Sense of Coherence is Associated with Functional Impairment in Individuals Diagnosed with ADHD

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Abstract

Aims: People diagnosed with ADHD are in a higher risk for anti-social behaviors, substance abuse, emotional distress, and low happiness. It is necessary to know about factors that can predict the increased risk of these comorbidities as well as the protective factors that can be implemented therapeutically, for the purpose of reducing the risk of these functional impairments. Sense of coherence (SOC) was found to protect against various risk factors and health conditions. The present study examined whether SOC correlates with better functioning among adults and adolescents diagnosed with ADHD.

Methods: 468 participants aged 15-50, who reported being diagnosed with ADHD, answered an online survey that included validated questionnaires regarding SOC and functional impairment in the following domain: anti-social behaviors, substance abuse, emotional distress, and low happiness.

Results: Participants who reported a higher SOC also reported lower functional impairments in all domains. The association between SOC and outcome variables was similar in both genders and in both adolescents and adults.

Conclusions: SOC is central for predicting various functional impairments among individuals diagnosed with ADHD. These findings have practical implications for the detection of an at-risk subgroup within the ADHD population and may inform the development of interventions aimed at increasing SOC for people with ADHD. The findings should be further tested in longitudinal and intervention studies.

Introduction

ADHD is a common neurodevelopmental disorder characterized by symptoms of inattention, hyperactivity, and impulsivity (Faraone et al., 2021). ADHD in children and adolescents persists into adulthood at significant rates, continuing to cause various functional impairments (Di Lorenzo et al., 2021; Kooij et al., 2019). The correlation between ADHD and unfavorable outcomes, such as criminal behavior and negative life events, remains even after controlling for confounding variables and risk factors (Garcia et al., 2020; Mohr-Jensen et al., 2019). Despite the distinct risk factor, outcomes are not the same among all those diagnosed with ADHD (Schubiner & Katragadda, 2008; Spencer et al., 2007). Tools are needed to help identify subgroups within this population that are at increased risk of comorbidities with various disorders. Additionally, in the research literature, much is known about risk factors for ADHD functional impairments and little is known about the protective factors (Chan et al., 2021; Climie & Mastoras, 2015; Davis, 2014; Duh-Leong et al., 2020; Dvosky & Langberg, 2016; Freire et al., 2021; Fuller-Thomson et al., 2022; Giannotta & Rydell, 2016; Jia et al., 2021; Lasky et al., 2016; Lee et al., 2016; Lesch, 2018; Sedgwick et al., 2019; Schoenfelder, 2016). The present study focuses on examining the contribution of the protective factor "sense of coherence" in reducing the relationship between ADHD and a variety of functional impairments: antisocial behavior, substance abuse, emotional distress and low happiness, among different age groups.

ADHD, anti-social behavior and emotional distress

Numerous studies have indicated that ADHD is associated with anti-social behavior and delinquent acts
These studies demonstrated that compared to individuals without ADHD, adolescents and adults with ADHD are more often involved in the criminal justice system. Thus, they are more likely to be arrested, convicted, and incarcerated and to be so at an earlier age. They also show an increased risk of criminal recidivism (Young & Cocallis, 2021).

ADHD is also associated with various forms of substance abuse, including tobacco and marijuana smoking, alcohol drinking, and illicit drug use (Di Lorenzo et al., 2021; Fuller-Thomson et al., 2022a; Oliva et al., 2021; Zulauf et al., 2014). Previous meta-analyses linked childhood ADHD to abuse and dependence on nicotine, alcohol, marijuana, cocaine, and other substances (Lee et al., 2011; Charach et al., 2011; Groenman et al., 2017).

In addition to its association with anti-social behaviors (like delinquency and substance abuse), ADHD was found also as a risk factor for emotional dysregulation and distress (Hirsch et al., 2018; Kessler et al., 2006; Lee et al., 2016). Relatedly, Individuals with ADHD have a higher tendency for comorbid psychiatric disorders, including anxiety, depression, behavioral disorders, and personality disorders (Anker et al., 2018; Ottosen et al., 2019). Finally, as well-being and happiness are considered the ultimate goal of health (Howell et al., 2007), it is notable that ADHD is also associated with low well-being and happiness (Agarwal et al., 2012; Fuller-Thomson et al., 2022b; Pinho et al., 2019; Stickley et al., 2018).

Protective and risk factors influencing ADHD-related functional impairment

Although ADHD is a neurodevelopmental disorder, its presentation and functional impairment depend on various environmental, personality, cognitive, and social factors (Weissenberger et al., 2017). Previous studies have examined risk and protective factors that correlate with ADHD-related functional impairment in the domains on which this study focuses: antisocial behaviors and mental health problems.

Factors influencing ADHD-related anti-social behavior

Various variables predicting risk for developing antisocial behavior patterns among people with ADHD have been examined in the research literature. For example, ADHD symptom severity, deviant peer affiliation and low non-verbal intelligence (Breuer et al., 2020; García et al., 2021; Thapar et al., 2006). Similarly, agreeable personality, religiosity and targeted pharmacotherapy were found as factors that decrease this risk (Young & Cocallis, 2021; Retz et al., 2020; Novis-Deutsch et al., 2021; Dew et al., 2020; Giannotta & Rydell, 2016; Sagar, 2021).

Factors influencing ADHD-related mental health problems

Various variables predicting levels of distress and happiness among people with ADHD have been examined in the research literature. For example, being married, being physically active, and using spirituality to cope with challenges was positively associated with complete mental health among adults with ADHD. Complete mental health was defined as an absence of mental illness and substance dependence and a presence of happiness and well-being. Additionally, adverse childhood experiences, debilitating pain, and a history of depression and anxiety were negatively associated with complete mental health (Fuller-Thomson et al., 2022b). Moreover, higher education and work participation were related to a lower probability of comorbid psychiatric disorders in a clinical sample of adults with ADHD (Anker et al., 2018).

Sense of Coherence

The Salutogenic Model of Health (Antonovsky 1987, Langeland & Vinge 2022) offers the concept of the “Sense of Coherence” (SOC) as a protective factor for various risk situations, including diseases and disorders (Langeland et al., 2022). 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 found associations between high SOC and physical, mental, social, and behavioral health (Eriksson & Lindström, 2006; Lewin et al., 2013; Mittelmark et al., 2017). Some studies demonstrated an association between increased SOC and an improved patient’s emotional state (Winger et al., 2016). It was also shown that interventions that increased SOC effectively reduced disease symptoms (Uzdil et al., 2022). Similarly, few studies pointed out the relation between SOC and normative behavior (Eriksson & Lindström, 2007). For example, it was found that poor SOC was associated with higher criminal offenses in young males and with recidivism (Ristikari et al., 2006; Kishi et al., 2018). High SOC was associated with decreased anti-social behavior, including violent behavior, smoking, and drinking (Nilsson et al., 2007; Mattila et al., 2011). Moreover, a broad study showed that patterns of substance use in the peer group predicted substance use of adolescents better in participants with low SOC than in participants with high SOC (García-Moya et al., 2013), suggesting that SOC is a moderator of the link between risk factors and anti-social behavior. The present study aims at examining the extent to which SOC is associated with the level of functioning in people diagnosed with ADHD.

SOC as a protective factor influencing ADHD-related functional impairment

In a recent study we conducted among general population children and adults, it was found that SOC moderated the association between ADHD symptoms and anti-social behavior, such that for people with high levels of SOC, ADHD symptoms were a weaker risk factor for anti-social behavior (Dayan, Khoury-Kassabri & Pollak, 2022). However, high levels of ADHD symptoms are not equivalent to an ADHD diagnosis since ADHD diagnosis relies on the presence of both ADHD symptoms and functional impairment (World Health Organization, 1993). Therefore, in the present study we firstly aim to examine the protective role of SOC against anti-social behavior for people diagnosed with ADHD.

Another inquiry for the present study focuses on whether sense of coherence will predict an improvement in mental health and happiness. As reviewed earlier, high SOC is associated with better mental health and well-being in both healthy people and patients (Del-Pino-Casado et al., 2019; Winger et al., 2015). However, the role of SOC in predicting mental health and happiness among individuals with ADHD has not been studied yet.

Moreover, studies that measured sense of coherence across different age and gender groups found that the measurement model remains consistent (Grevenstein & Bluemke, 2022). Sense of coherence is known to be present in the individual from a young age and to continue developing over the years (Eriksson & Contu, 2022). Additionally, sense of coherence is a resilience factor that was found as predicting mental health even from adolescence (Carlén et al., 2020). Hence, another aim of the present study is to examine whether the protective role of coherence will vary among different age groups.

To summarize, individuals with ADHD are at risk for functional impairments. In light of previous findings that demonstrated the protective role of SOC against anti-social and mental health problems, the current study sought to examine whether: a. Sense of coherence predicts a decrease in delinquency among ADHD diagnosed population. b. Sense of coherence predicts an improvement in mental health among ADHD diagnosed population. c. The protective role of coherence varies across different age groups.

Methods

Participants

The participants were recruited by convenience sampling, using an online questionnaire distributed on social networks in Israel from 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, delinquency, and sense of coherence. From the remaining 2960 participants, a sample of those who responded “yes” to the question: “Have you ever been diagnosed with a diagnosis of attention-deficit/hyperactivity disorder
(ADHD)?" was selected for the current study, resulting in 486 participants included in the statistical analysis. Participants were also asked to complete scales measuring behaviors, emotions, and perceptions in different life domains. In addition, participants were provided with information regarding the study procedures and how their privacy and confidentiality will be secured.

For analysis purposes, participants were grouped into two age groups: age below 18 (N=133, 27%) and age between 18-50 (N=353, 73%). 45.1% of the sample were women (N=217), and 96.3% were born in Israel. 48.2% of the participants were single, 45.3% were married or in a relationship, and 5.5% were divorced. 38.5% of the participants identified as ultra-orthodox, 22.6% as Orthodox, 10.9% as traditional, 25.1% as non-religious, and 2.9% did not define themselves religiously. 33.3% of the participants had an elementary or high-school education, 36.5% had up to 14 years of education, and 30.2% were graduates. Regarding economic status, 13.4% reported a very low level, 28.3% low level, 48.7% medium level, 8.2% high level, and 1.5% very high level. At the study time, 40.4% did not work, 12.3% worked part-time, and 47.3% worked full-time.

**Measures**

**Anti-social behavior**

Delinquency was measured using the Self Report Delinquency (SRD) (Elliott & Ageton, 1980). In its full version, the scale includes 47 items that 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. Test-retest reliability of the original scale was high (r = 0.8 – 0.99). The scale was translated to Hebrew using the back translation method; the internal consistency of the Hebrew version was high (Cronbach’s α = 0.908) (Elizur et al., 2007).

The scale included 27 items which referred to the following measures: violent crimes (15 items: 4 serious physical assaults (ω =.729), 4 mild physical assaults (ω =.769), 4 verbal assaults (ω =.790), 3 indirect violence (ω =.559)); property crimes (5 items, ω =.784); crimes against the public order (3 items, ω =.738); and cyber-crimes (4 items, ω =.623). As the internal consistency of the indirect violence scale was poor, this scale was not further analyzed.

Substance use was measured using a scale developed by Johnston, O’Malley, and Bachman (1995), the Hebrew translation of which is widely used 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).

**Mental Health**

Emotional distress was measured by the Strengths and Difficulties Questionnaire, which probes emotional and social adaptation (SDQ) (Goodman, 1997). The questionnaire consists of 25 items comprising 5 subscales. We used the emotional problems subscale as a covariate in the present study. The scale was found to be valid and reliable for children (Goodman, 2001) and adults (Brann et al., 2018).

Happiness was assessed using a single question: "In general, how do you feel about your life at present?" Predefined response categories were: “I feel very happy” (15.7% of responses), “I feel quite happy” (45.1%), “I don’t feel very happy” (31.9%), “I am not happy at all” (7.3%) (Natvig et al., 2003).

**Sense of coherence**

SOC was measured using a 13 items Likert scale (Antonovsky, 1987). We used a shortened version of the scale, which includes 13 items that were found to be highly correlated with items in the original long version of the scale. The items’ average was the participant’s SOC score (Antonovsky, 1993). This scale has a high internal consistency (α=0.83) and validity (Antonovsky, 1987, 1993). The internal consistency in the current study was also high (ω=.888 ). The different components of the scale were analyzed as one variable as suggested (Eriksson & Lindström, 2005).

**Socio-demographic characteristics**

4
The participants filled out a socio-demographic questionnaire that included variables related to anti-social behavior. For the sake of the current study, we used as covariates only the variables that are comparable between adolescents and adults, i.e., age and gender. Age was categorized as adolescence (15 – 17) and adults (18 – 50).

Analytic approach

Means and standard deviations of the study variables were computed. Non-parametric correlation analyses among the variables were conducted. Linear and ordinal regression analyses were performed using IBM SPSS Statistics 27 package with anti-social behavior, substance use, emotional distress, and happiness as the predicted variables, and coherence, age and gender as predictors. Moderation analyses were performed using the PROCESS macro (Hayes, 2013). Statistical significance was determined using a 95% CI based on 5,000 bias-corrected and accelerated bootstrap samples, which are more robust to violation of distributional assumptions.

Results

Descriptive statistics

The distributions of the demographic and study variables are presented in Table 1.

Correlations

As the distribution of part of the study variables is assumed not to be normal (e.g., delinquency), we analyzed the data using non-parametric tests. Spearman’s rho correlation coefficients were computed between age, gender, and the study variables (delinquency, substance use, emotional distress, happiness, and SOC) (see Table 2). SOC was positively correlated with age and with being male. Additionally, SOC was negatively correlated with delinquency, substance use, and emotional distress and was positively correlated with happiness.

Regression analyses

Hierarchical linear regression was conducted to examine the contribution of coherence to the prediction of the dependent variables above and beyond age and gender.

Table 3A summarizes the $R^2$ estimates of the four models. Tables 3B-E present the regression coefficient of the predictors of each of the models. In the first model, age, gender, and SOC predicted delinquency above and beyond each other. The relative contribution of SOC was considerably greater than the other variables (see Table 3B). In the second model, age, gender, and SOC predicted substance use above and beyond each other. The relative contribution of SOC was considerably greater than the contribution of age but not of gender (see Table 3C). In the third model, age, gender, and SOC predicted emotional distress above and beyond each other. The relative contribution of SOC was considerably greater than the other variables (see Table 3D). In the fourth model, gender and SOC predicted happiness above and beyond each other. The relative contribution of SOC was considerably greater than the contribution of gender (see Table 3E).

Moderation analyses were conducted to explore whether the prediction of the study variables by SOC was affected by age and gender. No significant moderation was found on any dependent variables (see supplementary TableS1-2). These findings indicate that the prediction of the dependent variables by SOC was similar across the different age and gender groups.

Discussion

The study examined differences in the severity of ADHD-related functional impairment in relation to SOC levels in a population of young and adult individuals with ADHD. It was found that individuals who reported high SOC levels also reported less anti-social behavior, less substance abuse, less emotional distress, and more happiness. Although ADHD is negatively associated with resilience in general and with SOC in particular, SOC remains an independent predictor of social and emotional functioning among individuals with ADHD.
Although the contribution of SOC to coping with various diseases and risk factors was well established in research literature, there is a lack of research regarding ADHD. In a previous study, we found that SOC moderated the link between ADHD symptoms and anti-social behavior in the general population (Dayan et al., 2022). The current study employed the same database to examine additional issues. First, diagnosed and non-diagnosed people are two different populations. Functional impairment (e.g., anti-social behavior) is necessary for diagnosing ADHD. Hence, whether SOC continues to relate to lower functional impairment even in a subsample consisting of individuals with ADHD diagnosis, i.e., who have functional impairment, remained an open question. Second, in the current study, functional impairment was studied in the mental health domain along with the anti-social domain.

Considering the high rates of ADHD diagnosis, and the serious functional damages attributed to the disorder (affecting individuals and society), it is important to develop tools that will help targeting the subgroups which are at greater risk of developing poor functional outcomes. In the current study we found that examining the level of sense of coherence can significantly predict who is likely to develop poor functional outcomes. Thus, according to these findings, among people with ADHD, sense of coherence explains 23% and 40% of the variance in delinquency and emotional distress, respectively.

Previous studies have indicated that the association of poor functional outcomes with ADHD depends on additional background variables. The current study focused on an early personality factor which is not on the criminal continuum. Additionally, some studies focused on factors that are less amenable to intervention such as past childhood experiences, level of intelligence, religiosity, etc. (Breuer et al., 2020; García et al., 2021; Thapar et al., 2006). In the current study, the focus was on an amenable protective factor that has been proven to be effective in other diseases and can also be applied in the context of ADHD.

These findings are consistent with research literature demonstrating that although ADHD is a major risk factor, it is not exclusive in causing the results attributed to it, and protective factors can significantly reduce functional impairments. This approach corresponds to the WHO’s International Classification of Functioning, Disability and Health (ICF) manual (World Health Organization, 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). In these implementations, ADHD symptoms comprise the impairment in body function, and the academic and social problems comprise the activity limitations and the participation restrictions. Personal and family factors were found to protect against the risk of academic and social problems. For example, it was found that among children with ADHD, family coherence and community support show protective effects on academic and social outcomes (Duh-Leong et al., 2020). The current study suggests that the ICF model can be implemented in the context of ADHD and anti-social behavior as well, with anti-social behavior as an activity limitation or participation restriction. Importantly, this implementation implies that the association between ADHD and anti-social behavior is not inevitable but rather depends on risk and protective factors. Specifically, the current study suggests that the personal factor SOC interacts with ADHD symptoms, reducing the risk for anti-social behavior.

Limitations

Notably, since this research is cross-sectional, one cannot infer the directionality and causality of the link between SOC and functional impairment, and these issues need 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 (Edsbom 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 anti-social behavior and distress.
While participants were requested to refer to a general SOC in their life, they were requested to refer to the previous year on the delinquency scale and emotional distress scales, the previous month on the substance use scale, and those days on the happiness scale.

The measuring of anti-social behavior relied on participants’ self-report without collateral support from other sources such as partners’ reports or criminal records. However, it allows referring to anti-social 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 (Brikkell et al., 2015). Finally, the study was conducted during a global pandemic, which might have influenced the level and severity of anti-social behavior (Cheung & Gunby, 2021).

Research contribution and recommendations

The main contribution of this study is showing that ADHD constitutes a risk factor for anti-social behavior and mental health problems only when combined with other factors, as implicated by the ICF model (WHO, 2013). The study suggests that the anti-social behavior and mental health problems stemming from ADHD are a product of the interaction between ADHD symptoms and a personal factor, namely 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 (Chan et al., 2021; Climie & Mastoras, 2015; Davis, 2014; Duh-Leong et al., 2020; Dvorsky & Langberg, 2016; Freire et al., 2021; Fuller-Thomson et al., 2022; Giannotta & Rydell, 2016; Jia et al., 2021; Lasky et al., 2016; Lee et al., 2016; Lesch, 2018; Sedgwick et al., 2019; Schoenfelder, 2016).

These findings have several implications for research, policy and clinical practice. Assuming that the findings are repeated in a longitudinal study, it will be possible to use a SOC questionnaire to estimate the participants’ prognosis and detect those with increased risk who require more intensive intervention. This also has implications for public health policy, since by measuring coherence levels, it is possible with a relatively small investment (short and accessible self-report questionnaire for children, adolescents and adults) to locate among ADHD-diagnosed population those subgroups which are at an excess risk of developing emotional or social distress, and to focus the intervention efforts at them.

In addition, it was suggested that new theoretical characterizations of ADHD should be developed and validated to provide novel treatment design opportunities (Champ et al., 2021). This study suggests that SOC is an important factor influencing functional outcome in ADHD and invites consideration of new ways of intervention with an emphasis on increasing SOC. The research findings suggest that interventions that increase SOC may be beneficial for people with ADHD, as has been demonstrated in the context of other medical and social conditions such as diabetes and dialysis patients, ICU survivors and older people in the community (Jensen et al., 2016; Odajima et al., 2017; Tan et al., 2015; Uzdil et al., 2021). In light of the research findings, there is a need to develop and test an intervention study targeting SOC among individuals with ADHD.

Declarations

Funding and/or Conflicts of interests/Competing interests: The author declares that there are no conflicts of interest that could have influenced the results or interpretation of this research. The author has no financial or personal relationships with individuals or organizations that could have influenced the work presented in this paper.

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**Tables**

**Table 1- Descriptive statistics of the study variables**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
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<th>Maximum</th>
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<tbody>
<tr>
<td>Age</td>
<td>486</td>
<td>23.62</td>
<td>8.47</td>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td>Gender</td>
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<td>1.45</td>
<td>0.49</td>
<td>1.00</td>
<td>2.00</td>
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<tr>
<td>ADHD</td>
<td>486</td>
<td>1.84</td>
<td>0.68</td>
<td>0.17</td>
<td>4.00</td>
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<tr>
<td>Delinquency</td>
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<td>0.59</td>
<td>0.54</td>
<td>0.00</td>
<td>3.00</td>
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<tr>
<td>Substance use</td>
<td>481</td>
<td>1.08</td>
<td>1.36</td>
<td>0.00</td>
<td>7.00</td>
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<tr>
<td>Emotional distress</td>
<td>482</td>
<td>1.68</td>
<td>0.52</td>
<td>1.00</td>
<td>3.00</td>
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<tr>
<td>Happiness</td>
<td>484</td>
<td>1.69</td>
<td>0.82</td>
<td>0.00</td>
<td>3.00</td>
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<tr>
<td>Sense of coherence</td>
<td>486</td>
<td>4.37</td>
<td>1.15</td>
<td>1.46</td>
<td>6.54</td>
</tr>
</tbody>
</table>

**Note** ADHD, Attention deficit/hyperactivity disorder

**Table 2- Non-parametric correlations between age, gender, and study variables**

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>Gender</th>
<th>Delinquency</th>
<th>Drug use</th>
<th>Emotional distress</th>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>Gender</td>
<td>.020</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Delinquency</td>
<td>-.275**</td>
<td>-.115*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substance use</td>
<td>.116*</td>
<td>-.238**</td>
<td>.245**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional distress</td>
<td>-.092*</td>
<td>.282**</td>
<td>.179**</td>
<td>-.039</td>
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<td></td>
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<tr>
<td>Happiness</td>
<td>.143**</td>
<td>-.202**</td>
<td>-.184**</td>
<td>-.003</td>
<td>-.464**</td>
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<tr>
<td>Sense of coherence</td>
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<td>-.131**</td>
<td>-.375**</td>
<td>-.031</td>
<td>-.611**</td>
<td>.505**</td>
<td>1</td>
</tr>
</tbody>
</table>

**Note** **.** Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

**Table 3A: Summary of hierarchical regression analysis of test variables as predicted by coherence**

13
<table>
<thead>
<tr>
<th>Variable</th>
<th>R²</th>
<th>Statistic</th>
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<tr>
<td>Delinquency</td>
<td>.230</td>
<td>F(3,477)=47.599, p&lt;.001</td>
</tr>
<tr>
<td>Substance use</td>
<td>.057</td>
<td>F(3,472)=9.459, p&lt;.001</td>
</tr>
<tr>
<td>Emotional distress</td>
<td>.408</td>
<td>F(3,473)=108.774, p&lt;.001</td>
</tr>
<tr>
<td>Happiness a</td>
<td>.301</td>
<td>χ²(3) = 153.18, p&lt;.001</td>
</tr>
</tbody>
</table>

Note aOrdinal regression was used to analyze the prediction of happiness. The Nagelkerke statistic was used to calculate pseudo R².

Table 3B: Regression analysis for variables predicting delinquency (N=480)

<table>
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<tr>
<th>Effect</th>
<th>Estimate</th>
<th>SE</th>
<th>95% CI</th>
<th>95% CI</th>
<th>β</th>
</tr>
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<td>Fixed effects</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Age</td>
<td>-.246</td>
<td>.057</td>
<td>-.358</td>
<td>-.134</td>
<td>-.202</td>
</tr>
<tr>
<td>Gender</td>
<td>-.186</td>
<td>.044</td>
<td>-.276</td>
<td>-.097</td>
<td>-.170</td>
</tr>
<tr>
<td>Sense of coherence</td>
<td>-.182</td>
<td>.023</td>
<td>-.229</td>
<td>-.137</td>
<td>-.381</td>
</tr>
</tbody>
</table>

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

Table 3C: Regression analysis for variables predicting substance use (N=475)

<table>
<thead>
<tr>
<th>Effect</th>
<th>Estimate</th>
<th>SE</th>
<th>95% CI</th>
<th>95% CI</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>.306</td>
<td>.145</td>
<td>.013</td>
<td>.578</td>
<td>.101</td>
</tr>
<tr>
<td>Gender</td>
<td>-.563</td>
<td>.118</td>
<td>-.801</td>
<td>-.328</td>
<td>-.208</td>
</tr>
<tr>
<td>Sense of coherence</td>
<td>-.160</td>
<td>.056</td>
<td>-.274</td>
<td>-.048</td>
<td>-.134</td>
</tr>
</tbody>
</table>

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

Table 3D: Regression analysis for variables predicting emotional distress (N=476)

<table>
<thead>
<tr>
<th>Effect</th>
<th>Estimate</th>
<th>SE</th>
<th>95% CI</th>
<th>95% CI</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>.037</td>
<td>.041</td>
<td>-.043</td>
<td>.116</td>
<td>.032</td>
</tr>
<tr>
<td>Gender</td>
<td>.193</td>
<td>.038</td>
<td>.119</td>
<td>.269</td>
<td>.188</td>
</tr>
<tr>
<td>Sense of coherence</td>
<td>-.266</td>
<td>.016</td>
<td>-.297</td>
<td>-.234</td>
<td>-.590</td>
</tr>
</tbody>
</table>

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

Table 3E: Regression analysis for variables predicting happiness a (N=479)
<table>
<thead>
<tr>
<th>Effect</th>
<th>Estimate</th>
<th>SE</th>
<th>95% CI</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>LL</td>
<td>UL</td>
</tr>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>.179</td>
<td>.217</td>
<td>-.259</td>
<td>.641</td>
</tr>
<tr>
<td>Gender</td>
<td>-.601</td>
<td>.177</td>
<td>-.958</td>
<td>-.280</td>
</tr>
<tr>
<td>Sense of coherence</td>
<td>.953</td>
<td>.089</td>
<td>.778</td>
<td>1.148</td>
</tr>
</tbody>
</table>

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

*a* Ordinal regression was used to analyze the prediction of happiness.