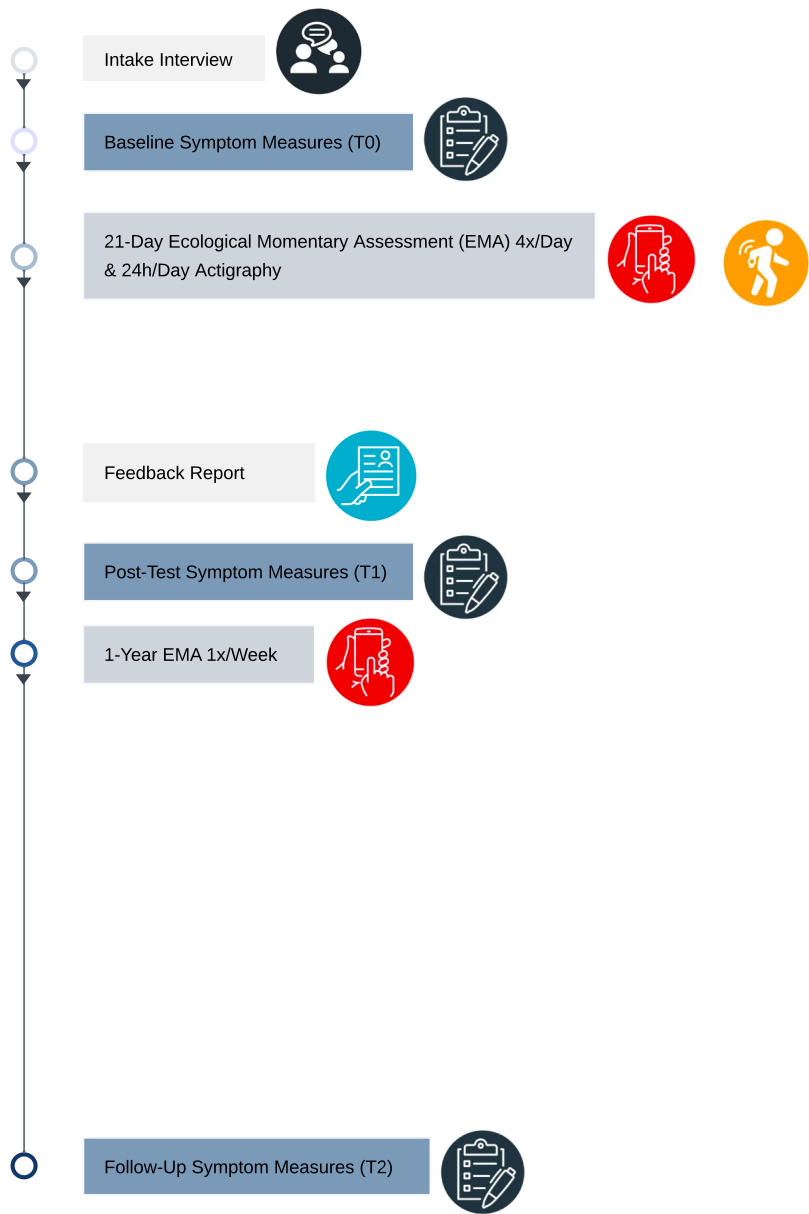
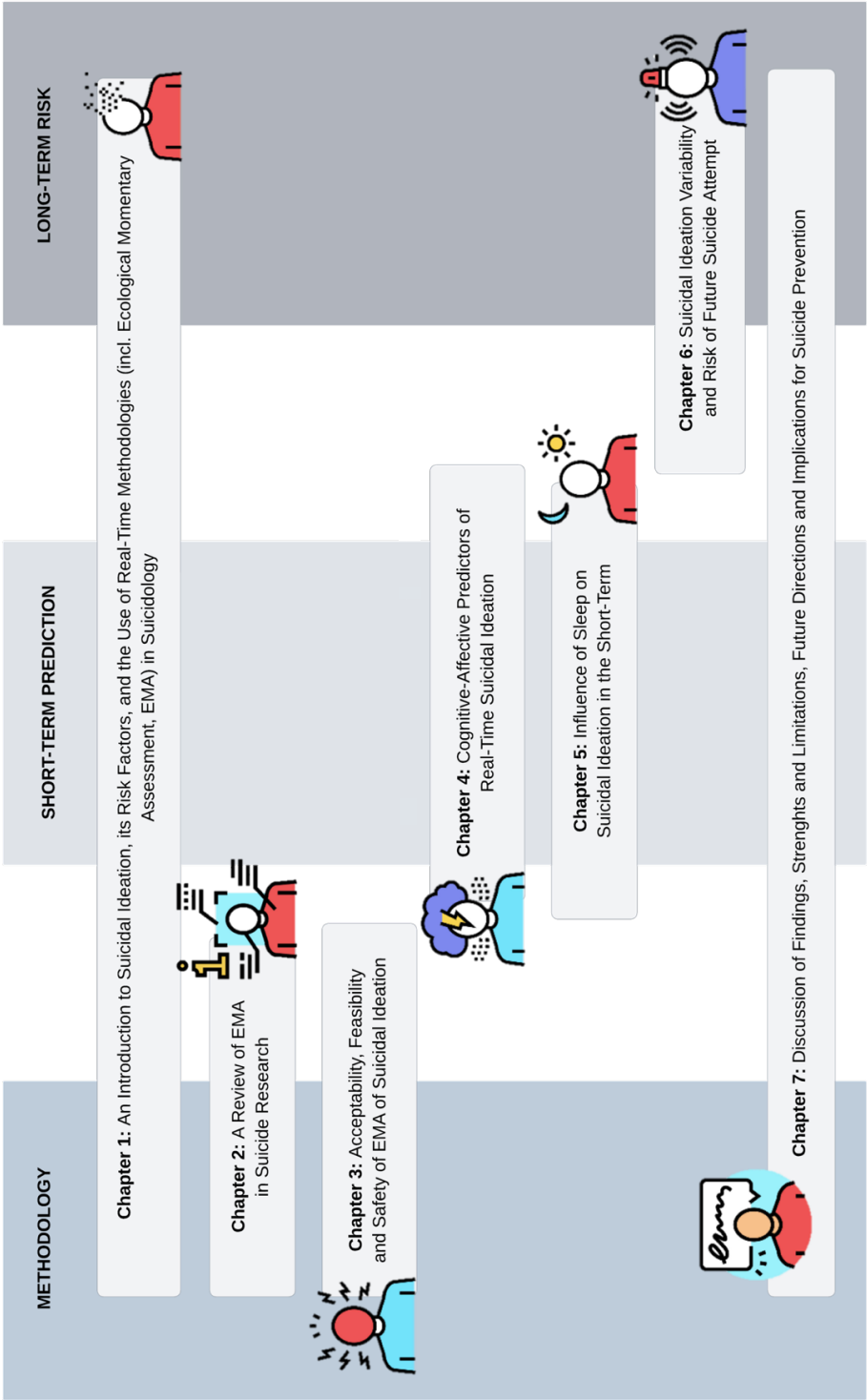


Figure 2. Visualizing the Use of the Ecological Momentary Assessment (EMA) Application (left) and Actigraphy Device (MotionWatch 8 ©) (right)



Figure 3. A Graphical Depiction of the Chapters in the Dissertation



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Appendix

Table S1. An Overview of the Measures Included in the SAFE study (Suicidal ideation Assessment: Fluctuation monitoring with Ecological Momentary Assessment)

INSTRUMENT	CONSTRUCT	SOURCE
INTAKE INTERVIEW	Sociodemographics	Interview
	Past & current psychiatric diagnoses	Mini-International Neuropsychiatric Interview (M.I.N.I. version 5.0) (Sheehan et al., 1998) & Structured Clinical Interview for DSM-5 Personality Disorders subscale for Borderline Personality Disorder (SCID-5-PD-BPD) (First, 2015)
	Physical illness	Interview
	Medications	Interview
	Suicidal ideation & attempt history	Columbia Suicide Severity Rating Scale (CSSRS) (Posner et al., 2011)
BASELINE QUESTIONNAIRES (T0)	Suicidal ideation	Beck Scale for Suicide Ideation (BSSI) (Beck et al., 1979)
	Depressive symptoms	Beck Depression Inventory (BDI-I) (Beck, 1961)
	Anxiety symptoms	Hamilton Anxiety and Depression Scale – Anxiety Subscale (HADS-A) (Hamilton, 1960)
	Insomnia symptoms	Insomnia Severity Index (ISI) (Morin et al., 2011)
	Borderline personality traits	Personality Assessment Inventory – Borderline Scale (PAI-BOR) (Morey, 1991)
	Trait anger	State-Trait Anger Expression Inventory – Trait subscale (STAXI-T) (Lievaart et al., 2016)
	Cognitive reactivity	Leiden Index of Depression Sensitivity – Revised (LEIDS-R) (Solis et al., 2017)
	Quality of life	Quality of Life Enjoyment and Satisfaction Questionnaire –

		Short Form (Q-LES-Q-SF) (Endicott et al., 1993)
ECOLOGICAL MOMENTARY ASSESSMENT (EMA) – 21 DAYS	Location, social contact & current activity	Adapted from Husky et al. (2017) (see Chapter 3 - Appendix for full list of EMA items)
	Positive & negative affective states	Adapted from the Positive and Negative Affect Scales (PANAS) (Watson et al., 1988)
	Cognitions	Adapted from the Interpersonal Needs Questionnaire (INQ) (van Orden et al., 2012)
	Suicidal ideation & acquired capability	Adapted from the BSSI, CSSRS and Acquired Capability for Suicide Scale (ACSS) (Ribeiro et al., 2014)
	Impactful events	Adapted from Chaudhury et al., (2017)
	Coping	Adapted from Chaudhury et al., (2017)
	Substance use	Adapted from Jahng et al. (2011)
	Sleep	Adapted from the Consensus Sleep Diary – Morning section (CSD-M) (Carney et al., 2012)
ACTIGRAPHY	Sleep	MotionWatch8® (CamnTech, Cambridge, UK) (Falck et al., 2019, 2020, 2021)
	Activity	“
	Light exposure	“
POST-TEST QUESTIONNAIRES (T1)	Suicidal ideation	“
	Depressive symptoms	“
	Anxiety symptoms	“
	Insomnia symptoms	“
	Participant feedback on EMA/actigraphy	Custom questionnaire (see Chapter 3 - Appendix)
ECOLOGICAL MOMENTARY ASSESSMENT (EMA) – 1 YEAR	Positive & negative affective states	“
	Cognitions	“

	Suicidal ideation & acquired capability & suicide attempts	“
	Depressive symptoms	Adapted from the BDI
	Impactful events	“
	Coping	“
	Substance use	“
	Sleep	“
FOLLOW-UP QUESTIONNAIRES (T2)	Suicidal ideation	“
	Depressive symptoms	“
	Anxiety symptoms	“
	Insomnia symptoms	“
	Borderline personality traits	“
	Trait anger	“
	Cognitive reactivity	“
	Quality of life	“

