

The Course of Self-Injury in Help-Seeking Adolescents

Treatment, Trajectory, and Prediction of a Transdiagnostic Phenomenon

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ABSTRACT

Nonsuicidal (NSSI) and suicidal self-injurious behaviors (SB) are common in adolescence. They occur in the general public but are particularly prevalent in psychiatric populations. The recognition of NSSI and SB as clinically relevant transdiagnostic phenomena has led to significant growth in scientific literature. However, profound knowledge regarding the courses and specific predictors is still scarce. The aim of the present dissertation is to address critical research questions with a focus on longitudinal analyses in a high-risk population of help-seeking adolescents. In the first study, the long-term effects of a brief intervention for adolescents with NSSI were examined. In a period of two to four years after the initial treatment phase, incidents of NSSI and SB reduced further, as did depression and borderline personality disorder criteria. Many patients received additional psychotherapy during the follow-up period which further decreased the frequency of NSSI. The focus of the second study was on the trajectory of NSSI over one year. An individualized analytical approach revealed that 75% of participants reduced the frequency of NSSI by at least half and 25% stopped NSSI completely. One in ten adolescents deteriorated over time and relapses were common. Predictors of change included depression, baseline NSSI frequency and the duration of inpatient treatment. The third publication analyzed the predictive value of self-rated risk for suicide attempts. Out of several clinically feasible variables, self-rated risk was the best predictor of actual suicide attempts. Depressive symptoms moderated the effect such that higher depression severity was linked to less accurate self-ratings. Suicidal and nonsuicidal self-injurious behaviors are complex and highly heterogeneous phenomena. Overall, the results reported in this dissertation provide important insight into the trajectory, treatment, and prediction of NSSI and SB in at-risk youth. Sophisticated longitudinal analyses with a focus on individual paths and alternative data sources have the potential to improve the current understanding of NSSI and SB and provide crucial knowledge for clinicians.

PUBLICATIONS INCLUDED IN THE PRESENT DISSERTATION

- 1) Rockstroh, F., Edinger, A., Josi, J., Fischer-Waldschmidt, G., Brunner, R., Resch, F., & Kaess, M. (2023). Brief psychotherapeutic intervention compared with treatment-as-usual for adolescents with nonsuicidal self-injury: Outcomes over a 2 to 4-year follow-up. *Psychotherapy and Psychosomatics*, 92(4), 243–254.
- 2) Reichl, C.*, Rockstroh, F.*, Lerch, S., Fischer-Waldschmidt, G., Koenig, J., & Kaess, M. (2023). Frequency and predictors of individual treatment outcomes (response, remission, exacerbation, and relapse) in clinical adolescents with nonsuicidal self-injury. *Psychological Medicine*, 1-10.
- 3) Rockstroh, F., Reichl, C., Lerch, S., Fischer-Waldschmidt, G., Ghinea, D., Koenig, J., Resch, F., & Kaess, M. (2021). Self-rated risk as a predictor of suicide attempts among high-risk adolescents. *Journal of Affective Disorders*, 282, 852–857.

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LIST OF ABBREVIATIONS

AtR!Sk	Ambulanz für Risikoverhalten und Selbstschädigung [specialized outpatient clinic for risk behavior and self-harm]
BPD	Borderline Personality Disorder
CBT	Cognitive Behavioral Therapy
CDP	Cutting Down Program
DBT-A	Dialectical Behavior Therapy for Adolescents
DSM	Diagnostic and Statistical Manual of Mental Disorders
MBT-A	Mentalization-Based Therapy for Adolescents
NSSI	Nonsuicidal Self-Injury
RCT	Randomized Controlled Trial
SB	Suicidal Behavior
TAU	Treatment-as-Usual

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INTRODUCTION

Adolescence is a time of change and the transition from childhood to adulthood presents numerous challenges. The body grows and changes, the brain develops, and social relationships and constructs undergo transformations (e.g., Berenbaum et al., 2015; Blakemore, 2012; Fuhrmann et al., 2015; Sawyer et al., 2018). This stage in a young person's life bears the potential for positive development and growth but at the same time, adolescents face difficult tasks in various areas of life. Crises and risk-taking behaviors are frequently observed (Braams et al., 2015; Levesque, 2011) and it is the period when many psychiatric disorders first emerge (Kessler et al., 2005; Solmi et al., 2022). During adolescence, one phenomenon of particular prevalence is self-injury. Self-injurious behavior is not limited to clinical populations but is observed frequently and transdiagnostically in this context. The methods and severity of self-injurious behaviors can vary, as can the underlying functions. Intuitively, self-injury is often linked to suicidal desire, but the intention may also be of nonsuicidal nature. The terminology of self-injurious behavior is diverse and in the literature around 30 different terms – such as deliberate self-harm – can be found to describe the overall behavior (Muehlenkamp, 2005). The heterogeneity in terminology reflects the complexity of the phenomenon itself which complicates scientific investigation and communication regarding the behavior.

To define a shared language and to emphasize its significance as a public health concern, Section III of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) defines two conditions for further research regarding self-injury: *Suicidal Behavior Disorder* and *Nonsuicidal Self-Injury* (American Psychiatric Association, 2013). The former includes at least one suicide attempt in the past 24 months, and the latter refers to self-injurious behavior without suicidal intent on at least five days in the past 12 months. Derived from this, suicidal behavior is abbreviated as *SB* and nonsuicidal self-injury as *NSSI* in the present dissertation. They are defined as two distinct diagnostic entities, but both share certain risk factors and frequently

appear as comorbid phenomena in the same person. In the following chapters, SB and NSSI are characterized separately, and common features are discussed.

Nonsuicidal Self-Injury

Nonsuicidal self-injury describes the direct and intentional damage of body tissue without suicidal intent which is not socially sanctioned (American Psychiatric Association, 2013). Most common methods of NSSI include cutting, scratching, and burning the skin or hitting oneself (Nock & Prinstein, 2004; Whitlock, 2006). NSSI is mostly used as a dysfunctional strategy for regulating emotions (P. J. Taylor et al., 2018). Further intrapersonal and social functions include anti-dissociation and anti-suicide, self-punishment, sensation-seeking, interpersonal boundaries and influence (Klonsky, 2007; Klonsky et al., 2015). In line with criterion A in the DSM-5 (American Psychiatric Association, 2013), NSSI is defined as repetitive if a person reports NSSI on five or more days in one year. As a repetitive behavior, NSSI is strongly linked to SB and other psychiatric symptoms (Brunner et al., 2007; Muehlenkamp et al., 2017).

For a long time, NSSI was mainly considered as a symptom of borderline personality disorder (BPD), but this notion has since been revised. Even though most adolescent patients with BPD report NSSI (Cipriano et al., 2017), only about half of adolescent clinical samples with NSSI meet diagnostic criteria for BPD (Ghinea et al., 2020; Glenn & Klonsky, 2013). In the psychiatric context, NSSI is highly prevalent with rates between 40-82% among adolescent patients (Adrian et al., 2011; Kaess et al., 2013; Klonsky & Muehlenkamp, 2007; Nock & Prinstein, 2004) and even among community youth, alarmingly high numbers of around 17-18% can be found (Muehlenkamp et al., 2012; Swannell et al., 2014). The emergence of NSSI is commonly observed in early adolescence at the age of around 12-13 years with a peak in mid adolescence. After reaching the highest prevalence at around 15-16 years of age, community NSSI rates often decline considerably during early adulthood (Plener et al., 2015). This generally encouraging finding should, however, be interpreted with caution. A symptom shift to other

risky behaviors is often observed in older youth and dysfunctional behaviors such as the abuse of alcohol and other substances may replace the emotion regulatory function of NSSI (Nakar et al., 2016; Turner et al., 2022).

A range of risk factors for NSSI during adolescence has been identified, including female gender, childhood maltreatment, comorbid depression, and BPD (Barrocas et al., 2015; Bresin, 2014; de Kloet et al., 2011; Ghinea et al., 2021; Marshall et al., 2013; Serafini et al., 2017). Systematically and meta-analytically, however, predictive effects tend to be weak. Only previous NSSI, cluster B personality disorder symptomatology, and hopelessness generated relatively strong predictive effects (Fox et al., 2015; Valencia-Agudo et al., 2018). The small amount of studies on predictors for the onset of NSSI have identified risk factors such as impulsivity, low self-esteem, peer victimization, or lack of family support (Andrews et al., 2014; Cassels et al., 2022; Tatnell et al., 2014; Victor et al., 2019). However, they are not specific to NSSI but well-known unspecific predictors of mental health issues in general. Similar predictors have been proposed regarding the continuation or cessation of NSSI. Additionally, factors such as the frequency of NSSI and the severity of wounds were shown to be linked to the persistence of NSSI (Andrews et al., 2013). Furthermore, the potential for positive personal development or growth after the remission of NSSI has recently been discussed. Psychological growth goes beyond the pure termination of self-harm and its negative consequences. It may encompass an adversity-inspired positive transformation to resilience including self-understanding, appreciation for life, and acceptance (Claréus et al., 2021; Turner et al., 2022; Whitlock et al., 2015). Specific literature regarding this aspect of NSSI is scarce, but the potential of evolving from mental health challenges over time should be further explored. In sum, a range of risk factors for NSSI are known but due to their unspecific character, differentiation between self-injury and other mental health issues is challenging. Additionally, most studies on this topic

were conducted in community samples and there is a lack of research on clinically relevant predictors of NSSI in specific at-risk populations.

Suicidal Thoughts and Behaviors

Suicidality can occur on a continuum ranging from suicidal ideation, plans, attempts, to completed suicide. The wish to die is present to some degree which differentiates suicidal from nonsuicidal self-injurious thoughts and behaviors. In community-based studies, 30% of adolescents report that they had thought about suicide before and 10% to have attempted to end their lives (Evans et al., 2005). Many suicide attempts are never registered officially and exact numbers are not available, but it is estimated that for every completed suicide of a young person there are 50 - 200 suicide attempts (McKean et al., 2018). According to the World Health Organization (2022), suicide was the fourth most common cause of death among 15-19 year-olds between 2000-2019 worldwide. In Switzerland, self-harm has been the leading cause of death in this age group since 2007 with 5.59 deaths per 100,000 citizens in 2019 (World Health Organization, 2020).

These numbers are highly concerning but it should be noted that suicidal ideation is far more common than effective suicidal behavior and many suicide attempts do not end in death. As a result, even though suicidal thoughts are present in most individuals who attempt suicide, thoughts are not a sufficient predictor of the actual behavior. This reveals a main issue in the prediction of suicide attempts or completed suicides: In the literature, various risk factors have been identified, ranging from depression, anxiety, BPD, adverse childhood experiences, to past suicidal behavior and NSSI (Angelakis et al., 2020; Asarnow et al., 2011; Carballo et al., 2020; Guan et al., 2012; Kaess et al., 2014; Kirkcaldy et al., 2006). A recent meta-analysis from Franklin et al. (2017) revealed that even after 50 years of suicidology research, prediction is still not considerably above chance. According to their analyses, prediction has not improved

over time, predictive value did not differ between thoughts, attempts, or completed suicide and they found no effect of age. Follow-up intervals of studies were often long, and population-based studies generated slightly better results. The usefulness of these studies for clinical work is rather limited. Clinicians do not necessarily need to know whether a person may attempt suicide some time in the distant future. They are more interested if a patient has an increased short-term risk and particularly, at what specific point in time a suicide attempt may happen. In addition to the above, most analyses included homogeneous, unspecific risk factors and the analytical methods which were employed were not appropriate for examining a highly fluctuating phenomenon such as suicidality. Franklin's meta-analysis (2017) shall be seen as an appeal to scientists to shift their focus away from distal, unspecific, and repetitive risk factors towards more proximal warning signs for suicidal thoughts and behaviors. In order to understand, predict, and eventually prevent the transition from one group to the other, it is crucial to distinguish between individuals who think about suicide and those who actually act on suicidal thoughts. This important aspect is further illustrated and theoretically embedded in the following chapter.

Association Between Nonsuicidal and Suicidal Thoughts and Behaviors

Even though NSSI and SB have a different underlying intention, parallels exist and both phenomena are often observed in the same person (American Psychiatric Association, 2013). Through the release of tension and stress, NSSI has been reported to regulate suicidal ideation and to have an anti-suicide effect in some cases. Feeling something rather than nothing may be preferred, even if it is painful (Klonsky, 2007). In the short term, NSSI has the potential to reduce suicidal thoughts in the moment of acute crisis, but from this, a vicious circle may develop. Groschwitz et al. (2015) found that common other functions differ in both behaviors:

NSSI and SB were both linked to negative reinforcement, but positive reinforcement was reported significantly more often in connection with NSSI. Furthermore, NSSI began about 1.5 years before SB, revealing an important temporal pattern. Shared risk factors of both behaviors include impulsivity, adverse childhood experiences, and comorbid psychopathology such as affective disorders and BPD (Asarnow et al., 2011; Dougherty et al., 2009; Groschwitz et al., 2015; Liu et al., 2018; McMahon, 2018; Nitkowski & Petermann, 2011). Independent of common risk factors, NSSI is one of the most significant predictors of SB (Castellví et al., 2017; Griep & MacKinnon, 2022; Ribeiro et al., 2016; Whitlock et al., 2013) including completed suicide (Hawton et al., 2020).

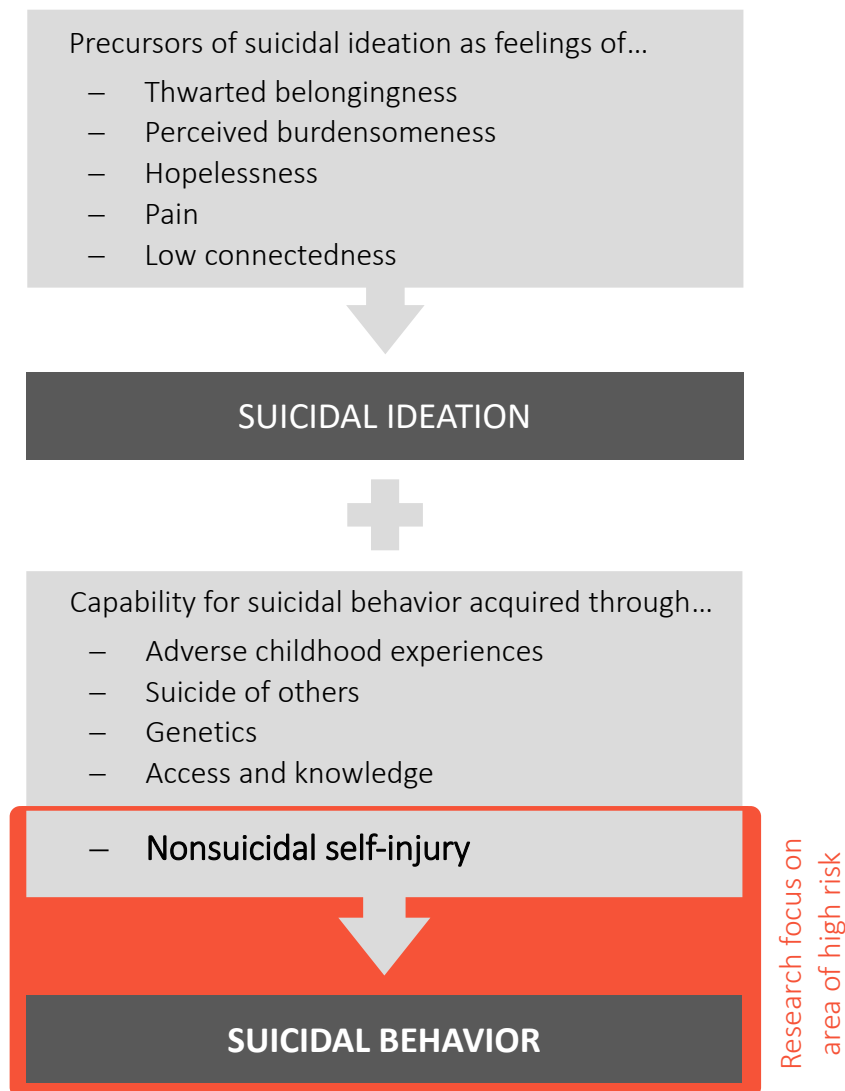
Looking at mechanisms linking NSSI and SB together, two theories are often mentioned: The Interpersonal Theory of Suicide (Joiner, 2005; Van Orden et al., 2010) and the Three-Step Theory of Suicide (Klonsky & May, 2015). Both theories are based on an ideation-to-action-framework and provide a theoretical foundation for the transition from suicidal thoughts to actual behaviors. Elements involved in the emergence of suicidal ideation are defined as feelings of perceived burdensomeness and thwarted belongingness as well as pain, hopelessness, and lack of connectedness. While they describe slightly different paths to suicidal ideation, in both theories the capability for suicide is postulated as an essential step for differentiating between individuals thinking about suicide and a person acting on those thoughts. Joiner (2005) mainly considers the capability for suicide to be acquired through adverse experiences such as abuse, the suicide of a familiar person, or NSSI. This aspect was extended by Klonsky and May (2015) with what they call dispositional and practical capability. The first describes mainly genetic factors which may influence certain phenomena such as pain sensitivity and proneness to blood phobia. The latter refers to more external factors which include access to and knowledge about suicide methods. Through repeated exposure to such experiences

(including NSSI) or certain predispositions, the natural fear of death may decline, pain sensitivity may shift, and a habituation to pain stimuli can set in (Barzilay et al., 2015; Chu et al., 2017; Koenig et al., 2016; Liu, 2017). This habituation has also been described to have a “gateway” function to suicide (Whitlock et al., 2013). Figure 1 illustrates aspects of both ideation-to-action theories and highlights an area of high risk after the capability for suicide has been acquired. Research in this field is growing, yet at-risk adolescents still constitute an understudied population. In the present dissertation, the focus lies on this particular area with research questions targeting both NSSI, SB and their connections.

These theories support the distinction between suicidal thoughts and behaviors and build an important framework for researchers and clinicians trying to better understand the continuum of self-harm. Furthermore, they provide a theoretical construct to understand the association between NSSI and SB through acquired capability and, further, emphasize the significance of NSSI as a transdiagnostic risk marker for SB. This concept highlights the importance of effectively treating NSSI: If NSSI was an isolated behavior, it could be viewed as a dysfunctional but effective coping strategy for regulating emotions. Instead, the successful reduction of NSSI seems to be a key element of suicide prevention among adolescents. Koenig et al. (2017) demonstrated the relevance of this approach in a large community sample. Adolescents who continued or began to self-injure one year after the first assessment had a two to three times increased risk for SB in the following year. The probability for SB among participants who reported self-harm at baseline but had stopped after one year, however, was comparable to those who never self-harmed. This highlights the potential of stopping NSSI in regard to the prospective risk for SB. As discussed before, NSSI often follows a natural trajectory over time with a decline into early adulthood and in some cases a spontaneous remission may occur. Still, many adolescents who self-harm require professional support on their journey. The next chapter gives an overview of psychotherapeutic options for treating NSSI and SB.

Figure 1

Overview of an Ideation-to-Action-Framework of Suicide



Note. The area of increased risk for suicidal behavior, which is the focus of this dissertation, is highlighted in red.

Psychotherapeutic Treatment

Help-seeking tends to be low among adolescents in general and those with self-injury in particular (Doyle et al., 2015; Rowe et al., 2014). Many adolescents may refrain from seeking help because the emotion regulation function and the rapid relief that sets in after NSSI rein-

forces the behavior (Robinson et al., 2019). Other barriers include the widespread negative connotation and stigma surrounding psychotherapeutic treatment and self-harm, often coming from peers and parents but also teachers and professionals (Burke et al., 2019; Hasking et al., 2015). This prevents many adolescents from receiving adequate care for self-injuries.

Once these barriers are overcome, different interventions are available for treating NSSI and SB. Most common programs include *Cognitive Behavioral Therapy* (CBT; L. Taylor et al., 2011), *Dialectical Behavior Therapy* (DBT-A; Mehlum et al., 2014, 2019; Tørmoen et al., 2014) and *Mentalization-Based Therapy for Adolescents* (MBT-A; Rossouw & Fonagy, 2012). Meta-analytically, CBT, DBT-A, and MBT-A had the largest effect sizes of any therapeutic intervention for the reduction of self-harm (Ougrin et al., 2015), and they showed the only replicable effects (Iyengar et al., 2018). Although commonly used to treat patients with NSSI and SB, the last two programs were developed for treating personality disorders. Therefore, the downside of these programs includes their long duration, long waiting times, high costs and severe demands on patients. Brief and low-threshold interventions such as the *Treatment for Self-Injurious Behaviors* and the *Cutting Down Program* (CDP) are attractive alternatives. Randomized controlled trials (RCT) suggest they may produce comparable effects while being significantly shorter than treatment-as-usual (TAU; Andover et al., 2017; Kaess et al., 2020; L. Taylor et al., 2011).

The main priority across treatment settings is the safety of the patient. A thorough exploration of suicidality is always indicated if a person presents with self-inflicted injuries, independent of the initially stated intent. If possible, outpatient therapy is preferred over an inpatient facility due to less disruptions and better transferability into daily life (Plener et al., 2017). If hospitalizations are necessary, they should be clearly structured and brief (Haynes et al., 2011; Linehan, 1993). The Association of the Scientific Medical Societies in Germany has proposed guidelines for clinical decision-making including a detailed treatment algorithm for

managing adolescent patients with self-injuries (Plener et al., 2017). In recent years, stepped-care approaches have been repeatedly proposed for the treatment of NSSI to reflect its multifaceted and transdiagnostic character (Plener, 2020). One specialized center implementing such a concept is the outpatient clinic for risk behavior and self-harm (AtR!Sk) in Heidelberg, Germany. The clinic is part of the Department of Child and Adolescent Psychiatry at the University Hospital Heidelberg. In addition to psychotherapeutic treatment a focus lies on the study of diagnostic assessment, early detection, and treatment of risk-taking and self-injurious behavior as well as personality psychopathology. Psychotherapeutically, a staging principle is in place. There is a weekly open office hour for a low threshold point of first contact, followed by a comprehensive diagnostic assessment and a treatment offer or referral in accordance with the patient-program fit. Psychotherapeutic treatment currently includes either the CDP or DBT-A, or a consecutive combination of both depending on personality psychopathology. On the research side, an accompanying cohort study was initiated in 2013. Help-seeking patients between 12-17 years old were recruited to participate. Until baseline closure in early 2020, a total of $n = 625$ adolescents were included in the study with a participation rate of 86%. In 2018, a second AtR!Sk unit was opened in Bern, Switzerland. The data used in the three publications included in this dissertation were collected at the Heidelberg AtR!Sk facility and are extremely valuable due to the high-risk composition of the sample and the rigorously structured long-term data collection.

SCIENTIFIC CONTRIBUTION

Nonsuicidal and suicidal self-injuries are prevalent high-risk behaviors. Researchers and clinicians have tried to understand the phenomena for decades and still, many questions regarding treatment, assessment, and prediction remain unanswered. The aim of the present dissertation is to shed light on some clinically highly relevant aspects of NSSI and SB with a focus on long-term development, trajectories, and predictors among at-risk adolescents. In the first study, we looked at the long-term treatment effects of a brief psychotherapeutic intervention for NSSI. In this context, we used follow-up data from a RCT comparing the CDP to TAU in a subset of the cohort sample. In the second study, we adopted a more individualized approach to examine actual response and remission rates as well as exacerbation and relapses of NSSI over periods of one and two years, respectively. Clinically relevant predictors of change were identified. The third work focused on the prediction of suicide attempts. We investigated if adolescents who have attempted suicide before can accurately forecast their probability of attempting suicide again in the following year. In the next section, all three publications are summarized which is followed by a discussion and outlook for future research.

Long-Term Treatment Effects of the Cutting Down Program

Appendix A

Rockstroh, F., Edinger, A., Josi, J., Fischer-Waldschmidt, G., Brunner, R., Resch, F., & Kaess, M. (2023). Brief psychotherapeutic intervention compared with treatment-as-usual for adolescents with nonsuicidal self-injury: Outcomes over a 2 to 4-year follow-up. *Psychotherapy and Psychosomatics*, 92(4), 243–254.

Various interventions exist and were shown to effectively reduce NSSI. However, such treatment programs are often long, expensive, and require extensive training for therapists. The CDP is a brief intervention for treating NSSI in adolescents based on CBT elements. Kaess et al. (2020) translated the program and evaluated the German version in a RCT, comparing the CDP to high-quality TAU. NSSI was reduced significantly in both groups without any between-group differences. Participants in the CDP, however, reduced NSSI earlier and received significantly less therapy sessions. In the present study, we examined whether these effects remained stable over two to four years after baseline assessments.

Incidents of NSSI further reduced in both treatment groups with additional reductions in each follow-up year. Number of suicide attempts and depression severity decreased over the follow-up period and quality of life remained on a consistent level. Due to its relatively stable character over shorter time frames, BPD was not included in the original analyses. Over two to four years, however, BPD symptoms reduced significantly in both groups. This is highly encouraging considering the burdened sample composition.

In both groups, over two thirds of patients received more therapy after the initial treatment period with comparable number of treatment sessions. Additional treatment was associated with significant reductions in NSSI. On the one hand, this shows that even after receiving significantly less therapy and having a treatment break of around six months, the CDP group did not compensate by requiring more therapy sessions after the initial study phase. On the

other hand, a large proportion of the complete sample were in need of further treatment after having received high-quality psychotherapy. Even though NSSI significantly reduced during the initial period of the study, it showed that there remained a strong need for additional support. In the long term, neither the CDP nor high-quality TAU seem to sufficiently treat NSSI and comorbid psychopathology in many patients. In line with a stepped care approach, however, as has been frequently proposed for treating NSSI, the CDP seems to be an adequate low-threshold therapy option for help-seeking adolescents. With less initial treatment sessions and comparable longitudinal results to TAU, the CDP has the potential to be an economical intervention for patients, therapists, and mental healthcare providers alike.

Treatment Outcome of Nonsuicidal Self-Injury

Appendix B

Reichl, C., Rockstroh, F., Lerch, S., Fischer-Waldschmidt, G., Koenig, J., & Kaess, M. (2023). Frequency and predictors of individual treatment outcomes (response, remission, exacerbation, and relapse) in clinical adolescents with nonsuicidal self-injury. *Psychological Medicine*, 1-10.

As presented above, there are good psychotherapeutic options for treating NSSI. The natural course of NSSI in the general adolescent population also seems to decline when entering young adulthood. We can assume that NSSI is a dynamic behavior which in most cases does not remain stable at a high level. As with other psychiatric disorders, some patients, however, do not respond to treatment or even deteriorate. To date, there is only limited research on outcomes of NSSI treatment on an individual level. In this paper, we aimed to examine the trajectories of NSSI over up to two years. On this basis, the goal was to determine the frequencies of responses, remission, exacerbation, and relapse as well as respective predictors of change.

Most participants (75%) reduced NSSI considerably with a mean decline of 90% in the response group. But only 25% achieved a remission and reported no NSSI one year later. At the same time, 11% exacerbated and showed an increase of NSSI by at least 50%. Among participants with a remission, 40% reported a relapse another year later. This illustrates that the usually applied analyses on a mean level do not sufficiently differentiate individual trajectories or consider variability of NSSI over time.

In a second step, we examined potential clinically relevant predictors of group membership. On a symptom level, only depression was a significant negative predictor for remission. Psychiatric inpatient care between baseline and 1-year follow-up was negatively associated with response and remission: The longer the inpatient stay, the lower the likelihood for a reduction in NSSI. This finding can be interpreted in two ways, which may be interlinked: First, patients who require inpatient care tend to be highly burdened and have a lower psychosocial functioning compared to those who solely receive outpatient therapy. Secondly, inpatient units can be a highly stressful environment. Factors such as loneliness and isolation, but also social contagion through the contact to other patients who self-harm, can reinforce the urge for NSSI. An exacerbation in NSSI was significantly predicted by lower NSSI rates at baseline. One year later, this group reported comparable NSSI numbers to the complete sample at baseline. We assume that these patients were at a different stage in the longitudinal course of self-harm. They may reach their peak of NSSI at a later point. If a patient seeks psychotherapeutic help and reports low frequency NSSI at first contact, the development of NSSI should be closely monitored over time to detect subsequent increases early.

This study revealed the variability of NSSI that can be observed in a clinical sample of adolescents with NSSI. There is a need for more personalized, dynamic treatment options, and more research is required to gain a better understanding of NSSI aggravation and relapse in such a highly burdened population.

Self-Rated Risk for Suicide Attempts

Appendix C

Rockstroh, F., Reichl, C., Lerch, S., Fischer-Waldschmidt, G., Ghinea, D., Koenig, J., Resch, F., & Kaess, M. (2021). Self-rated risk as a predictor of suicide attempts among high-risk adolescents. *Journal of Affective Disorders*, 282, 852–857.

Predicting suicide attempts is a challenging task for clinicians and researchers. Even adolescents who are affected by it often struggle with detecting a suicide attempt before it happens. Since traditional risk assessments were found to have limited predictive value, the focus in these analyses was on the adolescent's self-rating as an alternative informational source. Specifically, we examined whether help-seeking adolescents who had attempted suicide before were able to predict their probability of attempting suicide again in the following year. BPD and depressive symptomatology were tested as potential moderators of this association.

Between baseline and follow-up assessment after one year, 38% of participants attempted suicide. Out of the well-known risk factors of suicidal behavior that were included in the model (number of past suicide attempts, BPD, and depression), self-rated risk was the only significant predictor for subsequent suicide attempts. When including BPD in the model, self-rated risk remained significant. BPD did not act as a moderator of self-ratings on the occurrence of a suicide attempt. This finding is particularly interesting when considering BPD characteristics. Impulsivity and instability in affect and identity may have the effect that patient statements are considered as unreliable and even manipulative by clinicians. Our findings indicate that self-ratings of suicide attempt risk should be taken seriously independent of BPD severity.

The inclusion of depressive symptomatology, on the other hand, led to self-rated risk losing statistical significance. The analysis of the interaction of both factors revealed a moder-

ating effect: Self-rated risk and depression predicted suicide attempts in the following year independently and as an interaction. In other words, adolescents with lower levels of depression were able to predict the risk of attempting suicide, whereas those with severe depression were not. With increasing depression levels, the predictive accuracy of self-ratings dropped. A possible explanation may be found in the interaction between negative views of the self and the future – typically observed in individuals with depression on a cognitive level –, and lethargy which inhibits patients with severe depression from performing the actual behavior.

Self-ratings were identified as a valuable element in the prediction of a suicide attempt in a highly burdened sample of help-seeking adolescents who had attempted suicide before. Self-rated risk even outperformed other predictors, such as the number of suicide attempts in the past, BPD, and depressive symptomatology. In routine care, the assessment of self-rated risk is simple and easily implemented and can be an invaluable addition to traditional risk assessment. However, clinicians should keep depressive symptoms in mind when collecting risk self-ratings for suicide attempts and they should be aware of potential bias in patients with severe depression.

CONCLUSION

The objective of the present dissertation was to examine the longitudinal evolution and the predictors of nonsuicidal and suicidal self-injury in adolescents with an increased risk for these behaviors. Our findings revealed that NSSI can be reduced significantly and sustainably through a brief therapeutic intervention. Still, many patients may require additional treatment after initial therapy and complete, lasting remission is difficult to attain. In order to plan treatment more efficiently and to identify patients who may not profit from a particular intervention early on, more research should go into identifying tangible predictors of treatment outcome. The concept of measurement-based care and personalized treatment in psychotherapy has recently gained increasing attention (Cuijpers et al., 2016; Hickie et al., 2019). This approach has not been applied to the treatment of NSSI and SB yet, but it may be particularly promising for a transdiagnostic phenomenon such as self-harm. One important aspect of treating NSSI has always been and still is the reduction of risk for SB. The first study showed that suicide attempts were significantly less frequent up to four years after treatment initiation. In future analyses, the effects of individual NSSI trajectories (e.g., response, remission, exacerbation, relapse) on SB risk should be further examined with a focus on adolescent at-risk samples.

One important question that arises from these findings is how clinicians and scientists should define the terms “Successful Treatment” and “Remission” regarding self-harm. There is a range of interventions for adolescents with NSSI but due to various barriers many do not receive adequate care. Even patients who seek help often face lengthy treatment with long waiting times. Brief programs such as the CDP have an enormous potential to reach a wider audience of patients and therapists alike, and they are an important step in the direction of more personalized psychotherapeutic treatment. Having said this, even after seeking help and receiving high-quality treatment, remission rates remain low, and relapses are common. Recent literature on NSSI recovery revealed the complexity of remission. Patients reported that they would link recovery more to the urge to self-injure than to the simple cessation of the behavior (Claréus

et al., 2022; Kelada et al., 2018; Lewis et al., 2019). To comprehend NSSI remission as part of an intricate, dynamic process rather than a dichotomous state may facilitate a shared understanding of what recovery means. By including patient experiences, Lewis and Hasking (2021) propose a novel framework for NSSI recovery as a nonlinear and multifaceted phenomenon. This perspective could guide future clinical and research decision-making and ultimately support NSSI treatment. The inclusion of lived experiences may prove particularly helpful for explaining highly fluctuating and dynamic phenomena such as NSSI and SB which to date are difficult to comprehend for researchers, clinicians, and those affected. In line with the finding that adolescents' self-ratings of suicide attempt risk had a high predictive value, the above highlights the potential of working with multiple data sources and actively involving affected individuals in research.

This brings us to further challenges which the field of self-injury research currently faces. As Fox et al. (2015) and Franklin et al. (2017) sophisticatedly illustrated, many studies on NSSI and SB predictors included similar potential risk factors with long follow-up time spans. The results of these meta-analyses were alarming, and much more attention currently lies on diversifying self-harm research projects. Particularly, the collection of intensive longitudinal data is becoming increasingly popular. This includes high-frequency surveys as well as biobehavioral and passive mobile data. So-called ecological momentary or ambulatory assessment methods enable researchers to collect data in almost real-time in the life of participants (Shiffman et al., 2008). Large data sets have the benefit that advanced statistical methods such as machine learning can be applied to identify novel relevant variables. Further, shorter intervals between assessments allow thorough monitoring of risk-behaviors and bring us closer to identifying proximal warning signs for self-injury. Self-harm research often focuses on *who* may injure themselves, not *when* that person is at risk of doing so. The aim of shifting the focus on the latter question is to improve short-term prediction of the actual self-injurious behavior

and to ultimately being able to intervene during that critical phase. In line with this, a theoretical shift from the Interpersonal and Three-Step Theories of Suicide which concentrate on the *who*, to an adapted version of a fluid vulnerability model of suicide (e.g., Bryan et al., 2020; Rudd, 2006) may better represent the real-life fluctuations of self-injury.

In conclusion, there is a lot of potential for future research on self-injury. In the short term, digitalization will allow us to collect new and multifaceted data through ambulatory assessment methods. Through the examination of intrapersonal change, much knowledge has already been gained regarding fluctuations of NSSI and suicidal ideation which will lead to a more in-depth understanding of the phenomena. In the middle term, the goal must be to identify proximal risk factors for moments of crisis in form of NSSI, SB, and other interlinked high-risk behaviors that are tangible and applicable in a clinical setting. Ultimately, this knowledge will help us to develop and optimize personalized treatment for self-injury and to intervene during such high-risk states. Building a sound data basis and using sophisticated analysis methods to our advantage will not only improve patient care but also play an important role in managing a public mental health crisis through early detection and intervention.

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APPENDICES

Appendix A.....

Brief Psychotherapeutic Intervention Compared With Treatment-as-Usual for Adolescents With Nonsuicidal Self-Injury: Outcomes Over a 2 to 4-Year Follow-Up

Appendix B.....

Frequency and Predictors of Individual Treatment Outcomes (Response, Remission, Exacerbation, and Relapse) in Clinical Adolescents With Nonsuicidal Self-Injury

Appendix C.....

Self-Rated Risk as a Predictor of Suicide Attempts Among High-Risk Adolescents

APPENDIX A

Brief Psychotherapeutic Intervention Compared With Treatment-as-Usual for Adolescents With Nonsuicidal Self-Injury: Outcomes Over a 2 to 4-Year Follow-Up

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Brief Psychotherapeutic Intervention Compared with Treatment as Usual for Adolescents with Nonsuicidal Self-Injury: Outcomes over a 2–4-Year Follow-Up

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Keywords

Nonsuicidal self-injury · Randomized controlled trial · Adolescents · Psychotherapy · Longitudinal outcome

Abstract

Introduction: The “Cutting Down Programme” (CDP), a brief psychotherapeutic intervention for treating nonsuicidal self-injury (NSSI) in adolescents, was comparable to high-quality treatment as usual (TAU) in a previous randomized controlled trial (RCT). **Objective:** The aim of the study was to evaluate the long-term outcomes of the CDP over up to 4 years. **Methods:** Assessments of NSSI, suicide attempts, borderline personality disorder (BPD), depression, and quality of life took place 2 to 4 years (T3) after enrollment in a RCT. The evolution of NSSI, suicide attempts, depression, and quality of life was analyzed using (generalized) linear mixed-effects models. Ordered logistic regression was used for analyzing BPD diagnoses. Data from T0, T2, and T3 are reported. **Results:** Out of 74 patients, 70 (95%) were included in the T3 assessment. The frequency of NSSI events alongside with suicide attempts and depression

further decreased between T2 and T3 and BPD between T0 and T3 in both groups. Quality of life remained stable in both groups between T2 and T3. Both groups received substantial but comparable additional treatment between T2 and T3. More treatment sessions during the follow-up period were linked to larger improvements of NSSI. **Conclusions:** The CDP was found to be as effective as TAU in promoting recovery from NSSI and comorbid symptoms in the long term. Results suggest that treatment effects from a brief psychotherapeutic intervention may endure and even further improve after completion of the program. However, additional treatment seems to improve chances for recovery independent from CDP versus TAU.

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Introduction

Nonsuicidal self-injury (NSSI) is defined as “the deliberate, self-directed damage of body tissue without suicidal intent and for purposes not socially or culturally sanctioned”

[1]. It is particularly prevalent in mid-adolescence with a decrease in frequency over the course of adolescence and young adulthood [2]. Prospectively, NSSI is an important predictor for suicidal behavior [3–5] as well as long-term morbidity and mortality [6]. The reduction of NSSI has been shown to be linked to a risk decrease for suicidal behavior in community adolescents [7], which emphasizes the potential of and need for effective interventions. Cross-sectionally, it is associated with severe emotion dysregulation [8] and a wide range of comorbid diagnoses [9, 10] including borderline personality disorder (BPD) [11, 12].

NSSI is one of the most frequent symptoms in adolescents with BPD; however, a diagnosis of BPD is only present in around 30–50% of clinical samples with NSSI [9]. Besides categorical diagnoses, dimensional BPD pathology commonly underlies NSSI [12], and in those engaging in NSSI, underlying BPD pathology is associated with a variety of unfavorable parameters such as more severe NSSI and lower psychosocial functioning [13]. Furthermore, affective disorders are common among adolescents with NSSI, and depressive symptoms were found to be both correlated with and predictive of NSSI [3, 14–16]. NSSI can lead to impairment in different areas of life and is often linked to a considerable decrease in quality of life [13, 17]. Noteworthy, both depression and BPD seem to independently contribute to lower psychosocial functioning in individuals with NSSI [18].

Despite the serious clinical and functional impairments commonly associated with repeated NSSI [19, 20], the majority of adolescents with NSSI do not receive adequate treatment [21, 22]. While help-seeking behavior tends to be particularly low among adolescents with NSSI [23, 24], this patient group is also considered to be challenging by professionals and, as a result, limited treatment capacities are available. Specific treatment options for NSSI are scarce, and research regarding positive as well as potential negative effects of psychotherapy or medication is limited in this context. Side effects in both treatment modalities may include perceived lack of control, feelings of stagnation, or even worsening of symptoms [25, 26], and for antidepressant medication, which is commonly prescribed among adolescents with self-injury, significantly increased rates of excessive mood elevation (e.g., mania-hypomania) have been reported [27]. Therefore, there is a great need for long-term effective interventions that are easily accessible for patients as well as feasible to deliver by clinicians in outpatient settings [28–30]. Brief programs, such as the Attempted Suicide Short Intervention Program (ASSIP), which is delivered after a suicide attempt, are promising [31],

but further research is needed on the distinction between such brief interventions and other treatment options [32].

To address this gap among high-risk adolescents with self-injurious behavior, our group previously translated and evaluated a brief psychotherapeutic program, the “Cutting Down Programme” (CDP), which specifically aims to reduce adolescent NSSI [33, 34]. Because of its short duration of only 8 to 12 sessions, it sets a low threshold and can be provided to a larger number of help-seeking adolescents. Beyond that, the CDP is mainly based on cognitive-behavioral elements and does not require extensive additional training for therapists. Previously, we have reported on the treatment outcome from a randomized controlled trial (RCT) comparing the CDP with high-quality treatment as usual (TAU) [33]. In this RCT, the CDP was as effective as TAU (which involved a significantly higher treatment dose) in reducing frequency of NSSI, attempted suicides, severity of depression as well as improving overall well-being with generally large effect sizes for outcomes in the CDP condition (reduction of NSSI: Cohen’s $d = 0.99$) as well as in the TAU condition (reduction of NSSI: Cohen’s $d = 0.79$) [33]. While these findings are encouraging and show that adequate treatment can lead to significant reductions in NSSI, the literature on the maintenance of treatment effects is scarce, and the effectiveness of brief treatments – such as the CDP – over longer follow-up periods has not yet been examined.

In the present study, we report 2–4-year follow-up outcomes of the previously published RCT. Our main aim was to evaluate whether the equality of treatment outcomes would be sustained 2–4 years after baseline assessment. Primary outcome was number of NSSI events in the 6 months before T3 (2–4-year follow-up), in addition to suicide attempts, BPD pathology, depression, and overall well-being as secondary outcome measures. Beyond that, the impact of further treatment sessions between T2 and T3 was investigated.

Materials and Methods

Participants and Procedure

The original sample consisted of 74 adolescents (mean age 14.9 years, $SD = 1.2$) who were mainly female (96%) and for the most part recruited at the Clinic of Child and Adolescent Psychiatry at the University Hospital Heidelberg, Germany. Inclusion criteria were as follows: a history of at least 5 episodes of NSSI within the previous 6 months, at least 1 episode within the last month, and aged between 12 and 17 years. Exclusion criteria were acute psychotic symptoms, acute intent to harm self or others that

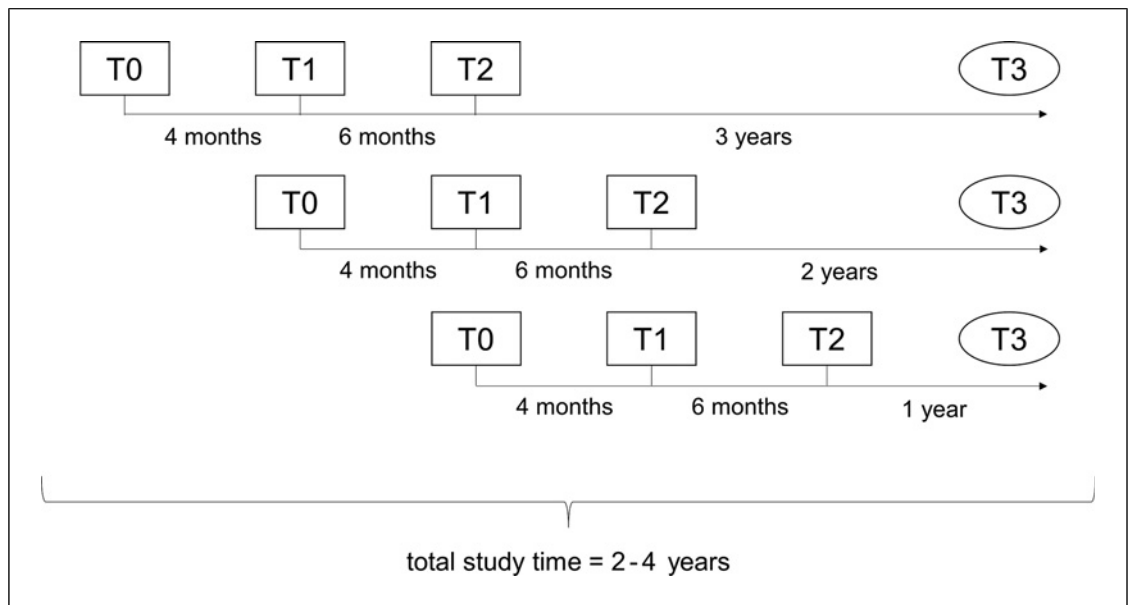


Fig. 1. Study design with assessment time points depending on initial study participation.

requires intensive psychiatric inpatient treatment, impaired intellectual functioning, and/or currently receiving psychotherapeutic treatment.

Participants were randomly assigned to receive, on average, 10 sessions of either CDP or high-quality TAU. CDP was conducted at our university hospital for an average of 10 sessions according to the manual [33]. TAU was delivered by one of our cooperating local child and adolescent psychotherapists or psychiatrists either in private practice or in psychotherapeutic services. It comprised non-manualized standard care enhanced for the purpose of the trial by requiring that TAU therapists agree to provide a first appointment and subsequent therapy within 2–4 weeks to prevent waiting times. TAU was delivered on average for 19 sessions. Both treatment conditions included general child and adolescent psychiatric management as well as ancillary pharmacotherapy as needed. For detailed information on both interventions, see the original study [33].

Study participants were assessed at four time points: T0 (baseline), T1 (postline), T2 (follow-up 1), and T3 (follow-up 2). Postline took place at the end of the CDP or 4 months after baseline in the TAU group. Data from this time point have been published previously and are not included in the current analyses. T2 (primary endpoint of the initial RCT) was conducted 6 months after postline. T3 was conducted 1 to 3 years after T2. The varying time points for T3 are a result of the longer than expected recruitment period for the initial study. In order to examine long-term treatment effects in this valuable high-risk sample, the pragmatic decision was made to implement an additional follow-up assessment during a condensed time period instead of spreading measurements across another 3 years. For patients who began treatment and study participation first, T3 therefore took place 3 years after T2. Participants who enrolled last in the study returned for T3 1 year after T2. See Figure 1 for an overview of the assessment time points. As data from the trial period of time

up to T2 have been published previously [31], current analyses focus on T3 as the outcome.

The study was approved by the Institutional Review Board of the medical faculty at the University of Heidelberg (Ethics Committee No.: S-363/2011), and all patients and parents or caregivers (if participants were below 16 years of age) provided written informed consent. Similar to the assessments of the original RCT, assessments at T3 were performed by an independent interviewer (trained and experienced clinical psychologist) blinded to treatment allocation. The interviewer was asked to guess treatment group allocation after the interview, which resulted in 49.1% correct responses, indicating that blinding was successful. Participants received a monetary compensation for participating in the assessment.

Assessments

The same measures of outcome as in the original study were used at T3. The number of NSSI events in the 6 months prior to T3 was measured through the German version of the Self-Injurious Thoughts and Behaviors Interview (SITBI-G) [35, 36]. The number of NSSI events in the first, second, and third years after T2 was measured at T3. The number of suicide attempts since the last study appointment was also assessed using the SITBI-G. Borderline personality pathology was assessed using parts of the Structured Clinical Interview for DSM-IV-Axis II (SCID-II) [37]. Interrater reliability was checked within our outpatient clinic for adolescent risk-taking and self-harm behavior with very good agreements for the SITBI-G (κ s = 0.77–1.00) [35] and for full-threshold BPD (93.62%) [13]. The clinician responsible for the interviews was involved in all inter-rater reliability checks. The level of depressive symptoms was measured by the self-report Beck Depression Inventory-II (BDI-II) [38] and subjective health and well-being by the KIDSCREEN-27 questionnaire for children and adolescents [39]. For further information on psychometric criteria,

see the original study [33]. Data on the use of psychotherapeutic and psychiatric services as well as psychiatric hospitalization during the period between T2 and T3 were collected from each participant through standardized questions at the beginning of the interview.

Statistical Analysis

To analyze the evolution in the frequency of NSSI until T3, two generalized linear mixed models were fit. In model 1, the response variable was the number of NSSI events in the last 6 months, measured at T0, T2, and T3. Since the response is a count variable and significant overdispersion was present, the response was modeled using a negative binomial distribution with a log link. The model included fixed effects for therapy group, time point and an interaction between the two, and a random intercept per study participant. To account for the different durations between T2 and T3 (1, 2, or 3 years), time between T2 and T3 was added in this model (model 1) as a linear predictor at T3. The second model (model 2) also used NSSI counts as the response variable but measured over different time spans. The 6 months before T0 and T2 were included as in the first model, but now the yearly NSSI counts in the first (T3₁), second (T3₂), and third (T3₃) year between T2 and T3 were included. These observations were partially missing depending on the number of years between T2 and T3 for each participant. To make the different time spans comparable, a corresponding exposure correction was specified in the negative binomial mixed model. The effect sizes for these count models are reported as incidence rate ratios (IRRs).

In secondary analyses, means and standard deviations or median and interquartile ranges were computed for normally distributed and non-normally distributed variables, respectively. Yearly suicide attempts were analyzed using mixed-effects Poisson regression, and in line with model 2, an exposure correction was included to account for varying time spans between T2 and T3. The evolution of the number of BPD criteria was modeled using an ordered logistic regression model, where the proportional odds assumption was checked using Brant's test. For data on depression and quality of life over time, mixed-effects linear regression was used, with fixed and random effects as in model 1. Results from T2 to T3 are reported, except for BPD data which were only assessed at T0 and T3.

Age at baseline was included as a covariate in all models to account for the development of NSSI and associated psychopathology across adolescence. A significance level of $\alpha = 0.05$ was used for all analyses. All analyses were performed using STATA 17 (StataCorp LLC, College Station, TX, USA).

Results

Of the 74 adolescents who were enrolled in the study, all continued their participation in the study until T2. At T3, 3 participants of the CDP and 1 participant of the TAU chose to decline further participation or were not contactable, whereas 70 adolescents remained in the study, resulting in a 95% retention rate for T3. The progress of the participants during the trial is shown in Figure 2. The follow-up at T3 was performed one (TAU

$n = 10$; CDP $n = 10$), two (TAU $n = 11$; CDP $n = 10$), or three (TAU $n = 15$; CDP $n = 14$) years after T2, depending on the time of enrollment of the participant (Fig. 1). There was no association between the treatment group and the duration between T2 and T3 ($\chi^2(2) = 0.02$; $p = 0.988$). The sociodemographic sample characteristics have been published in detail elsewhere [33]. There were no differences in the baseline demographic characteristics and pretreatment NSSI between treatment groups.

Development of NSSI

Frequencies and changes of NSSI over time are shown in Table 1. The distributions of NSSI frequencies for the last 6 months at T0, T2, and T3 are shown in Figure 3a. There was no evidence for a group difference between TAU and CDP ($\chi^2(1) = 0.00$, $p = 0.965$) or a group \times time point interaction ($\chi^2(2) = 3.32$, $p = 0.190$), but the time point had a significant effect ($\chi^2(2) = 72.8$, $p < 0.0001$), with a further reduction in the NSSI rate from T2 to T3 (IRR = 0.16, 95% CI: [0.09, 0.28], $p < 0.0001$), meaning that the NSSI frequency further decreased by 84% between T2 and T3. The duration between T2 and T3 also had a significant effect, with each additional year after T2 further reducing the rate of NSSI events at T3 (IRR = 0.59, 95% CI: [0.37, 0.96], $p = 0.032$). The results of model 2, which had as outcome the number of NSSI events in the first, second, and third years after T2, were consistent with the results of model 1, with strong evidence for a decrease in NSSI over time (overall $\chi^2(4) = 155.75$, $p < 0.0001$; IRR from T2 to T3₁ = 0.42, 95% CI: [0.26, 0.70]; IRR from T3₁ to T3₂ = 0.32, 95% CI: [0.19, 0.56]; IRR from T3₂ to T3₃ = 0.64, 95% CI: [0.30, 1.35]), no main group effect ($\chi^2(1) = 0.16$, $p = 0.686$), and no group \times time point interaction ($\chi^2(4) = 5.58$, $p = 0.233$). Age was a significant predictor of NSSI frequency in model 1 (IRR = 0.79, 95% CI: [0.64, 0.99], $p = 0.038$) and model 2 (IRR = 0.71, 95% CI: [0.56, 0.89], $p = 0.004$).

Suicide Attempts

After a significant reduction between T0 and T2 (IRR = 0.46; 95% CI: [0.25, 0.87]; $\chi^2(1) = 5.65$; $p = 0.017$), the number of yearly suicide attempts was further reduced between T2 and T3₁ (IRR = 0.27; 95% CI: [0.10, 0.70]; $\chi^2(1) = 7.32$; $p = 0.007$) as shown in Figure 3b. Between T3₂ and T3₁, there was no additional decrease of suicide attempts (IRR = 0.53; 95% CI: [0.13, 2.23]; $\chi^2(1) = 0.76$; $p = 0.384$), and at T3₃, no suicide attempts were reported since T3₂. There was no evidence for a group effect ($\chi^2(1) = 1.02$; $p = 0.312$) or a group \times time point interaction ($\chi^2(3) = 4.45$; $p =$

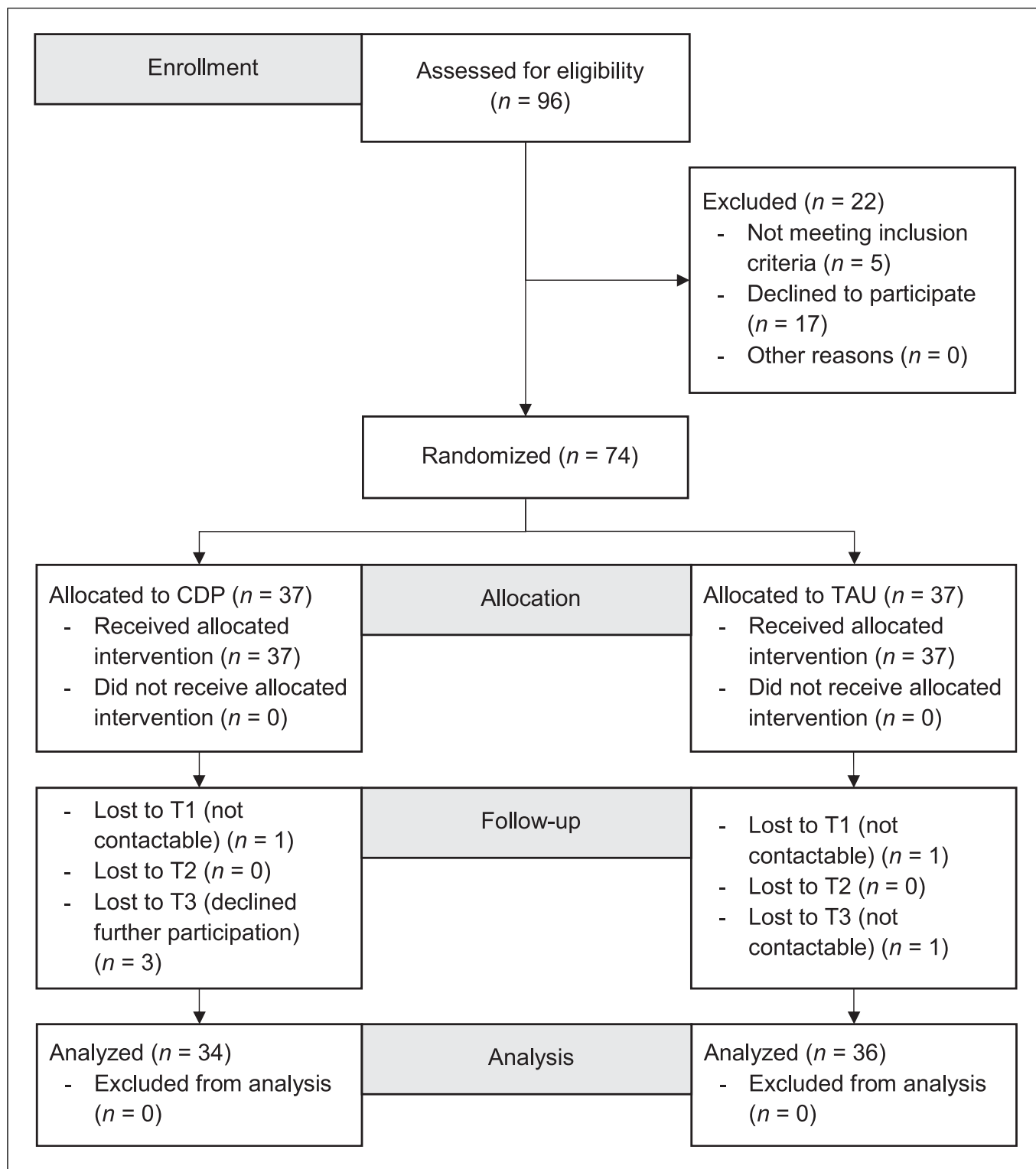


Fig. 2. Flow of study participants through recruitment, intervention, T1, T2, and T3 assessments, and analysis.

Table 1. Clinical characteristics of the sample

Clinical outcome	TAU	CDP	Group differences <i>p</i> value
NSSI in the last 6 months, Md (IQR)			
Before T2	8 (1–50)	10 (2–40)	0.668 ^a
Before T3	0 (0–1)	1 (0–6)	0.066 ^a
NSSI frequency, Md (IQR)			
In the first year after T2	8.5 (0–33.5)	7.5 (1–30)	0.712 ^a
In the second year after T2	0 (0–6)	2.5 (0–22.5)	0.228 ^a
In the third year after T2	1 (0–5)	0 (0–4)	0.516 ^a
SA yes/no, <i>n</i> (%)			
In the first year after T2	7 (19.4)	2 (5.9)	0.090 ^b
In the second year after T2	1 (2.8)	1 (2.9)	0.367 ^b
In the third year after T2	0 (0)	0 (0)	–
BPD diagnosis, <i>n</i> (%)			
At T0	8 (22.2)	15 (44.1)	0.079 ^b
At T3	1 (2.8)	3 (8.8)	0.276 ^b
Depression score, M (SD)			
At T2	20.9 (14.9)	22.8 (13.9)	0.586 ^c
At T3	16.6 (13.7)	19.2 (15.2)	0.456 ^c
Quality of life, M (SD)			
At T2	44.7 (8.4)	43.7 (8.9)	0.638 ^c
At T3	42.9 (6.3)	44.6 (7.8)	0.460 ^c
Number of therapy sessions between T2 and T3, M (SD)	34.7 (39.5)	33.7 (44.0)	0.926 ^c

TAU, treatment as usual; CDP, cutting down program; *n*, sample size; M, mean; SD, standard deviation; Md, median; IQR, interquartile range; NSSI, nonsuicidal self-injury; SA, suicide attempt; BPD, borderline personality disorder. ^a*p* value for a two-sample Wilcoxon rank-sum test at the presented point in time. ^b*p* value for a χ^2 test for group differences at the presented point in time. ^c*p* value for a two-sided *t* test for group differences at the presented point in time.

0.217). Age significantly predicted the decrease in suicide attempts (IRR = 0.73; 95% CI: [0.56, 0.97]; *p* = 0.027).

Borderline Personality Disorder

The development of BPD was assessed using the number of BPD diagnostic criteria according to the DSM-IV (between 0 and 9) as ordinal outcome. The distribution of the outcome at T0 and T3 in each group is shown in Figure 3e. The CDP group met significantly more BPD criteria at T0 compared to the TAU group (Wilcoxon rank-sum *p* = 0.049). To analyze the evolution of BPD from T0 to T3, an ordered logistic regression model was fit, with therapy group, time point (T0 or T3), and their interaction as predictors. Brant's test showed no evidence against the proportional odds assumption ($\chi^2(12) = 9.44$; *p* = 0.665). There was a significant decrease in the number of BPD diagnostic criteria from T0 to T3 (OR = 0.10; 95% CI: [0.04, 0.26]; *p* < 0.001), but the reduction did not differ significantly between the two groups (CDP \times T3: OR = 0.68; 95% CI: [0.21, 2.24]; *p* = 0.526).

Depression

The mean depression scores by group and time point are shown in Figure 3c; means and standard deviations are reported in Table 1. There was a significant further reduction in depression scores between T2 and T3 ($\chi^2(1) = 4.86$; *p* = 0.028; difference in means: -3.97 ; 95% CI: [-7.50 , -0.44]) with no group effect ($\chi^2(1) = 0.17$; *p* = 0.682) and no group \times time point interaction ($\chi^2(1) = 0.10$; *p* = 0.754). The duration between T2 and T3 had no significant effect on the depression score at T3 (*p* = 0.201).

Quality of Life

Concerning quality of life, there was no further improvement between T2 and T3 (difference in means across both groups: -0.61 , 95% CI: [-3.16 , 1.94], *p* = 0.639), with no group difference ($\chi^2(1) = 0.08$, *p* = 0.784) and no group \times time point interaction ($\chi^2(1) = 1.21$, *p* = 0.545). The duration between T2 and T3 had no significant effect on the quality of life at T3 (*p* = 0.250). The mean quality of life scores by group and time point are shown in Figure 3d; means and standard deviations by group and time point are reported in Table 1.

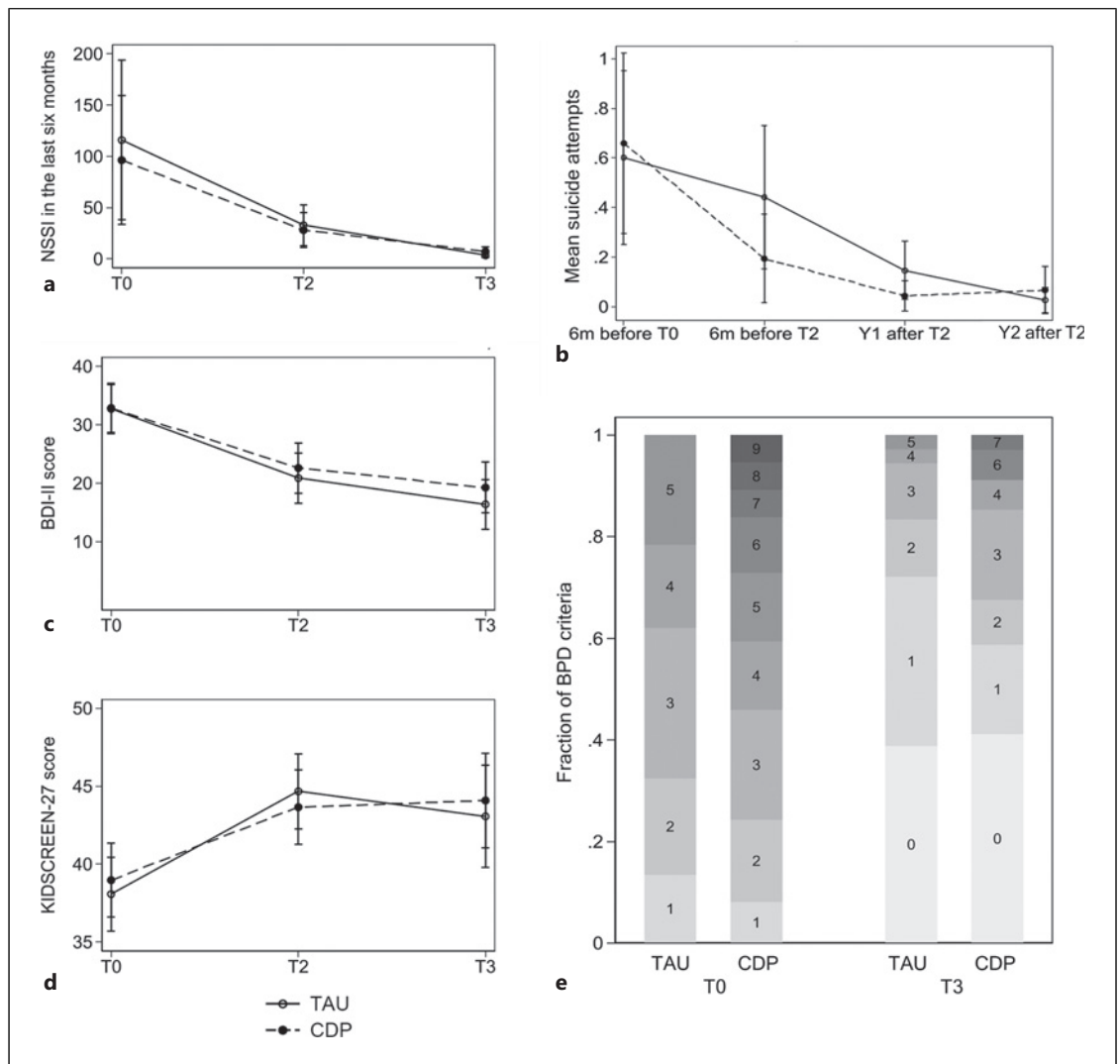


Fig. 3. Trajectory or distribution of all outcomes from T0 to T3. **a** Predicted mean NSSI frequencies over 6 months. **b** Mean suicide attempts. **c** Mean depression scores (BDI-II). **d** Mean quality of life scores (KIDSCREEN-27) over time by group with pointwise 95% confidence intervals. **e** The distribution of the number of BPD diagnostic criteria according to the DSM-IV at T0 and T3 by therapy group. TAU, treatment as usual; CDP, cutting down program. Follow-up of brief therapy for NSSI versus TAU.

Participants' Use and Impact of Treatment between T2 and T3

The TAU group completed on average 34.67 (SD = 39.49; 95% CI: [21.30, 48.03]) therapeutic sessions between T2 and T3, whereas the CDP group attended on average 33.74 sessions (SD = 43.99; 95% CI: [18.39, 49.08]). The between-group difference concerning number of attended therapeutic sessions between T2 and T3 was not statistically significant [$t(68) = 0.09$; $p = 0.926$]. Eleven (32.4%) participants of the CDP group did not attend any sessions between T2 and T3, whereas this was

true for eight (22.2%) participants within the TAU group. Again, there was no difference between the two groups ($\chi^2(1) = 0.91$; $p = 0.341$).

About half of patients who attended psychotherapy between T2 and T3 received behavioral therapy ($n = 26$), and other treatment programs included dialectical behavior therapy ($n = 7$), psychiatric ($n = 4$) and psychoanalytical treatment ($n = 3$), or other forms that were not further specified ($n = 15$). Psychotropic medication was administered to $n = 17$ patients with most adolescents receiving antidepressants ($n = 15$), followed by

methylphenidate ($n = 4$), neuroleptics ($n = 3$), or others ($n = 1$). Some patients received more than one form of psychotherapy ($n = 5$) or types of medication ($n = 6$).

To check for an association between further treatment after T2 and NSSI in the 6 months before T3, the number of outpatient therapy sessions between T2 and T3, standardized by the duration between T2 and T3, was added as an additional predictor to model 1. This model demonstrated that each additional outpatient therapy session was associated with a 5.5% reduction of NSSI at T3 (IRR = 0.95; 95% CI: [0.91, 0.98]; $p = 0.001$), even when controlling for age. There was no significant interaction between further outpatient treatment and treatment group (IRR = 0.97; 95% CI: [0.91, 1.04]; $p = 0.380$) or between further treatment and whether the participant received inpatient treatment between T2 and T3 (IRR = 0.96; 95% CI: [0.90, 1.04]; $p = 0.333$).

Discussion

Research on the long-term course and outcome after psychotherapy in adolescents is very scarce. In an earlier RCT, we compared CDP, a brief psychotherapy program designed for treating NSSI, to a high-quality TAU. There was no superiority of CDP over TAU regarding the 6-month frequency of NSSI, but the CDP group had a faster reduction of NSSI and significantly less therapy sessions than the TAU group [33]. The goal of the current study was to examine the longitudinal outcome of treatment efficacy over a follow-up period of 2–4 years. Our findings provide support for the maintenance of treatment gains achieved in the original study: Improvements from T0 to T2 were maintained or even improved at T3 regarding NSSI frequency, suicide attempts, depression scores, and quality of life. The number of fulfilled BPD criteria dropped significantly from T0 to T3 in both groups.

The frequency of NSSI was further reduced by 84% between completion of the initial study period and up to 4 years after enrollment. The positive effects of treatment were sustained, and patients kept improving in the long term. Due to the study design, the time point of T3 differed between subjects, and assessments were conducted between 2 and 4 years after baseline. With each additional year, a further reduction of NSSI was observed. This finding did not differ between groups, and no superiority of either treatment condition could be detected. Furthermore, age was a significant predictor of NSSI frequency and higher age at treatment, and study initiation was associated with less NSSI at T3. A downward trajectory of NSSI over the course of adolescence

has been described before, and our finding is in line with previous literature. In a systematic review on the longitudinal evolution of NSSI in community and clinical samples, Plener [2] found that after a peak at the age of around 15–16 years, the prevalence of NSSI dropped in late adolescence. With a mean age of 14.9 years (SD = 1.2) at baseline, our study sample fits in this age range, and our findings are in line with the reported change over time. It should be noted, though, that NSSI has a highly transdiagnostic character, and symptom shifts are common. A reduction of NSSI may correspond to an increase in other risk-taking behaviors such as alcohol and drug misuse [40] which was not assessed in the present study.

Clinically, the reported reduction in NSSI frequency is particularly meaningful because repetitive NSSI has been identified as a powerful predictor of further NSSI and suicidality [3–5]. As presented in the original study [33], suicide attempts were reduced significantly in both groups during initial treatment, and this positive development continued over the follow-up period. In year three after T2, no suicide attempts were reported. This is in line with analyses from community data [7] showing that among adolescents who reported NSSI but stopped a year later, after another year, the risk for suicidal thoughts and behaviors was comparable to those who had never self-harmed. This finding is particularly meaningful because, in addition to general improvement of mental health, the goal of reducing NSSI through psychotherapeutic interventions ultimately is the long-term reduction of suicide risk. We found no group differences, and both CDP and TAU seem to effectively lower the risk for suicide attempts over up to 4 years.

Because BPD was not assessed at T1 and T2, firm conclusions about the effectiveness of CDP or TAU regarding BPD cannot be drawn. However, like NSSI, the highest mean levels of BPD symptoms are commonly found during mid-adolescence with a significant decline in mean-level symptoms during late adolescence [41]. Therefore, the critical risk period for BPD characteristics and the ideal time for successful interventions for BPD and NSSI seem to correspond to the mean age of our sample, and we provided treatment just during this critical time which may further explain the improvement of BPD criteria we found in this study. This finding is particularly encouraging because BPD used to be considered a persisting and hardly changeable diagnosis [11], and over a time frame of 2 to 4 years and through rather low-threshold interventions, the symptom severity of BPD was significantly reduced in this sample.

Findings regarding depression and quality of life were also encouraging. The improvement of depressive symptomatology that was achieved during initial treatment was enhanced between T2 and T3 with a significant further reduction of depression scores in both groups. According to BDI-II cut-off thresholds [38], the mean depression scores across the whole sample dropped from the severe range at baseline to moderate at T2 and mild at T3. In addition to NSSI, both interventions therefore seem to be effective in the reduction of depressive symptoms beyond the initial treatment period. Even though quality of life was not further improved between both follow-up assessments, the higher level achieved after initial treatment could be sustained at T3. Quality of life is a broad concept comprising more than symptom severity, and many adolescents with NSSI face impairment in this domain [13]. In such a highly burdened study sample, a rather comprehensive and extensive intervention may be necessary to achieve significant and sustainable advancements across different areas of life and well-being.

As could be expected, many patients attended further therapy sessions after completing the study. The number of participants who continued or resumed therapy between T2 and T3 did not significantly differ between both groups and neither did the quantity of therapy sessions. Although the TAU group received significantly more sessions than the CDP group during the initial treatment period [33], there was no difference in the amount of sessions after the original treatment. Over the complete duration of the study period, the CDP group therefore received less therapy than participants in the TAU condition in total and they did not, as may have been expected, compensate by utilizing more psychotherapeutic treatment after initial therapy completion. Additionally, patients in the CDP group not only received significantly less therapy during initial treatment but also had a 6-month treatment pause between treatment completion and T2. This break does not seem to have been harmful in the long term. Our findings support CDP as an adequate first intervention for adolescents who present with NSSI as we found no disadvantages compared to traditional high-quality TAU regarding treatment outcome. By initially providing a shorter, more accessible, and economical treatment option, patients, therapists, and health care providers in general benefit.

Independent of group or additional inpatient stays, it has to be noted that treatment between T2 and T3 significantly reduced NSSI further. This also means that

in many cases, neither CDP nor high-quality TAU seemed to sufficiently improve long-term NSSI frequency and comorbid psychopathology, and many patients required additional psychotherapeutic care. For a significant group of patients, additional treatment seems to be a vital aspect of long-lasting recovery. Notably, however, around one third of adolescents in this high-risk sample seemed to profit sufficiently from a brief psychotherapeutic program such as CDP as a stand-alone intervention, and they did not seek further treatment. To transfer the implications of our findings to routine clinical care, a “stepped care” approach is suggested [28, 29]. In these models, all patients begin treatment with a brief psychotherapeutic program, such as the CDP, and individuals who have not profited sufficiently from the initial intervention continue with prolonged treatment. This way, a short, easily accessible, and clinically feasible intervention may be offered to a larger group, and patients with an increased need for psychotherapeutic support are provided with more extensive treatment in a next step. Even if a patient received further treatment after the initial study, our analyses showed that the CDP did not result in a worse outcome than TAU. To predict whether a brief intervention may suffice for a patient early in the therapeutic process is extremely challenging, and further longitudinal research is needed to close this gap. Independent of later treatment length and intensity, a low-threshold intervention may reduce the barriers and stigma keeping many adolescents engaging in NSSI from seeking help in the first place and act as a gateway for receiving adequate further psychotherapeutic care.

Limitations and Strengths

There are study limitations to note. Limitations concerning the sample can be found elsewhere [33]. Due to the study design, follow-up time points for T3 were spaced over 2 to 4 years after baseline. As reported in the results, we did not find statistically significant group differences between CDP and TAU regarding any outcome. The non-significance should, however, be treated with caution. The sample size was predetermined by the original study [33] and the initially performed power analysis. Even though our analyses did not show group differences across the follow-up period, a larger sample may have been needed to statistically confirm the equality of both groups, in particular given the high variability of the individual trajectories of NSSI in both groups. This multifinality is not surprising for a transdiagnostic

phenomenon in an adolescent sample, but its exploration certainly constitutes an avenue of future research. As discussed, a high percentage of participants continued treatment, and we cannot distinguish whether the maintenance and further reduction of NSSI and comorbid symptoms are attributable to the initial CDP and TAU intervention or to the continuation of treatment after the study. Since treatment between T2 and T3 was not randomized and there was no waiting condition, we cannot verify a causal link between follow-up treatment intensity and NSSI reduction. NSSI is known for following a longitudinal trajectory with a peak in mid and decline in late adolescence [2], and in order to thoroughly disentangle the effects of treatment and the natural course, further RCTs would be necessary. However, a number of treatment sessions were comparable in both groups, and our results suggest additional therapy can significantly improve long-term outcome in adolescents with NSSI. The prospective follow-up design and the very high follow-up rates of 95% at T3 should be noted as important strengths of the study. Furthermore, rigorous procedures were applied during data collection and standardized instruments were used, ensuring the integrity of ratings.

Conclusions

The present study suggests that initial psychotherapy with the brief intervention CDP is associated with similar long-term outcomes of NSSI, suicide attempts, BPD, depression, and well-being than high-quality TAU involving a higher initial treatment dose. While our findings do not support the use of the CDP as a superior treatment to usual care available in Germany, its short duration, manualized administration, and accessibility make this program an attractive option for health care providers and patients. The CDP may be a suitable intervention as part of a stepped-care treatment approach in form of a low-threshold offer for adolescents. Some patients may profit sufficiently from this program and achieve satisfactory results in just 10 sessions. However, NSSI is a complex phenomenon, and many patients require additional and more extensive treatment which can then be specifically tailored to their needs. Such a customized approach has the potential to save time and costs as well as reduce waiting times for treatment-seeking adolescents who present with NSSI.

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Statement of Ethics

This study was reviewed and approved by the Institutional Review Board (Ethics Committee) of the medical faculty at the University of Heidelberg (approval number: S-363/2011). All patients and/or parents or caregivers (if participants were below age 16) provided written informed consent. According to the EU General Data Protection Regulation [42], the cognitive faculty to consent to data sharing and processing is typically acquired at age 16 which is adopted as the age at which minors are allowed to autonomously consent to participate in noninvasive research projects in Germany [43]. The study was conducted in accordance with the Declaration of Helsinki.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

F.Ro. interpreted data analyses and wrote the manuscript. A.E. was involved in initial analyses and manuscript drafts. A.E. and G.F.W. carried out data acquisition including recruitment and assessment. J.J. performed statistical analyses. M.K. was responsible for the conception, design, and coordination of the work. R.B. and F.Re. were involved in the study design and supervision. All authors revised the article critically, gave final approval of this version to be published, and agree to be accountable for all aspects of the work.

Data Availability Statement

The data that support the findings of this study are not publicly available due to the particularly sensitive nature of clinical data of minors. Inquiries regarding an anonymized dataset may be addressed to the corresponding author (M.K.) upon reasonable request.

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APPENDIX B

Frequency and Predictors of Individual Treatment Outcomes (Response, Remission, Exacerbation, and Relapse) in Clinical Adolescents With Nonsuicidal Self-Injury

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Frequency and predictors of individual treatment outcomes (response, remission, exacerbation, and relapse) in clinical adolescents with nonsuicidal self-injury

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Abstract

Background. Nonsuicidal self-injury (NSSI) is prevalent in adolescent clinical samples. There is evidence that NSSI can be treated effectively but data on individual treatment outcomes is limited. The goal of this study was to examine response, remission, exacerbation, and relapse rates over one and two years, respectively, among a clinical sample of adolescents with NSSI. Furthermore, we aimed to identify clinically relevant predictors of NSSI trajectories.

Methods. The sample consists of $n = 203$ adolescents (12–17 y., 94% female) from a specialized outpatient clinic for risk-taking and self-harming behavior with NSSI on at least five days in the six months before first assessment. Assessments were completed at baseline and one (FU1) and two (FU2) years later using structured clinical interviews and self-report questionnaires.

Results. At FU1, 75% reported a reduction in NSSI frequency by at least 50% (treatment response); among those, one third (25% of the entire sample) achieved a remission (0 NSSI); an exacerbation ($\geq 50\%$ more NSSI) was observed in 11% of patients. Of those in remission, 41% relapsed one year later. Predictors of non-response or non-remission were inpatient treatment and depressive symptoms. Adolescents with lower NSSI frequency at baseline had a higher risk of exacerbation. Due to limited sample size at FU2 no prediction model for relapse was established.

Conclusions. While most adolescents presenting with NSSI achieved significant improvement, more attention should be paid to the rather low rates of full remission. Prediction and early detection of individuals who deteriorate during or relapse after treatment is critical.

Introduction

Nonsuicidal self-injury (NSSI) refers to the deliberate, repetitive, and direct damage to one's own body tissue without suicidal intent (American Psychiatric Association, 2013). Emotion regulation is the most commonly reported function of NSSI (Taylor et al., 2018) and NSSI methods range from cutting to scratching, hitting, and burning. In community samples, a lifetime prevalence of 17–18% has been reported among adolescents (Muehlenkamp, Claes, Havertape, & Plener, 2012; Swannell, Martin, Page, Hasking, & John, 2014) but many individuals with NSSI seek no or delayed professional help (Lustig, Koenig, Resch, & Kaess, 2021). In adolescent clinical samples, up to 60% of patients report past NSSI (Kaess et al., 2013a). NSSI is commonly associated with a variety of mental disorders (Ghinea et al., 2020), adverse childhood experiences (ACE; Liu, Scopelliti, Pittman, & Zamora, 2018; McMahan, 2018), and has repeatedly been identified as the best predictor of future NSSI (Fox et al., 2015; Wichström, 2009). It should be noted that in the literature, umbrella terms such as 'direct self-injury' or 'self-harm' are frequently used to describe self-injurious behaviors irrespective of their intent, hindering comparability of studies (Muehlenkamp, 2005). In the present paper, SB refers to suicidal behavior such as suicide attempts and NSSI describes nonsuicidal behavior as defined above.

Despite a lack of intent to die from the behavior, NSSI is closely linked to suicidal behavior (SB; American Psychiatric Association, 2013), and both behaviors share comorbidities and risk factors (Groschwitz et al., 2015; McMahan, 2018). The role of NSSI as a significant risk factor for SB has been established in two meta-analyses (Castellví et al., 2017; Ribeiro et al., 2016). Adolescents from a community sample with onset or maintenance of self-harm (regardless of suicidal intent) had an increased probability of SB the following year, whereas for adolescents who stopped, the risk for SB dropped to a level comparable to those who never self-harmed

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(Koenig et al., 2017). This confirms the directional link between self-harm and SB and highlights the potential of reducing self-harm as an important element in preventing SB. Whether the cessation of NSSI alone has similar effects was not examined.

In the general population, NSSI rates have been shown to peak during adolescence and to decline into young adulthood (Plener, Schumacher, Munz, & Groschwitz, 2015) but literature on predictors of change is scarce. Depression has been identified as a risk factor for NSSI and its maintenance over different follow-up periods (Barrocas, Giletta, Hankin, Prinstein, & Abela, 2015; Duggan, Heath, & Hu, 2015; Hankin & Abela, 2011; Plener et al., 2015). In a sample of young adults, Glenn and Klonsky (2011) examined whether cross-sectional correlates of NSSI had predictive value over one year and identified NSSI frequency and borderline personality disorder (BPD) features as prospective predictors for future NSSI. Past research reported mixed findings regarding psychiatric treatment and the longitudinal trajectory of NSSI. In a systematic review including quantitative and qualitative studies, professional help was mentioned as an important element in terminating NSSI. However, this association was only reported in qualitative interviews and was found to be less relevant than family support and intrapersonal factors (Mummé, Mildred, & Knight, 2017). In other studies, adolescents who stopped NSSI were less likely to have received treatment (Andrews, Martin, Hasking, & Page, 2013) and those who continued had a lower probability of reporting therapy as being helpful in ceasing NSSI (Whitlock, Prussien, & Pietrusza, 2015). These findings do not necessarily present an evidence for a negative treatment effect but could point to a higher general psychosocial distress in those seeking professional care. Other sources of help, particularly family, may hold more meaning for affected adolescents during the process of stopping NSSI.

Previous research on treatment outcome reported promising effects for psychotherapeutic interventions with a focus on self-harm in general, including both suicidal and nonsuicidal self-injurious behaviors (Plener et al., 2017; Turner, Austin, & Chapman, 2014). Recently, specifically developed brief interventions for NSSI, such as the Cutting Down Program (CDP; Kaess et al., 2020) and the Treatment for Self-Injurious Behaviors (T-SIB; Andover, Schatten, Morris, Holman, & Miller, 2017) showed significant reductions in NSSI frequency (Calvo et al. 2022). This, however, unfortunately does not reflect significant improvement for each patient, as individual outcomes may differ. Analogous to treatment resistant depression, there are individuals who do not respond adequately to conventional treatment (Asarnow et al., 2011; Dwyer, Stringaris, Brent, & Bloch, 2020), which can result in a smaller reduction of NSSI than anticipated or even an exacerbation over time. The examination of mean changes bears the risk of overlooking individual trajectories.

Given the diverse trajectories of most mental health problems and individual differences in treatment response, the idea of personalized treatment in psychotherapy has been discussed extensively (Cuijpers, Ebert, Acarturk, Andersson, & Cristea, 2016) but only recently is examined for any form of self-injurious behaviors (Berk et al., 2022). Due to its transdiagnostic character, NSSI may profit particularly from a personalized therapeutic approach. Identifying clinically relevant features that predict individual trajectories of NSSI is key to establish prognostic markers and inform clinical decision-making.

The aim of the present study was to examine the individual changes of NSSI frequency in a sample of help-seeking adolescents with NSSI at a specialized outpatient clinic for risk-taking

and self-harming behavior. To account for individual trajectories of NSSI observed in clinical populations, we examined subgroups according to reported one-year change following certain criteria: We differentiated between a *response* if NSSI frequency was reduced by at least 50%, a *remission* with a complete cessation of NSSI after one year, and an *exacerbation* in NSSI frequency with a twofold increase of NSSI. Additionally, we explored potential *relapses* among patients showing remission another year later. Clinically relevant predictors of group membership were identified to study potential markers for the early distinction of patients experiencing an improvement or aggravation in the following year, and to generate potential targets for personalized medicine in the treatment of adolescent NSSI.

Methods

Participants and procedure

The sample consists of adolescents (12–17 years) who presented at the specialized outpatient clinic for adolescent risk-taking and self-harming behavior at the Department of Child and Adolescent Psychiatry, University Hospital Heidelberg, Germany (AtR!Sk; Ambulanz für Risikoverhalten und Selbstschädigung). Please refer to Kaess et al. (2020, 2017) for more details regarding the specialized outpatient clinic AtR!Sk.

Patients were recruited consecutively and included in the AtR!Sk cohort study after signing written informed consent. For participants under the age of 16, the parents' written consent was obtained. The local ethics committee (ID S-449/2013) approved the AtR!Sk cohort study and compliance with the Declaration of Helsinki (World Medical Association, 2013) was ensured. The present analyses only include individuals who reported repetitive engagement in NSSI (at least on five days in the previous six months) at the time of baseline assessment.

Assessments

Specially trained clinicians conducted structured clinical assessments at baseline and after one (FU1) and two (FU2) years, respectively. The following interview- and questionnaire-based assessments were conducted at baseline as well as at FU1 and FU2. Each assessment instrument was conducted in the respective validated German version.

The Self-Injurious Thoughts and Behaviors Interview (SITBI-G; Fischer et al., 2014) was applied to examine NSSI frequency and methods. The 6-month frequency of NSSI at baseline ('How many times in the past six months have you purposely hurt yourself without wanting to die?') was included as a predictor variable in analyses and the outcome grouping variables were created using the difference from baseline to follow-up data from this item (see statistical analyses for further details). In accordance with the definition of NSSI of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013), we rated NSSI events per day resulting in a maximum of 183 NSSI behaviors during a time period of six months. The SITBI-G has good psychometric properties (Fischer et al., 2014). *Borderline personality disorder (BPD)* was measured using the BPD module of the Structured Clinical Interview for DSM-IV Axis II (SCID-II; Wittchen, Zaudig, & Fydrich, 1997). On a scale from 1 (not fulfilled), 2 (partially fulfilled) to 3 (fulfilled), all nine BPD-criteria were rated. As an indicator of severity, the number of criteria rated as 3 were added up.

Previous analyses by our research group revealed excellent inter-rater reliability (Cohen's $\kappa = 1.00$) for this interview (Kaess et al., 2013b). Mental disorders were assessed using the structured Mini-International Neuropsychiatric Interview for Children and Adolescents (M.I.N.I.-KID; Sheehan et al., 2010). Finally, assessors rated the Clinical Global Impression Scale (CGI-S; Busner & Targum, 2007) at the end of the diagnostics appointment as an indicator of *general symptom severity*. Demographic data, such as *age, sex, school type* and *living situation* were assessed using standardized interview questions. At follow-up, participants reported the usage of any form of treatment and medication they had received in the past year. Dose of treatment (outpatient treatment sessions; days of inpatient treatment) was also assessed.

Depression severity was assessed using the Depression Inventory for Children and Adolescents (DIKJ; Stiensmeier-Pelster, Schürmann, & Duda, 1991). Twenty-seven items covering all substantial DSM-IV criteria were rated on a scale from 0 (no symptomatology) to 2 (high severity). We found good internal consistency (Cronbach's $\alpha = 0.88$) in the present study. To assess *adverse childhood experiences (ACE)*, the Childhood Experience of Care and Abuse Questionnaire (CECA.Q; Kaess et al., 2011) was conducted. This questionnaire measures antipathy, neglect, and physical and sexual abuse by the mother and/or the father or alternative parental figures. Number of ACE by any parent were counted and summed to a value between 0 (no ACE) and 4 (all forms of ACE) in accordance with a dose-response effect (Bifulco, Bernazzani, Moran, & Jacobs, 2005). For the German translation, Kaess et al. (Kaess et al. 2011) reported good to excellent psychometric properties across different types of ACE.

Statistical analysis

Participants who attended the 12-months follow-up (FU1) and reported NSSI on at least five days during the six months before baseline were included in the present analyses. To account for the fact that NSSI often does not cease immediately after seeking treatment, 6-month time periods relative to respective assessments were considered when examining changes in NSSI frequency: The frequency of NSSI in the six months before baseline was compared to six months before FU1.

Participants were classified within groups according to their individual change in NSSI frequency from baseline to FU1: As presented in Figure 1, we differentiated between response and non-response in a first step. *Response* was defined as a reduction

of NSSI frequency of at least 50% of days within a time interval of six months one year later. *Non-responders*, on the other hand, did not show a reduction of NSSI frequency of at least 50%. In a second step, both groups were further divided into subgroups. If participants with a response did not report any incidents of NSSI within six months prior to the follow-up assessment, they were assigned to the *remission* group and adolescents in the *non-remission* group had a reduction but no full remission. Within non-responders, a distinction was made between adolescents in the *exacerbation* group who reported an increase of NSSI frequency of at least 50% and those who neither improved nor deteriorated (*non-exacerbation*). Among patients with a remission at FU1, the *relapse* rates at FU2 were examined if data were available. For better comprehensibility and clarity, the present analyses focused on response, remission, exacerbation, and relapse as the clinically most relevant groups.

Sample characteristics were calculated using descriptive statistics. For testing the significance of change in NSSI frequency, the Wilcoxon signed-rank test was used and effect size was calculated according to Fritz et al. (2012). Logistic regression analyses were computed with group membership as the respective dichotomous outcome variable (e.g. *response no/yes*). Due to a limited sample size at FU2, relapses were only reported as descriptive statistics and no logistic regression model was established. To ensure comparability, predictor variable values were standardized. Analyses were performed using Stata/SE (Version 16.0, Stata Corp LLC, College Station, TX, USA) and the alpha-level was set to 0.05.

Results

Descriptive statistics

Out of $n = 625$ adolescent outpatients participating in the AtR!Sk cohort study (participation rate 86%), $n = 428$ fulfilled inclusion criteria of NSSI on at least five days in the six months before baseline, and $n = 240$ provided FU1 data (follow-up rate 56%). Due to missing questionnaire data, $n = 37$ participants were excluded from analyses, resulting in a sample of $n = 203$. Drop-out analyses are presented as online Supplementary material. Sociodemographic and clinical sample characteristics are presented in Table 1.

The most commonly reported methods of NSSI were cutting or carving (99%), scraping the skin (47%), manipulating a wound (45%), and hitting oneself (37%). On average, adolescents reported the use of three different NSSI methods ($M = 3.37$, $s.d. =$

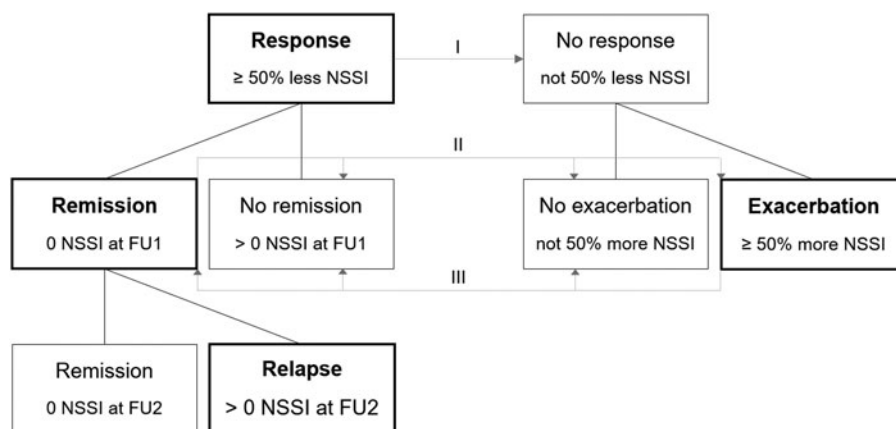


Figure 1. Groups according to change in non-suicidal self-injury frequency from baseline to follow-up.

Note. NSSI, non-suicidal self-injury; FU, follow-up.

^I Model 1: Response v. No Response.

^{II} Model 2: Remission v. No remission, no exacerbation, exacerbation.

^{III} Model 3: Exacerbation v. Remission, no remission, no exacerbation.

Table 1. Sample characteristics by group

	Total <i>n</i> = 203	Response <i>n</i> = 152	Remission <i>n</i> = 51	Exacerbation <i>n</i> = 23	Relapse <i>n</i> = 11
Age, <i>M</i> (s.d.)	14.89 (1.45)	14.89 (1.46)	14.67 (1.52)	14.96 (1.33)	15.09 (1.38)
Female sex, <i>n</i> (%)	190 (93.6)	142 (93.4)	46 (90.2)	21 (91.3)	10 (90.9)
School, <i>n</i> (%) ^a					
Gymnasium	89 (43.8)	63 (41.5)	16 (31.4)	11 (47.8)	6 (54.6)
Realschule	65 (32.0)	52 (34.2)	23 (45.1)	8 (34.8)	3 (27.3)
Hauptschule	19 (9.4)	16 (10.5)	7 (13.7)	2 (8.7)	1 (9.1)
Other	30 (14.8)	21 (13.8)	5 (9.8)	2 (8.7)	1 (9.1)
Living situation, <i>n</i> (%)					
Both parents	95 (47.5)	72 (48.3)	21 (41.2)	12 (52.2)	4 (36.4)
One parent	74 (37.0)	52 (34.9)	12 (37.3)	5 (21.7)	6 (54.6)
Other living situation (e.g. youth welfare)	31 (15.5)	25 (16.8)	11 (21.6)	6 (26.1)	1 (9.1)
Treatment, <i>n</i> (%)					
Outpatient	170 (83.7)	123 (80.9)	36 (70.6)	20 (87.0)	8 (72.7)
Inpatient	89 (43.8)	55 (36.2)	7 (13.7)	13 (56.5)	2 (18.2)
Psychotropic medication, <i>n</i> (%)	50 (24.6)	32 (21.05)	6 (11.8)	4 (17.4)	3 (27.3)
Diagnoses, <i>n</i> (%) ^b					
F1 Mental and behavioral disorders due to psychoactive substance use	36 (17.7)	31 (20.4)	14 (27.5)	3 (13.0)	6 (54.5)
F3 Affective disorders	155 (76.4)	113 (74.3)	35 (68.6)	18 (78.3)	8 (72.7)
F4 Neurotic, stress-related and somatoform disorders	86 (42.4)	62 (40.8)	20 (39.2)	10 (43.5)	5 (45.5)
F5 Behavioral syndromes associated with physiological disturbances and physical factors	31 (15.3)	23 (15.1)	5 (9.8)	3 (13.0)	0 (0.0)
F8 Disorders of psychological development	1 (0.5)	1 (0.7)	1 (2.0)	0 (0.0)	0 (0.0)
F9 Behavioral and emotional disorders with onset usually occurring in child and adolescence	36 (17.7)	31 (20.4)	17 (33.3)	2 (8.7)	3 (27.3)
NSSI frequency baseline, <i>M</i> (s.d.)	52.19 (45.64)	53.8 (47.13)	46.1 (43.48)	22.70 (17.05)	59.18 (57.90)
NSSI frequency follow-up, <i>M</i> (s.d.)	19.28 (31.01)	6.28 (10.59)	0.00 (0.00)	53.48 (34.50)	7.27 (7.16) ^c
Depression, <i>M</i> (s.d.)	32.18 (8.71)	32.00 (9.31)	29.53 (10.26)	30.96 (7.71)	28.82 (9.64)
BPD, <i>M</i> (s.d.)	3.81 (2.06)	3.81 (2.07)	3.67 (2.18)	3.65 (2.19)	3.64 (2.80)
ACE score, <i>M</i> (s.d.)	1.48 (1.25)	1.47 (1.28)	1.33 (1.31)	1.91 (1.28)	1.09 (1.38)
General symptom severity, <i>M</i> (s.d.)	5.11 (0.88)	5.16 (0.88)	5.06 (1.07)	4.96 (0.98)	5.09 (0.83)

Note. *M*, mean; *SD*, standard deviation; *n*, sample size; NSSI, nonsuicidal self-injury; BPD, borderline personality disorder; ACE, adverse childhood experiences.

^aGerman educational categories include Gymnasium = secondary school terminating with a general qualification for university, Realschule = secondary school terminating with a secondary school level-I certificate, Hauptschule = secondary elementary school.

^bF0 (organic mental disorders), F2 (schizophrenia, schizotypal and delusional disorders), F7 (mental retardation), were not fulfilled by any patient. Frequency of F6 (disorders of adult personality and behavior) is not reported since only the SCID-II BPD module was conducted.

^cFor relapses, 12-months frequency at follow-up 2 is reported.

2.05). The frequency of NSSI in the six months before baseline ranged between five and 180 with a mean of 52.19 (s.d. = 45.64). One year later, this number decreased significantly to 19.28 days with NSSI (s.d. = 31.01) over the same period of 6 months in the full sample ($z = 8.93, p < 0.001, r = 0.63$).

The majority of participants received outpatient therapy between baseline and FU1 ($n = 170$) and reported a mean number of 24.29 sessions (s.d. = 18.79). If any inpatient treatment was provided ($n = 89$), this lasted 71.39 days (s.d. = 63.64) on average. Of outpatients, 48% were treated at the specialized outpatient clinic AtR!Sk with either the CDP (10 single sessions;

36%), dialectical behavior therapy for adolescents (DBT-A; 25 single sessions and 20 sessions of skills training; 53%), or both (11%). Other outpatient treatment options that were provided outside AtR!Sk consisted of cognitive behavioral therapy (35%), psychodynamic methods (5%) or others (13%). In addition to standard inpatient care (63%), stays in acute inpatient units (51%) and day clinics (20%) were reported by those receiving inpatient treatment between baseline and FU1. Many patients reported a combination of different treatment types. At FU1, $n = 50$ (25%) reported taking at least one form of any psychotropic medication in the past year. The most

commonly named form of medication was antidepressants ($n = 44$, 88%), followed by neuroleptics ($n = 11$, 22%).

Individual outcomes

In the response group ($n = 152$; 75%), NSSI frequency dropped from $M = 53.79$ (s.d. = 47.13) to $M = 6.28$ (s.d. = 10.59) and among non-responders ($n = 51$; 25%), NSSI increased from $M = 47.41$ (s.d. = 40.97) to $M = 58.02$ (s.d. = 38.74) over one year. Per definition, there were zero incidents of NSSI in the remission group ($n = 51$; 25%) at FU1. The exacerbation group ($n = 23$; 11%) reported NSSI on $M = 22.70$ (s.d. = 17.05) days at baseline and $M = 53.48$ (s.d. = 34.50) at FU1. Among participants with neither a response nor an exacerbation ($n = 28$; 14%), NSSI frequency was $M = 67.71$ (s.d. = 43.86) at baseline and $M = 61.75$ (s.d. = 42.16) after one year. Figure 2 illustrates the distribution and sample size of groups according to change.

Out of $n = 51$ participants with a remission at FU1, $n = 27$ provided FU2 data. Out of those, $n = 11$ (41%) reported to have relapsed and self-injured at some point between FU1 and FU2. Four participants only relapsed once, and remaining adolescents reported between four and twenty incidents of NSSI.

Logistic regression models

Table 2 presents logistic regression analyses for all three previously defined models. Among univariate models, the duration of inpatient treatment ($OR = 0.56$, $p < 0.001$) and medication use ($OR = 0.49$, $p = 0.043$) were significant negative predictors of response. In multivariate analyses, inpatient treatment remained significant ($OR = 0.48$, $p < 0.001$) and general symptom severity also reached significance ($OR = 1.81$, $p = 0.006$). No or shorter inpatient stays and higher general symptom severity at baseline were therefore linked to a higher probability of a response. When controlling for inpatient treatment, medication lost significance as a predictor ($OR = 0.88$, $p = 0.784$).

Longer inpatient treatment was also found to negatively predict remission compared to non-remission in both uni- and multivariate models ($OR = 0.28$, $p = 0.002$; $OR = 0.30$, $p = 0.006$). Again, medication intake negatively predicted remission ($OR = 0.33$, $p = 0.017$) but not when including covariates ($OR = 0.78$, $p = 0.660$). Furthermore, depression was identified as a significant negative predictor in the uni- and multivariate models for

remission ($OR = 0.67$, $p = 0.013$; $OR = 0.68$, $p = 0.045$). Higher depression severity at baseline was associated with a decreased probability of a remission one year later.

Exacerbation was predicted by 6-month NSSI frequency in both models ($OR = 0.25$, $p = 0.003$; $OR = 0.22$, $p = 0.002$): less NSSI at baseline increased the probability for exacerbation one year later.

Discussion

This study focused on the investigation of individual treatment outcomes of NSSI among treatment-seeking adolescents. In a first step, we analyzed the frequencies of response, remission, exacerbation, and relapse of NSSI in this high-risk sample. Some results were overall encouraging: Three quarters were responders and reduced NSSI frequency at least by half, and – with almost 90% less NSSI events after one year – the response group without full remission displayed a vast improvement. However, and as commonly not reflected by mean symptom reductions, only one quarter of patients reported full remission of NSSI despite in many cases receiving evidence-based mental healthcare. Furthermore, one in ten patients showed an exacerbation of NSSI frequency one year later. Finally, out of patients with a remission after one year, another year later around two fifths relapsed, though in many cases relapse referred to NSSI on only one day. Considering the sample composition with high levels of psychopathology and low psychosocial functioning, the high response rates are notable and encouraging. However, our results show considerable heterogeneity in individual trajectories within a specialized outpatient service for adolescents with NSSI, that can clearly deviate from the overall positive mean outcomes.

Our findings are in line with studies on depression and self-harm reduction in adolescence. Treatment-resistant depression is common and between 30–40% of adolescent patients do not respond adequately to evidence-based first line treatment (Dwyer et al., 2020). Patients with treatment-resistant depression often report NSSI and SB and such behaviors can persist aligned with depressive symptomatology (Asarnow et al., 2011). The response rate in the present study is comparable to recently published data on self-harm trajectories. Using latent class analysis, Berk et al. (2022) reported improvement of NSSI and SB in 74% of patients receiving either DBT or individual and group supportive therapy over 6 to 12 months. Interestingly, in their analyses

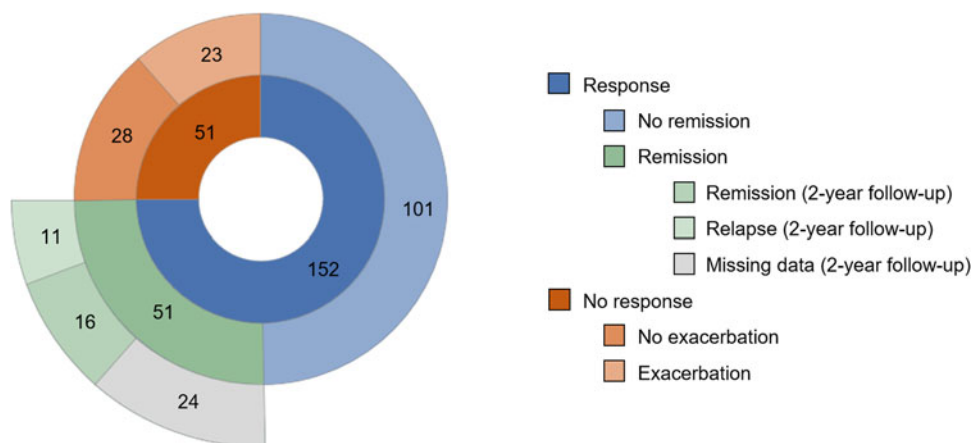


Figure 2. Distribution and group sizes.

Table 2. Univariate and multivariate logistic regression models for response, remission, and exacerbation

	univariate				multivariate			
	OR	CI	p	R2	OR	CI	p	R2
Model I: Response – No Response								
Age	1.00	0.73; 1.38	0.980	0.00	1.11	0.75; 1.64	0.591	
Sex ^a	1.13	0.30; 4.26	0.861	0.00	0.69	0.16; 2.89	0.609	
Outpatient treatment	0.91	0.66; 1.24	0.533	0.00	0.89	0.63; 1.24	0.490	
Inpatient treatment	0.56	0.41; 0.76	< 0.001	0.10	0.48	0.32; 0.71	< 0.001	
Psychotropic medication ^a	0.49	0.24; 0.98	0.043	0.03	0.88	0.35; 2.23	0.784	
NSSI frequency	1.16	0.83; 1.62	0.388	0.01	1.25	0.84; 1.87	0.266	
Depression	0.92	0.67; 1.27	0.606	0.00	0.93	0.63; 1.37	0.711	
BPD	1.00	0.73; 1.38	0.987	0.00	0.78	0.51; 1.18	0.237	
ACE score	0.97	0.71; 1.33	0.858	0.00	0.88	0.59; 1.39	0.525	
General symptom severity	1.25	0.91; 1.70	0.171	0.01	1.81	1.18; 2.77	0.006	0.17
Model II: Remission – No Remission								
Age	0.82	0.59; 1.12	0.211	0.01	0.81	0.55; 1.19	0.283	
Sex ¹	1.96	0.61; 6.28	0.259	0.01	1.89	0.50; 7.11	0.345	
Outpatient treatment	0.76	0.53; 1.08	0.122	0.02	0.79	0.53; 1.20	0.269	
Inpatient treatment	0.28	0.13; 0.62	0.002	0.14	0.30	0.13; 0.70	0.006	
Psychotropic medication ^a	0.33	0.13; 0.82	0.017	0.05	0.78	0.26; 2.33	0.660	
NSSI frequency	0.83	0.59; 1.16	0.271	0.01	0.81	0.56; 1.18	0.278	
Depression	0.67	0.49; 0.92	0.013	0.04	0.68	0.47; 0.99	0.045	
BPD	0.91	0.66; 1.26	0.571	0.00	1.05	0.69; 1.60	0.808	
ACE score	0.85	0.61; 1.18	0.325	0.01	0.90	0.61; 1.32	0.582	
General symptom severity	0.93	0.68; 1.27	0.643	0.00	1.29	0.86; 1.95	0.217	0.21
Model III: Exacerbation – No Exacerbation								
Age	1.06	0.68; 1.64	0.806	0.00	0.97	0.57; 1.63	0.896	
Sex ¹	1.46	0.30; 7.06	0.635	0.00	3.78	0.59; 24.34	0.162	
Outpatient treatment	1.19	0.80; 1.79	0.391	0.01	1.35	0.86; 2.12	0.187	
Inpatient treatment	1.08	0.71; 1.62	0.729	0.00	1.74	0.96; 3.18	0.069	
Psychotropic medication ^a	0.61	0.20; 1.90	0.396	0.01	0.29	0.06; 1.35	0.115	
NSSI frequency	0.25	0.10; 0.62	0.003	0.15	0.22	0.08; 0.59	0.002	
Depression	0.86	0.56; 1.31	0.473	0.01	1.06	0.63; 1.80	0.827	
BPD	0.92	0.59; 1.42	0.700	0.00	1.02	0.59; 1.77	0.937	
ACE score	1.46	0.95; 2.24	0.083	0.03	1.70	1.00; 2.90	0.050	
General symptom severity	0.83	0.55; 1.26	0.381	0.01	0.66	0.37; 1.17	0.154	0.23

Note. OR, odds ratio; CI, 95% confidence interval; p, p-value; R2, Nagelkerke Pseudo R2; NSSI, nonsuicidal self-injury; BPD, borderline personality disorder; ACE, adverse childhood experiences.

^aUnstandardized.

non-response was predicted by externalizing symptoms rather than internalizing, such as depression, which should be considered as an often overlooked but possibly crucial factor hindering self-harm treatment (Witte, Gauthier, Huang, Ribeiro, & Franklin, 2018). The slightly higher response rates of NSSI compared to depression may in part be attributed to the nature of both phenomena and their treatment. NSSI is a definable and often observable behavior which can be targeted by skills training and may

respond rather quick to intervention. During treatment, the reduction of self-injury is often a first step in a longer process of improving emotion regulation and profound dysfunctional assumptions. The sustainability of NSSI reduction may depend on the long-term changes in underlying thought patterns. Further research into NSSI treatment response and resistance may promote intervention tailoring and advance development of personalized treatment for related disorders, such as depression.

Cessation of NSSI was only reported by one in four adolescents and many had relapsed another year later. This raises the question whether the commonly used definition of remission as a complete cessation adequately depicts the true course of NSSI. Lewis, Kenny, Whitfield, and Gomez (2019) found that while complete cessation was an essential part of recovery, patients often reported it to be one piece in a bigger process. Even after having stopped NSSI, sometimes for years, many participants did not consider themselves to be recovered as long as thoughts and urges remained which was reinforced by the possibility of relapses. More analyses are needed regarding NSSI remission and relapse to gain a realistic concept of what lasting NSSI recovery may look like and how it can be achieved. Furthermore, the topic of biological underpinnings of NSSI should briefly be addressed. Researchers have made progress in recent years in identifying neurobiological states, correlates, and predictors of NSSI such as e.g. immunological markers, altered HPA functioning, and pain sensitivity (Kaess et al., 2021). However, little is known about temporal mechanisms linking biomarkers to NSSI and about the effect biological systems may have on the persistence of NSSI, which should be examined in future studies.

Some adolescents did not improve and one in ten even deteriorated between first contact and one-year follow-up. This negative direction of the trajectory has not been examined in previous literature and this small but potentially highly burdened group has been neglected in research so far. Particularly, the association between NSSI exacerbation with psychopathology and psychosocial functioning should be examined closely and to prevent increases in NSSI frequency and detect changes during treatment, early warning signs need to be identified.

The second goal was to identify clinically relevant predictors of NSSI outcome one year after first presentation at the outpatient clinic. Results varied between groups: Adolescents who received longer inpatient treatment after their baseline assessment had a significantly lower probability of attaining a response or remission. This finding is in line with community-based studies (Andrews et al., 2013; Whitlock et al., 2015) and has been similarly shown in inpatient settings (Ougrin et al., 2021). Different interpretations are possible. On the one hand, adequate care is often sought out by individuals with severe mental health problems (Zachrisson, Rödje, & Mykletun, 2006) and the initiation of inpatient treatment speaks for particularly high levels of psychopathology and poor psychosocial functioning. A non-response in inpatients may be a sign of general psychosocial stress beyond and not limited to NSSI that may not have been captured by the baseline assessment that was adjusted for. The need for inpatient treatment may not have been apparent at baseline but was a result of an escalation of impairment over time. On the other hand, an inpatient unit may not be the appropriate environment for treating NSSI. A psychiatric hospitalization can be a stressor in itself and patients are, in addition to their own burden, confronted with others' distress and self-harm (Haynes, Eivors, & Crossley, 2011; James, Stewart, & Bowers, 2012; Timberlake, Beeber, & Hubbard, 2020). This can lead to difficult group dynamics which may be met with NSSI as a coping strategy. Our findings can be interpreted as support for NSSI treatment guidelines by The Association of the Scientific Medical Societies in Germany (Plener et al., 2017), that generally recommend giving priority to out- over inpatient treatment under the prerequisite of safety measures. Further, our findings of inpatient treatment being negatively related to a decrease in NSSI frequency may in part be explainable by the fact that a substantial part of adolescents

received outpatient treatment at the outpatient unit Atr!Sk. The Atr!Sk therapy program is specialized in the treatment of self-harming and risk-taking behaviors and (sub)syndromal BPD. Adolescents receive treatment according to a brief cognitive-behavioral psychotherapy manual (CDP), and alternatively or additionally DBT-A, both of which have been shown to be efficient and effective in the reduction of mean NSSI frequency (Kaess et al., 2020; Mehlum et al., 2019, 2014). Overall, our results suggest outpatient programs may be more effective in the reduction of NSSI than inpatient treatments, which are often not specialized in the treatment of self-harming behavior and may even, as discussed above, have iatrogenic effects.

In addition, when controlling for inpatient treatment and other covariates, general symptom severity also reached significance in the prediction of response. Higher levels of general symptom severity at baseline were positively linked to response, which may be explained by a greater potential for improvement in those with initially higher levels of psychopathology and lower levels of psychosocial functioning who, at the same time, were able to receive adequate care in an outpatient setting. Psychotropic medication, on the other hand, negatively predicted a response as a univariate variable but lost significance when adding other covariates to the model. This finding can be explained analog to the effect of inpatient treatment. Individually, medication intake is generally associated with higher psychopathology which reduces the probability of a response (or remission) of NSSI. When controlling for severity by including inpatient treatment, however, this effect seems to be covered and medication no longer has any predictive value.

In line with previous studies, depression was identified as a negative predictor of remission (Barrocas et al., 2015; Duggan et al., 2015; Hankin & Abela, 2011; Plener et al., 2015). Patients with more severe levels of depression at baseline were significantly less likely to achieve a NSSI remission in the following year, however, depression had no significant effect on response without complete remission. This finding may seem surprising after greater general symptom severity was found to positively predict response, as discussed in the last paragraph. It should be noted, however, that the outcome was not the same. The response group seems to be distinct from the remission group in this regard which may in part be explained by the respective definition of the groups: A response describes a significant reduction of NSSI and therefore contains the baseline value of NSSI. In line with the concept of a regression towards the mean, a higher base level of NSSI (and general symptom severity) allows for a sharper decrease and therefore an increased likelihood of a response. Remission, however, is independent of the initial NSSI rates and can be reported irrespective of past NSSI frequency. This difference could explain why higher general symptom severity predicted a response but not a remission. Furthermore, depression is a specific psychiatric disorder and general symptom severity, as measured in this study, not only includes degree of symptomatology but also psychosocial functioning. This was rated by clinicians whereas depression was measured using a self-rating questionnaire. As discussed in the limitations, questionnaires are often used for screening purposes and may overestimate severity of depressive symptoms. Interestingly and in contrast to Glenn and Klonsky (2011), severity of BPD had no influence on the likelihood of a remission and independent of its persistent character we found no indication of elevated BPD symptomatology resulting in less favorable outcomes concerning NSSI.

Finally, exacerbation was predicted by lower NSSI rates at baseline. Adolescents with less NSSI therefore had a higher

probability of reporting an increase after 12 months. This could be expected since lower baseline-rates may double more quickly compared to high frequency behaviors. We also found the FU1 rates of NSSI in the exacerbation group to be comparable to baseline rates in the response group. There seemed to be a temporal shift in NSSI frequency between groups and adolescents experiencing an exacerbation may reach a peak in NSSI later, further illustrating variance in the timing of first clinical presentation. Due to the small group size no statement can be made regarding the trajectory of NSSI at FU2 and whether the frequency increased further or decreased analogous to the response group. Unfortunately, research on the rise of NSSI over time on an individual level is scarce and adolescents showing an aggravation in NSSI symptoms may require particular attention. Lastly and in addition to BPD, neither age, sex, nor dose of outpatient treatment had any predictive value in the prediction of change in NSSI frequency.

Some limitations should be noted. The sex ratio was clearly unbalanced with most of the sample being female. Although an effect could not be detected in the present data it cannot be ruled out that the longitudinal trajectory of NSSI differs depending on sex. As presented in the supplement (see online Supplementary Table S1), there was a small but significant effect of sex and NSSI frequency on drop-out. Male patients had higher drop-out rates as well as adolescents with lower NSSI rates at baseline, which may be explainable by lower feelings of identification with the study's target group. Due to drop-out, this cannot be confirmed. Furthermore, depression severity and ACE scores were assessed using questionnaires, which are mainly used for screening purposes. This may lead to an overestimation of symptoms compared to extensive clinical interviews we conducted to assess NSSI and BPD. Also, due to small sample sizes at FU2 no prediction model could be established for relapse. This is the first study using a more individualistic approach into examining trajectories of NSSI frequency by defining corresponding groups instead of mean changes. By identifying predictors of response, remission, and exacerbation, this study added to the important discussion of personalized treatment options in mental health care. Additionally, the sample size and composition of help-seeking adolescents as well as the longitudinal study design should be noted.

Conclusion

In line with previous research, we found high levels of response over one year in this high-risk adolescent sample. Complete remission, though, was rare and a small but considerable group reported an exacerbation of NSSI frequency. This highlights the heterogeneity of NSSI treatment outcomes and the importance of accounting for individual processes in the study of self-harming behaviors. Inpatient treatment and depression severity were identified as clinically relevant factors that may hinder a response or remission whereas general symptom severity increased the likelihood for a response. The negative effect of inpatient care on NSSI frequency endorses the general recommendation of favoring out-over inpatient settings for treating NSSI and should be taken into consideration in the clinical decision-making process. Furthermore, lower NSSI frequency at baseline is not necessarily an all-clear signal since it was found to elevate the risk of exacerbation. Early detection of patients with an increase in NSSI after seeking help is critical and further research in the development and promotion of personalized treatment options is clearly indicated.

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Conflict of interest. The authors declare none.

Ethical standards. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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APPENDIX C

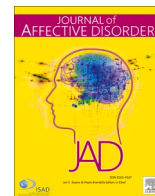
Self-Rated Risk as a Predictor of Suicide Attempts Among High-Risk Adolescents

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Research paper

Self-rated risk as a predictor of suicide attempts among high-risk adolescents

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ABSTRACT

Background. Predicting suicide attempts is a challenging task for clinicians and researchers, particularly among high-risk individuals (i.e. adolescents with lifetime suicide attempts). In this study, we examined whether adolescents were able to predict their own risk of attempting suicide in the future and whether borderline personality disorder (BPD) or depressive symptoms impacted the predictive value of self-ratings.

Methods. Structured clinical assessments were conducted at baseline and after 12 months in a high-risk sample of treatment-seeking adolescents ($n = 134$; 12-17y.; 90% female) with at least one lifetime suicide attempt.

Results. During the follow-up period, $n = 51$ participants (38%) attempted suicide at least once. Self-rated risk was a significant predictor for the recurrence of a suicide attempt, whereas BPD and depression were not. While there was no significant interaction between self-rated risk and BPD, a negative interaction emerged between self-rated risk and depression in the prediction of a suicide attempt. Greater depression severity diminished the predictive value of self-ratings.

Limitations. Depression severity was measured using a questionnaire, not a clinical interview. The findings may not be applicable to less burdened samples.

Conclusions. Asking high-risk adolescents to rate their own risk of attempting suicide appears to be an easy to apply method in improving the prediction of future suicide attempts in the clinical context.

1. Introduction

According to the World Health Organization (WHO; 2019), every year close to 800,000 individuals commit suicide, making it one of the leading causes of death worldwide. For each suicide death there are expected to be more than 20 suicide attempts (WHO, 2014) and the prevalence rate is alarming. In the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), a suicide attempt is defined as “a self-initiated sequence of behaviors by an individual who, at the time of initiation, expected that the set of actions would lead to his or her own death” (American Psychiatric Association, 2013). Notably, a much higher proportion of the population report suicidal ideation without necessarily attempting to end their life (Klonsky and May, 2014). The importance of studying suicide attempts as a distinct

phenomenon and risk factor for suicide has been highlighted through the proposition of a new condition for further study in the DSM-5: Suicidal Behavior Disorder could be diagnosed in individuals who have attempted suicide at least once within the past two years, whereas suicidal ideation is not a criterion (American Psychiatric Association, 2013). Distinguishing between those who think about suicide and those who act on such thoughts is critical in order to improve the understanding of suicidality, and to facilitate early detection and intervention for those particularly at risk.

Suicidal ideation and behavior (SIB) are especially common among adolescents and young adults. According to a systematic review of population-based studies, almost 10% of youths report having ever attempted suicide during their lifetime and up to 30% have had suicidal thoughts (Evans et al., 2005). In clinical samples, these numbers are

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even higher: In a sample of adolescent patients with depression, 23% reported at least one suicide attempt in the past and among adolescent patients with bipolar disorder, up to 57% confirmed suicidal thoughts at some point in their life (Asarnow et al., 2011; Hauser et al., 2013). One group of adolescents that is at particularly high risk for suicide attempts is the group of previous suicide attempters (Kirkcaldy et al., 2006). Hultén et al. (2001) examined rates of repeated suicide attempts and found 24% of adolescents to attempt suicide again within one year of the index attempt. In another follow-up study over a period of 8 to 10 years, Groholt and Ekeberg (2009) reported a repetition rate of 44% among adolescent suicide attempters.

In order to prevent suicide attempts, it is key to recognize individuals at high risk and find ways to predict such behaviors as accurately as possible. It is widely acknowledged that predicting suicide attempts is a difficult task for researchers and clinicians and the clinical utility of traditional suicide risk assessment is limited (Franklin et al., 2017; Lindh et al., 2019). In the present study, the focus therefore lies on a different source of information that may have the potential to yield better predictive validity: The individual affected by it. Former studies have examined adolescent patients' ability to predict future SIB and mixed findings have been reported. Janis and Nock (2008) tested if community adolescents with a history of suicidal or non-suicidal self-injurious thoughts and behaviors were able to rate the probability of such thoughts and behaviors to occur over the following six months. Individually, this effect was confirmed, but when controlling for past history of self-injurious thoughts and behaviors, self-ratings no longer explained additional variance in the respective statistical models. In a study of adolescents and young adults presenting at a psychiatric emergency department, Czyz et al. (2016), on the other hand, found self-rated expectation to refrain from suicidal behavior to predict actual suicide attempts in the following 18 months better than clinician-administered severity of suicidal ideation or any other covariate and to improve the accuracy of risk assessments.

Suicide attempts do commonly occur in the context of various psychiatric disorders. Two disorders that have been shown to put individuals at particularly high risk for suicide attempts are borderline personality disorder (BPD) and depression. BPD is characterized by a core symptomatology of instability in affect regulation, interpersonal relationships, and self-image and is composed of nine criteria (American Psychiatric Association, 2013). The characteristic instability in different domains is often reflected in impulsivity, risk-taking, and self-injuring behavior as well as suicidality. About three in four individuals with BPD attempt suicide at some point in their life and 10% eventually die by suicide (Black et al., 2004). Respective data are missing for adolescents (Kaess et al., 2014). Suicide attempts often occur impulsively and the intensity of suicidal thoughts fluctuates rapidly in adolescence (Auerbach et al., 2017; Czyz et al., 2019), making the prediction of suicide attempts even more difficult. The distinct pattern of instability in a range of intra- and interpersonal domains, commonly supplemented by issues with impulse control and different forms of suicidal or non-suicidal behavior, may lead to biased self-assessment and difficulties in anticipating one's own future behaviors in patients with BPD symptomatology.

Symptoms of depression range from low mood and reduced energy over feelings of hopelessness to suicidal thoughts and behaviors (WHO, 1992). In the general population, adolescents with depressive symptoms were clearly identified as being at higher risk for SIB (Evans et al., 2004) and using a meta-analytic approach on longitudinal data, Gili et al. (2019) found affective disorders to be the only significant predictor of suicide attempts out of several categories of mental disorders. Interestingly, though, higher levels of depression are not necessarily linked to higher risk for suicide attempts. While an association between suicidal ideation and depression was confirmed in a sample of psychiatric outpatients, the correlation between suicidal ideation and attempts was strongest at lower depression levels (Rogers et al., 2018). Lethargy and loss of energy, which is frequent in severe depression, is assumed to

hinder the transformation from suicidal ideation to suicidal behaviors. Beck (1976) postulated a well-known model of cognitive biases characteristic for depression, including negative thoughts about the self, the world and the future. This tendency for negative views has been found in depressed adolescents as well (Platt et al., 2017). Self-ratings of future behavior may therefore be shaped by pessimistic expectations and a biased perception of oneself and the future in general, leading to less dependable estimations.

On the basis of the research presented above, several research questions will be addressed in the present study: First, we investigate whether self-rated risk for future suicidal behavior accurately predicts the recurrence of suicide attempts over the course of one year. Second, we test whether this effect remains significant after controlling for age, sex, number of past suicide attempts and psychopathology (BPD; depression). Third, we examine whether psychopathology (BPD and depression) moderates the relationship between self-rated risk for future suicide attempts and the occurrence of suicide attempts in a one-year follow-up period.

2. Methods

2.1. Participants and procedure

Adolescents between the age of 12 and 17 years who were treatment-seeking at the specialized outpatient clinic for adolescent risk-taking and self-harm behavior at the Clinic of Child and Adolescent Psychiatry, University Hospital Heidelberg, Germany (Atr!Sk; Ambulanz für Risikoverhalten und Selbstschädigung) routinely underwent structured clinical assessments by specifically trained clinicians. Patients reporting at least one lifetime suicide attempt at baseline who returned for the 12-months follow-up were included in analyses. For detailed information on the clinic and its patients, please refer to Kaess et al. (2017). Patients were consecutively recruited for the Atr!Sk cohort study. This study was conducted in accordance with the Declaration of Helsinki (World Medical Association, 2013) and approved by the local ethics committee (ID S-449/2013) in Heidelberg, Germany. After participants or their legal guardians (if under 16 years) had signed written informed consent, patients' data was included in the cohort data set and study participants were re-invited and re-assessed after 12 months using a slightly adapted set of instruments.

2.2. Instruments

The following instruments were used in the baseline diagnostic appointment and in the 12-months follow-up assessment. All interviews and questionnaires were presented in their validated German translation.

Demographic data. A standardized set of interview questions was used in all patients, assessing age and sex as well as information about school type, family and living situation.

Psychiatric diagnoses. The Mini-International Neuropsychiatric Interview for Children and Adolescents (M.I.N.I.-KID; Sheehan et al., 2010) is a structured interview for the assessment of axis I psychiatric disorders according to DSM-IV and ICD-10 (International classification of diseases and related health problems; WHO, 1992).

Suicidal ideation and behavior. The German version of the Self-Injurious Thoughts and Behaviors Interview (SITBI-G; Fischer et al., 2014) measures the occurrence, frequency, and characteristics of suicidal ideation, suicide plans, suicide attempts, thoughts about non-suicidal self-injury (NSSI), and actual NSSI. One item assesses the self-rated risk for suicide attempts in the future on a 5-point Likert scale with higher values indicating an increased self-rated risk ("On the scale of 0 to 4, what do you think the likelihood is that you will make a suicide attempt in the future?"). Suicide attempts were defined in accordance with the DSM-5 criterion for Suicidal Behavior Disorder (American Psychiatric Association, 2013; see Introduction). The fulfilment of the

criterion was thoroughly explored by specially trained clinical psychologists. The occurrence of a suicide attempt in the following year was extracted from data collection one year later (“How many suicide attempts have you made in the past year?”) and dichotomized. Fischer et al. (2014) report good psychometric properties for the German version of this interview.

Borderline personality disorder. In order to assess borderline symptomatology, the respective module of the Structured Clinical Interview for DSM-IV Axis II (SCID-II; Wittchen et al., 1997) was conducted. The nine criteria of BPD (fear of abandonment, unstable and intense relationships, unstable self-image, impulsive behaviors, recurrent self-harm, affect instability, chronic feelings of emptiness, intense anger, stress-related paranoid ideation or dissociative symptoms) are rated on a scale from 1 (not fulfilled), 2 (partially fulfilled) to 3 (fulfilled). If five or more criteria are met, a BPD is diagnosed and the fulfillment of three or four criteria is considered as subclinical. In the present analyses, the number of fulfilled criteria (rated as 3) is used as an indicator for symptom severity.

Depression. The Symptom Checklist Revised (SCL-90-R; Franke and Derogatis, 2002) is a self-report questionnaire measuring symptom severity in the last seven days on a 5-point Likert scale that ranges from 0 (“not at all”) to 4 (“extremely”). Depressive symptoms, such as lethargy, crying, and feeling hopeless, are assessed with one out of nine subscales consisting of 13 items. In the present dataset, the depression subscale showed good internal consistency with a Cronbach’s alpha of .88.

2.3. Statistical analysis

For the dependent variable, data were collected one year after the baseline assessment. Due to the binary character of the outcome variable, univariate and hierarchical multivariate logistic regressions were calculated. A possible moderating influence of both forms of psychopathology was analyzed as an interaction effect between self-rated risk and BPD as well as depression. Age, sex, and number of suicide attempts before the baseline were included as control variables. Suicidal ideation and NSSI, despite their possible theoretical importance, were omitted due to the variance restriction in our selected clinical sample (see sample characteristics). Except for sex, which was binary, standardized values are reported in Tables 2 and 3 in order to allow comparison between the independent variables. The area under the receiver operating characteristic curve (AUC) was computed for each model as an indicator for accuracy of prediction, with an AUC of 0.50 revealing prediction to be at chance and 1.00 showing perfect accuracy (Zou et al., 2007). Analyses were conducted using Stata/SE (Version 16.0, Stata Corp LLC, College Station, TX, USA) and the alpha-level was set to 0.05.

3. Results

3.1. Descriptive statistics

From $N = 482$ adolescents included in the AtR!Sk cohort study (participation rate was 92%), $n = 227$ adolescents reported a lifetime suicide attempt at baseline (47%). Of those, $n = 93$ participants were subject to attrition at 12-months follow-up (41%), leaving a total sample of $n = 134$ adolescents (see Fig. 1). Compared to participants who returned for the 12-months follow-up, a F9 diagnosis from the ICD-10 was significantly more common in adolescents who were lost to attrition, as was the fulfillment of the “impulsive behaviors” BPD criterion ($\chi^2(1) = 5.47, p = .019$; $\chi^2(1) = 5.06, p = .025$, respectively). Both groups did not differ regarding any other baseline characteristics.

Thirty-nine percent of adolescents went to a Gymnasium (secondary school terminating with the general qualification for university entrance), 32% a Realschule (secondary school terminating with a secondary school level-I certificate), 10% a Hauptschule (secondary elementary school) and 19% attended some other form of school. While

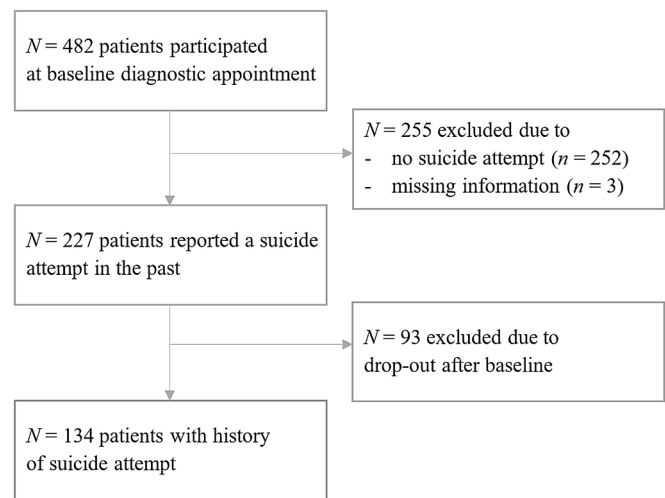


Fig. 1. Participant flow chart.

39% of the sample lived with both birth parents, 38% lived with one and 23% reported other living situations. At baseline, 44% of the sample reported having attempted suicide once in the past, 30% two or three and 26% four or more times. Every single participant has had suicidal thoughts at some point in his or her life (100%) and 98% reported to have ever engaged in NSSI.

Around one quarter of the sample attempted suicide once during the 12-months follow-up (24%), 6% made two or three attempts and 8% reported four or more suicide attempts. Half of the sample met five or more BPD criteria (51%) and 36% had subclinical BPD symptomatology (3 or 4 criteria). Compared to data obtained from a norm sample of community adolescents, 82% of participants had at least slightly elevated depression scores and half of them (53%) showed strongly increased values (Franke and Derogatis, 2002), which could be expected in this specific clinical sample. As presented in Table 1, baseline characteristics did not differ between participants with a suicide attempt in the following year and the ones without an attempt, except for self-rated risk.

3.2. Logistic regression analysis

As shown in Table 2, self-rated risk was a significant independent predictor for a suicide attempt over the course of one year ($p = .009$). For each increase in the risk prediction score by one standard deviation, the odds for a suicide attempt during the following year increased 64%. Age, sex, and number of previous suicide attempts did not predict a suicide attempt ($p = .511$; $p = .529$; $p = .544$, respectively), and neither did BPD ($p = .584$) nor depression severity ($p = .093$). Self-rated risk had the highest predictive accuracy for future suicide attempts with an AUC of 0.64.

Adding the control variables age, sex, and number of past suicide attempts into a multivariate model did not influence the effect of self-rated risk on the probability of a suicide attempt ($p = .010$), as shown in Table 3 (step 1). When BPD was included, the association remained stable ($p = .009$; step 2). However, the inclusion of depression as a predictor resulted in the effect of self-rated risk on suicide attempts to become non-significant ($p = .053$), yielding a model with no variable reaching statistical significance on its own (step 2).

The results of both interaction analyses are presented in Table 3, step 3. There was no significant interaction between self-rated risk and BPD ($p = .390$) and both main effects did not reach levels of statistical significance ($p = .089$; $p = .363$). The interaction between depression and self-rated risk was significant ($p = .028$) in predicting a future suicide attempt, as were the main effects of depression ($p = .019$) and self-rated risk ($p = .010$). As shown in Table 3 and Fig. 2, the interaction between

Table 1
Baseline sample characteristics.

	Total N = 134	SA n = 51	No-SA n = 83	Test statistic	p
Age in years, <i>M (SD)</i>	15.2 (1.4)	15.1 (1.4)	15.2 (1.4)	$t(132) =$ 0.65	.514
Female sex, <i>n (%)</i>	121 (90)	45 (88)	76 (92)	$\chi^2(1) =$ 0.40	.527
Diagnoses, <i>n (%)</i> ¹					
F1 Mental and behavioral disorders due to psychoactive substance use	34 (25)	10 (20)	24 (29)	$\chi^2(1) =$ 1.45	.229
F3 Affective disorders	95 (71)	39 (77)	56 (68)	$\chi^2(1) =$ 1.24	.265
F4 Neurotic, stress-related and somatoform disorders	47 (35)	22 (43)	25 (30)	$\chi^2(1) =$ 2.35	.125
F5 Behavioural syndromes associated with physiological disturbances and physical factors	19 (14)	10 (20)	9 (11)	$\chi^2(1) =$ 1.99	.158
F9 Behavioural and emotional disorders with onset usually occurring in childhood and adolescence	36 (27)	10 (20)	26 (31)	$\chi^2(1) =$ 2.21	.137
Self-rated risk for SA, <i>M (SD)</i>	1.7 (1.2)	2.1 (1.1)	1.5 (1.2)	$t(132) =$ -2.74	.007
Number of past SA, <i>M (SD)</i>	4.9 (11.4)	4.1 (7.8)	5.4 (13.1)	$t(132) =$ 0.62	.539
Number of BPD criteria, <i>M (SD)</i>	4.5 (1.8)	4.7 (2.0)	4.5 (1.7)	$t(132) =$ -0.54	.587
Fulfillment of BPD criterion, <i>n (%)</i>					
Fear of abandonment	36 (27)	14 (28)	22 (27)	$\chi^2(1) =$ 0.01	.905
Unstable relationships	67 (50)	26 (51)	41 (49)	$\chi^2(1) =$ 0.03	.859
Unstable self-image	51 (38)	21 (42)	30 (36)	$\chi^2(1) =$ 0.34	.560
Impulsive behaviors	37 (28)	12 (24)	25 (30)	$\chi^2(1) =$ 0.69	.407
Recurrent self-harm	129 (97)	49 (98)	80 (96)	$\chi^2(1) =$ 0.01	.927
Affect instability	98 (73)	38 (75)	60 (72)	$\chi^2(1) =$ 0.08	.778
Chronic feelings of emptiness	77 (58)	33 (65)	44 (53)	$\chi^2(1) =$ 1.77	.184
Intense anger	59 (44)	20 (39)	39 (47)	$\chi^2(1) =$ 0.77	.379
Stress-related paranoid ideation or dissociative symptoms	54 (41)	24 (47)	30 (37)	$\chi^2(1) =$ 1.56	.211
Depression severity, <i>M (SD)</i>	2.3 (0.8)	2.4 (0.9)	2.2 (0.8)	$t(127) =$ -1.71	.090

Note. *M* = mean, *SD* = standard deviation, *n* = sample size, SA = suicide attempt, BPD = borderline personality disorder.

¹ F0 (organic mental disorders), F2 (schizophrenia, schizotypal and delusional disorders), F7 (mental retardation), F8 (disorders of psychological development) were not fulfilled by any patient and were therefore omitted. Only the borderline module of the SCID-II was conducted and the frequency of F6 (disorders of adult personality and behavior) cannot be reported.

Table 2
Results of univariate logistic regression analyses for suicide attempt.

	OR	CI	p	AUC
Self-rated risk	1.64	1.13; 2.38	.009	0.64
Age	0.89	0.63; 1.26	.511	0.54
Sex ¹	1.45	0.46; 4.58	.529	0.52
No. of past SA	0.88	0.59; 1.32	.544	0.52
BPD	1.10	0.78; 1.57	.584	0.53
Depression	1.38	0.95; 2.02	.093	0.61

Note. OR = odds ratio, CI = 95% confidence interval, p = p-value, AUC = area under the curve, SA = suicide attempt, BPD = borderline personality disorder

¹ Statistical values for sex are unstandardized.

both factors was negative: With increasing depression severity, self-rated risk lost its significance as a predictor for a suicide attempt. The AUC in multivariate analyses (Table 3) was comparable to the univariate predictive effect of self-rated risk and the highest AUC emerged in the interaction model including self-rated risk and depression (AUC = 0.67).

4. Discussion

The goal of the present study was to examine the predictive value of self-rated risk for future suicide attempts among high-risk adolescents and to control for factors that may mitigate the reliability of self-ratings. Specifically, BPD and depression were expected to not only be prevalent, but to be associated with a higher probability of suicide attempts in the following year and to lead to less precise self-ratings of such behavior. We found mixed results: Higher self-rated risk was associated with significantly increased probability of a future suicide attempt. BPD and depression severity were both high in this sample, but neither of them were found to be significant independent predictors of suicide attempts. Furthermore, while no interaction between BPD and self-rated risk in the prediction of suicide attempts emerged, a significant negative interaction between depression and self-rated risk was found. These findings and their implications are discussed below.

Our finding of self-rated risk being a predictor for a subsequent suicide attempt is in line with a study by Czyn et al. (2016). In both studies, at-risk adolescents were able to predict their probability of attempting suicide in the following 12 to 18 months. Janis and Nock (2008), on the other hand, did not find self-ratings to improve the prediction of future self-injurious thoughts and behaviors beyond the assessment of such thoughts and behaviors in the past. The inconsistencies might be attributable to differently defined outcomes: Predicting suicide attempts as clearly defined behaviors may be less prone to inaccuracy compared to the prognosis of self-injuring thoughts and behaviors in general. Self-rated risk therefore seems to be a good predictor for the occurrence of suicide attempts over one year among at-risk adolescents. This finding may add to existing research and clinical assessments of suicide attempts by incorporating self-prognosis as a reliable and easy to assess add-on to traditional risk scales.

Contrary to previous research (Black et al., 2004; Evans et al. 2004; Gili et al., 2019), neither BPD nor depressive symptoms independently predicted suicide attempts. A possible explanation could be that patients with BPD or depression are at higher risk for suicide attempts compared to the general population, but when examining clinical samples, the severity of psychopathology does not differentiate well between people with and without suicide attempts. This finding fits with the ideation-to-action framework of suicide research and the assumption that established risk factors, such as psychiatric disorders, do not distinguish well between suicide ideators and attempters (Klonsky and May, 2014). In line with this theory, BPD and depression may be associated with general suicidal tendencies and in the general population, they serve as critical risk factors for self-harming behavior. In high-risk clinical samples, though, BPD and depression may not be well suited to predict specific suicidal behavior or to make a distinction between patients who attempt suicide and those who do not. According to our study, these findings can be interpreted as evidence that among psychiatric patients, more emphasis should be placed on the individual's own assessment in addition to psychiatric diagnoses in order to identify adolescents at risk for suicide attempts.

Furthermore, adolescents with high levels of BPD were able to predict their own suicidal behavior and BPD characteristics, such as instability in affect and identity as well as impulsivity, seemed to have no influence on the predictive value of self-ratings regarding subsequent suicidal behavior. Further research on self-prognosis of future behavior in other domains among individuals with BPD may provide additional insight into the characteristic instability in identity and eventually support decision-making in the clinical context. Self-ratings regarding future suicide attempts of adolescents with BPD should therefore be

Table 3
Results of multivariate logistic regression analyses for suicide attempt.

	OR	CI	p	AUC		OR	CI	p	AUC
Step 1									
Self-rated risk	1.67	1.13; 2.45	.010						
Age	0.98	0.67; 1.44	.935						
Sex ¹	1.24	0.37; 4.18	.734						
No. of past SA	0.83	0.55; 1.26	.385	0.66					
BPD									
Step 2									
Self-rated risk	1.63	1.13; 2.36	.009		Depression				
BPD	1.07	0.74; 1.54	.722	0.64	Step 2				
					Self-rated risk	1.48	0.99; 2.20	.053	
					Depression	1.22	0.82; 1.81	.318	0.64
Step 3									
Self-rated risk	2.51	0.87; 7.27	.089		Step 3				
BPD	1.35	0.71; 2.57	.363		Self-rated risk	7.50	1.62; 34.75	.010	
Self-rated risk x BPD ¹	0.93	0.79; 1.10	.390	0.65	Depression	3.08	1.21; 7.85	.019	
					Self-rated risk x Depression ¹	0.58	0.35; 0.94	.028	0.67

Note. OR = odds ratio, CI = 95% confidence interval, p = p-value, AUC = area under the curve, SA = suicide attempt, BPD = borderline personality disorder

¹ Statistical values for sex and interaction effects are unstandardized.

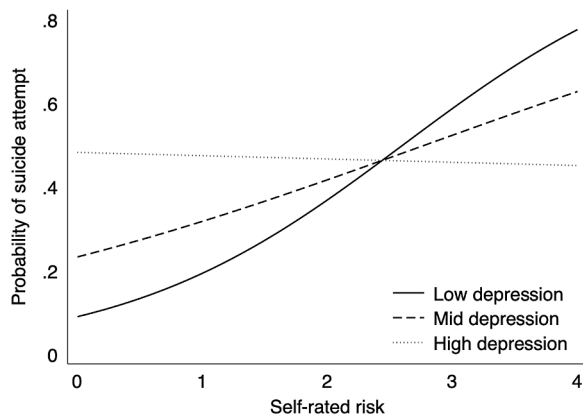


Fig. 2. Interaction between self-rated risk and depression in the prediction of a suicide attempt. Low depression = mean - 1 standard deviation; mid depression = mean; high depression = mean + 1 standard deviation.

taken seriously by clinicians and not disregarded as being instable, inaccurate or even manipulative.

Depression severity, on the other hand, did have an influence on the predictive value of self-rated risk: Participants with low levels of depression were able to predict their risk of attempting suicide in the near future, whereas participants with high depression levels were not. This finding can be interpreted as an interplay between negative views of the self and the future (Platt et al., 2017) and an interrupted process from suicidal ideation to suicide attempts in highly depressed individuals due to lethargy (Rogers et al., 2018). Adolescents with greater depression severity may feel negative about themselves and the future and believe they will attempt suicide again, but end up having too little energy to actually commit an attempt. It should be noted, though, that severity of depression was generally high in this sample and the difficulties in self-ratings did not apply to mild or moderate levels of depression, but rather severe forms.

The topic of prediction accuracy should also be addressed. While age, sex, number of past suicide attempts, and BPD were close to random as predictors, depression yielded slightly better results and in line with findings presented above, the highest AUC was found for self-rated risk as an univariate predictor and the model including the interaction between self-rated risk and depression. In other medical fields, higher AUCs are considered acceptable (Zou et al., 2007), but the values presented in this paper correspond to moderate prediction effects in psychiatry in general (Rice and Harris, 2005) and even slightly outperform popular suicide risk scales (Lindh et al., 2019). The limited accuracy of prediction in suicidality research and the clinical context has been discussed extensively (e.g., Franklin et al., 2017) and even though our

results were significant, further improvement of accuracy remains an essential goal for future studies.

4.1. Strengths and limitations

There are some limitations to this study. First, the sex ratio is skewed and the clear majority of this sample were females. Even though we did not find any significant effects of sex, we cannot rule out that these exist due to the small number of male participants. While the longitudinal character of the study is a great advantage, the 12-months time frame did not allow us to examine short-term effects, limiting clinical implications. Furthermore, symptoms of BPD and depression were highly prevalent. While the examination of such a specific high-risk sample is a clear strength, no statement can be made regarding these findings in less burdened samples or the general population. Also, this may to some extent explain the finding that neither BPD nor depression severity were significant predictors for suicide attempts in the present study with this specific clinical sample. It should also be noted that a questionnaire was used to measure depression severity, and not a clinical interview. This could in part explain the high prevalence of depression in this sample, since such questionnaires are mainly used as screening tools and psychiatric symptoms may be overestimated. To test general clinical utility, these findings should be replicated over shorter periods of time and in more diverse samples, in particular with a more balanced gender ratio and various levels of psychopathology severity.

5. Conclusions

We found self-rated risk to be a significant predictor for actual suicide attempts in the following year in an at-risk sample of treatment-seeking adolescents, even when controlling for key covariates. In this clinical sample, neither BPD nor depression severity were significant predictors and BPD characteristics seemed to have no influence on the predictive value of self-ratings. Severe depression did impact the precision with which participants were able to rate their risk to attempt suicide again, which should be considered when administering self-ratings of future suicidal behavior. In conclusion, asking an adolescent at high risk for suicide attempts about his or her personal estimation of showing such behaviors in the future, a question that is short and easy to implement in routine care, may allow better prediction of suicide attempts and improve reliability of risk assessments in the clinical context.

Contributors

MK designed and supervised the study. GFW and DG were responsible for data collection and recruitment. FRO performed the analyses and wrote the manuscript. CR and SL contributed to the analyses. CR, GFW, DG, JK, FRe, and MK edited the manuscript and provided a final

review. All authors gave final approval of this version to be published.

Declarations of Competing Interest

None.

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Erklärung zur Dissertation

Hiermit bestätige ich, dass ich die Dissertation (Titel):

The Course of Self-Injury in Help-Seeking Adolescents -
Treatment, Trajectory, and Prediction of a Transdiagnostic Phenomenon

im Fach

Psychologie

unter der Leitung von Prof. Dr. Stefanie Schmidt

ohne unerlaubte Hilfe ausgeführt und an keiner anderen Universität zur Erlangung eines akademischen Grades eingereicht habe.

Datum 04.02.2023

Unterschrift

