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Review Article

# Mental images of suicide: Theoretical framework and preliminary findings in depressed youth attending outpatient care

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## Introduction

Suicide is a leading cause of death worldwide, with one death by suicide occurring every 40 s, and an estimate of one million people taking their own lives every year (World Health Organization 2019). This important public health concern is even more pressing in young people, as suicide is the second leading cause of death worldwide in 10- to 24-year-olds (World Health Organization 2014). Despite national and international prevention strategies to reduce suicidal deaths, suicide rates in most countries have shown a rising trend over recent years (Alicandro et al., 2019).

Systematic reviews and meta-analyses have shown a few promising and potentially effective interventions targeting suicidal thoughts and behaviours; however, many of the evidence for promising treatments is based on single randomised controlled trials (Glenn et al., 2015; Riblet et al., 2017). This is especially true in young people (Busby et al., 2020; Robinson et al., 2018). Moreover, our understanding and ability to identify predictors of suicide or suicide attempts is still limited (Franklin et al., 2017), which hampers suicide prevention efforts.

Given the gravity of outcomes surrounding suicide, there is an urgent need to identify novel treatment targets and mechanisms of suicidal ideation and suicide attempt in order to develop better-informed and more effective treatment and risk management strategies. Suicide research and suicide risk assessment in clinical practice primarily focus on verbal thoughts of suicide. Here, we focus on a type of suicidal cognition that has received little attention to date: mental images of suicide. The aim of this paper is two-fold; first, we review the literature on mental images of suicide, including their potential clinical and cognitive correlates. We discuss why some of these cognitive factors could be involved in mediating the transition from suicidal mental images to suicidal behaviours (including suicide attempt). Second, we present findings from our pilot study, which was the first to examine characteristics of mental images of suicide in young people (aged 16–25).

## Part I: mental images of suicide

Humans rely on at least two modes of thought: verbal (inner speech) and visual (imagery). Although past research efforts and clinical treatment of suicidal ideation have generally focused on verbal expressions of suicidal thoughts, it is increasingly recognised that many people with suicidal ideation also experience visual images of suicide (Holmes et al., 2007a). These visual images of suicide are described as realistic, compelling, and detailed mental images of being dead or of a future suicide attempt. Because these mental images of future death or suicide seem to mimic the powerful, intrusive and repetitive nature of the past-trauma flashbacks that are common in post-traumatic stress disorder, but instead are future-oriented, they have also been referred to as 'suicidal flashforwards' (Holmes et al., 2007a).

Research on mental imagery in general indicates that prospective imagery (i.e., imagery of future events) enables people to simulate and pre-experience the future in order to aid decision-making (Schacter et al., 2012). It has been proposed that mental images of suicide may potentially be more distressing and realistic than verbal thoughts of suicide (Holmes and Mathews 2005). Studies have shown that future events that have been imagined are rated as more probable than those that have not been imagined, possibly because mental imagery enables individuals to identify barriers to realising the event (Gregory et al., 1982; Libby et al., 2007; Pham and Taylor 1999; Szpunar and Schacter 2013). In addition, mental images are both more emotionally arousing and more likely to be confused with real events than verbal thoughts of the same content (Mathews et al., 2013). The mental simulation of future events can provide great adaptive value (e.g., for athletes), as it supports planning, problem solving, and carrying out prospective intentions (Benoit et al., 2014). However, when applied to the context of suicidal ideation, it could have devastating consequences.

Holmes et al. (2007b) were the first to describe mental images of suicide. In their study in 15 adults, every participant who had a history

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of both depression and suicidal ideation reported having experienced such intrusive flashforwards of suicide during their most vulnerable periods. Since Holmes and colleagues' seminal study, several other studies have supported the notion that experiencing vivid, realistic and detailed mental images related to death and suicide are very common in adults with mood disorders or borderline personality disorder and co-morbid post-traumatic stress disorder, as across these studies 37% (in an epidemiological sample) to 63–100% (in clinical samples) reported experiencing mental images of suicide (Crane et al., 2012; Hales et al., 2011; Ng et al., 2016; Schultebraucks et al., 2019). Importantly, individuals with mental images of suicide had more severe suicidal ideation than individuals without mental images of suicide (Ng et al., 2016) and reported a greater preoccupation with mental images of suicide than with suicide-related verbal thoughts (Hales et al., 2011).

Two influential theoretical models of suicide support the idea that the experience of mental images of suicide may serve as a risk factor for transitioning from suicidal ideation to suicidal behaviour. According to the interpersonal psychological theory of suicidal behaviour (Joiner 2005), a person naturally fears death. However, through a process of repeated exposure to, and habituation to emotional or physical pain, one becomes increasingly capable of attempting suicide. This is referred to as acquired capability. Experiencing mental images of suicide attempt or suicidal death may serve as a means of exposure to the pain suicide, cause habituation, and thus lower the natural threshold for suicidal behaviour. According to a second model, the integrated motivational-volitional model, different factors are involved in suicidal ideation and suicide attempt, with motivational factors giving rise to suicidal ideation and volitional factors influencing the transition from suicidal ideation to attempt (O'Connor 2011). Given that mental images of suicide have been shown to further increase suicidal ideation (Ng et al., 2016) and may facilitate the transition to suicidal behaviour, in one study mental images of suicide were identified as a volitional factor - capable of differentiating between those who think about suicide and those that attempt suicide (Wetherall et al., 2018).

Due to the high prevalence of mental images of suicide in adults with suicidal ideation, and their potential facilitating role in suicidal behaviour, mental images of suicide may represent an important target for suicide prevention and novel interventions. However, in order to develop appropriate risk management strategies or treatments for mental images of suicide, it is important to understand their clinical and cognitive correlates and identify potential mechanisms by which mental images of suicide could facilitate suicidal behaviours. Below, we discuss potential clinical and cognitive mechanisms associated with mental images of suicide. While we acknowledge the extensive literature around mental images of nonsuicidal self-injury, this is beyond the scope of this study, for an overview of this literature please see (Cloos et al., 2020).

## Clinical and cognitive correlates of mental images of suicide

Previous studies have found associations between mental illness, mental images of suicide, as well as the overall severity and intensity of suicidal ideation. Below, we review clinical, behavioural and cognitive factors that may be influenced by, as well as influence one's vulnerability for mental images of suicide.

### *Severity of symptoms of mental illness*

The association between mental images of suicide and severity of symptoms of mental illness is likely bi-directional in nature. One large web-based study examined associations between occurrence of mental imagery (negative, positive and suicide-related imagery) and severity of depressive symptomatology in a sample of over 900 participants with various self-reported psychiatric disorders (e.g., depression, bipolar disorder, addiction, borderline personality disorder, social anxiety disorder and PTSD) (Weßlau et al., 2015). Higher frequency of negative and suicide-related imagery and lower occurrence of positive imagery was related to greater severity of depressive symptoms at baseline and at follow-up. Interestingly, the images related to self-injury and death were mostly described as pleasant, which may be related to the high controllability and low intrusive nature of these images in this sample. The finding that negative and suicide- and death-related mental imagery were most common in those with most severe depressive symptoms are in line with the postulation that mental imagery may exacerbate or amplify mood states and affect mood stability in patients with mood disorders (Holmes et al., 2008; Görgen et al., 2015).

Nonetheless, it remains unclear whether mental images of suicide are limited to, or more common in, individuals with more severe mood disorder symptoms, whether the experience of suicidal mental images increases the severity of mood disorder symptoms, or whether these associations are bidirectional.

### *Trait propensity for mental imagery*

There are strong inter-individual differences in visual imagery ability (e.g., generation of mental images, vividness and control over mental images) (Galton 1880; Faw 2009). Additionally, the degree to which an individual uses mental imagery in daily life also varies between individuals. This can be assessed using the Spontaneous Use of Imagery Scale (SUIS) (Reisberg et al., 2003). Scores on the SUIS were found to be significantly correlated with the vividness of mental imagery, with individuals that experience vivid mental images reporting higher use of imagery in everyday life (Reisberg et al., 2003). These inter-individual differences appear to link to psychopathology. In one study, Morina et al. (2013) showed participants videos of distressing events and found that the vividness of general mental imagery prior to viewing the images was positively associated with the occurrence of intrusive imaginal memories following the induced stressful event, suggesting that greater mental imagery abilities may be a risk factor for intrusive trauma-related mental images.

Specifically related to mental images of suicide, studies by Hales et al. (2011) and Ng et al. (2016) suggest that being a visualiser and having a greater overall tendency to generate mental images is associated with the impact and compellingness of mental images of suicide and potentially with risk for suicide. Using the SUIS, Hales et al. (2011) showed that individuals with bipolar disorder, who considered suicide-related flashforwards as more compelling than individuals with major depressive disorder, also had a higher trait propensity for mental imagery than those with major depressive disorder. While evidence is still limited regarding the association between trait propensity for mental imagery and mental images of suicide, we propose that individual differences in trait propensity for mental imagery may be a predisposing factor for mental images of suicide.

### *Sleep disturbances*

Sleep disturbances and insomnia may constitute an important risk factor for suicidal ideation and behaviours (for a recent review please see (Porras-Segovia et al., 2019)). Research also suggests that sleep quality influences an individual's capacity to actively generate and exert control over mental images. Sleep quality has been linked to motor imagery learning (Debarnot et al., 2009, 2011) and mental imagery ability in athletes (Shearer et al., 2018). Good sleep quality has been found to have protective effects on the development of subsequent intrusive memories and images. For example, studies have found that the number of intrusive memories and images following exposure to traumatic stimuli is reduced after sleep (Woud et al., 2018; Kleim et al., 2016). Conversely, poor sleep quality has been found to exacerbate symptoms in PTSD patients, including intrusive memories and nightmares (Woud et al., 2018). Recent evidence suggests that sleep disturbances in the form of too little sleep or too much sleep following a traumatic event posed a risk for developing trauma-related intrusive mental images in the following week (Porcheret et al., 2020). Given the similarities between intrusive

memories and images (i.e., flashbacks) in PTSD and mental images of suicide, we speculate that insomnia and other sleep disturbances may exacerbate mental images of suicide, potentially through impairment of cognitive control (Kusztor et al., 2019; Whitney et al., 2019), thereby increasing the intrusiveness of mental images of suicide, which in turn may increase sleep disturbances, potentially leading to a vicious cycle.

Sleep is also known to play an important role in emotion-regulation. Sleep disturbances have been associated with an increase in emotional reactivity (Palmer and Alfano 2017), and have been shown to increase distress associated with trauma-related mental images (Babson et al., 2012). Similarly, sleep disturbances may increase the emotional impact of mental images of suicide, including their distressing effects, although this remains to be investigated.

*Acquired capability of suicide*

In addition to clinical correlates of mental images of suicide, additional cognitive mechanisms may be involved in the maintenance of mental images of suicide and may mediate the transition from mental images of suicide to suicide attempt. One such mechanism may involve an acquired capability of suicide. The notion of an acquired capability of suicide was proposed as part of Joiner's Interpersonal-Psychological Theory of Suicide (2005). According to this theory, there are three contributing factors that explain suicidal behaviour: (1) perceived burdensomeness, (2) thwarted belongingness (e.g., loneliness and the absence of reciprocal care), and (3) capability of suicide. The theory posits that suicidal desire emerges when individuals experience intractable feelings of perceived burdensomeness and thwarted belongingness, and that near-lethal or lethal suicidal behavior occurs in the presence of both suicidal desire and capability for suicide. Hence, according to this theoretical model, an acquired capability for suicide is a necessary precursor for suicidal behaviours.

Capability for suicide develops after repeated exposures to painful and provocative events (e.g., self-injurious behaviour), which in turn lowers one's fear of death and elevates one's physical pain tolerance, perhaps through habituation to such experiences. Joiner's theory posits that, with the accumulation of exposure to such experiences, an individual progressively adopts a higher tolerance of pain, as well as a fearlessness of death.

Acquired capability for suicide may be particularly relevant in the context of mental images of suicide, because the accumulated, repeated experience of visually imagining one's own future suicide attempt or death could act in the same way as rehearsing or practicing other behaviours that may lower one's fear of death and increases ones pain tolerance (van Bentum et al., 2017; O'Connor and Nock 2014). From this perspective, mental images of suicide could be conceptualised as a means of habituation, inhibiting the fear response towards hurting oneself and the pain associated with suicide. Thus, we hypothesise that with increased mental imagination of a prospective suicide attempt or death, a decrease in fear of death and of the pain associated with suicide occurs, which may lead to an elevated risk of engaging in suicidal behaviour. Although increasing evidence supports the role of acquired capability of death in the transition from ideation to attempt (Chu et al., 2017), the links between acquired capability of suicide, mental images of suicide and the risk of acting on mental images of suicide remain to be investigated.

*Cognitive rigidity and impulsivity*

In addition to acquired capability of suicide, reduced cognitive flexibility and impulsivity may be potential mechanisms that mediate the transition from mental images of suicide to suicide attempt.

Cognitive flexibility is defined as the capability of an individual to respond to environmental change in an adaptive manner (Dajani and Uddin 2015). Poor cognitive flexibility limits one's ability to generate alternative solutions to a problem, causing them to fixate on automatic, less adaptive responses to the situations they are in. The generation of mental images of suicide could increase the cognitive availability of suicidal behaviour, i.e. the awareness that suicide is an option and knowledge of possible means (Florentine and Crane 2010). Various studies have supported the association between cognitive rigidity and suicidal cognitions and behaviour in general (Miranda et al., 2012; Perrah and Wichman 1987). However, associations between cognitive flexibility and mental images of suicide in specific remain to be elucidated.

While many studies support a link between impulsivity and suicidal ideation and attempt (Giegling et al., 2009; Gvion and Apter 2011), we postulate that impulsive decision making is one aspect of impulsivity that may be of particular relevance to mental images of suicide. Experiencing vivid and detailed visual images of future death or suicide can be perceived as comforting and as a desirable outcome to some, by representing routes to escaping the distress one experiences. For an individual who is prone to impulsive decision making, the immediacy of escape from distress can be viewed as reinforcing and desirable – potentially overshadowing the possibility that alternative solutions will lead to a more optimal resolution to the crisis over the longer term. The presentation of an immediate solution to distress via mental images of suicide may trigger an impulse decision to act in accordance with the images. Given these potential mechanisms, we propose that the higher the tendency of a person to make impulsive decisions, the more likely they are to act on mental images of suicide and engage in suicide attempt. It is worth noting that this hypothesis may be specific to explaining a relationship between mental images of suicide and impulsive suicide attempts, and in particular in people who regard mental images of suicide as comforting and rewarding (e.g., by representing a means to escape distressing emotions and life circumstances), as opposed to more carefully planned suicides and in people who experience these images as distressing.

*Distress intolerance and escape/avoidant coping*

The way people cope or react to mental images of suicide may determine how frequent, distressing and intrusive they are. For example, if mental images of suicide are experienced as intrusive and distressing, they may exacerbate negative emotional states, especially in individuals with low distress tolerance. In accordance with the Escape Theory of Suicide (Baumeister 1990), suicide or suicidal behaviours can be perceived as a desirable outcome, by representing routes to escape from the distress or the emotional pain associated with mental images of suicide. Therefore, we hypothesise that individuals with lower distress tolerance may be more inclined to engage in suicidal behaviours and to transition from mental images of suicide to suicide attempt. Maladaptive coping styles such as escape/avoidance may also intensify the very experience that an individual is trying to escape (Gross 2002, 1998; Wegner 1994), perhaps especially in those with lower distress tolerance. Therefore, we hypothesise that an escape/avoidant coping style in response to mental images of suicide will increase the frequency, vividness and intrusiveness of subsequent mental images of suicide, thereby in turn potentially mediating the transition to suicidal behaviours.

## Hypothetical model

Summarising the reviewed literature on mental images of suicide and hypothesised associations with clinical and cognitive characteristics, we propose the following working model of correlates of mental images of suicide, and cognitive mechanisms that may mediate the transition from suicidal thoughts to behaviour (see Fig. 1). We acknowledge that this is not an exhaustive overview of potentially relevant factors, but propose this as a useful preliminary model for directing and evaluating hypothesis-driven research on mental images of suicide. Importantly, it should be recognized that different pathways and risk-factors may either facilitate or protect from engaging in suicidal behaviour in different individuals. A better understanding of the content and appraisal

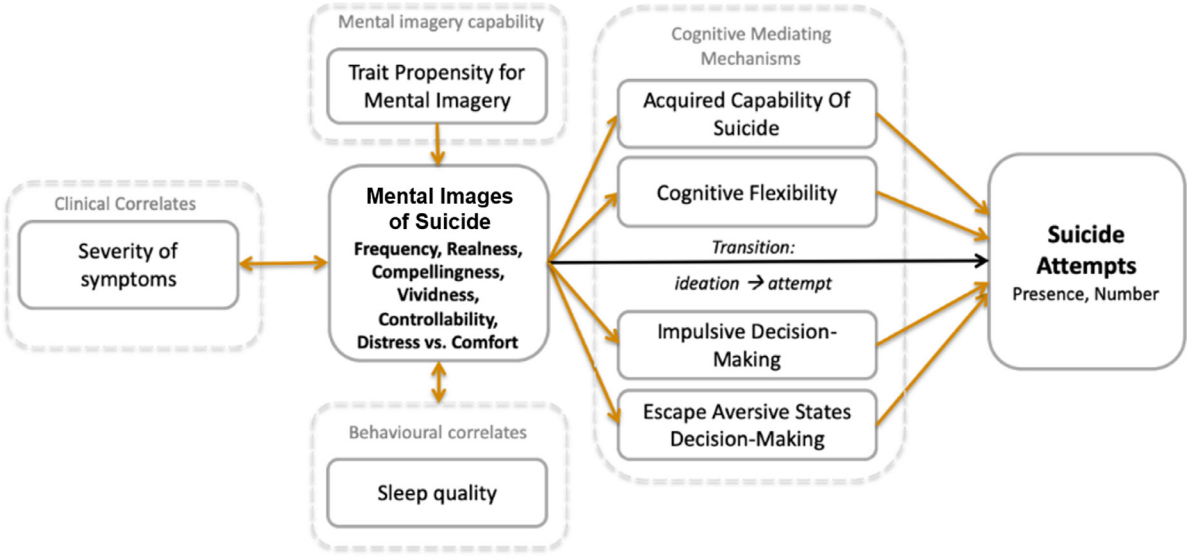


**Fig. 1.** Hypothesised clinical, behavioural and cognitive correlates of mental images of suicide.

of the content of mental images of suicide is needed to elucidate these subconstructs.

**Part II: mental images of suicide in young people: a pilot study**

Given that our (still limited) knowledge on mental images of suicide is based on research conducted in adults with suicidal ideation (mean age of referenced studies, $M = 40.66$ years), we conducted a pilot study to determine whether mental images of suicide are also commonly experienced by young people and to investigate some of the proposed associations with clinical (severity of symptoms, suicide attempts) and behavioural (sleep) characteristics.

*Sample*

We examined the characteristics of mental images of suicide in young people who received treatment for a mood disorder at Orygen's Youth Mood Clinic, a youth mental health clinic in Melbourne (Rice et al., 2017), Australia, and who reported recent (in past 4 weeks) suicidal ideation. To ensure the safety of participants, those (1) at imminent risk for suicide (i.e., individuals with current suicidal ideation with a plan, as well as the means and intent to enact on the plan), and (2) who were actively manic or psychotic, were excluded from participation in the study. The final sample in this pilot study consisted of 33 young people (17 males, 15 females - with missing information on sex for 1 participant) between the ages of 15 to 25 ($M = 19.27$). Thirty-two of the young people in our sample had a diagnosis of a mood disorder (28 Major Depressive Disorder, 3 Bipolar Disorder, 1 Persistent Depressive Disorder). The one participant who did not have a mood disorder diagnosis was primarily diagnosed with borderline personality disorder and bulimia nervosa at the time of assessment. Anxiety disorders ($N = 13$, 39.4%) and substance use disorders ($N = 3$, 9.1%) were common comorbid disorders in the sample.

*Measures and statistical analysis*

The content and characteristics of mental images of suicide were assessed with the Suicidal Flashforwards and Cognitions Interview (SCFI) (Holmes et al., 2007a), which was administered by an experienced research assistant and then checked by a psychologist. The SCFI is a structured interview assessing the content of visual imagery of suicide as well as verbal suicidal thoughts at the time participants felt at their most suicidal. The time period between the assessment and the most suicidal point varied between 1 day and 1095 days (median: 148 days). Participants are asked to rate (1) how much time they spent preoccupied with suicide-related imagery and verbal thoughts, (2) how compelling and real these images and verbal thoughts were, (3) how controllable they were, (4) how distressing and comforting they were; (5) how vivid the images were; (6) how intense the urge to act on these images/thoughts were. Additional questions in the SCFI included whether the images are observed from a field or observer perspective and what the images mean to the participants. Participants were asked to describe their most significant mental image of suicide in as much detail as possible, including the scenes, actions, locations, people present, other sensory experiences (smell, taste, sound, touch) and feelings. In order to investigate relationships with the potential clinical correlates proposed in Fig. 1, the young people were also asked to respond to a number of self-report measures. Severity of depressive in the past week were assessed using the Quick Inventory of Depressive Symptomatology (QIDS) (Rush et al., 2003). Sleep quality in the past month was examined using the Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989), while a trait measure of imagery use in everyday life was assessed using the Spontaneous Use of Imagery Scale (SUIS) (Reisberg et al., 2003). Suicidal thoughts and behaviour at a participant's most suicidal moment was assessed using the Columbia-Suicide Severity Rating Scale (C-SSRS) (Posner et al., 2008). Descriptive statistics were used to examine how many young people experienced mental images of suicide, the content of the mental images of suicide, and their ratings of the mental images of suicide in terms of frequency, realness, vividness, controllability and distressing and comforting effects. Pearson correlation analysis was employed to investigate associations between characteristics of mental images of suicide and clinical characteristics. In addition, ANOVA analyses were performed to examine whether characteristics of mental images of suicide or verbal thoughts of suicide differed between participants with 0, 1 or more than 1 actual attempt.

*Results*

The results of this pilot study indicate that mental images of suicide are very common in (if not almost unanimously experienced by) young people with present suicidal ideation and a mood disorder. Of the 33 participants in the sample, 32 (97%) reported experiencing mental images of suicide – with the majority of the sample reporting that they experienced flashforwards often ($n = 21$; 64%). Of the 32 who experienced mental images of suicide, 18 (56%) reported that mental images

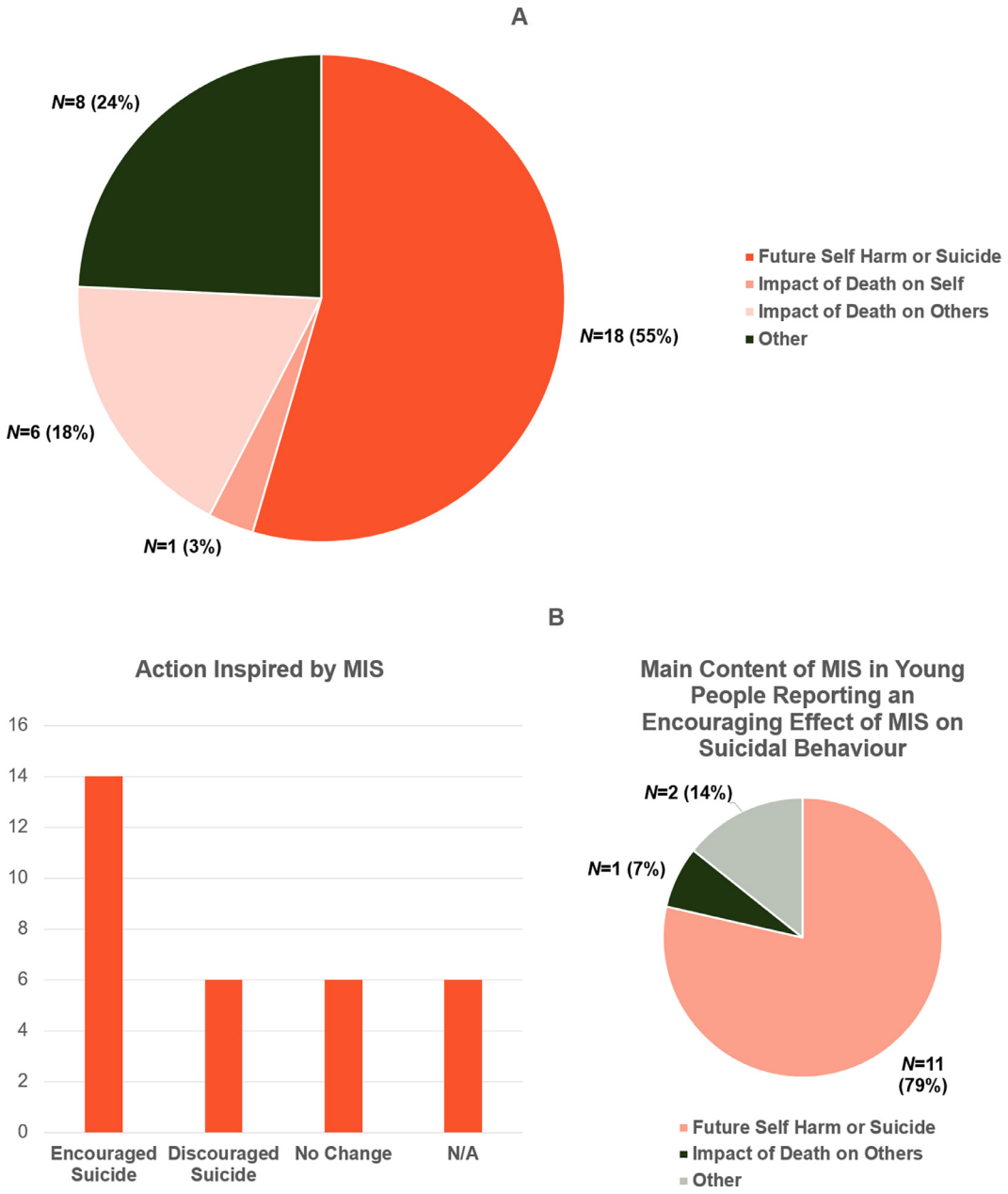


**Fig. 2.** (A) Main content of mental images of suicide in $N = 32$ young people with mental images of suicide. (B) Action inspired by mental images of suicide and main content of mental images of suicide in young people reporting that mental images of suicide encouraged suicide. SFs: mental images of suicide.

of their future suicide attempt or self-harm constituted the main content of any mental imagery they experienced. Another prominent theme was that of the impact of the young person's death on others ($n = 6$, 18%) (Fig. 2A). Of the young people who indicated that the images made them want to act on these images ($n = 14$, 44%), most of them had mental images of suicide that primarily constituted envisioning their own future death or suicide (Fig. 2B).

The majority of the young people who experienced mental images of suicide found their imagery of suicide to be realistic, compelling, and vivid (Fig. 3). While previous studies in adults found that mental images of suicide can be both comforting and distressing (Crane et al., 2012; Holmes et al., 2007a), the majority of the young people in our pilot rated them as distressing, with very few young people rating the mental images of suicide as comforting (Fig. 3). In addition, most young people indicated that they did not have control over the mental images of suicide, indicating that the images were mostly experienced as intrusive (Fig. 3).

*Associations with past suicide attempt or suicidal ideation*

In our pilot study, 25 (75.8%) of the young people had a history of at least one actual suicide attempt. We found that ratings of distress associated with mental images of suicide were positively associated with suicidal behaviour in the C-SSRS (i.e., the cumulative total of past actual, aborted and interrupted attempts; $r = 0.42$, $p = 0.016$; Fig. 4), while no association between characteristics of verbal suicidal thoughts (frequency, controllability, distressing and comforting effects) and number of attempts was found. However, when comparing the characteristics of verbal and visual thoughts of suicide between those with no history of actual attempt, those with one actual attempt and those with more than one actual attempt in ANOVA analyses, we did not find significant group differences. In addition, there were no significant associations between characteristics of mental images or verbal thoughts of suicide, and lifetime intensity of suicidal ideation of lifetime frequency of suicidal ideation.

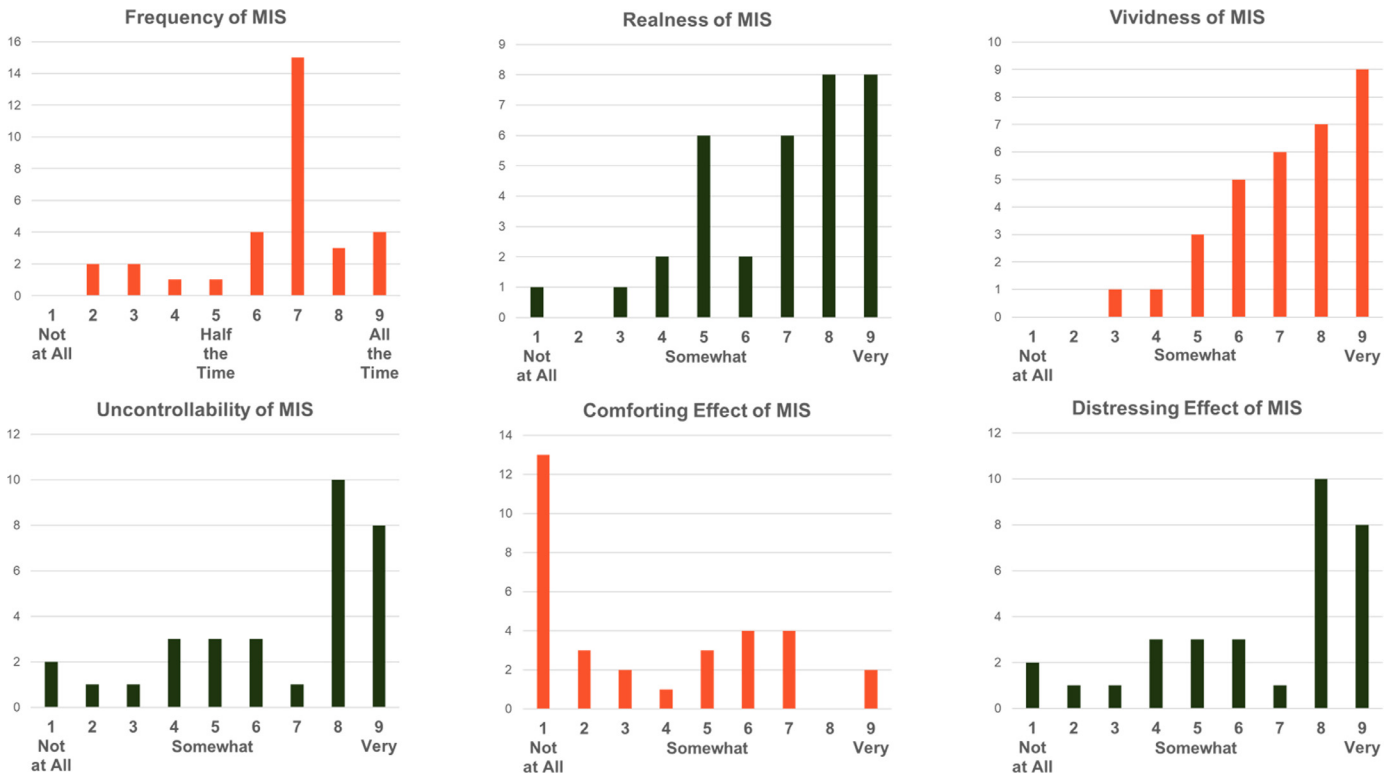


**Fig. 3.** Ratings of characteristics of mental images of suicide in $N = 32$ young people with mental images of suicide. SFs: mental images of suicide.

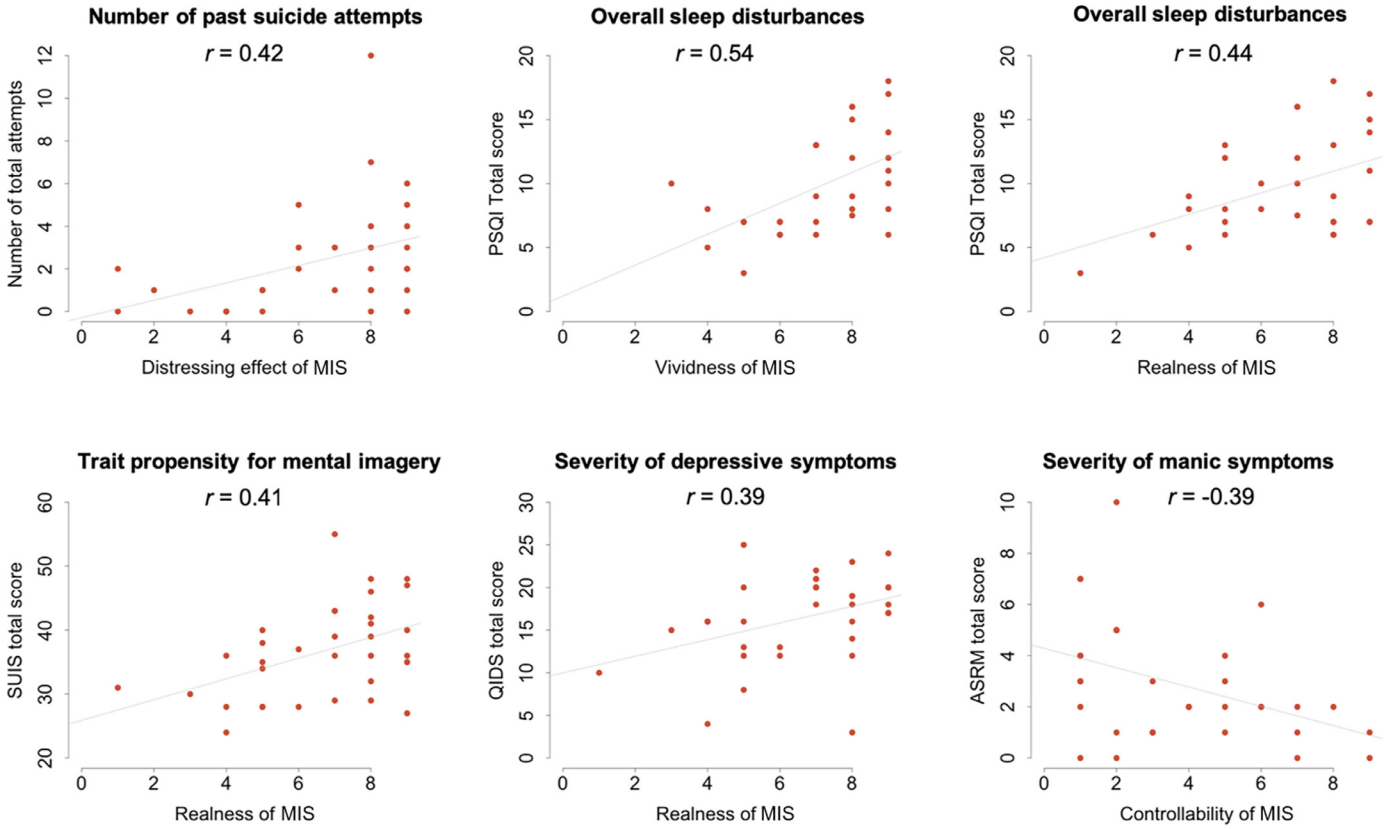


**Fig. 4.** Scatterplots of associations between clinical and cognitive correlates and characteristics of mental images of suicide in $N = 32$ young people with mental images of suicide. SFs: mental images of suicide.

*Associations between characteristics of mental images of suicide and clinical characteristics*

With regard to clinical characteristics, we found significant correlations between greater overall sleep disturbances, as measured with the PSQI total score, and higher ratings of vividness ($r = 0.53$, $p = 0.016$) and realness ($r = 0.45$, $p = 0.017$) of the mental images of suicide (Fig. 4). Higher ratings of the realness of the mental images of suicide were also associated with a higher trait propensity for mental imagery (SUIS total score; $r = 0.45$, $p = 0.021$) and greater depressive symptoms severity (QIDS total score; $r = 0.38$, $p = 0.029$) **(Fig. 4 and supplemental table S1)**.

*Discussion of findings*

This study aimed to elucidate how commonly young people with a mood disorder and suicidal ideation report experiencing mental images of suicide, as well as to investigate some of the proposed associations of mental images of suicide with proposed clinical characteristics. 97% of young people in our sample reported having experienced mental images of suicide - suggesting that such imagery is a highly common experience in young people with ongoing suicidal ideation and a mood disorder.

This pilot study also elucidated links between characteristics of mental images of suicide and greater severity of depressive symptoms. Moreover, these preliminary findings in young people also highlighted a potential role of sleep disturbances in the vividness and realness of mental images of suicide - suggesting that disturbed sleep may be an indirect target for treatment of mental images of suicide. However, caution is warranted when interpreting the association between mental images of suicide at most suicidal, sleep quality and severity of depressive symptoms, as sleep quality and symptom severity were assessed in the week or month preceding the assessment, while the mental images of suicide were at a participants most suicidal moment. In addition, because our pilot study was exploratory in nature and very little research on potential correlates and mechanisms of suicidal mental imagery exists, we did not correct for multiple testing. Therefore, the current findings should be interpreted with caution and regarded as a pilot for future larger studies."

Our finding that distress associated with mental images of suicide were associated with suicidal behaviour in the C-SSRS, aligns well with how mental images of suicide are conceptualised within the Integrated Motivational-Volitional Model of suicide (O'Connor 2011), i.e. as a volitional factor - a factor that is specifically associated with transition from suicidal ideation to suicide attempt. Importantly, in line with a previous study in adults (Wetherall et al., 2018), our preliminary findings suggest that mental images of suicide, differentiate between those who experienced suicidal ideation without attempt, and those who experienced both suicidal ideation and attempt. Such findings were not observed in the consideration of verbal thoughts of suicide, These findings raise the possibility that mental images of suicide, more than verbal thoughts of suicide, might play a unique role in the progression from suicidal ideation to suicidal behaviours. Our findings supported the hypothesis that high levels of distress associated with mental imagery of suicide increase the likelihood of young people engaging in suicidal behaviours. While further studies should be conducted to elucidate the underlying mechanisms supporting the transition from imagery to behaviour, it is plausible that mental images of suicide can be perceived as a desirable outcome, by representing routes to escape from distress and emotional pain (Baumeister 1990; van Bentum et al., 2017). Additionally, these studies should also examine the relationship between the content and appraisals of mental imagery of suicide, with distress associated with these images. This is especially pertinent, given findings from past studies indicate both content and appraisals can attenuate levels of distress associated with imagery of self-injury, and subsequent urges to act on these images (McEvoy et al., 2017).

**Part III: future directions and clinical implications**

The literature reviewed and initial findings presented indicate that mental images of suicide are a form of suicidal cognition that are highly common across both adults and young people. Although these findings are preliminary and need to be confirmed in larger samples, the observations that mental images of suicide are associated with past suicide attempts and predict worsening of suicidal ideation over time (Ng et al., 2016) underscore the importance of targeting mental images of suicide in suicide risk management and treatment. This counters current approaches in clinical practice and suicide research, which have mainly focused on suicidal ideation in verbal form and seldom explore the presence of suicidal mental images. For example, Hales et al. (2011) found that less than a quarter of the 40 participants in their study had discussed their suicidal images with their counsellor.

Although the associations between characteristics of mental images of suicide and number of past suicide attempts may suggest that mental images of suicide are a risk factor for transitioning from ideation to attempt, longitudinal studies are required to confirm this hypothesis. Such longitudinal studies would benefit from including measures of mechanisms that may mediate the progression from mental images of suicide to suicide attempt. In this article, we have proposed various cognitive mechanisms that could increase the risk of acting on the mental images of suicide (e.g., acting in accordance with the content of the visual images of future suicide), including acquired capability of suicide, cognitive rigidity, impulsive decision making, distress intolerance and an avoidant coping style.

Our findings support the notion that mental images of suicide may be a valuable avenue to treat suicidal ideation, possibly through alternative treatments that specifically target mental imagery processes. Treatment strategies for mental images of suicide that have been proposed, include (but are not limited to): imaginal exposure, imagery re-scripting, systematic desensitization, eye movement desensitization and reprocessing (EMDR), imagery-focused cognitive behaviour therapy (CBT), and positive imagery training (Pearson et al., 2015; van Bentum et al., 2017; Holmes et al., 2007a; Murphy et al., 2015; Blackwell et al., 2015). These interventions may represent stand-alone treatments or additions to traditional psychological interventions for a distressing and underrecognised aspect of suicidal ideation.

Given that imagery-based therapies target distinct aspects of disturbing mental imagery, a better understanding of the cognitive and neurobiological mechanisms involved in mental images of suicide could help decide which intervention should be prioritised. For example, identifying the neural mechanisms underlying the generation and maintenance of mental images of suicide could provide important information on how to potentially disrupt mental images of suicide and may stimulate further treatment-oriented research via the identification of novel neural mechanisms. To date, no studies have directly examined the neural mechanisms underlying mental images of suicide. This research would increase our understanding of the underlying pathophysiology, reveal novel treatment targets, and provide biomarkers for monitoring the effects of treatment. For example, transcranial magnetic stimulation of regions that modulate the intrusiveness of suicidal mental images could help boost control over these images. Better control over mental imagery of negative emotional events have been shown to reduce involuntary intrusive visual images and reduce feelings of worry about feared scenarios (Benoit et al., 2016). In addition, neurofeedback could enable people to learn to regulate patterns of local brain activation that modulate the intrusiveness, vividness and emotional impact of mental images of suicide, through use of real-time feedback of these brain signals. By providing neurofeedback, individuals are enabled to adapt their cognitive strategies (e.g., for self-regulating distress during suicidal imagery) based on whether the strategies successfully contribute to achieving the desired brain target state.

Further studies on mental images of suicide would also benefit from investigating mental images of suicide in individuals with mental disor-

ders other than mood disorders or borderline personality disorder. Suicidal ideation, many of the neural mechanisms underlying it, and the majority of the novel treatment strategies proposed above are transdiagnostic in nature. As most of the research on mental images of suicide to date has focused on participants with mood disorders (both unipolar and bipolar depression), the presence and nature of mental images of suicide in other mental health conditions need to be confirmed.

## Conclusion

In conclusion, our study suggests that mental images of suicide are very commonly experienced by young people with current suicidal ideation and a mood disorder. Preliminary results of the study suggest that, when mental images of suicide are assessed in conjunction with specific clinical and cognitive correlates, novel and informative insights into a young person's suicidal ideation and suicidal behaviour can be obtained. Future longitudinal studies with larger sample sizes are needed to further our understanding of the relationships between mental images of suicide, suicidal ideation, and a young person's risk for suicidal behaviours. Potential key research questions pertaining to mental images of suicide include further study into cognitive mechanisms that could increase the risk of acting on the mental images of suicide, as well as the neural mechanisms underlying mental images of suicide. With an improved understanding of mental images of suicide, alternative treatments for suicidal ideation and behaviour may be identified and aid in the reduction of suicide risk.

## Declarations of Competing Interest

None

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## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jadr.2021.100114.

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