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Nonsuicidal self-injury, suicidal behaviour and life events in adolescence

PhD Thesis Abstract

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My publications related to the topic of the dissertation

List of my publications used in the dissertation[1]:

Horváth, L. O., Mészáros, G., & Balázs, J. (in press). Mikor nemszuicidális az önsértés? Az önsértő és öngyilkos magatartás kapcsolatának áttekintése. *Psychiatria Hungarica*.

Horváth, L. O., Győri, D., Komáromy, D., Mészáros, G., Szentiványi, D., & Balázs, J. (2020). Nonsuicidal Self-Injury and Suicide: The Role of Life Events in Clinical and Non-Clinical Populations of Adolescents. *Frontiers in Psychiatry*, *11*, 370. https://doi.org/10.3389/fpsyt.2020.00370

Kaess, M., Eppelmann, L., Brunner, R., Parzer, P., Resch, F., Carli, V., Wasserman, C., Sarchiapone, M., Hoven, C. W, Apter, A., Balazs, J., Barzilay, S., Bobes, J., Corcoran, P., Cosman, D., Haring, C., **Horvath, L. O.,** Kahn, J. P., Keeley, H., Marchetti, Marco; Podlogar, T., Postuvan, V., Saiz, P. A., Tubiana, A., Varnik, A., & Wasserman, D. (2020). Life Events Predicting the First Onset of Adolescent Direct Self-Injurious Behavior-A Prospective Multicenter Study. *Journal of Adolescent Health*, *66*(2), 195–201. http://doi.org/10.1016/j.jadohealth.2019.08.018

Farkas, B. F., Győri, D., **Horváth, L. O**., Mészáros, G., & Balázs, J. (2019). Overview of the current knowledge on nonsuicidal self-injury. *Buletinul Asociației Balint*, *21*(81–82), 20–27.

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[1] The co-authors have approved the use of the publications in my dissertation.

Meszaros, G., **Horvath, L. O.,** & Balazs, J. (2017). Self-injury and externalizing pathology: a systematic literature review. *Biomed Central Psychiatry*, *17*(1). http://doi.org/10.1186/s12888-017-1326-y

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Further publications related to the topic, which are not included in my dissertation

Hillekens, J., Buist, K. L., **Horváth**, **L. O.,** Koper, N., Ólafsdóttir, J., Karkdijk, E., Balázs, J. (in press). Parent-Early Adolescent Relationship Quality and Problem Behavior in Hungary, the Netherlands, India, and Iceland. *Scandinavian Journal of Psychology*.

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I. BACKGROUND[2]

I.1. A cultural understanding of self-injury

Most of the currently accepted definitions of self-injurious behaviours – including the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013) – include that the behaviour is not widely accepted or practiced in the individual's culture (Favazza, 2011; Klonsky & Muehlenkamp, 2007). This part of the definition implies that based on social consensus, most cultures find certain self-injurious behaviours tolerable or downright desirable. The cultural-historical background of self-injury is comprehensively examined by Favazza (2011), who distinguishes between socially accepted or expected and deviant/pathological forms of self-injurious behaviours. In line with the cultural psychiatric approach, he hypothesizes that studying self-injurious acts of different cultures that are carried out for socially sanctioned purposes (e.g. healing rituals) and thus considered culturally accepted may also contribute to the understanding of deviant or pathological self-injuries that do not fit into the social-cultural context of those engaging in it.

I.2. Terminology

Since the first case studies on self-harm, several terms have been used in the literature to describe the phenomenon, many of which also place it in a theoretical framework: e.g. localized self-destruction (Menninger, 1938, cited by Favazza, 1996), self-mutilation (Favazza, 1996), parasuicide (Kreitman, 1977), deliberate self-harm (DSH) (Pattison & Kahan, 1983) or direct self-injurious behaviour (D-SIB), defined as intentional self-inflicted damage to one's body surface, regardless of suicidal intent (Brunner et al., 2014; Kaess et al., 2020; Koenig et al., 2017).

The most commonly used terminology in the current literature is nonsuicidal self-injury (NSSI) (Andover, Morris, Wren, & Bruzzese, 2012; Klonsky & Muehlenkamp, 2007), for which the most widely accepted definition is the deliberate infliction of damage to one's own body tissue without the observable intention of suicide, and for reasons socially/culturally not sanctioned (Favazza, 2011; Klonsky, 2007; Nock, 2010).

[2] The Introduction chapter of my dissertation is based on our previous work in the topic, in which I have done significant work (Farkas, Győri, Horváth, Mészáros, & Balázs, 2019; Horváth, 2014; Horváth et al., 2015, 2018, 2020; Horváth, Mészáros, & Balázs, in press)

Although the phenomenon was also introduced in the DSM-5 as NSSI (American Psychiatric Association, 2013), most meta-analyses and systematic reviews studies highlight the issue of data comparability because different authors often use different terms for the same phenomenon or mean different phenomena when using the same terminology (Huang, Ribeiro, & Franklin, 2020; Nock, 2010). In my dissertation, I mostly use the term NSSI to describe the phenomenon; when I use different terms, the different terminology in the cited literature refers to a conceptually different phenomenon.

I.3. Self-injury in the classification systems

A fundamental question that runs through the classification is whether to interpret the phenomenon of self-injury as a symptom or an independent diagnosis. NSSI became an independent disorder worthy of further consideration in the DSM-5 in Section III. 'Conditions for Further Study' (American Psychiatric Association, 2013). NSSI being proposed as an independent diagnostic category was the result of the growing number of adolescents that did not fulfill the criteria for borderline personality disorder (BPD) but were distressed, in need of help, and potentially at increased risk for suicide. (Plener & Fegert, 2012).

The introduction of NSSI as an independent diagnostic category has been met with controversy among researchers and clinicians, resulting in a still ongoing scientific debate. (Brown & Plener, 2017). The most common counter-arguments are the low number of longitudinal studies on a large number of samples (Kapur, Cooper, O'Connor, & Hawton, 2013) and the questions that arise about distinguishing between NSSI and suicidal behaviour (Kapur et al., 2013) and the definition of methods that can be considered NSSI (Fox, Millner, & Franklin, 2016), furthermore, the risk of stigmatizing a large number of adolescents as "mentally ill" (Kapur et al., 2013). The introduction of the independent diagnostic category is supported by the promise that in many cases those seeking help could get an accurate formal diagnosis for which they could receive adequate treatment (Brown & Plener, 2017; Kapur et al., 2013; Plener & Fegert, 2012).

The diagnostic criteria proposed in DSM-5 include the following: 1. intentional self-injury to the body surface without suicidal intent on at least 5 days within the past year.; (2) the expectation that NSSI will solve an interpersonal problem, provide relief from unpleasant thoughts and/or emotions, or induce a positive emotional state; (3) interpersonal problems or negative thoughts/emotions immediately prior to NSSI and/or preoccupation with NSSI and/or frequent thoughts about NSSI. Further criteria include that the behaviour is not socially

sanctioned or restricted picking of scars or nail-biting; results in clinically significant distress impairment, does not occur only in during psychosis, delirium or substance use/withdrawal, in case of mental retardation is not part of a repetitive-stereotypic pattern and is not better accounted for by another psychiatric disorder or medical condition (American Psychiatric Association, 2013).

I.4. Epidemiology

The onset of NSSI typically occurs in adolescence between the ages 12-16 years (Kiekens et al., 2018; Nock, 2009), with prevalence rates consistently higher among adolescents than among adults (Nock, 2010). Studies among community samples suggest that the lifetime prevalence of self-injury is 15%–46% of adolescents (Brunner et al., 2014; Lloyd-Richardson, Perrine, Dierker, & Kelley, 2007; Plener, Libal, Keller, Fegert, & Muehlenkamp, 2009; Ross & Heath, 2002), and 40-80% in clinical samples of adolescents (Darche, 1990; Jacobson, Muehlenkamp, Miller, & Turner, 2008; Nock & Prinstein, 2004). Regarding gender differences, some results show that among adolescents, lifetime prevalence of NSSI is approximately two-three times higher in girls compared to boys (e.g. Bakken & Gunter, 2012; Madge et al., 2008), other studies show smaller or no difference between genders (Klonsky, Oltmanns, & Turkheimer, 2003; Whitlock, Eckenrode, & Silverman, 2006).

Regarding epidemiological data on adolescents in Hungary, a clinical sample was collected in the Pannonia survey, according to which 25.6% of young people reported self-injury (Csorba, 2010). On non-clinical population, data were collected in two international studies: the Saving and Empowering Young Lives in Europe (SEYLE) and the Child and Adolescent Self-Harm in Europe (CASE) study. According to the SEYLE study (Brunner et al., 2014), the lifetime prevalence of self-injury was 19.0% in girls and 14.4% in boys, while in the CASE study it was 10.3% in girls and 3.4% in boys (Madge et al., 2008). However, a significant limitation of both the SEYLE and the CASE study is that only high school students were included as participants, although the ratio of students with socially disadvantaged backgrounds is higher in vocational schools compared to high schools (Ercsei, 2015). According to the findings of our research group, the prevalence of self-injury is significantly higher among vocational school students (29.4%) than among high school students (17.2%) ($\chi^2(1) = 12.231$, $p < .001$) (Horváth, 2014; Horváth et al., 2018).

I.5. The functions of NSSI

According to Klonsky's review (2007), NSSI most commonly functions to regulate emotions, particularly to (temporarily) alleviate overwhelming negative emotions with high arousal and increase positive emotions with low arousal (e.g. relief). Results also provide support for self-punishment, anti-dissociation, interpersonal-influence, anti-suicide, sensation-seeking, and interpersonal boundaries functions. Nock's integrated theoretical model suggests that individuals who engage in NSSI had developed intra- or interpersonal vulnerabilities due to distal risk factors, and these vulnerabilities predispose them to respond to stressful events with affective or social dysregulation, creating a need to use specific behaviours – for example, NSSI – to modulate their experience (Nock, 2009).

I.6. The relationship between NSSI and mental disorders

Glenn and Klonsky (2013) found in a clinical adolescent sample that 50% of the total sample and 78% of the self-injuring sample met the proposed DSM-criteria for NSSI disorder. Nock and colleagues (2006) found that in an adolescent inpatient sample 87.6% of adolescents engaging in NSSI met criteria for a DSM-IV Axis I diagnosis, and 67.3% met criteria for an Axis II personality disorder (Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006). In the high school community sample of the SEYLE study, the strongest predictors of self-injury were suicidality, anxiety and depressive symptoms and illegal drug consumption (Brunner et al., 2014). Based on the epidemiological studies, NSSI in adolescence is not necessarily associated with psychiatric disorders that meet the criteria of the classification systems, however, almost all research has found an association with some mental health problems; of these, those related to negative emotionality, emotion dysregulation, self-directed negative emotions and self-criticism are particularly pronounced.

I.7. The relationship between NSSI and suicidal behaviour

The distinction between NSSI and suicidal behaviour may be complicated by a number of issues: the surface features may mask the underlying suicidal ideation due to the severity of the injury, a self-injuring episode with nonsuicidal intent can lead to a fatal outcome (Csorba, 2011), furthermore, the presence/absence of suicidal intention can often only be inferred from the person's self-report (Horváth, Mészáros, & Balázs, 2015; Nock, 2010). Although several studies highlight the potential anti-suicidal function of NSSI (Klonsky & Muehlenkamp, 2007),

most theories interpret NSSI as a risk factor for suicide. Based on the "gateway theory" NSSI may increase the risk of engaging in more serious self-injurious behaviors (Brausch & Gutierrez, 2010). Based on Joiner's interpersonal model of suicidal behaviour, due to its association with emotional and interpersonal distress, NSSI simultaneously increases the chances of suicidal ideas and increases the capacity to commit suicide (e.g., through habituation to fear and pain) (Joiner, 2005; Klonsky, Victor, & Saffer, 2014). Shared risk factors (e.g., overlapping comorbid psychiatric disorders, negative life events) should also be taken into consideration in the relationship between the two phenomena (Hamza, Stewart, & Willoughby, 2012)

To provide a more detailed overview of the relationship between NSSI and suicidal behaviour, we reviewed the relationships between NSSI and suicidal behaviour within a broader-focused systematic search (Horváth, Mészáros, & Balázs, in press). The process of inclusion/exclusion of articles in the systematic search is shown in the Quorum flow chart (Figure 1).

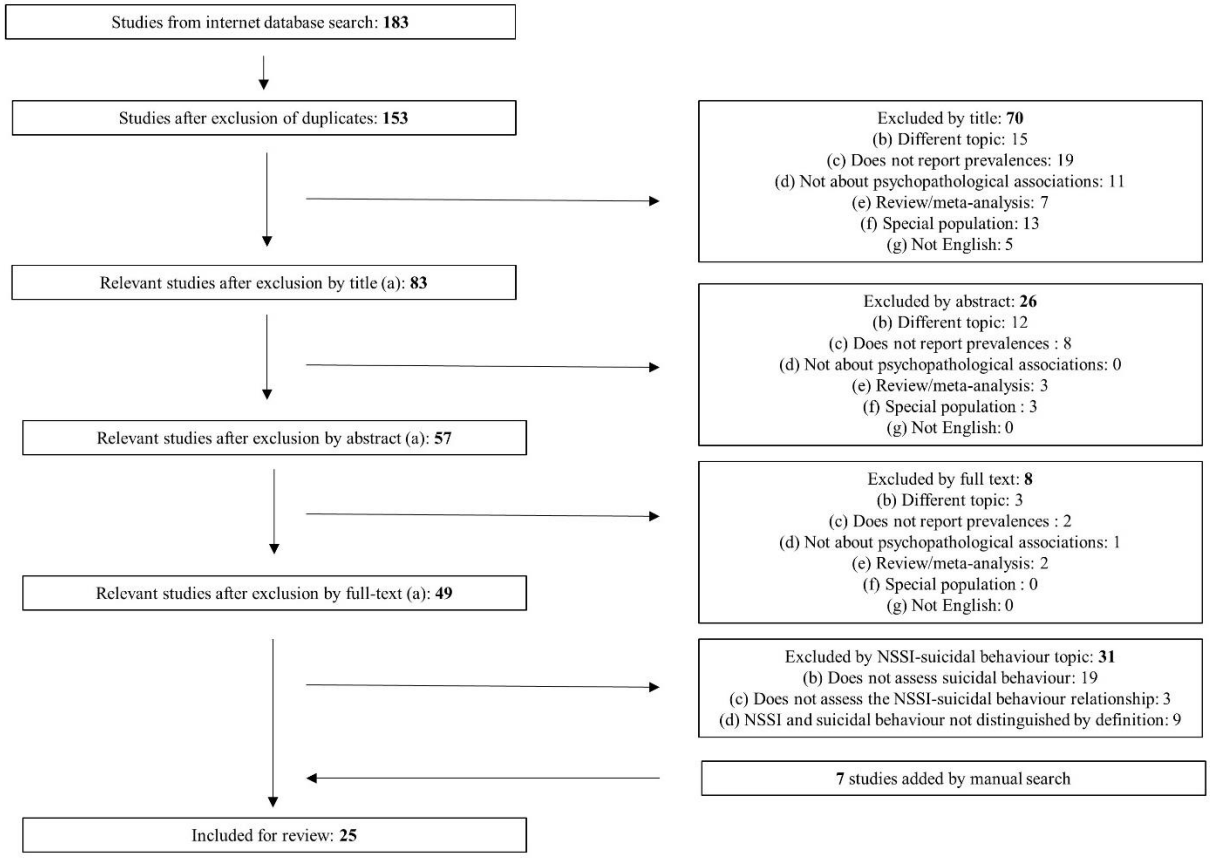

Figure 1. Flowchart of inclusion/exclusion of articles in the systematic search (Horváth et al., in press)

Among the 25 articles, altogether 15 assessed child/adolescent (Ammerman et al., 2016; Brausch, Decker, & Hadley, 2011; Brausch & Gutierrez, 2010; Csorba, Dinya, Plener, Nagy, & Páli, 2009; Esposito-Smythers et al., 2010; Horváth et al., 2018, 2020; Isohookana, Riala, Hakko, & Räsänen, 2013; Jacobson, Muehlenkamp, Miller, & Turner, 2008; Muehlenkamp, Ertelt, Miller, & Claes, 2011; Muehlenkamp & Gutierrez, 2007; Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006; Tuisku et al., 2014; Victor et al., 2015; Zetterqvist, Lundh, Dahlström, & Svedin, 2013), and further 9 adult – among these, 5 young adult (college/university students) (Kiekens et al., 2018; Paul, Tsypes, Eidlitz, Ernhout, & Whitlock, 2015; Stewart et al., 2017; Taliaferro & Muehlenkamp, 2015; Wilcox et al., 2012), and 4 older adult – populations (Baus et al., 2014; Brausch & Muehlenkamp, 2018; Chartrand, Sareen, Toews, & Bolton, 2012; Evren, Kural, & Cakmak, 2006), and one study assessed adolescent, young adult and adult populations as well (Klonsky, May, & Glenn, 2013).

According to the results reviewed, 50-70% of those who report self-injury also report suicidal thoughts or attempts. The relationship between the two phenomena is described in both clinical and non-clinical adolescent, young adult, and adult populations. Those who did not report suicidal intent differed from those who also reported suicidal intent in some intra- and interpersonal traits (e.g., fewer depressive and borderline personality disorder symptoms, fewer negative life events, more social support) and in some features of self-injury (e.g., frequency, methods, age at the time of the onset). The obtained results are influenced by the terminological-definitional and methodological heterogeneity of the reviewed studies, which makes the distinction of the two phenomena and the comparability of the results difficult (Horváth et al., 2015; Meszaros, Horvath, & Balazs, 2017).

I.8. The relationship between life events, NSSI, and suicidal behaviour

Broad theoretical and empirical evidence has previously suggested possible pathways between life events and both suicidal behaviour (Adams, Overholser, & Spirito, 1994; Lewinsohn, Rohde, & Seeley, 1994) and NSSI (Kaess et al., 2020; Madge et al., 2011; Portzky, De Wilde, & van Heeringen, 2008) separately. In line with the stress-diathesis models of suicidal behavior, the relationship between stressful life events, and particularly interpersonal stress and suicidal behavior, has been described in several studies (e.g. Stein et al., 2010). Regarding NSSI, as distal risk factors, life events can increase vulnerability to stressors through pathways such as dysregulation of the immune and stress-response systems (Lê-Scherban, Brenner, & Schoeni, 2016; Pascoe et al., 2016). Results support both the number of life events, particularly

interpersonal events predicting the first onset of NSSI (Kaess et al., 2020), and the frequency of NSSI predicting the occurrence of interpersonal life events (Burke, Hamilton, Abramson, & Alloy, 2015), suggesting that this relationship may not be unidirectional.

The role of life events in the relationship between NSSI and suicidal behaviour can be understood through Joiner's interpersonal theory of suicide (Joiner, 2005). According to Joiner's model, four main factors can be identified behind suicidal behaviour: 1. thwarted belongingness (feeling alienated/alone), 2. perceived burdensomeness, 3. desire for suicide, which can appear in the intersection of the first two factors, and 4. capacity for suicide, which can be increased through habituation to fear and pain. Lethal or near-lethal suicidal behaviour will occur when these constructs co-occur (Orden et al., 2010). (Interpersonal) life events can represent the two interpersonal constructs that contribute to the desire for suicide, which, in the case of those who engage in NSSI, can meet the increased capacity for suicide, contributing to a shift towards more lethal methods on the spectrum of suicidal behaviour.

In the small number of studies available on the role of life events in the relationship between NSSI and suicidal behaviour, the number of stressful life events was found to differentiate between adolescents engaging in suicidal and nonsuicidal self-injury by most (Baetens, Claes, Muehlenkamp, Grietens, & Onghena, 2011; Horesh, Nachshoni, Wolmer, & Toren, 2009; Liu et al., 2014), but not all authors (Tuisku et al., 2014). Zetterqvist, Lundh, and Svedin, (2013) found that individuals who engaged in both NSSI and attempted suicide differed from those engaging only in NSSI in terms of traumatic life events, that is, adolescents with both NSSI and suicide attempts reported higher rates of interpersonal events when discriminating between interpersonal, non-interpersonal and more longstanding adverse childhood circumstances.

I.9. NSSI and suicidal behaviour – how can we help? Prevention and intervention for adolescents

In summary, NSSI can be described as a phenomenon that is highly prevalent among adolescents, its appearance may indicate significant intra- and interpersonal difficulties, and in its more severe forms may be associated with a number of psychiatric disorders and suicidal behavior. Based on all this, prevention and intervention programs related to NSSI and associated difficulties may be of particular importance for maintaining the mental health of adolescents.

As most adolescents are required to spend a lot of time in the school, it can be an important scene for prevention programs (Balázs, 2019; Gould et al., 2009; Scott et al., 2009). School prevention programs can be classified according to three strategies: 1. gatekeeper training that provides adults in the adolescents' environment with knowledge about how to identify youth with suicidal risk, and once identified, how to take responsible actions (Balázs, 2019; Balázs & Kapornai, 2011); 2. screening by psychologists/psychiatrists with referral of at-risk pupils (Balázs, 2019; Gould et al., 2009); 3. programs addressing adolescents directly, aiming to enhance awareness regarding mental disorders and suicide by educating students to recognize possible signs of suicidal behaviour in themselves and others, and providing them with information about the school and community resources available for help (Balázs, 2019; Cusimano & Sameem, 2011). These programs usually consist of sessions on 3 to 5 school days (Cusimano & Sameem, 2011), and are most effective when integrated into the curriculum (Portzky & van Heeringen, 2006). According to the SEYLE study, when comparing the three types of intervention arms, at 12-month follow-up only the Youth Aware of Mental Health Programme (YAM) proved to be effective in decreasing suicidal behaviour significantly compared to the minimal intervention control group (Wasserman et al., 2015). At present, to the best of our knowledge, there is no evidence-based program with such focus in Hungary that is freely available to schools.

II. AIMS AND HYPOTHESES

Based on the literature reviewed in the Introduction chapter, the aims of the studies presented as part of my Ph.D. work were to explore the associations between NSSI, suicidal behaviour and life events in clinical and non-clinical groups of adolescents, the latter involving both high school and vocational school students; furthermore, to start the development of a mental health promotion program that targets a wide range of adolescents. Accordingly, the objectives and related hypotheses of the studies presented in my dissertation were as follows:

1. In the first study (S1), by extending the SEYLE study, our primary aim of was to assess self-injury among vocational school students and compare them with the Hungarian high school sample of the SEYLE study, as part of my doctoral work primarily focusing on the relationship between D-SIB and life events. *As our hypothesis, we assumed that*

> *S1–H1. The prevalence of life events six months prior to assessment is higher in the vocational school group than in the high school group.*

The further aim of our study was to explore the relationship between D-SIB and life events by studying the relationship between the number of life events, individual life events, and life event categories; and to explore possible differences in the associations between life events and D-SIB in the two groups.

2. Taking the results of the first study (S1) into consideration, in the second study (S2) our aim was to assess the associations between NSSI, life events and suicidal behaviour in a clinical and a nonclinical group of adolescents, the latter consisting of both vocational school and high school students.

In accordance with the aims of the study, the hypotheses of my doctoral thesis were as follows:

S2-H1. The number of lifetime NSSI methods is more strongly associated with suicidal behaviour in the clinical group compared to the nonclinical group.

S2-H2. A higher quantity of life events is associated with an increased number of lifetime NSSI methods in both groups.

S2-H3. Interpersonal events have a stronger moderating effect on the relationship between the number of lifetime NSSI methods and suicidal behaviour compared to non-interpersonal events and adverse childhood circumstances.

Furthermore, our aim was to explore if the patterns described in Hypothesis 3 (S2-H3) differ between the clinical and non-clinical groups.

3. In the third study (S3), our aim was to develop a health promotion program for adolescents with a special focus on promoting mental health and preventing risk behaviours, including NSSI. We aimed to develop a program that is sensitive to the diversity of the students' personal and sociocultural situation, as well as being freely accessible and easy to integrate into school life. During my doctoral work, our goal was to work out the structure of the program, the lesson plans of three sessions, and to carry out a pilot study to test the feasibility of the program.

In all three studies, our further aim was to screen adolescents with acute suicidal risk and to offer immediate help for those in need by referring them to specialized care services. Moreover,

also in the first two studies, we provided an interactive prevention program in the participating schools with a mental health promotion and suicide prevention focus.

III. METHODS[3]

III.1. First Study

III.1.1. Participants and procedure

A community sample of adolescents was assessed, with a special focus on vocational school students. As an extension of the SEYLE international project, we have completed the Hungarian sample of the SEYLE study consisting of high school students attending class 9-10 with a sample of students attending classes 9-10 in randomly selected vocational schools in Budapest, Hungary. Schools from both school types were randomly selected. For the high school sample, data collection took place from September 2009 to February 2010; data for the vocational school group were collected in October and November 2013. The protocol for the SEYLE Randomized Control Trial (RCT) (Carli et al., 2013; Wasserman et al., 2010) was registered at the German Clinical Trials Register (DRKS00000214). Approval for this study was obtained from the National Scientific and Ethical Committee of Ethics Committees of the Medical Research Council of Hungary (ETT-TUKEB) (protocol number: 24798/2013/EKU). Participation was voluntary, all participants and caregivers gave informed written consent prior to data collection. For emergency cases (participants with acute suicide risk) we followed the methodology of the SEYLE project: students who were categorized as high risk for suicidal behavior according to cut-off criteria of the SEYLE project (Wasserman et al., 2010) were referred to specialized care services (Horváth et al., 2018).

III.1.2. Measurements

The questionnaire was based on the SEYLE study's questionnaire package, which consisted of well-known questionnaires and a series of questions developed for the research (Wasserman et al., 2010).

[3] The Methods chapter of my dissertation is based on our previous work on the topic, in which I have done significant work (Horváth, 2014; Horváth et al., 2018, 2020)

III.1.2.1. Measurement of D-SIB

The lifetime prevalence of D-SIB was measured with the modified 6-item version of the Deliberate Self Harm Inventory (DSHI), which is a shortened version of the 17-item DSHI by Gratz (Gratz, 2001). The questionnaire measures the lifetime prevalence of the most common self-injury methods and emphasizes the intentionality of the behaviours. Since the nonsuicidal intent is not emphasized in the instruction of the questionnaire, the adequate term for the phenomenon measured with this instrument is D-SIB, defined as intentional self-inflicted damage to one's body surface, regardless of suicidal intent (Brunner et al., 2014; Kaess et al., 2020).

III.1.2.2. Measurement of life events

The Life events list was developed for the SEYLE study (Kaess et al., 2020; Wasserman et al., 2010), based on former life events literature, mainly the Social Readjustment Rating Scale (SRRS) (Holmes & Rahe, 1967); the Life Events Checklist (LEC) (Johnson & McCutcheon, 1980). The list consists of 27 minor and major life events, from which participants indicate the ones they had experienced during the six months prior to assessment.

III.1.3. Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics 20.0 (IBM Corporation, 2013). During the selection of statistical tests, it was considered that D-SIB values did not exhibit normal distribution (Vargha, 2003). Descriptive statistics are reported in the text. Chi-square tests for categorical variables were applied when examining group differences between the vocational school and high school groups. Bonferroni correction was applied to control for multiple comparisons.

For D-SIB prevalence, a dichotomized variable was created based on the first five items of the D-SIB questionnaire to determine D-SIB occurrence/absence. Binary logistic regression was used to estimate the probability of D-SIB based on life events both in vocational school and in high school groups. The dependent variable was D-SIB occurrence. For this statistical testing, as a second step, the 27 life events were categorized in 9 major categories, based on previous literature (Madge et al., 2011): problems with or in the family; the death of someone; trouble with police or law; trouble with bullies; problems with schoolwork; personal health problems; difficulties with romantic/sexual relationships; difficulties with friends, and pregnancy.

III.2. Second study

III.2.1. Participants and procedure

Associations between NSSI, suicidal behaviour and life events were assessed in a clinical and non-clinical group of adolescents. Participants between the ages of 13 and 18 were recruited from both clinical and non-clinical settings. The clinical group was recruited from the acute adolescent inpatient department of Vadaskert Child and Adolescent Psychiatric Hospital and Outpatient Clinic, Budapest, Hungary between 25.02.2015 and 09.05.2016. Participants for the non-clinical group were recruited from classes 8-11 of state-funded high schools, vocational schools, and secondary vocational schools in different districts of Budapest, Hungary between 12.09.2015 and 28.04.2017. In both groups, exclusion criteria were conditions preventing the completion of self-administered questionnaires and answering the questions of the diagnostic interview (e.g. lack of sufficient Hungarian language skills, acute psychotic episodes, or mental retardation).

The study was approved by the ETT-TUKEB (protocol number: 5750/2015/EKU). Participation was voluntary, all participants and caregivers gave informed written consent prior to data collection. A code-decode system was used to identify participants at acute suicidal risk based on a structured diagnostic interview (see below); these participants were referred to the specialized health care system.

III.2.2. Measurement

III.2.2.1. Measurement of NSSI

NSSI was examined in this study with the original 17-item version of the DSHI (Gratz, 2001) the instruction of this version of the instrument emphasizes the lack of suicidal intent. The DSHI is a behaviourally based, self-administered questionnaire that assesses 16 different methods of NSSI. The questionnaire was also completed with questions about the proposed diagnostic criteria in the NSSI DSM-5.

III.2.2.2. Measurement of suicidal behaviour

Suicidal behaviour was assessed with the Hungarian version of the Mini International Neuropsychiatric Interview Kid (MINI Kid) 2.0 (Balázs, Bíró, Dálnoki, Lefkovics, Tamás, & Gádoros, 2004; Lecrubier et al., 1997; Sheehan et al., 1998; Sheehan et al., 2010)., a structured diagnostic interview designed for the assessment of the major child/adolescent psychiatric

disorders according to the DSM-IV (at the time of data collection, the new DSM-5 based version of the instrument was not yet available in Hungarian). With the suicide module of the interview, both lifetime and current suicidal behaviour can be measured. A weighted score belongs to each of the questions of the module, and the total score of the questions answered with a "yes" indicates the level of suicidal risk. Scores from 1–5 indicate low suicidal risk, scores from 6–8 indicate moderate risk, and scores of 10+ indicate a high suicidal risk. After contacting their caregivers, students at acute suicidal risk were referred to the specialized health care system.

III.2.2.1.Measurement of life events

Life events were assessed with The Life events list developed for the SEYLE study in the second study as well.

III.2.3. Statistical analyses

Data were analysed using R version 3.6.1. (51). The suicidal behaviour variable was calculated based on the number of symptoms reported in the MINI Kid, weighted with scores of suicide risk severity. The number of NSSI methods was calculated as the sum of NSSI methods reported in the DSHI (49). Life events were calculated as a sum of 27 life events. Group was a dichotomous variable (0 = non-clinical, 1 = clinical). Descriptive statistics are reported.

Before estimating the models, the factor structure of the suicidal behaviour and NSSI scales were confirmed by factor analysis using the *lavaan* package (Lavaan, 2012). Since the items in both scales had only two levels, a diagonally weighted least squares (DWLS) estimator was used in the models (Rhemtulla, Brosseau-Liard, & Savalei, 2012). To guarantee an acceptable level of model fit, five out of the seven fit measures listed below had to be in the acceptable range. Afterwards, normality of the number of life events, the suicidal behaviour weighted sum, and the sum of self-harm variables were assessed by separate Shapiro–Wilk tests. Due to normality violations, Wilcoxon tests were used to test differences in suicide, NSSI, and life event measures between the clinical and non-clinical groups.

Spearman's rank correlations between suicide and NSSI with a 95% confidence interval were used to compare the magnitude of the relationship in non-clinical and clinical groups. To estimate whether life events have a stronger effect on the NSSI–suicidal behaviour relationship in the non-clinical than in the clinical group, we estimated generalized linear models (GLM). We estimated Poisson regressions, and, in case of overdispersion, we used negative binomial

models. Since the large number of zeros observable in the distribution of the dependent variable is due to "structural zeros" (Price, Muncy, Bonner, Drayer, & Barton, 2016), this structural zero component (the fact that non-suicidality is not the same as an extremely low level of suicidal behaviour) requires estimating zero-inflation parameters: otherwise, the model could yield in biased parameter estimates (Harrison, 2015).

First, we estimated a model with the weighted sum of suicidal behaviour as the dependent variable, group membership, number of life events, and number of NSSI methods, and all two- and three-way interactions between them as independent variables. Regarding life events, beyond the sum of the life events, we created additional explanatory variables to explore the effect of type of stressful life events. Based on the work of Nilsson and colleagues (Nilsson, Gustafsson, Larsson, & Svedin, 2010) and Zetterqvist and colleagues (Zetterqvist, Lundh, Dahlström, et al., 2013) the general classification principles of the literature on life events (Gershon et al., 2011; Rudolph & Hammen, 1999; Sheets & Craighead, 2014), we sorted life events into three groups: interpersonal, non-interpersonal and adverse childhood circumstances.

IV. RESULTS[4]

IV.1. First study

IV.1.1. Sample

The vocational school sample consisted of 140 students. Forty percent were female, aged between 14 and 17, and the mean age was 15.21 ± .77 years. In the high school group, 1009 students participated; 58.9% were female, aged 13–18 years and the mean age was 15.01 ± .8 years. For a matched sample, we have left out cases under and above the age range 14–17 from the high school sample (14 cases). This resulted in a sample of 995 participants in the high school group, with a mean age of 15.09 ± .75 years, 59.2% were female. Weighting for age and gender) were applied in this sample to match it with the vocational school sample; after the weighting procedure, none of the variables differed between the two groups (t = .000; df = 1132; p = 1.0 for age; t = .07; df = 1133; p = .95 for gender).

[4] The Results chapter of my dissertation is based on our previous work on the topic, in which I have done significant work (Balázs, Horváth, Mészáros, & Péczely, 2020; Horváth et al., 2018, 2020).

IV.1.2. Life Events in Vocational and High School Students

The following life events differed significantly in frequency of occurrence in the vocational school and high school groups: increased workload at school; appearing for an exam, interview; new family member; divorce between parents; the death of a close friend and change of school. Increased workload at school and appearing for an exam or interview were more frequent in the high school group. New family member; divorce between parents; death of a close friend and change of school were more frequent in the vocational school group.

Frequencies of occurrence of life events that showed significant differences in the two groups and results of the Chi-tests are presented in Table 1.

Table 2. Frequencies of life events with significant differences between high school and vocational school students

Life event in Past 6 Months	**Occurrence in High School (N=767) (%)**	**Occurrence in Vocational School (N = 128) (%)**	χ^2	***df***	**Sig.**	ϕ
New family member	4.7	**11.7**	12.672	1	>.001	.120
Change of school	.4	**7.9**	46.573	1	>.001	.230
Divorce between parents	1.3	**7.0**	16.767	1	>.001	.138
Death of a close friend	.9	**4.7**	14.288	1	>.001	.128
Increased workload in school	**54.8**	33.9	15.368	1	>.001	−.132
Appearing for an exam, interview	**36.6**	6.2	46.745	1	>.001	−.231

* Bonferroni correction $p < .05/27 = 0.003$. $\chi 2$ = Chi square test value; df = degrees of freedom; Sig = significance; ϕ = Phi coefficient.

In the high school group (N = 995) when testing for associations between D-SIB and individual life events, D-SIB was significantly associated with trouble with parents and breakup with boyfriend/girlfriend (Cox and Snell $R^2 = .054$; Nagelkerke $R^2 = .087$; Omnibus test of model

coefficients: χ^2 = 41.413, df = 26, p = .028; Hosmer and Lemeshow test: $\chi 2$ = 8.443, df = 8, p = .391). Among life events categories problems with or in the family; trouble with police or law and difficulties with romantic/sexual relationships were associated with D-SIB (Cox and Snell R^2 = .058; Nagelkerke R^2 = 0.094; Omnibus test of model coefficients: χ^2 = 45.575, df = 1; p < .001; Hosmer and Lemeshow test: χ^2 = 4.053, df = 7, p = .774).

In the vocational school group (N = 140), no significant associations were found between either of the individual life events and D-SIB (Cox and Snell R^2 = .155; Nagelkerke R^2 = .226; Omnibus test of model coefficients: χ^2 = 19.339; df = 26, p < .822; Hosmer and Lemeshow test: χ^2 = 4.782, df = 7, p = .687) nor the life event categories and D-SIB (Cox and Snell R^2 = .152; Nagelkerke R^2 = 0.226; Omnibus test of model coefficients: χ^2 = 12.028; df = 10, p < .238; Hosmer and Lemeshow test: χ^2 = 7.624, df = 8, p = .471)

IV.2. Second study

IV.2.1. Sample

Altogether 363 adolescents were involved in the study, 202 of whom (103 girls; 51%) belong to the clinical sample and 161 (80 girls; 50%) of whom belong to the non-clinical sample. For the whole study population, mean age was 15.12 years (SD = 1.31); in the non-clinical population, the mean age was 15.43 years (SD = 1.14); and in the clinical sample, the mean age was 14.87 years (SD = 1.39) (t(360) = 4.1, p < .001). From the clinical group, 107 adolescents (53.0%) reported NSSI, while 38 (23.6%) had NSSI from the non-clinical group. Data were missing for 21 participants (for most of the NSSI and stressful life events items), so they were dropped from the database. The final sample consisted of 201 clinical and 141 non-clinical participants; in the clinical group 107 participants (53.2%), and in the non-clinical group 35 participants (24.8%) reported NSSI.

IV.2.2. Descriptive Statistics and Reliabilities of Study Variables

Results of the confirmatory factor analysis showed an excellent fit for both suicidal behaviour and NSSI inventories. Normality was explored by the Shapiro–Wilk test. Results show that the distribution of suicidal behaviour (W =.64, p < .001), NSSI (W =.66, p < .001), as well as life events (W =.91, p < .001) violates the normality assumption. Consequently, differences between clinical and non-clinical groups in suicidal behaviour, NSSI, and life events were

tested with Wilcoxon tests. Table 1 shows the descriptive statistics related to suicidal behaviour, NSSI, and life events.

Table 1. Descriptive statistics of non-clinical and clinical groups (Horváth et al., 2020)

		Nonclinical group	**Clinical group**
Suicidal behaviour - prevalence	Lifetime	24.8% (n=35)	63.7% (n=128)
	Current	12.8% (n=18)	47.3% (n=95)
	High suicidal risk	5.67% (n=8)	32.8% (n=66)
Suicidal behaviour – M (SD)		1.45 (4.18)	9.41 (12.03)
Suicidal behaviour – Mdn		0	3
NSSI – M (SD)		.57 (1.32)	1.84 (2.55)
NSSI – Mdn		0	1
Life events – M (SD)		3.61 (2.49)	5.12 (3.43)
Life events – Mdn		3	5

M=median, Mdn=mean, SD=standard deviation

IV.2.3. The role of life events in the relationship between NSSI and suicidal behaviour

The prevalence of suicidal behaviour ($W = 7.306$, $p < .001$), NSSI ($W = 9.652$, $p < .001$) and life events ($W = 10.410$ $p < .001$) was significantly higher in the clinical group than in the non-clinical group of adolescents. Assessed as a dichotomous variable, the prevalence of NSSI was significantly higher in the clinical group compared to the non-clinical group ($\chi2(1)=26$, $p <.001$). Based on our supplementary questions, in the clinical group 39 participants (19.4%) and in the non-clinical group 5 participants (3.5%) met the proposed DSM-criteria for NSSI disorder, indicating a significant difference between the two groups in this aspect as well $\chi2(1)=20$, $p<.001$).

As for the prevalence rate of suicidal behaviour (dichotomous variable), the presence of any suicidal behaviour was a significantly higher in the members of the clinical group (n = 133, 66.2%) than in the non-clinical group (n = 36, 25.5%) ($\chi^2(1) = 53$, $p < .001$). More specifically, significantly higher rate of clinical group (n = 95, 47.3%) engaged in recent suicidal behaviour than the non-clinical group (n = 18, 12.8%) ($\chi^2(1) = 43$, $p < .001$). Additionally, a significantly

higher rate of the of members of the clinical group (n = 128, 63.7%) displayed lifetime suicidal behaviour compared to the non-clinical group (n = 35, 24.8%) ($\chi^2(1) = 49$ $p < .001$). Moderate suicide risk was found to be significantly higher in the clinical group (n = 26, 12.9%) than in the non-clinical group (n = 3, 2.13%) ($\chi^2(1) = 11$ $p < .001$). Finally, a significantly higher rate of the members of the clinical group (n = 66, 32.8%) were at high suicidal risk compared to the non-clinical group (n = 8, 5.67%) ($\chi^2(1) = 34$ $p < .001$) (Table 1).

Spearman's rank correlations with 95% confidence intervals indicate that there is a significant correlation between suicidal behaviour and the number of NSSI methods in both groups. This correlation was significantly stronger in the clinical group (95% CI: [.56,.72]) than in the non-clinical group (95% CI: [.24,.52]). It provides evidence for Hypothesis 1, namely, that NSSI is more strongly associated with suicidal behaviour in the clinical group compared to the non-clinical group.

As for the relationship between the number of life events and NSSI methods, the Spearman correlation shows a medium effect size of .38, 95%CI [.28,.46] in the whole sample, .36, CI 95% [.23,.47] in the clinical group, and.31, CI 95% [.16,.46] in the nonclinical group. As for the relationship between the number of life events and suicidal behaviour, there were no significant differences between the two groups: the correlation was 0.3, 95% CI 95% [.17, .42] in the clinical group and .18 CI 95% [.01, .33] in the non-clinical group,

After group comparisons, we estimated four regression models. In the following, I will highlight the significant effects in the text. We estimated a Poisson GLM with zero-inflation; however, the simulated scaled residuals showed significant overdispersion (ratio of observed vs. simulated residuals: 1.5, $p < .001$), as well as a significant deviation from the assumed distribution (Kolmogorov–Smirnov test D =.17, $p < .001$). Hence, we re-estimated the model with a negative binomial distribution (and zero-inflation), and the diagnostics showed no problems (Kolmogorov–Smirnov test D =.88, p =.34; ratio of observed vs. simulated residuals for dispersion:.88, p =.34; ratio of observed vs. simulated residuals for zero-inflation:.99, p =.93).

In the negative binomial model (Table 2), the main effect of the number of NSSI methods ($\chi^2(1) = 109.65$, $p < .001$) along with group membership ($\chi^2(1) = 39.13$, $p < .001$) significantly predicted lifetime suicidal behaviour; however, the main effect of the number of life events did not explain the dependent variable. The interaction between the number of NSSI methods and the number of negative life events ($\chi^2(1) = 10.49$, $p < .01$) was significantly associated with suicidal behaviour. This indicates that a higher number of interpersonal life events is associated

with a stronger association between NSSI and suicidal behaviour, over and beyond the main effects of NSSI. However, in this model, it did not differ by groups. Furthermore, neither the effect of life events nor that of the interaction between life events and NSSI differed across groups. This latter finding means that according to this model, compared to the clinical group, stressful life events do not have a stronger effect on the NSSI–suicidality relationship in the non-clinical group.

The distribution of participants with simultaneous consideration of NSSI, life events, suicidal behaviour, and group is shown in Figure 2 for the whole sample, and among participants with a value greater than zero on the NSSI and/or suicidal behaviour scales is shown in Figure 3.

Table 2. Negative binominal regression model: effects of the number of life events, group and NSSI on suicidal behaviour (Horváth et al., 2020)

	IRR	**χ^2**	**df**	**Sig.**
NSSI	1.52	109.65	1	<.001***
life events	1.12	1.46	1	.23
group	3.75	39.13	1	<.001***
NSSI:life events	.98	10.49	1	.001**
NSSI:group	.91	.88	1	.35
life events:group	1.00	0	1	.98
NSSI:life events:group	1.00	.02	1	.89

le = life event, IRR = incident rate ratio, χ^2: value of the Chi-square test, df: degrees of freedom, Sig: significance; **p<.005; *** <.001

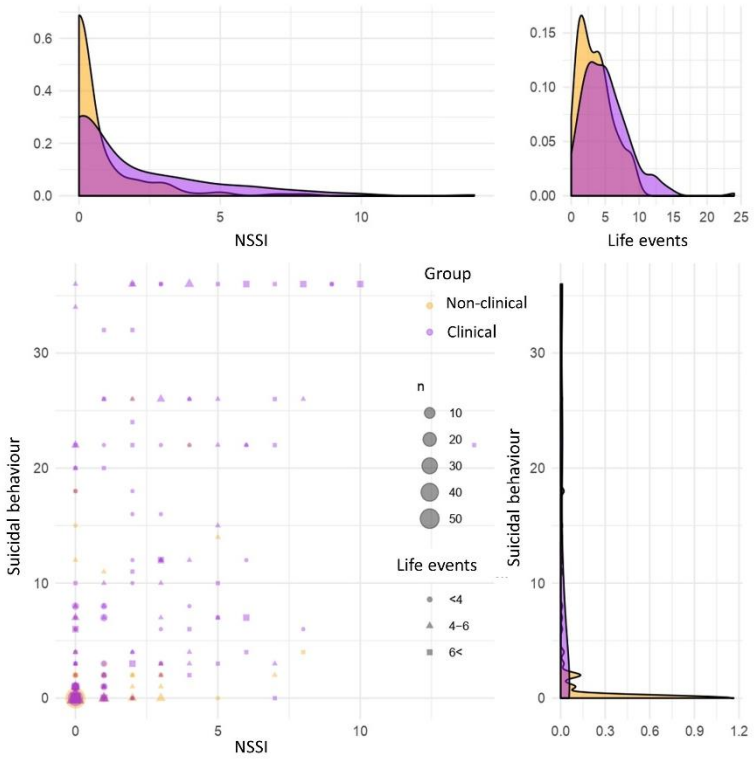

Figure 2. Distribution of participants with simultaneous consideration of the number of NSSI methods and life events, lifetime suicidal behaviour and group

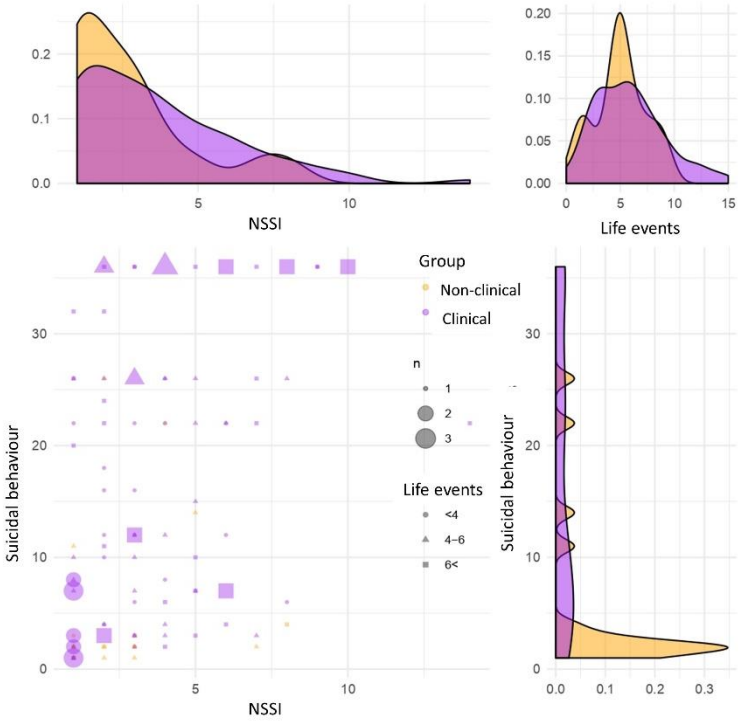

Figure 3. Distribution of participants with a value greater than zero on the NSSI and suicidal behaviour scales, with simultaneous consideration of the number of NSSI methods and life events, lifetime suicidal behaviour and group

Next, we grouped life events into three categories based on the aforementioned literature and investigated their relationship with suicidal behaviour. For interpersonal life events, the diagnostics were acceptable (Kolmogorov–Smirnov test D =.03, p =.9; ratio of observed vs. simulated residuals for dispersion:.88, p =.3; ratio of observed vs. simulated residuals for zero-inflation: 1, p =.8). Interpersonal life events had a significant influence on suicidality ($\chi^2(1)$ = 5.77, p =.016) just as group ($\chi^2(1)$ = 39.38, p < .05) and NSSI ($\chi^2(1)$ = 91.26, p < .001). Interpersonal life events proved to be a significant moderator of NSSI ($\chi^2(1)$ = 19.04, p < .001), indicating that a higher number of interpersonal life events is associated with a stronger association between NSSI and suicidal behaviour, over and beyond the main effects of NSSI and interpersonal events (Table 2).

Table 2. Negative binomial regression model: effects of the number of life events, group and NSSI on suicidal behaviour (Horváth et al., 2020)

	IRR	**Chisq**	**df**	**Sig.**
NSSI	1.46	91.26	1	< .001***
IPE	1.49	5.77	1	.02*
group	3.49	39.38	1	< .001***
NSSI:IPE	.94	19.04	1	< .001***
NSSI:group	.96	.38	1	.54
IPE:group	1.02	.01	1	.94
NSSI:IPE:group	.99	0	1	.97

IPE: interpersonal life events, IRR = incident rate ratio, χ2: value of the Chi-square test, df: degrees of freedom, Sig: significance; * <.05; *** <,001

As for non-interpersonal life events, a negative binomial model with zero-inflation showed good fit (Kolmogorov–Smirnov test D =.033, p =.8; ratio of observed vs. simulated residuals for dispersion:.9, p =.4; ratio of observed vs. simulated residuals for zero-inflation: 1, p =.4). Among the predictors, group ($\chi^2(1)$ = 40.61, p < .001) and NSSI ($\chi^2(1)$ = 137.43, p < .001) were significant. The main effect of life events did not reach significance ($\chi^2(1)$ =.05, p =.83), and neither did its interaction with group ($\chi^2(1)$ =.69, p =.41), nor the three-way interaction ($\chi^2(1)$

=.01, p =.93). Finally, a negative binomial model with zero-inflation for adverse childhood circumstances exhibited a good fit (Kolmogorov–Smirnov test D =.04, p =.7; ratio of observed vs. simulated residuals for dispersion:.9, p =.4; ratio of observed vs. simulated residuals for zero-inflation: 1, p =.4). Neither the main effect of adverse childhood circumstances ($\chi^2(1)$ =.34, p =.06) nor the interaction with NSSI ($\chi^2(1)$ = 1.21, p =.27) reached significance.

IV.3. Introducing our prevention program

With the aim to develop an adolescent mental health promotion program, our multidisciplinary team was formed within our research group in the spring of 2019 with the involvement of external experts. The members of our team are Judit Balázs, child and adolescent psychiatrist and adult psychiatrist, Piroska Mészáros, actress, Dóra Péczely, book editor, and me as a psychologist. Our prevention program designed for 14-16-year-old adolescents has been named the School of Life (Balázs, Horváth, Mészáros, & Péczely, 2020)

IV.3.1. Introducing the „School of Life" program

The "School of Life" program is led by the school psychologist and another adult with a helping profession (such as a school social worker or school nurse) in the school. Each occasion consists of two 45-minute lessons. During these sessions, through interactive roleplay and subsequent discussion, participants can process different topics that contribute to a deeper understanding of problematic life situations, risk behaviour, or mental illness.

The interdependent occasions developed so far focus on depression, bullying, and self-harm, but the social context in which the stories take place also offers an opportunity to discuss other critical issues, such as equality-based friendships and romantic relationships, sexuality, or school and family conflicts. Each time, four volunteer students take the roles of students in a fictional school, and in the form of roleplay, they deliver a story that is related to one of the above-mentioned topics. Those who impersonate the fictional characters, like in real life, only learn about the story in their own narrative based on the diary entries of the character they form. After reading their own diary entries, a joint situational game starts, during which the characters interact with each other and with other members of the class. To understand the story in its complexity, it is necessary to consider each other's points of view, feelings, goals, and to take into consideration what the rest of the class sees as an "external eye".

Of the two facilitators leading the session, the school psychologist assists the students from within the scenes, playing the role of the psychologist in the fictitious school, while the other is present as an external facilitator. According to the scenario, at some point of the play one of the characters need the help of a trustworthy adult and turns to the school psychologist, who helps to summarize and articulate the feelings, questions and possible conflicts that arise in and between the characters. After the roleplay, the characters step out of their role, and a joint discussion begins with the involvement of the whole class, during which the psychologist leading the session helps the students to elaborate on the different perspectives related to the situation in an integrative way. All this leads to comprehensive psychoeducation-based discussion on the topic of the given session, including the transfer of practical information and sensitization.

IV.3.1.1. Introducing the session about NSSI

In the following, I would like to present the structure of the sessions of our prevention program by describing the session related to the topic of self-injury.

As an introduction about the characters and their relationship in the story, the facilitators shared the following with the class: “Vali, Eszti, Gergő, and Peti are classmates. Vali is an introverted girl, constantly wearing long pants and a sweater. She usually doesn’t talk to anyone but Gergő, who is trying to get as close to the girl as possible. Gergő, Peti, and Eszti are friends, but since Gergő and Vali are getting closer, Gergő spends less time with his friends. Peti and Eszti try to stand by him, even if they don't fully understand what exactly is going on between Gergő and Vali.”

After the school psychologist leaves the classroom with the four students who volunteer for roleplay, the instructor initiates a conversation with the rest of the class about their ideas based on the prior information about the characters and asks them to think about what goals and feelings might each character experience during the play. In the meantime, those impersonating the characters get to know their own diary entries and some questions to which their character is looking for answers during the game.

The diary pieces introduce the characters' life situation from four different perspectives: the emerging relationship between Gergő and Vali after Gergő accidentally witnessed Vali's self-injurious behaviour and Peti’s and Eszti's reactions to the balance of their trio being disrupted due to this new relationship they are struggling to understand.

The script provides some key events for each scene as a frame, but within this, the students are free to shape the events and dialogues. Based on the fixed points in the script, at one point Eszti, learning about the background of the events, starts to think about how she could support Vali. For this she feels that she needs the help of an adult, so she visits the school psychologist. The school psychologist involves the class in this conversation. Together they discuss the feelings and needs of the characters and then agree on a possible ending of the story. After the students step out of their characters, an educational discussion takes place – using the story played as an illustration, but now speaking about the issues related to the topic of the session in more general. The aim of the session is to drive the conversation towards practical, specific information about the possibilities of getting help (e.g. making a list of trusted adults who can be called for help, sharing the number of helplines).

IV.3.2. Procedure during the pilot study

In the pilot study, we first tested the program with smaller groups of adolescent volunteers: we modelled the session with small groups (4-6 people) of youth who knew each other well; then we made further improvements based on their feedback. Subsequently, we aimed to gain experience about the feasibility of the program across a wide range of schools, thus the institutions involved include a school that provides continuing education for young people who had dropped out of formal education, a school for students with special educational needs, and an independent school with tuition fee. The adaptation of the program to groups of pupils with special educational needs took place in cooperation with psychologists Fruzsina Balázs and Dávid Ipacs. Based on our pilot study with these youth, we made further improvements in the program. The pilot study was started with the ethical permission of ETT-TUKEB (protocol number: 42020-4/2019/EKU), the adolescents participated in the program during their school time, but on a voluntary basis.

IV. DISCUSSION[5]

V.1. Discussion of the first study

To my knowledge, this is the first study to assess and compare the occurrence of life events and their relationship to D-SIB among groups of vocational school and high school students.

[5] The Discussion chapter of my dissertation is based on our previous work on the topic, in which I have done significant work: (Horváth et al., 2018, 2020; Horváth, Mészáros, & Balázs, in press).

According to the previously published results in the same sample, we found that the lifetime prevalence of D-SIB is significantly higher in the vocational school group (29.4%) compared to the high school group (17.1%), moreover, that the prevalence of suicidal behaviour is significantly higher among vocation school students who report D-SIB compared to those who do not report D-SIB (Horváth, 2014; Horváth et al., 2018). Based on all these, we hypothesized that the pattern of stressful life events as well as their relationship to self-harm may also differ in the two groups.

In line with these previous results and our hypotheses, in our current study, the two groups differed in the frequencies of several life events. While adolescents in the high school group were more likely to report increased workload at school and appearing for an exam/interview compared to their vocational school peers, vocational school students were more likely to report having a new family member, change of school, divorce of parents and death of a close friend. These results on differences regarding the numbers and severity of life events in the two groups support findings from studies that identified vocational school students as a group with increased vulnerability regarding several bio-psycho-social conditions (Nemzeti Egészségfejlesztési Intézet, 2017).

Our results also show that association between life events and D-SIB differ in the two groups: in the high school group, D-SIB was associated with trouble with parents and breakup with boyfriend/girlfriend when testing for individual life events, and family problems with or in the family; trouble with police or law and difficulties with romantic/sexual relationships when testing for life event categories, while in the vocational school group, none of the life events or life event categories were associated with D-SIB. Our results suggest that life events might be associated with D-SIB in various ways in the two groups – for example, in adolescents where stressors are present chronically in large numbers and severity, some life events might be less of a prominent event that can be directly related to self-harm. The idea that personal experiences behind the same life event labels can be very different in these populations should also be considered. Our results suggest that life events might be associated with D-SIB in various ways in groups with different socioeconomic backgrounds. Assessing the subjective severity and the perceived stress associated with the life events might contribute to a deeper understanding of this issue (Horváth et al., 2018).

Our results need to be interpreted with the consideration of several limitations. The cross-sectional nature of our data does not provide information about causality. Additional limitations are the use of only dichotomous variables that reduce the variability in the model and using a

small sample size compared to the number of explanatory variables in the vocational school group. Possible biases due to the methods of self-administered questionnaires in a classroom setting should also be considered. Furthermore, differences in SES between vocational and high school groups were not directly measured. However, we used randomly selected high schools and vocational schools, and as we have highlighted previously, former studies have shown that in Hungary, the SES of students' families is related to the education type attended by their children (Ercsei, 2015). A limitation necessarily arising from the method of data collection is that students who might be at the highest risk were more likely to be missed during the recruitment of participants. This lack of inclusion was also due to school absence and the dropout rates associated with a higher risk level in this population. Thus, real effect sizes might be deflated compared to the ones estimated in this study (Horváth et al., 2018).

The strengths of the research are that the vocational school students who we assessed have received little visibility so far in terms of the phenomena studied, which may help to ensure that prevention and intervention programs also reflect on the problems of adolescents in this population. The results and the lessons learned from the first study were incorporated into the design and development of our second study and our prevention program.

V.2. Discussion of the second study

To our knowledge, this study is the first to explore the role of quantity and type of stressful life events in the relationship between NSSI and suicidal behaviour in clinical and non-clinical populations of adolescents. Based on the results of our first study, participants in the non-clinical group were recruited from both high schools and vocational schools.

In line with previous findings in the literature, the prevalence of NSSI was significantly higher among psychiatric inpatient adolescents (53.0%) compared to adolescents recruited from heterogeneous educational settings (23.6%). Nevertheless, the lifetime prevalence of NSSI in the non-clinical group was higher in the current sample compared to data on lifetime NSSI prevalence in Hungarian community samples in previous international studies (Brunner et al., 2014; Madge et al., 2008), where only high school students were involved. Our current results are in line with previous findings, where we found significant differences between high school and vocational school students regarding the prevalence of self-injury in a non-clinical sample of adolescents in Hungary (Horváth et al., 2018, 2015). These results call attention to the

necessity of including adolescents from various educational settings in both research and prevention projects.

Regarding suicidal behaviour, although both lifetime and current suicidal behaviour were significantly higher in the clinical group, alarmingly high rates of suicidal behaviour were reported in the non-clinical group, as well: a quarter of adolescents reported some level of suicidal behaviour during their lifetime, and more than one-tenth of them did so in the last month prior to assessment, and more than 5% of adolescents were at high suicidal risk at the time of the assessment. Screening for these adolescents and referring them to the specialized health care system was an important aim of our study (Horváth et al., 2020).

Regarding the relationship between NSSI and suicidal behaviour, NSSI proved to be associated with suicide in both groups, and this association was significantly stronger in the clinical than in the non-clinical group. These results are in line with studies that describe NSSI and suicidal behaviour as frequently overlapping (e.g. Mars et al., 2019; Muehlenkamp & Gutierrez, 2007). Group differences, in particular, raise the possible role of mental disorders as mediating variables between the two phenomena, or as third variables behind both NSSI and suicidal behaviour. underlining the importance of prevention and intervention for those who engage in NSSI (Horváth et al., 2020).

Another possible third variable can be the presence of stressful life events. In line with previous findings (Kaess et al., 2020; Madge et al., 2011), in the present study, the number of life events experienced was associated with NSSI. According to our results, a higher number of life events was correlated with an increased number of NSSI methods in both groups but had no main effect on suicidal behaviour in either of the groups. Nevertheless, for those adolescents who engaged in NSSI, the number of stressful life events proved to be an important factor in also engaging in suicidal behaviour. Although when life events were not considered, we found group differences for the NSSI–suicidality association, when we controlled for life events, this relationship was no longer significant. Hence, experiencing life events may be a potential (third) factor behind group differences in both NSSI and suicidal behaviour (Horváth et al., 2020).

When investigating life events based on their type (interpersonal / non-interpersonal events / adverse childhood circumstances), only interpersonal events proved to be associated with both suicidal behaviour and had a moderating effect on the NSSI–suicidality relationship. The association between interpersonal conflicts and NSSI suggests that these events might be highly triggering for adolescents vulnerable to NSSI, and highlight the role of possible intra- and interpersonal factors contributing to the increased risk of both interpersonal conflicts and NSSI

(e.g. difficulties with emotion regulation, an environment that is unresponsive to the adolescent's needs) (Nock, 2010). Moreover, engagement in NSSI might also contribute to certain interpersonal life events (Burke et al., 2015)

Although clinical and non-clinical groups differed significantly not only in the prevalence of NSSI and suicidal behaviour but also in the number of life events reported, the patterns described above of the effects of life events on the NSSI–suicidality relationship did not differ in the two groups. This result can indicate that these patterns might be associated with the aforementioned functions of NSSI being frequent in both clinical and non-clinical populations.

Our results need to be interpreted with consideration of the limitations of our study. The cross-sectional nature of our data does not provide information about causality. Possible bias due to the self-administered questionnaires should also be considered. Similarly to our first study, it should be considered that some items of the Life event list can cover a wide range of personal experiences. It is a possible direction for future research to further develop different facets of the life event inventory. Furthermore, exploring the role of sociodemographic factors and the role psychiatric disorders was out of the cope of this study; the possible effects of these phenomena should be further explored in future research.

The strength of the research are that the relationship between life events, NSSI and suicidal behaviour has been assessed on both clinical and non-clinical samples, that besides self-report questionnaires, diagnostic interview has been used as well, furthermore, that participants were screened for acute suicidal risk, and those at risk were offered professional help. The results of the study call attention to the high prevalence of NSSI and suicidal behaviour in both groups, the relationship between the two phenomena, and the role of life events, especially interpersonal events. These results were used in the prevention program that our research group is currently developing, and which I introduced as the third unit of my dissertation.

V.3. Discussion of the prevention program

As the third block of the results presented in my dissertation, I introduced the development of a new school mental health promotion program for adolescents that is currently in the pilot study stage, and within this program, the session focusing on the prevention of NSSI. To the best of my knowledge, there is currently no similar freely available, evidence-based program in Hungary that relies on the results of the current literature and can be incorporated into the curriculum to support the work of school psychologists.

Based on our experiences during the pilot study, the program is feasible for 14-16-year-old students of high schools, vocational school, schools that provide opportunity to continue education for youth who had dropped out of formal education, and schools for students with special educational needs as well. Based on all this, we consider it worthwhile to develop additional topics and to carry out a follow-up study to assess the efficacy of the program. In case of satisfactory results, we plan to develop the full program, including a detailed manual and training for professionals. With the final version of the program, our goal is to provide the professionals working in the schools with a training and manual based on which they can build up a series of sessions that they consider to be the best suited for the needs of the given community.

V.4. Conclusions and new results

In my doctoral dissertation, I presented two consecutive empirical studies that aimed to examine the relationship between NSSI and life events, NSSI and suicidal behaviour, and the role of life events in the relationship between NSSI and suicidal behaviour. Furthermore, I introduced the structure of a school prevention program we are currently developing, and the results from the pilot study of this program.

The results of the first study presented in my dissertation show that the group of vocational school and high school students differ significantly both in terms of the severity of life events overrepresented in one group or another and in the pattern of the relationship between D-SIB and life events. On the one hand, these results confirm that vocational school students can be considered a more vulnerable group compared to high school students regarding several psychosocial aspects (Arnold, 2017; Ercsei, 2015; Költő, 2017b, 2017a; Zsiros & Várnai, 2017), thus involving them in research and prevention projects can be an important goal. On the other hand, our results draw attention to the complex patterns of associations between life events and self-injury, which we studied more in detail in our second study.

In our second study, beyond the abovementioned issues, we explored the role of life events in the relationship between NSSI and suicidal behaviour in clinical and non-clinical populations of adolescents, the latter consisting of both vocational school and high school students. Our results highlight the frequent association between NSSI and suicidal behaviour in both groups, as well as the association between life events and the number of NSSI methods, which may indicate the severity of self-injury (Black, Garratt, Beccaria, Mildred, & Kwan, 2019; Black &

Mildred, 2018). Among the different life event types, only interpersonal events were associated with both suicidal behaviour and had a moderating effect on the NSSI–suicidal behaviour relationship.

Overall, the findings of the studies that are part of my doctoral dissertation confirm – in line with previous literature – that NSSI is highly prevalent among adolescents not only in clinical but also in nonclinical populations recruited from schools. Moreover, according to our results, the prevalence of suicidal behaviour is also remarkably high in the non-clinical adolescent population. After reviewing the literature, the extent to which NSSI should be considered an independent entity or part of a „suicidal spectrum" is still unclear, which may further justify the need for universal prevention programs. Nevertheless, NSSI prevention and intervention can not only contribute to the prevention of suicide, and the recognition of possible mental disorders, but also to maintaining and improving the quality of life and mental health of young people who do not (yet) have suicidal ideations and are not (yet) to be diagnosed with any psychiatric disorder (Horváth et al., in press).

With all this in mind, with our currently developed prevention program we aim to respond to the shortage that, to the best of our knowledge, there is no evidence-based mental health promotion, self-injury and suicide prevention program that is freely available to schools in Hungary. Based on our pilot study, we consider it worthwhile to start testing the efficacy of the program as well as the development of further session plans. With our program, we aim to provide an opportunity for a discourse about mental health that helps to decrease stigmatization, normalize help-seeking behaviour, and identify specific sources of available help in the participants' environment.

My doctoral dissertation contributes to the Hungarian and international literature with the following new results:

1. Our study was the first to assess and compare the occurrence of life events and their relationship to D-SIB among groups of vocational school and high school students. Assessing vocational school students who have previously received little visibility in terms of the phenomena studied may help to ensure that prevention and intervention programs also reflect on the problems of adolescents in this population.
    - According to our results, vocational school and high school students differ significantly both in terms of the severity of life events overrepresented in one group or another: vocational school students report higher number and severity of life events.

The results on the differences regarding the numbers and severity of life events in the two groups support findings from earlier studies that identified vocational school students as a group with increased vulnerability regarding several bio-psycho-social conditions.

- The association between life events and D-SIB differed significantly in the two groups as well: in the high school group, D-SIB was associated with trouble with parents and breakup with boyfriend/girlfriend when testing for individual life events, and family problems with or in the family; trouble with police or law and difficulties with romantic/sexual relationships when testing for life event categories, while in the vocational school group, none of the life events or life event categories were associated with D-SIB.

  Our results suggest that life events might be associated with D-SIB in different patterns in the two populations.

2. Our study was the first to explore the role of quantity and type of stressful life events in the relationship between NSSI and suicidal behaviour in clinical and non-clinical populations of adolescents. Based on the results of our first study, participants in the non-clinical group were recruited from both high schools and vocational schools.
   - The lifetime prevalence of NSSI in the non-clinical group was higher in the current sample compared to data on lifetime NSSI prevalence in Hungarian non-clinical samples in previous international studies where only high school students were involved.

     In line with previous findings, these results call attention to the necessity of including adolescents from various educational settings in both research and prevention projects.
   - Although clinical and non-clinical groups differed significantly not only in the prevalence of NSSI and suicidal behaviour but also in the number of life events reported, the patterns described above of the effects of life events on the NSSI–suicidality relationship did not differ in the two groups.

     This result indicates that these patterns might be associated with the aforementioned functions of NSSI being frequent in both clinical and non-clinical populations.
   - A higher number of life events was correlated with an increased number of NSSI methods (presumably more severe NSSI) in both groups but had no main effect on suicidal behaviour in either of the groups. When life events were not considered, we

found group differences for the NSSI–suicidality association, when we controlled for life events, this relationship was no longer significant.

According to our results, experiencing life events may be a potential (third) factor behind group differences in both NSSI and suicidal behaviour.

- Among interpersonal, non-interpersonal events and adverse childhood circumstances, only interpersonal events were associated with both suicidal behaviour and had a moderating effect on the NSSI–suicidal behaviour relationship in both groups.
  To support the prevention and treatment of NSSI and suicidal behaviour, the presence of stressful life events in the life of adolescents requires special attention in both clinical and non-clinical adolescent populations

3. Our further new result is the beginning of the development of an evidence-based mental health promotion, self-injury and suicide prevention program that is and is freely available to schools, and feasible for 14-16-year-old students of high schools, vocational school, schools where students with social disadvantages are overrepresented, and schools for students with special educational needs as well.

   Our study draws attention to the need for freely available, evidence-based mental health promotion, self-injury, and suicide prevention programs that can engage students in different types of schools.

V.5. Future directions

Based on the experience of the research presented in my dissertation, we aim to further investigate NSSI, suicidal behaviour and life events, and mental health issues of adolescents in a broader sense in clinical and non-clinical settings, striving to exceed the limitations of our previous research.

In our ongoing research projects which we have started following the studies presented in my dissertation and which are in the data collection stage, we approach the phenomena assessed with new measurement tools, such as the Inventory of Statements About Self-injury (ISAS) (Klonsky & Glenn, 2009; Klonsky & Olino, 2008) and we use the new, DSM-5-based version of the MINI interview. In order to overcome the methodological limitations arising from the cross-sectional design, the clinical group presented in my dissertation is also being followed

up. Over the past year, it has become possible to expand our research so that we can engage participants from several parts of the country.

Our planned research directions include, in addition to our current research, the launch of studies using qualitative methodology, with which the personal meanings, functions, and related subjective experiences of the NSSI can be explored.

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