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Exploring the relationship between ADHD symptoms and suicide risk through the lens of the Integrated Motivational-Volitional Model of suicidal behaviour

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ABSTRACT

Introduction: Attention Deficit-Hyperactivity Disorder (ADHD) is associated with increased vulnerability to suicide. However, understanding of the psychological factors associated with increased risk is limited. Therefore, we investigated the extent to which psychological factors from the Integrated Motivational–Volitional (IMV) model of suicidal behaviour were associated with suicide risk.

Methods: 696 adults who were recruited to a study on ADHD, mental health and suicide risk completed validated measures that assessed components of the IMV model, ADHD symptoms and mental health history.

Results: 642 (92.2 %) participants scored 4 or more on the Adult ADHD Self-Report screener (ASRS; Kessler et al., 2005), indicating recent ADHD symptoms. Analyses of IMV model factors were conducted in this subgroup. More than nine out of ten (93 %) participants reported lifetime suicidal thoughts (n = 597), and 41.7 % (n = 268) reported a history of suicide attempts. Multivariable analyses showed higher defeat, internal entrapment and perceived burdensomeness were associated with recent suicidal thoughts, while mental imagery distinguished those with suicide attempt from suicidal thought histories. Perceived burdensomeness moderated the entrapment-to-suicidal thoughts relationship. Exploratory mediation analysis indicated entrapment may mediate the defeat-to-suicidal thoughts relationship.

Conclusions: This is the first study to apply the IMV model to understanding the ADHD-suicide risk relationship. Psychological factors from the IMV model warrant investigation longitudinally as potentially targets for suicide prevention in people with ADHD.

1. Introduction

Suicide is a complex, leading cause of death globally (World Health Organization (WHO, 2025). Despite extensive research, identifying which individuals within high-risk groups will die by suicide remains challenging (Franklin et al., 2017; O'Connor, 2011; O'Connor and Kirtley, 2018).

One high-risk group needing urgent research attention is individuals with Attention-Deficit Hyperactivity Disorder (ADHD). Characterised by inattention, hyperactivity and impulsivity symptoms (APA, 2013), ADHD has been associated with suicidal thoughts and behaviours (Garas and Balas, 2020; Giupponi et al., 2018; Septier et al., 2019). Some studies found suicide attempts to be five times higher in adults with ADHD compared to those without ADHD (14.0 % vs. 2.7 % respectively; Fuller-Thomson et al., 2022). Suicidal ideation is also more prevalent (Septier et al., 2019), especially among students (Arsandaux et al., 2021; Brown et al., 2022), with one study reporting double the lifetime suicidal thoughts in students with ADHD compared to those without ADHD (44.8 % vs. 21.7 % respectively; Brown et al., 2022).

ADHD is associated with executive function deficits including impaired problem-solving, distractibility and lower impulse control (Chen et al., 2020; Garas and Balas, 2020; Wilson and Marcotte, 1996), impacting daily functioning and behaviour regulation (Martínez et al., 2016).

Inhibitory control impacts cognition, memory, and behaviour (Barkley, 1997), contributing to academic and interpersonal difficulties and low self-esteem. One study found low perceived self-competence, linked to poor executive function, predicted suicidal ideation 16 years later in females with ADHD (Meza et al., 2021).

Although the ADHD -suicide risk link is well established (see Garas

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and Balas, 2020; Giupponi et al., 2018; Septier et al., 2019), its nature remains unclear. Some studies suggest an indirect relationship with suicide risk via comorbid psychiatric conditions (Giupponi et al., 2020); others found ADHD to be associated with suicide risk when comorbid substance use (Brown et al., 2022), or psychiatric conditions were controlled for (Yoshimasu et al., 2019), potentially indicating a direct relationship between ADHD and suicidality.

A key limitation in the literature is that psychological processes are often studied in isolation, rather than within theoretical frameworks. One exception is Triece et al. (2020) who applied the interpersonal theory of suicide (IPT; Joiner, 2005). The IPT posits that suicidal ideation arises from perceived burdensomeness and thwarted belongingness (Joiner, 2005; van Orden et al., 2010). Triece et al. (2020) found both factors mediated the ADHD–suicidal ideation relationship.

More recently, the Integrated Motivational-Volitional (IMV; O'Connor, 2011; O'Connor and Kirtley, 2018) model of suicidal behaviour (Fig. 1) was developed. The IMV model incorporates IPT factors and components and broader psychological and health research to better understand suicide risk.

The IMV model outlines a tripartite framework highlighting the complex interplay between psychological, biological, and environmental influences on suicide risk. It outlines a trajectory from biosocial context (pre-motivational phase), to psychological mechanisms proximal to the development of suicidal ideation (motivational phase), to factors influencing suicidal behaviour (volitional phase).

The IMV model proposes that suicidal thoughts develop when individuals feel defeated, humiliated, and powerless, leading to the individual feeling trapped and unable to escape the situation (entrapment; Gilbert and Allan, 1998). Transitions from feeling defeated to entrapment is governed by 'threat to self' moderators; executive functions such as social problem-solving skills, coping and rumination alongside feelings of perceived burdensomeness and thwarted belongingness. These latter factors are key in the emergence of suicidal ideation from entrapment.

The IMV model differentiates between motivational factors (precipitating suicidal ideation) and volitional factors (increasing the likelihood of acting on suicidal thoughts). Volitional factors including impulsivity, fearlessness of dying or death, and mental imagery (O'Connor and Kirtley, 2018; Holmes et al., 2007) are hypothesised to reduce the 'intention-suicidal behaviour' gap by increasing the cognitive accessibility of suicidal behaviour (O'Connor and Kirtley, 2018), thereby increasing behavioural enaction.

Although evidence supporting the IMV model is growing (O'Connor and Kirtley, 2018; Wetherall et al., 2019; Souza et al., 2024) few studies have applied it to neurodiverse populations. One exception is Cassidy et al. (2023) who demonstrated that the IMV model was a useful framework to understand suicide risk in autistic adults (Cassidy et al., 2023). To our knowledge, the IMV model has not been used to explore the ADHD–suicide risk relationship.

Given the heightened vulnerability to suicidal thoughts and behaviours among individuals with ADHD, we applied the IMV model to participants who screened positive for recent ADHD symptoms (ASRS score $\geq$4) in order to examine factors associated with suicidality in this population.

In this study, we used Part A (the screener) of the Adult ADHD Self-Report screener (ASRS-v1.1; Kessler et al., 2005) as a proxy for recent ADHD symptoms, focusing on individuals scoring $\geq$4. We addressed three core questions and one exploratory analysis:

1. Which IMV model factors are associated with recent suicidal ideation?
2. Do perceived burdensomeness and thwarted belongingness moderate the entrapment -suicidal ideation relationship?
3. Which IMV factors differentiate between individuals with a history of suicidal ideation (SI) and those with a history of suicide attempt (SA)?

Additionally, we conducted exploratory mediation analysis examining (4) whether entrapment mediated the defeat - suicidal ideation relationship.

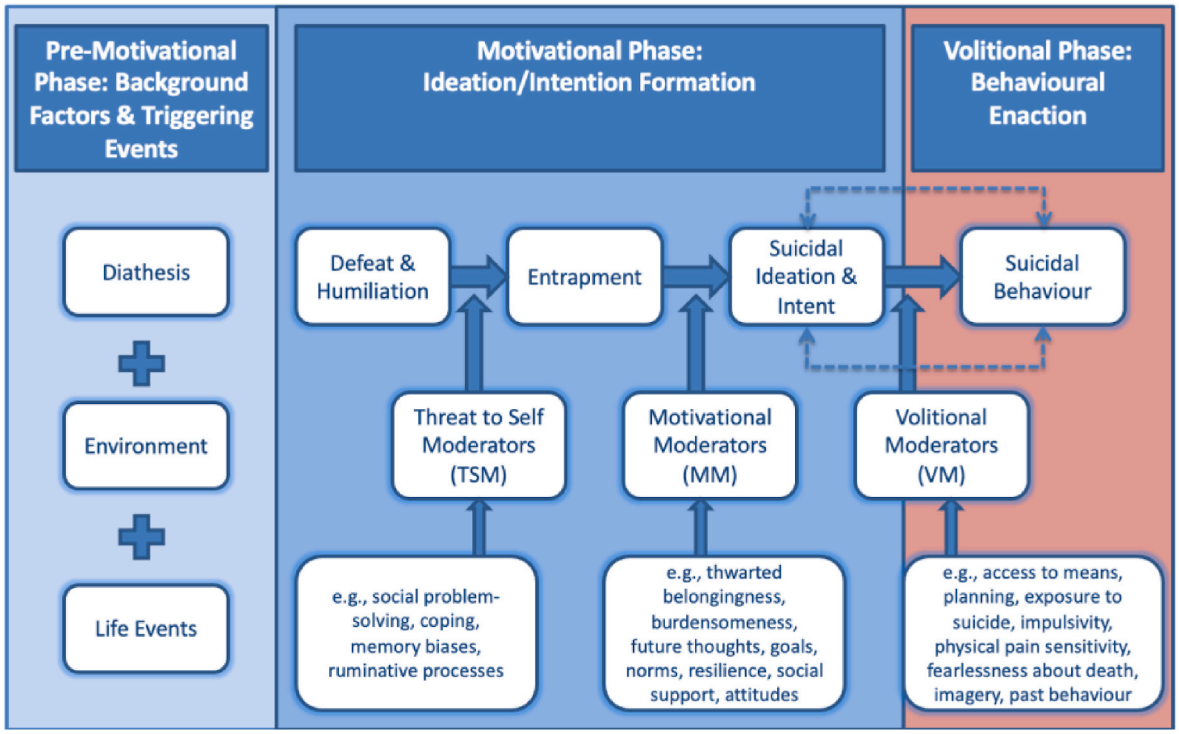

Fig. 1. The Integrated Motivational-Volitional (IMV) model of suicidal behaviour (O'Connor, 2011; O'Connor and Kirtley, 2018).

2. Method

2.1. Participants and procedure

Six hundred and ninety six adults (age 18+) living in the UK took part in an anonymous, online cross-sectional survey hosted on Qualtrics. This study reports on those participants in this sample who scored ≥4 on the Adult ADHD Self-Report screener (ASRS; Kessler et al., 2005), indicating recent potential symptoms of ADHD (n = 642, 92.2 %). Recruitment occurred between 17th March and 26th July 2023. Two adverts; one for a study exploring the relationship between ADHD symptoms, mental health and suicide risk, the other for mental health and suicide risk were placed on Social media platforms (e.g. Facebook, X) and ADHD-UK's networks. To ensure informed consent, participants actively selected that they understood participation was voluntary, that they could withdraw at any time, and they consented to take part in the study before being able to proceed to the questions. Details of support organisations were downloadable throughout the survey. Participants could opt-in to a separate prize draw at the end of the survey.

2.2. Ethics

Ethical approval was granted by University of Glasgow's School of Medical, Veterinary and Life Sciences ethics committee (ref: 200220157).

2.3. Measures

Demographic information including age, gender identity, sexuality, ethnicity, marital status and employment status were collected from participants.

2.4. Mental health and neurodivergence

Mental health history and neurodivergence. Participants were asked "Have you ever experienced any of the following (e.g. depression, anxiety, ADHD)?". If yes, they were then asked if they had received a diagnosis. Participants could select multiple conditions. However, it is important to note that this information reflects lifetime experience only; details about the timing of diagnosis or symptoms, and current diagnoses, were not assessed.

Symptoms of ADHD. ADHD symptoms over the previous 6 months were assessed using Part A of the WHO's Self-Report Scale for ADHD (ASRS-v1.1; Kessler et al., 2005). This six-item screener (e.g. "How often do you have trouble wrapping up the final details of a project, once the challenging parts have been done?") is recommended for community surveys (Kessler et al., 2005). The ASRS has a 5-point scale from 'never' to 'very often'. The scale contains dark shaded boxes for response options (varies by item). If an individual checks ≥4 of the shaded boxes, then it is considered a positive screen for potential ADHD symptoms. The ASRS has been shown to be a reliable and valid screener for recent ADHD symptoms (Adler et al., 2006).

However, the ASRS does not assess symptoms before age 12, which are important to diagnose ADHD (APA, 2013). Reliability was acceptable in this study (α = 0.70).

Recent suicidal ideation. Suicidal ideation in the previous week was measured using the eight-item Suicidal Ideation subscale (e.g. item "I feel the world is not worth continuing to live in") of the Suicide Probability Scale (SPS; Cull and Gill, 1988). The SPS subscale is scored 0 (None or a little of the time)- 3 (Most or all of the time), giving a max score of 24. The SPS has demonstrated internal consistency previously (Atlı et al., 2009), and displayed very good internal reliability in this study (Cronbach's alpha α = 0.87).

History of suicidal thoughts and behaviour. Items adapted from the Adult Psychiatric Morbidity Survey (APMS; McManus et al., 2016) assessed lifetime suicide history: "Have you ever seriously thought of taking your life, but not actually attempted to do so?"; "Have you ever made an attempt to take your life, by taking an overdose of tablets or in some other way?". Participants indicated the timing of suicidal thoughts and attempts with the options "The past week", "The past year", "Longer ago", or "Never." For analysis, these responses were recoded as a binary variable indicating any lifetime history of suicidal ideation (SI) or suicide attempt (SA) (yes/no).

Exposure to suicidal behaviour. Participants answered an item on friends or family's suicidal behaviour (e.g., "Has anyone among your family or close friends attempted or died by suicide?"), this has been previous used in similar research (O'Connor et al., 2012).

Symptoms of anxiety. The seven-item General Anxiety Disorder scale (GAD-7; Spitzer et al., 2006) assessed anxiety symptoms in the previous two weeks (e.g. "Over the last two weeks, how often have you been bothered by the following problems? … Feeling nervous, anxious, or on edge".

The GAD-7 is scored 0 (Not at all) to 3 (Nearly every day), giving a max score of 21. The GAD-7 can be used to indicate cut-offs for levels of anxiety (0–4 = Minimal, 5–9 = Mild, 10–14 = Moderate, ≥15 = Severe anxiety), however in this study we compare the scores rather than using cut-offs.

The GAD-7 is well-established with good reliability (Löwe et al., 2008), reliability was very good in this sample (α = 0.88).

Depressive symptoms. The nine-item Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001) assessed depressive symptoms in the past two weeks (e.g. …" Little interest or pleasure in doing things?"). The PHQ-9 is scored 0 (Not at all) to 3 (Nearly every day), giving a max score of 27. All nine items of the PHQ-9 were used in calculating the total score. The PhQ-9 can be used to indicate cut-offs for levels of depressive symptoms (0–4 = Minimal, 5–9 = Mild, 10–14 = Moderate, 15–19 = Moderately severe, 20–27 = Severe depression), however in this study we compare the scores rather than using cut-offs. The PHQ-9 is widely used with good reliability and validity (Kroenke et al., 2001). **Reliability** was very good in this study (α = 0.87).

2.5. Psychological and clinical-related measures

Defeat and Entrapment. Defeat and Entrapment were measured via four-items from the brief defeat scale (Griffiths et al., 2015) and the four-item Entrapment Scale-Short-form (De Beurs et al., 2020). The Defeat scale measures defeat in the past 7 days (e.g., "I feel defeated by life"). The Defeat Scale is rated on a 5-point Likert-type scale (0 = Not at all, 4 = Completely). The total score ranges from 0 to 16, with higher scores indicating greater feelings of defeat. The Entrapment scale assesses feelings of being trapped by internal (e.g. trapped by ruminations or self-critical thoughts) and external (e.g. feeling trapped by circumstances) factors. Example item for internal is "I feel trapped inside myself", and for external entrapment is "I feel powerless to change things". The entrapment Scale-Short Form is scored on a 5-point scale (0 = Not at all like me, 4 = Exactly like me), a max score of 16 and higher scores indicate higher levels of entrapment.

Both measures have been found to be reliable measures of defeat (Griffiths et al., 2015) and entrapment (De Beurs et al., 2020). In this study, the scales demonstrated excellent (α = 0.90) and very good (α = 0.86) reliability respectively.

Interpersonal Needs. The 12-item Interpersonal Needs Questionnaire (INQ; Van Orden et al., 2008) was used to assess perceived burdensomeness (7-items assessing feeling a burden on those around you) and thwarted belongingness (5-items assessing feeling like you don't belong). Example item for perceived burdensomeness is "These days I think the people in my life wish they could be rid of me", and for thwarted belongingness is "These days, I feel disconnected from other people". Items are rated on a 7-point scale (1 = Not at all true for me, 7 Very true for me) giving subscale ranges from 12 to 49 and 12 to 35, with higher scores representing greater levels of perceived burdensomeness and thwarted belongingness, respectively.

The INQ subscales have demonstrated good reliability (Van Orden et al., 2012), and was good in our sample (perceived burdensomeness α = 0.88; thwarted belongingness α = 0.84).

Impulsivity. Negative urgency (i.e., acting rashly when experiencing extremely negative emotion) was assessed using the negative urgency subscale of the UPPS-P Impulsive Behaviour scale (Lynam et al., 2006; e.g., "When I feel bad, I will often do things I later regret in order to make myself feel better now"). The UPPS-P contains 12 items scored on a 4-point scale (1 = Agree strongly to 4 = Disagree strongly; some items reverse-coded). Scores range from 12 to 48, with higher scores indicating greater impulsive actions under negative emotions.

This scale has good reliability and validity in other samples (Moore et al., 2023), and internal reliability was very good (α = 0.87) in this study.

Acquired Capability. The five-item Acquired Capability for Suicide Scale (ACSS; Van Orden et al., 2008), assessed fearlessness about death. The ACSS asks respondents to record the extent to which they feel items such as "Things that scare most people do not scare me" are reflective of them. The ACSS uses a 5-point scale (0 = Not at all like me, 4 = Exactly like me) to yield a maximum score of 20, with higher scores reflecting greater capability for suicide.

The ACSS has adequate reliability (Van Orden et al., 2008), and in this study, the ACSS had acceptable reliability (α = 0.73).

Mental imagery. Frequency of suicide-related mental imagery was assessed using the eight-item mental imagery scale (Crane et al., 2012; Holmes et al., 2007). Participants use a 5-point Likert scale (0 = never to 4 = very frequently) to report how often they experience "e.g.…Images of what might happen to other people if you died". The scale is totalled to give a range from 0 to 32 with higher scores indicating greater frequency of intrusive suicide-related mental images. The mental imagery scale has been found to have excellent internal consistency (Crane et al., 2012) and in this sample was acceptable (α = 0.78).

Social perfectionism. Social or socially prescribed perfectionism (i.e., the perception that others require perfection of them) was measured using the five-item Socially Prescribed Perfectionism subscale (MPS-Social) of the Multidimensional Perfectionism Scale (MPS; Hewitt and Flett, 1991). An example items is "People expect more from me than I am capable of giving". The MPS-Social is scored on a 7-point Likert-type scale (1 = Strongly disagree to 7 = Strongly agree), giving a score range from 1 to 35, with higher scores indicate stronger socially prescribed perfectionism.

The MPS- Social is used widely to assess social perfectionism, and has shown good reliability (Hewitt and Flett, 1991). It had good reliability in the current sample (α = 0.81).

Emotion Regulation. The ability to control and regulate emotions was assessed using the 10-item Emotion Regulation Questionnaire (ERQ; Gross and John, 2003). The ERQ assesses regulation of negative emotions through subscales assessing cognitive reappraisal (6-items; e.g. "When I want to feel less negative emotion (such as sadness or anger), I change what I'm thinking about"), and expressive suppression (4-items; e.g. "I control my emotions by not expressing them"). Items are scored on a 7-point scale (1 = Strongly disagree to 7 = Strongly agree). Max scores are 42, and 28 for cognitive reappraisal and emotional suppression, respectively, with higher scores indicating greater use of the respective emotion regulation strategy.

The ERQ has demonstrated good reliability (Preece et al., 2020), and in this study, reliability for the subscales was very good (α = 0.90, α = 0.76 respectively).

2.6. Statistical analysis

2.6.1. Sample size

G*Power software (Faul et al., 2007) was used to calculate the sample size for regression, with medium effect size (Cohen, 1992) of ρ = 0.15 and power (1-β) of 0.90 ($p < 0.05$), with maximum 11 variables per analysis, and to compare between subgroups, it was estimated that 450 participants were required.

This study reports on participants who scored ≥4 on the Adult ADHD Self-Report screener (ASRS; Kessler et al., 2005), indicating recent ADHD symptoms (n = 642 (92.2 %).

The analyses were not pre-registered.

Data were analysed using SPSS version 29 (IBM Corp., Armonk, NY). Missing data were examined at measure level. Participants completing <85 % of items on a measure were excluded from analysis of the scale (see Table 1 [Supplementary materials] for number of participants completing each scale). Missing data affected one item (INQ; 0.014 %); Little MCAR test indicated this was missing completely at random ($\chi^2 = 17.84$, df = 11, $p = 0.085$). Expectation maximisation (EM) was applied to the single missing item. Categorical data (e.g., declined responses on the suicidal history) and demographic data were not imputed.

Collinearity diagnostics indicated no serious multicollinearity concerns (max Condition index = 22.23). Age (64 %) and Gender (47 %) indicated moderate variance proportions. All other dimensions showed acceptable values (CI < 15), confirming model stability.

Although Shapiro-Wilk and Kolmogorov-Smirnov tests indicated non-normality in all variables evaluated ($p < 0.001$), regression analyses remain valid given the large sample size and the fact that normality of residuals (not raw data) is the key assumption. Visual inspection of residuals suggested approximate normality.

Age and gender identity were included as covariates in all analyses to control for their potential confounding effects given their established relationships with ADHD symptoms and suicide risk factors (e.g. Balázs et al., 2018; Hawton et al., 2012; Price et al., 2023).

Multinominal logistic regression explored sociodemographic differences between those reporting; a) no lifetime suicide history (NH), b) lifetime suicidal ideation (SI), c) lifetime suicide attempt (SA).

Linear regression analyses examined associations between IMV model factors and recent suicidal ideation (Table S3). Factors from the motivational phase of the IMV model univariately associated with recent suicidal ideation were included in a multivariable model.

To identify psychological variables distinguishing groups, a multinomial logistic regression was conducted. IMV model factors differentiating SI and SA groups univariately were included in multivariable analyses.

Moderation and mediation analyses were conducted using Hayes' Process macro version 4.2 (Hayes, 2022). Bootstrapping was set to 1000, and HC4 was selected for a robust standard error (HSE).

Model 3 tested whether perceived burdensomeness and thwarted belongingness moderated the relationship between internal and/or external entrapment and suicidal ideation.

For our exploratory analysis, Model 4 was used to test whether internal and/or external entrapment acted as mediators of the defeat – suicidal thoughts relationship.

3. Results

Table 1 describes participant characteristics. The sample had a mean age of 37 years (SD = 10.5), most identified as female (76.8 %), white (87.7 %) and 44.5 % (n = 286) identified as non-heterosexual. 6.2 % of participants (n = 40) reported no history of suicidal thoughts or attempts (NH). 52 % (n = 334) had experienced suicidal thoughts (SI; but had not attempted suicide) and 41.7 % (n = 268) had attempted suicide (SA). Univariate multinomial regression analyses showed those with SA history were more likely to be younger than the NH group. SA participants were more likely to be sexual minorities, than the NH and SI groups. No other demographic factors differentiated the groups.

Table S2 presents the samples self-reported mental health and neurodivergence diagnoses.

64.3 % (n = 413) of the sample reported a diagnosis of ADHD. There were no significant differences in ADHD diagnoses across the groups (NH n = 23, 57.5 %; SI n = 206, 61.7 %; SA n = 184, 68.7 %, $\chi^2 = 3.23$, p = 0.199). Participants with SA history were more likely to report

Table 1
Sociodemographic characteristics of the sample.

	Total sample (n = 642)	No suicidality (n = 40)	Suicidal thoughts (n = 334)	Suicide attempts (n = 268)	Chi-square (χ^2)	Significant differences (p value)
Age in years m (s.d.)	37.0 (10.5)	40.3 (12.7)	36.9 (10.8)	36.6 (9.7)	4.23	(OR) SA < C (1.03)
Categorical variables n (%)						
Ethnicity						
White (ref)	561 (87.7)	34 (89.5)	297 (88.9)	230 (85.8)	1.43	N/S
Ethnic minority	79 (12.3)	4 (10.5)	37 (11.1)	38 (14.2)		
Gender identity						
Male	105 (16.4)	10 (25.0)	60 (18.0)	35 (13.1)	3.62	N/S
Female	493 (76.8)	30 (75.0)	255 (76.4)	208 (77.6)		
Non-binary/third gender/other	44 (6.9)	0 (0)	19 (5.7)	25 (9.3)		
Sexual orientation						
Heterosexual	356 (55.5)	29 (72.5)	201 (60.2)	126 (47.0)	15.65	SI < SA (1.70); C < SA (2.97)
Sexual minority	286 (44.5)	11 (27.5)	133 (39.8)	142 (53.0)		
Gay/Queer	79 (12.3)	4 (10.0)	38 (11.4)	37 (13.8)		
Bisexual	147 (22.9)	5 (12.5)	68 (20.4)	74 (27.6)		
Other	60 (9.3)	2 (5.0)	27 (8.1)	31 (11.6)		
Marital status						
Not married	343 (53.5)	20 (50)	176 (52.7)	147 (55.1)	2.51	N/S
Married/Common law/ Relationship	218 (34.0)	17 (42.5)	115 (34.4)	86 (32.2)		
Separated/Divorced/Widowed	80 (12.5)	3 (7.5)	43 (12.9)	34 (12.7)		
Living situation						
Living alone	135 (21.03)	5 (12.5)	69 (20.66)	61 (22.76)	15.61	N/S
Spouse/Common law/Partner	313 (48.75)	25 (62.5)	167 (50)	121 (45.15)		
Children	51 (7.94)	4 (10)	18 (5.39)	29 (10.82)		
Direct family (parents or/and siblings)	61 (9.50)	1 (2.5)	31 (9.28)	29 (10.82)		
Extended family	2 (0.31)	0 (0)	1 (0.29)	1 (0.37)		
Roommate/academic	76 (11.83)	5 (12.5)	45 (13.47)	26 (9.70)		
Other	4 (0.62)	0 (0)	3 (0.89)	1 (0.37)		
Employment status						
Employed	456 (71.25)	28 (70)	259 (77.78)	169 (63.30)	18.87	N/S
Not employed	130 (20.32)	7 (17.5)	48 (14.41)	75 (28.09)		
Student	54 (8.44)	5 (12.5)	26 (7.81)	23 (8.61)		

Note: [a]Analysis conducted on binary gender identity (male vs female) due to small numbers in the non-binary/third gender/other group; [b] Analysis conducted on binary sexual orientation variable due to small numbers across the sexual minorities; N/S= not significant.

diagnoses of depression (SA n = 214, 81.7 %; SI n = 224, 70.2 %; NH, n = 17 58.6 %, $\chi^2 = 14.07$, $p < 0.001$), anxiety (SA n = 159, 62.6 %; SI n = 164, 51.4 %; NH, n = 16, 47.1 %, $\chi^2 = 8.31$, $p = 0.016$), and autism (SA n = 47, 40.9 %; SI n = 26, 23.2 %; NH n = 3, 27.3 %, $\chi^2 = 8.25$, $p = 0.016$) than the other groups. Further, participants with SA history were more likely to report having three or more mental health diagnoses (n = 183, 68.3 %) than SI history (n = 155, 46.4 %), and almost twice as likely compared to the NH group (n = 14, 35 %; $\chi^2 = 40.66$, $p < 0.001$).

3.1. IMV model factors and recent suicidal ideation

Univariate regression analyses showed all psychological factors were significantly associated with suicidal thoughts in the past week, controlling for age and gender identity (Table S3). Defeat (B = 0.780, 95 % CI 0.70–0.86, $p < 0.001$), internal entrapment (B = 1.086, 95 % CI 0.96–1.21, $p < 0.001$), external entrapment (B = 1.167, 95 % CI 1.02–1.31, $p < 0.001$), perceived burdensomeness (B = 0.321, 95 % CI 0.29–0.35, $p < 0.001$), thwarted belongingness (B = 0.286, 95 % CI 0.23–0.34, $p < 0.001$) and both forms of emotional regulation; cognitive reappraisal (B = −0.108, 95 % CI -0.16 - 0.06, $p < 0.001$) expressive suppression (B = 0.209, 95 % CI 0.14–0.28, $p < 0.001$) were significantly associated with recent suicidal ideation. Recent suicidal ideation was associated with impulsivity (B = 0.257, 95 % CI 0.20–0.32, $p < 0.001$), acquired capability (B = 0.143, 95 % CI 0.06–0.23, $p = 0.013$) and mental imagery (B = 0.537, 95 % CI 0.48–0.59, $p < 0.001$).

The multivariate regression model, including all significant univariate predictors from motivational phase explained 54 % of the variance in suicidal thoughts (adjusted $R^2 = 0.544$). Defeat (B = 0.266, t = 4.115, 95 % CI 0.14–0.39, $p < 0.001$), internal entrapment (B = 0.246, t = 2.597, 95 % CI 0.06–0.43, $p = 0.010$), perceived burdensomeness (B = 0.217, t = 10.544, 95 % CI 0.18–0.26, $p < 0.001$) and expressive suppression (B = 0.058, t = 2.094, 95 % CI 0.00–0.11, $p = 0.037$) were significant in the model (Table 2, below).

3.2. Do perceived burdensomeness and thwarted belongingness moderate the relationship between entrapment and suicidal ideation?

Model 1: External entrapment

The overall model was significant ($F(9, 552) = 65.11$, $p < 0.001$), explaining 52 % of the variance in suicidal thoughts ($R^2 = 0.515$). As Table 3 highlights, external entrapment (b = 0.570, $t(552) = 6.61$, $p < 0.001$) and perceived burdensomeness (b = 0.243, $t(552) = 11.90$, $p < 0.001$) were both significantly associated with suicidal thoughts.

Table 2
Multivariate model of predictors of recent suicidal thoughts from the motivational phase of the IMV model (controlling age and gender ID) in people with ADHD symptoms (n = 642).

	B	t	95 % Confidence Intervals	p value
Age	−0.040	−2.773	−0.07–−0.01	**0.006**
Gender ID	−0.150	−0.464	−0.78 - 0.49	0.643
Defeat	0.266	4.115	0.14–0.39	**<0.001**
Internal Entrapment	0.246	2.597	0.06–0.43	**0.010**
External Entrapment	0.135	1.289	−0.07 - 0.34	0.198
Perceived Burdensomeness	0.217	10.544	0.18–0.26	**<0.001**
Thwarted Belongingness	−0.067	−2.465	−0.12–−0.01	**0.014**
Cognitive reappraisal	0.003	0.176	−0.03 - 0.04	0.860
Expressive suppression	0.058	2.094	0.00–0.11	**0.037**

Note: B, Unstandardised Coefficients, $p < 0.05$.

Table 3
Exploring perceived burdensomeness and thwarted belongingness as moderators of the entrapment to suicidal ideation relationship.

Model 1: External entrapment and suicidal ideation pathway						
	coeff	SE	t	95 % Confidence Intervals		p value
Age	−0.043	0.015	−2.762	−0.072	−0.015	**0.003**
Gender	−0.301	0.327	−0.921	−0.943	−0.341	0.358
Ext Entrapment	0.570	0.086	6.608	0.401	0.739	**<0.001**
Perceived burdensomeness	0.243	0.020	11.904	0.203	0.284	**<0.001**
Thwarted belongingness	−0.024	0.030	−0.806	−0.082	0.034	0.420
Interaction						
1: ext entrapment X perceived burdensomeness	0.018	0.008	2.096	0.001	0.034	0.037
2: ext entrapment X thwarted belongingness	0.0007	0.013	0.536	−0.018	0.032	0.592
3: perceived burdensomeness X thwarted belongingness	−0.002	0.003	−0.241	−0.007	0.004	0.484
4: ext entrapment X perceived burdensomeness X thwarted belongingness	0.001	0.001	0.578	−0.001	0.002	0.563
Model 2: Internal entrapment and suicidal ideation pathway						
Age	−0.040	0.015	−2.61	−0.067	−0.009	0.009
Gender	−0.234	0.326	−0.719	−0.875	−0.406	0.472
Int Entrapment	0.557	0.078	7.183	0.405	0.710	<0.001
Perceived burdensomeness	0.241	0.020	12.020	0.202	0.281	<0.001
Thwarted belongingness	−0.027	0.030	−0.890	−0.086	0.032	0.374
Interaction						
1: Int entrapment X perceived burdensomeness	0.016	0.007	2.210	0.002	0.030	0.028
2: Int entrapment X thwarted belongingness	−0.001	0.012	−0.103	−0.025	0.022	0.918
3: perceived burdensomeness X thwarted belongingness	−0.001	0.003	−0.190	−0.006	0.005	0.850
4: Int entrapment X perceived burdensomeness X thwarted belongingness	0.000	0.001	0.180	−0.002	0.002	0.857

Note: Ext: external entrapment, Int: internal entrapment

Consistent with IMV model predictions, the interaction between external entrapment and perceived burdensomeness was significant (b = 0.018, t(552) = 2.10, p = 0.037; Fig. 2, Panel A), with suicidal thoughts highest when external entrapment and perceived burdensomeness were high. Thwarted belongingness was not a significant predictor (b = −0.024, p = 0.420), and none of the other two- or three-way interactions were significant. Age was negatively associated with suicidal thoughts (b = −0.043, p = 0.003), while gender was not significant. Table 3 summarises the main and moderation effects in the final models.

Model 2: Internal entrapment

This model was also significant (F(9, 552) = 66.91, p < 0.001), accounting for 52 % of the variance in suicidal thoughts (R^2 = 0.522). Internal entrapment (b = 0.557, t(552) = 7.18, p < 0.001) and perceived burdensomeness (b = 0.241, t(552) = 12.02, p < 0.001) were significantly associated with suicidal thoughts (Table 3). The interaction between internal entrapment and perceived burdensomeness was significant, with suicidal thoughts highest when both internal entrapment and perceived burdensomeness were elevated (b = 0.016, t(552) = 2.21, p = 0.028; Fig. 2, Panel B). Thwarted belongingness was not a significant predictor (b = −0.027, p = 0.374), and none of the other two- or three-way interactions were significant. Age was negatively associated with suicidal thoughts (b = −0.038, p = 0.009), while gender was not significant.

3.3. Differentiating suicidal ideation and suicide attempt

Univariate multinominal analyses (Table 4) showed that most psychological risk factors (depressive symptoms, defeat, entrapment, acquired capability, stress, perfectionism, and impulsivity differed between all three groups) differentiated between the NH and SI groups and also between the SI and SA groups. While SA participants were more

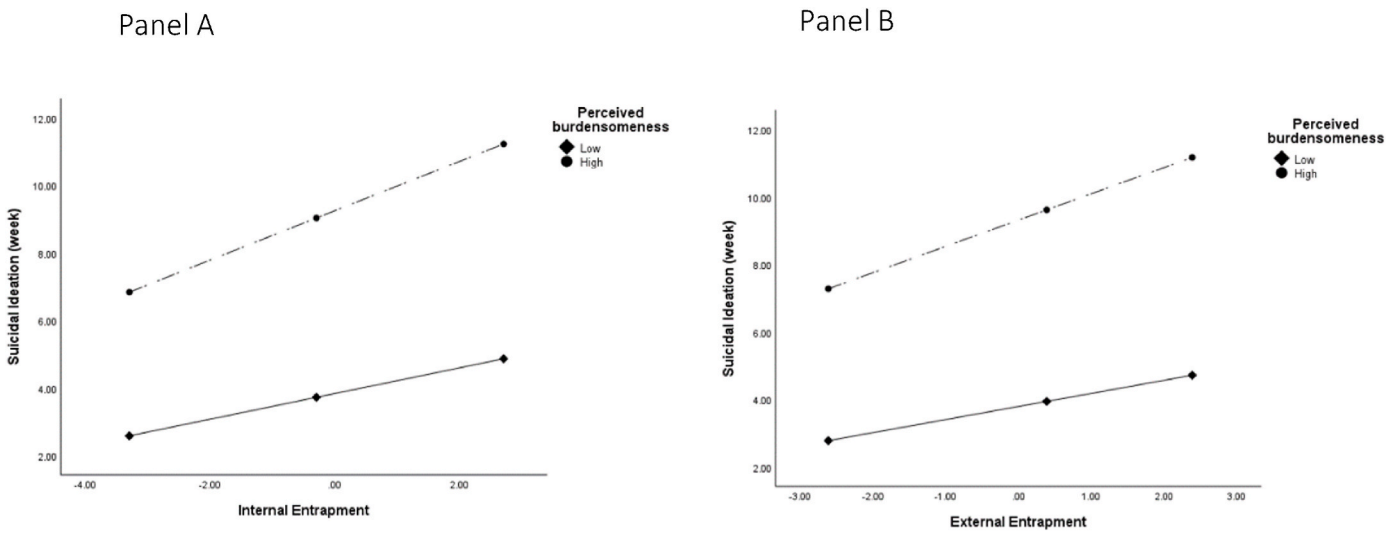

Fig. 2. Panel A. Perceived burdensomeness as a moderator of the relationship between internal entrapment and suicidal thoughts (n = 562). Panel B. Perceived burdensomeness as a moderator of the relationship between external entrapment and suicidal thoughts (n = 562).

Table 4
Descriptive statistics and univariate multinomial regression analyses showing differences between non-suicidal control, suicide ideation and suicide attempts groups.

	Total sample (n = 642)	No suicidality (n = 40)	Suicidal thoughts (n = 334)	Suicide attempts (n = 268)	Chi-square (χ^2)	Significant differences (OR)
	m (s.d)	m (s.d)	m (s.d)	m (s.d)		
Suicidal Ideation (week)	6.52 (4.92)	1.4 (1.91)	5.81 (4.17)	8.18 (5.35)	119.28	C < SI (1.89); C < SA (2.12); SI < SA (1.12)
Anxiety symptoms	12.47 (5.36)	11.00 (5.47)	11.99 (5.18)	13.28 (5.46)	9.46	C < SA(1.08); SI < SA(1.05)
Depressive symptoms	14.41 (6.27)	10.39 (5.69)	14.00 (6.07)	15.51 (6.31)	21.67	C < SI(1.09); C < SA(1.14); SI < SA (1.04)
Perfectionism	24.33 (6.46)	20.25 (7.53)	24.34 (6.52)	24.91 (6.01)	15.08	C < SI(1.09)
Emotion Regulation						
Cognitive reappraisal	21.82 (8.32)	23.91 (9.05)	21.89 (8.33)	21.55 (8.14)	12.63	N/S
Expressive suppression	14.67 (5.77)	13.62 (4.42)	14.79 (5.80)	14.87 (5.94)	11.93	N/S
Defeat	7.95 (3.92)	4.13 (3.31)	7.83 (3.80)	8.68 (3.81)	50.80	C < SI(1.31); C < SA(1.40); SI < SA(1.07)
Internal Entrapment	4.24 (2.56)	1.85 (1.83)	4.14 (2.53)	4.71 (2.49)	47.64	C < SI (1.54); C < SA (1.70); SI < SA (1.11)
External Entrapment	4.56 (2.30)	2.18 (1.96)	4.48 (2.29)	4.98 (2.16)	46.49	C < SI (1.56); C < SA (1.74); SI < SA (1.11)
Perceived Burdensomeness	21.63 (10.27)	12.42 (5.37)	20.60 (9.63)	24.17 (10.63)	53.29	C < SI(1.14); C < SA(1.19); SI < SA(1.04)
Thwarted Belongingness	15.61 (6.91)	12.03 (7.69)	15.23 (6.81)	16.57 (6.74)	15.59	C < SA (1.11); C < SI (1.08); SI < SA (1.03)
Impulsivity	38.39 (6.63)	34.43 (7.52)	37.89 (6.71)	39.59 (6.09)	25.65	C < SI(1.08); C < SA(1.32); SI < SA(1.05)
Acquired capability	10.31 (4.86)	8.86 (5.02)	9.94 (4.82)	10.98 (4.82)	10.43	C < SA(1.11); SI < SA (1.05)
Mental Imagery	21.39 (5.70)	14.89 (3.09)	20.84 (5.35)	23.03 (5.64)	83.83	C < SI(1.38); C < SA(1.50); SI < SA (1.07)
Exposure to others suicidal behaviour n(%)	311 (49.9)	16 (40)	146 (45.5)	148 (56.9)	8.38	SI < SA (1.61)

Note: gender identity and age controlled for in all analyses; N/S= not significant; Significant differences (OR) column: ORs derived from multinomial logistic regression comparing ideation/attempt groups to non-suicidal reference group ($p < 0.05$).

likely to report exposure to others' suicidal behaviour than NH or SI participants there was no difference between NH and SI participants on this variable.

A multivariate regression model including IMV model factors that univariately differentiated between the SI and SA histories was conducted to explore the independent effects of each variable in distinguishing suicide histories, controlling for gender identity and age (see Table 5). The model was statistically significant ($\chi 2$ (26) = 147.00, $p < 0.001$; pseudo R-square (Cox and Snell) = 0.24). Suicide-related mental imagery differentiated between all the groups when all other variables were included (see Table 4), and was the only variable that differentiated between those in the SI and SA groups (B = −0.049, OR = 0.952, 95 % CI 0.913–0.993). Perceived burdensomeness (B = −0.088, OR = 0.916, 95 % CI 0.838–1.001) was approaching significance between SA and NH groups. No other significant differences were found.

3.4. Mediation analyses: Does entrapment mediate the Defeat–Suicidal ideation relationship?

As shown in Fig. 3, panel A (below), higher defeat was significantly associated with suicidal thoughts (b = 0.559, t = 10.04, 95 % CI 0.450–0.668, $p < 0.001$) and internal entrapment (b = 0.478, t = 5.58, 95 % CI 0.310–0.646, $p < 0.001$). Internal entrapment was associated with suicidal thoughts (b = 0.478, t = 5.58, 95 % CI 0.310–0.646, $p < 0.001$). The indirect effect of internal entrapment was significant (b = 0.226, SE = 0.037, 95 % CI 0.155–0.299). The defeat - suicidal ideation relationship remained significant when internal entrapment was included in the model (B = 0.567, SE = 0.057, 95 % CI 0.454–0.680, $p < 0.001$) indicating internal entrapment acted as a partial mediator.

Fig. 3, panel B shows that external entrapment also mediated the defeat -suicidal ideation relationship. Defeat was related to suicidal thoughts (b = 0.597, t = 10.58, 95 % CI 0.487–0.708, $p < 0.001$), and external entrapment (b = 0.429, t = 26.74, 95 % CI 0.397–0.460, $p < 0.001$) with external entrapment also associated with suicidal thoughts

Table 5
Multinomial logistic regression of variables associated with suicidal history group membership (n = 642).

Model variables	Ideation (SI) vs. No Suicidality (NH)[a]			Attempts (SA) vs. No Suicidality (NH)[a]			Ideation (SI) vs. Attempts (SA)[b]		
	B	OR	95 % CI	B	OR	95 % CI	B	OR	95 % CI
Age	−0.032	0.969	−0.931 - 1.008	0.026	1.026	0.984–1.070	−0.005	0.995	0.974–1.015
Defeat	0.085	1.089	0.900–1.318	−0.082	0.921	0.756–1.123	0.003	1.003	0.921–1.093
Internal entrapment	0.039	1.040	0.761–1.422	−0.034	0.967	0.701–1.334	0.006	1.006	0.887–1.141
External entrapment	0.121	1.129	0.809–1.576	−0.127	0.881	0.624–1.243	−0.006	0.994	0.863–1.145
Perceived burdensomeness	0.062	1.064	0.976–1.161	−0.088	0.916[@]	0.838–1.001	−0.025	0.975	0.947–1.004
Thwarted belongingness	−0.076	0.927	0.854–1.005	0.079	1.082	0.994–1.177	0.002	1.002	0.967–1.039
Impulsivity	−0.001	0.999	0.937–1.065	−0.020	0.980	0.915–1.049	−0.022	0.979	0.946–1.012
Acquired capability	0.050	1.051	0.957–1.155	−0.084	0.919	0.834–1.014	−0.034	0.966	0.927–1.007
Mental imagery	0.262	1.300***	1.135–1.488	−0.311	0.732***	0.638–0.841	−0.049	0.952*	0.913–0.993
Gender	−0.015	0.985	0.337–2.883	0.468	1.596	0.509–5.006	0.453	1.573	0.903–2.741
Exposure to others suicidal behaviour	−0.419	0.658	0.274–1.577	0.733	2.081	0.838–5.169	0.314	1.368	0.920–2.035

OR = Odds ratio, B = unstandardised beta, 95 % CI = 95 % Confidence intervals *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, [@]$p = 0.052$; [a]: no suicidal history as reference, [b] Attempts [suicide attempt history lifetime] as reference, [1]: reference category, [2]: sexual minority as reference, gender identity and age controlled for in all analyses.

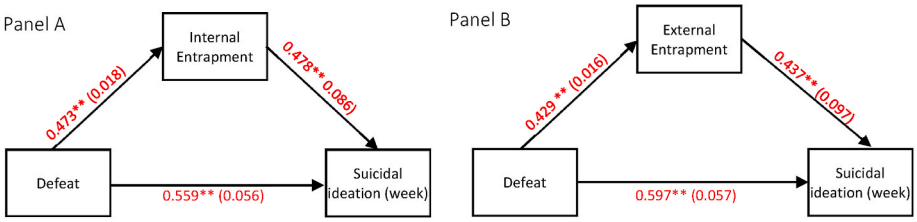

Fig. 3. Panel A. Mediation analysis of internal entrapment as a mediator of the defeat to suicidal thoughts pathway (n = 619). Panel B. Mediation analysis of external entrapment as a mediator of the defeat to suicidal thoughts pathway (n = 619).

(b = 0.400, t = 4.021, 95 % CI 0.205–0.596, p < 0.001). The indirect effect of external entrapment was significant (b = 0.437, t = 4.52, 95 % CI 0.247–0.626, p < 0.001) and defeat remained significantly associated with suicidal thoughts when external entrapment was included in the model (b = 0.597, SE = 0.057, 95 % CI 0.487–0.708, p < 0.001) indicating partial mediation.

4. Discussion

This study addressed four questions related to suicide risk in people who scored ≥4 on the ASRS screener. First, we explored associations between factors from the motivational phase of IMV model and recent suicidal ideation. In our multivariate model, defeat, internal entrapment and perceived burdensomeness were significantly associated with suicidal ideation. Consistent with IMV model predictions, perceived burdensomeness moderated the relationship between internal and external entrapment and recent suicidal thoughts. We found significant interactions between burdensomeness and both forms of entrapment on suicidal thoughts. This aligns with previous research (Chu et al., 2017; Li et al., 2021; Triece et al., 2020) and generates hypotheses for future confirmatory research using clinically diagnosed ADHD populations.

In exploratory mediation analysis, both internal and external entrapment partially mediated the defeat - suicidal ideation relationship.

While cross-sectional data limit our understanding of the temporal relationships, these findings support entrapment's mechanistic role in the transition from defeat to suicidal ideation, particularly internal entrapment (Wetherall et al., 2019; Owen et al., 2018; O'Connor and Portzky, 2018). Longitudinal studies are needed to explore this further.

Although our cross-sectional study design prevents causal conclusions, we found mental imagery, including suicidal "flash-forwards," significantly differentiated individuals with no history of suicidality, those with suicidal ideation, and those with suicide attempts, even after controlling for all other relevant variables. This suggests that mental imagery uniquely contributes to distinguishing between these groups beyond other risk factors.

This builds upon previous research in young adults from the general population which has found that mental imagery distinguishes between those who have thought about suicide versus those who have attempted suicide (Wetherall et al., 2018). Taken together, these findings suggest that mental imagery may be uniquely associated with suicide attempts. In addition, mental imagery may also be associated with suicidal ideation in people with symptoms of ADHD. Future work should consider exploring whether specific aspects of imagery act as a potential motivational factor in the IMV context. Indeed, mental imagery has been associated with increased preoccupation and a cognitive rehearsal mechanism for suicide (Holmes et al., 2007; Lawrence et al., 2023).

This may relate to ADHD traits such as attentional inflexibility and hyperfocus on activities including getting stuck on details (Ashinoff and Abu-Akel, 2021; Hupfeld et al., 2019), potentially intensifying focus on suicidal thoughts, distressing imagery or defeating events. Theoretically, imagery could amplify defeat/entrapment feelings (motivational phase) thereby potentially facilitating an individual's progress along the IMV pathway to suicidal outcomes. Future longitudinal studies are needed to test these causal pathways.

Imagery rescripting is used in some therapies for post-traumatic stress and personality disorders, to help individuals reframe past distressing events (Kroener et al., 2023). Mental imagery may therefore represent a novel intervention target for people with symptoms of ADHD with potential to reduce the risk of transitioning from suicidal thoughts to suicidal behaviours.

Previous research showed that imagery and entrapment interact to predict ideation prospectively (Ng et al., 2016), and reductions in suicidal imagery are linked to fewer suicidal thoughts over time. Identifying the role of mental imagery during suicidal crisis could inform the development of alternative "flash-forward" outcomes which could be integrated in safety planning.

However, the mechanisms underlying mental imagery during suicidal crisis need further exploration. For some individuals, imagery may increase the cognitive availability of powerful images (Florentine and Crane, 2010), leading to greater distress (Holmes and Mathews, 2005), or reduce fear of suicidal acts—similar to acquired capability (Crane et al., 2012). For others, imagery may function as a deterrent for suicidal behaviour, but we do not understand the mechanisms sufficiently.

Impulsivity did not differentiate between suicidal ideation and attempt groups in the multivariate analyses. This may reflect high impulsivity, often characteristic in ADHD, across all groups. Indeed, it is worth remembering that our analyses focused on participants who scored 4 or more on the ASRS screener of recent symptoms (e.g., "How often do you feel overly active and compelled to do things, like you were driven by a motor?"). It is also worth considering the conceptual debate about the nature of the relationship between impulsivity and suicide risk more widely (e.g., Anestis et al., 2014). There remains no consensus about how best to operationalise impulsivity and this may be a particular issue in this population which requires further research attention.

Overall, these findings highlight the complexity of the factors associated with the emergence of suicidal thoughts and behaviours. While experiencing ADHD is associated with increased risk for suicidal behaviour, it is not inevitable. Psychological and contextual factors such as defeat and entrapment, play key roles (O'Connor, 2011; O'Connor and Kirtley, 2018). Despite growing interest in research into ADHD and suicide risk (Garas and Balas, 2020; Giupponi et al., 2018; Septier et al., 2019), more theory driven research is needed. Future studies should examine how experiences of people with ADHD contribute to defeat, humiliation, entrapment, and the development of suicidal imagery.

5. Limitations and future directions

The study findings should be interpreted in the context of their limitations.

Firstly, the sample is not representative of the broader ADHD population, and group comparisons should be interpreted cautiously given the imbalance across the possible ADHD vs non ADHD groups.

Recruitment via social media and ADHD-UK networks, and the nature of the study introduced self-selection bias, particularly attracting participants with prior suicidality. ADHD symptoms were identified via the ASRS screener (Kessler et al., 2005), not a clinical assessment, so symptom onset before age 12 was not captured. Use of the screener also

omits comparisons across ADHD presentations (e.g. inattentive, impulsive, combined).

In addition, this strategy may also have excluded those most affected by ADHD symptoms, at highest suicide risk, or impacted by digital poverty.

Consequently, the findings may not generalise to the wider ADHD or community populations. However, it is important to highlight that the study was designed to explore associations within a high-risk population rather than estimate prevalence. Further, future research would benefit from more equitable distribution of participants across all groups.

Additionally, use of self-report online studies may have resulted in social desirability bias and misunderstandings of questions.

A further limitation of our methods is the absence of formal correction for multiple comparisons across all statistical tests. However, we conducted comprehensive multivariate models and were guided by theoretical framework, which mitigates this concern to an extent. Future confirmatory research with preregistered, focused analyses and larger samples is warranted to enhance clarity and guard against selective reporting.

Finally, as the study is cross sectional there are important considerations for interpreting the findings particularly around mental imagery and suicidal history. In addition, as there was a temporal mismatch between recent-state predictors (e.g. depressive symptoms, anxiety, recent suicidal ideation [past week]) and lifetime suicide attempt status, the precise relationship between the state variables and suicidal history is unclear. However, at the very least, it is evident that among those with suicidal history, their recent mental health indicators appear to be less positive than those without a suicidal history. A longitudinal design, which accounts for this temporality, is necessary to determine the predictive power of these factors. These were measured retrospectively over the lifetime and due to the design, we cannot determine the directionality of the relationship.

Our data showed a stepwise increase across the suicide history groups on many of the measures, which may reflect a shared underlying dimension of distress or psychopathology factor that elevates risk across multiple constructs. Such pervasive gradients are common in clinical or at risk populations where comorbidity and symptom overlaps exist, underscoring the complexity of psychological phenomena rather than invalidating the role of specific mechanisms. Future research would benefit from methods such as bifactor modelling or structural equation modelling to explicitly parse general versus specific factors driving associations.

Specifically, we cannot establish whether higher mental imagery reflects ongoing processes or reflects reflection on past experiences.

Therefore, we present these findings cautiously and emphasise the need to investigate these factors longitudinally in this high-risk population. Consequently, the clinical implications related to mental imagery are also presented cautiously, highlighting the need for longitudinal research to explore mechanisms further.

Future research should explore how ADHD and its diagnosis are experienced across the lifespan. For instance, does receiving a diagnosis affect mental health, coping responses, or suicide risk? Both qualitative and quantitative approaches are necessary to address these gaps. It would also be valuable to examine how mental imagery, stressors, defeat, and entrapment fluctuate over the course of hours and minutes and identify which factors are protective.

6. Conclusion

These findings underscore the importance of psychological factors in understanding suicide risk in people with ADHD. Our findings suggest that IMV model constructs could help us understand the emergence of suicidal ideation and behaviour in this population, and offer promising targets for intervention.

Future research should apply theoretical frameworks to develop testable hypotheses about suicide risk in ADHD, advancing both understanding and prevention.

CRediT authorship contribution statement

Seonaid Cleare: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Rory C. O'Connor:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Funding acquisition, Formal analysis, Conceptualization.

Creative commons attribution

Data statement

The data, code and research materials that support the findings of this study are available from the corresponding author, SC, upon reasonable request.

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Declaration of competing interest

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychires.2026.01.036.

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