

***DIMENSIONAL APPROACH IN EXTERNALIZATION DISORDERS:
AGGRESSION, SUICIDALITY AND SOCIAL ASPECTS***

We completed the planned project. We published more papers both in Hungarian and in international journals and we disseminated our results in national and international conferences more often as we originally planned in the proposal. Our results have scientific and clinical impact and can lead to financial growth. See the details below.

1. BACKGROUND

There is an ongoing debate in the literature as to whether a categorical or a dimensional approach to psychiatric disorders should be used. Though classification systems rely mainly on a categorical approach, but both clinicians and researchers feel the need to introduce a dimensional approach to the assessment of psychiatric symptoms. Our project focused on both subthreshold and full psychopathology of externalizing disorders, i.e. attention-deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD) and conduct disorder (CD)

2. AIMS

The aims of the project were:

- 1) to present a systematic review of subthreshold ADHD among children and adolescents with a focus on the following topics:
 - 1.1. What is the prevalence of subthreshold ADHD among children and adolescents?
 - 1.2. What have researches found on the comorbidity of subthreshold ADHD?
 - 1.3. Is there already any impact of subthreshold ADHD on functioning?
- 2) to review the literature on the impact of ODD and CD on quality of life (QoL).
- 3) to review systematically the literature with a special focus on the associations between self-injurious behaviours and externalizing psychopathology. An additional aim was to review terminology and measurements of self-injurious behaviour and the connection between self-injurious behaviours and suicide in the included publications.
 - 2) to investigate the possible association between the symptoms ADHD, as an externalizing disorder and its subthreshold form and non-suicidal self-injury (NSSI) with special focus on the role of comorbidities and gender in a clinical sample of adolescents with both a dimensional and a categorical approach to psychopathology,
- 4) to systematically review the literature as an extension of previous reviews: to investigate suicidality and ADHD,
- 5) to establish emotion recognition profile in adolescent boys with ADHD in comparison with control adolescents.
- 6) to investigate the comorbidity of subthreshold and full psychiatric disorders, with special focus on externalizing disorders with reading disorders while comparing subgroups based on age of RD recognition (early vs. late).
 - 6.1. to describe the vocational school population, compared to the high school population.
 - 6.2. in terms of direct self-injury and life events (i.e., whether vocational school students experience more life events than high school students),
 - 6.3. to explore how direct self-injurious behavior is associated with suicidal ideation in the vocational school group,
 - 6.4. to explore possible differences in the associations between life events and D-SIB,
- 7) to examine the differences in self and caregiver's proxy report of QoL and to investigate the possible mediational role of self-reported QoL in the relationship between psychopathology and level of suicidal risk in a clinical sample of adolescents,
- 8) to screen acute suicidal risk (emergency cases) of adolescents and to offer immediate help for those in need by referring them to specialized care services.

3. METHODS

3.1. Systematic literature review

3.1.1. Subthreshold ADHD in children and adolescents

Searching five computerised databases (Ovid MEDLINE, Psycinfo, PubMed, Scopus, Web of Science) with two categories of search terms [(1) subclinical; subsyndromal; subthreshold (2) ADHD)]. (*Balazs and Kereszteny, 2014*)

3.1.2. Quality of life in children and adolescents with symptoms or diagnosis of conduct disorder or oppositional defiant disorder

A systematic literature search was conducted in five databases (PubMed, OVID Medline, OVID Psychinfo, Scopus, Web of Science) with the following keywords: oppositional defiant disorder, conduct disorder, quality of life. (Szentiványi and Balázs, 2018)

3.1.3. Self-injury and externalizing pathology

A systematic literature search was conducted in five databases (PubMed, OVID Medline, OVID Psychinfo, Scopus, Web of Science) with two categories of search terms (1. nonsuicidal self-injury, non-suicidal self-injury, NSSI, self-injurious behaviour, SIB, deliberate self-harm, DSH, self-injury; 2. externalizing disorder, attention deficit hyperactivity disorder, ADHD, conduct disorder, CD, oppositional defiant disorder, ODD). (Mészáros et al, 2017)

3.1.4. ADHD and suicide

Five databases (Ovid MEDLINE, Psychinfo, PubMed, Scopus, Web of Science) were searched systematically with two categories of search terms: (1) suicide; suicidal; suicide behavior; suicide attempt; suicidal thought; and (2) ADHD. (Balazs and Keresztesy, 2017)

3.2. Empirical study

The recruitment happened according to the original study plan: to clinical group were recruited from the Vadaskert Child Psychiatric Hospital and Outpatient Clinic, Budapest, Hungary and from the Department of Children and Family Services, Vecses City, Hungary. Controls, were recruited from public high and vocational schools, their ages, sex, and geographic location will match the characteristics of the clinical sample. In all groups exclusion criteria will be mental retardation and in the control group additional exclusion criteria will be the presence of any past or present mental disorders (Aspan et al, 2014; Balázs et al, 2016; Balazs et al, 2018a; Balazs et al, 2018b; Horváth et al, 2018; Kis et al, 2017; Szentivanyi et al, 2017; Törő et al, 2018)

3.2.2. Ethical consideration

The study was approved by the Scientific and Research Ethics Committee. The parents of each child and children older than 14 years included into this study provide written informed consent after being informed of the nature of the study. (Aspan et al, 2014; Balázs et al, 2016; Balazs et al, 2018a; Balazs et al, 2018b; Horváth et al, 2018; Kis et al, 2017; Szentivanyi et al, 2017; Törő et al, 2018)

3.2.3. Instruments

We used the following instruments in line with the original study plan: modified version of the *M.I.N.I. Kid* (structured diagnostic interview, it determines 22 child-psychiatric diagnoses according to the classification system and their subthreshold form and suicide behavior), *Strengths and Difficulties Questionnaire (SDQ)* (a brief dimensional instrument screening childhood behavior and functional impairment, has a parent and a self-report version. SDQ has a parent and a self-report version), *Erfassung der Lebensqualität Kindern und Jugendlichen (ILK) Scale* (QoL is assessed by the (ILK) scale. ILK has a parent and a self-report version), *Reactive/Proactive Aggression Questionnaire (RPA)* (it is a self-reported questionnaire for measuring reactive and proactive aggression), *Inventory of Callous/Unemotional Traits (ICU)* (it is a dimensional measure, which has parent and self-report versions), *Cognitive Emotion Regulation Questionnaire (CERQ)* (self-report measure assesses conscious, cognitive processes of emotion regulation), *Trait subscale of the State-Trait Anxiety Inventory (STAI-T)* (self-report measure of anxiety), *Child Depression Inventory (CDI)* (self-report assessment to measure the severity of depressive symptoms in children), *Parental Stress Scale* (assesses positive and negative themes of parenthood). (Balázs et al, 2016; Balazs et al, 2018a; Balazs et al, 2018b; Horváth et al, 2018; Kis et al, 2017; Szentivanyi et al, 2017; Törő et al, 2018)

Facial Expressions of Emotion- Stimuli and Tests (FEEST) (based on the six universal basic emotions, the computerized and extended version of the original 60 faces test), *EmoVision* (unique combination of gaze control and automated analysis (facial emotion recognition) of the individual's face watching emotional content is applied by the EmoVision software). *Heart Rate Variability (HRV)* (Stress Pilot Plus – HRV Biofeedback Professional System (Biocomfort GmbH, Germany). *Dyslexia Differential Diagnosis Maastricht-Hungarian Standard Test* (it determines reading disability spectrum). (Aspan et al, 2014)

3.2.4. Statistics

All statistical analyses were performed using IBM SPSS Statistics 20.0 (IBM Corp. in Armonk, NY, USA). Descriptive statistics are reported in the text. T-tests were applied for continuous variables and Chi-square test for categorical variables. All tests of hypotheses were considered statistically significant if p-value was less than 0.05. Bonferroni correction was applied to control for multiple comparisons. (Aspan et al, 2014, Balázs et al, 2016; Balazs et al, 2018a, Balazs et al, 2018b, Horváth et al, 2018, Szentivanyi et al, 2017, Törő et al, 2018)

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 (Horváth et al, 2018).

Multiple mediation analyses resulted in a moderated mediation model was tested in which the symptoms of comorbid conditions mediated the relationship between symptoms of ADHD and the prevalence of current NSSI. A mediational model was tested by means of regression analyses in which QoL mediated the relationship between psychopathology and suicidal risk controlling for gender and age. (Balazs et al, 2018a, Balazs et al, 2018b)

F-factor analysis (Principal Component Analysis and direct oblimin rotation) were used to analyse caregivers' and their children's reports on different domains of QoL. (Szentivanyi et al, 2017)

4. RESULTS

4.1. Systematic literature review

4.1.1. Subthreshold ADHD in children and adolescents

The results of the 18 articles included show that different definitions of subthreshold ADHD in children and adolescents exist, a large variety of instruments are used, the prevalence rate of subthreshold ADHD is wide-ranging (0.8–23.1%), the comorbidity of subthreshold ADHD is high and there are several areas where subthreshold ADHD has a meaningful impact on functioning. (Balazs and Keresztesy, 2014)

4.1.2. Quality of life in children and adolescents with symptoms or diagnosis of conduct disorder or oppositional defiant disorder

Altogether, 15 articles were included. Four studies agreed that the presence of CD/ODD increased the odds of reduced QoL in children with ADHD; however, two studies found no differences. Dealing with adulthood outcomes, three studies agreed that CD and ODD negatively affect the QoL in the long-term. Thirteen found that the presence of the ODD and CD reduces the QoL in children. (Szentivanyi and Balázs, 2018)

4.1.3. Self-injury and externalizing pathology

Altogether, 35 papers were included. Eleven different terms were found for describing self-injurious behaviours and 20 methods for measuring it. NSSI has the clearest definition. All the examined externalizing psychopathologies had strong associations with self-injurious behaviours according to: higher prevalence rates in externalizing groups than in control groups, higher externalizing scores on the externalizing scales of questionnaires, higher symptom severity in self-injurious groups. Eight studies investigated the relationship between suicide and self-injurious behaviours and found high overlap between the two phenomena and similar risk factors. (Mészáros et al, 2017)

4.1.4. ADHD and suicide

The search resulted 26 articles. There is a positive association between ADHD and suicidality in both sexes and in all age groups. Comorbid disorders mediate between suicidality and ADHD. (Balazs and Keresztesy, 2017)

4.2. Empirical study

4.2.1. ADHD and nonsuicidal self-injury in a clinical sample of adolescents

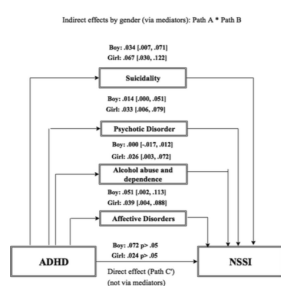


Figure 1. Multiple mediation model (published in Balazs et al, 2018a).

Fifty-two adolescents met full criteria for ADHD and a further 77 showed symptoms of ADHD at the subthreshold level. From the 52 adolescents diagnosed with ADHD, 35 (67.30%) had NSSI, of whom there were significantly more girls than boys, boys: n = 10 (28.60%), girls: n = 25 (71.40%) ($\chi^2(1) = 10.643$ p < .001 $\phi = .452$). Multiple mediation analyses resulted in a moderated mediation model in which the relationship between symptoms of ADHD and the prevalence of current NSSI was fully mediated by the symptoms of comorbid conditions in both sex. Significant mediators were the symptoms of affective and psychotic disorders and suicidality in both sexes and the symptoms of alcohol abuse/dependence disorders in girls (Figure 1.). (Balazs et al, 2018a)

4.2.2. Emotion recognition pattern in adolescent boys with ADHD

Compared to controls, adolescents with ADHD were more sensitive in the recognition of disgust and, worse in the recognition of fear and showed a tendency for impaired recognition of sadness. Hyperactivity measures showed an inverse correlation with fear recognition. (Aspan et al, 2014)

4.2.3. Reading disability spectrum: early and late recognition, subthreshold, and full comorbidity

A higher proportion of children in the reading disability spectrum group were assessed as having internalizing or externalizing disorders. When subthreshold and full diagnoses were considered together, the prevalence of internalizing but not externalizing pathology was higher in the reading disability spectrum group than the control group. The prevalence of internalizing pathology was similar in the early and late reading disability spectrum subgroups, but externalizing pathology was more common in the late reading disability spectrum subgroup. When subthreshold and full diagnoses were considered together, mood disorder and externalizing pathology were more prevalent in the late reading disability spectrum subgroup than the early reading disability spectrum subgroup. (Balázs et al, 2016; Törő et al, 2018)

4.2.4. Direct self-injurious behavior and life events among vocational school and high school students

Lifetime prevalence of direct self-injurious behavior was significantly higher (29.4%) in the vocational school group compared to the high school group (17.2%) ($X^2(1) = 12.231, p < 0.001$). Direct self-injurious behavior was associated with suicidal ideation in the vocational school group. Different life events were more frequent in the high school than in the vocational school group, and associations between Direct self-injurious behavior and life events differed in the vocational school group compared to the high school group. (Horváth et al, 2018)

4.2.5. Suicidal risk, psychopathology and QoL in a clinical population of adolescents

Gender and age were both associated with suicidal risk. Altogether 138 caregiver–child dyads filled the ILK questionnaire. The caregivers’ ratings were settled sorted into three factors, the adolescents’ ratings were settled sorted into two factors. We found significant differences between mothers, fathers and other caregivers’ ratings in the following domains of QoL: school, loneliness, peer relations, physical health, mental health and problem/illness. The caregivers evaluated adolescents’ QoL more positively than the adolescents did ($t=761, df=139, p < 0,0001$). (Szentivanyi et al, 2017)

Self-reported QoL significantly mediated the relationships between emotional problems ($\beta=1.846$; 95% BCa CI: 0.731–2.577), as well as peer problems ($\beta=0.883$; 95% BCa CI: 0.055–1.561) and suicidal risk: more emotional and peer problems were associated with lower QoL, which in turn was related to higher level of suicidal risk (Figure 2.). (Balázs et al, 2018b)

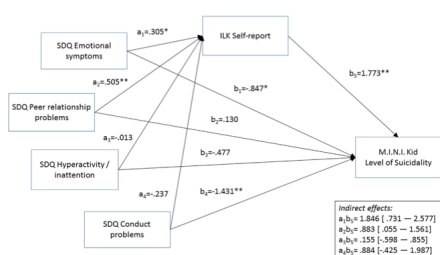


Figure 2. Multiple mediation model (published in Balázs et al, 2018b).

5. LIMITATIONS

5.1. Systematic literature review

Some relevant papers on this topic may be missing. Firstly, because we included only articles that are written in English. Secondly, we have chosen the standard method and searched for publications in large indexed literature databases. ((Balázs and Keresztesy, 2014, 2017, Mészáros et al, 2017, Szentiványi and Balázs, 2018)

5.2. Empirical study

Limitations of these findings include their being cross-sectional, therefore no causal relationship was revealed among the investigated factors. We cannot ensure that the mediator (i.e., comorbid diagnoses/ symptoms) came after psychopathology (i.e. ADHD symptoms) and before suicide behavior / NSSI, moreover mediator variables may temporally occur in between the predictors and the criterion measures. Although the MINI Kid screens for multiple child psychiatric disorders, it does not cover all of them—for example, language and motor difficulties. Several data are based on self-reported instruments, which can be biased, i.e., it can be an underestimation, why adolescents may want to deny it. A further potential limitation is that the clinical study population are inpatients, which suggests that these patients belonged to the more severe end of the spectrum. Finally, in the vocational schools students who might be at the highest risk were more likely to be missed during recruitment of participants since consent also depended on adults (school staff and parents) with various levels of involvement and various attitudes towards mental health prevention. This lack of inclusion was also due to school absence and the dropout rates associated with the higher risk level in this population. (Aspan et al, 2014; Balázs et al, 2016; Balázs et al, 2018a; Balázs et al, 2018b; Horváth et al, 2018; Szentivanyi et al, 2017; Törő et al, 2018)

6. CONCLUSIONS

6.1. Systematic literature review

6.1.1. Subthreshold ADHD in children and adolescents

The results suggest that focusing on subthreshold ADHD can be important in preventative interventions. This systematic review supports the dimensional approach of ADHD. Further research on uniform criteria of subthreshold ADHD is needed to support the inclusion of this condition in classification systems. (*Balazs and Kereszteny, 2014*)

6.1.2. Quality of life in children and adolescents with symptoms or diagnosis of conduct disorder or oppositional defiant disorder

CD and ODD are associated with lower QoL. Clinicians should screen them. (*Szentiványi and Balázs, 2018*)

6.1.3. Self-injury and externalizing pathology

Based on the current findings the association between externalizing psychopathology and self-injurious behaviours has been proven by the scientific literature. Similarly to other reviews on self-injurious behaviours the confusion in terminology and methodology was noticed. NSSI is suggested for use as a distinct term. Further studies should investigate the role of comorbid conditions in NSSI, especially when internalizing and externalizing pathologies are both presented. (*Mészáros et al, 2017*)

6.1.4. ADHD and suicide

Recognizing ADHD, comorbid conditions and suicidality is important in prevention. (*Balazs and Kereszteny, 2017*)

6.2. Empirical study

6.2.1. Attention-deficit hyperactivity disorder and nonsuicidal self-injury in a clinical sample of adolescents

ADHD symptoms are associated with an increased risk of NSSI in adolescents, especially in girls. Our findings suggest that clinicians should routinely screen for the symptoms of ADHD and comorbidity, with a special focus on the symptoms of affective disorders, alcohol abuse/dependence and psychosis to prevent NSSI. (*Balazs et al, 2018a*)

6.2.2. Emotion recognition pattern in adolescent boys with ADHD

Our data suggest that adolescent boys with ADHD have alterations in the recognition of specific emotions (*Aspan et al, 2014*).

6.2.3. Reading disability spectrum: early and late recognition, subthreshold, and full comorbidity

This study demonstrated that early recognition of reading disability spectrum may play a role in determining comorbid, especially externalizing psychopathology and should therefore be an educational and clinical priority. Clinicians should routinely screen children with reading disability spectrum for comorbid disorders, with special focus on externalizing psychopathology, including subthreshold pathology. (*Balázs et al, 2016; Törő et al, 2018*)

6.2.4. Direct self-injurious behavior and life events among vocational school and high school students

Vocational school students are a vulnerable population with a higher prevalence of direct self-injurious behavior compared to high school students. Life events and their association with direct self-injurious behavior also differ in vocational school students compared to high school students. Taking all these into account might contribute to prevention/intervention designed for this population. (*Horváth et al, 2018*)

6.2.5. Suicidal risk, psychopathology and QoL in a clinical population of adolescents

The caregivers and their children's reported different domains of QoL as problematic. Therefore, it is important to gain information from several sources about the adolescent's QoL. (*Szentiványi et al, 2017*)

Furthermore, our findings suggest that clinicians should routinely screen the QoL of their patients, especially in adolescents with emotional and peer problems. It is important to focus intervention and treatment efforts on improving the QoL of adolescents with emotional and peer problems. (*Balazs et al, 2018b*)

6. IMPACT

The results of this project can be used during the further development of:

- the classification systems: dimensional approach should get more focus in diagnostics: subthreshold psychopathology can serve as a bridge between categorical and dimensional approach of diagnostics. (*Balazs and Kereszteny, 2014; Szentiványi and Balázs, 2018*)

- self-injury and suicide prevention programs. (*Balazs et al, 2018a; Horváth et al, 2018; Mészáros et al, 2017*)
- the routine clinical practice with the inclusion of measurements into the daily work, e.g. screening-tools for:
 - comorbid subthreshold psychopathology in children with reading disability. (*Balázs et al, 2016; Törő et al, 2018*)
 - QoL of adolescents referred to psychological/psychiatric assessment (*Balazs et al, 2018b; Szentivanyi et al, 2014, 2017*),
 - suicidality in ADHD clinics. (*Balazs and Kereszteny, 2017*)

As high level of treatment of psychopathology, better QoL and effective suicide prevention results in increasing life-years in work, our project can lead to financial growth as well.

7. COMPLETED DISSEMINATION OF THE RESULTS

We planned to publish 14 papers altogether. We ended up with 30 papers:

- 9 research papers in international peer reviewed journals with impact factor, Σ 24.024 (see References below)
- 2 research papers in international journals peer reviewed journals without impact factor (see References below)
- 2 research papers in Hungarian peer reviewed journals without impact factor (see References below)
- 17 conference papers (we presented our results in several Hungarian and international conferences)

Furthermore, 43 psychology bachelor and master theses were based on this project.

Additionally, Judit Balazs (principal investigator of the current OTKA grant) submitted her Doctoral Theses to the Hungarian Academy of Sciences - it is currently under review - which is partly based on this project.

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