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Research report

Attention-deficit hyperactivity disorder and suicidality in a treatment naïve sample of children and adolescents

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ABSTRACT

Background: The aim of the present study was to investigate the possible association between attention-deficit/hyperactivity disorder (ADHD) and suicidality.
Methods: Using a structured interview (Mini International Neuropsychiatric Interview Kid), the authors examined 418 treatment naïve children/adolescents (aged: 3–18 years). Suicidality was defined by the M.I.N.I. Kid as having any current suicidal ideations and/or suicide attempts.
Results: Two hundred and eleven children/adolescents fulfilled the DSM-IV diagnosis of ADHD and a further 105 showed symptoms of ADHD in subthreshold level. Multiple mediation analyses resulted in a moderated meditational model in which the relationship between symptoms of ADHD and current suicidality was fully mediated by the symptoms of comorbid conditions, but this was moderated by age. In children under 12 years, significant mediators were the symptoms of specific anxiety disorders, while in the adolescent group symptoms of major depressive episode and dysthymia and symptoms of substance abuse/dependence approved as significant mediators.
Limitations: As the study was cross-sectional, it did not reveal any causal relationship among the investigated factors. Furthermore, as the study population included a treatment naïve clinical sample, we can assume that adolescents, who and/or whose family seek for help at the first time in this age belonged to the less sever end of the spectrum.
Conclusions: ADHD symptoms are associated with an increased risk of suicidality in treatment naïve children/adolescents. The mechanisms of this relationship can be understood only when developmental factors are considered. Our findings suggest that clinicians should screen suicidality and comorbid symptoms routinely in patients with ADHD.

1. Introduction

Suicide is the second leading cause of death among people aged 15–24 years in Europe and the third in the US (World Health Organization, 2012). Several studies showed that similar to adults most youth who commit, attempt or think about suicide have at least one concurrent psychiatric disorder (Brent et al., 1988; Gould et al., 2003; Fergusson and Lynskey, 1995; Marttunen et al., 1991; Shaffer et al., 1996). Among psychiatric disorders mood disorders, substance use disorder and conduct disorder are the well-known leading suicide risk factors in this age group (Beautrais, 2003; Brent et al., 1988; Brent, 1995; Cavanagh et al., 2003; Gould et al., 2003; Lowe and Gibson, 2005; Lowenstein, 2005).

Recently there is a growing interest in a possible association between attention-deficit/hyperactivity disorder (ADHD) and suicide (Biederman et al., 2008; Cho et al., 2008; Chronis-Tuscano et al., 2010; Galéra et al., 2008; Goodman et al., 2008; Lam, 2005; Manor et al., 2010).

Lam (2005) reported a four-fold higher likelihood of having the diagnosis of ADHD for children and adolescents hospitalized for suicide attempts and self-harm. In their pilot study Manor et al. (2010) found that 65% of the adolescents who had attempted suicide met the criteria of ADHD, but only 22% of them had been diagnosed with ADHD prior to suicide attempt.

The results on the possible association between ADHD and suicidality are controversial: the main question is whether there

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is a direct association between ADHD and suicidality or ADHD increases the risk of suicide by increasing the prevalence of comorbid conditions.

Reviewing the age aspect of the studies on the possible association between ADHD and suicidality, the vast majority of them focused on adolescents or adults (Cho et al., 2008; Manor et al., 2010) and there are only a very few studies which investigated children under 12 (Goodman et al., 2008). Additionally to our knowledge it has not been done any research on the suicidality of treatment naïve children and adolescents with the symptoms of ADHD.

Despite of this lack in the literature it is well known that the prevalence and pattern of psychiatric comorbidity of children and adolescents with ADHD differ (Huh et al., 2011; Taurines et al., 2010).

During the last decades several researchers highlighted that both categorical and dimensional approaches to diagnosis are important for clinical work and research as well (Helmchen and Linden, 2000; Lecrubier, 2008; Möller, 2008; Okasha, 2009). Previous studies suggested that subthreshold disorders, which can be defined as syndromes, which do not fulfill the required criteria of threshold definition (according to the classification systems) have a negative impact on education/work impairment, quality of life, comorbidity (both with other subthreshold and threshold disorders) and suicide as well (Balázs et al., 2000, 2013; Bertha and Balázs, 2013; Lecrubier and Ustun, 1998; Olfson et al., 1996; Oral et al., 2012; Wittchen et al., 1998).

1.1. Aims of the study

The aim of the present study was to describe the prevalence of suicidality in a treatment naïve clinical sample of children and adolescent with the symptoms ADHD and to examine weather there is a direct association between ADHD symptoms (fulfilling or not the diagnostic threshold) and suicidality in the different age groups and how the symptoms of comorbid psychiatric conditions influence it.

2. Methods

2.1. Subjects

We enrolled into the study a group of psychiatric treatment naïve children and adolescents ($n=418$), who had their first psychiatric appointment in the Vadaskert Child Psychiatric Hospital and Outpatient Clinic, Budapest, Hungary. Only subjects <18 years old were included, there was no age limit to pass for inclusion. Exclusion criterion was mental retardation in the medical history.

The study was approved by the Regional Ethics Committee. The parents of each child and children older than 14 years included into this study provided written informed consent after being informed of the nature of the study.

2.2. Measures

The modified Mini International Neuropsychiatric Interview Kid (M.I.N.I. Kid) 2.0 (Balázs et al., 2004; Lecrubier et al., 1997; Sheehan et al., 1998, 2010) was applied to evaluate psychiatric diagnose and symptoms. The modified M.I.N.I. Kid is a structured diagnostic interview for the assessment of DSM-IV and subthreshold child/adolescent psychiatric disorders and suicidality. Current suicidality was assessed via questions: “In the past month did you” “Wish you were dead?”, “Want to hurt yourself?”, “Think about killing yourself?”, “Think of a way to kill yourself?”, “Attempt suicide?” To ensure inter-rater reliability, all interviewers had participated in a training course before the study, and during the study the interviewers were regularly supervised.

2.3. Statistical analysis

Data were analyzed using IBM SPSS Statistics 20 (SPSS, 2011). An α-level of.05 was considered to be significant. To test the possible mediational effects of symptoms of comorbid conditions on the relationship between symptoms of ADHD and suicidality, total, direct, and the specific indirect effects (defined as the product of the two unstandardized paths linking perceived stress to anxiety via that mediator) were calculated using the multiple meditation approach and SPSS macro provided by Preacher and Hayes (2008). Symptoms of all M.I.N.I. Kid diagnoses, which had an occurrence of $>5\%$ in the study sample were included in the model. Ten mediators were tested: symptoms of agoraphobia, symptoms of panic disorder, symptoms of obsessive–compulsive disorder (OCD), symptoms of tic disorders, symptoms of generalized anxiety disorder (GAD), symptoms of specific anxiety disorders (including social phobia, separation anxiety disorder and specific phobia), symptoms of MDE and dysthymia, symptoms of (hypo)mania, symptoms of ODD and CD, and symptoms of alcohol and substance abuse and dependence as assessed with the modified M.I.N.I. Kid. Bootstrapping with a resample procedure of 1000 bootstrap samples (bias corrected and accelerated (BCa) estimates and 95% CI) was used for significance testing, because this method does not impose the assumption of normality of the sampling distribution (Preacher and Hayes, 2008). Age and gender were included as covariates. Because of the differences in the administration of the M.I.N.I. Kid, we divided our sample into children (aged younger than 12 years old) and adolescents (12 years or older).

3. Results

Mean age of children ($n=220$) was 7.67 years ($SD=2.03$, range 3–11 years), there were 39 (17.7%) girls and 181 (82.3%) boys among children. Mean age of adolescents ($n=198$) was 14.31 years ($SD=1.67$, range 12–17 years), 85 (42.9%) girls and 113 (57.1%) boys. There were significantly more boys among children then in adolescents ($\chi^2(1)=31.722$ $p<.001$ $\phi=.275$).

Altogether 152 (69.1%) of children and 59 (29.8%) of adolescents fulfilled the diagnosis of ADHD according to M.I.N.I. Kid ($\chi^2(1)=64.364$ $p<.001$ $\phi=.392$), and a further 43 (19.5%) of children and 62 (31.3%) of adolescent showed symptoms of ADHD in a subthreshold level. Regarding the severity of ADHD, 87.3% of children and 55.5% of adolescents had more than five symptoms (which is the threshold for subthreshold ADHD), and median of ADHD symptoms were 13 and 7, respectively (Interquartile range: 9–16 and 3–11). Current suicide risk was present in 28 children (12.7%) and in 77 adolescents (38.9%) ($\chi^2(1)=37.919$ $p<.001$ $\phi=.301$). Characteristics of the two study groups regarding M.I.N.I. Kid diagnoses are presented in Table 1.

Results of the multiple mediations are presented in Table 2 and Fig. 1a and b. In both samples of children and adolescents, age was significantly and positively associated with suicidality, indicating that older children and adolescents had an increased risk for suicidality.

In children aged <12 years old, the total and direct effects of ADHD symptoms on suicidality were. 137 ($p=.019$) and .051 ($p=.508$), respectively. In the adolescent sample (≥ 12 years old), the total and direct effects of ADHD symptoms on suicidality were .112 ($p=.002$) and .014 ($p=.797$), respectively. These results suggest that the association between ADHD symptoms and suicidality was fully mediated in both samples.

Table 1
Characteristics of the two study groups regarding M.I.N.I. Kid diagnoses.

M.I.N.I. Kid diagnoses	*N* (%)		χ^2 (*p*)	ϕ
	Children (*n*=220)	Adolescents (*n*=198)		
ADHD	152 (69.1)	59 (29.8)	64.364 (<.001)	−.392
Agoraphobia	36 (16.4)	38 (19.2)	.572 (.449)	.037
(Hypo) mania	68 (30.9)	35 (17.7)	9.826 (.002)	−.153
Panic disorder, current	4 (1.8)	17 (8.6)	10.003 (.002)	.155
OCD	16 (7.3)	32 (16.2)	8.101 (.004)	.139
Tic disorders	15 (6.8)	7 (3.5)	2.253 (.133)	−.073
GAD	20 (9.1)	41 (20.7)	11.282 (.001)	.168
MDE and dysthimia	20 (9.1)	46 (23.2)	15.673 (<.001)	.194
Specific anxiety disorders (Sep, SpecPh, SocPh)	60 (27.3)	53 (26.8)	.013 (.908)	−.006
ODD and CD	131 (59.5)	70 (35.4)	24.431 (<.001)	−.242
Substance use disorders	3 (1.4)	11 (5.6)	5.657 (.017)	.116

ADHD: attention deficit/hyperactivity disorder, OCD: obsessive compulsive disorder, GAD: generalized anxiety disorder, MDE: major depressive episode, Sep: Separation anxiety disorder, SpecPh: specific phobia, SocPh: social phobia, ODD: oppositional defiant disorder, CD: conduct disorder.

Table 2
Results of the multiple mediations of the effect of ADHD symptoms on current suicidality through comorbid symptoms in the two study groups.

M.I.N.I. Kid diagnoses	Children (<12 years old) (*n*=220)						Adolescents (≥12 years old) (*n*=198)					
	b	*SE*	*z*	*p*	Wald	BCa 95% CI	*b*	*SE*	*z*	*p*	Wald	BCa 95% CI
Total effect	.137	.059	2.340	.019	5.476		.112	.036	3.102	.002	9.625	
Direct effect	.051	.077	.662	.508	.439		.014	.053	.258	.797	.066	
Partial effects of control variables child's gender (0=boys, 1=girls)	.474	.645	.735	.462	.541		−.534	.400	−1.340	.180	1.796	
Child's age	.398	.137	2.912	.004	8.482		.335	.126	2.672	.008	7.138	
Specific indirect effects												
Agoraphobia symptoms	.001	.008				−009–.029	.010	.005				−.003–.030
Mania symptoms	.056	.041				−.036–.133	−.013	.033				−.084–.048
Panic symptoms	−.005	.012				−.035–.014	−.003	.016				−.031–.034
OCD symptoms	.007	.009				−.008–.025	−.006	.014				−.037–.023
Tic symptoms	−004	.008				−.026–.007	.006	.010				−.009–.021
GAD symptoms	−008	.018				−.041–.030	.012	.019				−.023–.054
MDE and dysthimia symptoms	.051	.039				−.026–.131	.094	.031				.016–.137
Sep, SpecPh, SocPh symptoms	.024	.015				.001–.060	−.006	.018				−.048–.024
ODD and CD symptoms	−.033	.044				−116–.056	.017	.040				−.064–.094
Substance abuse and dependence symptoms	.031	.069				−.046–.176	.037	.028				.002–.102
Model summary	Nagelkerke R^2=.273; Cox & Snell R^2=.145 χ^2=98.576; *df*=10; *p*<.001						Nagelkerke R^2=.408; Cox & Snell R^2=.301 χ^2=127.998; *df*=10; *p*<.001					

Outcome variable is current suicidality (*present*=1; *not present*=0) as measured by the M.I.N.I. Kid. *b:* unstandardized regression coefficient. *SE*: standard error of *b*; BCa 95% CI: bias corrected and accelerated 95% confidence interval; ADHD: attention deficit/hyperactivity disorder, OCD: obsessive compulsive disorder, GAD: generalized anxiety disorder, MDE: major depressive episode, Sep: separation anxiety disorder, SpecPh: specific phobia, SocPh: social phobia, ODD: oppositional defiant disorder, CD: conduct disorder. Number of bootstrap resample: 1000.

In children, the examination of the specific indirect effects indicates that symptoms of specific anxiety disorders emerged as significant (*b*=.024; 95% BCa bootstrap CI:.001—.060). Paths A and B in Fig. 1a indicate that more ADHD symptoms were associated with more anxiety symptoms, which in turn were associated with a higher risk of suicidality. More ADHD symptoms were also associated with more symptoms of (hypo)mania, GAD, MDE and dysthymia, as well as ODD and CD; but these were not significant mediators between ADHD symptoms and suicidality.

In the adolescent sample, symptoms of MDE and dysthymia (*b*=.094; 95% BCa bootstrap CI:.016—.137) and symptoms of substance use disorders (*b*=.037; 95% BCa bootstrap CI:.002—.102) were significant mediators. More ADHD symptoms were associated with more symptoms of MDE and dysthymia, as well as of substance use disorders, which in turn were associated with a higher risk of suicidality. More ADHD symptoms were also associated with more symptoms of (hypo)mania, panic disorder, OCD, Tic disorders, GAD, specific anxiety disorders, as well as ODD and CD; but these were not significant mediators between ADHD symptoms and suicidality.

4. Discussion

To our knowledge it is the first study, which investigated if ADHD symptoms are associated with an increased probability of suicidality in a treatment naïve clinical sample of children and adolescents and among the few ones, which focused next to adolescents and adults to children under 12 as well. Several previous studies showed a possible link between the symptoms of ADHD and suicidality, but to our knowledge the current study is the first one, which compared it between children and adolescents.

Contrary to the majority of previous studies, where either a screening tool was used to measure symptom severity of ADHD, which did not make possible to diagnose according to the classification systems (Cho et al., 2008), or a (semi)structured diagnostic interview was used, which set up categorical diagnoses, but it was not able to screen symptom severity of ADHD (Goodman et al., 2008; Manor et al., 2010; Mannuzza et al., 1998), in the present study the modified version of a structured diagnostic interview was used, which made us possible to measure ADHD both in a categorical and in a dimensional way as well. Additionally in all previous

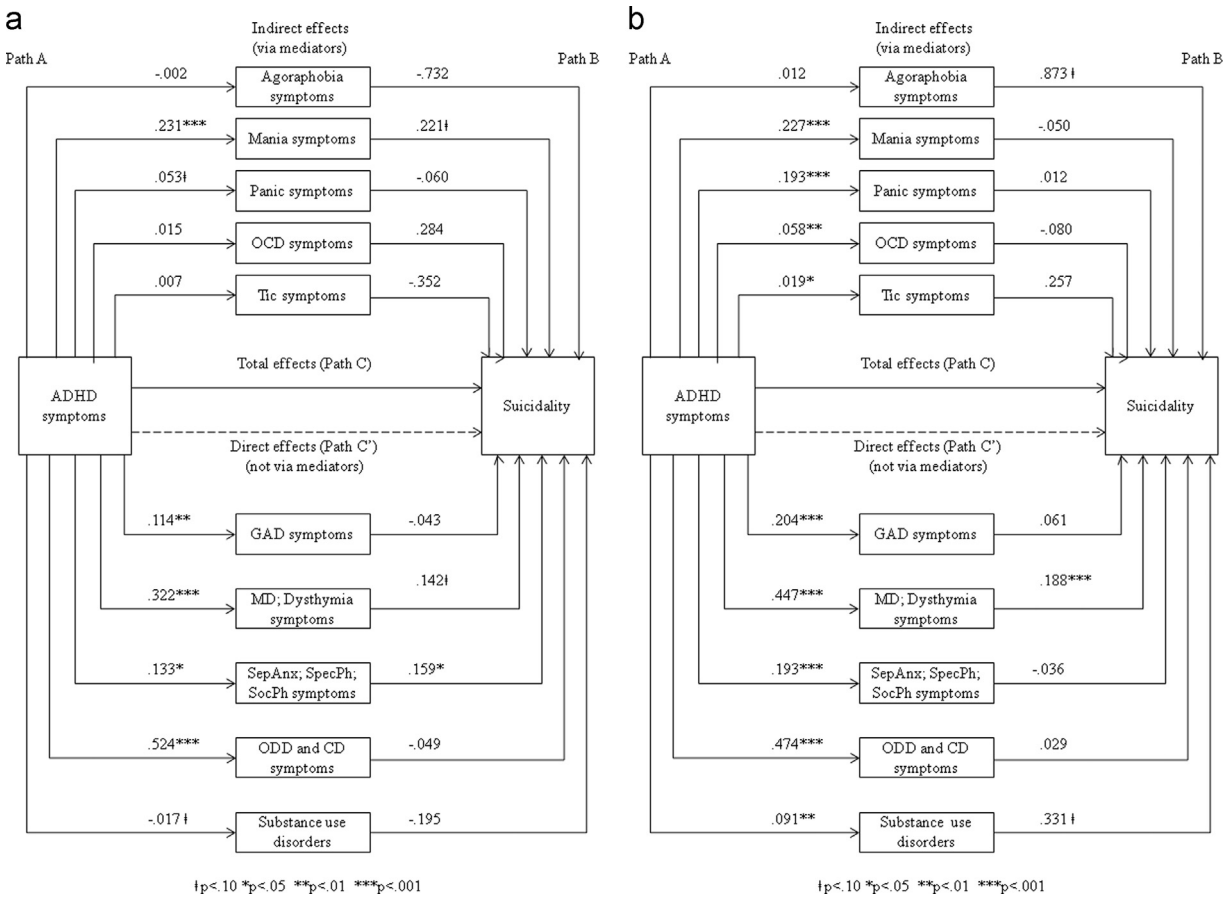

Fig. 1. (a) and (b) Indirect effects of symptoms of ADHD on current suicidality in children under 12 years old ($n=220$) (1/a) and in adolescents ($n=198$) (2/b), as mediated by comorbide symptoms (unstandardized regression coefficients). *Note.* Age and gender are included in the model as covariates but not represented in the figure for reasons of clarity.

studies except one (Cho et al., 2008) comorbid disorders with ADHD were assessed in a categorical way by structured diagnostic interviews, but in the present study the modified structured diagnostic interview screened comorbidity both in a categorical and a dimensional way.

Though the M.I.N.I. Kid measures suicidality in a sensitive way (it belongs to current suicidality, if somebody wished to be dead in the previous month) (Balázs et al., 2004; Lecrubier et al., 1997; Sheehan et al., 1998, 2010), still a striking result of our study is that already more than 10% (12.7%) of children, whose family ask for psychiatric assessment for the first time of their life and furthermore almost 40% (38.9%) of adolescents had current suicidality according to a structured diagnostic interview. Similarly to previous data, which showed an increase in the suicide with age (National Institute of Mental Health, 2012), based on our results both older children and older adolescents had an increased risk for suicidality as well. As children and adolescents in our study represented a treatment naïve study group, and knowing that psychiatric disorders (mainly untreated) are present in more than 90% of suicidal people (Gould et al., 2003), our results highlight the importance of early recognition of patients with suicidality.

Our results are consistent with those previous studies, which stated that people with ADHD have a higher risk than the ones without it of developing comorbid psychiatric problems (Biederman et al., 2006a; Willcutt and Pennington, 1999; Lewinsohn et al., 1995): in the younger age group more ADHD symptoms were associated with more symptoms of anxiety, mood and disruptive behaviour disorders, while in the adolescent group in addition to the same comorbidities which were present in the younger age group, more ADHD symptoms were associated with more symptoms of tic disorders and substance abuse and dependence as well.

Although knowing that ADHD is a strong predictor of psychiatric comorbidity in both males and females, the results on the influence of sex on the pattern and course of comorbid psychopathological conditions next the ADHD are still controversial (Gittelman et al., 1985; Biederman et al., 2006b). The current study supports that gender does not have an effect on the prevalence of current suicidality.

The results of the current study confirm previous studies showing a possible link between the symptoms of ADHD and suicidality in both age groups (Biederman et al., 2008; Cho et al., 2008; Chronis-Tuscano et al., 2010; Galéra et al., 2008; Goodman et al., 2008; Lam, 2005; Manor et al., 2010). Additionally our results support those previous studies, which suggested that comorbid conditions fully mediate between ADHD symptoms and suicidality (Cho et al., 2008).

According to our results the psychiatric symptoms, which mediate between ADHD symptoms and suicidality, are different between children and adolescents. In children the symptoms of anxiety disorders, such as separation anxiety disorder, specific phobia and social phobia were the significant mediators between the symptoms of ADHD and suicidality, while among adolescents the symptoms of depression and dysthymia, as well as of substance use disorders.

The present study should be interpreted in the context of its limitations. First, the study was cross-sectional, which made us

unable to think about any causal relationship among the symptoms of ADHD, comorbid disorders and suicidality. Second, as the study population included a treatment naïve clinical sample, we can assume that adolescents, who and/or whose family seek for help at the first time in this age belonged to the less sever end of the spectrum. Third, although the M.I.N.I. Kid measures a wide range of child and adolescent psychiatric diagnoses, it does not assess all of them. Finally, we did not use a scale for the assessment of the severity of ADHD it the current study. It would be useful, if further studies on this topic add such an instrument to their measures.

In summary, we would like to highlight, that the high prevalence of current suicidality among both treatment naïve children and adolescent with the symptoms of ADHD calls the attention of the clinicians to the importance of screening routinely suicidality in this population. Children with the symptoms of ADHD and comorbid anxiety symptoms, and adolescents with the symptoms of ADHD and comorbid depressive, dysthymic and substance use symptoms need to get special focus. Clinical implication of the current study is that early recognition and adequate combined treatment of the symptoms of ADHD and also comorbid conditions can be important in suicide prevention.

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Conflict of interest

All authors report that they have no competing interests.

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