# Suicide Risk and Attention Deficit-Hyperactivity Disorder (ADHD): A Review of Recent Evidence

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## Contents

## Summary

Background: Attention Deficit-Hyperactivity Disorder (ADHD) is a neurodevelopmental condition that commonly emerges during childhood. ADHD presents with various combinations of inattention, hyperactivity and impulsivity symptoms which can impair interpersonal or academic functioning. Higher levels of ADHD symptoms have been associated with suicidal thoughts and behaviours throughout the lifespan. However, the nature of this relationship remains unclear.

Aims: This review aims to provide an update of ADHD and suicide risk research literature produced since previous reviews were published between 2018 and 2020 and to identify potential gaps in the current research evidence base.

Methods: A literature search of the main academic databases was conducted for studies published between 2018 and July 2022 with 49 unique studies being identified.

Key Findings: Studies showed that individuals with ADHD have a higher risk of suicidal thoughts and suicidal behaviour. Indeed, premature all-cause mortality is also higher when compared to individuals without ADHD.

Studies exploring why these relationships may exist have often focused on the presence of co-occurring psychiatric conditions, rather than exploring the role of psychological or other biopsychosocial factors. However, a few studies investigated the role of psychological factors such as executive functioning and perfectionism as potential factors that may be associated with vulnerability to suicide.

Studies were heterogeneous in design and a wide range of populations were examined. Further, despite the plethora of new publications since 2018, much of these studies focused on secondary analyses of existing datasets, rather than new research.

Conclusions: Consistent with previous findings, we found clear associations between ADHD and suicidal thoughts and suicidal behaviours. This review highlights the need for studies to move away from simply focusing on the ADHD–suicide risk relationship to exploring factors that may underpin this complex relationship. Currently, our understanding of mechanisms that may underlie this relationship remains limited; as a result, it is unclear which specific factors should be targeted for treatment and suicide prevention.

## Acknowledgment

Jane Roberts funded ADHD UK to sponsor this research following the death by suicide of her adult ADHD son, Ben Brimley. After he died, Jane began working to raise awareness and improve the experiences of others with ADHD and discovered that more needs to be known about the relationship of ADHD and suicide. Ben was 30 when he took his own life in December 2020.

## Introduction

Suicide remains one of the leading causes of death globally (World Health Organization [WHO], 2018), indeed it is the second leading cause of death in young people aged 15-29 years (WHO, 2018) and there is some indication that suicide rates may be increasing in younger age groups. A report from the National Centre for Health Statistics in America recorded a 56% increase in suicides for young people (age 10-24) between 2007 and 2017 (Curtin & Heron, 2019).

Suicide deaths, although devastating, do not represent the full extent of the burden of suicidal behaviour (Hawton et al., 2012). It is estimated that for every person who dies by suicide, around 20 more people have attempted suicide (WHO, 2014). However, rates of suicide attempts or suicidal ideation are harder to quantify as individuals may not seek support. Findings from the Adult Psychiatric Morbidity Survey (McManus et al., 2016) in England indicated that while 6.7% of respondents had made a suicide attempts, only a quarter (25.5%) of these individuals had attended hospital for their most recent episode. Additionally, 20.6% of respondents in the Adult Psychiatric Morbidity Survey reported having thought about taking their life.

Suicide can affect individuals from any country, of any gender, and across all stages of the lifespan, however rates vary between countries, genders, and age groups. For instance, it is well established that in most countries of the world, more men die by suicide than women, while women attempt suicide more often than men (WHO, 2018). Research has identified a range of factors which may increase an individual's risk of suicide (e.g., depression, lack of social support, social disadvantage), however these factors are often too generic and our knowledge of the specific markers of suicide risk remains relatively limited (Franklin et al., 2017). As a result, it is difficult to identify specific individuals within high-risk groups who are more likely to take their own lives than others (Franklin et al., 2017; O'Connor, 2011; O'Connor & Kirtley, 2018).

The relationship between mental illness and suicide risk is well established, with as many as 90% of those who die by suicide having a diagnosable psychiatric disorder at the time of their death (Arsenault-Lapierre et al., 2004). In light of this, the presence of psychiatric diagnoses such as depression, substance use, and psychosis have historically been focused on as predominant risk factors for suicide (Bachmann, 2018). However, as the majority of individuals who have a mental illness do not die by suicide, it is recognised that the presence of mental illness itself is not a sufficient marker for suicide risk (Turecki & Brent, 2016) although the presence of certain conditions has been associated with vulnerability to experiencing suicidality.

In light of the complexity of suicide risk, recent models of suicidal behaviour present a more holistic view and emphasise the interaction between psychological, biological and environmental factors in increasing suicide risk. For instance, the Biopsychosocial Model described by Turecki et al. (2019) highlights the interplay between predisposing, developmental, and triggering factors in the emergence of suicide risk. Psychological models, such as the Interpersonal Theory of Suicide (IPT; Joiner, 2005) and the Integrated Motivational-Volitional Model of Suicidal Behaviour (IMV; O'Connor, 2011; O'Connor & Kirtley, 2018), detail factors which may lead to the emergence of suicidal ideation as being distinct from those which may increase an individual's risk of suicide attempts – or death by suicide. In the IPT, individuals are more likely to experience suicidal ideation in the presence of two interpersonal psychological factors; feeling a burden on others (perceived burdensomeness) along with feelings of not belonging (thwarted belongingness) (Joiner, 2005; van Orden et al., 2010). Risk of an individual making the transition from suicidal thoughts to suicidal behaviour is increased in the presence of acquired capability, consisting of fearlessness about death and a high tolerance of physical pain.

The IMV model incorporates factors from the IPT, alongside components from other areas of health and psychological research and expands on their roles as moderators which may act to increase risk of suicidal thoughts or behaviour emerging. Specifically, the IMV model details three phases: the pre-motivational phase (biopsychosocial context), the motivational phase in which suicidal ideation may emerge, and the transition to suicidal behaviours in the volitional phase. Importantly, the IMV model highlights that to understand the role of psychological factors, suicide risk has to be considered within an individual's biopsychosocial context as biological (e.g., genetic), psychological (e.g., personality trait) or environmental (e.g., childhood maltreatment) factors may increase an individual's vulnerability to stress; and it is in the presence of triggering events, that an individual's risk of suicide is increased.

*Attention-Deficit Hyperactivity Disorder*

Attention-Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterised by symptoms including persistent inattention, hyperactivity, and impulsivity, which can negatively impact upon an individual's development or functioning (American Psychiatric Association, 2013). The symptoms of ADHD do not occur in equal measures and some individuals may present with higher symptoms of inattention (ADHD-I) or hyperactivity (ADHD-H) or a combination (ADHD-C). A review conducted in 2012 found that ADHD-I symptoms were more predominant, but individuals with ADHD-C were more likely to be referred for clinical services (Willcutt, 2012). ADHD has been associated with

problems such as impaired problem-solving abilities, distractibility, lower impulse control, lower self-esteem, which may lead to problems in educational and interpersonal functioning as well as lower perceived quality of life (Chen et al., 2020; Garas & Balazs, 2020; Wilson & Marcotte, 1996).

A WHO World Mental Health Survey conducted across 20 countries estimated the prevalence of individuals diagnosed with ADHD to be approximately 2.2% (range 0.1-8.1%) for youth under 18 years old, and 2.8% in adults (range 0.6-7.3%; Fayyad et al., 2017). It is important to note that there is greater variation in estimates of ADHD prevalence in research studies, with one meta-analysis finding prevalence of ADHD to be between 4% and 13.3% across studies (Willcutt, 2012). A recent study conducted between 2012 and 2014 with young inpatients who had a primary diagnosis of major depressive disorder (n= 141, 530), found that the prevalence of ADHD diagnoses increased from 50.8% to 60.4% in females, whereas there was 9.6% decrease in males being diagnosed with ADHD over the same period (Zahid et al., 2020). The change in rates of diagnosis may reflect an increased recognition of ADHD symptoms in females (Anderson 2018). For instance, males are more likely to present with more outwardly obvious symptoms such as hyperactive/impulsive symptoms, like blurting out or being unable to sit still, whereas females may present more with inattentive symptoms, including forgetfulness, trouble paying attention, and problems with organisation.

Although the symptoms of ADHD are often detected in childhood (Scahill & Schwab-Stone, 2000), this is not always the case. It is important to highlight that the identification of ADHD in adulthood remains poor which may be, in part, due to the different presentation of ADHD symptoms in adulthood (e.g., concentration impairment, forgetfulness, procrastination, poor time management). A further consideration is that ADHD often occurs alongside somatic conditions, behavioural impairments (such as antisocial or aggressive behaviours, low self-esteem, social impairment and exclusion; Johnson & Suhr, 2021; Merrill et al., 2020) and psychiatric conditions (such as mood and anxiety disorders, substance use disorders and personality disorders; Katzman et al., 2017) which impede identification. A recent 10-year prospective study found that the prevalence of suicide attempts among those with the combined type of ADHD was substantially higher than among those with the inattentive form of ADHD (Hinshaw et al., 2012).

Previous research has also highlighted an association between ADHD and suicidal thoughts and behaviours (Garas & Balazs, 2020; Giupponi et al., 2018; Septier et al., 2019) as well as higher all cause morality including unnatural deaths and suicide (Sun et al., 2019). A large scale (n= 2,207,840) database study in Taiwan found that those with a diagnosis of ADHD had an increased risk of dying

from suicide than individuals without a diagnosis of ADHD (suicide death; 0.62 vs. 0.19 per 10 000 person-years; Chen et al., 2019). Although there has been an increase in research into ADHD and suicide, there is a dearth of research understanding the complex relationship between these two.

Since 2018, three reviews have been conducted synthesising the research on ADHD and suicidal ideation and behaviours. Giupponi and colleagues (2018) conducted a selective review of existing literature with the aim of understanding factors which may contribute to suicidal behaviour and self-harm in people with ADHD up to 2017. It is unclear how many papers were included in this selective review. In this review, ADHD was associated with higher rates of suicidal thoughts and self-harm with/without suicidal intent. However, the authors concluded that although many studies indicate an association between ADHD and suicidal behaviour, the nature of the relationship remains unclear. These authors highlight that the high rate of comorbidities makes it unclear as to whether or not there is a direct ADHD-suicide risk relationship or whether the association depends on the presence of other factors, such as pre-existing comorbid conditions, or other factors such as individual/ family interpersonal factors.

Septier and colleagues (2019) conducted the first meta-analysis of cross-sectional studies investigating the relationship between ADHD, suicidal ideation, and behaviours. Fifty-seven cross-sectional studies conducted with participants of any age, so long as participants had a diagnosis of ADHD or met criteria for ADHD on a validated scale were included. Studies frequently reported more than one outcome. Suicide attempts were the most frequently reported outcomes (n= 50 studies), followed by suicidal ideation (n= 26 studies). The remaining studies assessed suicide (n= 4), unspecified suicide related symptoms (n= 8) and suicide plans (n= 2). In their study, Septier and colleagues (2019) found an association between ADHD and suicidal behaviours while accounting for possible confounding, mediating, or moderating factors in the relationship.

Finally, the third review: Garas and Balazs (2020) focused on longitudinal studies investigating suicide risk in young people (<18) with ADHD. Of the eighteen papers included in the review, the majority (n= 11) had been published in the 5 years prior to the review. Garas and Balazs (2020) reported that most of the included studies (n= 10) had follow up of 5-10 years, the remaining seven studies had follow up of over 10 years. Overall, the review found that childhood diagnosis of ADHD was associated with risk for suicidal thoughts and behaviours at follow up. This review also highlighted that children with ADHD had earlier age of onset of suicidality and this was associated with more frequent repetition of suicide attempts and non-suicidal self-injury (NSSI). Further, the review found that ADHD was an

independent risk factor for suicide attempt and death in studies using health registry data. This relationship held when comorbid disorders were included in the analysis.

Throughout the reviews and using meta-analytic techniques, all of the authors report significant heterogeneity (i.e., variability) across the studies. Despite this, significant associations were consistently found for ADHD and suicidal ideation, suicide attempts, and suicide deaths when other variables were included in the analyses. In Septier's meta-analysis, ADHD was associated with suicidal ideation and suicide attempts in clinical populations. However, the latter became non-significant when other factors were included in the analyses (Septier et al., 2020). However, the authors highlight that it is important to interpret these findings cautiously as there were very few studies included in their subgroup analyses. Despite the limitations of the literature, and different methodologies used in the reviews, in all three reviews, higher rates of suicidal ideation, suicide plans and suicide attempts were observed in individuals with ADHD compared to those without ADHD.
The authors emphasise some important limitations of the research in this area to date. Firstly, Garas and Balazs (2020) highlight the overlap in the datasets used. For instance, of the eight papers reporting on clinical populations, five of these reported on the same dataset (original dataset; Hinshaw et al., 2002), and a further two papers reported on another dataset - the Rochester Epidemiology Project, Minnesota data (Melton, 1996).

Another important limitation highlighted in the reviews is the gender imbalance in the studies. In Garas and Balazs's review (2020) four studies had similar numbers of males and females, while eight studies were comprised of over 60% males and the final six studies were conducted in solely female populations. Septier et al. (2020) noted the absence of research generated by their search which looks at the effects of ADHD medication on suicide risk.

The reviews also highlight that our understanding of the nature of the ADHD-suicide risk relationship and potential mechanisms that increase or ameliorate suicide risk in people with ADHD is lacking. For instance, we currently do not know whether there is a *direct* relationship between ADHD and suicide risk or whether the relationship is *indirect* and risk is conferred through the existence of other factors. Studies have suggested that impairments in goal orientated cognitive processes such as planning, inhibition, organisation, working memory, problem-solving (i.e., executive functioning) (Becker et al., 2018), or vulnerability to stress (Chen et al., 2020), or co-occurring psychiatric conditions (Giupponi et al., 2018) may be implicated. The aim of this report, therefore, is to synthesise the research published

since these reviews, on the relationship between ADHD and suicide risk and identify potential gaps which should be prioritised in future research.

## Methods

When we conducted our initial scoping review, we identified three relevant recent systematic reviews published between 2018 and 2020 (as summarised above). As a result, we adopted a two-pronged approach to the present review. 1. We used the findings from these reviews to form the basis for our review, and 2. we restricted our updated search to 2018 to 2022 as the older studies will already have been covered by the three systematic reviews. Specifically, a literature search of the three main bibliographic databases (PsycInfo, OVID and Web of Science core collection) was conducted for studies published in English between 2018 and July 2022.

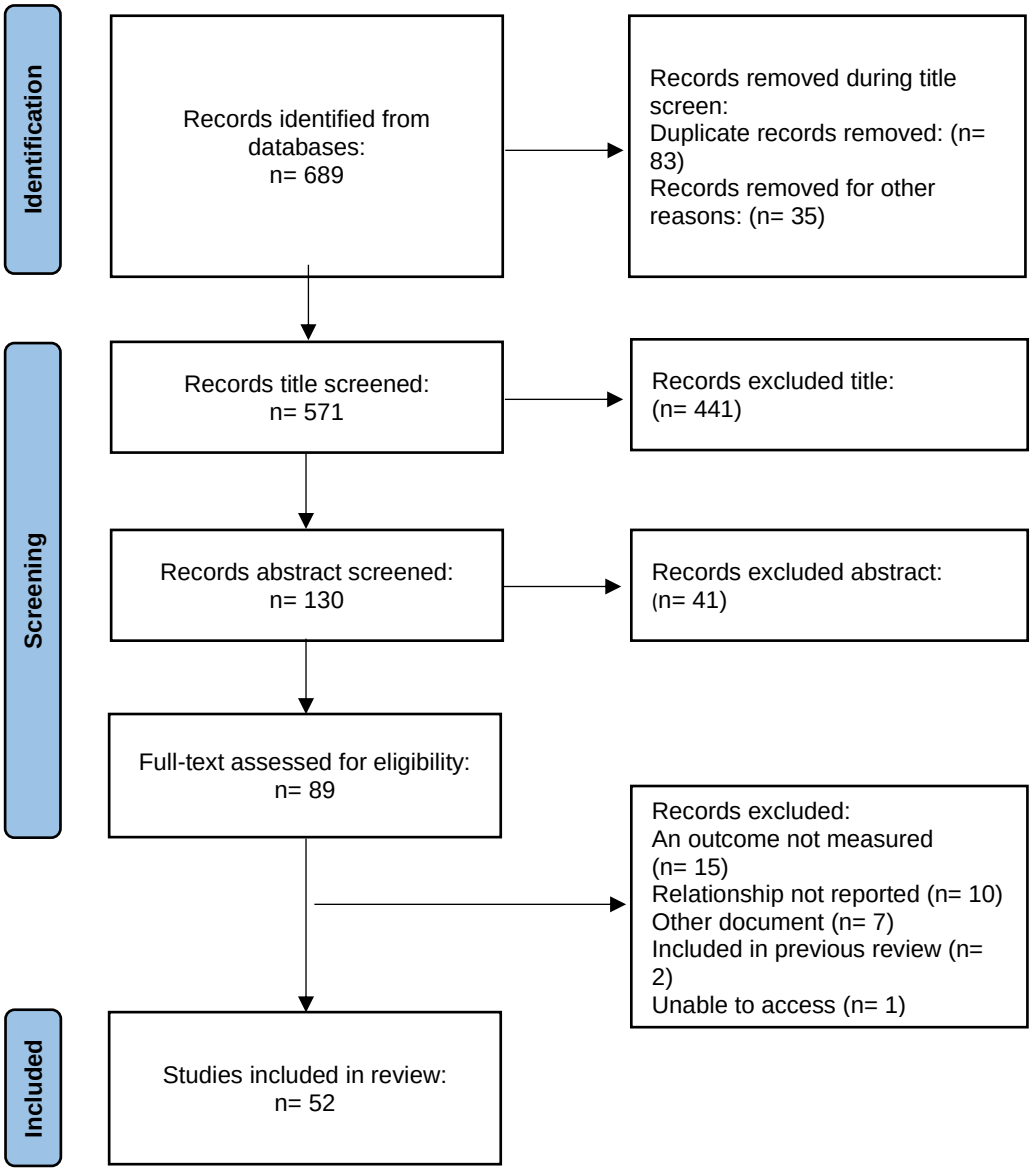
The Search strategy was based on Septier et al.'s (2019) review methodology (PROSPERO CRD42018093003; Cortese et al., 2018). Search terms are listed in Appendix 1. No limitations were applied regarding assessment of ADHD or suicide-related outcome (e.g., clinician/ diagnosis vs. self-report), population or study methodology.

Studies were eligible for inclusion if they (a) reported on ADHD; (b) reported on suicidal ideation, suicide plans, suicide attempts or deaths; and (c) recorded the relationship between ADHD and a suicide-related outcome.

### Data extraction

As outlined above, a keyword search of relevant databases was conducted, producing 689 records. Demographic characteristics, study design, assessment of ADHD and suicide-related outcome were extracted along with the main findings of the individual studies.

Figure 1. Prisma chart summarising the study selection process




## Findings

Our search strategy produced a total of 689 articles including duplicates. After screening, 52 papers meeting our inclusion criteria reporting on ADHD and suicide risk have been published since Septier et al.'s (2019). However, of these 52 papers, two studies reported on the same sample (the i-Share cohort in France; Arsandaux et al., 2021; Gbessemehlan et al., 2020) while two reported on the same cohort of medical students in China (Shen et al., 2018, 2021). Subsequently, relevant information on the ADHD-suicide relationship is included, but the methodology and reported sample size only includes that of the first study.

In total, forty-nine unique studies, reporting on n= 884, 7196 participants[1], are included. Table 1 below provides an overview of the studies by population and outcome. Studies have been categorised as recruiting adults when participants were age 18 or older at recruitment/baseline, this includes registry database studies, whereas 'young people' represents those younger than 18 at recruitment.

Table 1. Summary of outcomes and populations assessed in the included studies

| Population | No of studies | Deliberate Self-harm | Suicidal thoughts | Suicide attempts | Suicide deaths | Suicidal thoughts and behaviours | Suicide risk |
|---|---|---|---|---|---|---|---|
| **Adults (n= 25)** | | | | | | | |
| Community | 3 | | 1 | 1 | | 1 | |
| Clinical | 9 | 1 | | 2 | | 5 | 1 |
| Special pop (military) | 1 | | 1 | | | | |
| Students | 7 | | 4 | | | 3 | |
| All ages (registry studies) | 5 | | | 1 | 3 | 1 | |
| **Young people (n= 24)** | | | | | | | |
| Children (<age 12) | 4 | | 1 | | | 3 | |
| Adolescents (12+) | 6 | | 1 | | | 5 | |
| Youth | 8 | 1 | | 1 | | 6 | |
| Clinical Youth (Child/ Adolescent) | 5 | | | 1 | | 4 | |
| Forensic Adolescents | 1 | | 1 | | | | |
| **TOTAL Number of Studies** | 49 | 2 | 9 | 6 | 3 | 28 | 1 |

## Summary of studies

As illustrated in Table 1, the majority of studies investigated both suicidal ideation and behaviours (n= 28), nine studies focused solely on suicidal ideation, and another nine focused on suicide attempts or death from suicide. The final three recorded deliberate self-harm (i.e., any self-injurious behaviour regardless of suicidal intent, n= 2) and one focused on suicide risk. As highlighted in Tables 2 and 3, the studies were conducted in the following geographical populations: North America (n= 25), Asia (n= 12), Europe (n= 12) and South America (n= 2).

[1] Claudius & Axeen, 2022 recorded n=169047 hospital attendances for suicidal events, however, unclear whether an individual could be recorded for more than one event, so they have not been included in total sample size.

The findings in the report have been structured to provide an overview of the measurement of ADHD and suicide outcomes within the young people and adult studies. The next sections then provide an overview of the research into the ADHD-suicide risk relationship for young people and adults separately. We then discuss the research which aims to unpick the relationship further by exploring the role of different factors potentially associated with the ADHD-suicide risk relationship including different ADHD profiles, psychological factors and comorbid mental health conditions. To minimise repetition, these latter sections combine young people and adult studies. Finally, we draw the report together and highlighting key findings and recommendations for future research.

*Assessing ADHD in young people*

In young people, ADHD symptoms were most often recorded through structured clinical interviews conducted by a researcher/ clinician (n= 11), caregiver or teacher accounts (n= 11); three studies combined self and caregiver assessments. One study used genotype data to calculate Polygenic Risk Scores for ADHD (Lee et al., 2021). Although three studies used self-report measures, the only detail included by Orri and colleagues (2020) was that 'validated measures were used'.

*Assessing ADHD in adults*

As detailed in Table 3, measures used to assess the presence of ADHD varied. Seventeen studies used clinician/researcher assessment (n= 6) or diagnosis of ADHD (n= 11). Three studies used commencement of ADHD treatment and four studies included clinician and self-report measures. Of the thirteen studies that included a self-report measure of ADHD symptoms, the most commonly used self-report measure was the Adult ADHD Self-Report Scale (ASRS-v1.1; (Kessler et al., 2005), which was used in eight studies (Bitter et al., 2019; Brown et al., 2022; Gbessemehlan et al., 2020; Shen et al., 2018; Stickley et al., 2018; Triece et al., 2020; Yeguez et al., 2018; Zhong et al., 2021). The Wender Utah Rating scale (WURS; Ward et al., 1993) was employed in two studies (Delibas et al., 2019; Giupponi et al., 2020), another two (Kakuszi et al., 2018; Yang & Kim, 2020) used Conners' Adult ADHD Rating Scale (CAARS; Conners et al., 1999), and one study (Becker et al., 2018) used The Barkley Adult ADHD Rating Scale-IV (Barkley, 2011). Eddy et al (2020) asked participants "Have you ever been diagnosed with ADD/ADHD?".

*Assessing suicidal history in young people*

The majority of studies assessed suicidal history by clinician/ researcher interviews and used a combination self-report and clinical interviews.

Five studies (Akca et al., 2020; Claudius & Axeen, 2022; Gomes et al., 2019; Katzenmajer-Pump et al., 2021; Zahid et al., 2020) used diagnoses or diagnostic interviews such as the Mini-International Neuropsychiatric Interview for Children and Adolescents (M.I.N.I.-KID; Sheehan et al., 2010) to establish the presence of ADHD. The Kiddie-Structured Assessment for Affective Disorders and Schizophrenia (KSADS; Puig-Antich & Chambers, 1978) was used in six studies (Bauer et al., 2018; Chen et al., 2020; Chen et al., 2019; Lee et al., 2021; Liu et al., 2021; Shoval et al., 2021). Other studies included questions around experiences of suicidal ideation or attempts.

Four studies used self-report measures; Depressive Symptom Index – Suicidality Subscale (DSI-SS; Joiner et al. 2002; Becker et al., 2020) or the Korean version of the Beck Scale for Suicidal Ideation (BSSI; Shin, 1992; Chung et al., 2020). Doyle and Fite (2021) used the Risk of Suicide Questionnaire (RSQ; Horowitz et al., 2001) and the Suicidal Behaviours Questionnaire-Revised (SBQ-R; Osman et al., 2001), while Orri et al. (2020) asked participants questions around experiences of suicidal thoughts or attempts.

*Assessing suicidal history in adults*

Assessing suicidal history varied. In fourteen of the studies suicidal history was recorded by clinicians/ researchers (Bitter et al., 2019; Blanco-Vieira et al., 2019; Chen et al., 2019; Delibas et al., 2019; Fitzgerald et al., 2019; Fuller-Thomson et al., 2022; Giupponi et al., 2020; Howlett et al., 2018; Oh et al., 2021; Olsson et al., 2022; Siffel et al., 2020; Stickley et al., 2018; Yang & Kim, 2020; Yoshimasu et al., 2019). However, the assessment ranged from interviews such as The Columbia-Suicide Severity Rating Scale (Posner et al., 2008), Mini-International Neuropsychiatric Interview (M.I.N.I.; Structured Diagnostic Psychiatric Interview for DSM-IV and ICD-10; Sheehan et al., 1998) to items such as 'Have you ever thought about ending your life?; Have you ever attempted suicide?'. Four studies reviewed medical records (Chen et al., 2019; Lee et al., 2022; Ohlund et al., 2020; Sun et al., 2019).

While nine studies used self-report measures, the assessment of suicidal thoughts and behaviours was mixed. The self-report version of the Self-Injurious Thoughts and Behaviours Interview (SITBI; Nock et al., 2008) was used in one study (Brown et al., 2022), validated self-report measures such as the SBQ-R (Osman et al., 2001), Beck Scale for Suicidal Ideation (BSSI; Beck & Steer, 1991), Adult Suicidal Ideation Questionnaire (ASIQ; Reynolds, 1991) were used in four studies. One study used a single item (Q9) from the Beck Depression Inventory (BDI; Beck et al., 1996) to assess the presence of suicidal ideation (Kakuszi et al., 2018). The remaining studies asked participants whether they had experienced suicidal ideation or attempts and their frequency of occurrence.

## Children and young people

This section provides and overview of recent research discussing prevalence of ADHD and suicidal thoughts and behaviours in young people. A summary of the studies and main findings can be found in Table 2.

Higher ADHD symptoms were associated with higher risk of suicidal ideation and suicide attempts (Katzenmajer-Pump et al., 2021). Compared to control groups, young people with ADHD were more likely to report suicidal ideation, non-suicidal self-injury (NSSI) and suicide attempts (Bauer et al., 2018; Becker et al., 2020; Chen et al., 2019; Chung et al., 2020; Claudius & Axeen, 2022; Katzenmajer-Pump et al., 2021). In one study of young people with ADHD, suicidal ideation was reported by 19.7-22.7%, suicide plans by 17.7%, and suicide attempts by 11.3% of the sample (Chen et al., 2020). In a sample of 623 children aged 7-12 years old, Bauer and colleagues (2018) found that 37% of participants in the ADHD group reported suicidal ideation compared to 18% of the control group. Further, individuals with ADHD were more likely to present to hospital for suicidal ideation (Claudius & Axeen, 2022).

In a community sample of 228 females (n= 140 with ADHD, n= 88 matched controls), Meza and colleagues (2021) found participants with ADHD were more likely to report having engaged in self-harm regardless of intent (Meza et al., 2021). In this sample, those with ADHD were twice as likely to report NSSI than controls (46.5% vs. 21.8%, $p < .001$), and were almost 4 times more likely to report suicide attempts compared to controls (19.4% vs. 5.8%, $p=.005$). However, thoughts about suicide were reported by 43.7% of the sample overall, however, there were no differences found between those with ADHD and the control group (Meza et al., 2021).

In a clinical sample of adolescents who all had diagnoses of ADHD, girls were more than twice as likely to report suicide-related problems than boys (63.6% vs. 31.1%) (Chen et al., 2020), highlighting the potential importance of gender in understanding suicide risk in young people with ADHD. Another clinical study which highlighted the importance of gender looked at the association between ADHD, borderline personality disorder (BPD) and suicide risk with young people who had not previously responded to treatments. Akca and colleagues (2020) found that males were more likely to have a single ADHD diagnosis (m= 54.6% vs f= 18.7%) whereas females more likely to have a BPD diagnosis (54% vs. 31.8%) or ADHD+BPD (f= 27.3% vs m= 13.6%; Akca et al., 2020). Some studies have suggested that gender differences in suicide risk may be as a result of the differences in presentation

of ADHD between males and females (i.e., males may be more likely to present with hyperactivity whereas females may be more likely to experience inattentive symptoms). However, other studies highlight that the gender proportions between groups can often be skewed with more males being in the ADHD group than females (e.g., ADHD males= 92% vs. controls males = 54%; Katzenmajer-Pump et al., 2021).

Table 2. Overview of papers investigating the relationship between ADHD symptoms and suicidal ideation/behaviour in young people (n= 24).

| Author (year) & country | Sample, n | Prevalence ADHD (%) Prevalence Suicide outcome | ADHD assessment (completed by) | Suicide outcome, assessment (completed by) | Main Results |
|---|---|---|---|---|---|
| Abel et al. (2020), USA | Clinical; Children (age 6-12); n= 115, male = 62% | 44% externalizing problems (inattention, hyperactivity, oppositional defiant behaviours, conduct problems);<br>Suicidal thoughts and behaviours<br>Mean score SBQ-R = 0.7 | Hyperactivity/impulsivity and inattention symptoms; Conners' Parent Rating Scale (Conners et al., 1998)<br>(Caregiver) | Suicidal thoughts and behaviours<br>Suicidal behaviors Questionnaire (SBQ-R; Osman et al., 2001)<br>(Self) | No correlation between inattention, hyperactivity and suicidal behaviours.<br>Reactive aggression and SITBI's were positively associated at high levels of hyperactivity/ impulsivity (B = 0.39, SE = 0.11, p < 0.001, 95% CI: 0.17, 0.61).<br>Reactive aggression and SITBI's were unrelated at low levels of hyperactivity/impulsivity (B = 0.10, SE = 0.12, p = 0.39, 95% CI: − 0.13, 0.34). The greatest risk for SITBI's occurred when levels of both reactive aggression and hyperactivity/impulsivity were high. |
| Akca et al. (2020), USA | Clinical; Adolescents who had not responded to prior intervention. (age 12–17); n= 550, male= 37% | ADHD = 22.8% total sample.<br>ADHD without BPD = 12.5%<br>BPD without ADHD = 21.1%<br>ADHD + BPD = 10.3%<br><br>Lower suicidal ideation in ADHD only (mean scores ADHD = 66.3 vs. BPD = 76.7 vs. ADHD + BPD = 80.0) | The Diagnostic Interview Schedule for Children – Computerized Version (DISC-IV; Shaffer et al., 2000)<br>(Clinician) | SITBIs borderline-selfharm (BOR-S)<br>(Clinician) | High co-morbidity ADHD+BPD= 45%. Males more likely to have single ADHD diagnosis (m= 54.6% vs f= 18.7%); females more likely BPD diagnosis (54% vs. 31.8%) or ADHD+BPD (f= 27.3% vs m= 13.6%). ADHD+ BPD group more likely to report SI and self-harm.<br>Lower SI scores in ADHD only (mean scores ADHD= 66.3 vs. BPD= 76.7 vs. ADHD + BPD = 80.0), $\chi 2$= 16.8, p<0.001. BPD presence increased risk SI and self-harm. |

| | | | | | |
|---|---|---|---|---|---|
| Bauer et al. (2018), USA | Children (age 7– 12);<br>n= 623, male = 62% | ADHD = 62.3%<br><br>Suicidal ideation<br>ADHD = 37%<br>no ADHD = 18% | Conners' Rating Scales-Revised (CRS-R, Conners 2003), ADHD Rating Scale (ADHD-RS, DuPaul et al. 1998), Kiddie Schedule for Affective Disorders and Schizophrenia, K-SADS, Kaufman et al. 1997), Strengths and Difficulties Questionnaire (SDQ) (Goodman 2001) Parents rate child's overall level of impairment in academic, family, and peer relationships.<br>(Caregiver/ Clinician) | SI<br>Parent report on the K-SADS and self (child) report on the Children's Depression Inventory (CDI; Kovacs 2004)<br>(Caregiver/ Self) | ADHD lower working memory scores (e.g., accuracy, spatial domains). Working memory negatively correlated SI (r=-.12, p<.01).<br>Working memory impairment mediated both increased negative affect and increased SI in ADHD.<br>Serial mediation model of working memory and negative affect as mediators of ADHD to SI, (controlling for child oppositional defiant disorder symptoms). ADHD to SI through negative affect was not significant. Working memory mediated ADHD to SI (indirect effect = .05, SE = .03, p < .05; 95%CI: .001 to .096). |
| Becker et al. (2020), USA | Adolescents (age 12–14);<br>n= 302, male= 55.3% | ADHD 53.6% (male= 64.8%), no ADHD male= 44.3%<br><br>Suicidal ideation Present in 10.6% of sample. Prevalence of suicidal ideation in ADHD is not discussed. Suicidal ideation significantly correlated with ADHD-I. | Eligible: meet criteria ADHD on parent version of Children's Interview for Psychiatric Syndromes (P-ChIPS; Weller et al. 1999) gives DSM-IV ADHD score; ADHD Self-Report Scale (ASRS; Kessler et al. 2005)<br>(Caregiver/ Self) | SI<br>Depressive Symptom Index – Suicidality Subscale (DSI-SS) (Joiner et al. 2002); 4 items suicidal ideation and impulses over the past two weeks.<br>(Self) | SI present in 10.6% of sample. Scale testing paper Sluggish Cognitive Tempo (SCT). ADHD-I significant correlation with suicidal ideation (r= .30), depressive symptoms (r=.57), problems in goal orientated behaviours (r=.42) and impulse control (r=.38). |

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| Chen et al. (2019), Taiwan | Youth (age 7–15),<br>n= 4739 | ADHD= 8.7%<br><br>Suicidal ideation:<br>ADHD = 18.2%<br>no ADHD= 6.66%<br><br>Suicide plan:<br>ADHD= 7.52%<br>no ADHD= 2.61%<br><br>Suicide attempt:<br>ADHD= 2.18<br>no ADHD= 0.76% | Mandarin version of the Kiddie Schedule for Affective Disorders and Schizophrenia-epidemiological version (K-SADS-E; Chen et al., 2017)<br>(Clinician) | SITBIs<br>K-SADS-E; "have you ever thought of ending your own life?" if Y: "did this kind of thought occur within the past six months?", "have you ever planned suicide?" if Y: "did you have such kind of plans to end your life within the past six months?" if Y: "having a current suicide plan", "have you ever attempted suicide?"<br>(Clinician) | No differences between genders in SITBI prevalence.<br>SITBI's were more than twice as likely to be reported by children with ADHD when demographics controlled for:<br>SI (18.2% vs. 6.65%, OR = 2.76, 95% Cl 1.86- 4.09)<br>SP (7.52% vs. 2.61%, OR = 2.59, 95% CI: 1.46–4.58)<br>SA (2.18% vs. 0.76%, OR = 3.04, 95% CI: 1.34–6.89.<br>In mediation models, direct relationship between ADHD and SI, SP remained when mediating role of depressive/anxiety symptoms, conduct problems and family function tested. |
| Chen et al. (2020), Taiwan | Clinical; Adolescents (age 12-18) n= 203, male= 78.8% | All participants ADHD.<br><br>Suicidal ideation= 22.7%<br>Desire to die= 19.7%<br>Suicide plan= 17.7%<br>Suicide attempt= 11.3% | ADHD module Mini-International Neuropsychiatric Interview for Children and Adolescents (MINI-KID); Chinese Version of the Swanson, Nolan, and Pelham DSM-4 ADHD symptoms<br>(Clinician) | SITBIs<br>Kiddie Schedule for Affective Disorders and Schizophrenia (Puig-Antich & Chambers, 1978)<br>SA and SI 12m<br>(Clinician) | Suicidal outcomes assessed over 12months:<br>Females more likely to report suicide-related problems (63.6%) than boys (31.1%) OR = 3.81, 95% CI: = 1.89–7.68.<br>Participants reporting SITBI's reported lower QoL, and higher feelings of victimization from school bullying.<br><br>Correlations between bullying and SITBI's; ADHD symptoms may mediate pathways. No associations between ADHD symptoms, suicide, and school bullying in network model.<br>Interaction between higher inattention, lower personal |

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| | | | | | competence and higher SITBI's. Hyperactivity indirect association with suicidality through personal competence and a positive direct association with suicide. ADHD inattentive symptoms associated academic problems; hyperactive-impulsive type was less impairing academically. |
| Chung et al. (2020), Korea | Forensic vs. control; Adolescents n= 251 Forensic (Parole group; PG) n= 149, male= 75.8%. Control n= 102, male= 58.8% | Compared to controls, PG higher levels of: ADHD symptoms PG 27.90 vs. C 23.86<br><br>Suicidal ideation PG 3.9 vs. C 3.05 | Korean ADHD rating scale (KARS, Kim et al., 2003) (Self) | SI Korean version BSSI (Shin, 1992) (Self) | Parole group (PG) significantly higher scores on ADHD (PG 27.90 vs. C 23.86, F = 6.55, P = .011) and BSSI (PG 3.9 vs. C 3.05, F= 4.01, P=.046) than control group. ADHD significant correlation BSSI score (r=.19). |
| Claudius & Axeen (2022), USA | Youth (age 5-19) database study ED attendance for suicidal ideations and attempts n= 169047 events identified | ADHD more likely present in attendance of suicidal ideation (0.117) than suicide attempt (0.072) | ICD-9 Code: 314.01 (ADHD) (Clinician) | SITBIs SI ICD-9 code V62.84, SA codes E950.x through E959.x (Clinician) | Overall, the majority of presentations at ED were for SI (n= 139613, 82.6%; SA n= 29,434, 17.41%). ADHD more likely in SI encounters than SA (SI 0.117 vs 0.072, diff 0.045 [0.041, 0.049]. |

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| Doyle & Fite (2022), USA | Clinical; children (age 6 – 12)<br>n= 232; male = 64.7% | ADHD = 36.2% overall sample. Of those with a psychiatric diagnosis, ADHD most common (61.3%)<br>1+ indicator of suicide risk present in 54.1%; 23.5% some suicidal thoughts or behaviour. Neither suicide outcome associated with ADHD. | Inattention and Hyperactivity subscales of the caregiver-report Conners Parent Short Rating Scale (Conners, 2008)<br>(Caregiver) | SITBIs<br>Risk of Suicide Questionnaire (RSQ; Horowitz et al., 2001); SBQ-R (Osman et al., 2001)<br>(Clinician; Self) | 59% of sample had psychiatric diagnosis; 61.3% of these diagnoses were ADHD. Males had higher hyperactivity and inattention scores than females. Hyperactivity associated with high levels of inattention, anger dysregulation, and depressive symptoms.<br>Age associated with decrease hyperactivity.<br>Mediation: Hyperactivity positively associated SB, inattention negative relationship. Moderation interaction effect between hyperactivity and sadness dysregulation found for suicide risk. Additionally, an interaction effect between hyperactivity and worry dysregulation was also found for suicide risk.<br>Hyperactivity was positively associated with suicide risk at low levels of sadness dysregulation (β=0.326 p= .036) and worry (β=0.262 p= .052; when sadness/worries is well-regulated suicide risk increase. |
| Evald & Mohl (2020), Denmark | Birth cohort; born 1995, followed up to 2014 (age 18); n= 3291 | Age 18<br>ADHD diagnosis= 2.5%<br>Symptoms= 27.7%<br><br>34.9% with ADHD had a history with self-harm. | Strengths and Difficulties Questionnaire (SDQ).<br>Age 7. Similar questions asked age 3<br>(Caregiver)<br><br>Age 18<br>Adult Self-Report Scale (ASRS) | DSH<br>Development and Well-Being Assessment (DAWBA) based items. Age 15 and 18 “over the last four weeks have you tried to harm yourself on purpose?” or “have you ever tried to harm or hurt yourself?” they were classified as engaging in DSH.<br>SA assessed age 18 | Age 18, 17.9% of participants had a history of DSH; 20% included SA; 72% were female.<br>Age 18 ASRS 43.5% of the DSH group showed symptoms of ADHD compared to 27.7% of the whole sample.<br>Hyperactivity symptoms at ages 3 and 7 significantly increased the risk of future DSH when other factors covaried.<br>Mediation analysis showed that peer difficulties mediated relationship between ADHD symptoms and DSH. |

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| | | | | (Clinician) | |
| Galera et al. (2021), Canada | Adolescents, (age 5 months - 17 years), n= 1407, male = 47.3% | Focused on ADHD and irritability clusters. Moderate/high ADHD symptoms present in 33.2%<br><br>Higher suicidal thoughts and behaviours associated with the mod/high ADHD groups regardless irritability level | Selected items from behaviour scales:(1) could not sit still, was restless and hyperactive; (2) was impulsive, acted without thinking; (3) had difficulty waiting for his/her turn in games; (4) could not settle down to do anything for more than a few moments; For inattention: (1) was unable to concentrate, could not pay attention for long, (2) was easily distracted, had trouble sticking to any activity, (3) was inattentive. (Teacher assessed ages 6-12) | SITBIs<br>"in the past 12 months, did you ever seriously think of attempting suicide" If yes, then asked: "in the past 12 months, how many times did you attempt suicide" (Self assessed ages 13,15,17) | SI/SA combined to binary SITBI. Four trajectories: absent/ low ADHD and absent or very low irritability (940 [66.8%]; reference group), moderately high irritability and low ADHD (158 [11.2%]), moderately high ADHD and low irritability (198 [14.1%]) and combined high ADHD and high irritability (111 [7.9%]). Higher SITBI associated with the mod/high adhd groups regardless irritability level. High ADHD and high irritability higher risk of psychiatric symptoms showed higher levels of ADHD continuity (d-ranges = 0.40–0.50), externalizing (d-ranges = 0.25–0.59), internalizing (d-ranges = 0.20–0.29), and functional impairments from behaviour depression/ anxiety (d-ranges = 0.17–0.48) and 2 x higher risk SITBIs than reference group (OR = 2.12, CI = 1.47–3.06). Moderately high ADHD and low irritability 1.5 higher SB risk. When separated by gender, the latter held for males. |
| Geoffroy et al. (2021), Canada | Youth, n= 2233, followed children who were age 7-11 in cycle 1 up to age 23 in cycle 8. | Caregiver reported Preteen ADHD symptoms increased the risk of suicide attempts persisting into adulthood compared to never-attempted | Children's Behaviour Questionnaire (CBQ, Child and Parent form) (Achenbach et al., 1987) (Caregiver ages 10/11; Self ages 12/13) | SA<br>If participants had seriously considered suicide in the past 12 months they were asked: 'During the past 12 months, how many times did you attempt suicide?' Coded | SA in last year increased from 3.6% at age 12/13, to 5.6% ages 14/15 then decreased to 1.0% at age 22/23. Created 3 group trajectories: No SA (96.0%), adolescence-limited SA (2.0%) and SA persisting into adulthood (2.0%).<br>Caregiver reported Preteen ADHD symptoms increased the risk of attempts persisting into adulthood as compared to never-attempted when demographic variables, risk factors and mental health were entered simultaneously (RR 2.05; 95% CI: 1.29–3.28) |

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| | | | | 'Never' or 'At least one attempt' (Self ages 12/13) | |
| Gomes et al. (2019), Brazil | Youth, 22nd year Follow up point from 1993 Pelotas birth cohort used; n= 3637 | ADHD= 4.5%<br><br>No mention SITBI's prevalence in ADHD.<br><br>ADHD associated with 2.3 increase in suicide risk. | Mini (Clinician) | SITBIs<br>Mini; suicide risk wish to be dead, wish to self-harm, suicidal thoughts, suicidal planning, suicide attempt in the past month and lifetime (LT) suicide attempt (Clinician) | Total sample prevalence of suicide ideation, plan, and LT attempt was 2.8%, 1.7%, and 5.7%, respectively.<br>About 60% of those who had suicidal ideation also had a suicide plan, and 46.5% made a lifetime attempt of suicide. The prevalence of current suicide risk was 8.8% (95%CI 7.9–9.7) and it was higher in women. ADHD had a 2.3 prevalence suicide risk- lowest of MH conditions. |
| Katzenmajer-Pump et al. (2021), Hungary | Adolescents, (age 13-18); n= 184, ADHD n= 88, male= 92%, non-clinical no ADHD n= 96 male= 54% | ADHD = 47.8%<br><br>ADHD higher suicidal ideation mean scores (.3) than no ADHD (.01) | Mini kid (Clinician) | SITBIs<br>Mini kid: In the past month did you" "Wish you were dead?", "Want to hurt yourself?", "Think about killing yourself?", "Think of a way to kill yourself?", "Attempt suicide?" Have a method in mind to kill yourself?" yes to any= 1 (Clinician) | ADHD group higher SI (.3, sd 1.17) than no ADHD (.01, sd.1 [$z(182) = -2.975$, $p = 0.003$, $r = 0.22$]). Small effect size.<br>Log regression (SB binary): ADHD increased the chance of SB by 48% (OR = 1.48, p = 0.012).<br>Binominal regression: IRR for ADHD was 1.57 (p – 0.012), increase of one unit in ADHD total incident rate for SB increases 57 %.<br>Perfectionism: Total Perfectionism IRR 0.90, ($p < 0.001$), one unit increase perfectionism total SB decreased by 10%. |

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| Lee et al. (2021), USA | Youth, n= 11878 (age 9-10 at baseline); genotype data n= 4344 | ADHD prevalence not reported<br><br>Suicidal ideation reported by:<br>Child= 8.63%<br>Caregiver= 7.5%<br><br>Suicide attempts reported by:<br>Child= 1.31%<br>Caregiver= 0.44% | Polygenic Risk Scores (PRSs) calculated (n/a) | SITBIs<br>Kiddie Schedule for Affective Disorders and Schizophrenia (Baseline-Caregiver; follow-ups- Self) | Low child/ carer concordance in reporting suicidal thoughts and behaviour. Children reported 3x higher SAs 3 than reported by caregivers (1.31% vs. 0.44%). ADHD PRS associated with baseline and predictive of SI 1 year follow-up; LT SI (OR = 1.15, 95% CI: = 1.05–1.26, p< .01) (child self-report only). ADHD PRS predictive of SA 1 year follow-up (OR= 1.47, 95% CI:= 1.16- 1.86, p<.001). MDD was only other PRS to be associated with SI/SA. ADHD/MDD markers were associated with majority of measures included, additionally, stronger relationship with follow-up than baseline. Regression analysis showed ADHD was second strongest predictor of SI 1 year after child psychopathology. Largest US sample young people supports predictive utility of common genetic variants underlying ADHD and MD in SI. MD more associated SA whereas ADHD more related SI- indicating distinct contributions. |
| Levy et al. (2020), Canada | Youth; clinical, n= 1516 (age 6–17); male= 74% | Diagnosis ADHD= 61.1%<br><br>Suicidality reported by:<br>Parent: 12.1%<br>Teacher: 3.8% | Created teacher/parent composite: summing the scores of six items of inattention and eight items of hyperactivity or impulsivity from the OCHS-R (Caregiver/teacher) | SITBIs<br>Parent- and a teacher-reported composite suicidality measure (P-Sui and T-Sui, respectively) by adding two items from the OCHS-R, “talks about killing self” and “deliberately harms self or attempts suicide” (Caregiver/teacher) | Of ADHD, 50.2% secondary MH diagnosis. Mediator model showed association between ADHD and suicidality in both parent-report (B = 0.10, OR = 1.10, 95% CI: 1.07–1.14, p = .001) and teacher-report (B = 0.08, OR = 1.08, 95% CI: 1.03–1.15, p = .002. Parent-reported hyperactivity/impulsivity (OR = 1.08, 95% CI: 1.02–1.15, p = .014) and inattention symptoms (OR = 1.14, 95% CI: 1.05–1.25, p = .003) were both associated with higher suicidality (R2 = 0.11, χ25 = 85.46, p < .001). Teacher reported hyperactivity/impulsivity (OR = 1.16, 95% CI: 1.06–1.38, p = .001) associated with suicidality (R2 = 0.07, χ25 = 25.92, p < .001). ADHD symptoms and suicidality mediated by depressive and irritability symptoms (both parent and teacher rated). Diagnosis of intellectual disability, psychosis, bipolar disorder or autistic spectrum disorder exclusion criteria. |

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| Liu et al., (2021), Taiwan | Youth; clinical, n= 195 (age 11–18); male= 84% | All participants ADHD<br><br>Suicidal ideation or attempt: 26.7% | Chinese version of the Child Behavior Checklist (CBCL; Achenbach et al., 1984)<br>(Caregiver) | SITBIs<br>Kiddie Schedule for Affective Disorders and Schizophrenia (Puig-Antich & Chambers, 1978)<br>(Self) | Experiencing cyberbullying associated with almost 3 fold increase risk of suicidality (OR 2.678, 95% CI: 1.011–7.093, p= 0.048) when age, gender, ADHD symptom severity controlled for. Including displaying hostility in the model reduced impact of cyberbullying to not significant however, hostility was associated with suicidality in ADHD (OR= 1.031, 95% CI: 1.001–1.064, p= 0.049. |
| Meza et al. (2021), USA | Youth, n= 228, (age 6-12)<br>Follow up 5, 10, 16 years. (16 year follow-up n= 211); all female | ADHD = 61.4%<br><br>Suicidal thoughts, self-harm and suicide attempt:<br><br>NSSI<br>ADHD = 46.5%<br>no ADHD = 21.8%<br><br>Suicidal ideation<br>43.7% no differences ADHD and no ADHD<br><br>Suicide attempt<br>ADHD= 19.4%<br>no ADHD = 5.8%<br><br>ADHD-C higher proportion report:<br>NSSI= 51.5 (ADHD-I= 29.8%)<br>Suicidal ideation = 51.6%<br>ADHD-I= 25.5% | Parent rated Diagnostic Interview Schedule for Children; Swanson, Nolan and Pelham Questionnaire (SNAP) Inattention and Hyperactivity assessed (Parent/ self) | SITBIs; W3 Barkley Suicide Questionnaire "Have you ever considered suicide?"; "Have you ever attempted suicide?"; Self-Injury Questionnaire (SIQ) "Have you ever been hospitalized for an attempt?"<br>W4 SITBI since w3 (self/clinician) | Of the whole sample 36.7% (n= 80) had engaged in NSSI. NSSI was more prevalent in those with ADHD (46.5%, n= 61) than those without (21.8%, n= 19; $\chi 2$ [3,N= 200] = 13.52, p < .001, OR: 3.13, CI: 1.74, 6.15).<br>SI reported by 43.7% overall sample. No differences between those with ADHD and those without. However, comparing ADHD types ADHD-C (n= 48; 51.6%) and ADHD-I (n= 12; 25.5%) subgroups regarding LT SI, with higher rates in the former (1, N= 127) = 7.85, p < .005, OR: 3.05, CI: 1.38, 6.77). ADHD 16.4% persisted SI vs 6.8% comparison group. SA ADHD overall 13.95% (n= 25; ADHD-C = 22, ADHD-I = 3) and comparison group (5.8%, n= 5); $\chi 2$ (3, N= 200) = 9.12, p < .05, OR: 3.89, CI: 1.43, 10.62).<br>Those in the ADHD group were almost 4 times more likely to report SA than those without ADHD (19.4% vs. 5.8%, OR 3.9, 95% CI: 1.43-10.62, p=.005). Within ADHD presentations, those with ADHD-c reported higher rates of NSSI (51.5 vs 29.8%), SI (51.6% vs. 25.5%) and SA (23.7% vs. 6.3%) than ADHD-I. Further, those in the ADHD-C group were more likely to experience SI which persisted across Waves 3 and 4 follow-ups (ADHD-C 65.5% vs ADHD-I 13.8%)<br>Multivariate analysis predicting SA: Inattention symptom severity (p < .05; d = .51), Hyperactivity/Impulsivity |

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| | | Suicide attempt= 23.7%<br>ADHD-I= 6.3% | | | symptom severity ($p < .001$; $d = .68$) both significant predictors. |
| Orri et al. (2020), Canada | Youth, n= 1618 (age 13-20); follow ups: age 13, 15, 17, or 20 | ADHD prevalence not reported | validated/ standardised measures (no further info)<br>(Self) | SITBIs<br>13, 15, 17, and 20 year olds; (1) "Did you ever think about suicide?" ("never" to "very often"; this item was not available at 20 years old). If yes, they were asked, (2) "Did you ever seriously think of attempting suicide? " (yes or no). If yes, they were asked, (3) "How many times did you attempt suicide?": a) passive SI: suicidal ideation, with no serious ideation or suicide attempt; (b) serious SI; reported SI with no attempt; and (c) suicide attempt.<br>(Self) | Around 9.8% of adolescents experienced serious SI and 6.7% SA by age 20. Tested independent associations of each Mental Health Problem with suicide-related outcomes. Depressive/anxiety symptoms highest association with Suicide outcomes.<br>Univariately ADHD associated with SI and SA at all follow ups; stronger associations seen in younger participants.<br>ADHD and SI; age 13 (risk rate ratio) RRR= 1.86 (95% CI: 1.33-2.62); age 15 RRR= 2.09 (95% CI: 1.56–2.80), age 17 RRR= 1.70 (95% CI: 1.33–2.16), age 20 RRR= 1.48 (1.23–1.78).<br>ADHD and SA: age 13 RRR= 2.40 (1.75–3.28), Age 15 RRR= 2.15 (1.58–2.93), age 17 RRR= 2.11 (1.57–2.84), age 20 RRR= 1.39 (1.02–1.91). Analysis adjusted for gender.<br>Multivariable analyses ADHD no longer significantly associated with any suicide outcome. |

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| Shoval et al. (2021), USA | Children, n= 11878 (age 9 – 10) | ADHD diagnosis= 25.5%<br><br>Lifetime suicidal behaviour:<br>ADHD = 33.1%<br>no ADHD = 20.6%<br><br>Follow up current suicidality<br>ADHD = 30.9%<br>no ADHD = 21.4% | Kiddie-Structured Assessment for Affective Disorders and Schizophrenia for Diagnostic and Statistical Manual of Mental Disorders (Fifth Edition) (KSADS-5; Kaufman et a;., 1997)<br>(Caregiver) | SITBIs<br>Kiddie-Structured Assessment for Affective Disorders and Schizophrenia for Diagnostic and Statistical Manual of Mental Disorders (Fifth Edition) (KSADS-5)<br>(Clinician) | At baseline, n= 1040 reported SB; 33.1% (n= 341) ADHD diagnosis vs no SB 20.6% (n= 2198, p<.001). Follow up current suicidality 30.9% ADHD (n= 60) vs 21.4% (n= 2298, p< .001).<br>ADHD mediation reduced impact of higher externalising symptoms to non-significant. No ADHD medications, higher externalizing symptoms (ADHD, Conduct disorder, oppositional defiant disorder) higher SB (OR, 1.42; 95% CI:, 1.33-1.52; P<.001); ADHD medication, no association (OR, 1.15; 95% CI:, 0.97-1.35; P=.10). |
| Sultan et al. (2021), USA | Adolescents, n= 6483 (age 13-18) male= 51.3%; | ADHD = 9.5% (male = 75.3%)<br><br>Suicidal thoughts:<br>ADHD = 23.1%<br>no ADHD = 11.0%<br><br>Suicide plan:<br>ADHD = 8.8%<br>no ADHD = 3.5%<br><br>Suicide attempts:<br>ADHD = 7.4%<br>no ADHD = 3.8% | World Health Organization CIDI (Kessler & Ustun, 2004)<br>(Clinician) | SITBIs<br>Have you ever had thoughts of suicide?; Have you ever made a plan to kill yourself?;Have you ever tried to kill yourself?<br>(Clinician) | ADHD group significantly more likely to have comorbid MH (Any 69.5% vs. 40.8%; Mood disorder 23.2% vs. 13.1%, anxiety 33.3% vs 25.1%, disruptive behaviour 50.8% vs. 11.9%, substance 20.5% vs 10.6%). Controlling demographics, odds of SI (aOR 3.1, CI 2.2- 4 .3), SP (aOR 3.2, 95% CI: 2.0-5.0), and SA (OR 2.9, 95% CI: 1.3-6.6) around three times higher ADHD cohort than no ADHD (not sure if demographics actually controlled for). |

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| Vuijk et al. (2019), USA | Youth; clinical, n= 758 (age 6-18); male= 63.6% | ADHD diagnosis= 59.9%<br><br>Suicidal thoughts and behaviours<br>ADHD= 22.7% | DSMIV-TR Axis I diagnoses (Clinician) | SITBIs<br>Child Behavior Checklist (CBCL) items; "Talks about killing self" and "Deliberately harms self or attempts suicide" and one item from the Child Symptom Inventory-IV (CSI-IV; [24]): "Has recurrent thoughts of death or suicide." (Caregiver) | Univariate analysis, ADHD increased SITBI risk almost 4fold (OR= 3.86, z= 3.48, 95% CI: 1.80–8.26, p <0.001). When mood, anxiety and conduct disorders were controlled for, ADHD no longer significantly associated SITBI's.<br>As a single condition, ADHD did not increase risk of SITBI's. However, comorbid MH diagnosis and ADHD increased risk e.g., ADHD + MD (OR 5.59, z = 2.75, p = 0.006 [95% CI: 1.61–17.11]). ADHD increased risk further in multimorbidity. |
| Zahid et al. (2020), USA | Adolescents; clinical (MDD diagnosis), n= 141530 (age 12–18), male= 43.2% | Comorbid ADHD diagnosis= 16%<br><br>Suicidal behaviours:<br><br>MDD + ADHD= 54.3%<br>MDD= 52.7% | ICD-9 classifications (Clinician) | SA<br>ICD-9 diagnosis codes and Clinical Classification Software (CCS) for Mental Health (Clinician) | Males were twice as likely to have ADHD diagnosis (OR= 2.3, 95% CI: 2.25-2.41, p< .001).<br>Comorbid ADHD group higher SA than the MDD group controlling for demographic confounders (54.3% vs 52.7%, OR = 1.04, 95% CI: 1.01-1.08, p= .011). Further comorbidities more frequently recorded in ADHD group; significantly more participants diagnosed with impulse control, anxiety and substance misuse disorders.<br>Between 2012 and 2014 diagnosis of comorbid ADHD increased in females from 50.8% to 60.4%. The pattern reversed in males with a 9.6% decrease in males diagnosed with ADHD over the same period. In patients with ADHD and MDD presentations for SA increased from 51.1% (n= 3360) in 2012 to 58.2% (n= 5115) in 2014 (p< .001). |
| Zelazny et al. (2021), USA | Adolescents, n= 545 (age | ADHD= 21.28% | 10–17 year olds: School Aged Schedule for | SITBIs | Early onset suicidal behaviour (< age 13) more likely to have diagnosis of ADHD (X2 = 8.35, p<.015); |

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| | 10-21),male= 54% | Age of suicidal behaviour onset:<br><br><13 = 5.87%<br>ADHD= 42%<br>13–21 years = 9.36%<br>ADHD= 20% | Affective Disorders and Schizophrenia: Present and Lifetime Version (K-SADS-PL) (Kaufman et al., 1997). 18–21 year olds lifetime and current Axis I disorders using the Structured Clinical Interview for DSM-IV Diagnoses (SCID-I) (Spitzer et al., 1992). (Clinician) | Columbia Suicide History Form, Medical Lethality Rating Scale, and Suicide Intent Scale (Beck et al., 1975, 1979; Mann et al., 1992). BSSI (SR) (Clinician; Self) | Suicidal behaviour preadolescent onset predicted by DD (RRR = 11.41, p<.001) and ADHD (RRR = 2.86, 95% CI: 1.14- 7.13, z= 2.25 p = .02). |

Table note: Mental health terms: NSSI- non-suicidal self-injury, SA- suicide attempt, SI- suicidal ideation, SITBI's- suicidal thoughts and behaviours, O/C- outcomes, SB- suicidal behaviour; SRE- suicide related events; SR- suicide risk. ADHD-I: ADHD predominately Inattentive; ADHD-H: ADHD predominately hyperactive; ADHD-C: ADHD–combined; CNS Central stimulant; MH- Mental health; LT- lifetime; Psych ED psychiatric Emergency Department; MDD- Major depressive disorder; MD- Major depression, DD- depressive disorder, BPD- borderline personality disorder, SCZ- schizophrenia/ typal disorders; QoL-quality of life; PB- perceived burdensomeness; TB - thwarted belongingness
Statistical terms: OR's – odds ratio, 95%CI 95% confidence intervals, IRR- incidence rate ratios, RRR- relative risk ratio; HRs- hazard ratios, R- Pearson's r correlation (univariate analysis), SD- standard deviation, 95% CI: -95% confidence intervals, $\chi 2$- chi-square comparison, df- degrees freedom, B- beta; $p<.05$ significant result, $R^2$ = R-Squared coefficient

## Understanding the relationship between ADHD and suicide risk in young people

In this section we look at studies which aim to understand how ADHD may increase suicide risk in some young people. We identified 10 studies that investigated the role of different factors such as different characteristics of ADHD presentations or psychological factors and how these may increase an individual's vulnerability to suicidality.

One of those studies was by Meza and colleagues (2021). Within their study of 140 females with ADHD and 88 matched controls, they explored suicide-risk within people with different ADHD profiles. Lifetime suicidal ideation was reported by 51.6% of participants with ADHD-C compared to 25.5% of those with ADHD-I (Meza et al., 2021). Additionally, suicidal ideation persisted across the follow up period (5, 10 and 16 years) in 16.4% of participants with ADHD compared to 6.8% in the control group. Within the ADHD-C group, 65.5% of participants continued to experience suicidal ideation over a 16 year follow-up period compared to 13.8% of those predominantly ADHD-I. A similar pattern was observed where the ADHD-C group was more likely to report NSSI (51.5 vs 29.8%), and suicide attempts (23.7% vs. 6.3%) than ADHD-I. In multivariate analysis severity of ADHD-I and ADHD-H were significant predictors of suicide attempts (Meza et al., 2021).

This study also found that the strongest predictors of NSSI were early externalizing symptoms (e.g., disruptive, hyperactive, and aggressive behaviours) and impaired executive functioning. Lifetime suicidal ideation was predicted by low perceived self-competence and also affected by poor executive function (e.g., deficits in processes that associated with goal directed and problem-solving behaviour). Whereas recent suicidal ideation was predicted by adverse childhood experiences and low self-esteem. Further, suicide attempts were predicted by childhood inattention, hyperactivity/impulsivity symptoms, adverse childhood experiences, low self-esteem and externalizing symptoms. The latter was found to be the most predictive factor. Further, at 12-month follow up, ADHD was related to suicidal ideation through its effect on self-esteem. These authors conclude that these findings potentially indicate that females with ADHD-C, in the presence of adverse childhood experiences, may internalise negative feedback from childhood, resulting in low perceived self-competence (Meza et al., 2021). These findings highlight the importance of not only research to identify factors which may increase an individual's risk factors, but also when and under what circumstances these factors are most important.

In another study with a large sample (n= 4739) of young people aged 7-15 years old, a direct relationship between ADHD and suicidal thoughts and suicide plans was found and this relationship

still remained when the role of depressive/anxiety symptoms, conduct problems and family function were accounted for in the model (Chen et al., 2019). As detailed in Table 2, even after accounting for demographic factors, children with ADHD were more than twice as likely to report suicidal ideation, suicide plans and suicide attempts than controls (Chen et al., 2019).

Two further studies of clinical samples in participants with a diagnosis of ADHD found that both in-person and cyber bullying were associated with increased suicide risk (Chen et al., 2020; Liu et al., 2021 respectively). In a longitudinal study of 203 adolescents with ADHD (12-18 years old) by Chen and colleagues (2020), school bullying was correlated with suicide-risk over 12 months. Participants who reported suicidal thoughts and behaviours also reported lower quality of life, and higher feelings of victimization from bullying. This study found a possible role of ADHD symptoms in the relationship between bullying and suicidal thoughts and behaviours. Chen and colleagues (2020) also explored the difference between the different profiles of ADHD. The authors found an interaction between higher inattentive symptoms, lower personal competence and higher suicidal thoughts and behaviours. Hyperactivity had opposing indirect association with suicidality through personal competence and a positive direct association with suicide. The pathway between bullying and suicide risk relationship seemed to be explained by lower self-competence and higher symptoms of ADHD-I (Chen et al., 2020).

In a sample of 195 youth (11-18 years old) Liu et al (2021) found that cyber-bullying was associated with almost 3 times increase in suicide risk. However, the relationship between cyber-bullying and suicidality was accounted for by hostility when age, gender and ADHD symptom severity were controlled for in the analyses (Liu et al., 2021). In another study, the role of irritability was explored as a potential explanatory variable to explain the association between ADHD symptoms and suicidal ideation and behaviours in 1407 young people (Galera et al., 2021). These researchers compared four trajectories and found that higher suicidal thoughts and behaviours were associated with the moderate/high ADHD symptoms regardless of irritability level. The young people who had higher ADHD symptoms and higher irritability levels had higher risk of psychiatric symptoms; they were twice as likely (compared to controls) to experience suicidal thoughts and behaviours. Suicidal thoughts and behaviours were 1.5 times higher than those in the control group for individuals who had moderately high ADHD symptoms and low levels of irritability. When they looked at males and females separately, the relationship held for males. Interestingly in a clinical sample of 232 children, Doyle and Fite (2022) found that ADHD-H was positively associated with suicide risk at low levels of sadness dysregulation and worry, suggesting that when sadness/worry were low, suicide risk increased.

Perfectionism has also been explored. For example, in a study looking at perfectionism as a risk factor for suicidal behaviour in adolescents (n= 184), some of which had ADHD (n= 96) and others without ADHD (n= 88), Katzenmajer-Pump et al. (2021) found that ADHD increased the probability of suicidal behaviour by 57%. This study also found that for every one unit increase in perfectionism, there was a 10% reduction in the suicidal behaviour incident rate. Surprisingly, there were no significant results for any maladaptive perfectionism subscales (concern over mistakes, parental criticism, parental expectation, doubts about actions), however, the groups did differ on the adaptive perfectionism subscales. Specifically, the ADHD group scored significantly lower than the control group on the organisation subscale. Furthermore, higher scores on the personal standards subscale were associated with decreases in suicidal behaviour.

In a recent study the relationship between suicidality and both parent and teacher rated ADHD symptoms in a large clinical sample (n= 1516) was examined (Levy et al., 2020). They found that depressive and irritability symptoms seemed to explain the relationship between ADHD symptoms and suicidality (Levy et al., 2020). They also found that parent-reported hyperactivity/impulsivity and inattention symptoms were significantly associated with higher suicidality, whereas teacher reported hyperactivity/impulsivity was associated with suicidality. In this study, 50.2% of those with ADHD had a secondary psychiatric diagnosis (Levy et al., 2020).

In a community sample of 545 adolescents, researchers found that the risk of preadolescent suicidal behaviour was around 3 times higher in individuals with an ADHD diagnosis and over 10 times higher in those with depressive disorder (Zelazny et al., 2021). Similarly, a large sample of young people (n= 4344) looking at common genetic variants underlying ADHD and major depression (MD), found MD was more strongly associated with suicide attempts while ADHD was more commonly associated with suicidal ideation (Lee et al., 2021). In a final study, polygenic risk scores (PRS) for ADHD were calculated and found to be associated with baseline suicidal ideation and predictive of both suicidal ideation and attempt at 1-year follow-up (Lee et al., 2021). In addition, ADHD/MD markers were associated with the majority of the measures included; moreover, the ADHD-suicide risk relationship was stronger at follow-up than at baseline. Regression analysis showed ADHD was the second strongest predictor (after child psychopathology) of suicidal ideation at follow up.
Importantly, this study also compared relationships between ADHD and caregiver and child reports of suicide risk separately. Firstly, the reported prevalence of suicidal ideation and suicide attempts were higher from the child's report than that of the caregivers. This was particularly pronounced, with

children reporting 3 times higher rates of suicide attempts than those reported by caregivers (1.31% vs. 0.44%).

## Understanding the relationship between ADHD and suicide risk in adults

This section provides an overview of recent research discussing prevalence of ADHD and suicidal thoughts and behaviours. A summary of the studies and main can be found in Table 3.

There were 26 studies of adults. Rates of ADHD varied across the populations assessed (see Table 3 for full details). For instance, one military sample reported baseline ADHD prevalence of 6.1% (Howlett et al., 2018). While in a recent study using the Canadian Community Health Survey–Mental Health (CCHS-MH) database (a nationally representative survey of n=21,744) Fuller-Thomson and colleagues found ADHD reported by 2.4% of the population and those with ADHD were more likely to report suicide attempts than those without (weighted; 14.0% vs. 2.7%, p<.001; Fuller-Thomson et al., 2020).

Studies conducted with student populations have reported prevalence of ADHD ranging from 3.5% to 40.1% (Shen et al., 2018; Arsandaux et al., 2021 respectively). In terms of suicide risk, in a large student sample (n= 1829), Brown and colleagues (2022) found rates of suicidal ideation were twice as high in those with ADHD compared to those with no symptoms. Further, suicide attempts and NSSI were 2.5 times, and suicide plans were almost 3 times more likely to be reported by people with ADHD than those without. In another sample of 5693 medical students in China, suicide risk was more frequently reported by those with ADHD symptoms than those without (Shen et al., 2018). Specifically, 67.5% of participants with ADHD symptoms reported suicidal ideation, 29.5% suicide plans and 48.50% suicide attempts compared to 26.03%, 7.12% and 13.54%, respectively. In another large student sample (n= 4333) using the i-Share student cohort (Gbessemehlan et al., 2020), 19.9% of those with ADHD symptoms reported suicidal ideation over the follow up period. This study also found that higher levels of ADHD symptoms were reported by those who experienced suicidal ideation. Similar findings come from matched-control studies. For example, in a study of 204 students with ADHD (n= 102) and controls (n= 102) matched for sex, age and ethnicity, 40.2% of those with ADHD reported suicidal ideation compared to 34.3% of the control group (p= .031; Eddy et al., 2020). ADHD remained associated with suicidal ideation (p = .040) when depressive symptoms and ethnicity were accounted for. This study also found rates of suicide attempts to be 4 times higher in those with ADHD compared to those in the control group (13.7% vs. 2.9% p< .001; Eddy et al., 2020).

In an adult sample of 206 participants; 103 with a diagnosis of ADHD and a control group (n= 103) matched on gender, age, and education level, Kakuszi and colleagues (2018) found suicidal ideation was around 3 times higher in participants with ADHD compared to controls (28.16% vs 7.77%). This was particularly pronounced in females with ADHD who were 16 times more likely to report suicidal ideation than females in the control group (37.21% vs 2.33%). Kakuszi et al (2018) also found gender differences in ADHD symptom severity. In addition, "Problems with Self-Concept" was strongly associated with suicidal ideation in females while in males "Impulsivity" most strongly associated with suicidal ideation. Similarly, Becker and colleagues (2018) found that in a large student sample (n= 1704), females (4.6%) were more likely to report having made a suicide attempt than males (2.7%). Over a quarter (26.1%) of females also scored as being at risk of suicide (>7) on the SBQ-r compared to around a fifth of males (20.4%). This study also found that suicide risk was significantly correlated with and ADHD-H and ADHD- I (Becker et al., 2018).

Also, Giupponi et al (2020) found that those in the ADHD group were more likely to report suicidal outcomes than those in the control group; (suicidal ideation 46.0% vs. 5.9%, $p < 0.001$; suicide attempts 9.5% vs. 0.0%, $p = .020$). In this sample, those with ADHD were also more likely to be male (71.4% vs. 31.9%, $p < .001$).

There have also been relevant clinical studies. For example, a study of 804 individuals who attended the psychiatric emergency department following either a suicide attempt (83%) or NSSI (17%), found that 12% of the sample had either a diagnosis ADHD or were receiving ADHD medication (Olsson et al., 2022). There were no differences in prevalence of ADHD between genders, however those with ADHD tended to be younger (age 29 vs 39 no ADHD). Although no differences were found in the medical severity of suicide attempts, those with ADHD more likely report an impulsive attempt (ADHD 62% vs. no ADHD 40%). Further, NSSI was more common in ADHD group (29% vs. 16%). In this sample, the ADHD group was more likely to have a diagnosis of personality disorder (e.g., BPD 24% vs 16%), and less likely to have diagnosis of depression (ADHD 13%) at discharge than those in the no ADHD group (31%, $p<.001$). However, despite having lower rates of depression diagnoses, the ADHD group tended to score higher on the depressive symptoms measure than those without ADHD (38.6 vs 27.6 respectively). The authors highlight that this may be a result from how the groups interpret the items, or a difference between groups. However, as diagnoses were collected from medical records, this could indicate that those with ADHD were experiencing elevated depressive symptoms around the time they attended psychiatric emergency department. Relationship problems prior to

suicide attempts were reported by 75% of those in the ADHD group compared to 64% of those without ADHD (Olsson et al., 2022).

Over a 6-month follow-up period, 55% of those with ADHD recorded a further visit to a psychiatric emergency department compared to 38% without ADHD. In addition, 29% of those with ADHD reattempted or died by suicide compared to 19% of people without ADHD; equating to a 70% increase in odds of further suicidal behaviour in patients with ADHD (p= .03) compared to those without. Additionally, the risk of further suicidal behaviour remained significant for the ADHD group when baseline depression was included (Olsson et al., 2022).

Table 3. Overview of papers investigating the relationship between ADHD symptoms and suicidal thoughts/behaviour in adults (n= 28).

| Author (year) & country | Sample, n, age | Prevalence ADHD (%)<br>Prevalence Suicide outcome | ADHD assessment (completed by) | Suicide outcome, assessment (completed by) | Main Results |
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| Arsandaux et al. (2021), France [a] | Students, n= 2331 (mean age 20.7); male= 20.5% | ADHD symptoms = 40.1%<br><br>Suicidal ideation= 16.5% of sample<br><br>More likely in individuals with high ADHD symptoms | ASRS (Caci et al., 2014) (Self) | SI; Since the last time, did you ever think of suicide (suicidal ideation)" "No never," "Yes, already happened to me," "Yes, repeatedly" (Self) | Data from 1 year follow-up (46%) used to test role of depressive symptoms and self-esteem as mediators of ADHD and SI relationship. 16.5% of sample reported SI at least once since previous assessment. Total effect ADHD and SI direct: increase of 1 sd in ADHD score, increased likelihood of participants reporting SI (β =.168, p < .0001). Including the mediators reduced the effect of ADHD on SI to not significant levels (β = .019; p = .524). Paths ADHD to SI through depressive symptoms (β = .042, p < .0001) and self-esteem (β = .055, p < .0001) were both statistically significant. Self-esteem accounted for half of the total effect of ADHD symptoms on SI; depressive symptoms explained part of self-esteem's effect. |
| Becker et al. (2018), USA | Students, n= 1,704 (age 18-29), male= 35.51% | ADHD-I mean= 1.70<br><br>ADHD-H mean= 1.71<br><br>Suicide risk mean score= 24.2 | The Adult Concentration Inventory; The Barkley Adult ADHD Rating Scale-IV 18 items consistent DSM-4 (Self) | SITBIs; SBQ-R (Self) | Suicide attempt in overall sample: 4%<br>Females more likely to report LT SA and SBQ-r total score of >7 (indicating at risk of suicide) than males (SA:4.6% vs. 2.7%; χ2 3.9, p<0.05; SBQ-r 26.1% vs. 20.4%, χ2 6.82, p<.01 respectively). SBs and ADHD-H (r=. 20, p<0.001) and ADHD- I (r= .31, p<0.001) correlated.<br>Hierarchical regression when demographics were covaried, ADHD-H no longer associated with SB's; ADHD-I symptoms remained significantly associated with SB's (β= .29, t= 10.84, p<0.001).<br>ADHD when depressive symptoms and SCT included in regression model, they accounted for the effect of ADHD-I. SCT includes: symptoms (e.g., daydreaming) or impairment (e.g., social impairment). |

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| Bitter et al. (2019), Czech Republic and Hungary | Clinical; patients undergoing inpatient or outpatient psychiatric treatment for a DSM-IV-TR Axis I diagnosis (not ADHD) n= 708, (age 18-60 years) | ADHD= 6.99%<br><br>Suicide risk<br>Undiagnosed ADHD= 73.68%<br><br>no ADHD= 54.43% | ASRS; CASRS; MINI assessment (Clinician/self) | SR; MINI Current risk and lifetime reported on- not clear how established MINI and DSM included. Psychiatric services, (Clinician) | Investigated undiagnosed ADHD (aADHD) in adults attending MH services.<br>Current SR significantly associated with the presence of undiagnosed aADHD (aADHD 73.68% vs no ADHD 54.43% $\chi2(1)$ 5.21, p=0.02); however, LT SA, depression, dysthymia, alcohol and substance dependence, anxiety and stress related disorders were not. |
| Blanco-Vieira et al. (2019), Brazil | Clinical; patients with OCD, n= 955, (age 18-82)<br>male= 41.88% | ADHD= 13.7%<br><br>Suicide attempt<br>OCD+ ADHD= 18.32%<br><br>No ADHD= 9.31%, | Kiddie Schedule for Affective Disorders and Schizophrenia for School Age Children-Present and Lifetime version (KSADS-PL; Kaufman et al.,1997); Adult ADHD Self-Report Scale (Clinician) | SA; SCID | Prevalence of ADHD in adult patients with OCD was 13.7%. ADHD+OCD group more LT suicide attempts (18.32% vs 9.31%, p<0.011). Significant associations found between OCD all symptoms depressive and anxiety symptoms and ASRS inattention score. |
| Brown et al. (2022), Ireland | Students, n= 1,829, (age 77.5% <21 years); male = 28% | ADHD= 27.2%<br><br>Suicidal ideation<br>ADHD= 44.8% no ADHD= 21.7%<br><br>Suicide attempt<br>ADHD= 13.4%<br>no ADHD= 5.5% | ASRS (Self) | SITBIs; Self Injurious Thoughts and Behavior Interview (SITBI; Nock et al., 2007) (Self) | SI in students with ADHD 2x higher than those without ADHD (44.8% vs. 21.7%, $\chi2$ 95.656, p<0.001). Reports of SA (13.4% vs. 5.5%, $\chi2$= 31.742, p<0.001) 2.5 times higher in students with ADHD than in those without ADHD. SP were almost three times higher (26.6% vs. 9.8%, $\chi2$= 82.738, p<0.001).<br>Mediation; ADHD directly and indirectly increased SB and NSSI and SP adjusting for comorbid disorders, substance and alcohol use, significant direct associations remained between ADHD and suicidality and ADHD and NSSI. ADHD, age and gender indirect |

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| | | Suicide plan<br>ADHD= 26.6% no ADHD= 9.8% | | | effect suicidality via drug use and depressive symptoms. ADHD was associated with alcohol (ß = 2.243, SE = 0.379, p < .001), drug use (ß = .757, SE = 0.163, p < .001), anxiety (ß = 2.726, SE = 0.367, p < .001) and depressive symptoms (ß = 3.803, SE = 0.330, p < .001).<br>Substance use and depressive symptoms were significant predictors of suicide ideation, plans and attempts. |
| Chen et al. (2019), Taiwan | National Health Insurance database; All ages, n= 2207840 (age 4-44); male= 75.88% | ADHD= 12.5%<br><br>Suicide death<br>ADHD= .62 per 10000 person years<br>no ADHD= .19 per 10000 person years | ADHD diagnosis (International Classification of Diseases, Ninth Revision[ICD-9] code 314 (Clinician) | Mortality; All-cause mortality; including deaths due to suicide,ICD-9codes E950 to E959 (suicide) and E980 to E989 (injury undetermined whether accidentally or purposely inflicted); unintentional injuries was defined a sICD-9 E800 to E949;homicide ICD-9codes E960 to E969. natural causes | Overall n= 4321 died during follow-up. In the ADHD group rates of suicide, 0.62, per 10 000 person-years compared to 0.19, per 10 000 person-years in non-ADHD group.<br><br>Adjustment for confounders (demographics, comorbid conditions), those with ADHD remained at higher risk for unnatural cause mortality from suicide (adj HR, 2.09; 95% CI:, 1.62-2.71) compared with the non-ADHD group. |
| Delibas et al. (2019), Turkey | Clinical, case control study (n= 96) inpatients with MDD n= 48 | MDD+ ADHD= 50% (purposive recruitment) | Turgay's Adult ADHD scale, wender Utah | SITBIs; Previous suicidal ideation (Have you ever thought about | Higher proportion of those in the MDD+ ADHD had experienced SI (85.4% vs. 64.6% $\chi 2$ 5.556, p=0.018), SA (65% vs. 35% $\chi 2$ 6.171, p=0.013) and had required medically serious SA (41.7% vs 8.3%, $\chi 2$ 14.222, p<0.001). |

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| | and MDD+ADHD n= 48, (age 18-65); male = 43% | Suicidal ideation<br>ADHD= 84.5%<br>no ADHD= 64.6%<br><br>Suicide attempt<br>ADHD= 65%<br>no ADHD= 35% | rating scale (Clinician/ Self) | ending your life?/Yes or No), suicide attempt (Have you ever attempted suicide?/Yes or No), and number of suicide attempts (Clinician) | |
| Eddy et al. (2020), USA | Students, case control study (n= 204) ADHD n= 102; matched no ADHD n= 102 (mean age = 18.46), male = 29.1% | ADHD= 50%<br><br>Suicidal ideation<br>ADHD= 40.2%<br>no ADHD= 34.3%<br><br>Suicide attempt<br>ADHD= 13.7%<br>no ADHD= 2.9% | "Have you ever been diagnosed with ADD/ADHD" (Self) | SITBIs; "Have you ever thought about killing yourself" ; "Did you have a plan" and "Have you ever tried to kill yourself" (Self) | In the ADHD group, SI 40.2%, No ADHD 34.3%, $\chi 2$= 4.676, p=0.031). Rates of past SA were 4x higher in ADHD group than noADHD (13.7% vs. 2.9% $\chi 2$= 11.241, p<0.001). Hierarchical regression: Depressive symptoms, gender, ethnicity covaried; ADHD remained associated with SI (β=.067, p = .040) when controlling depressive symptoms (β = .391, p < .001) and ethnicity. ADHD (β = .158, p < .001) predicted SA. |
| Fitzgerald et al. (2019), Denmark | Database study, All ages, n= 2924780 persons, male 52.1% | ADHD= 1.11%<br><br>Suicidal behaviour<br>ADHD= 415.6 per 10000 person years<br><br>no ADHD= 75.5 per 10000 person years | ICD8 and 10 diagnosis (Clinician) | SA; diagnosis of suicidal behaviour (ICD-8: 950–959; ICD-10: X60–X84) or a reason for contact of 'suicide attempt (Clinician) | Over 20 years, 37 705 suicidal events (4 930 suicide deaths, 32 775 suicide attempts) recorded. Within those with ADHD 697 suicidal events (35 suicide deaths, 662 suicide attempts) recorded. Incidence rate of suicide in full cohort: 75.5 and ADHD: 415.6 per 100 000 person-years.<br>Compared to no ADHD, those with ADHD rates of SB were 4.7 times higher (IRR 4.7, 95% CI:, 4.3–5.1). 4.1-fold higher rate (95% CI:, 3.5–4.7) when compared with those without any psychiatric diagnoses. Compared to those without ADHD, rates of SB were 3.4-fold higher rate (95% CI:, 3.04–3.76) for Males with ADHD and 9.1- fold higher in females (95% CI:, 8.12–10.12). |

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| | | | | | Rates of SB were particularly high for those with ADHD aged 20–29 years (IRR 10.07, 95% CI: 8.81–11.51).<br>Those with ADHD were at higher (IRR 3.20, 95% CI:, 2.29–4.47) risk of dying by suicide. Compared to age-matched persons without ADHD, persons aged 30–39 years with ADHD (IRR: 3.01; 95% CI:, 1.66–5.44), and in males with ADHD (IRR 2.98, 95% CI:, 2.06–4.30) were at highest risk of dying by suicide deaths.<br>For persons with ADHD and comorbid MH condition the IRR was higher (IRR: 10.4; 95% CI:, 9.5–11.4).<br>Increased rates of SB seen for the majority comorbid diagnoses in persons with ADHD. ADHD and comorbid MH condition generally produced IRR equivalent to that of those only with the other disorder; possible ADHD doesn't further contribute to risk in these individuals. |
| Fuller-Thomson et al. (2020), Canada | Population sample, n=21744 (age 15+), male= 46.1% | ADHD= 2.4%<br><br>Suicide attempt<br>ADHD= 41.0%<br>no ADHD= 2.7% | long-term conditions, last six months+ or more and that have been diagnosed by a health professional (Clinician) | SA; Have you ever attempted suicide or tried to take your own life? (Clinician) | Individuals with ADHD more likely to report SA (weighted; 14.0% vs. 2.7%, p<.001). Adjusting for demographics, ADHD group remained three times more likely to report SA than those without ADHD (OR=3.27; 95% CI: 2.39, 4.48). Adjusting for depression and anxiety substance abuse, chronic pain, and childhood adversities ADHD remained significantly associated with SA (OR = 1.56; 95% CI: 1.08, 2.25). Within ADHD group, experiencing parental domestic violence as child (OR = 3.47; 95% CI: 1.37, 8.81), being female (OR = 2.59; 95% CI: 1.36, 4.94), SUDs (OR = 2.35; 95% CI: 1.23, 4.49), and lifetime depression (OR = 7.06; 95% CI: 3.52, 14.16) were associated with SA. |
| Gbessemehlan et al. (2020), France[a] | Students, n= 4333 (age 18+), male = 21% | ADHD= 4.6%<br><br>Suicidal ideation<br>Overall sample= 19.9% | 6-item version ASRS-v1.1 (Self) | SI; "In the past 12 months, have you ever thought about committing suicide (or have you ever had | Overall sample: ADHD (score ≥ 18) 4.6%, SI reported by 19.9% during follow-up.<br>Higher ADHD mean scores were seen in the SI group (11.9) compared to those without SI (10.4, p<0.001). No gender differences. ADHD was associated with SI (aOR = 1.15, 95% CI: 1.04-1.26, p<.001). No interaction between perceived stress |

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| | | Suicidal ideation had higher ADHD mean score (11.9) compared to no suicidal ideation (10.4) | | suicidal thoughts)?" (Self) | and ADHD. When stress included in mediation, the strength of SI, ADHD relationship decreased by 16%. |
| Giupponi et al. (2020), Italy | Clinical, case control study (n= 132)<br>ADHD n= 63, mean age 36.78, male= 71.4%<br><br>No ADHD n= 69, mean age 42.39 male= 31.9% | ADHD-C= 73%<br>ADHD-H= 15.9%<br>ADHD-I= 11.1%.<br><br>Suicidal ideation<br>ADHD= 46.0% no ADHD=. 5.9%<br>Suicide attempt<br>ADHD= 9.5%<br>No ADHD= 0.0%, | Wender Utah Rating Scale (WURS) (Self) | SITBIs; The Columbia-Suicide Severity Rating Scale (Clinician) | ADHD group more likely to report suicidal outcomes than no ADHD group; (SI 46.0% vs. 5.9%, phi = 0.46, p < 0.001; SA 9.5% vs. 0.0%, phi .22, p=0.020).<br><br>ADHD-I more likely to report SI (57.1%) compared to ADHD-H (30.0%, $\chi 2$= 1.44; df= 2;p=0.49), however ADHD-I reported no SA, whereas SA reported by 20.0% of the ADHD-H ($\chi 2$= 2.05; df= 2;p=0.36). ADHD group 46% comorbid axis-1 diagnosis. |
| Howlett et al. (2018), USA | Military, U.S. Army Brigade Combat Teams, n= 4645. Further sample details not reported | ADHD = 6.1%<br><br>Suicidal ideation prevalence not reported | Composite International Diagnostic Interview Screening Scales (Clinician) | SI; Columbia Suicide Severity Rating Scale; "Did you ever in your life have thoughts of killing yourself?" "Did you have these thoughts at any time in the past 30 days? (Clinician) | Weighted ADHD prevalence no differences in prevalence for age, gender. T0 comorbid ADHD and PTSD 1.7%. No significant association between pre-deployment ADHD and past-month SI baseline or at follow up. |
| Kakuszi et al. (2018), Hungary | Case control study (n= 206), patients with ADHD, n= 103, matched controls | ADHD= 4.6%<br><br>Suicidal ideation<br><br>ADHD= 28.16% | ADHD- diagnosis and part of outpatient service. Controls Conners' Adult | SI; Beck Depression Inventory (BDI; Beck et al., 1979) Item 9 (Self) | Higher proportion SI in the ADHD compared to C (28.16% vs 7.77% respectively, OR = 4.65, 95%CI = 2.01–10.78; Chi-square = 14.53, df = 1, p< 0.0001). Interaction between gender and SI found. Females in the ADHD group were 16x more likely to report SI than females in C group (37.21% vs 2.33%, OR = 25.0, |

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| | (gender, age, and education) n= 103, (age 18-65) | No ADHD= 7.77% | ADHD Rating Scale (CAARS) screen comorbidity (Clinician/Self) | | 95%CI: 2.98–200.0).Gender impact seen for comorbidity and held multivariately.<br>Gender differences in ADHD symptom severity. On the CAARS, "Problems with Self-Concept" was most associated with SI in females (f= 5.6 vs. 2.61)(OR = 5.60, 95%CI 2.34–13.41), while in males "Impulsivity" most associated with SI (m= 4.40 vs. f= 3.01) (OR = 3.01,95%CI:1.50–6.06). |
| Lee et al. (2022), Taiwan | Database; Nested case–control study design; n= 159 suicide decedents; 20 living age- and sex-matched controls per person who died by suicide (n= 3180) | All ADHD. case–control study. Ratio of 1:20 applied ADHD suicide death: matched living controls with ADHD | ADHD diagnosis (ICD-9 code: 314.0–314.9, ICD-10: F90) (Clinician) | Mortality; Suicide death (Clinician) | Deaths majority men (73%); Most patients died aged between 15 and 29 years (78.0%) mean age 22.6.<br>Over follow up suicide decedents were more likely to have had at least one healthcare visit 3 months before suicide (85.5%, controls 74.8%, OR = 2.03, P = 0.002). Visits particularly to psychiatry, emergency, internal medicine, neurosurgery, and plastic surgery departments. Those who died were more likely to have at least two comorbid MH conditions (5.75 vs. 2.4%, OR= 2.48,95% CI: 1.19-5.17, p=0.016) than the control group. This persisted in multivariate model. Cases had a higher risk of sleep disorder, depression, schizophrenia, and bipolar. ED and suicide death: stronger with a shorter interval between emergency department presentation and suicide death. |
| Oh et al. (2021), Korea | Clinical (all ADHD) n= 77 (age 18-65) | All ADHD<br>Created and compared symptom clusters.<br><br>Suicidal ideation ranged from 10.3%- 39.5%<br>Suicide attempts Ranged 15.8% - 30% | MINI (Clinician) | SITBIs; MINI (Clinician) | Generated 3 clusters of symptoms: C1; ADHD-C with less mood symptoms (38%), C2 ADHD-I predominantly inattentive (13%); C3 ADHD-C with significant mood symptoms (50%). C3 higher proportion SI (39.5%) compared to C1 (10.3%; AOR 6.07, 1.50-24.5, p=0.011). No significant difference between profiles in SA prevalence. |

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| Ohlund et al. (2020), Sweden | Clinical; diagnosed with ADHD and BD or SZD, n= 206 (mean age 35) male= 44% | All ADHD<br><br>Self-harm (SA/NSSI)<br>Pre-treatment n= 52<br>Post-treatment n= 31 | BD/ SZD and ADHD within 2 years before CS initiation or used Li as a mood stabiliser. (Clinician) | SITBIs; Medical records | Data available 204 participants. 75.2% ADHD, 15.5% ADD, 2.9% hyperactivity disorder NOS.<br>2-year pre-and post-mirror periods, number of SA/NSSI events n= 52 before treatment decreased to n= 31 following CS initiation (p = 0.028).<br>SA/NSSI events decreased with age. |
| Olsson et al. (2022), Sweden | Clinical, presenting to Psychiatric ED for self-harm (regardless of intent) n= 804; (age 18+), male= 32.7% | ADHD= 12%<br><br>Suicide attempts<br>ADHD= 62%<br>No ADHD= 40%<br><br>Suicide reattempt or death<br>ADHD= 29%<br><br>No ADHD= 19% | Medical records ICD-10 diagnoses or ADHD treatment (Clinician) | DSH; Columbia Suicide Severity Rating Scale (C-SSRS) was rated on a scale of 0–5 according to the C-SSRS item 21a >3 high lethality; suicide intent scale medical lethality; Suicide Assessment Scale (SUAS) used for impulsivity; suicide deaths identified National Cause of Death Register (Clinician) | ADHD: 10%, receiving ADHD medication: 2%.<br>NSSI more common in ADHD group (29% vs. 16%, $\chi2(1)10.4$, p<.001).<br>83% of whole sample SA according to C-SSRS, 17% NSSI.<br>No difference in severity of SA. ADHD more likely report impulsive attempt (ADHD 62% vs. no ADHD 40%, $\chi2(1)$ 7.04, p<0.01).<br>75% ADHD group compared to 64% non- ADHD reported relationship problems prior to index SA ($\chi2(1)$ 4.44, p=.04).<br>Across follow-up, 29% of those with ADHD reattempted or died by suicide. Equated to 70% increase in odds for SB during the 6-month among participants with ADHD (crude OR = 1.70, 95% CI: 1.05, 2.76, Wald $\chi2(1) = 4.59$, P = .03) compared to those without. Risk of further SB remained elevated for the ADHD group after depression at baseline included in model (OR = 1.65, 95% CI: [1.01–2.68], Wald $\chi2(1) = 3.97$, P = .046).<br>At follow up those with ADHD twice as likely attempt using ligature (30% vs 13% chi: 4.68 1 .03). ADHD group more likely to have recorded visit to Psychiatric ED (55% vs 38%; $\chi2(1)$= 9.28, p= .002). |
| Shen et al. (2018), China[b] | Students, n= 5693, (age 14-25); male= 10.8%, | ADHD= 3.5%<br><br>Suicidal ideation<br>ADHD= 67.5% | Wender Utah Rating Scale (WURS), brief Chinese version, | SITBIs; Qs suicidal ideation, plans and attempts: 1) "Have you ever | In those with ADHD, SI reported by 67.5% (no ADHD= 26.03%, OR= 5.901, 95% CI: 4.363–7.981, p<0.001); 29.50% reported SP (no ADHD= 7.12%; OR= 5.46, 95% CI: 3.962–7.525, p<0.001), and 48.50% SA (no ADHD= 13.54%; OR= 6.011, 95% CI: 4.508– |

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| | | No ADHD= 26.03%<br><br>Suicide plan<br>ADHD= 29.5%<br>No ADHD= 7.12%<br><br>Suicide attempt<br>ADHD= 48.5%<br>No ADHD= 13.54% | 2) the WHO Checklist (ASRS) (Self) | had thoughts of committing suicide?"; 2) Have you ever made a suicide plan?"; and 3) Have you ever tried committing suicide?" (Self) | 8.017, p<0.001). |
| Shen et al. (2021), China[b] | Students, n= 5693 (age 14-25), male= 10.8% | ADHD symptoms experienced by 8.6% of those with suicidal ideation<br>13.1% with suicide plan<br>11.5% of those reporting suicide attempt | Wender Utah Rating Scale (WURS); childhood history of ADHD symptoms, and 2) the WHO Checklist (ASRS) ADHD in adulthood. (Self) | SITBIs; Qs adapted from CSSRS- t suicidal ideation, plans and attempts: 1) "Have you ever had thoughts of committing suicide?"; 2) Have you ever made a suicide plan?"; and 3) Have you ever tried committing suicide?". If positive to these questions, ask about method, frequency and further relevant details on the attempts of the suicide. (Self) | Meeting criteria both scale considered ADHD. Score >17 on inattention/ hyperactivity ADHD combined; >17 inattention ADHD-I, >17 hyperactivity/impulsivity ADHD-H.<br>Suicidality in overall sample; SI 27.5%, SP 7.9%, SA 14.8%.<br>ADHD present in 1.5% of students with no suicidal history compared to 8.6% of those who reported SI (OR= 6.38, 95% CI: 4.671–8.714, p<0.001), 13.1% SP (OR= 10.197, 95% CI: 7.005–14.844) and 11.5% with SA (OR= 8.810, 95% CI: 6.315–12.291).<br>In multivariate when demographics and depressive/anxiety symptoms included, ADHD combined remained associated with all SITBI's (ADHD-combined: SI aOR= 2.374, 95%CI: 1.453–3.876, p<0.001; SP aOR= 2.805, 95% CI: 1.506–5.225, p< 0.001; SA aOR= 2.879, 95% CI: 1.668–4.969, p< 0.001), as did ADHD-I: SI aOR= 4.381, 95% CI: 2.721–7.055, p< 0.001; SP aOR= 5.648, 95% CI: 3.125–10.208, p<0.001; SA aOR= 5.153, 95% CI: 3.082–8.617) whereas ADHD-H remained associated with SA (aOR= 3.704, 95% CI: 1.020–13.458, p= 0.047). |

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| Siffel et al. (2020), USA | US IBM marketscan database n= 797189 (age 6+) patients receiving CNS stimulants: n= 622,536; non-stimulants n= 54,615; no pharmacotherapy n= 120,038; male= 59.4% | All ADHD<br><br>Suicide related events (SRE) Recorded in .64% (n= 5175).<br><br>SRE less frequent with CNS medication (SRE per 1000 person-years: 5.8 CNS cohort, 10.5 non-stimulants, 10.0 no pharmacotherapy). | Diagnosis ADHD ICD (Clinician) | SITBIs; Rated on ICD | Across the follow up, at least one SRE recorded by n= 5175. Most frequently recorded in 13-17 year olds (32.9%). SRE's more common in female (6.9 vs 5.1 per 1000 person years). SRE's less frequent with CNS medication (SRE per 1000 person-years: 5.8 CNS cohort, 10.5 non-stimulants, 10.0 no pharmacotherapy).<br>CNS stimulant (vs. no treatment) associated with lower SRE all age groups (6–12 years: HR = 0.59, 95% CI: = 0.49–0.72, p < 0.001; 13–17 years: 0.77, 0.69–0.85, p < 0.001; 18–24 years: 0.66, 0.57–0.75, p < 0.001; 25–44 years: 0.56, 0.46–0.70, p < 0.001; ≥45 years: 0.74, 0.55–1.00, p < 0.05). CNS stimulants significantly lower SRE among children and adolescents (6–12 years: HR = 0.64, 95% CI: = 0.48–0.85, p < 0.01; 13–17 years: 0.59, 0.47–0.75, p < 0.001) compared to non-stimulants. |
| Stickley et al. (2018), Japan | Clinical, n= 864 (age 18+), m= 41.4% | ADHD= 20%<br><br>ADHD associated with current and lifetime suicidal ideation and lifetime suicide attempt. | Adult ADHD Self-Report Scale (ASRS) Screener and records screened for ICD codes (Clinician) | SITBIs; (i) participants asked: had ever felt (thought) like taking their own lives; (ii) had ever attempted to take their own lives. (ii) yes/no (i) Yes, in the past; Yes, currently; and No. (Clinician) | Current SI= 14.6%; LT SI 74.0%; SA 30.7%. Higher ADHD symptoms (ASRS ≥14) were significantly associated with current SI (PR: 2.36, 95%CI: 1.72–3.25), LT SI (PR: 1.17, 95%CI: 1.09–1.26) and LT SA (PR: 1.59, 95%CI: 1.32–1.92) when demographics, severity of psychopathology and comorbidity are controlled for. |
| Sun et al. (2019), Sweden | Database study n= 2675615<br>All ages, male= 1374790 | ADHD= 3.2%<br><br>Suicide death ADHD= 31.4% | Diagnosis of ICD-10 (code F90) from NPR or the first prescription | Mortality; All-cause mortality after 1 year old. Secondary | During follow-up, 424 individuals with ADHD and 6231 without ADHD died (respective mortality rates of 11.57 and 2.16 per 10 000 person-years). Mortality (all cause) risk significantly increased with the age of ADHD diagnosis (HRs for ≤12 years, |

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| | | No ADHD = 24.5% | of ADHD medications (Clinician) | outcome, cause-specific mortality. Specific causes of death: natural (including somatic diseases and medical conditions; ICD-10codes A00-R99); unnatural (including un-intentional injuries (ICD-10codes V00-X59), suicide (ICD-10codes X60-X84 and Y87.0), and external causes (ICD-10codes S00-T98 and X85-Y98, excluding Y87.0) | 1.50 [95% CI:, 10.4-2.17]; 13-17 years, 2.69 [95%CI, 2.20-3.31]; ≥18 years, 10.34 [95%CI, 8.94-11.96]).<br>In those with ADHD, the majority of deaths were from unnatural causes (81.6%). Around a third of these were from unintentional injury (35.8%) and suicide (31.4%). ADHD group were more likely to die by suicide than those without (3.63 vs. .40 Adjusted HR 8.63, 95% CI: 6.27-11.88).<br>Diagnosis of ADHD without comorbid condition conferred 40% risk from any cause mortality. Risk increased further with additional conditions (1 comorbidity, adj HR 3.71,95% CI: 2.88-4.78, ≥4 comorbidities adj HR 25.22, 95% CI:,19.60-32.46). Over half (52.2%) ADHD group had co-occurring MH condition compared to 6.7% Non ADHD group. |
| Triece et al. (2020), USA | Students, n= 217 (mean age= 20.72), male= 22.1% | ADHD= 37.3%<br><br>Suicidal ideation overall sample= 32%<br><br>ADHD and SI correlated (r=.27, p<0.05) | ASRS (Adler et al., 2006) (Self) | SI; Adult Suicidal Ideation Questionnaire (ASIQ; Reynolds, 1991) (Self) | 32% of the sample scored >14 on ASIQ indicating higher SI. 37.3% higher ADHD symptoms; ADHD and SI significant correlation. ADHD also correlated (all r=.27, p<0.05 perceived burdensomeness (PB) and thwarted belongingness (TB). Multivariate model, significant indirect effects PB (b = 1.86, 95% CI:1.57 to 2.15) and TB (b = 0.24, 95% CI:0.07 to 0.41) on association ADHD and SI. Indirect effect of inattention symptoms on SI through PB (b = 1.87, 95% CI: 1.59 to 2.16) and TB (b = 0.24, 95% CI: 0.07 to 0.41). Significant indirect effect of |

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| | | | | | hyperactive/impulsive symptoms on SI through PB (b = 1.85, 95% CI: 1.56 to 2.14) and TB (b = 0.23, 95% CI: 0.07 to 0.40). |
| Yang et al. (2020), Korea | Clinical, patients with unipolar or bipolar depression and ADHD; n= 100 (mean age= 20.5), all male | All ADHD CAARS mean score= 77.4<br><br>Suicide risk= mean 14.1<br><br>Suicide attempt Unipolar dep= 45.9%<br>Bipolar dep= 63.5% | Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) childhood ADHD symptoms and screener Adult ADHD Self-Report Scale (ASRS); Conners' Adult ADHD Rating Scale (CAARS) (Clinician; self) | SR and SA; No of past SA and MINI (Clinician) | ADHD symptom severity associated with SR (r=0.412, p<0.05) in patients with unipolar depression, no of SA not associated with symptom severity. Bipolar depression group; associations between ADHD symptom severity and no of SA (r=0.324, p<0.01) and not SR. ADHD remained predictive of suicide attempts when all sociodemographic variables controlled for (β=0.249, p<0.05). |
| Yeguez et al. (2018), USA | Students, n= 432; (age 18-30), male= 27.5% | ADHD= 25%<br><br>Suicidal ideation (whole sample) Mean score = 7.38 | ASRS (Self) | SI; Adult Suicidal Ideation Questionnaire (ASIQ; Reynolds 1991a, b) (self) | 25% of sample scores above cut off for ADHD. ADHD symptoms associated with SI (r = .291, p < .001), stress-reactive rumination (r = .367, p < .001) and stress (r = .508, p < .001). Covarying depressive symptoms was also statistically significant R2 = .324, F(8, 419) = 25.105, p < .001.<br>Stress and stress-reactive rumination contribute towards the association between ADHD and SI. Effect was strongest at high levels stress-reactive rumination; held when depressive symptoms controlled for. Higher stress is partially responsible for higher SI in people who ruminate. |
| Yoshimasu et al. (2019), USA | Adults, from birth cohort born (January 1976-December 1982), purposeful | ADHD= 40.9%<br><br>Suicidality ADHD= 22%<br>No ADHD= 10.4% | history of symptoms, and individual assessment used to select ADHD group; Mini | SITBIs; MINI (Clinician) | Childhood ADHD significantly associated with adult suicidal risk. ADHD twice as likely to report suicidality (22% vs.10.4% OR 2.58 95% CI: 1.54, 4.31) and were more than twice as likely to be recorded as being currently at high risk of suicide (3.9% vs. 1.5%). ADHD group significantly more likely to have comorbid MH conditions. When MH conditions were included in the |

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| | sampling, n= 5718; male = 67% | Suicide risk<br>ADHD= 3.9%<br>No ADHD= 1.5% | International Neuropsychiatric Interview (M.I.N.I.) (Clinician) | | model (individually), ADHD remained associated with suicidality. MDD accounted for 25.7% of the effect of ADHD on suicidality, followed by occurrence of a hypomanic episode (18.3%) and dysthymia (18.1%). Presence of any MH condition and ADHD increased suicide risk males. 29.3% of those who had childhood ADHD met criteria for ADHD as adult. |
| Zhong et al. (2021), China | Students, n= 904, (age 16-22)<br>male= 48.2% | ADHD= 11.9%<br><br>Suicidal ideation overall= 29.2%<br><br>Suicidal ideation Correlated with ADHD | Adult ADHD Self-Report Screening Scale for DSM-5 (ASRS-5) (Self) | SI; BSSI (self) | High ADHD symptoms present in 11.9% (95% CI: 9.9%–14.2%) of sample and LT SI reported by 29.2% (95% CI: 26.3%–32.2%). Three aspects of ADHD reported separately; inattention, executive dysfunction, hyperactivity. Significant correlations between SI and ADHD total score (r=.17,p<0.001), and hyperactivity subscale (r=0.15, p<0.001), and executive function (r=0.13, p<0.001); no correlation SI and inattention. Mediation model of ADHD and SI: anxiety and depressive symptoms included as mediators, executive dysfunction (B = 0.026, β = 0.011, p < 0.05) and hyperactivity (B = 0.035, β = 0.015, p < 0.05) indirect relationship with the SI. Depression and anxiety symptoms direct influences on SI. |

Table note: Mental health terms: [a] studies both conducted on i-Share database; [b] studies report on same sample

NSSI- non-suicidal self-injury, SA- suicide attempt, SI- suicidal ideation, SITBI's- suicidal thoughts and behaviours, O/C- outcomes, SB- suicidal behaviour; SRE- suicide related events; SR- suicide risk. ADHD-I: ADHD predominately Inattentive; ADHD-H: ADHD predominately hyperactive; ADHD-C: ADHD–combined; CNS Central stimulant; MH- Mental health; LT- lifetime; Psych ED psychiatric Emergency Department; MDD- Major depressive disorder; MD- Major depression, DD- depressive disorder, BPD- borderline personality disorder, SCZ- schizophrenia/ typal disorders; QoL-quality of life; PB- perceived burdensomeness; TB - thwarted belongingness

Statistical terms: OR's – odds ratio, 95%CI 95% confidence intervals, IRR- incidence rate ratios, RRR- relative risk ratio; HRs- hazard ratios, R- Pearson's r correlation (univariate analysis), SD- standard deviation, 95% CI: -95% confidence intervals, $\chi 2$- chi-square comparison, df- degrees freedom, B- beta; p<.05 significant result, $R^2$ = R-Squared coefficient

## Factors or characteristics which may explain the relationship between ADHD and suicide risk

In this section we discuss studies exploring the role of different factors such as different characteristics of ADHD presentations or psychological factors and how these may increase an individual's vulnerability to suicidality.

Throughout the research literature, a diagnosis or symptoms of ADHD is associated with increased suicide risk, however, the factors or circumstances underlying this relationship are not clearly understood. The clinical presentation of ADHD is not uniform and differs between individuals; for instance, some may present with higher symptoms of inattention (ADHD-I), whereas others are characterised by higher levels of hyperactivity (ADHD-H), or a combination of both (ADHD-C). The research herein highlights the importance of looking at the role of different symptom clusters within ADHD as studies indicated that suicide risk varies as a function of different ADHD profiles.

There was also evidence of a higher proportion of students with ADHD reporting symptoms of anxiety (66.50% vs. 19.81%) and depression (79.00% vs. 32.31%; Shen, 2021) compared to those without ADHD. In Shen's study, when all factors were analysed together, different ADHD symptom profiles (i.e. hyperactivity [ADHD-H], inattentive [ADHD-I], combined [ADHD-C]) remained significantly associated with anxiety after accounting for demographic factors. Further, ADHD-C and ADHD-I both remained associated with suicidal ideation, suicide plans and suicide attempts in multivariate analyses, whereas ADHD-H remained associated with suicide attempts (p= 0.047; Shen et al., 2021). In another student sample (n= 904), Zhong and colleagues (2021) found significant correlations between suicidal ideation and ADHD total score, ADHD-H, and executive function. However, these authors found no association between correlation suicidal ideation and ADHD-I.

In another study which included 63 inpatients with ADHD and 69 controls, Giupponi et al. (2020) found that ADHD-C was the most prevalent presentation (73%), followed by ADHD-H (15.9%) and ADHD-I (11.1%). Once again, experiences of suicidal thoughts or behaviours varied by ADHD profiles. Specifically, suicidal ideation was reported by 57.1% of people with predominantly ADHD-I, compared to 30.0% predominantly ADHD-H. Conversely, no suicide attempts were reported by those with ADHD-I, whereas 20.0% of the ADHD-H group reported a history of a suicide attempt.

The importance of profiles was further reinforced in a large student sample (n= 1704). Although Becker et al. (2018) found that ADHD-I and ADHD-H were both associated with suicidality, ADHD-I was

more strongly associated. When demographics were included in the analysis ADHD-H was no longer associated with suicidality whereas ADHD-I symptoms remained significantly associated with suicidality. However, it is important to note that this study looked at suicidality overall rather than differentiating between ideation and attempts.

Finally, in a chart review study, Oh et al (2021) used cluster analysis methods to generate profiles of symptoms within adults with ADHD (n= 77). This exploratory technique allows different profiles and characteristics to group together and generates data-driven subgroups. In this study, three symptom profiles emerged: Cluster 1; ADHD-C with lower levels of reported mood and anxiety symptoms (38%), Cluster 2 ADHD-I (13%); Cluster 3 ADHD-C with higher levels of reported mood and anxiety symptoms (50%). A higher proportion of those with Cluster 3 profile reported suicidal ideation (39.5%) compared to those in Cluster 1 (10.3%, p= .011). The Cluster 3 profile was associated with more frequent functional impairment in adulthood than Cluster 1 and significantly greater childhood functional impairments than those in Cluster 2. Further people in Cluster 3 tended to have higher comorbid major depressive disorder (44.7%) than those in Cluster 2 (30.0%) or in Cluster 1 (13.8% p= .025). There were no significant differences between the clusters in prevalence of suicide attempts. It is important to note that this is a small sample for this level of subgroup analysis.

Several studies tested the role of different factors in the ADHD-suicide risk pathways. Two papers reporting on longitudinal data from the i-Share cohort (Arsandaux et al., 2021; Gbessemehlan et al.,2020) found that the role of different psychological factors may underpin this relationship. Firstly, Arsandaux and colleagues (2021) tested the role depressive symptoms and self-esteem as potential mechanisms underpinning the ADHD and suicidal ideation relationship. In their analyses, the path from ADHD to suicidal ideation which included both depressive symptoms and self-esteem was statistically significant and rendered the effect of ADHD on suicidal ideation non- significant which may indicate that ADHD is related to suicidal ideation through depressive symptoms and self-esteem rather than a direct relationship (Arsandaux et al., 2021).

Gbessemehlan and colleagues (2020) looked at the role of stress in the ADHD-suicide-risk relationship. Using the i-Share cohort, the authors found no interaction between stress and ADHD, but stress partially accounted for the ADHD and suicidal ideation relationship. When stress was included in the analyses, the strength of the ADHD-suicidal ideation relationship decreased by 16% (Gbessemehlan et al.,2020).

Interestingly, Yeguez et al. (2018) explored how stress and stress-reactive rumination (rumination in response to stressful events) affected the strength of the ADHD-suicidal ideation relationship in 432 students and found that stress and stress-reactive rumination contributed to this association when depressive symptoms were controlled for. The authors found that the strongest effect was at high levels stress-reactive rumination suggesting that higher stress is partially responsible for higher suicidal ideation in people who ruminate.

Cognitive factors were examined in three studies. In a sample of 632 children, Bauer et al (2018) found that impairments in working memory contributed to both increased negative affect and increased suicidal ideation in ADHD (controlling for child oppositional defiant disorder symptoms). Similar findings came from Becker and colleagues' (2020) study with adolescents. The authors looked at the role of sluggish cognitive tempo (SCT) in the ADHD–suicide risk relationship. SCT includes symptoms such as excessive daydreaming or being lost in thoughts, mental confusion, and fogginess. When demographics were included, ADHD-H was no longer associated with suicidality while ADHD-I remained associated. When depressive symptoms and SCT were also included in the analysis, they accounted for the effect of ADHD-I; which may indicate that the relationship between ADHD-I and suicidality is indirect through other factors. Further, in a student sample (n= 904), Zhong and colleagues (2021) found a significant correlations between suicidal ideation and ADHD total score, ADHD-H, and executive function. However, the authors found no association between correlation suicidal ideation and ADHD-I.

In their student sample, Brown and colleagues (2022) found ADHD to be associated with alcohol use, drug use, anxiety and depressive symptoms. Substance use and depressive symptoms were significant predictors of suicidal ideation (Brown et al., 2022). Further, the authors found ADHD both directly and indirectly increased suicidal behaviours, NSSI and suicide plans when adjusting for comorbid disorders, substance and alcohol use (Brown et al., 2022).

Similar findings came from Fuller-Thomson and colleagues' study (2020). After controlling for demographic characteristics in the model, those with ADHD were 3 times more likely to report suicide attempts than those without ADHD. Accounting for effects of depression, anxiety, substance abuse, chronic pain, and childhood adversities, ADHD remained significantly associated with suicide attempts. Within those in the ADHD group, factors including experiencing parental domestic violence as a child, being female, misusing substances, and lifetime depression were associated with suicide

attempts. There was no difference in prevalence of suicide attempts between genders (both 11.4%) within individuals with ADHD (Fuller-Thomson et al., 2020).

Finally in this section, Triece et al. (2020) tested the role of core components from the interpersonal theory of suicide (IPT; Joiner, 2005); perceived burdensomeness and thwarted belongingness in a sample of 217 students. ADHD was significantly correlated with perceived burdensomeness and thwarted belongingness. Although both perceived burdensomeness and thwarted belongingness had significant indirect effects on the ADHD–suicidal ideation relationship, a stronger effect was seen for perceived burdensomeness. Additionally, there were an indirect effect of inattention hyperactive/impulsive symptoms on suicidal ideation perceived burdensomeness and thwarted belongingness.

## ADHD and comorbidity

A further consideration in the ADHD-suicide risk relationship is that ADHD often occurs alongside other mental health conditions with mood and anxiety disorders being the most commonly co-occurring conditions (Gomes et al., 2019; Yoshimasu et al., 2019; Zahid et al., 2020). Subsequently, in this section we discuss research around ADHD, comorbidity and suicide-risk in all age groups.

In a study conducted with data from 3637 individuals from the 1993 Pelotas birth cohort (Gomes et al., 2019), 4.5% (n= 169) of the sample had ADHD. Within these individuals, 30.8% had generalised anxiety disorder, 20.7% post-traumatic stress disorder, 18.9% social anxiety, 10.1% major depressive disorder and 6.5% bipolar1. mood disorder 23.2% vs. 13.1%, anxiety 33.3% vs 25.1%, disruptive behaviour 50.8% vs. 11.9%, substance 20.5% vs 10.6%.

Further, in their case control study, Giupponi et al. (2020) found that 46% of those with ADHD also had a comorbid axis-1 mental health diagnosis, while in their clinical sample of young people with ADHD, Levy et al. (2020) found rates of comorbid mental health conditions of 50.2%. The most frequently recorded additional diagnoses were depression or anxiety (Levy et al., 2020). In a large sample (n= 141530) of adolescents who had a primary diagnosis of Major Depressive Disorder (MDD), 16% had comorbid ADHD and males were twice as likely to have an additional ADHD diagnosis than females (Zahid et al., 2020).

The presence of a co-occurring mental health diagnosis such as major depression has been associated with increased risk for suicidal ideation and suicide attempts (Vuijk et al., 2019). Yang et al. (2020) also

carried out a study with an all-male sample of 100 adults with a primary diagnosis of unipolar or bipolar depression. These researchers found that in participants with unipolar depression, concurrent ADHD symptom severity was associated with suicide risk, while the number of suicide attempts was not associated with symptom severity. Whereas in the group with bipolar depression, ADHD symptom severity was associated with number of suicide attempts but not suicide risk (Yang et al., 2020).

In a study by Delibas and colleagues (2019), with a clinical sample of adults with major depressive disorder (n= 96), those with concurrent ADHD had earlier onset of depression (age 26.79 vs. age 31.75, p= .011), higher levels of depressive symptoms at admission to hospital (31.28 vs. 25.73, p< .001) and discharge (21.59 vs 16.73, p< .001) than those with only major depressive disorder. Additionally, a higher proportion of those with depression and ADHD had experienced suicidal ideation (85.4% vs. 64.6%, p= .018), suicide attempts (65% vs. 35%, p= .013) and were more likely to have experienced a medically severe suicide attempt than those with major depression only (41.7% vs 8.3%, p< .001; Delibas et al., 2019).

In another sample of 550 adolescents with mental health diagnoses who had not responded to prior intervention, Akca et al. (2020) found that 45% of those with ADHD also had borderline personality disorder (BPD). Those with ADHD+ BPD were more likely to report substance misuse disorders, aggression, suicidal ideation and self-harm than those with a single diagnosis (Akca et al., 2020). Additionally, in a study with 708 adults undergoing inpatient or outpatient psychiatric treatment (e.g., anxiety or mood disorders, PTSD), Bitter et al. (2019) found that undiagnosed ADHD was associated with current suicide risk.

In a large clinical sample (n= 955) with patients with Obsessive Compulsive Disoder (OCD), 13.7% of the sample had concurrent ADHD (Blanco-Vieira et al., 2019). Those with both OCD and ADHD reported higher symptoms of anxiety, more severe OCD symptoms, depression and more lifetime suicide attempts. Those with OCD+ ADHD also had higher rates of current multimorbidity than those with OCD without ADHD. As detailed above, ADHD often occurs alongside other mental health conditions. Clinical studies have found that the presence of ADHD was associated with increased suicide risk in the presence of multimorbid mental health conditions. One study of 6483 adolescents found the prevalence of comorbid mental health conditions as high as 69.5% in participants with ADHD (Sultan et al., 2021). Similarly, in an analysis of a national registry database (n= 2675615) Sun et al. (2019) found co-occurring mental health conditions in 52.2% of those with a diagnosis of ADHD compared to 6.7% of individuals without. Further, this study also found that individuals who had 4 or

more conditions concurrently were at 25 times higher risk from any cause mortality than those without multimorbidity (Sun et al., 2019).

It is important to note that the majority of studies investigating comorbidity was conducted in clinical populations which may confer higher levels of diagnoses and may not be representative of the population more generally. Additionally, Vuijki et al. (2019) found ADHD to be associated with an almost 4-fold risk of suicidal thoughts and behaviours, however, when mood, anxiety and conduct disorders were included in the model ADHD was no longer significantly associated with suicidal ideation and behaviours.

Interestingly, when occurring without comorbid conditions, ADHD was found to not increase an individual's risk of suicidal ideation or behaviours compared to other mental health diagnosis (Gomes et al., 2019; Vuijk et al., 2019). However, Sun and colleagues (2019) found that having a diagnosis of ADHD without a comorbid condition conferred a 40% increased risk from any cause mortality, which increased association increased substantially with the number of comorbidities suggesting psychiatric comorbidity aggregate risk.

In a sample of 4645 military personnel, Howlett et al. (2018) found ADHD was recorded by 6.1% of the sample, with 1.7% of the sample having comorbid ADHD and PTSD at baseline assessment. No significant association between pre-deployment ADHD and past-month suicidal ideation was found at either baseline or at 9 month follow up. Lee and colleagues used a nested case control study design to compare mental health history in people with ADHD who died by suicide (n= 159) and an age and gender matched group of people with ADHD (living controls n= 3180; Lee et al., 2022). These researchers found that suicide decedents were more likely to have at least two comorbid mental health conditions (5.75 vs. 2.4%, p= .016) compared to the living controls. Further, decedents were more likely to have attended at least one healthcare visit in the three months before their death than those who died from other causes (Suicide, 85.5%, other cause, 74.8%, p= 0.002).

Similar findings come from birth cohort data (born January 1976- December 1982) in Japan (Yoshimasu et al., 2019). Those with ADHD were significantly more likely to have comorbid mental health conditions. When mental health conditions were included in the model (individually), ADHD remained significantly associated with suicidality, suggesting that that the relationship is not fully explained by comorbid disorders. Major depressive disorder accounted for 25.7% of the effect of ADHD on suicidality, followed by occurrence of a hypomanic episode (18.3%) and dysthymia (18.1%).

Presence of any mental health condition and ADHD increased suicide risk for males (Yoshimasu et al., 2019).

Of the registry studies included in this review, three focused on mortality (Chen et al., 2019; Lee et al., 2022, Sun et al., 2019). In addition, Fitzgerald et al. (2019) focused on occurrence of 'suicidal events' (e.g., attending hospital for suicidal ideation, suicide attempt, or suicide death) recorded in medical records. A diagnosis of ADHD was associated with increased mortality from unnatural causes in all studies (Chen et al., 2019; Fitzgerald et al., 2019; Lee et al., 2022; Sun et al., 2019). Across these studies, a diagnosis ADHD was associated with a 2.09 - 8.63 increased risk of suicide (Chen et al., 2019; Sun et al., 2019). Within those with a diagnosis of ADHD, being aged 20-29 years, being male and having a comorbid mental health condition were at highest risk of dying by suicide (Fitzgerald et al., 2019). Fitzgerald et al. (2019) recorded 37705 suicidal events (4930 suicide deaths, 32775 suicide attempts) over a 20-year period. Of these events, 1.8% were recorded in individuals with ADHD (697 events; 35 suicide deaths, 662 suicide attempts). Fitzgerald et al. (2019) found an incidence rate of 415.6 per 100 000 person-years in individuals with a diagnosis of ADHD compared to 75.5 per 100000 person-years compared to the full cohort. In males with ADHD, rates of suicidal behaviour were 3.4-fold higher and they were 9.1- fold higher in females with ADHD than their respective cohorts.
The risk of suicidal events was around 4 times higher for people with ADHD and a comorbid mental health condition compared to individuals with no psychiatric diagnoses. In those with ADHD, the presence of a comorbid psychiatric diagnosis increased rates of suicidal events. However, this study found that when ADHD occurred with another mental health condition, the risk ratios remained equivalent to that of those with only one other condition, possibly indicating that ADHD did not further exacerbate risk in these individuals (Fitzgerald et al., 2019).

In a further study using the National Health Insurance database (n= 2207840) in Taiwan, Chen and colleagues (2019) found that 12% of the sample had ADHD. After controlling for demographics and comorbid conditions, individuals with a diagnosis of ADHD had a 2 times higher risk for mortality from suicide, or homicide and they were more likely to die from unintentional injuries, compared with the non-ADHD group. Using the Swedish National register (n= 2675615), Sun et al. (2019) found that in people with ADHD, deaths from unnatural causes were 11.57 per 10 000 person-years compared to 2.16 per 10 000 person-years in those without a diagnosis. Of these deaths, over half resulted from unintentional injury (35.8%) and suicide (31.4%).

Siffel et al. (2020) compared suicide-related events (SRE) in 797189 patients with ADHD who were receiving central stimulants (CNS; n= 622536), non-stimulant medication (n= 54615) and no pharmacotherapy (n= 120038) from age 6 onwards. Across the follow up, 5175 individuals had at least one SRE. SREs were most frequently recorded between ages 13 to 17 (32.9%) and were more common in females. SREs were less frequent in those who were receiving CNS medication (SRE per 1000 person-years: 5.8 CNS cohort, 10.5 non-stimulants, 10.0 no pharmacotherapy). CNS stimulants (vs. no treatment) were significantly associated with lower SRE for all age groups (all $p < 0.05$). Significantly lower SRE were seen among children and adolescents prescribed CNS stimulants compared to non-stimulants. Further, in the CNS group, lower rates of comorbidities were observed compared to those who received non-stimulants and no pharmacotherapy (anxiety disorders 19.5%, 25.7%, and 27.0% respectively; depressive disorders 14.9%, 17.9%, 21.2%, respectively; Siffel et al., 2020).

In a study based on what was written in medical notes, Ohlund and colleagues (2020) followed up 206 individuals with diagnoses of ADHD and bipolar disorders or schizoaffective disorders before and after central stimulant treatment initiation. In the period prior to treatment 52 events were identified which decreased to 31 following central stimulant treatment initiation ($p = 0.028$). Additionally, suicide attempts /NSSI events decreased with age (Ohlund et al., 2020). More evidence of the potential protective effects of stimulant treatment.

## Discussion

The aims of this review were to explore recent research investigating the relationship between suicidality and ADHD and to identify gaps in our knowledge to inform future research.

ADHD is a common neurodevelopmental condition (Fayyad et al., 2017; WHO, 2018) which can affect individuals across different domains and throughout their lifespan. In both younger and adult populations, ADHD was associated with higher suicidality. In clinical samples presence of current suicidal ideation, lifetime suicidal ideation and lifetime suicide attempts were significantly associated with higher ADHD symptoms when demographics, severity of psychopathology and comorbidity were controlled for (Stickley et al., 2018). Further, ADHD in adulthood was associated with premature mortality from homicide, unintentional injury and suicide.

Given the impact that ADHD and suicide have on individuals' lives and the association between the two, it is encouraging that such a range of research into this relationship has been published in in the last four years (2018 to 2022). This reflects the growing recognition that this is such an important area

of research. It was also helpful that three systematic reviews summarising the earlier research literature have been published in recent years. Taken as a whole, we have summarised the key findings is in table 4 below.

Table 4. Summary of key findings

| Key findings |
| --- |
| ADHD is associated with higher suicide risk and risk of premature mortality |
| The ADHD–suicide risk relationship is incredibly complex and the nature of the relationship remains poorly understood |
| Some studies suggest a direct relationship between ADHD–suicide risk |
| Some studies suggest an indirect relationship between ADHD–suicide risk via other biopsychosocial factors |
| Different profiles within ADHD may be associated with different levels of suicide risk |
| Comorbid mental health conditions frequently occur with ADHD |
| Heterogeneity in study design, samples and assessment of ADHD and suicidal behaviour is extensive; this heterogeneity hinders comparability across studies |
| CNS medication appears to have protective effects |
| The growth in research indicates that there is growing recognition of the importance of focusing on ADHD–suicide risk as a priority research area |

The heterogeneity in study design, samples and assessments employed across the studies renders it difficult to directly compare the different findings. Nonetheless, the majority of the research indicates a robust relationship between ADHD and suicidal behaviour. Although there have been some attempts to understand why suicide risk is elevated in individuals with ADHD, it remains unclear from the current research what factors and mechanisms might explain this elevation in suicide risk.

The highest rates of suicide ideation were recorded in student populations (e.g., Arsandaux et al., 2021; Brown et al., 2022), therefore, it is important to consider this in the context of identifying interventions to support those who may be vulnerable. It is also essential to consider the data within the constraints of the studies included. For instance, there are many reporting biases that may have skewed the findings. For example, Lee and colleagues found low concordance between child and carer reports of suicidal ideation and attempts with children reporting suicide attempts around 3 times higher than those reported by caregivers (1.31% vs. 0.44%, Lee et al., 2021).

For the most part the papers included in this review emphasise the possible role that other factors may play in the relationship between ADHD and suicidality. In light of the prevalence of comorbidity of ADHD and psychiatric conditions, and the increased risk posed by the presence of a comorbid

mental health condition, it is understandable that a lot of research has focused on trying to understand the impact of psychiatric conditions on ADHD. However, the majority of people with a mental illness do not die by suicide and there is recognition in suicide research that focussing on mental illness, in isolation, is not a sufficient predictor of suicide risk (Turecki & Brent, 2016).

It is also worth highlighting that Yoshimasu et al. (2019) found a significant direct effect of ADHD on suicidality even after controlling for 11 different comorbid mental health conditions, thereby suggesting that the relationship is not fully accounted for by comorbid disorders. In light of how prevalent ADHD symptoms are among adult psychiatric outpatients, detecting and treating ADHD in this population may be important in reducing suicide risk.

A potentially important emerging area in this field is the focus on the subtypes of ADHD and how they are differentially associated with suicide risk. We need to do so much more to understand the mechanisms through which suicide risk might increase. The research included in this review indicates the potential role of psychological factors such as interpersonal problem-solving but more research is needed to understand how, and when such factors are associated with suicidal ideation and suicide attempts.

The studies comparing suicidal ideation with suicide attempts were of interest. For instance, ADHD-H was associated with suicide attempts rather than suicidal ideation (Giupponi et al., 2020; Shen et al., 2021). This may be a result of emotional impulsivity (Pearlstein et al., 2019). Indeed, in the IMV model, impulsivity is a volitional moderator which may increase the likelihood that people make the transition from suicidal ideation into suicide attempts (O'Connor, 2011). Studies have also suggested that ADHD-H may be indirectly related to suicidality through factors such as low self-esteem depressive and irritability symptoms (Levy et al., 2020; Meza et al., 2021). Further, Becker and colleagues (2018) found that ADHD-H symptoms were accounted for by demographic variables. In short, though, more research is needed to understand the role of different ADHD symptoms more fully.

The study on perfectionism by Katzenmajer-Pump et al (2021) was also intriguing. This study found that for every unit increase in perfectionism, there was a 10% reduction in the incident rate of suicidal behaviour. While none of the maladaptive subscales was significantly associated with suicidality, the two adaptive perfectionism subscales were. These findings are particularly interesting as the maladaptive constructs echoed socially prescribed perfectionism (SPP; the individual believes that others require perfection from them); which is often associated with suicide risk (O'Connor & Kirtley 2018; O'Connor 2007; O'Connor & Nock 2014). However, it is important to note that gender was not

controlled for in the analyses which may impact upon the findings. Further exploration of the role of perfectionism requires urgent attention.

Although several studies investigated the potential mechanistic role of psychological factors in the ADHD-suicide risk relationship, only one study investigated factors from one of the predominant models of suicidal behaviour. Triece et al. (2020) explored the core constructs (perceived burdensomeness and thwarted belongingness) of the interpersonal theory and found that ADHD-H and ADHD-I were related to suicidality indirectly through burdensomeness. This may indicate that such factors are potential indicators of early suicide risk and, therefore, intervention points.

Based on our synthesis of the research literature, we have made a number of recommendations for future research in Table 5 (below). Future research should aim to identify potential differences in factors associated with suicide attempts compared to suicidal ideation in individuals with ADHD. Applying frameworks such as the IMV model to further our understanding of suicide risk in people with ADHD may aid the development of targeted psychological interventions to reduce or allow early identification of suicide risk in more vulnerable populations. According to the IMV model, defeat and entrapment are key components in the emergence of suicidal ideation (O'Connor & Kirtley, 2018), however, the importance of these factors in early identification of suicide risk in specific populations such as those with ADHD model is unclear.

There is also a need to explore how individuals with ADHD experience their ADHD, to understand how it affects their mental health, their coping response and their suicide risk. Qualitative as well as quantitative research is required to address these gaps in knowledge. For the most part, the research herein has focused on risk factors, it may be helpful for future research to explore factors which may offer individuals some protection against suicide risk.

Table 5. Summary of key recommendations

| Key research recommendations |
| --- |
| Future research should apply a theoretical framework of suicidal behaviour to inform the selection of factors included in subsequent studies with a focus on psychological and social factors. |
| Where possible, studies should endeavour to conduct sub-group analyses (e.g., by gender) to better understand the complexity of suicide risk in different population sub-groups. |
| Where possible, validated measures of ADHD symptoms (e.g., ASRS) should be used to allow for a better understanding of the prevalence of ADHD – and to make direct comparisons across studies. |

| |
|---|
| It is important to compare different profiles within ADHD. This will provide valuable insights into which factors increase vulnerability within specific symptomologies and under what circumstances.<br>Research should also seek to explore the stability of ADHD symptoms over time.<br>Studies should aim to understand possible protective factors in the ADHD–suicide risk relationship as these may present accessible, modifiable, person-centred intervention points<br>Interview-based studies with people with ADHD and different suicide histories should be conducted and these will complement then findings from quantitative studies.<br>Given the developmental nature of ADHD, research would benefit from adopting a life span approach to understand the ADHD-suicide risk relationship and how it evolves over time. |

Mental health and primary care clinicians treating people with ADHD should be aware of the increased risk of suicidal behaviour and should consider enquiring about any thoughts of suicide at routine appointments as this may ensure the provision of appropriate support. More broadly, in light of Lee et al.'s (2022) study, clinicians working in other specialties such as internal medicine, neurosurgery, and plastic surgery should consider incorporating a brief measure which enquires about thoughts of suicide.

## Limitations

This was a very focused review, primarily looking at studies published in the last four years (albeit supplemented by the findings from the earlier systematic reviews). As a result, there is a risk that some important research may have been missed. For instance, no qualitative studies were included in this review. This may be a result of the time-frame restriction and/or the adoption of Septier et al.'s (2019) key word search methodology. However, as no qualitative research featured in the earlier reviews, we are reasonably confident that we did not miss any major studies. The previous reviews emphasise the need to move away from cross-sectional methodologies and to design studies which can explore potential mechanisms that may underlie this pernicious relationship over time (Garas & Balazs, 2020; Giupponi et al., 2018; Septier et al., 2019). However, the challenge moving forward will be to conduct research at sufficient scale and with a long enough follow-up period to be able to predict incident suicidal episodes over time.

## Conclusions

This review highlights the need for more in-depth research to better understand the factors, mechanisms and circumstances, associated with increased risk of suicide in individuals with ADHD. Specifically, more research is required on the psychological and social factors which may underpin

that risk. A better understanding of the latter will help to improve the identification of specific early detection and intervention points for those people with ADHD at high risk of suicide. Finally, this review highlights the need to focus on specific populations across the life span to understand the role of ADHD in suicide risk and how this complex relationship evolves over time.

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# Appendix 1

Search terms- adapted from Septier et al., 2019

ADHD OR adhd OR attention deficit disorder with hyperactivity OR minimal brain disorders OR syndrome hyperkinetic OR hyperkinetic syndrome OR hyperactivity disorder OR hyperactive child syndrome OR childhood hyperkinetic syndrome OR attention deficit hyperactivity disorders OR attention deficit hyperactivity disorder OR adhd attention deficit hyperactivity disorder OR overactive child syndrome OR attention deficit hyperkinetic disorder OR hyperkinetic disorder OR attention deficit disorder hyperactivity OR attention deficit disorders hyperactivity OR child attention deficit disorder OR hyperkinetic syndromes OR syndromes hyperkinetic OR hyperkinetic syndrome childhood) OR attention deficit OR hyperactivity OR Attention-deficit/hyperactivity disorder OR attention-deficit hyperactivity disorder

AND

suicid*