

Suicidality in Autistic Spectrum Disorders (ASD): A systematic review

Zahid, Sofia; Upthegrove, Rachel

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Abstract

Background: - There is suggestion that people with Autistic Spectrum Disorders (ASD), may be at increased risk of suicide, however the research surrounding this topic has been minimal. There are conflicting reports in existing studies.

Aim: - To bring together research investigating the prevalence, risk factors and co-morbid factors of suicidality in ASD.

Method: - A Systematic search following PRISMA guidelines of Medline, Psych Info, Embase and Web of Science. After exclusion criteria were applied, 70 full text articles were screened. The final review contained 12 papers with a total sample size of 2651.

Results: Prevalence of suicide attempts varied between 7% and 47%, suicidal ideation reported in up to 72%. Being male, a history of self harm and depression were cited as significant risk factors. Papers were cross sectional and contained a number of limitations. Only one paper used 'gold standard' for diagnosis of ASD, and one a standardised measure of suicidal behaviour.

Conclusion: - Suicidal attempts and ideation are increased in ASD, however to what extent and what risk factors are identified within this group remain under-investigated. There is a lack of research surrounding protective factors. The correlation between ASD and suicidality needs further examination with longitudinal research.

Key Words: - Suicidal Behaviour, Suicide, Autism Spectrum Disorders, Asperger's Syndrome, and Pervasive Developmental Disorders-others not specified.

Introduction

In the United Kingdom, nearly 6,000 people complete suicide. Suicide rates are three times higher in males than females, and suicide remains a leading cause of death in young adults (ONS, 2012). There are known risk factors for suicide, such as depression; of individuals who have died from suicide, 90% had depression (BarracloUGH, Bunch, Nelson, and Sainsbury (1974), and psychosis (Upthegrove et al., 2010). Autistic Spectrum Disorders (ASD) are a group of neurodevelopmental disorders which impact on a person's behaviour, social communication, social skills and interests. There are three main subtypes of ASD; Autistic disorder, Asperger syndrome (AS), and Pervasive Developmental Disorder otherwise-not specified (PDD-NOS) (American Psychological Association, 2000). Throughout this paper, all three sub-types will be referred to as ASD rather than their individual names unless otherwise stated. Many individuals who receive a diagnosis also have other co-morbid diagnoses such as ADHD, anxiety, and depression.

The risk of suicide attempts and ideation in ASD is not clearly established. Mikami, Onishi, and Matsumoto (2014) suggested that a number of factors may contribute to suicide in ASD, and when diagnosing ASD it is important to consider risk based on other co-morbid disorders. In this study, ASD alone was not a risk factor for suicidality, rather being diagnosed with a co-morbid mood disorder added risk. Lainhart (1999) suggested that depression and anxiety are more likely to occur alongside ASD, a factor found in a number of other studies (Fitzgerald, 2007; Kato et al., 2013; Kocourkova, Dudova, & Koutek, 2013; Shtayermman, 2007). It is estimated that over 700,000 people have been diagnosed with ASD in the UK (National Autistic Society). Individuals with ASD are usually diagnosed within childhood, however there have been some cases where this has not been the case. Case studies have examined this area, demonstrating that ASD is often not diagnosed until hospitalization after a suicide attempt. The delay of diagnosis can have a profound impact on quality of life and the support available. A study by Shtayermman (2007) examined suicidal ideation in an AS population, and demonstrated that suicidal ideation was present in 50% of

the sample; of which 20% met the diagnosis for Major Depressive Disorder (MDD) and 30% for Generalised Anxiety Disorder (GAD), therefore suggesting that a number of co-morbid factors can impact on suicidality alongside a diagnosis of ASD. Case studies have reported how attempted suicide can be common in ASD. Simoncini et al. (2014) presented the case of a man who attempted suicide who displayed psychotic symptoms; a diagnosis of ASD was not previously made despite showing autistic traits from infancy. The authors suggest that looking for risks and signs for suicidal ideation or behaviours should be implemented into ASD screening early on.

There have been two previous literature reviews examining suicidality in ASD. Hannon and Taylor (2013) carried out a systematic review which looked at 4 papers reporting suicidality in adolescents and young adults. Their review found that the prevalence of suicidality ranged between 7-42%. While this review did suggest that being aged below 25 is the prime age for suicide, a case study Spencer et al (2011) suggests that suicidal behaviour in an ASD can also occur in older adults. Segers and Rawana (2014) published a systematic review examined 10 clinical studies and 3 case studies. Their review suggested that suicidality can significantly impact the ASD population, where the prevalence varied between 10.9-50%. Whilst both reviews were published in recent years, Hannon and Taylor (2013) examined a small number of studies and their review did not include children or adolescents, an important age range to consider. Segers and Rawana (2014) retrieved more papers, however since their literature retrieval in 2013, additional papers may have been published.

In the present systematic review will look at clinical studies that focus on children, adolescents and adults. As we know this area is under researched, it is important to examine all studies that contribute to this area and increase in evidence base. The aim of this systematic review was to bring together research investigating the prevalence, risk factors and co-morbid factors of suicidal attempts and ideation in ASD.

Methods

Following PRISMA guidelines, a systematic search was carried out on the 11th November 2014. A comprehensive search was carried out by searching PsychInfo, Medline (Ovid), Embase and Web of Science databases combining key word searches. Keyword searches included 1. "Autism" "Pervasive Developmental Disorders" "Asperger's Syndrome" "Autism Spectrum Disorders", 2. "Suicidal Ideation" "Suicide" "Attempted Suicide" "Suicidal Behaviour" "Suicidal Attempt". In addition to this, the Royal College Psychiatry Journals and NHS evidence were also searched using the above keywords. Three author groups were also contacted to see if they had additional information regarding their study and if some of them could clarify their results that could be of use for the review; (Mukaddes & Fateh, 2010; Raja, Azzoni, & Frustaci, 2011a and Segers and Rawana (2014).

Inclusion criteria consisted of primary research on a topic surrounding Suicide (Suicide Attempt, Suicidal ideation) in a population of people with an Autistic Spectrum Disorder (ASD) diagnosis. This included Asperger's syndrome (AS), Pervasive developmental disorder otherwise not specified (PDD-ONS) and ASD. There were no exclusions on age or gender. Self-injurious behaviour was excluded as whilst this action is one of deliberate injury harms there is no intention of ending their life; rather this behaviour is understood as a way of communicating distress (Muehlenkamp & Gutierrez, 2004). The exclusion criteria consisted of duplicates of the papers, text not in English, the study was not primary research, or the paper was based on an unrelated topic and case studies. If the paper did not specifically examine ASD and suicidality it was also excluded.

From the search strategy, a total of 121 studies were screened; 51 duplicated were removed, 7 were not in English, 6 were not primary research, and 15 were based on an unrelated topic. This then led to 40 articles being examined for eligibility of the inclusion criteria. Upon reading the papers, a further 22 articles were excluded as they did not meet the inclusion criteria. 6 case studies were also excluded. In total there were 12 quantitative studies. See Figure 1.

Results

12 papers with quantitative data were reviewed. See Table 1. Age was evenly distributed across the papers; 5 looked at adults, 5 children and 2 adolescents. Males were mostly studied with an average of 62% across all the papers in this review. A range of measures were used to assess ASD severity including the Autism Behaviour Quotient (AQ), Checklist for Autism Spectrum Disorder, (CASD), Autism Behaviour Checklist (ABC) and Krug Asperger's Disorder Index (KADI). One study used a diagnostic instrument; Autism Diagnostic Interview schedule (ADOS)(Storch et al., 2013). Standardised measures were used to assess suicidality in one study (Shtayermman, 2007) and co-morbid disorders in seven studies.

Prevalence of suicide attempts in ASD

Four papers examined only suicide attempts (Kato et al., 2013; Mikami et al., 2009; Paquette-Smith, Weiss, & Lunsy, 2014; Takara & Kondo, 2014) with prevalence rates from 7-47%.

Kato et al (Kato et al., 2013) and Takara and Kondo (Takara & Kondo, 2014) compared suicidal attempts in an adult ASD sample with a Non-ASD sample (depression and adjustment disorder respectively). Kato et al found that the ASD group used more lethal means than a non-ASD group. In meta-analysis using Mantel-Haenszel method (Mantel & Haenszel, 1959) for calculating the weighted pooled odds ratio with a fixed effects model, using the combined samples from these two papers, with a total sample of 923, ASD was a significant risk factor for suicide attempt: pooled O.R. 1.70 (95% C.I. 1.05-2.77), z 2.17. $p=0.02$.

In studies without a control group, Paquette-Smith (Paquette-Smith et al., 2014) found that 35% of their sample who were diagnosed AS had attempted suicide, whereas Mikami (Mikami et al., 2014) found 47% of their sample of participants with ASD had attempted suicide.

Prevalence of Suicidal ideation in ASD

There were 4 papers which examined both suicide attempts and suicidal ideation (Cassidy et al., 2014; Mayes, Gorman, Hillwig-Garcia, & Syed, 2013; Mukaddes & Fateh, 2010; Raja, Azzoni, & Frustaci, 2011a). The rates of suicide attempts and suicidal ideation varied from 3.8% to 66%. Raja (Raja et al., 2011a) found that 7.7% of their sample had attempted suicide, while 30.8% of their sample had suicidal ideation. Mayes et al (Mayes et al., 2013) found the mothers of children who had ASD rated suicidality to be a significant difficulty with 10.9% reporting suicidal ideation and 7.2% for suicidal attempts. They found that suicidal ideation or attempts was 28 times higher compared to the typical children group. Mukaddes & Fateh (Mukaddes & Fateh, 2010) found that 6 children in their sample displayed suicidal ideation or suicide attempts, of which 5 had attempted suicide and 1 had strong suicidal ideation. Cassidy et al (Cassidy et al., 2014) found that 66% of their sample had self-reported a history of suicidal ideation and 35% had reported a history of planned or attempted suicide, which was 9 times higher than the general population

4 papers examined only suicidal ideation in ASD (Ghaziuddin, Alessi, & Greden, 1995; Hardan & Sahl, 1999; Shtayermman, 2007; Storch et al., 2013). Storch (Storch et al., 2013) overall found, 20% of their sample had previously had suicidal ideation and found that suicidal ideation was more prevalent in those who had a diagnosis of Autism, compared to children who had a diagnosis of ASD. Shtayermman (2007) found that half of their sample had suicidal ideation. Ghaziuddin et al (Ghaziuddin et al., 1995) found that 8 of their participants reported suicidal ideation however they stated that these thoughts cannot be caused due to the fact that these participants have a diagnosis of ASD, therefore suggesting that ASD alone does not account for suicide. Hardan and Sahl (1999) found that 20% of their sample experienced suicidal ideation, however overall, suicidality was underreported in ASD sample.

Co-morbidity

All papers reported psychiatric co-morbidities, however high prevalence rates were seen in Mukaddes and Sateh (Mukaddes & Fateh, 2010) who reported 94% of their sample had at least one psychiatric co-morbidity, of which anxiety disorder was the highest (54%), followed by disruptive behaviour disorder (48%) and mood disorder (37%). Interestingly individuals who presented with suicidality all had depression. Kato et al (Kato et al., 2013) found that adjustment disorders were significantly higher in the ASD group compared a non-ASD group, however mood disorders were significantly lower in the ASD group than the non-ASD group. Similarly Raja (Raja et al., 2011a) found that 67% of the sample had psychiatric co-morbidity of Schizophrenia. Other co-morbidities reported were alcohol abuse, mania with psychotic symptoms, and mood disorder with psychotic symptoms by Storch et al (Storch et al., 2013) and social phobia, anxiety disorder, specific phobia, PTSD and depression by Shtayermman (Shtayermman, 2007)

Risk factors of suicide attempts

8 papers discussed risk factors for suicidal attempts. Depression was the most cited risk factor (Mayes et al., 2013; Mikami et al., 2009; Paquette-Smith et al., 2014; Storch et al., 2013; Takara & Kondo, 2014). Cassidy et al (Cassidy et al., 2014) found depression singularly influences suicide attempts, however Mayes et al (Mayes et al., 2013) found being over 10 years of age , Black/Hispanic, Low Social Economic Status and Male were also risk factors for suicidality in their ASD sample. Paquette-Smith et al (Paquette-Smith et al., 2014) also found a high score on Autism Questionnaire (AQ) was predictive, and although gender differences was small, it was still significant. Takara (Takara & Kondo, 2014) used binary logic regression and found 3 significant risk factors which were; agitation during a depressive episode, historical suicide attempts and co-morbid pervasive developmental disorder. They suggested that there was very little research being carried out looking at agitation and suicidal ideation; however it has shown it is a contribution.

In contrast to the findings above, Storch et al (Storch et al., 2013) found that factors such as age, sex, and ethnicity, sub-types of ASD and medication status were not significant predictors of suicide attempts. They carried out independent logistic regression models which only found depression as a significant predictor for attempts in children with ASD.

Discussion

This systematic review confirms that there is a limited amount of research looking at suicidality in an ASD sample, however that which is present suggest patism with ASD are at heightened risk of both suicidal ideation and attempts. This supports previous findings from (Hannon & Taylor, 2013; Segers & Rawana, 2014) , and highlights that this area remains a neglected field. The prevalence of suicidal behaviour, attempts and ideation was higher in an ASD sample, compared to the non-ASD sample in two papers with control groups with significant increased odds ratio of 1.7 in meta-analysis. It was also found that that more lethal means of suicidal attempts were used in an ASD sample compared to a non-ASD sample. Life time suicidal ideation rates was also reported as higher in ASD compared to suicidal attempts, however rates varied significantly with suicidal ideation averaging 32% and suicidal attempts 24.6%. This could be due to the differing samples chosen by the authors, their aims and inclusion and exclusion criteria's.

Eight of the twelve papers looked at the risks of suicidal attempts (Cassidy et al., 2014; Ghaziuddin et al., 1995; Mayes et al., 2013; Mikami et al., 2009; Paquette-Smith et al., 2014; Raja et al., 2011a; Storch et al., 2013; Takara & Kondo, 2014). Overall depression was the highest risk factor. There were inconsistencies between papers on whether age, sex, ethnicity and sub-types of ASD are risk factors for suicidal behaviour. Although some papers report ASD as a risk factor for suicidal behaviour it is difficult assume causality between the two. All papers reported other co-morbid factors for suicidal attempts, ranging from schizophrenia, adjustment disorders, anxiety disorders and mood disorders.

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A systematic review by Keith Hawton, Casañas i Comabella, Haw, and Saunders (2013) was carried out looking at 19 studies in 28 papers. Their main aim was to investigate literature which examined risk factors for suicide for people who have depression. Overall they found a strong association between suicide and depression. A number of risk factors associated suicide for people with depression were found including being male, family history of a psychiatric disorder, previously attempted suicide, severe depression, hopelessness, co-morbid disorders and misuse of alcohol and drugs. They concluded that these factors should be included in risk assessments. These findings support research regarding the link between suicidality and mental health problems. This systematic review provides evidence that an ASD population are at further risk of suicide attempts, and so assessing individuals who have ASD for depressive symptoms or vice versa, should become part of professional practice to pick up suicidal behaviours earlier. All papers in this review reported co-morbid mental illness, many of which report that individuals with ASD also have at least one co-morbid mental illness which range from a variety of illnesses such as depression, anxiety disorders, adjustment disorders and schizophrenia. Given the high prevalence of co-morbid mental illness reported, ASD alongside a co-morbid disorder could increase the risk of suicidal behaviour; therefore it is important that suicidality is examined if it is shown that this population have other psychiatric disorders. Whilst papers reviewed suggest that being diagnosed with ASD may be a risk factor for suicidal attempts, it is difficult to show causality without larger longitudinal studies.

Quality of papers available

There are clear limitations to the scope and quality of papers available for this systematic review. Apart from one paper (Storch et al. 2013); none the papers used 'gold standard' diagnosis assessments to diagnosis ASD. Storch et al. (2013) used ADOS and ADIS, which both have been recognised as reliable and highly valid tools to assess ASD (Falkmer, Anderson, Falkmer, & Horlin, 2013). Majority of the papers relied on the DSM-III-R/DSM-IV as a way to certain a reliable diagnosis of ASD. Some of the papers used the AQ, which has

been reported as a reliable self-administered questionnaire for ASD. It has been translated to other languages and this was seen in this review, as it was translated to Japanese. (Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001). This is a strength as the same questionnaire is standardised and used in different countries, however it is not a diagnostic assessment. The majority of the papers in this review were cross-sectional studies. Thus the majority of studies measure participants at one point in time; it is unclear whether the risk of suicidal behaviour increases or decreases throughout their life and when the risk of suicidal behaviour was at its highest. Furthermore using a cross-sectional method only allows you to infer an association between ASD and suicidality and not a causation which is what is missing in this particular area of research (Raja, Azzoni, & Frustaci, 2011b). Some papers reported using a retrospective method, which is a good way at examining participant's history relating to suicidality. This type of study can however impact on sample bias, as only participants with a history of suicidality with ASD traits are examined compared to participants who may not have had a history of this, or only inpatients were included in their study etc.

Many of the papers did not report how they recruited for their sample, however of the small amount of papers did, this varied from snowball sampling (Shtayermman, 2007), consecutive sample (Mikami et al. (2009), and self-selected (Paquette-Smith et al., 2014). Although a number of different sample methods were used, the samples in these studies may not have been representative thus making it difficult to generalise to this specific population. Protective factors were missing in all the papers. Cassidy et al. (2014) suggested that more research is required at promoting protective factors that can prevent suicide, for example early diagnosis, social support, coping strategies and social skills, which this particular group of individual's lack, consequently having these skills can hopefully, protect them for suicide.

The strength of this review include the large total sample and the range of demographic populations covered (i.e. male and female and all age groups). The total sample reflects that

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a large proportion of the ASD population, i.e. more male than female however it does highlight a gap in research, where females with ASD and the rates of suicide should be examined too see the prevalence of this and whether being females is a risk factor for suicide. The total sample size across all papers was 2,651. This large number is an additional strength, as generalizability is increased. The origins of the papers differed across the world, there were papers from the USA and Japan, mostly but other places were included such as the UK and Turkey. 2 papers included a control group, which is a strength as it allows comparison with a ASD group, however to increase the validity of the results, more papers should include comparison groups.

Future Research

Longitudinal designs can examine whether suicidal rates change over a course of time, or whether there is a prime age when it occurs. More research looking at females should be carried out. Protective factors were not addressed in the papers that were incorporated into this review. This area of research is highly important, and further research should examine this as it would be helpful for both clinicians and patients identifying factors during assessments and implementing these into interventions. Protective factors such as social support, religious beliefs and being a carer for children were found by K. Hawton and van Heeringen (2009) in a typical population; therefore identifying factors like these in an ASD population may prove to be beneficial in the prevention of suicidality.

In addition to this, it is important for further studies to use the gold standard for ASD diagnosis and for suicidality instead of relying on other measures and previous diagnosis. In doing so, it would increase the reliability of future studies as there are standardised measures being used which have been certified appropriate. And finally more education for families and professionals to pick up the signs and traits of ASD at an earlier stage, to ensure there is no delayed diagnosis as we have seen the implications this has had on some individuals.

Conclusion

To conclude, research looking at suicidal attempts and ideation in ASD has increased, however remains limited. Evidence that is present suggests an increased risk in ASD. Larger, longitudinal studies are required to establish the association between suicidal behaviour and ASD, comorbid and further risk factors together with protective factors. Better quality measures need to be used to increase the validity and the reliability of studies. Further research will allow better steps taken in the future to ensure those with suicidal ideation and attempts in ASD receive the best support they need and a delayed diagnosis does not occur, and suicide prevented.

Declaration of Interest: None

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Table 1. Included Studies

Reference	Study Purpose	Sample	Analysis	Measures for ASD	Measure for Suicidality	Other Measures Used	Method of data collection	Main Findings
Paquette-Smith, Weiss and Lunksy, 2014 (Canada)	Suicidality in AS	Sample: Adult, N=50, (56% Males), mean age: 34.5	T tests and χ^2 tests	AQ	Questionnaire	-	Survey	N=18 (36%) attempted suicide, 100% of whom had depression and anxiety. Women more frequent. AS symptomology was higher for suicide attempters than non-attempters
Kato et al, 2013 (Japan)	Frequency and clinical features of suicide attempts with ASD	Sample: Adult, N=587, (34% Males), mean age: 33.7, SD, 12.6	Fishers Exact test, Mann Whitney U	AQ-J	Interview with Individual	MINI	Unstructured Interviews	N=43 (7.3%) diagnosed ASD. Mood disorders significantly lower, adjustment disorders significantly higher in the ASD group compared to the Non-ASD group N=30 (70%). N=10 (23.3%) of the ASD group attempted suicide. Lethal method of suicide significantly higher in ASD group e.g. Fatal cutting/Stabbing and carbon monoxide intake.
Mikami, et al 2009 (Japan)	Frequency and clinical features of PDD relative to suicide.	Sample Adolescents. N=94. (15% Males).	Chi-square test, fisher exact test, Mann-Whitney U	WAIS-R, WISC-III, AQ-J	Interview	DSM-IV-TR	Interview/Questionnaires, Retrospectively by record review.	N=12 (12.8%) individuals diagnosed with PDD (of that, 6 diagnosed with PDD-NOS and 6 diagnosed with AS). Significant difference between the PDD group and Non-PDD group mood or anxiety disorder. In the PDD group, N=1 (8.3%) diagnosed with mood disorder, N=1 (8.3%) Anxiety Disorder, N=10 (83%) adjustment disorder. N=5 (41.7%) with PDD had attempted suicide. N=6 (50%) with PDD had psychiatric problems; however the rate was lower than the Non-PDD group.
Takara and Kondo, 2014	ASD as a risk factor for	Sample: Adult	T Tests, Fischer's exact	AQ-J	Case History	JART, SQID-II	Self-Report Questionnaire	N=37 (11%) diagnosed with ASD, of this group N=25 (68%) diagnosed with PDD-NOS, 24% diagnosed with AS, 8%

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(Japan)	suicide	N=336, (38% of Males) mean age: 41.2,SD, 14.3	test, Binary Logistic regression				(Developmental info-interviews,	diagnosed with AD. Suicide Attempt was significantly higher in the ASD group than the Non-ASD group N=9(24.3%). N=5 (56%) of the SA in ASD had a history of suicidal behaviour. ASD not a significant contribution to ASD. PDD-NOS were a significant risk factor in Suicide with MDD.
Cassidy et al 2014, (UK)	Prevalence of Suicidal ideation and suicide plans with AS	Sample: Adult, N=374, (68% of Males) Mean age: 31.5 years, SD 10.9	Pearson's x2, T-tests	Empathy Quotient, AQ	Self-report screening questionnaire, clinical assessment interview	-	Self-report questionnaire, Face-to-face interview	N=374 (100%) diagnosed with AS, N=243(66%) self-reported lifetime experience of suicidal ideation: 9x higher than general population. N=127(35%) self-reported lifetime experience of planned or attempted suicide. AS significantly more likely to report suicidal ideation, plans or attempts if they had depression. High levels of self-reported autistic traits were reported by individuals who had planned or attempted suicide.
Mukaddes & Fateh, 2010 (Turkey)	Co-morbidity of psychiatric disorders in AD	Sample: Children N=37 (86% Males) Mean age of 10.9	-	WISC-R, Interview with parents and children, K-SADS-PL (Follow up study)	K-SADS	-	Interview/Questionnaire	N=35 (94%) had at least 1 psychiatric disorder; from Anxiety Disorder N=20(54%), N=18, (48%) disruptive behaviour disorder and Mood Disorder N=14 (37%). N=11 (29%) diagnosed with MMD, N=6 (16%) of whom had suicidal behaviour.
Storch et al, 2013 (USA)	Correlation of suicidal thoughts and behaviours in ASD	Sample: Children N=102 (77% Males) Mean age: 10.55 years, SD, 2.3	T-Tests, Chi Square tests, Kruskal-Wallis Test and Mann-Whitney U Test	ADOS	ADIS-IV-C/P	ADIS-IV-C/P, PARS, CBCL, MASC-P, CIS-PV	Interviews/Assessments	100% had a diagnosis of ASD. N=20 (20%) had suicidal thoughts or had a history of suicidal attempts. Children with Autism are more likely to have suicidal thoughts/behaviours than those with Asperger's Disorder. Suicidal thoughts and behaviours are predicted when there is a co-morbid diagnosis such as MDD, PTSD.
Ghaziuddin, Alessi and Greden, 1995	Determined the role of life events	Sample: Children, N=11 (81% Males)	Fisher's exact test (two tailed)	ABC	Not stated	DSM-III-R, The Reiss Scale, Life Events	Test, Interviews and observations	N=11 (100%) diagnosis of Autism/PDD. N=9 (82%) gave history of depression. N=8 (72%) presented history of suicidal thoughts. N=1 (9%) attempted suicide. Social and

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(USA)	with depression and PDD.	Mean age 11				Schedule		environmental factors are important stressors in the occurrence of depression in participants with Autism/PDD.
Shtayermman , 2007 (USA)	Suicidal ideation in AS.	Adolescents and young adults Snowball Sample, N=10 (90% Males) Mean age: 19.7 years, SD, 3	Bivariate Correlation	KADI	Suicidal Ideation Questionnaire	Social Experience Questionnaire , (PHQ-A), Suicidal Ideation Questionnaire	Questionnaires	100% of the sample diagnosed with AS. N=5 (50%) had suicidal ideation. N=2 (20%) met criteria for MDD. N=3 (30%) met criteria for GAD. Significant negative correlation between level of suicidal ideation and severity AS symptomology. Correlation with suicidal ideation and age, age of diagnosis, level of depressive symptoms, degree of peer victimisation.
Harden and Sahl, 1999 (USA)	Examined suicidality	Sample: Children N=233, (72% Males)	Yates corrected χ^2 test, fisher exact test	WISC-R, Suicidal data form filled out	Patient records	DSM-III-R	Medical charts reviewed, assessments	N=47 (20%) present or past suicidal ideation and suicidal attempts. 17% of the suicidal group autism/MR. Suicidal ideation and attempts underreported in Autistic disorder.
Raja, Azzoni, Frustaci, 2011 (Italy)	Suicidal ideation and behaviour of patients with ASD	Sample: Adult, N=26, (96% Males), mean age of 30.2, SD, 9.8 Comparison group N=2495	Chi-square test, fisher exact test, Mann-Whitney U	-	Standardised questionnaire and Interview	BPRS, SANS, SAPS, MMSE, CGI, GAF, Morrison's Scale, UPDRS	Interviews for diagnosis.	N=2 (7.7%) committed suicide. N=1 (3.8%) attempted suicide twice. N=1 (3.8%) self-harm. N=8(30.8%) presented suicidal ideation.
Mayes, Gorman, Hillwig-Garia and Syed, 2013 (USA)	Frequency of suicidal ideation and attempts	Sample: child 3 groups Autism N=791 (84.1% Males) Mean age: 6.6, SD, 3.1 Depression N=35 (25.7% Males) Mean age 13, SD,	X2 and Analysis of Covariance tests, Analysis of variance	CASD	PBS	WISC-III, WISC-IV, PBS,	Assessments and parent interviews	Age 10 years old, Black/Hispanic, Low Social Economic Status (SES) and Male were significant risk factors for children who had suicidal ideation or attempts. 42% of the depressed group had suicidal ideation or attempted suicide, 13.8% of the autism group had suicidal ideation or attempted suicide and 0.5% of typical group had suicide ideation or attempts. 77% with ideation or attempts considered depressed by

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		2.3 Typical N=186, (43.5% Males) Mean age 8.7, SD, 1.7						their mothers.
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ABC, Autism Behaviour Checklist; ADIS-IV-C/P, Anxiety Disorders Interview Schedule for Children for DSM-IV; ADOS, The Autism Diagnostic Observation Schedule; AQ, Autism Spectrum Quotient questionnaire; AQ-J, Autism Spectrum Quotient- Japanese Version questionnaire; BPRS, Brief Psychiatric Rating Scale; CASD, The Checklist for Autism Spectrum Disorder; CBLC, The Child Behaviour Checklist; CGI, Clinical global impression; CIS-PV, Columbia Impairment Scale-Parent Version; DSM-III-R, Diagnostic and Statistical Manual of Mental Disorders-Third Edition- Revised; DSM-IV-TR, Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition, text revision; GAF, Global assessment of functioning; JART, Japanese Version Adult Reading Test; KADI, Krug Asperger's Disorder Index, K-SADS, Kiddie Schedule for Affective Disorders and Schizophrenia for School-Age Children--Present and Lifetime; MASC-P, Multidimensional Anxiety Scale for Children-Parent; MDS-UPDRS, Unified Parkinson's Disease Rating Scale; MINI, Mini International Neuropsychiatric Interview ; MMSE, Mini- Mental State Examination; PARS, The Paediatric Anxiety Rating Scale; PBS, Paediatric Behaviour Scale; PHQ-A, Patient Health Questionnaire for Adolescents; SANS, Scale for the Assessment of Negative Symptoms; SAPS, Scale for the Assessment of Positive Symptoms; SIQ, Suicidal Ideation Questionnaire; SQID-II, The Structured Clinical Interview for DSM-IV Axis II Personality Disorders; WAIS-R, Wechsler Adult Intelligence Scale—Revised; WISC-R, Wechsler Intelligence Scale for Children- Revised; WISC-III, Wechsler Intelligence Scale for Children-Third Edition; WISC-IV, Wechsler Intelligence Scale for Children-Fourth Edition

Figure 1. PRISMA 2009 Flow Diagram

