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The Psychological Role of Dissociation and Repetitive Negative Thinking in the Development of Suicidal Behavior in Posttraumatic Stress Disorder

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ABSTRACT

Cognitive and metacognitive processes, along with dissociative symptoms, play a significant role in the development of suicidal behavior in the context of traumatic experiences and posttraumatic stress disorder. This article reviews theoretical models that conceptualize the transition from suicidal ideation to actions, emphasizing the mechanisms and mediating variables underlying this progression. The discussed models include the interpersonal theory of suicide, the three-step theory, the integrated motivational–volitional model, the perfectionism-based model of suicide risk, the fluid vulnerability theory, the integrated pain-brain evolutionary model, the dual-system model of suicidality, the stage-based theory of antivital behavior, and a dynamic model of antivital and suicidal behavior taking into account the roles of negative social emotions and resilience factors, strength model of self-regulation, the mindsponge-based model of suicide risk simulation, the network analysis model, the cry of pain model, the narrative model of suicidal crisis, the dual-process conceptualization of suicidality, the theory of repetitive negative thinking, suicidal rumination, and others. The cognitive model of trauma memory processing and encoding, along with the model of trauma-induced dissociation and the emergence of hallucinations, helps explain the increasing intrusiveness and uncontrollability of trauma-related experiences. These phenomena are marked by alienation from one's own physical and psychological suffering and emotional detachment from others. Such mechanisms provide insight into the transition from suicidal ideation to actions as a nonlinear and dynamic process in the development of suicidal behavior.

Keywords: suicidal ideation and behavior; dissociation; repetitive negative thinking; ruminations; post-traumatic stress disorder; traumatic experience; ideation-to-action theories of suicide; suicide as a nonlinear dynamic phenomenon.

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Психологическая роль диссоциации и негативного повторяющегося мышления в динамике суицидального поведения при посттравматическом стрессовом расстройстве

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АННОТАЦИЯ

В формировании суицидального поведения при травматическом опыте, посттравматическом стрессовом расстройстве значимую роль играют когнитивные, метакогнитивные процессы и диссоциативные симптомы. Рассматриваются модели суицида «от мыслей к действиям» при осмыслении механизмов и промежуточных переменных данного перехода, в частности, интерперсональная теория самоубийства, трёхшаговая теория, интегративная мотивационно-волевая модель, концепция роли перфекционизма в риске суицида, теория флюидной уязвимости, интегрированная теория эволюции суицида «боль и мозг», двухсистемная модель суицидальности, положения теории об этапах антивитального поведения, а также динамической модели антивитального и суицидального поведения с учётом роли негативных социальных эмоций, факторов жизнестойкости, модель саморегуляции, основанная на силе воли, моделирование суицидального риска с помощью механизма mindsponge («губка разума») и модель сетевого анализа, модель суицида «крик боли», нарративная модель суицидального кризиса, двухпроцессная концептуализация суицидальности, теория повторяющегося негативного мышления, руминаций о самоубийстве и другие. Когнитивная модель обработки и кодирования воспоминаний о травме, модель усиления диссоциации в результате травматического опыта и возникновения галлюцинаций объясняют нарастающую неподконтрольность интрузий с отчуждением физических и психических страданий, отстранённостью от других, позволяя уточнить переход от мыслей к действиям в формировании суицидального поведения как нелинейного динамического процесса.

Ключевые слова: суицидальные мысли и поведение; диссоциация; повторяющееся негативное мышление; руминации; посттравматическое стрессовое расстройство; травматический опыт; модели суицида «от мысли к действию»; суицид как нелинейный динамический феномен.

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Травмага бәйле стресс вакытындагы суицидаль тәртип динамикасында диссоциация һәм кабатлана торган тискәре фикерләүнең психологик роле

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АННОТАЦИЯ

Травмадан соң күзәтелгән стресс тайпылышлары вакытында суицидаль тәртип формалаштыруда когнитив, метакогнитив процесслар һәм диссоциатив симптомнар мөһим роль уйный. Әлеге күчешнең механизмнары һәм арадаш үзгәрешлеләре турында фикер йөрткәндә, «фикерләрдән гамәлләргә» суицид модельләре, аерым алганда, үз-үзеңә кул салуның интерперсональ теориясе, өч адымлы теория, интегратив мотивация-ихтыяр моделе, суицид куркынычында перфекционизм роле концепциясе, флюид зәгыйфьлек теориясе, «авырту һәм баш мие» суицид эволюциясенең интеграцияләнгән теориясе, суицидальлекнең ике системалы моделе, антивиталь үз-үзеңне тоту этаплары турындагы теория положениеләре, шулай ук тискәре социаль эмоцияләр, тормыш тотрыклылыгы факторлары ролен исәпкә алып, антивиталь һәм суицидаль тәртипнең динамик моделе, ихтыяр көченә нигезләнгән үз-үзеңне көйләү моделе, mindsponge механизмы ярдәмендә суицид куркынычын модельләштерү ("акыл губкасы«) һәм челтәр анализы моделе, суицидаль кризисның нарратив моделе, суицидальлекнең нарратив моделе, кабатлана торган тискәре фикерләү теориясе, үз-үзенә кул салу турындагы руминацияләр һ.б. Травма турындагы истәлекләрне эшкәртү һәм кодлауның когнитив моделе, травматик тәҗрибә нәтиҗәсендә диссоциациянең көчәюе һәм галлюцинацияләр барлыкка килү моделе физик һәм психик газапларны читләштерү, башкалардан читләшү белән интрузияләрнең контрольсезлеген аңлата, бу исә фикерләрдән суицидаль тәртипне туры булмаган динамик процесс буларак формалаштыруда фикерләрдән гамәлләргә күчүне ачыкларга мөмкинлек бирә.

Төп сүзләр: суицидаль фикерләр һәм үз-үзеңне тоту; диссоциация; кабатлана торган тискәре фикерләү; руминацияләр; травмадан соңгы стресс; травматик тәҗрибә; «фикердән гамәлгә» суицид модельләре; суицид туры булмаган динамик форма буларак.

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INTRODUCTION

Contemporary psychological models assess various variables to understand the connection between traumatic experiences and the formation of suicidal ideation (SI) and suicidal behavior (SB). Recent studies focus on the role of dysfunctional metacognitive strategies aimed to manage the experience and associated with the dissociation of intermediate phenomena in the transition from ideation to actions (e.g., detachment from physical and emotional pain, social isolation, guilt and shame, and impaired self-agency). Variables may configure into an individual SB path. The possibility of impulsive behaviors that deviate from the gradual progression of suicidal ideation underscores the non-linear nature of the observed pattern. A multitude of factors have been identified as contributors to the accumulation of tension as the primary feature of SB, which can result in an acute suicidal crisis. These include a history of unfavorable interpersonal relationships, anxiety, rumination, impulsivity, negative future vision, and deficient social support. The prediction of risk for suicidal trajectory involves the consideration of individual differences in emotion regulation disorders, traumatic experiences, and a propensity for repetitive negative thinking [1–3].

The presented line of research seems relevant in the context of the revision of the diagnostic criteria for stress and trauma-related disorders in the classifications of mental illness. This revision has contributed to a narrower operationalization of post-traumatic stress disorder (PTSD) and the introduction of the category of complex PTSD (CPTSD). Most authors agree that SI and past attempts are predictors of completed suicide, but some scientists are reluctant to consider SI as a predictor of potential SB [4]. The factors and pathways associated with suicidal risk in individuals experiencing traumatic experiences and PTSD symptoms may differ [5]. A discourse has emerged regarding the risk of SI in the context of time course, i.e., whether the past persistence of SI can predict SB in the future, or whether the predictive potential of SI should be explored exclusively across a short time period [6].

Dissociation and repetitive negative thinking have the potential to mediate the connection between the traumatic experience and SB [5, 7]. The significance of the discussed issue underscores the challenge to public health posed by the considerable limitations of the suicide prediction and, consequently, the effective prevention of suicide attempts based on classical suicide models. This highlights the need for theoretical and methodological understanding of suicidality, with consideration for the most recent data.

CONTRIBUTION OF DISSOCIATION TO INCREASED SUICIDAL RISK IN TRAUMATIC EXPERIENCES AND SPECIAL TYPE OF MEMORY ENCODING IN PTSD

The growing interest in the mechanisms and variable range of dissociative experiences in the context of mental disorders has prompted the fact that the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision (DSM-5-TR) categorizes dissociative disorder (DD) defined as an impairment or interruption of the typical integration of consciousness, memory, identity, emotions, perception, body image, motor control, and behavior, into five categories: dissociative identity disorder, dissociative amnesia, depersonalization-derealization disorder, other specified and unspecified dissociative disorder (American Psychiatric Association, 2022). Amnesia, depersonalization, and derealization are collectively referred to as dissociative symptoms (DSs), which do not inherently signify a particular DD.

The DSM-5 diagnostic criteria (American Psychiatric Association, 2013) for PTSD first included DSs in the dissociative subtype (PTSD-DS), which was clarified in DSM-5-TR (American Psychiatric Association, 2022). For an accurate diagnosis, it is essential to observe the symptoms that meet the criteria for PTSD (i.e., obsessive symptoms, avoidance behavior, specific changes in cognitive processes and mood, including amnesia, reactivity disorders) and persistent or recurrent symptoms of depersonalization and derealization.

Dissociation is widely regarded as a risk factor for the occurrence and progression of PTSD [8]. In patients with PTSD, DSs differ in intensity while maintaining similar structural properties [9]. Dissociation in chronic PTSD is associated with the highest level of disorders [10]. Some studies have proposed the conceptualization of PTSD and CPTSD as forms of DD [10]. Amnesia has been classified as a non-dissociative form of PTSD, yet it can be regarded as dissociative. Several authors have raised concerns about the comprehensiveness of the DSM-5 classification, which focuses on certain aspects of DSs, as the symptoms of recurrent experiences attributed to PTSD in the DSM-5 are indicative of dissociation. Dissociation is the primary symptom of PTSD and CPTSD; however, in ICD-11, it only figures as a symptom of CPTSD in cases of repeated experiences [10, 11].

The significance of differentiating PTSD-DSs is based on a higher risk of suicide. It is believed that the earlier traumatic experience is associated with an increased risk of DR and repeated suicide attempts. PTSD, PTSD-DSs, and CPTSD are characterized by an unequivocal propensity for suicidality caused by post-traumatic symptoms

and feeling of hopelessness [5]. Research suggests that hopelessness mediates the relationship between post-traumatic symptoms and SI, especially in CPTSD and DSs [5]. In patients with CPTSD, dissociation is an important factor associated with depressive symptoms and SB, even when the effects of trauma and the primary symptoms of chronic PTSD are considered [11].

The neurobiological model of PTSD explains how traumatic experiences can trigger changes in the brain function, contributing to DSs. PTSD is associated with abnormal activation of the medial pre-frontal and anterior cingulate cortex, indicating an inability to inhibit (emotional undermodulation) activity of the limbic system, including the amygdala, by the areas involved in modulating arousal and emotional regulation. This leads to obsessive feelings and compulsive actions. In contrary, PTSD-DSs are characterized by high activation of the brain regions involved in the emotional regulation, which reduces the activity of the limbic system, representing emotional overmodulation and causing a state of emotional numbness [12].

The theory of emotional regulation defines dissociation as a coping mechanism for emotions. However, its protective function can impair functioning and provoke comorbid disorders in the long term [13], by detaching from threatening stimuli, suppressing responses, and disrupting cognitive processes required for voluntary self-regulation. A high level of DSs is associated with cognitive and social impairments that increase the risk of recurrent trauma experiences. These impairments include delayed processing of threat-related stimuli, poor attention, deficits in short-term and long-term memory, executive function, and abnormal social cognition [14].

Dissociation is considered a significant factor in SB, especially in the context of its ability to reduce sensitivity to physical pain [15]. DSs are associated with greater mental pain, which further increases the risk of suicide [16]. DSs can interact with pain tolerance and correlate with an increase in suicide attempts, regardless of pain sensitivity [16]. Non-suicidal self-injury (NSSI), which may be a precursor to SB in patients with PTSD, engagement in life-threatening activities, alcohol and drug abuse contribute to the escalation of these tendencies, desensitize the fear of death and bodily suffering, and facilitate the transition from passive ideation to impulsive actions. NSSI can precede SB, as it is associated with DS-triggering negative social emotions of shame and guilt related to traumatic experiences of violence, social defeat, or grief. Together with the reduction of pain sensations through repeated NSSI, the pain sensations themselves can provide emotional relief, functioning as a form of self-regulation and recovering the sense of agency through deliberate pain enhancement with prolonged DSs [1–3].

Dissociation may play a role in forgetting events during NSSI and suicidal attempts. In the study, patients reported difficulty remembering the details of a suicide attempt. They were characterized by higher rates of hopelessness and DSs compared to the control group [17]. The cognitive model of PTSD by Ehlers and Clark [18] describes the features of encoding traumatic memories and extracting them from the memory. The specific symptoms of PTSD include involuntary, distressful traumatic memories that are vividly perceived. Traumatic memories are characterized by their fragmented and unstructured nature. They are triggered by sensory stimuli and manifest as uncontrolled images (sounds, smells, tactile sensations, thoughts, memories, or dreams). They are characterized by difficulty in voluntary retrieval, disrupted chronology of events, and even amnesia with the partial loss of the experience. The memory pattern in patients with PTSD is based on a special type of trauma-related processing with the predominance of instantaneous, non-reflexive sensory experience processing as opposed to categorical processing and contextualization. The decontextualized type of processing is associated with a higher risk of PTSD symptoms, whereas the categorical type involves the sequential encoding of information that facilitates the voluntary retrieval of memories. Impression-based processing is related to an undetailed, perceptually encoded memory trace, which is involuntarily retrieved as a response to event-associated signals in the form of intrusions. The hypothesis is that autobiographical memory processing can help people overcome the uncontrollability of traumatic memories. Dissociation has been demonstrated to function as a survival mechanism during the acute phase of trauma, thereby alleviating emotional distress. However, it has also been observed to impede the further integration and contextualization of memories, depriving recently acquired experiences of the sense of agency, thereby supporting intrusive processes and increasing the suicidal risk [15].

Halligan et al. [8] further supported the theory of specific trauma-related information processing as opposed to one of a categorical nature. Their study sought to elucidate the relationship between non-categorical processing and disorganized memories, with the relationship remained significant despite individual differences in dissociation and anxiety, factors that are implicated in encoding a traumatic event. Experimental processing of distressing material has been demonstrated to increase the risk of repeated experiences and PTSD-like symptoms, and the extent of memory disorganization is associated with subsequent avoidance, increased arousal, and intrusive thoughts. The deficit of voluntary memories mediates the relationship between cognitive processing strategy and repeated experience symptoms, and differences in symptom levels between groups focused on different strategies have been found to be insignificant after controlling for variables of memory disorganization. The discussion focuses on the potential confusion between distorted information and memory disorganization in tasks involving free memories. The veracity of memories is rendered negligible compared to the systematized nature of memory, and incorrect

yet structured memories are likely to offer protection against PTSD, as do correct memories. Autobiographical memories are susceptible to distortion, with errors increasing as new information is generalized. This should be considered in the planning of intervention strategies [8, 18].

Metacognitive strategies that are aimed to regulate intrusive memories and traumatic thoughts play an important role in maintaining PTSD. The dysfunctional significance of intrusions is duly recognized, yet the methods used to terminate them are equally crucial. Ruminations, thought suppression, distraction, and the deliberate avoidance, including dissociative avoidance, of memories significantly correlate with the severity of PTSD symptoms. The avoidance of traumatic memories as a significant factor in the maintenance of PTSD symptoms, attention to and monitoring of intrusive memories can lead to an increase in their frequency. This hinders the optimal emotional processing of experiences and the restructuring of dysfunctional representations of trauma, thereby facilitating the transition of uncontrolled mental experience toward experiences similar to psychotic ones, including voices and multisensory hallucinations [19]. The general dissociation factor elucidates the observed similarity between intrusions and related hallucinations, which are characteristic of PTSD, and the relationship between hallucinatory experiences and traumas from both distant and recent pasts is discussed. As reported by McCarthy-Jones and Longden [20], hallucinations are defined as a phenomenon of repeated experiences. However, there is ongoing debate regarding whether "voices" are dissociative or psychotic phenomena [21]. Similar to intrusions, they are actualized in conjunction with cognitive efforts, and they are characterized by source monitoring errors, and the PTSD-specific dissociation affects the propensity to detach from experience. The experience of trauma has been shown to trigger negative self-perception, where the content of consciousness is perceived as aberrant, with connections with others being disrupted [20]. The integration of intrusive factors, the uncontrolled realism of repeated experiences that acquire hallucinatory quality, and a transformed system of relationships with others, are associated with a high risk of suicidality.

Therefore, the variety of mechanisms through which dissociation in patients with PTSD contributes to SB determines the significance of a detailed analysis of the phenomenon in the context of contemporary models of suicide, which claim to be more predictive and to offer a better understanding of the mechanisms of transition from ideation to actions.

IDEATION-TO-ACTION SUICIDE MODELS. ROLE OF DISSOCIATION IN TRANSITION FROM IDEATION TO SUICIDE ATTEMPTS

The mechanisms by which trauma relates to SB are studied using various concepts, including the models that explain the transition from ideation to actions [1–3]. The transition from SI to SB is particularly evident among high-risk groups with specific injuries (abuse, violence). In this context, PTSD complicates the relationship, requiring targeted interventions to address it effectively [5]. The relationship between DSs and SB may be further elucidated through the prism of the psychological structure of stress-related disorders and their corresponding phenomena that support the symptoms. The seminal psychological theories discuss the mechanism of the suicidal ability acquired through the dissociation and analyze the DSs as a way of detachment from unbearable experiences.

Contemporary models of SB and antivital behavior [1–3, 6, 22] focus on exploring mechanisms that facilitate the transition from ideation to action and on balancing constraints supported by the understanding of changes in systemic processes. The conceptual and empirical revision of ideation-to-actions theories, driven by the importance of the problem, has influenced several models, including the time-based model of antivital and suicidal behavior presented by Sagalakova et al. [1–3], Joiner's interpersonal theory of suicide [23], Klonsky and May's three-step theory of suicide [24], O'Connor's integrated motivational-volitional model of suicidal behavior [25], Kholmogorova's concept describing the role of perfectionism in SB among young people [6], and Rudd's fluid vulnerability theory [26]. These theories are consistent with the idea that the development of STs and the transition from suicidal ideation to attempts are distinct processes explained by different factors. Key factors of this transition include affective and cognitive features and changes in the social and interpersonal context [1–3]. Suiciders not always perceive suicide attempts as planned actions and may deny the presence of SI. Therefore, the most promising models are those that consider the non-linear, time-related nature of the phenomenon and systemic risk factors.

Ideation-to-actions theories aim to identify central psychological factors of suicidal risk, such as perceived burden, disrupted agency, and feeling trapped, which should reliably distinguish people at risk of suicide from those who actually attempt suicide [25]. Risk factors differ significantly between individuals, demonstrating the diversity of ways to commit suicide. The ability to commit suicide distinguishes those who have attempted suicide from those with SI who have not. Meanwhile, pain and hopelessness motivate suicidal intentions more than other factors, based on the three-step theory [22]. Levinger et al. [16] observe that physical dissociation contributes to suicidality, particularly when combined with mental distress and low tolerance among young individuals. As stated in the theory of acquired suicidal competence, the features of dissociation associated with detachment from emotional and bodily experiences provoke SB. In the interpersonal theory of suicide, an increase in DSs implies a sense of social withdrawal, which increases suicidal ideation [23].

In his integrated theory of suicide evolution (Pain and Brain), Soper [27] supports the idea that preventive

solutions from public health services and restrictions to lethal drugs will be effective rather than the search for predictive biomarkers of suicide risk. Current approaches based on the theory of complex systems conceptualize non-linear processes as the basis for the transition from SI to actions [28]. SI and related risk factors vary and transform over short periods of time. The transition to suicidal action is characterized by sudden shifts from low to high risk, skipping the intermediate stages of SI or action planning [1–3].

The fluid vulnerability theory considers both SI and suicide attempts as influenced by the continuous interaction of individual vulnerabilities and situational factors. The suicide risk does not remain constant, but rather fluctuates over time, demonstrating a significant progression [27]. Levels of vulnerability vary throughout life in response to events, mental health and environmental factors [24]. Consistent with the interpersonal model, the theory recognizes the role of perceived burden and low social agency in SB, but it seeks to explain the non-linear progression of SI and attempts over time. SB prevention strategies should focus on eliminating both individual vulnerabilities and situational triggers [27]. Further development of ideation-to-action theories requires longitudinal studies.

NON-LINEAR TRANSFORMATION OF SUICIDAL RISK AND DISSOCIATIVE PATTERN OF MENTAL REGULATION IN TRAUMATIC EXPERIENCE

The unpredictability of SB, as demonstrated in several studies, poses significant challenges to risk assessment, suggesting that conventional prediction models may be ineffective [27] and highlighting the need to enhance our understanding of suicide as a universal phenomenon in the context of individual cases. Considerable variability of suicidal attempts requires innovative theoretical concepts and assessment methods to clarify the various potential ways to suicide. The two-system model of suicidality proposed by Brüdern et al. [29] is predicated on the concept of limited resources of self-regulation and offers two systems of information processing and behavior: 1) the reflexive system, in which suicidal attempts are considered in terms of self-regulation and are regarded as behavior aimed at overcoming perceived goal inconsistencies; and 2) the impulsive system, in which SI and SB are conceptualized as a self-organizing model activated by acute stress and depletion of the resources of the reflexive system.

The two-system model of suicidality is consistent with the concepts of self-regulation developed by Kholmogorova [6], Ambrumova [22], etc. and with the time-based model of antivital behavior and resiliency in explaining the patterns of the non-linear transition from antivital experiences to SI and SB [1–3]. The concept emphasizes the significance of unrealized, conflicting actual points of attraction of the system (motives) in the context of anomalies in regulatory strategies and increasing tension, which may result in the onset of antivital trajectories in the system, attracting mental activity and exhibiting a trend to system restructuring towards SB. The model is consistent with the theory of time-related complex systems, the patterns described by the catastrophe theory and the chaos theory in the context of biopsychosocial phenomena. The model also aligns with the understanding of the trauma process and its relationship to SB. The model elucidates how initially minor changes (stressors in interaction with vulnerability) through the cumulative effect of self-reinforcing instability in a non-equilibrium open system can lead to its self-organization toward the attractive trajectory of NSSI and suicide by the mechanism of sudden transition. The increasing crisis-related disorganization within the system of mental activity has the potential to significantly contribute to the emergence of various types of catastrophes, aimed at a rapid transition to an antivital chaotic scenario. Choosing a suicide can be defined as a radical, paradoxical form of resolving long-term stress when other regulatory mechanisms have been completely consumed or proven to be unfeasible [1, 2].

SI and SB function as a regulatory mechanism to address challenges related to stress reduction and coping with the perceived discrepancy between expectations and reality. The antivital inclination conflicts with personal goals, resulting in a state of motivational uncertainty surrounding SB. However, this condition necessitates the management of suicidal intentions. Interpersonal traumatic experiences, exacerbated by ruminative processing, have been shown to create a threshold effect in the transition from SI to action. Initially, traumatic experiences contribute to the onset or worsening of dissociation, thereby initiating and maintaining an inert dissociative pattern of mental functioning, characterized by impaired integration and detachment. In the presence of DSs, mental activity undergoes a sharp transition to SB [1–3].

The risk of SB can be conceptualized as a continuum, originating from passive antivital thoughts [22] and evolving into active SI, SB planning, and ultimately, SB [1–3, 29]. The continual evolvement of the risk level is associated with a decrease in self-control. Output function efforts fail to reduce the discrepancy between the actual condition and the target. An individual may choose to abandon or modify their target, or continue self-regulation until the discrepancy is mitigated. However, this can deplete limited energy resources, particularly if the targets are unrealistic and the methods of self-regulation are maladaptive [1–3, 6, 22]. The loss of regulatory abilities combined with an absence of strategic planning leaves an individual vulnerable to resource depletion, in which the influence of the reflexive system decreases, and the maladaptive impulsive suicidal processes become more prevalent [29]. Compared to voluntary SB, which is governed by the reflexive system, this behavior

is not triggered by a conscious intention to commit suicide and is not an intentional act. Once SI and SB have been linked with tension reduction, it is activated immediately in provoking circumstances.

Understanding suicidality requires contemplating the non-equilibrium system operating within the time-related interplay of forces, including the self-organizing balance of life-affirming factors that counteracts the abrupt phase transition from SI to SB, which has been brought about by the prior cumulative period. The dysregulation of emotions, cognitive and metacognitive distortions amplify emotional experiences, contributing to the perception of suicide as a solution to an unbearable experience. The interplay of social and cultural factors, in combination with interpersonal influences, has been demonstrated to be a contributing factor to the exacerbation of individual vulnerability and the depletion of personal regulatory resources, ultimately resulting in SB [1, 2].

Based on the promising strength model of self-regulation proposed by Muraven and Baumeister [30], self-regulation, i.e., the suppression and control of suicidal impulses to achieve long-term targets, is associated with energy depletion, which in turn reduces the ability to engage in further self-regulation. This paves the way for impulses to influence behavior and minimizes the influence of the reflexive system. Suicidal impulses are defined as a pattern of the impulsive system, which is engaged when an individual attempts to cope with distress effortlessly while experiencing limited regulatory resources. The impulsive processing system is associated with the concept of self-organization, which is characterized by information processing from the bottom up and is a feature of connectionist models that lack a central executive mechanism. The predominant mechanism of the impulsive system is the reduction of inconsistencies or errors; that is, the system is moving toward tension minimization. Tension is defined as total unsatisfied limitations, and the patterns of the impulsive system emerge through a self-organizing manner. These patterns are created or intensified through repeated co-activation of stimuli, emotional responses, and behavioral habits. The impulsive system has been shown to respond with exceptional acuity to stress.

The connectionist models have been successfully used to simulate the occurrence of SI using the mindsponge mechanism offered by Nguyen et al. [31] and in the network analysis model. The network theory has been identified as a relevant framework for the study of suicide risk, which is characterized by systemic relationships between factors. However, there is a paucity of specific studies in this area. In a sample of young individuals, De Beurs et al. [32] demonstrated that the majority of the variance in the analysis of SB was explained by perceived burden, a sense of being trapped, symptoms of depression, and a history of prior SI. Most studies are still concentrated in the conventional domains of social sciences, conceptualizing SB as the consequence of a series of variables, avoiding objective methods of modeling phenomena. Xu et al. [33] developed a comprehensive suicide risk assessment model based on fuzzy mathematics that incorporates social and personal factors to determine the non-linear risk of suicide.

In most SB theories derived from intergroup analysis, mental changes are interpreted as predictors of SI and SB. However, there is a paucity of empirical studies that would provide further insight into the development of personalized time-related models that explore suicidality. Coppersmith et al. [34] used the method of group iterative multiple model estimation as mathematical modeling to study the interpersonal theory of suicide in the context of the analysis of personalized and common suicidality pathways. A real-time study involving adults and adolescents with SI and SB revealed that none of the effects of the theory, including the instant transition from hopelessness to SI, were common at the group level. This finding supports the conclusion that the paths of transition from SI and SB are not identical [1–3].

The concept of defeat is addressed in the motivational-volitional model, which functions as a predictor of SI, and in the Williams and Pollock's cry of pain model [35], where the defeat is conceptualized as a metaphor for "suspended action." Suicidal behavior is defined as a behavioral response to a situation characterized by a sense of defeat, being trapped, and having no way to escape. The sense of being trapped is combined with the desire to escape. As reported by Klein [36], the experience of humiliation occurs when an individual feels insulted for their identity rather than for their actions. The narrative model of suicide of Bloch-Elkouby et al. [4] comprises feelings of rejection and burden. In the interpersonal theory of suicide, these feelings have a synergistic effect on SI; Baumeister and Leary [37] reported the need for belonging as a fundamental motivation for interpersonal attachments.

The narrative model of the suicidal crisis describes the terminal stage and the primary characteristic of the suicidal narrative, which is characterized by a recurrent experience of being trapped and the inability to escape. The crisis symptoms include affective, cognitive, physiological, and behavioral disorders. However, SI remains a poor predictor and is not considered as a part of suicide crisis syndrome [4].

Based on the concept of ideation-to-action transition, researchers are reviewing risk factors to differentiate between thoughts and attempts. Variables demonstrate a low or moderate ability to differentiate and predict suicide [24]. The resolution of this issue may be achieved by defining the intermediate processes underlying the transition from SI to SB. The concept of ideation-to-action transition considers an action only as a suicide attempt or death as a result of suicide, whereas a broad spectrum of different types of suicidal thoughts are combined into ideation. The heterogeneity of ideation reduces the ability of risk factors to distinguish between SI and suicide attempts,

therefore, clarifying the intermediate types is important to identify predictors of transition.

The direct predictive ability of SI has been called into question by Hou et al. [38], who studied the feasibility of the phenomenon of pre-suicidal attempts as an intermediate type in the transition from SI to attempts as part of the ideation-to-action concept. Pre-suicide attempts have been demonstrated to mediate the association between SI and attempts and influence pain tolerance and defiance of death. Individuals who had made suicide attempts exhibited higher scores for defiance of death and the risk of suicide compared to those who had merely contemplated suicide.

Standard suicide risk scales may not be appropriate for assessing sudden changes during an acute suicidal crisis, and their clinical value for predicting suicide attempts is low. Retrospective methods can be unreliable, particularly in measuring the temporal relationships between variables. Therefore, methods of real-time monitoring have become widespread in suicide studies [39]. The ecological immediate assessment using mobile devices can measure minor processes occurring at a particular moment, including contexts without distortions associated with memories, and can capture variations in risk factors. In measuring the propensity to SB, alternatives to self-reports are used, e.g., the death implicit association test is used to measure implicit identification with death.

In the study by Joiner et al. [40], which included an analysis of video recordings, a clinically significant marker of suicide readiness was revealed. This marker is characterized by an abnormally low blink rate and other gaze irregularities that are not only indicative of a high risk of suicide, but also of SI and depression. The detection of abnormal blinking, along with the well-known phenomenon of the so-called thousand-yard stare among individuals with PTSD, can be indicative of dissociation and may precede suicide, in some cases extending over a suicide and including mass murders, sometimes long before the act itself. This prolonged period includes undiagnosed antivital experiences and SI.

Consequently, the models that seek to use the theory of non-linear systems, contemporary approaches to catastrophe theory, and chaos theory to understand the mechanisms of changes in biopsychosocial systems, including those associated with suicidality (ideation-to-actions), do not always consider the role of dissociation as a way to alleviate increasing tension and provide short-term improvement. However, the detachment may preserve the established pathological balancing system in the long term and facilitate the regulation switch [2, 28]. In patients with PTSD, dissociation is considered as a process that facilitates the transition to suicide. Its role in separation from reality and the need to overcome difficulties is emphasized, which can increase the risk of SB [15]. The integration of the presented theories into the modeling of SB provides the basis for clarifying the mechanisms of antivital behavior targeting NSSI or SB.

TWO-PROCESS CONCEPTUALIZATION OF SUICIDALITY, CONTRIBUTION OF FEELING OF BEING TRAPPED, REPETITIVE NEGATIVE THINKING, AND SUICIDAL RUMINATION TO SUICIDE RISK

As reported by Olson et al. in their two-process conceptualization of suicidality [41], automatic (negative self-perception) and controlled cognitive processes affect SI and SB, functioning as their precursors. The two-process cognitive models differ between the analyzed processes based on their impact on perception, judgment, and behavior, which informs predictions. The conceptualization of suicide integrates the two-process models of social cognition with the understanding of SB in the context of ideation-to-action process. The model outlines the suicide-specific automatic associations involving the self, other people, the future, death, and body harm; motives involving the self, interpersonal relationships, the future, and the wish to die; and hypotheses concerning the conditions in which automatic associations and motives, both individually and in interaction, influence SI and actions at different stages of the ideation-to-action trajectory. Automatic associations related to death, NSSI, and hopelessness are characteristic after traumatic experiences, and these associations cause SI without conscious contemplation in conditions of limited cognitive resources.

Controlled processes, such as voluntary thinking and reflection, can be used to evaluate one's own SI, which either increases or decreases them, based on one's coping abilities and emotional state [41]. In contrast to automatic responses, reflection encourages the consideration of alternative points of view, reducing the likelihood of impulsive actions, and enabling decision-making based on context and consequences. Metacognitive monitoring and control involve the analysis of cognitive processes, thereby improving the understanding of the reliability of conclusions to a certain extent. However, excessive processing in the form of repetitive negative thinking (RNT) can amplify DSs, leading to a further increase in the voluntary control over thoughts and exacerbating the situation.

As a non-linear phenomenon, RNT is considered a transdiagnostic factor of suicidality, adversely affecting mood and intermediate risk predictors, and representing a maladaptive cognitive process, including rumination and anxiety. Rumination and brooding as a subtype of rumination have been found to be associated with SI [42]. Anxiety is focused on the future and can be seen as a hallmark of anxiety disorders, whereas rumination focuses on the past and may be indicative of depression. The relationships between RNT and suicide risk is predominantly characterized by a fragmented research focus, with most studies focusing on the inclusion of individual

disorders in the analysis. RNT subtypes share a common process [42] characterized by (1) cyclical, persistent thinking; (2) unproductive thinking, which is marked by its inability to solve problems or make effective predictions; and (3) significant cognitive efforts.

PTSD is characterized by rumination regarding the causes of the trauma, which functions as an avoidance strategy by focusing on the condition rather than the event itself. Wells and Sembi [43] proposed that rumination impeded the emotional processing of traumatic experiences, thereby linking these experiences to other stimuli and enhancing their accessibility within memory networks, which may contribute to the manifestation of PTSD symptoms. RNT and rumination indirectly contribute to chaotic transformations through uncontrolled processes characterized by unproductive attempts to suppress intrusive mental images. This cyclical, inert process, driven by positive feedback, leads to increased arousal and resource depletion, as greater suppression amplifies processing, which in turn fosters further suppression. This process tends toward an inversion of the established regime, creating conditions for a sudden shift in self-regulation where direct intervention becomes ineffective or counterproductive [1, 2].

Without addressing the underlying problem, energy expenditure may function as a mechanism for the escalation of dissociation as a protective strategy to disengage from retraumatizing images and to temporarily reduce involvement in repetitive thinking. However, DSs have been shown to further bolster dysfunctional behaviors over time, and the decreased emotional and physical sensitivity associated with dissociation has been found to increase the risk of SB. Individuals diagnosed with PTSD experience intrusive trauma memories. The decontextualized encoding and storage of traumatic information leads to the involuntary occurrence of intrusive trauma memories, whereas metacognitive suppression of these memories can intensify them [18].

Suicide risk models are particularly focused on the variables that contribute to the risk of SI and SB, such as the association between negative thoughts, depressed mood, and suicide (including the perseverance characteristic of negative interpersonal content), and the perceived irresistibility of thoughts and feeling of being trapped. Rumination intensifies negative emotions and cognitive processes, which in turn amplify rumination (the interactive rumination model and the emotional cascade model). The experience of falling into a loop of unproductive reflections increases the feeling of an internal trap, generating a sense of hopelessness, because of which suicide may be considered as a means to break out of a vicious circle. RNT directly increases the risk of suicide through mood deterioration, as metacognitive attempts to suppress intrusive thoughts are unproductive [25]. The feeling of being trapped mediates the relation between rumination and SI, regardless of the symptoms of depression and anxiety, and thoughts associated with suicide can be perceived as uncontrollable [42].

RNT can be evaluated using a transdiagnostic scale, which focuses on the key features of the process (repeatability, unproductivity) without emphasizing the content of thoughts and their temporal context. Elevated levels of cognition have been observed in association with SI, despite the impact of anxiety and depression. The perception of the unproductive nature of RNT and its main characteristics are associated with SI [7]. The feeling of being trapped in constant rumination related to interpersonal trauma intensifies the risk of suicide by increasing hopelessness. Difficulties of switching from perceptual reflection are explained by impaired neurocognitive resources, which initiates a self-reproducible cognitive cycle that determines a lack of control over the content of thinking, an increase in negative affect, and rumination [42], and also leads to SI and SB [13].

The absence of the perceived cognitive control has been associated with SI and SB, including through dissociation as a method of distancing oneself from unbearable, involuntary thought patterns. Among a variety of rumination characteristics, low controllability was identified as being specifically associated with SI, suicide planning and attempts. Excessive rumination, also known as ruminative flooding, is a hallmark of a high risk of SB. Suicide-specific rumination identified as part of RNT is associated with SI and SB and may be co-dependent. The distinctive characteristics of suicide rumination suggest that SI is a subtype of RNT. Rogers et al. [42] suggested that, in addition to the well-known risk factors (SI, global rumination, depression, and anxiety), specific rumination is a superior predictor of SI and SB compared to global rumination or general RNT. The relationship between suicide rumination, SB, and SI is mediated by an acute suicidal condition, and potential suicide rumination is closely related to the intention of SB, which was assessed by a simple question: "How would you rate your current intention to attempt suicide in the near future?"

In their study of suicide rumination, Rogers et al. [42] used the Suicide Rumination Scale (SRS) to measure fixation on suicidal thoughts, intentions, and plans. Teismann et al. [44] believed that some items of the SRS may confound general preparation behavior, mental preparation for suicide with generic features of RNT. They suggested the Perseverative Thinking about Suicide Questionnaire (PTSQ), which is a modified version of the Perseverative Thinking Questionnaire (PTQ). Suicide rumination, as measured by the PTSQ, discriminated between those who had attempted suicide and those who had experienced SI in the past, predicted suicide attempts, and explained the relationship between SI and SB.

Höller et al. [45] examined the psychometric properties of the PTSQ among participants with lifelong SI as part of the study on the psychological impact of SI on healthcare professionals. Testing the model using confirmatory factor analysis determined the optimal four-item structure of the questionnaire: (1) "I can't stop dwelling about suicide"; (2) "I get stuck on thoughts about suicide and can't move

on"; (3) "I keep thinking about suicide all the time"; (4) "I feel driven to continue dwelling about suicide." Individuals who reported SI in the past four weeks were more likely to have suicide rumination than those without SI. Participants who reported prior suicide attempts were more likely to have suicidal rumination than participants without attempts, but with SI; therefore, suicidal rumination is a more serious risk factor than non-specific rumination.

Information concerning the relationship between RNT and SB is conflicting. Johnson et al. [46] suggested that variables have no significant lifetime relationship, while Caudle et al. [7] found that RNT directly correlates with the suicide risk, regardless of the severity of depression and anxiety. The relationship is likely to increase when considering a specific type of RNT (suicidal rumination). Cognitive behavioral psychotherapy that targets the transdiagnostic process of RNT is an important and evidence-based component of psychological intervention for developing self-regulation skills during a suicidal crisis and preventing the accumulation of time-related stress in the system of mental activity with the risk of a sudden transition to SB [2].

CONCLUSION

Suicide models discuss the mechanisms of the transition from thoughts to actions and the intermediate variables that affect risk. This is especially relevant in the context of the universality and suddenness of suicide. Dissociation, repetitive negative thinking, and rumination, especially suicidal ones, appear to be key mediators of this non-linear time-related process. While PTSD symptoms are closely related to the risk of SB, further research is needed to identify reliable predictors that mediate the relationship based on the methodology of psychological science.

The role of SI as a mechanism underlying SB remains unclear, as direct diagnosis of SI in patients with DSs and psychotic-like experiences is challenging. Traumatic memories included in the suicidal narrative are fragmented and uncontrollable. DSs are often observed in individuals who deny having SI or attempting suicide, which is an unreliable marker of suicidality.

The predictive potential of SI can reduce the vague nature of the concept definition in models and the shortcomings of risk assessment. An updated diagnosis of SI and SB risk factors is needed, including identification of selectivity to talk about death, and RNT. Alternative prediction criteria are being considered, such as blink abnormalities. Dissociation associated with traumatic experiences throughout the non-linear path of transition from thoughts to action intensifies NSSI, SI, and SB, and increases the risk of suicide by reducing sensitivity to emotional and physical suffering, and detachment from oneself and others.

Generalized data suggest that classical predictors of SB have limited predictive potential. The integration of the advantages of models that consider the non-linear time-related nature of suicidality trajectories and systemic risk factors seems to be the most promising.

ADDITIONAL INFORMATION

Authors' contribution: O.A. Sagalakova — key idea and methodological logic of the article, selection of sources for systematization, literature sources analysis; structuring, text writing and editing of the article; D.V. Truevtsev — key idea and methodological logic of the article, selection of sources for systematization, literature sources analysis, drafting and writing of the article text, editing, editing; O.V. Zhirnova — selection of sources, literature sources analysis and synthesis, drafting and writing of the article text, editing. All authors confirm that their authorship meets the international ICMJE criteria (all authors have made a significant contribution to the development of the concept, research and preparation of the article, read and approved the final version before publication).

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