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Article

The link between ADHD and antisocial behavior: The moderating role of the protective factor sense of coherence

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Abstract: Numerous studies have established the link between ADHD and antisocial behavior, one of the most serious functional impairments caused by the disorder. However, research on protective factors that mitigate this link is still lacking. The Salutogenic Model of Health offers the "Sense of Coherence" (SOC), establishing that individuals who see their lives as logical, meaningful, and manageable are more resistant to various risk factors and diseases. The present study examines for the first time whether SOC is also a protective factor against ADHD-related different types of antisocial behaviors (severe/mild violent behavior, verbal violence, property crimes, public disorder, and drug abuse). 2260 participants aged 15-50 completed online questionnaires assessing the level of ADHD symptoms, antisocial behaviors, and SOC. An interaction between ADHD and SOC was found in predicting each type of antisocial behavior. The link between ADHD and antisocial behavior was significantly weaker for high than low SOC participants, regardless of age group. The current study found that people with high SOC are protected against the effect of ADHD on one of the most serious functional impairments, antisocial behavior. These findings suggest that SOC is a protective factor from the adverse effects of ADHD, justifying further prospective and intervention studies.

Keywords: ADHD; Antisocial Behavior; Sense of Coherence; Protective Factors

1. Introduction

1.1. The link between ADHD and antisocial behavior: The moderating role of the protective factor sense of coherence

ADHD is a common neurodevelopmental condition defined by symptoms of inattention, hyperactivity, and impulsivity, accompanied by academic, occupational, or social functional impairment (Faraone et al., 2021). The functional impairment that this study focuses on is antisocial behavior. This term refers to a range of antisocial behaviors, both criminal and non-criminal (such as verbal aggression) (Cuevas et al., 2013).

1.2. ADHD and antisocial behavior

Numerous studies have indicated that ADHD is associated with antisocial behavior and delinquent acts (Retz et al., 2020). The results of these studies indicated that in comparison to individuals without ADHD, adolescents, young adults, and middle-aged adults with ADHD tend to be more involved in the criminal justice system, are arrested and convicted at an earlier age, and have an increased risk of conviction, incarceration, and criminal recidivism (Young & Cocallis, 2021).

The prevalence of ADHD among incarcerated people is high and estimated at around 25-45%, varying depending on the measurement method (Baggio et al., 2018; Young et al., 2015). Longitudinal studies that examined childhood ADHD found that it predicts a higher prevalence of antisocial behavior in adulthood (Cherkasova et al., 2021). In the general population, levels of ADHD symptoms predict antisocial behavior even after con-

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trolling for additional risk factors (Mohr-Jensen & Steinhausen, 2016). Similarly, the association between ADHD and antisocial behavior remained significant after controlling for a wide range of psychosocial variables (Baggio et al., 2018; Young & Cocallis, 2021). It seems, therefore, that there is a clear correlation between ADHD and antisocial behavior. Still, most people with ADHD do not engage in antisocial behavior, suggesting that other factors influence the relationship. Therefore, we suggest looking for a factor that mitigates the link between ADHD and antisocial behavior.

1.3. Interaction in the prediction of antisocial behavior

Various variables that interact with ADHD symptoms in the prediction of antisocial behavior have been examined in the research literature. For example, it was found that targeted drug therapy for ADHD decreases antisocial behavior by 30-40% (Young & Cocallis, 2021; Retz et al., 2020). Other studies reported an interaction between ADHD and variables such as substance use and past arrest in predicting delinquent behavior (van der Maas et al., 2018; Breuer et al., 2020; García et al., 2021). Notably, these moderating variables are in themselves on the spectrum of antisocial behavior. Therefore, to understand how ADHD leads to antisocial behavior, it is crucial to find other factors that do not constitute a type of antisocial behavior themselves.

Several studies focused on religiosity as a potential moderator, yielding inconsistent results. In one study, religiosity increased the risk of antisocial behavior such that for religious people, ADHD was a weaker predictor of antisocial behavior (Novis-Deutsch et al., 2021). In another study, high ADHD symptoms combined with high religious participation predicted increased levels of antisocial behavior (Dew et al., 2020). A prospective study, which examined the effect of childhood ADHD on adolescent antisocial behavior, found that a good parent-child relationship moderated and decreased the risk of antisocial behavior. Thus, among 15 years old adolescents whose parents showed a more considerable decrease in parental involvement, increases in hyperactivity/impulsivity predicted higher levels of antisocial behaviors.

In contrast, among adolescents whose parents showed a more considerable or no decrease in parental involvement, increases in hyperactivity/impulsivity did not predict antisocial behaviors (Giannotta & Rydell, 2016). Another study found positive parenting to moderate the relation between ADHD symptoms and positive alcohol expectancies among children in grades 4-12 (Morse, 2020). ADHD symptoms predicted higher positive alcohol expectancies at high levels of positive parenting, whereas at low levels of positive parenting, ADHD symptoms predicted lower positive alcohol expectancies. As alcohol expectancies are highly related to alcohol use (Armeli et al., 2000), this moderation effect was not in the expected direction, yet it shows that contextual characteristics may affect the relation between ADHD and antisocial behaviors. Furthermore, it was found that an agreeable personality moderated the relation between ADHD and antisocial behavior. Specifically, among adults with a childhood history of ADHD and conduct problems, higher levels of agreeableness weakened the association between inattention and level of criminal involvement (Sagar, 2021).

To summarize, a literature review demonstrates the paucity of research on psychosocial factors that do not constitute antisocial behavior by themselves but moderate the relation between ADHD and antisocial behavior. The present study aims to fill in this gap.

1.4. Sense of Coherence

The Salutogenic Model of Health focuses on health promotion, setting out against what is termed the "pathogenic approach": the assumption that the basic human condition is health, hence focusing on risk factors involved in disease generation (Antonovsky, 1987; Antonovsky, 1993; Haugan & Eriksson, 2021). On the other hand, the Salutogenic Model assumes that health is under constant threat by various risk factors, thus focusing on factors contributing to defense mechanisms, which help to generate health (Haugan & Eriksson, 2021). Analogously, other researchers claimed that ADHD symptoms exist on a

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spectrum and do not necessarily entail functional impairment (Faraone & Biederman, 2016; Taylor et al., 2019) and that the severity of both symptoms and functional impairment can be recompensated by various protective factors (Lasky et al., 2016; Sedgwick, Merwood & Asherson, 2019). Therefore, it is vital to study the protective factors which decrease various risks associated with ADHD.

The Salutogenic Model of Health offers the concept of the "Sense of Coherence" (SOC) as a protective factor. SOC consists of three components (usually treated as a unified concept): *Comprehensibility* (the cognitive component) - the degree to which one perceives the world as logical, consistent, and predictable; *Meaningfulness* (the emotional component) - the degree to which one sees her or his life as meaningful and worthy of effort; *Manageability* (the behavioral component) – the degree to which one views oneself as competent and capable of influencing reality (Antonovsky, 1993; Eriksson & Lindström, 2005). The theory contends that individuals with high SOC, who see their lives as logical, meaningful, and manageable, are more resistant to various risk factors.

Numerous studies pointed out the relation between SOC and normative behavior (Eriksson & Lindström, 2007). For example, it was found that poor SOC was associated with a higher level of criminal offenses in young males and with recidivism (Ristkari et al., 2006; Kishi et al., 2018). High SOC was associated with decreased antisocial behavior such as smoking, alcohol consumption, and violent behavior (Nilsson et al., 2007; Mattila et al., 2011). Moreover, a study that was conducted on 5000 participants showed that patterns of substance use in the peer group predicted substance use of adolescents better in subjects with low SOC than in subjects with high SOC (García-Moya et al., 2013), suggesting that coherence is a moderator of the link between risk factors and antisocial behavior.

Only a few studies examined SOC in the context of ADHD. A longitudinal study demonstrated both an association and an interaction between SOC and ADHD. Thus, 16-year-old adolescents with ADHD reported lower SOC. Moreover, ADHD scores at age 16 predicted ADHD scores at age 21 more strongly for people with lower SOC (Edbom et al., 2010). It was also found that the high SOC was positively related to life satisfaction in ADHD students (Allah-Gholilo et al., 2015).

To summarize, the literature suggests that high SOC constitutes a protective factor against antisocial behavior. Furthermore, it may moderate various risk factors, including ADHD, and adverse outcomes, including antisocial behavior. Therefore, the research hypothesis is that the association between ADHD and antisocial behavior will be moderated by the level of coherence and reduced among subjects with high SOC.

2. Materials and Methods

2.1. Participants and Procedure

The study was authorized by the Hebrew University School of Social Work and Social Welfare's ethics committee. The participants were recruited by convenience sampling, using an online questionnaire distributed on social networks in Israel in October-November 2020. Three thousand four hundred fifteen participants between the ages of 15-and 50 responded to the questionnaire. Four hundred fifty-five participants were excluded since they did not fully answer the questionnaires that referred to the main variables: ADHD, antisocial behavior, and SOC, resulting in 2960 included in the statistical analyses. Participants were asked to complete scales that measure behavior, emotions, and perceptions in different life domains. Participants were provided with information regarding the study procedures and how their privacy and confidentiality will be secured.

2.2. Measures

Antisocial behavior was measured using the Self Report Antisocial behavior (SRD) (Elliott & Ageton, 1980). In its full version, the scale includes 47 items, which describe illegal or non-normative actions, and the respondent is requested to note the number of times the actions were performed in the last year. Internal consistency of the original scale was high (alpha = .91) (Liau et al., 1998). The scale was translated to Hebrew using the

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back translation method; the internal consistency of the Hebrew version was high (Cronbach's α = 0.908) (Elizur et al., 2007). The scale consisted of 23 items, which referred to the following measures. Four types of violent crimes: serious physical assault (4 items, ω=.729), mild physical assault (4 items, ω=.769), verbal assault (4 items, ω=.790), indirect violence (3 items, ω=.559)); property crimes (5 items, ω=.784); crimes against the public order (3 items, ω=.738). As the internal consistency of the indirect violence scale was poor, this scale was not further analyzed.

Drug use was measured using a scale developed by Johnston, O'Malley, and Bachman (1995), widely used in Hebrew translation in Israel (Schiff, Benbenishty, & Hamburger, 2008). Participants were asked to indicate their substance use in the last year. Specifically they rated their use of cannabis (2 items), alcohol (2 items), and cigarette smoking (1 item) on a 7-point Likert scale (0= never to 5= 30 times or more). The internal consistency of the scale was high (ω=.756).

The Hebrew version of the Adult ADHD Self-Report Scale (ASRS-v1.1) was used to measure the level of ADHD symptoms (Konfrotes, 2010). A total ASRS score was given by averaging all 18 items. In order to measure positive attention and impulse regulation behaviors in the general population, the wording of the 18 ADHD symptoms was phrased positively, in a similar manner to the SWAN questionnaire (Swanson et al., 2012). The internal consistency of the scale was high (ω=.887). The convergent validity of the scale was confirmed by a strong correlation (r = 0.655) with the Hyperactivity Problems subscale of the Strengths and Difficulties Questionnaire (see below).

A 13-item version of the SOC was used. The original scale has a high consistency and validity (Antonovsky, 1987, 1993), and the internal consistency in the current study was good as well (ω=.888). The different components of the scale were analyzed as one variable (Eriksson & Lindström, 2005).

Emotional problems were measured by the Strengths and Difficulties Questionnaire, which measures emotional and social adaptation (SDQ) (Goodman, 1997). The questionnaire consists of 25 items yielding five subscales. We used the emotional problems subscale as a covariate in the present study. We also used the Hyperactivity Problems scales for testing the convergent validity of the adapted ADHD symptoms scale. The reliability and validity of the scale have been established both for children (Goodman, 2001) and adults (Brann et al., 2018).

The participants filled out a socio-demographic questionnaire that included variables related to antisocial behavior and comparable between adolescents and adults: age, gender, and religiosity. Religiosity was measured by the question, "what is the level of your religiosity from 0 to 6? (0=not religious, 6=very religious)". Age was categorized as late adolescence (15-18 years), young adulthood (19-30 years), and mid-adulthood (31-50 years).

2.3. Analytic approach

The overall score of each scale was obtained by averaging the items of each respondent. Descriptive statistics of the dependent, independent, and covariates and the first-order correlations among the variables were computed. Using PROCESS (Hayes, 2017), regression analyses were conducted with antisocial behavior as the predicted variable, age, gender, religiousness, emotional symptoms, ADHD symptoms, coherence, and ADHD symptoms by coherence as predictors. A follow-up exploratory analysis examined whether the interaction between ADHD and coherence was moderated by age. The significance of the regression analyses' effects was tested via a commonly performed bootstrap analysis (bias-corrected and accelerated, 5,000 samples), which allows for greater statistical power and does not have distributional assumptions (e.g., lack of multicollinearity). All analyses were conducted using SPSS 27.0, including an SPSS macro designed for assessing moderation models (Preacher & Hayes, 2008).

3. Results

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3.1. Descriptive statistics

The means, standard deviations, medians, and minimum-maximum values of the demographic characteristics, ADHD symptoms, and antisocial behavior types are presented in Table 1. 54.5% were women (N=1614), 89.7% identified as Jewish, 87.3% were born in Israel. Age groups consisted of 1125 late adolescents (38%), 925 young adults (31.3%), and 910 mid-adults (30.7%). The average religiosity level (on a 0 to 6 scale, see below) was 2.77 (SD=1.44), and the average emotional problem score (on a 1 to 3 scale, see below) was 1.56 (SD=0.48). Notably, 10.2% of the participants reported a diagnosis of ADHD.

Table 1. Descriptive statistics of the demographic characteristics, ADHD and antisocial behavior types.

	N	Median	Mean	SD	Minimum	Maximum
Religiosity	2949	3.00	2.77	1.44	0.00	4.00
Emotional symptoms	2803	1.40	1.56	0.48	1.00	3.00
ADHD	2960	1.28	1.33	0.67	0.00	4.00
Severe physical antisocial behavior	2960	0.00	0.11	0.34	0.00	4.00
Mild physical antisocial behavior	2960	0.00	0.24	0.51	0.00	4.00
Verbal antisocial behavior	2960	0.75	1.01	0.92	0.00	4.00
Property crimes	2960	0.00	0.09	0.32	0.00	4.00
Public order crimes	2956	0.33	0.52	0.75	0.00	4.00
Drug use	2833	0.40	0.77	1.13	0.00	7.00

3.2. Correlations

Spearman's rho correlation coefficients were computed between demographic variables and ADHD, antisocial behavior types, and coherence (see Table S1 in the supplementary materials). ADHD was negatively correlated with age and religiosity and positively correlated with emotional symptoms. All antisocial behavior types were negatively correlated with age, gender, and religiosity (except for mild physical antisocial behavior, which was not significantly correlated with religiosity). Coherence was positively correlated with age and religiosity and negatively correlated with emotional symptoms and was higher in men than in women.

Spearman's rho correlation coefficients were also computed between ADHD, antisocial behavior types, and coherence (Table 2). ADHD was positively correlated with all types of antisocial behavior (severe physical, mild physical, verbal, property, public order, and drugs). Coherence was negatively correlated with ADHD and all types of antisocial behavior.

Table 2. Nonparametric Correlations between ADHD, antisocial behavior types and coherence.

	ADHD	Severe physical antisocial behavior	Mild physical antisocial behavior	Verbal antisocial behavior	Property crimes	Public order crimes	Drug use	Coherence
ADHD	1							
Severe physical antisocial behavior	.213**	1						
Mild physical antisocial behavior	.231**	.696**	1					
Verbal antisocial behavior	.247**	.444**	.571**	1				
Property crimes	.174**	.655**	.571**	.379**	1			

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Public order crimes	.273**	.446**	.481**	.542**	.434**	1		
Drug use	.127**	.286**	.265**	.271**	.300**	.362**	1	
Coherence	-.426**	-.215**	-.307**	-.380**	-.229**	-.309**	-.130**	1

**. Correlation is significant at the 0.01 level (2-tailed).

3.3. Moderation analysis

Moderation analyses were conducted to examine whether coherence levels moderated the relation between ADHD and the various types of antisocial behavior.

3.4. Severe physical antisocial behavior

This total model accounted for 12.8% of the severe physical antisocial behavior variance. As shown in Table 3, young age, male gender, lower emotional symptoms, higher ADHD symptoms, and lower coherence were significant predictors of severe physical antisocial behavior. In addition, ADHD by coherence interaction was found significant. As shown in Figure 1, ADHD symptoms predicted severe physical antisocial behavior when coherence was low but not when high. An additional model in which the age group was added as a moderating variable was tested to examine whether the ADHD by coherence interaction is stable across age groups. Notably, age by ADHD symptoms by coherence was not a significant predictor suggesting that the interaction effect of ADHD symptoms by coherence was similar across age categories.

Table 3. Moderation analysis for variables predicting severe physical antisocial behavior (N=2781).

Effect	Estimate	*SE*	95% CI	
			LL	*UL*
Fixed effects				
ADHD	**.054**	**.012**	**.031**	**.078**
Coherence	**-.048**	**.008**	**-.065**	**-.032**
ADHD*Coherence	**-.057**	**.017**	**-.093**	**-.026**
Gender	**-.065**	**.014**	**-.092**	**-.039**
Religiosity	-.003	.004	-.005	.011
Emotional symptoms	**-.052**	**.019**	**-.089**	**-.014**
Age	**-.142**	**.022**	**-.185**	**-.101**

Note. CI= confidence interval; *LL* = lower limit; *UL* = upper limit.

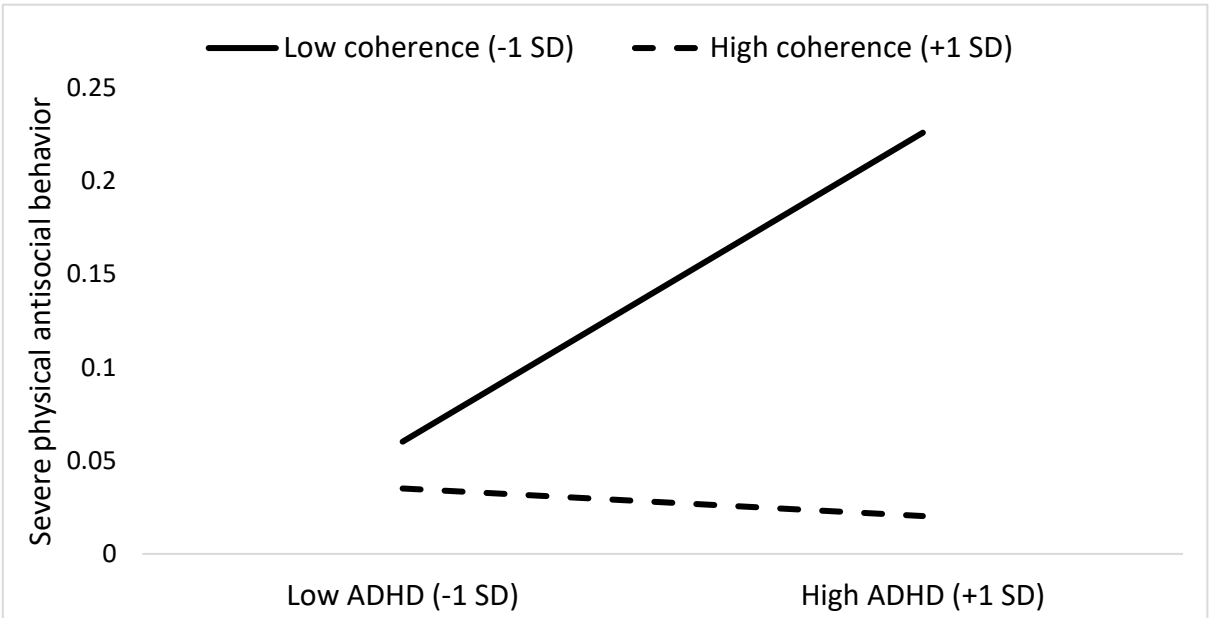

Figure 1. The Interaction Between ADHD and Severe Physical Antisocial Behavior as Moderated by Coherence.

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3.5. Mild physical antisocial behavior

This total model accounted for 18.7% of the mild physical antisocial behavior variance. As shown in Table 4, young age, male gender, lower emotional symptoms, higher ADHD symptoms, and lower coherence were significant predictors of mild physical antisocial behavior. In addition, ADHD by coherence interaction was found significant. As shown in Figure 2, ADHD symptoms predicted antisocial property behavior when coherence was low but not when high. An additional model in which the age group was added as a moderating variable was tested to examine whether the ADHD by coherence interaction is stable across age groups. Notably, age by ADHD symptoms by coherence was not a significant predictor suggesting that the interaction effect of ADHD symptoms by coherence was similar across age categories.

Table 4. Moderation analysis for variables predicting mild physical antisocial behavior (N=2781).

Effect	Estimate	*SE*	95% CI	
			LL	*UL*
Fixed effects				
ADHD	**0.080**	**.016**	**.048**	**.111**
Coherence	**-.125**	**.013**	**-.149**	**-.099**
ADHD*Coherence	**-.076**	**.019**	**-.113**	**-.038**
Gender	**-.098**	**.019**	**-.136**	**-.061**
Religiosity	**.024**	**.006**	**.012**	**.036**
Emotional symptoms	**-.105**	**.028**	**-.160**	**-.051**
Age	**-.235**	**-.030**	**-.295**	**-.178**

Note. CI= confidence interval; *LL* = lower limit; *UL* = upper limit.

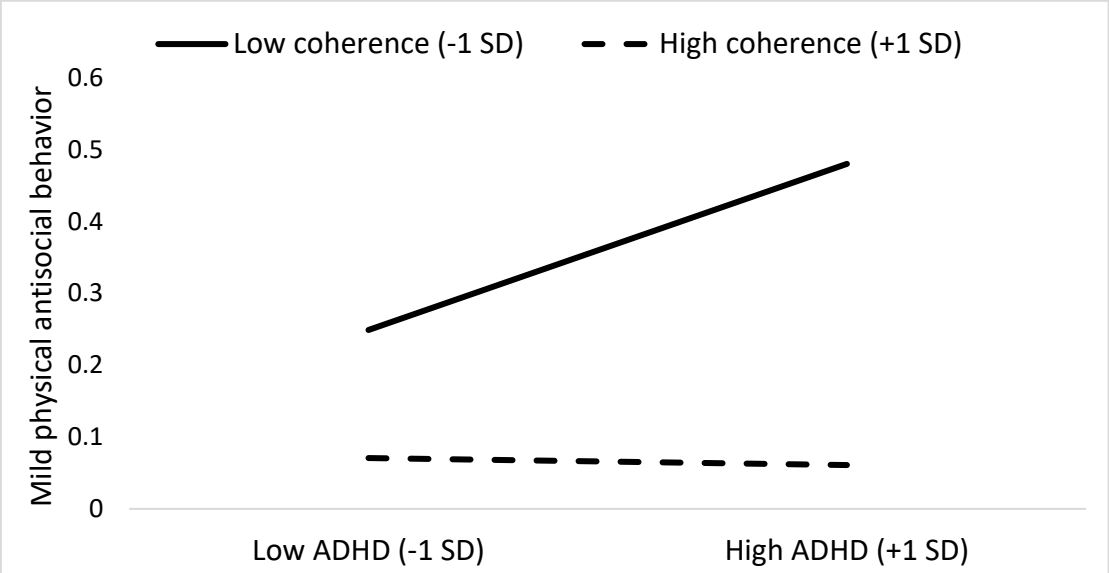

Figure 2. The Interaction Between ADHD and Mild Physical Antisocial Behavior as Moderated by Coherence.

3.6. Verbal antisocial behavior

This total model accounted for 23.3% of the variance in verbal antisocial behavior. As shown in Table 5, young age, male gender, lower religiosity levels, lower emotional symptoms, higher ADHD symptoms, and lower coherence were significant predictors of verbal antisocial behavior. In addition, ADHD by coherence interaction was found significant. As shown in Figure 3, ADHD symptoms predicted verbal antisocial behavior more strongly when coherence was low than when coherence was high. An additional model in which the age group was added as a moderating variable was tested to examine whether the ADHD by coherence interaction is stable across age groups. Notably, age by

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ADHD symptoms by coherence was not a significant predictor suggesting that the interaction effect of ADHD symptoms by coherence was similar across age categories.

Table 5. Moderation analysis for variables predicting verbal antisocial behavior (N=2781).

Effect	Estimate	*SE*	95% CI	
			LL	*UL*
Fixed effects				
ADHD	**.137**	**.027**	**.085**	**.190**
Coherence	**-.274**	**.020**	**-.313**	**-.235**
ADHD*Coherence	**-.052**	**.021**	**-.091**	**-.010**
Gender	**-.199**	**.032**	**-.256**	**-.137**
Religiosity	**-.036**	**.012**	**-.050**	**-.005**
Emotional symptoms	**-.180**	**.043**	**-.263**	**-.096**
Age	**-.418**	**.046**	**-.511**	**-.330**

Note. CI= confidence interval; *LL* = lower limit; *UL* = upper limit.

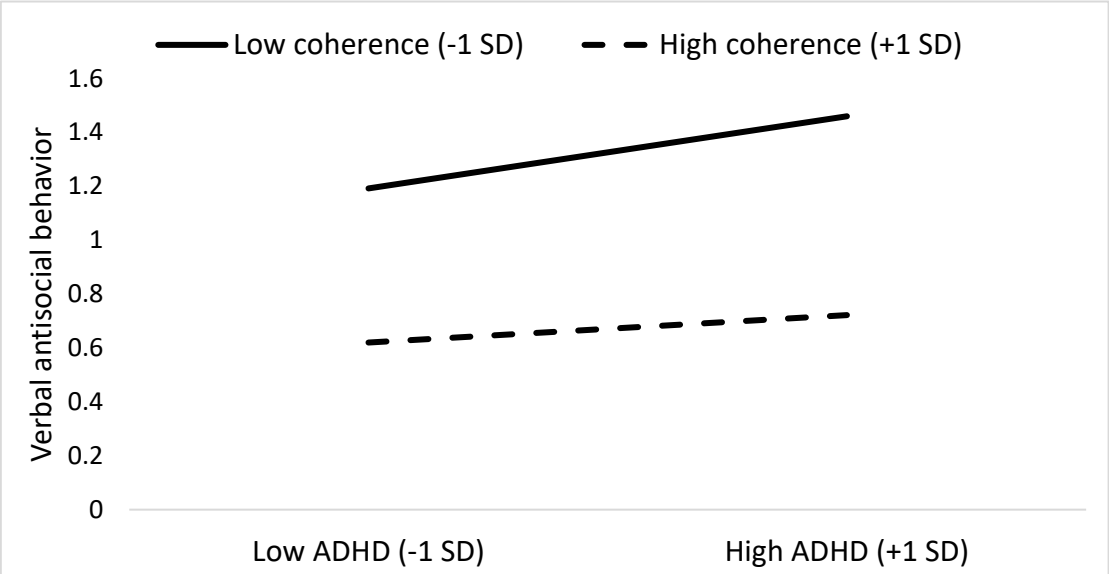

Figure 3. The Interaction Between ADHD and Verbal Antisocial Behavior as Moderated by Coherence.

3.7. Property crimes

This total model accounted for 10.4% of the variance in property crimes. As shown in Table 6, young age, male gender, lower religiosity levels, higher ADHD symptoms, and lower coherence were significant predictors of property crimes. In addition, ADHD by coherence interaction was found significant. As shown in Figure 4, ADHD symptoms predicted property crimes when coherence was low but not when high. An additional model in which the age group was added as a moderating variable was tested to examine whether the ADHD by coherence interaction is stable across age groups. Notably, age by ADHD symptoms by coherence was not a significant predictor suggesting that the interaction effect of ADHD symptoms by coherence was similar across age categories.

Table 6. Moderation analysis for variables predicting property crimes (N=2781).

Effect	Estimate	*SE*	95% CI	
			LL	*UL*
Fixed effects				
ADHD	**.022**	**.011**	**.001**	**.044**
Coherence	**-.047**	**.007**	**-.060**	**-.034**
ADHD*Coherence	**-.039**	**.017**	**-.075**	**-.010**
Gender	**-.065**	**.012**	**-.088**	**-.043**
Religiosity	**-.012**	**.004**	**-.020**	**-.004**

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Emotional symptoms	-.024	.016	-.055	.007
Age	**-.087**	**.019**	**-.125**	**-.051**

Note. CI= confidence interval; *LL* = lower limit; *UL* = upper limit.

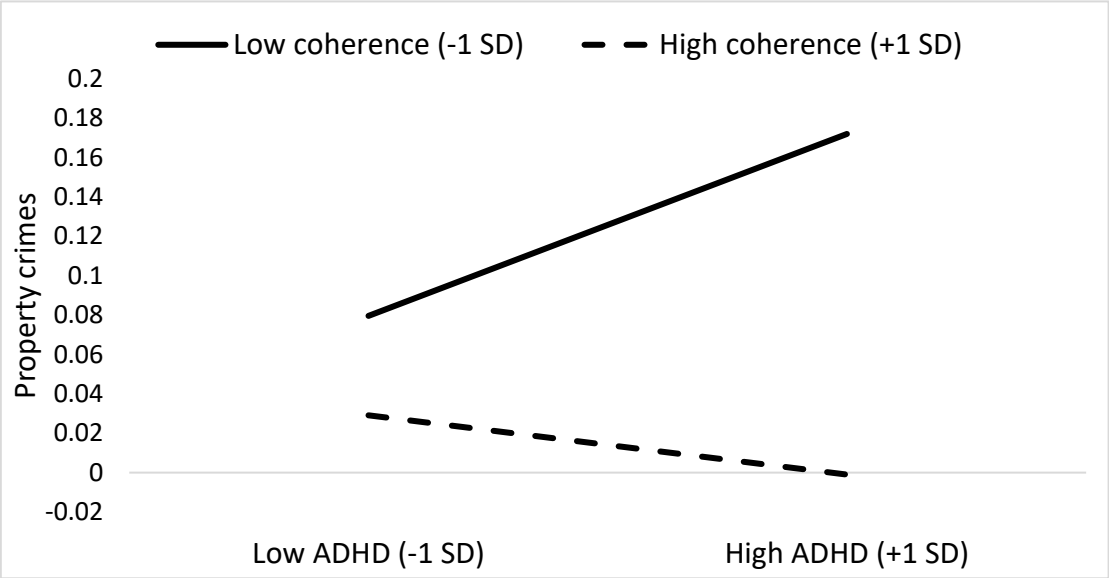

Figure 4. The Interaction Between ADHD and Property Crimes as Moderated by Coherence.

3.8. Public order crimes

This total model accounted for 22.2% of the public order antisocial behavior variance. As shown in Table 7, young age, male gender, lower religiosity levels, lower emotional symptoms, higher ADHD symptoms, and lower coherence were significant predictors of public order antisocial behavior. In addition, ADHD by coherence interaction was found significant. As shown in Figure 5, ADHD symptoms predicted mild physical antisocial behavior more strongly when coherence was low than high. An additional model in which the age group was added as a moderating variable was tested to examine whether the ADHD by coherence interaction is stable across age groups. Notably, age by ADHD symptoms by coherence was not a significant predictor suggesting that the interaction effect of ADHD symptoms by coherence was similar across age categories.

Table 7. Moderation analysis for variables predicting public order crimes (N=2778).

Effect	Estimate	*SE*	95% CI	
			LL	*UL*
Fixed effects				
ADHD	**.176**	**.023**	**.132**	**.220**
Coherence	**-.173**	**.017**	**-.206**	**-.139**
ADHD*Coherence	**-.083**	**.021**	**-.123**	**-.042**
Gender	**-.097**	**.027**	**-.149**	**-.044**
Religiosity	**-.049**	**.010**	**-.067**	**-.029**
Emotional symptoms	**-.234**	**.037**	**-.304**	**-.164**
Age	**-.332**	**.042**	**-.414**	**-.249**

Note. CI= confidence interval; *LL* = lower limit; *UL* = upper limit.

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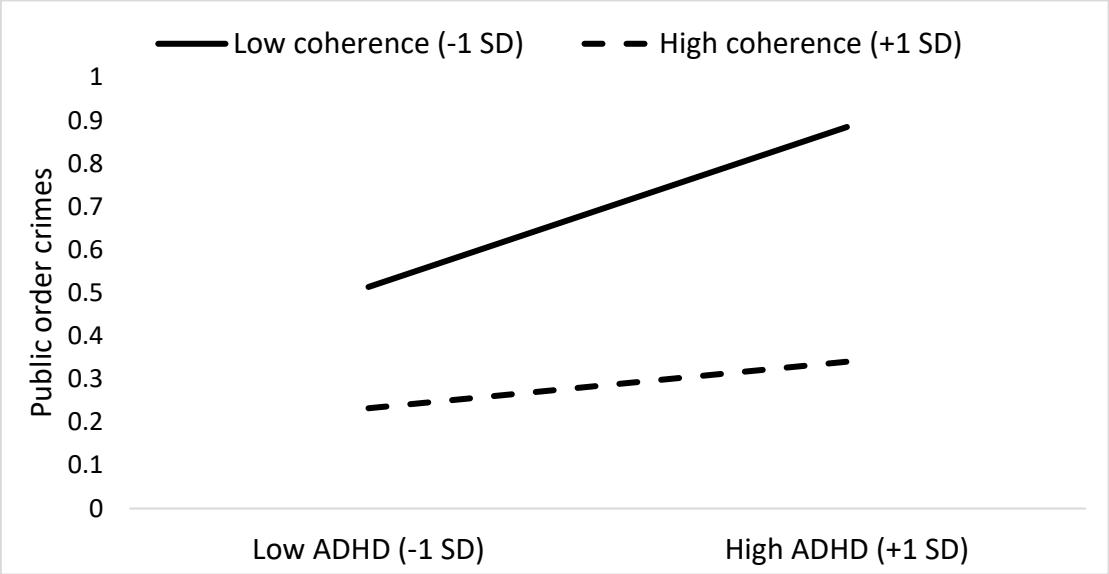

Figure 5. The Interaction Between ADHD and Public Order Crimes as Moderated by Coherence.

3.9. Drug use

This total model accounted for 16.6% of the drug's antisocial behavior variance. As shown in Table 8, older age, male gender, lower religiosity levels, lower emotional symptoms, higher ADHD symptoms, and lower coherence were significant predictors of drug use. In addition, ADHD by coherence interaction was found significant. As shown in Figure 6, ADHD symptoms predicted drug use when coherence was low but not when high. An additional model in which the age group was added as a moderating variable was tested to examine whether the ADHD by coherence interaction is stable across age groups. Notably, age by ADHD symptoms by coherence was not a significant predictor suggesting that the interaction effect of ADHD symptoms by coherence was similar across age categories.

Table 8. Moderation analysis for variables predicting drug use (N=2773).

Effect	Estimate	*SE*	95% CI	
			LL	*UL*
Fixed effects				
ADHD	**.109**	**.033**	**.043**	**.172**
Coherence	**-.113**	**.025**	**-.164**	**-.066**
ADHD*Coherence	**-.076**	**.032**	**-.137**	**-.013**
Gender	**-.716**	**.043**	**-.801**	**-.633**
Religiosity	**-.183**	**.016**	**-.213**	**-.153**
Emotional symptoms	**-.135**	**.056**	**-.246**	**-.028**
Age	**.284**	**.054**	**.177**	**.386**

Note. CI= confidence interval; *LL* = lower limit; *UL* = upper limit.

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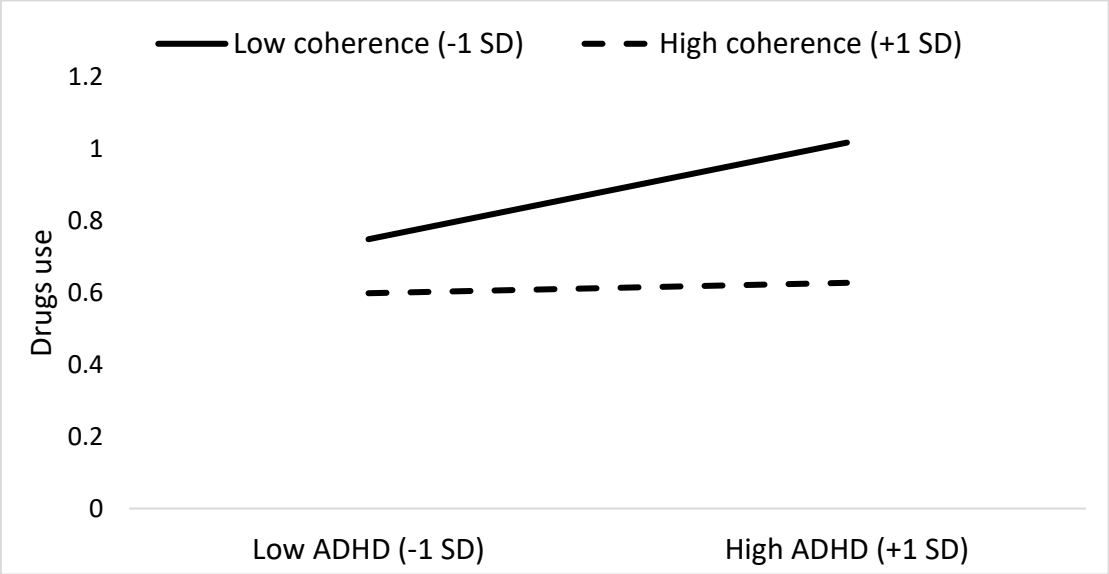

Figure 6. The Interaction Between ADHD and Drugs Use as Moderated by Coherence.

4. Discussion

The present study examined the interaction between ADHD and the sense of coherence (SOC) in predicting various types of antisocial behavior. The research hypothesis was that SOC, which constitutes a protective factor in coping with diseases and neutralizing other risk factors (Mittelmark et al., 2017), will also be a protective factor moderating the antisocial behavior risk which stems from ADHD.

This study examined several types of antisocial behavior and found that SOC moderated the relation between ADHD and antisocial behavior: for people with a strong SOC, the relation between ADHD and antisocial behavior decreased; in certain types of antisocial behavior, it was neutralized; and in some cases, a negative association was found between ADHD and antisocial behavior. The research findings suggest that SOC constitutes a protective factor for the antisocial behavior risk of ADHD, similarly to its ability to moderate another kind of risk for antisocial behavior, namely, peer influence. Specifically, the peer group's patterns of substance use predicted adolescents' substance use better in subjects with low SOC than in subjects with high SOC (García-Moya et al., 2013).

Assuming that SOC indeed decreases the levels of antisocial behavior, the generalizability question arises, i.e., whether SOC specifically protects against antisocial behavior or constitutes a general protective factor that decreases all functional impairments related to ADHD, including the impairment in well-being. The moderating role of coherence in protecting against other risks to well-being has been examined in many studies (Mittelmark et al., 2017). For example, a study investigating the relationship between work characteristics and well-being found that SOC has a moderating role in the relationships between specific risk factors and well-being. In another study, the association between social relations at work and well-being was stronger among subjects with a very low SOC, whereas these associations were less critical in determining well-being in subjects with a stronger SOC (Feldt, 1997). This question of moderating the risk of ADHD to other functional impairments is especially pertinent to the present study's findings since, in this study, ADHD symptoms were measured by self-report without an ADHD diagnosis. As ADHD diagnosis relies on the combination of ADHD symptoms and self-report of functional impairment, it is possible that participants who reported high SOC are those whose symptoms did not cause functional impairment and would not meet the criteria of ADHD diagnosis.

4.1. Limitations

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Notably, since this research is cross-sectional, one cannot infer causality, and this issue needs to be examined using longitudinal and interventional designs. Findings of previous longitudinal studies indicate that SOC constitutes a protective factor for other outcome variables. For example, it was found that a strong SOC moderates the risk for long-term persistence of ADHD (Edbom et al., 2010). In addition, the phrasing of the items in the present study may also suggest that higher levels of SOC preceded the decrease in antisocial behavior. While participants were requested to refer to a general SOC in their life, in the antisocial behavior scale (SRD), they were requested to refer only to the last year.

The measuring of antisocial behavior relied on participants' self-report without collateral support from other sources such as partners' reports or criminal records. However, it allows referring to antisocial behaviors that are not documented in criminal records. Notably, criminal records might contain a certain rate of false convictions due to false confessions, which are more prevalent among individuals with ADHD (Gudjonsson, Gonzalez &Young, 2021).

Another limitation is that the study examined ADHD symptoms in the past six months. Referring only to adulthood ADHD symptoms might supply a partial picture since ADHD symptoms tend to be less conspicuous in adults (Cherkasova, 2021). Additionally, measuring ADHD symptoms using only self-report tends to lessen the actual level of ADHD symptoms (Brikell et al., 2015). Finally, the study was conducted during a global pandemic, which might have influenced the level and severity of antisocial behavior (Cheung & Gunby, 2021).

4.2. Research contribution and recommendations

The main contribution of this study is showing that ADHD constitutes a risk factor for antisocial behavior only when combined with further factors. This approach corresponds to the WHO's International Classification of Functioning, Disability and Health (ICF) manual (WHO, 2013). The ICF distinguishes between several concepts: *impairments* - problems in body function and structure such as significant deviation or loss; *activity limitation* - difficulties an individual may have in executing activities; and *participation restriction* - problems an individual may experience in involvement in life situations. The individual's functioning and health consist of the interactions between these three components with personal and developmental factors (WHO, 2013). The ICF model was implemented in previous studies of ADHD (Loe & Feldman, 2007; de Schipper et al.,2015; Sedgwick et al.,2019). The present study adds to the existing literature by implementing the ICF model in the context of ADHD and antisocial behavior.

Antisocial behavior can be defined as one of the central functional impairments associated with ADHD, which creates a participation restriction in normative society. The findings call for the application of the ICF model in the domain of ADHD and antisocial behavior, suggesting that the antisocial behavior stemming from ADHD is a product of the interaction between ADHD symptoms and a personal factor (SOC). This finding is consistent with the growing trend in the research literature calling for examining resilience factors for the risks for functional impairments associated with ADHD (Climie & Mastoras, 2015; Davis, 2014; Dvorsky & Langberg, 2016; Giannotta & Rydell, 2016; Jia et al., 2021; Lasky et al., 2016; Lee et al., 2016; Lesch, 2018; Sedgwick et al., 2019; Schoenfelder, 2016).

5. Conclusions

Our study points out the SOC, a protective factor that can be influenced by therapeutic intervention, similarly to what has been done in the context of other disorders (Jensen et al., 2016; Mayer & Boness, 2011; Odajima et al., 2017; Tan et al., 2015; Uzdil et al., 2021). In light of the research findings, there is a need to explore the ICF model further using a longitudinal study. Moreover, an interventional study is also needed to explore new methods of strengthening SOC among individuals with ADHD.

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