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S.I. : SUICIDALITY AND SELF-HARM IN AUTISM

Suicidality in Adults with Autism Spectrum Disorder: The Role of Depressive Symptomatology, Alexithymia, and Antidepressants

Andreia P. Costa[1] · **Cathia Loor**[2] · **Georges Steffgen**[1]

Abstract
People with autism spectrum disorder (ASD) have an increased risk of suicidality. However, the risk factors remain under-investigated. This study explored factors that increase suicidality risk in ASD. Through an online survey, 150 adults with ASD were compared to 189 control adults. Autistic traits, depressive symptomatology, alexithymia, and antidepressant intake were assessed on their contribution predicting suicidality. Among people with ASD, 63% scored above the cutoff for high suicidality risk. Increased autistic traits, depressive symptomatology, and antidepressant intake significantly predicted suicidality. Furthermore, among those with high levels of autistic traits, the risk of suicidality was increased if they also had high levels of alexithymia. These results highlight the importance of considering depression, antidepressants, and alexithymia to prevent suicidality in ASD.

Keywords Suicidality · Depression · Alexithymia · Antidepressants · ASD · Risk factors

Research from the past years systematically shows that people with autism spectrum disorder (ASD) are at an increased risk of suicidality, a term that encompasses suicidal ideation, suicide plans, and suicide attempts (for systematic reviews, see Hedley and Uljarević 2018; Segers and Rawana 2014; Zahid and Upthegrove 2017). However, the risk and protective factors remain under-investigated and guidelines for preventive and intervention measures are still lacking (Cassidy and Rodgers 2017). The aim of the present study is to explore the relation between autistic traits, depressive symptomatology, alexithymia, and antidepressant intake to suicidality.

Depression in ASD

ASD is a neurodevelopmental condition characterized by challenges in social communication, social interaction, and by restricted and repetitive patterns of behaviors and interests (American Psychiatric Association 2013). Other than these difficulties, people with ASD frequently experience associated psychiatric concerns (Lainhart 1999). Among those psychiatric concerns, mood disorders such as depression are described as the most common among people with ASD (Ghaziuddin et al. 2002; Ghaziuddin and Zafar 2008; Hofvander et al. 2009).

The prevalence rates of depression among adults with ASD without intellectual disability or with Asperger's syndrome have been found to vary widely depending on the studies. For instance, Sterling et al. (2008) reported that 43% of their participants with ASD had depressive symptoms, while Lugnegård et al. (2011) found that 70% of their participants with ASD had at least one episode of major depression and 50% had recurrent episodes of depression. In a recent meta-analysis, one of the first studies to quantitatively summarize the rates of depression in ASD, Hudson et al. (2019) showed a lifetime prevalence rate of 14.4% and a current prevalence rate of 12.3% for depression among people with ASD. The World Health Organization (2018) estimates that 4.4% of the global population is affected by depression. Comparing the rates for the global population with even the most conservative rates of depression prevalence in ASD, it becomes clear that depression is more frequent among people with ASD than in the general population.

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Suicidality in ASD

Because of the known link between depression and suicidality in the general population (Angst et al. 1999) and based on the high prevalence of depression among individuals with ASD (Lugnegård et al. 2011; Sterling et al. 2008), it is important to consider suicidality in people with ASD. According to the World Health Organization (2018), suicide is stated as a cause of death for 1.4% of all deaths worldwide. Furthermore, there are indications that for each adult who dies by suicide, there may be more than 20 others who attempt it (World Health Organization 2014).

Regarding suicidality in ASD, there are only a few studies exploring suicidal ideation or suicide attempts among this population. However, despite the limited amount of research in the area, all of the existing studies report a higher prevalence of suicidality among people with ASD compared to the general population. In one of the first studies reporting suicidality in adults with ASD, Balfe and Tantam (2010) reported that 40% of their participants had suicidal thoughts and 15% had attempted suicide. One study with 26 participants with ASD reported that 30.8% had suicidal ideations and two had died by suicide (Raja et al. 2011). In a study with adults with ASD, especially with Asperger's Syndrome, 66% experienced suicidal ideations during their lifetime and 35% either had planned or attempted suicide (Cassidy et al. 2014). Another study showed that 35% of individuals with ASD had attempted suicide (Paquette-Smith et al. 2014). In a recent systematic review, the prevalence rates for suicidal ideation among people with ASD ranged between 11 and 66% and suicide attempts had a prevalence of up to 35% (Hedley and Uljarević 2018). Overall, the prevalence of suicide attempts is estimated to be at 4.6% in the general population (Kessler et al. 1999), which is markedly lower than among people with ASD.

Taken together, these results show a higher prevalence of suicidality among people with ASD compared to the general population. It is also reported that 0.31% of all premature deaths in people with ASD are due to suicide, which is significantly higher compared to the general population (0.06%), and is a leading cause of premature death among people with ASD (Hirvikoski et al. 2016).

Risk Factors of Suicidality

The existing research consistently describes a high risk of suicidality among people with ASD. It is thus imperative to understand why there is an increased risk in this population and what are the factors of vulnerability that predispose people with ASD to suicidality. According to the World Health Organization (2018), there are various risk factors of suicidality in the general population but having a psychiatric condition seems to be the most common risk factor to die by suicide (Hawton and van Heeringen 2009).

Among the different psychiatric concerns that are risk factors of suicidality (e.g. substance-related disorders, self-harm, anxiety, psychotic and personality disorders), mood disorders such as depression are among the most common risk factors for suicidality (Hawton and van Heeringen 2009; Segers and Rawana 2014). Given the usually high rates of reported depression among people with ASD (Wigham et al. 2017), depression should be considered when evaluating risk factors of suicidality among people with ASD. The more so because depression has been designated as a single factor to put people with ASD at increased risk of suicidality (Hedley et al. 2017).

The combination of depression with additional risk factors may particularly predispose people with ASD to suicidality. Among adults with ASD, it was found that those who have depression have higher cognitive abilities and higher social skills, which suggests that being more aware of own challenges, such as difficulties interacting socially, can lead to a higher risk of depression (Sterling et al. 2008). Another study (Kraper et al. 2017) examined the relationship between adaptive functioning described as "real-life skills", intelligence, and associated psychiatric concerns among people with ASD. The results indicate that poor adaptive functioning can lead to greater psychiatric concerns, such as depression. Moreover, there is a higher risk for depression or other mental conditions among those individuals with ASD with the largest gap between intelligence and adaptive functioning, indicating that high cognitive abilities cannot be considered as protective factors for mental health concerns in ASD (Kraper et al. 2017).

As reported in a systematic review about suicidality in ASD (Segers and Rawana 2014), other chief risk factors for suicidality in ASD are substance abuse (Raja et al. 2011), behavioral problems, and taking psychotropic medication (Mayes et al. 2013). A study with a general population sample has found that antidepressants may pose a particular risk of suicidality for those younger than 25 years old (Stone et al. 2009). However, in one of the few studies assessing medication intake and their link to suicidality among young people with ASD, it was found that there are no differences on psychiatric medication status between those with and without suicidal thoughts (Storch et al. 2013).

Age and gender have also been identified as relevant factors for suicidality with particular patterns among people with ASD. While in the general population suicide rates are the lowest in persons under 15 years of age and highest in persons aged 70 years or older (World Health

Organization 2018), among people with ASD, being younger than 10 years old is a protective factor against suicidality (Mayes et al. 2013). However, in a study examining suicide incidence over a period of 20 years, it was found that young people with ASD are two times more likely to die by suicide than young people without ASD (Kirby et al. 2019). In relation to depression, individuals with ASD with depression tend to have a significantly higher age (Sterling et al. 2008). A possible explanation could be that with age, the social expectations of relationships or of getting a job have a greater impact, thus leading to feelings of stress and pressure in individuals with ASD (Sterling et al. 2008). Regarding gender, in the general population of high-income countries, three times as many men die of suicide compared to women (World Health Organization 2018). Among people with ASD, some studies have found that being a male is a risk factor for suicidality (Mayes et al. 2013; Mikami et al. 2009) but females with ASD with intellectual disability have an increased risk of premature mortality (Hirvikoski et al. 2016). It has also been found that in the most recent years (from 2013 to 2017) females with ASD were three times more likely to die by suicide than females without ASD (Kirby et al. 2019).

Alexithymia, Depression, and Suicidality

Even though research into the causes of suicidality in ASD can take indications from the research in the general population, it is possible that the risk factors may be different among people with ASD. For instance, in one of the large-scale clinical studies conducted on suicidality among people with Asperger's syndrome, the rates of suicidal ideation (66%) were the double of those of people with depression (32%; Cassidy et al. 2014). Therefore, there must be other risk factors particular to people with ASD (Cassidy and Rodgers 2017) and one such factor could be alexithymia.

Alexithymia was first described by Sifneos (1973) as a lack of words for emotions and it can be defined as a general difficulty to recognize, describe, and distinguish own emotions (Sifneos 1973) and emotions in others (Taylor et al. 1997). Alexithymia impairs both the experience and the expression of emotion (Taylor et al. 1997) and has an impact at the intrapersonal and interpersonal levels. Whereas the rate of alexithymia in the general population is estimated at 10% (Salminen et al. 1999), there are higher rates of alexithymia in ASD with a prevalence of 40 to 65% (Berthoz and Hill 2005; Hill et al. 2004).

Research indicates that alexithymia is tightly linked to depression. In a study examining the relationship between alexithymia and depression in the general population, it was found that 4.3% of the non-depressed subjects had alexithymia whereas 32% of the depressed subjects had alexithymia (Honkalampi et al. 2000). In another study, it was found that individuals with higher levels of alexithymia also had higher levels of depression (Honkalampi et al. 2010). As depression is highly linked to suicide, and alexithymia to depression, Hintikka et al. (2004) examined the association between alexithymia and suicidality. The results indicated that suicidal ideations are more common among individuals with alexithymia than among individuals without alexithymia, even after controlling for depression (Hintikka et al. 2004). Furthermore, in a review assessing risk factors for depression in people with ASD, it was found that alexithymia is one of the factors that present the greatest specific risk (De-la-Iglesia and Olivar 2015).

Many individuals with ASD have difficulties to process emotions, to identify facial expressions, to react to emotions, as well as regulating emotions (Mazefsky 2015). Even though some studies have found that emotional difficulties in people with ASD cannot be solely attributed to alexithymia (Samson et al. 2012; Stephenson et al. 2019), several other studies indicate that emotional difficulties in people with ASD are not specific to their condition, but are rather due to associated alexithymia (Bird and Cook 2013; Costa et al. 2017; Shah et al. 2016). The "alexithymia-hypothesis" presented by Bird and Cook (2013) provides that the emotional symptoms common in ASD can be explained by higher rates of alexithymia among these individuals. Therefore, according to this hypothesis, there are people with ASD without emotional impairments and thus, emotional disturbances should not be considered ASD-specific symptoms but caused by associated alexithymia.

The Present Study

Depression and alexithymia have been reported to play an important role in explaining suicidality in the general population (Hintikka et al. 2004). However, and even though people with ASD have increased rates of both depression and alexithymia, there is to date, and to our knowledge, no reported study on the potential role alexithymia and depression may play on suicidality among people with ASD. It is thus the aim of this study to explore the relationship between suicidality, depressive symptomatology, and alexithymia in ASD. Furthermore, other factors that are known to be linked to suicidality such as antidepressant intake, age, and gender will also be assessed. This will be assessed using an online survey on a sample of adults with ASD without intellectual disability and adults without ASD.

First, and based on the reviewed literature, it is hypothesized that people with ASD will have higher rates of autistic traits, suicidality, depressive symptomatology, and alexithymia than participants in the control group. Furthermore, individuals with ASD will take more antidepressant

medication than the control group. Secondly, because the risk of suicidality can be explained by high levels of depression and alexithymia in the general population (Angst et al. 1999; Honkalampi et al. 2000; Hintikka et al. 2004) and because antidepressant intake can pose a suicidality risk (Stone et al. 2009), it is also hypothesized that the higher rates of suicidality can be explained by increased autistic traits, higher rates of depressive symptomatology, increased alexithymia, and antidepressant intake.

Methods

Participants

From the initial sample of 441 participants, 101 were excluded because the surveys were not complete and another was excluded because the participant was younger than 18 years old, the minimum age required to participate. Therefore, a final sample of 339 participants composed of 150 adults with a self-reported diagnosis of ASD (98 female, 49 male, 3 unreported) and 189 adults without a diagnosis of ASD (142 female, 47 male) as control group was used in the present study. Because the study design consisted of an online survey in which we could not verify participants' diagnosis, participants in the ASD group were required to have received an ASD diagnosis before starting the survey and participants in the control group were asked whether they had ever been diagnosed with ASD, to which all answered negatively. To improve the likelihood that participants in the ASD group had indeed an ASD diagnosis, the link to the survey was only shared with institutions working with people with ASD and closed forums dedicated to people with a diagnosis of ASD. The link to the control survey was shared in mainstream social media and university campuses and was advertised as a study dealing with mental health. Based on the self-report questionnaire AQ-short (Hoekstra et al. 2011), $n = 10$ participants in the ASD group had a score below the diagnosis confidence cutoff of 66 and $n = 57$ participants in the control group had a score above that cutoff. Preliminary analysis excluding the ASD participants with a score below the cutoff and excluding the control participants with a score above the cutoff yielded similar results to those obtained with their inclusion. Therefore and despite the fact that these participants did not have a score within the range expected for their group, they were included in the analysis so that the sample can be representative of natural occurrences of autistic traits as well as often co-occurring alexithymia.

Participants were aged from 18 to 64 years and the ASD group ($M_{age} = 33.74$; $SD_{age} = 11.81$) was significantly older than the control group ($M_{age} = 27.84$; $SD_{age} = 8.55$), $t(337) = 5.33$, $p < 0.001$. Groups did not differ on gender distribution, $\chi^2(1) = 2.90$, $p = 0.11$. Table 1 summarizes participants' reported current use of antidepressants, currently receiving or having received psychotherapy support, and having ever had a diagnosed psychiatric condition (other than ASD). The ASD group reported using antidepressants, psychotherapy, and having one or more diagnosed psychiatric conditions (apart from ASD) significantly more than the control group.

Measures

Autistic Traits

The AQ-short (Hoekstra et al. 2011), an abridged version of the Autism Spectrum Quotient (AQ; Baron-Cohen et al. 2001) was used to measure the degree of autistic traits. The AQ-short is composed of 28 items scored from 1 = "definitely agree" to 4 = "definitely disagree". A cutoff score of 66 or greater was used, which as indicated by Hoekstra et al. (2011), provides a sensitivity of 0.97 and a specificity of 0.82. The AQ-short correlates significantly with the full-scale AQ, providing a good criterion validity (r between 0.93 and 0.95, $p < 0.001$). Even though test–retest reliability is not provided for the AQ-short version, the full-scale AQ provides a good test–retest reliability ($r = 0.78$; Hoekstra

Table 1 Frequency and percentage (%) of participants reporting currently using antidepressants, currently receiving or having received psychotherapy support, and having ever had a diagnosed psychiatric condition (other than ASD such as depression, anxiety, or other psychiatric concerns), Pearson's chi square values for group differences (χ^2), significance levels (p), and odds ratio (OR)

	ASD frequency (%) $n = 150$	Control frequency (%) $n = 189$	Statistics (ASD/control)
Antidepressants	38 (25%)	8 (4%)	$\chi^2(1) = 31.75$, $p < 0.001$, OR 11.72
Psychotherapy	133 (89%)	62 (33%)	$\chi^2(1) = 106.81$, $p < 0.001$, OR 16.03
(Co-)occurrence of 1 or more psychiatric conditions	121 (81%)	37 (20%)	$\chi^2(1) = 125.42$, $p < 0.001$, OR 17.14
Depression	100 (67%)	26 (14%)	$\chi^2(1) = 100.25$, $p < 0.001$, OR 12.54
Anxiety	57 (38%)	21 (11%)	$\chi^2(1) = 34.13$, $p < 0.001$, OR 4.90
Other conditions	59 (39%)	9 (5%)	$\chi^2(1) = 62.33$, $p < 0.001$, OR 12.97

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et al. 2008). Reliability analyses based on the present sample revealed a very good internal consistency with Cronbach's $\alpha = 0.95$.

Suicidality

The Suicide Behaviors Questionnaire-Revised (SBQ-R; Osman et al. 2001) was used to assess four dimensions of suicidality with one item each. Item 1 explores life time suicide ideation and/or suicide attempt, scored from 1 to 4. Item 2 assesses the frequency of suicidal ideation over the past 12 months, scored from 1 to 5. Item 3 assesses the threat of suicide attempt scored from 1 to 3. Item 4 evaluates the self-reported likelihood of suicidal behavior in the future, scored from 0 to 6. A cutoff score of 8 or greater indicates risk of suicidality, providing a sensitivity between 0.80 and 0.93 and a specificity indicator between 0.91 and 0.96 across clinical and non-clinical samples, thus indicating evidence for a good criterion-related validity. Even though test–retest reliability is not provided for the revised version, Cole's (1988) version provides a good test–retest reliability ($r = 0.95$; Cotton et al. 1995). Reliability analysis based on the present sample revealed a satisfying internal consistency with Cronbach's $\alpha = 0.79$.

Depressive Symptomatology

The Center for Epidemiological Studies-Depression Scale (CES-D; Radloff 1977) was used to assess the levels of depressive symptomatology. The CES-D is composed of 20 items with statements about feelings or behaviors the person might have experienced during the past week. Responses to the items are scored from 0 = "rarely or none of the time" to 3 = "most or almost all of the time". A cutoff score of 23 or greater indicates risk of depressive symptomatology (Husaini and Neff 1980). Even though sensitivity and specificity indicators are not available for a cutoff score of 23, a cutoff score of ≥ 20 provides a sensitivity of 0.61 and specificity of 0.85 (Klinkman et al. 1997). The measure has moderate criterion validity to other measures of similar constructs ($r > 0.58$) in ASD samples (Cassidy et al. 2018a, b). The CES-D provides a moderate test–retest validity (between 0.45 and 0.70). However, it is to be noted that the CES-D is designed to measure current levels of symptomatology and those are expected to vary over time (Radloff 1977). Reliability analysis based on the present sample revealed a very good internal consistency with a Cronbach's $\alpha = 0.92$.

Alexithymia

The Toronto Alexithymia Scale (TAS-20; Bagby et al. 1994) was used to assess the level of alexithymia. The TAS-20 is composed of 20 items exploring the cognitive and affective processes of emotion. Responses to the items are scored from 1 = "strongly disagree" to 5 = "strongly agree". A cutoff score of 61 or greater indicates high levels of alexithymia. The scale provides good convergent and concurrent validity and modest discriminant validity (Bagby et al. 1994). The TAS-20 has been found to correlate highly with other measures of alexithymia using an ASD sample ($r = 0.77$; Bird et al. 2010), thus indicating good criterion-related validity by individual differences in alexithymia being reliably measured. The TAS-20 has good test–retest reliability ($r = 0.77$) and reliability analysis based on the present sample revealed a good internal consistency with a Cronbach's $\alpha = 0.88$.

Procedure

The study was conducted through an online survey using Qualtrics survey software (Qualtrics 2013). The survey had a version for people with ASD that was distributed through partner institutions for people with ASD (e.g. Fondation Autisme Luxembourg, Autisme Luxembourg asbl, Autismuszentrum Trier) and posted in closed forums specific to people with ASD (e.g. autismus.de, asperger-forum.de, community.autism.org.uk). Aversion for the control group was distributed through different social networks (e.g. Facebook, students' forums at the University of Luxembourg) and was advertised as a study dealing with mental health. Versions only differed on their initial presentation, on the requirement to have an ASD diagnosis (ASD version) or not (control version), and on the question regarding the (co-)occurrence of psychiatric conditions. Participants were requested to agree to the preconditions of participation, and were asked to answer to demographics questions regarding age, gender, country of residence, medication intake, receiving psychotherapy support, and (co-)occurrence of psychiatric conditions. After that, participants were asked to fill out the questionnaires AQ-short, SBQ-R, CES-D, and TAS-20. The survey was available in German ($n = 243$) and English ($n = 96$). Because preliminary analyses revealed that language version did not change the reported results, we decided for parsimony, to not include this variable in subsequent analyses. The study complied with ethical and data protection requirements of the respective institutional and national committees.

Results

Group Differences in Autistic Traits, Suicidality, Depressive symptomatology, and Alexithymia

Because age, gender, and antidepressant intake have been reported in previous literature to be important factors in suicidality (Hirvikoski et al. 2016; Mayes et al. 2013), analyses

of covariance with age, gender, and antidepressant intake included as covariates were used to compare the ASD group with the control group on their self-reported scores on autistic traits (AQ-short), suicidality (SBQ-R), depressive symptomatology (CES-D), and alexithymia (TAS-20). Bonferroni corrections were applied to all tests to control for Type I error rate. Additionally, Pearson's chi-square tests, with Bonferroni corrections, were conducted to compare groups (control/ASD) on their rates of scoring above the cut-off for each scale (see Table 2).

The scores of the levels of autistic traits ranged between 45 and 108 in the ASD group and between 32 and 87 in the control group. There were higher levels of autistic traits in the ASD group than in the control group. Age [$F(1, 331) = 0.09$, $p = 0.77$, $\eta_p^2 = 0.00$] and gender [$F(1, 331) = 0.29$, $p = 0.59$, $\eta_p^2 = 0.00$] did not significantly affect autistic traits scores but taking antidepressants was significantly related to more autistic traits [$F(1, 331) = 5.91$, $p < 0.05$, $\eta_p^2 = 0.02$]. The scores for suicidality ranged between 3 and 17 in the ASD group and between 3 and 15 in the control group. The ASD group scored significantly higher in suicidality than the control group. Age [$F(1, 331) = 6.83$, $p < 0.01$, $\eta_p^2 = 0.02$] significantly affected suicidality scores with younger ages predicting higher suicidality scores. Taking antidepressants was also significantly related to higher suicidality scores [$F(1, 331) = 15.47$, $p < 0.001$, $\eta_p^2 = 0.05$]. Gender did not have a significant effect on suicidality scores [$F(1, 331) = 1.33$, $p = 0.25$, $\eta_p^2 = 0.00$]. The scores for depressive symptomatology ranged between 1 and 54 in the ASD group and 0 and 55 in the control group. The ASD group had significantly higher depressive symptomatology scores than the control group. Age [$F(1, 331 = 19.42$, $p < 0.001$, $\eta_p^2 = 0.06$] and gender [$F(1, 331) = 6.21$, $p < 0.05$, $\eta_p^2 = 0.02$] significantly affected depressive symptomatology scores with younger ages and being a female predicting higher depressive symptomatology scores. Taking antidepressant medication did not have a significant effect on depressive symptomatology [$F(1, 331) = 1.07$, $p = 0.30$, $\eta_p^2 = 0.00$]. The scores of the levels of alexithymia ranged between 27 and 85 for the ASD group and between 22 and 80 for the control group. The ASD group had significantly higher levels of alexithymia than the control group. Age [$F(1, 331) = 16.41$, $p < 0.001$, $\eta_p^2 = 0.05$] and antidepressant intake [$F(1, 331) = 4.31$, $p < 0.05$, $\eta_p^2 = 0.01$] significantly affected alexithymia scores with younger ages and taking antidepressants predicting higher alexithymia scores, but gender did not have a significant effect [$F(1, 331) = 0.98$, $p = 0.32$, $\eta_p^2 = 0.00$].

Pearson correlations were calculated to determine the relationship between the different assessment tools and antidepressant intake. Results revealed a significant correlation between all measures for the whole sample (Table 3).

Predictors of Suicidality

A hierarchical multiple regression analysis was conducted to examine the role of autistic traits, depression, and alexithymia in predicting suicidality (SBQ-R). Control variables, *z*-standardized age, gender (female/male), and antidepressant intake (no/yes) were entered in a first step. *Z*-standardized scores on autistic traits (AQ-short), depressive symptomatology (CES-D), and alexithymia (TAS-20) were entered in

Table 3 Pearson correlations for scores on autistic traits (AQ-short), suicidality (SBQ-R), depressive symptomatology (CES-D), alexithymia (TAS-20), and point-Biserial correlations for antidepressant intake (no/yes)

Measure	AQ-short	SBQ-R	CES-D	TAS-20
AQ-short	–			
SBQ-R	0.51***	–		
CES-D	0.51***	0.58***	–	
TAS-20	0.72***	0.46***	0.56***	–
Antidepressants	0.32***	0.31***	0.17***	0.24***

***$p < 0.001$

Table 2 Means (*M*), standard deviations (*SD*), *F*-values (ANCOVA), significance levels (*p*), and effect sizes (η_p^2) on the total scores comparing the ASD group and the control group on autistic traits (AQ-short), suicidality (SBQ-R), depressive symptomatology (CES-D), and alexithymia (TAS-20), controlling for age, gender, and antidepressant intake as covariates

	ASD *M* (*SD*) % above cutoff	Control *M* (*SD*) % above cutoff	Statistics (ASD/control)
AQ-short cutoff: ≥ 66	87.12 (12.15) 93%	58.76 (10.89) 30%	$F(1, 331) = 396.67$, $p < 0.001$, $\eta_p^2 = 0.55$ $\chi^2(1) = 137.11$, $p < 0.001$, OR 33.00
SBQ-R cutoff: ≥ 8	8.66 (3.66) 63%	5.51 (2.83) 18%	$F(1, 331) = 65.51$, $p < 0.001$, $\eta_p^2 = 0.17$ $\chi^2(1) = 71.03$, $p < 0.001$, OR 7.71
CES-D cutoff: ≥ 23	25.75 (12.07) 59%	15.41 (10.43) 20%	$F(1, 331) = 83.41$, $p < 0.001$, $\eta_p^2 = 0.20$ $\chi^2(1) = 53.25$, $p < 0.001$, OR 5.69
TAS-20 cutoff: ≥ 61	62.31 (12.55) 59%	45.68 (13.55) 15%	$F(1, 331) = 127.13$, $p < 0.001$, $\eta_p^2 = 0.28$ $\chi^2(1) = 69.45$, $p < 0.001$, OR 7.91

Percentage (%), Pearson's chi square values for group differences (χ^2), significance levels (*p*), and odds ratio (OR) comparing groups on the scores above cutoff values

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a second step. Finally, because the ASD group used more antidepressants than the control group and had higher levels of depressive symptomatology as well as alexithymia than the control group, the cross-product of *z*-standardized scores on autistic traits with antidepressant intake, *z*-standardized scores on depressive symptomatology (CES-D), and *z*-standardized scores on alexithymia (TAS-20), were entered in a third step.

The model with age, gender (female/male), and antidepressant intake (no/yes) (Step 1), significantly contributed to a predictive model of suicidality [$R^2 = 0.10$, $F(3, 332) = 11.82$, $p < 0.001$] but only antidepressant intake was a significant predictor of suicidality. Taking antidepressants significantly predicted a higher suicidality score. When autistic traits (AQ-short), depressive symptomatology scores (CES-D), and alexithymia scores (TAS-20) were added to the model (Step 2), antidepressant intake remained a significant predictor of suicidality. Autistic traits and depressive symptomatology were also significant predictors and this resulted in a significant increase in the model's predictability of suicidality [$\Delta R^2 = 0.32$, $F_{change}(3, 329) = 61.18$, $p < 0.001$] and in a significant model [$F(6, 329) = 39.71$, $p < 0.001$]. Scoring higher on autistic traits and on depressive symptomatology significantly predicted a higher suicidality score. Age and gender did not contribute significantly to the model nor did alexithymia scores. When the cross-product of autistic traits with antidepressant intake (AQ-short x Antidepressants), with depressive symptomatology scores (AQ-short × CES-D), and with alexithymia scores (AQ-short × TAS-20) were added to the model (Step 3), antidepressant intake, autistic traits, and depressive symptomatology remained significant predictors, while age, gender, and alexithymia remained non-significant predictors. Furthermore, a significant interaction effect was found, as the cross-product of autistic traits with alexithymia incrementally predicted suicidality above and beyond antidepressant intake, autistic traits, and depressive symptomatology, resulting in a significant increment in the model's predictability of suicidality [$\Delta R^2 = 0.02$, $F_{change}(3, 326) = 3.01$, $p < 0.05$] and resulting in a significant model [$F(9, 326) = 27.96$, $p < 0.001$] (see Table 4).

Participants with high levels of autistic traits (+1 SD) had higher levels of suicidality at high levels of alexithymia (+1 SD) than at low levels of alexithymia (− 1 SD), while participants with low levels of autistic traits (− 1 SD) had similar levels of suicidality at low and high levels of alexithymia (± 1 SD; see Fig. 1). Simple slope analysis confirmed this interpretation: a significant relationship was found between alexithymia and suicidality on participants with high levels of autistic traits [$b = 1.04$, SE = 0.30, $p < 0.001$], as well as on participants with mean levels of autistic traits [$b = 0.71$, SE = 0.23, $p < 0.01$].

Table 4 Three-step hierarchical multiple regression analysis for variables predicting suicidality (SBQ-R)

Variables	*β*	SE *β*	*t*	95% CI for *β*	
				Lower	Upper
Step 1					
Constant	6.95	0.75	9.27***	5.47	8.42
Age	− 0.01	0.02	0.53	− 0.05	0.03
Gender	− 0.16	0.42	0.38	− 0.97	0.66
Antidepressants	**3.29**	**0.56**	**5.90*****	**2.20**	**4.39**
Step 2					
Constant	7.09	0.65	10.92***	5.81	8.36
Age	− 0.01	0.02	0.68	− 0.04	0.02
Gender	− 0.06	0.34	0.18	− 0.73	0.61
Antidepressants	**1.72**	**0.47**	**3.65*****	**0.79**	**2.64**
Autistic traits (AQ-short)	**0.89**	**0.24**	**3.65*****	**0.41**	**1.36**
Depressive sympt. (CES-D)	**1.48**	**0.19**	**7.82*****	**1.11**	**1.85**
Alexithymia (TAS-20)	0.04	0.24	0.18	− 0.42	0.50
Step 3					
Constant	6.87	0.65	10.59	5.59	8.14
Age	− 0.02	0.02	1.07	− 0.05	0.01
Gender	− 0.02	0.34	0.07	− 0.69	0.65
Antidepressants	**2.28**	**0.62**	**3.67*****	**1.06**	**3.50**
Autistic traits (AQ-short)	**1.00**	**0.25**	**3.97*****	**0.51**	**1.50**
Depressive sympt. (CES-D)	**1.49**	**0.20**	**7.54*****	**1.10**	**1.88**
Alexithymia (TAS-20)	− 0.00	0.24	0.01	− 0.47	0.47
AQ-short × antidepressants	− 0.77	0.59	1.31	− 1.93	0.39
AQ-short × CES-D	0.06	0.19	0.31	− 0.31	0.43
AQ-short × TAS-20	**0.47**	**0.20**	**2.38***	**0.08**	**0.85**

Predictors: in Step 1 control variables *z*-standardized age, gender (female/male), and antidepressant intake (no/yes); in Step 2 *z*-standardized autistic traits (AQ-short), *z*-standardized depressive symptomatology (CES-D), and *z*-standardized alexithymia (TAS-20); in Step 3 the cross product of *z*-standardized autistic traits and antidepressant intake (AQ-short × Antidepressant), the cross product of *z*-standardized autistic traits and depressive symptomatology (AQ-short × CES-D), and the cross product of *z*-standardized autistic traits and alexithymia (AQ-short × TAS-20)

β standardized beta coefficient, *β SE* standard error, *CI* confidence interval

*$p < 0.05$; ***$p < 0.001$

However, alexithymia was not related to suicidality on participants with low levels of autistic traits [$b = 0.39$, SE = 0.27, $p = 0.15$]. No interaction effects between autistic traits and antidepressant intake or with depressive symptomatology scores were found (see Table 4).

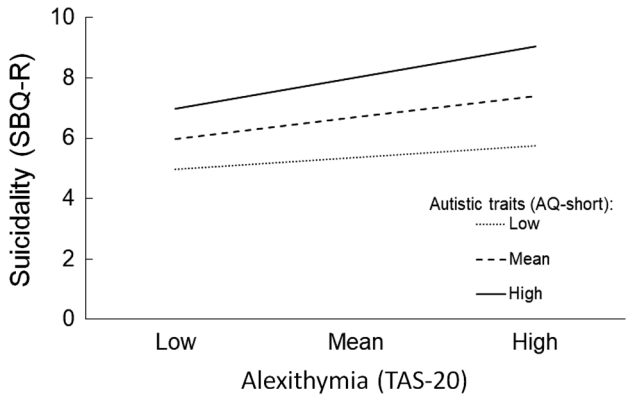

Fig. 1 Regressing suicidality scores (SBQ-R) as function of autistic traits (± 1 *SD*; AQ-short) and alexithymia (± 1 *SD*; TAS-20)

Discussion

Recent research has systematically identified increased rates of suicidality among people with ASD (e.g. Hedley and Uljarević 2018). However, the research into the risk factors that predispose people with ASD to suicidality has been scarce and much is yet to be learned. From the few studies that have been conducted, it becomes apparent that suicidality among people with ASD may follow a pattern different from that in the general population (Cassidy and Rodgers 2017). It was thus the aim of the present study to contribute to the state of the art by exploring possible factors that can explain the high prevalence of suicidality among people with ASD. Among these factors are depression and antidepressant intake. Another factor is alexithymia. Depression is a well-known risk factor for suicidality in the general population. However, as it was found in one of the few studies assessing risk factors in ASD, depression might not account for most of the variability of suicidality in ASD (Cassidy et al. 2014). Antidepressant intake is associated with being diagnosed with depression and is a well-reported risk factor for suicidality, particularly among people younger than 25 years old (Stone et al. 2009). Alexithymia has not been assessed as a risk factor for suicidality in ASD. However, it is five times more frequent among people with ASD than in the general population, it has strong ties to depression, and has been identified as an important contributor to explain suicidality in the general population (Hintikka et al. 2004). Furthermore, antidepressant intake has been found to be linked to increased alexithymia (Kajanoja et al. 2018).

To assess how antidepressant intake, depressive symptomatology, and alexithymia are linked to suicidality in ASD, we have first compared the rates of self-reported suicidality, antidepressant intake, autistic traits, depressive symptomatology, and alexithymia among a sample of adults with ASD and a control group. Then, we analyzed how antidepressant intake, autistic traits, depressive symptomatology, and alexithymia contribute to explain suicidality. Our findings indicate that adults with ASD have higher levels of suicidality, take more antidepressant medication, have more autistic traits, increased depressive symptomatology, and increased alexithymia than adults without ASD. It is also shown that antidepressant intake, increased autistic traits, and increased depressive symptomatology contribute significantly to explain higher rates of suicidality. Furthermore, those with high levels of autistic traits have an increased risk of suicidality if they have higher levels of alexithymia than lower levels of alexithymia, but those with low levels of autistic traits have a similar risk of suicidality regardless of their levels of alexithymia.

Associated Difficulties in ASD

In our study, we found a high rate of self-reported lifetime diagnosed associated psychiatric conditions among people with ASD (81%) compared to controls (20%). The most common associated psychiatric condition was depression, followed by anxiety, and other concerns (e.g. ADD/ADHD, personality disorders, eating disorders, and sleeping disorders). This result is in agreement with previous studies that found that having other psychiatric conditions (apart from ASD) was more common among people with ASD than in the general population, particularly depression (e.g. Lugnegård et al. 2011; Sterling et al. 2008). Even though, the rates in the present study, are high compared to those reported in other studies, also among the general population (Hudson et al. 2019; WHO 2018), they are, at least for depression, in agreement with the rate of those who scored above the cutoff for depression in the CES-D scale. One reason for that could be that the study was advertised as dealing with mental health and that may have thus attracted more participants with mental health concerns.

Furthermore, participants with ASD mention much more often that they went to therapy or are currently in therapy than those without ASD. One possible reason for the high rate of therapy among those with ASD could be that, because of their diagnosis, they often benefit from a specialized assistance, and are thus more in contact with therapists. Moreover, people with ASD reported using more often antidepressant medication (e.g. venlafaxine paroxetine, escitalopram, bupropion), which is in agreement with increased rates of depression observed among people with ASD (Hofvander et al. 2009) and highlights the high rate of co-occurring mental health concerns among people with ASD compared to the general population. Furthermore, this result supports our hypothesis that people with ASD take more antidepressant medication than people without ASD.

Prevalence of Autistic Traits, Suicidality, Depressive Symptomatology, and Alexithymia

In the present study, we found, as expected, that participants with ASD had significantly more autistic traits than the control group. Similarly, the proportion of those scoring above the cutoff was significantly higher for people with ASD than for people without ASD. This result is particularly relevant given the fact that the survey was conducted online and that we were thus unable to confirm participants' diagnostic status. Nevertheless, 7% of participants with ASD had a score below the cutoff and 30% of participants in the control group had a score above the cutoff. Even though we cannot explain the reasons for the particularly high percentage of people in the control group scoring above the cutoff for autistic traits, we can speculate that the fact that the study was advertised as a study about mental health among the control group might have attracted more participants with mental health issues who are thus more likely to score high in autistic traits. Indeed, it has been found in other samples that the AQ scale and its short forms might measure mental health problems other than autistic traits (Kurita and Koyama 2006).

The findings of the present study show that adults with ASD score significantly higher than the control group in suicidality and that the proportion of those scoring above the cutoff for increased risk is also significantly higher among the ASD group than the control group. Indeed, we found that 63% of people with ASD scored above the cutoff for increased risk of suicidality. These results are in agreement with previous research that found similar high rates of suicidality among people with ASD (e.g. Balfe and Tantam 2010; Cassidy et al. 2014; Hedley and Uljarević 2018).

Similarly, we found that participants with ASD scored significantly higher in depressive symptomatology than controls and that the rate of those scoring above the cutoff was also significantly higher among the ASD group than the control group. These results are also in agreement with previously reported prevalence rates of depression and depressive symptomatology among people with ASD (Lugnegård et al. 2011; Sterling et al. 2008).

Regarding alexithymia, and in agreement with previous research (Berthoz and Hill 2005; Hill et al. 2004), we also found that people with ASD had a significantly higher score compared to the control group. Furthermore, the proportion of those scoring above the cutoff was significantly higher among those with ASD than the controls, and the rates are in line with those reported in previous research (Berthoz and Hill 2005; Salminen et al. 1999).

The combination of these results supports our first hypothesis that people with ASD would score significantly higher than the control group in autistic traits, suicidality, depressive symptomatology, and alexithymia. These results also add to a growing body of research demonstrating that people with ASD are more prone to suffer from other disturbances in addition to their difficulties related to ASD and that the rates of suicidality among people with ASD are high. Furthermore, correlations based in the entire sample revealed all of our key measures to be significantly correlated to each other. This highlights the fact that people who have one mental health concern tend to also have others. This is particularly expected in a sample including people with ASD who, as demonstrated above, have higher scores than the control group in all measures and have a high prevalence of suicidality, depressive symptomatology, as well as alexithymia, and take more antidepressant medication.

Predictors of Suicidality

The main aim of the present study was to explore risk factors of suicidality. For this, and based on the literature, we considered age, gender, antidepressant intake, autistic traits, depressive symptomatology, and alexithymia as predictors of suicidality. Age and gender have been found to play a role in suicidality among people with ASD (e.g. Kirby et al. 2019; Mayes et al. 2013). It is generally accepted that antidepressant intake, at least for people younger than 25 years old, can pose a risk of suicidality (Stone et al. 2009). Since our sample was overall young and had a big proportion of participants younger than 25 years old, antidepressant intake is of relevance. Previous studies have demonstrated that people with ASD, and thus with more autistic traits, are at an increased risk of suicidality, compared to people without ASD (e.g. Hedley and Uljarević 2018). In addition, several studies have analyzed the association between depression and alexithymia, specifically in ASD, such as De-la-Iglesia and Olivar (2015) or Shah et al. (2016). Other studies analyzed the association between depression or suicidality and alexithymia in the general population (e.g. Hintikka et al. 2004; Honkalampi et al. 2000). However, so far, and to our knowledge, no other study has examined the role alexithymia may play in suicidality among people with ASD. Regression analyses revealed that taking antidepressants, scoring high in autistic traits and in depressive symptomatology explained 42% of the variability in suicidality. Moreover, alexithymia alone did not predict suicidality. However, an interaction between autistic traits and alexithymia proved to significantly contribute to the model explaining suicidality above and beyond antidepressant intake, autistic traits, and depressive symptomatology alone. Gender and age did not play a significant role predicting suicidality risk.

Further analyses, revealed that autistic traits moderate the relation between alexithymia and suicidality. While there are no differences in suicidality among those with low and high levels of alexithymia if they have low levels of autistic traits, those with high levels of autistic traits have an increased risk

of suicidality if they have high levels of alexithymia than if they have low levels of alexithymia. Together, these results indicate that taking antidepressants, having increased levels of autistic traits and higher scores in depressive symptomatology contribute to an increase risk of suicidality. Furthermore, among those with high levels of autistic traits, scoring higher in alexithymia increases the risk of suicidality. The present results are in line with previous studies that found that antidepressants intake might put young adults at an increased risk of suicidality (Stone et al. 2009). This result, however, can be linked to the fact that individuals who are depressed, and thus at increased risk of suicidality, tend to take antidepressants. Our results are also in agreement with studies that found that depressive symptomatology contributes to suicidality among people with ASD (Hedley et al. 2017) and advance our understanding about the potential role of alexithymia in predicting suicidality, particularly among people with ASD, who have high levels of autistic traits. In previous studies, it was found that in the general population, alexithymic individuals had higher rates of suicidal ideation than non-alexithymic individuals did (Hintikka et al. 2004). However, the present study cannot corroborate these results. Instead, it shows that alexithymia plays a role in predicting suicidality only when combined with increased levels of autistic traits, but not with low levels of autistic traits. This demonstrates that alexithymia may be particularly relevant in explaining suicidality among people with ASD. It has also been shown that there is a close link between alexithymia and anxiety in ASD (Maisel et al. 2016). This could help explain the role of alexithymia in suicidality among people with ASD. Because anxiety is linked to decreased quality of life (van Steensel et al. 2012), it could increase suicidality risk among people with ASD. Finally, in our study, age and gender did not contribute significantly to predict suicidality. This is in contradiction with previous studies that found that young people with ASD are more likely to die by suicide than young people without ASD (Kirby et al. 2019) and that being younger than 10 years old is a protective factor (Mayes et al. 2013). One explanation could be that our sample was limited to adults (18+ years old), which could thus explain why no age effects were found. Regarding gender effects, it is possible that those might be restricted to samples including people with ASD with intellectual disability (Hirvikoski et al. 2016), and could thus not be found in our sample because it did not include individuals with ASD with intellectual disability.

Risk Factors for Suicidality in ASD

Several studies identified possible risk factors for suicidality in ASD, such as a higher intelligence with greater social skills or low social support and high loneliness (Sterling et al. 2008; Hedley et al. 2017). In the present study, the findings indicate that antidepressant intake, autistic traits, depressive symptomatology, and alexithymia in association with autistic traits play a role in the occurrence of suicidality. However, factors such as age and gender that have been found to be important in other studies (Hirvikoski et al. 2016; Mayes et al. 2013), have not contributed to the explanation of suicidality in the present study.

Taken together, these factors show that individuals with ASD are confronted with a large number of challenges that are directly linked to their specific difficulties. There is a higher prevalence of alexithymia among people with ASD, which may predispose individuals with ASD to more problems in expressing and identifying emotions. Furthermore, people with ASD often have difficulties with social skills and social communication. Adults with ASD with average or above average intelligence are often aware of their difficulties interacting and communicating with others, and often have a desire of "fitting in" the society (Sterling et al. 2008). These problems might explain why people with ASD are more often vulnerable to social situations and have more difficulties finding their place in society. Those with more autistic traits, who have increased alexithymia, might feel overburdened more quickly, as they have more difficulties in identifying emotions or correctly interpreting social situations. As a result, the risk of suicidality may increase.

Implications

The results of this study indicate some implications for assessment and interventions for individuals with ASD. As autistic traits moderated the relation between alexithymia and suicidality, one possible implication is that interventions on alexithymia might be helpful in order to prevent suicidality among people with high and mean levels of autistic traits. It is important to assess alexithymia in people with ASD and individuals with ASD might benefit from trainings targeting skills such as emotional awareness to learn identifying emotions and to develop coping strategies to manage emotional stress in order to prevent suicidal ideations. However, as the causality link between alexithymia and suicidality is not clear yet, further research is needed to examine this link more closely and to examine the effects of such interventions. Another possible implication from this study considers the need of assessment tools for depression, suicidality, and other frequent associated mental conditions, such as alexithymia, that are specific to people with ASD. Even though the assessment tools used in the present study are frequently used with people with ASD (Bird et al. 2010; Cassidy et al. 2018a, b), these tools have been designed for the general population. Hence, tools conceived taking into consideration the specificities of people with ASD may enable associated mental health concerns to be more reliably detected in ASD.

Furthermore, the present findings implicate that it is important to be aware of the large number of difficulties individuals with ASD are facing. A greater awareness for this population, especially in clinical settings, is needed. As depression is a strong predictor of suicidality, psychotherapeutic approaches are helpful, but might be adjusted accordingly to the specific needs of people with ASD, such as the lack of social skills or high levels of alexithymia. Finally, more studies are needed on the impact of antidepressant medication in the suicidality of people with ASD. Our study showed that 25% of people with ASD take antidepressant medication and even though antidepressant intake is linked to having depression and thus the contributing effect of antidepressants to suicidality could partially be explained by depression, it played an independent role.

Limitations

Even though the present study contributes to further the understanding of the risk factors associated with suicidality in ASD, a few limitations pertaining to this study need to be mentioned. First, it is important to consider the possible difficulties people with ASD may face when answering to the questions of the assessment tools due to their specific problems in literal thinking (i.e. difficulties in abstract thinking or "reading between the lines"). There is a lack of specific assessment tools for mental health problems in ASD and the measures used in this study have been designed for the general population. Therefore, the possibility of under- or over-reporting of mental health problems, while answering to the survey must be taken into account. Furthermore, while we opted for the CES-D as a measure of depressive symptomatology due to its good psychometric properties and usage of current depressive state, other measures such as the Beck Depression Inventory, second edition (BDI-II; Beck et al. 1996) or the Patient Health Questionnaire (PHQ-9; Kroenke and Spitzer 2002), have been shown to be more appropriate to be used with people with ASD (Cassidy et al. 2018a).

For the interpretation of the results, it is noteworthy that even though there are more males than females diagnosed with ASD, more women participated in the present study, both in the control and the ASD groups. The present study was advertised as a study about mental health. Therefore, it is possible that, as indicated by previous research (Hirvikoski et al. 2016), women with ASD may be further affected by mental health issues, which might have attracted their participation in the study. However, and even though, gender was associated with depressive symptomatology, it was not associated with suicidality or alexithymia and it did not significantly contribute to the explanation of suicidality in the regression model.

Moreover, due to the fact that the survey data were collected online, it was not possible to confirm the ASD diagnoses by ourselves, but only through participants' self-reporting. To circumvent this, the recruitment of participants with ASD was limited to institutions working with people with ASD and to closed online forums for people with ASD. Furthermore, we included the assessment tool AQ-short to determine participants' autistic traits and the regression analysis was conducted using autistic traits as a predictor. The AQ-short explores autistic traits and provides good sensitivity and specificity of clinically significant autistic levels but it cannot be considered a diagnostic instrument (Hoekstra et al. 2011). Among the control group, 30% of the participants had a score on autistic traits above the cutoff. It is not clear why there were so many participants with high autistic traits in the control group.

Additionally, in the present study it was not possible to distinguish the separate effects of depressive symptomatology and antidepressant intake. However, depressive symptomatology together with anxiety effects, which were not measured in the present study, likely explain a large part of the contribution of antidepressants. Nevertheless, as indicated in our results, antidepressant intake still had a contribution of its own.

A final limitation of this study is related to the fact that only individuals with ASD without severe intellectual disability could participate in this study. Therefore, the present results only apply to a portion of the population with ASD and cannot be generalized to all those with ASD. Further research should be conducted to assess the suicidality risk among people with ASD with intellectual disability, which also includes measures of alexithymia.

Conclusions

Acknowledging its limitations, the present study provides some important findings about suicidality in ASD. It shows that individuals with ASD, compared to individuals without ASD, are at an increased risk of suicidality and that specific risk factors may be present among people with ASD. The main contribution and novelty of this study is that alexithymia, in combination with increased levels of autistic traits, play an important role in the determination of suicidality risk. Furthermore, the present study confirmed again that antidepressant intake and depressive symptomatology play an important role in predicting suicidality. Thus, prevention and intervention programs on suicidality among people with ASD should take alexithymia severity into account along with antidepressant's intake and depressive symptomatology. Further research is needed, however, in order to examine those relationships as well as the specific risk factors of suicidality in ASD more closely.

Acknowledgments This manuscript has not been previously published and is not under consideration in the same or substantially similar form in any other journal.

Author Contributions All authors whose names appear on the submission, made substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data; drafted the work or revised it critically for important intellectual content; approved the version to be published; and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Angst, J., Angst, F., & Stassen, H. H. (1999). Suicide risk in patients with major depressive disorder. *The Journal of Clinical Psychiatry, 60*(2), 57–62.

Bagby, R. M., Taylor, G. J., & Parker, J. D. (1994). The twenty-item Toronto alexithymia scale—II. Convergent, discriminant, and concurrent validity. *Journal of Psychosomatic Research, 38*(1), 33–40.

Balfe, M., & Tantam, D. (2010). A descriptive social and health profile of a community sample of adults and adolescents with Asperger syndrome. *BMC Research Notes, 3*(1), 300.

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The autism-spectrum quotient (AQ): Evidence from asperger syndrome/high-functioning autism, malesand females, scientists and mathematicians. *Journal of Autism and Developmental Disorders, 31*(1), 5–17.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). Beck depression inventory-II. *San Antonio, 78*, 490–498.

Berthoz, S., & Hill, E. L. (2005). The validity of using self-reports to assess emotion regulation abilities in adults with autism spectrum disorder. *European Psychiatry, 20*(3), 291–298.

Bird, G., & Cook, R. (2013). Mixed emotions: The contribution of alexithymia to the emotional symptoms of autism. *Translational Psychiatry, 3*(7), e285.

Bird, G., Silani, G., Brindley, R., White, S., Frith, U., & Singer, T. (2010). Empathic brain responses in insula are modulated by levels of alexithymia but not autism. *Brain, 133*(5), 1515–1525.

Cassidy, S., & Rodgers, J. (2017). Understanding and prevention of suicide in autism. *The Lancet Psychiatry, 4*(6), e11.

Cassidy, S., Bradley, P., Robinson, J., Allison, C., McHugh, M., & Baron-Cohen, S. (2014). Suicidal ideation and suicide plans or attempts in adults with Asperger's syndrome attending a specialist diagnostic clinic: A clinical cohort study. *The Lancet Psychiatry, 1*(2), 142–147.

Cassidy, S. A., Bradley, L., Bowen, E., Wigham, S., & Rodgers, J. (2018a). Measurement properties of tools used to assess depression in adults with and without autism spectrum conditions: A systematic review. *Autism Research, 11*(5), 738–754.

Cassidy, S. A., Bradley, L., Bowen, E., Wigham, S., & Rodgers, J. (2018b). Measurement properties of tools used to assess suicidality in autistic and general population adults: A systematic review. *Clinical Psychology Review, 62*, 56–70.

Cole, D. A. (1988). Hopelessness, social desirability, depression, and parasuicide in two college student samples. *Journal of Consulting and Clinical Psychology, 56*(1), 131.

Costa, A. P., Steffgen, G., & Samson, A. C. (2017). Expressive incoherence and alexithymia in autism spectrum disorder. *Journal of Autism and Developmental Disorders, 47*(6), 1659–1672.

Cotton, C. R., Peters, D. K., & Range, L. M. (1995). Psychometric properties of the suicidal behaviors questionnaire. *Death Studies, 19*(4), 391–397.

De-la-Iglesia, M., & Olivar, J. S. (2015). Risk factors for depression in children and adolescents with high functioning autism spectrum disorders. *The Scientific World Journal, 2015*, 127853.

Ghaziuddin, M., Ghaziuddin, N., & Greden, J. (2002). Depression in persons with autism: Implications for research and clinical care. *Journal of Autism and Developmental Disorders, 32*(4), 299–306.

Ghaziuddin, M., & Zafar, S. (2008). Psychiatric comorbidity of adults with autism spectrum disorders. *Clinical Neuropsychiatry, 5*(1), 9–12.

Hawton, K., & van Heeringen, K. (2009). Suicide. *Lancet, 373*, 1372–1381.

Hedley, D., & Uljarević, M. (2018). Systematic review of suicide in autism spectrum disorder: Current trends and implications. *Current Developmental Disorders Reports, 5*(1), 65–76.

Hedley, D., Uljarević, M., Wilmot, M., Richdale, A., & Dissanayake, C. (2017). Brief report: Social support, depression and suicidal ideation in adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 47*(11), 3669–3677.

Hill, E., Berthoz, S., & Frith, U. (2004). Brief report: Cognitive processing of own emotions in individuals with autistic spectrum disorder and in their relatives. *Journal of Autism and Developmental Disorders, 34*(2), 229–235.

Hintikka, J., Honkalampi, K., Koivumaa-Honkanen, H., Antikainen, R., Tanskanen, A., Haatainen, K., et al. (2004). Alexithymia and suicidal ideation: A 12-month follow-up study in a general population. *Comprehensive Psychiatry, 45*(5), 340–345.

Hirvikoski, T., Mittendorfer-Rutz, E., Boman, M., Larsson, H., Lichtenstein, P., & Bölte, S. (2016). Premature mortality in autism spectrum disorder. *The British Journal of Psychiatry, 208*(3), 232–238.

Hoekstra, R. A., Bartels, M., Cath, D. C., & Boomsma, D. I. (2008). Factor structure, reliability and criterion validity of the Autism-Spectrum Quotient (AQ): A study in Dutch population and patient groups. *Journal of Autism and Developmental Disorders, 38*(8), 1555–1566.

Hoekstra, R. A., Vinkhuyzen, A. A., Wheelwright, S., Bartels, M., Boomsma, D. I., Baron-Cohen, S., et al. (2011). The construction and validation of an abridged version of the autism-spectrum quotient (AQ-Short). *Journal of Autism and Developmental Disorders, 41*(5), 589–596.

Hofvander, B., Delorme, R., Chaste, P., Nydén, A., Wentz, E., Ståhlberg, O., et al. (2009). Psychiatric and psychosocial problems in adults with normal-intelligence autism spectrum disorders. *BMC Psychiatry, 9*(1), 35.

Honkalampi, K., Hintikka, J., Tanskanen, A., Lehtonen, J., & Viinamäki, H. (2000). Depression is strongly associated with alexithymia in the general population. *Journal of Psychosomatic Research, 48*(1), 99–104.

Honkalampi, K., Koivumaa-Honkanen, H., Lehto, S. M., Hintikka, J., Haatainen, K., Rissanen, T., et al. (2010). Is alexithymia a risk factor for major depression, personality disorder, or alcohol use disorders? A prospective population-based study. *Journal of Psychosomatic Research, 68*(3), 269–273.

Hudson, C. C., Hall, L., & Harkness, K. L. (2019). Prevalence of depressive disorders in individuals with autism spectrum disorder: A meta-analysis. *Journal of Abnormal Child Psychology, 47*(1), 165–175.

Husaini, B. A., & Neff, J. A. (1980). Characteristics of live events and psychiatric impairment in rural communities. *Journal of Nervous and Mental Disease, 168*(3), 159–166.

Kajanoja, J., Scheinin, N. M., Karukivi, M., Karlsson, L., & Karlsson, H. (2018). Is antidepressant use associated with difficulty identifying feelings? A brief report. *Experimental and Clinical Psychopharmacology, 26*(1), 2–5.

Kessler, R. C., Borges, G., & Walters, E. E. (1999). Prevalence of and risk factors for lifetime suicide attempts in the National Comorbidity Survey. *Archives of General Psychiatry, 56*(7), 617–626.

Kirby, A. V., Bakian, A. V., Zhang, Y., Bilder, D. A., Keeshin, B. R., & Coon, H. (2019). A 20-year study of suicide death in a statewide autism population. *Autism Research, 12*(4), 658–666.

Klinkman, M. S., Coyne, J. C., Gallo, S., & Schwenk, T. L. (1997). Can case-finding instruments be used to improve physician detection of depression in primary care? *Archives of Family Medicine, 6*(6), 567–573.

Kraper, C. K., Kenworthy, L., Popal, H., Martin, A., & Wallace, G. L. (2017). The gap between adaptive behavior and intelligence in autism persists into young adulthood and is linked to psychiatric co-morbidities. *Journal of Autism and Developmental Disorders, 47*(10), 3007–3017.

Kroenke, K., & Spitzer, R. L. (2002). The PHQ-9: A new depression diagnostic and severity measure. *Psychiatric Annals, 32*, 509–515.

Kurita, H., & Koyama, T. (2006). Autism-Spectrum Quotient Japanese version measures mental health problems other than autistic traits. *Psychiatry and Clinical Neurosciences, 60*(3), 373–378.

Lainhart, J. E. (1999). Psychiatric problems in individuals with autism, their parents and siblings. *International Review of Psychiatry, 11*(4), 278–298.

Lugnegård, T., Hallerbäck, M. U., & Gillberg, C. (2011). Psychiatric comorbidity in young adults with a clinical diagnosis of Asperger syndrome. *Research in developmental disabilities, 32*(5), 1910–1917.

Maisel, M. E., Stephenson, K. G., South, M., Rodgers, J., Freeston, M. H., & Gaigg, S. B. (2016). Modeling the cognitive mechanisms linking autism symptoms and anxiety in adults. *Journal of Abnormal Psychology, 125*(5), 692.

Mayes, S. D., Gorman, A. A., Hillwig-Garcia, J., & Syed, E. (2013). Suicide ideation and attempts in children with autism. *Research in Autism Spectrum Disorders, 7*(1), 109–119.

Mazefsky, C. A. (2015). Emotion regulation and emotional distress in autism spectrum disorder: Foundations and considerations for future research. *Journal of Autism and Developmental Disorders, 45*(11), 3405–3408. https://doi.org/10.1007/s10803-015-2602-7.

Mikami, K., Inomata, S., Hayakawa, N., Ohnishi, Y., Enseki, Y., Ohya, A., et al. (2009). Frequency and clinical features of pervasive developmental disorder in adolescent suicide attempts. *General Hospital Psychiatry, 31*(2), 163–166.

Osman, A., Bagge, C. L., Gutierrez, P. M., Konick, L. C., Kopper, B. A., & Barrios, F. X. (2001). The Suicidal Behaviors Questionnaire-Revised (SBQ-R): Validation with clinical and nonclinical samples. *Assessment, 8*(4), 443–454.

Paquette-Smith, M., Weiss, J., & Lunsky, Y. (2014). History of suicide attempts in adults with Asperger syndrome. *Crisis, 35*(4), 273–277.

Qualtrics, I. (2013). Retrieved from https://www.qualtrics.com. Provo, UT, USA.

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*(3), 385–401.

Raja, M., Azzoni, A., & Frustaci, A. (2011). Autism spectrum disorders and suicidality. *Clinical Practice and Epidemiology in Mental Health, 7*, 97–105.

Salminen, J. K., Saarijärvi, S., Äärelä, E., Toikka, T., & Kauhanen, J. (1999). Prevalence of alexithymia and its association with sociodemographic variables in the general population of Finland. *Journal of Psychosomatic Research, 46*(1), 75–82.

Samson, A. C., Huber, O., & Gross, J. J. (2012). Emotion regulation in Asperger's syndrome and high-functioning autism. *Emotion, 12*(4), 659.

Segers, M., & Rawana, J. (2014). What do we know about suicidality in autism spectrum disorders? A systematic review. *Autism Research, 7*(4), 507–521.

Shah, P., Hall, R., Catmur, C., & Bird, G. (2016). Alexithymia, not autism, is associated with impaired interoception. *Cortex, 81*, 215–220.

Sifneos, P. E. (1973). The prevalence of 'alexithymic'characteristics in psychosomatic patients. *Psychotherapy and Psychosomatics, 22*(2–6), 255–262.

Stephenson, K. G., Luke, S. G., & South, M. (2019). Separate contributions of autistic traits and anxious apprehension, but not alexithymia, to emotion processing in faces. *Autism, 23*(7), 1830–1842.

Sterling, L., Dawson, G., Estes, A., & Greenson, J. (2008). Characteristics associated with presence of depressive symptoms in adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 38*(6), 1011–1018.

Stone, M., Laughren, T., Jones, M. L., Levenson, M., Holland, P. C., Hughes, A., et al. (2009). Risk of suicidality in clinical trials of antidepressants in adults: Analysis of proprietary data submitted to US Food and Drug Administration. *BMJ, 339*, b2880.

Storch, E. A., Sulkowski, M. L., Nadeau, J., Lewin, A. B., Arnold, E. B., Mutch, P. J., et al. (2013). The phenomenology and clinical correlates of suicidal thoughts and behaviors in youth with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 43*(10), 2450–2459.

Taylor, G. J., Bagby, R. M., & Parker, D. A. (1997). *Disorders of affect regulation. Alexithymia in medical and psychiatric illness*. New York: Cambridge University Press.

van Steensel, F. J., Bögels, S. M., & Dirksen, C. D. (2012). Anxiety and quality of life: Clinically anxious children with and without autism spectrum disorders compared. *Journal of Clinical Child & Adolescent Psychology, 41*(6), 731–738.

Wigham, S., Barton, S., Parr, J. R., & Rodgers, J. (2017). A systematic review of the rates of depression in children and adults with high-functioning autism spectrum disorder. *Journal of Mental Health Research in Intellectual Disabilities, 10*(4), 267–287.

World Health Organization. (2014). *Preventing suicide: A global imperative*. Geneva: World Health Organization.

World Health Organization. (2018). *National suicide prevention strategies: Progress, examples and indicators*. Geneva: World Health Organization.

Zahid, S., & Upthegrove, R. (2017). Suicidality in autistic spectrum disorders. *Crisis, 38*(4), 237–246.