From ideation to action: differentiating between those who think about suicide and those who attempt suicide in a national study of young adults

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Abstract

Background: Although many suicide risk factors have been identified, there is still relatively little known about the factors that differentiate those who think about suicide from those who make a suicide attempt.

Aims: Using the integrated motivational-volitional model (IMV) of suicidal behaviour as a framework, this study hypothesised that i) motivational and volitional phase factors would differentiate non-suicidal controls from those who had a history of suicidal ideation or suicide attempts, and ii) within a multivariable model only volitional phase factors would differentiate between those who had a history of suicidal ideation and those who had attempted suicide.

Method: The Scottish Wellbeing Study (n=3508) is a nationally representative study of young people (18-34 years) recruited throughout Scotland. Using multinomial regression analysis, three groups (non-suicidal control (n=2534), lifetime suicide ideation (n=498) and lifetime suicide attempt (n=403) groups) were compared on motivational and volitional phase variables.

Results: Consistent with the IMV model, motivational and volitional phase variables differentiated the control group from both the ideation and attempt groups. Only volitional phase variables differentiated between the suicide attempt group and the suicidal ideation group in the multivariable model; with those reporting a suicide attempt being higher on acquired capability, mental imagery about death, impulsivity, and being more likely to know a friend who had made a suicide attempt. Having a family member or friend die by suicide or a family member attempt suicide did not differentiate between the groups.

Limitations: The findings were based on cross-sectional data derived from self-report measures.

Conclusions: These findings provide further support for the IMV model, and highlight potential targets for clinical intervention.

1. Introduction

Suicide is a global health problem, and although suicide affects people across the lifespan, it is the second leading cause of death of 16-29 year olds worldwide (World Health Organisation, 2014), as well as being the leading cause of death among people under 50 in the UK (Samaritans, 2017). Recent research has identified a wide range of social, psychological and biological factors that act to increase suicide risk (O'Connor and Nock, 2014), although these factors often do not distinguish between those who will think about suicide and those who will go on to act on suicidal thoughts (Klonsky and May, 2014). With around 60% of transitions from suicidal ideation to a first attempt occurring within a year of ideation onset (Nock et al., 2008), it is crucial that we identify factors that distinguish those whose suicidal thoughts may transition into suicidal behaviours (Kessler et al., 2005).

In light of this, recent models of suicidal behaviour have adopted an *ideation-to-action* framework, where the development of suicidal ideation and the transition to a suicide attempt are viewed as distinct processes (Klonsky et al., 2017). The first theoretical model to emphasise this distinction was the interpersonal-psychological theory of suicide (IPT; Joiner, 2005), proposing that suicidal desire (comprised of perceived burdensomeness and thwarted belongingness) alone was insufficient to lead to a serious suicide attempt/death by suicide. A suicidal individual must also have the capability to act upon that desire characterised by a lowered physical pain sensitivity and high fearlessness about death that overrides the instinct towards self-preservation (Joiner, 2005). Although there has been considerable evidence for the key premises underpinning the IPT (Chu et al., 2017), a recent systematic review of IPT studies found limited evidence for an interaction between perceived burdensomeness, thwarted belongingness and acquired capability in association

with suicide attempts, with the authors concluding that the relationships between the variables may be less straightforward than originally presented (Ma et al., 2016). Therefore, models of suicidal behaviour may need to account for a more complex relationship between suicidal ideation and the transition to a suicide attempt.

[Figure 1]

In this vein, the integrated motivational-volitional model of suicidal behaviour (IMV; O'Connor, 2011) was proposed in 2011 and refined in 2018 (O'Connor and Kirtley, 2018). The IMV model is a tri-partite framework (Figure 1) that builds upon previous theories to map the context in which suicide may occur (the pre-motivational phase), the development of suicidal ideation (the motivational phase) and the transition of suicidal thoughts into suicidal behaviours (the volitional phase). Building upon the *cry of pain hypothesis* (Williams, 1997), the motivational phase focuses on feelings of defeat and entrapment as the key drivers of suicidal ideation. Importantly for the present study, within the final phase of the model (volitional phase), it is argued that a group of factors, labelled volitional moderators, governs the transition from thinking about suicide to attempting/dying by suicide. In addition to Joiner's concept of acquired capability, these factors include impulsivity, planning, exposure to the suicidal acts of others, access to means, past suicidal behaviour and mental imagery about death (O'Connor and Kirtley, 2018).

There has been support for the main facets of the IMV model (e.g., Dhingra et al., 2016; O'Connor et al., 2013; Wetherall et al., 2018), including a growing body of evidence demonstrating that volitional moderators do indeed differentiate between those who think about suicide and those who engage in suicidal behaviour (O'Connor et al., 2016; O'Connor and Kirtley, 2018). For example, in one study of adolescents, only volitional phase variables

(self-harm by friends and family, thinking about peers' self-harm, impulsivity) and stress differentiated between those with thoughts of self-harm and those who engaged in self-harm (O'Connor et al., 2012). Similarly, in a test of the IMV facets with students, within a multivariable model, only the volitional phase factors (exposure to suicide, impulsivity and fearlessness about death) distinguished between those who had experienced suicidal ideation and those who had attempted suicide (Dhingra et al., 2015). Additionally, in a recent cohort study, exposure to the self-harm of others (alongside psychiatric disorder) was key to differentiating between adolescents who had made a suicide attempt compared to those who had thought about but not attempted suicide (Mars et al., 2018).

A final model utilising the *ideation-to-action* framework is the more recent three-step theory (3ST; Klonsky and May, 2015). The initial steps tap the development and escalation of suicidal ideation with a combination of pain, hopelessness and a lack of connectedness, and in the final step ideation progresses to an attempt when the capability for suicide is present. The concept of acquired capability has been a consistent component across all three models explored, with recent evidence suggesting that when those high on capability become agitated, suicidal intensity increases, thereby facilitating suicidal behaviour by providing sufficient energy and arousal (Ribeiro et al., 2015). Therefore, this concept, along with the additional volitional factors of impulsivity, exposure to suicide and mental imagery about death, are key variables to be explored more fully as factors that can differentiate those who think about suicide from those who will make a suicide attempt.

Current study

This study aimed to investigate a key premise of the IMV model; namely that volitional phase variables govern the transition from suicidal ideation to suicide attempts when

motivational phase variables are controlled for (O'Connor & Kirtley, 2018). Although a small number of studies have investigated the psychological factors associated with behavioural enaction (e.g., Dhingra et al., 2015), to our knowledge this is the most detailed study of its kind and the first study to do so in a nationally representative sample. To this end, the Scottish Wellbeing Study (O'Connor et al., 2018), a nationally representative interview-based survey of young adults aged 18 to 34 years across Scotland, was conducted. In short, we hypothesised that i) motivational and volitional phase factors would differentiate non-suicidal controls from those who had a history of suicidal ideation or suicide attempts, and ii) only volitional phase factors would differentiate between those who had a history of suicidal ideation and those who had attempted suicide in a multivariable model.

2. Method

2.1 Sample and procedure

The data are from the Scottish Wellbeing Study (O'Connor et al., 2018) which is a nationally representative sample of young people aged 18 to 34 years (n=3508) from across Scotland. Recruitment was conducted by Ipsos MORI, a social research organisation, between 25th March 2013 and 12th December 2013. A quota sampling methodology was utilised; quotas were based on age (three quota groups), sex and working status (for more details, see O'Connor et al., 2018). Following written consent, participants completed an hour-long interview, carried out face-to-face in their homes, using Computer Assisted Personal Interviewing (CAPI), with confidential completion of sensitive questions (including suicidal history) on a personal computer. Participants were compensated £25 for their time. Ethical approval was obtained from the University of Stirling (Psychology Department) ethics

committee as well as from the US Department of Defense Human Research Protections Office.

2.2 Measures

2.2.1 Outcome measure: Lifetime history of suicidal ideation and attempts. This was assessed with two items drawn from the Adult Psychiatric Morbidity Survey (APMS; McManus et al., 2007): "Have you ever seriously thought of taking your life, but not actually attempted to do so?" and "Have you ever made an attempt to take your life, by taking an overdose of tablets or in some other way?". Responses to these questions were "no", "yes" or "would rather not say". These items were used to create a 3 category variable indicating if participants had (i) no history of suicidal ideation/ attempt (control group), (ii) had experienced suicidal ideation but had never attempted suicide (suicidal ideation group), or (iii) had reported having attempted suicide in the past (suicidal attempt group).

2.2.2 Motivational phase risk factors

2.2.2.1 Defeat. The Defeat Scale (Gilbert & Allan, 1998 (Gilbert and Allan, 1998)) is a 16-item self-report measure of perceived failed struggle and loss of rank (e.g., "I feel that I have not made it in life"). This scale has good psychometric properties and is significantly correlated with depressive symptoms (Griffiths et al., 2014). In the present study the measure had high internal reliability (Cronbach's α = 0.96).

2.2.2.2 Entrapment. The 16-item Entrapment Scale (Gilbert & Allan, 1998) is a measure of the sense of being unable to escape feelings of defeat and rejection (e.g., I am in a situation I feel trapped in). This measure consists of 10 items reflecting external entrapment (entrapment by external situations), and 6 items tapping internal entrapment (entrapment

by one's own thoughts and feelings). The scale has good psychometric properties (Griffiths et al., 2014) and demonstrated high internal consistency in the present study (Cronbach's α = 0.96).

2.2.2.3 Perceived burdensomeness and *thwarted belongingness.* These were assessed using the 12-item Interpersonal Needs Questionnaire (INQ; Van Orden et al., 2012). The INQ includes 7-items to tap burdensomeness (e.g., "I feel like a burden on the people in my life") and 5-items to assess belongingness (e.g., "I feel disconnected from other people"). The scales have been shown to have good internal consistency and construct validity (Van Orden et al., 2012), including in this study (perceived burdensomeness Cronbach's α = 0.87, thwarted belongingness Cronbach's α = 0.84).

2.2.2.4 Goal Disengagement and *Goal Reengagement.* The 10-item goal adjustment scale (GAS; Wrosch et al., 2003) consists of a 4-item goal disengagement (e.g., "If I have to stop pursuing an important goal in my life its easy for me to stop thinking about the goal and let it go") subscale and a 6-item goal reengagement (e.g., "If I have to stop pursuing an important goal in my life I start working on other new goals") subscale. Both subscales have shown good validity (Wrosch et al., 2003), and in the present study they had adequate to good internal consistency (goal disengagement Cronbach's α = 0.70, goal reengagement Cronbach's α = 0.87).

2.2.2.5 *Social support.* The 7-item ENRICHD Social Support Instrument (ESSI; Mitchell et al., 2003), taps four defining attributes of social support: emotional, instrumental, informational, and appraisal (e.g., "Is there someone available to give you good advice about a problem?"). It has been found to be a valid and reliable measure of social support

(Vaglio et al., 2004), and displayed good internal reliability in the present study (Cronbach's α = 0.87).

2.2.2.6 Resilience. Resilience was measured using the 10-item Brief Resilience Scale (BRS; Campbell-Sills and Stein, 2007), adapted from the 25-item Connor-Davidson Resilience Scale (CD-RISC; Connor and Davidson, 2003). This 10-item version (e.g., "Coping with stress can strengthen me") has good psychometric properties and is highly correlated with the original 25-item version (Campbell-Sills and Stein, 2007), and in the present study it displayed excellent internal consistency (Cronbach's α = 0.90).

2.2.3 Volitional phase risk factors

2.2.3.1 Acquired capability. The Acquired Capability for Suicide Scale (ACSS; Van Orden et al., 2008) is a 5-item measure designed to assess one's fearlessness about death and physical pain sensitivity (e.g., "The pain involved in dying frightens me"). The scale has demonstrated convergent and discriminant validity (Van Orden et al., 2008), and in this study the ACSS had a relatively low internal consistency of 0.63 (Cronbach's α).

2.2.3.2 Impulsivity. This was assessed using the 30-item Barratt Impulsiveness Scale Version 11 (BIS-11; Patton et al., 1995); a self-report questionnaire that accounts for the multi-faceted nature of the construct (i.e., attentional, motor and non-planning impulsiveness) that provides a general impulsiveness score (e.g., "I act on the spur of the moment"). The BIS is a commonly used scale that has been shown to correlate with behavioural measures of impulsivity (Martins et al., 2004), and it displayed good internal validity in the present study (Cronbach's α = 0.83).

2.2.3.3 Mental imagery. Eight questions were asked to establish the frequency with which participants imagine death related imagery when they feel down or distressed, including engaging in self-harm or suicidal behaviour (e.g., "…images of yourself planning/preparing to harm yourself or make a suicide attempt"). Greater presence of suicide-related imagery has been linked to higher levels of suicidal ideation (Holmes et al., 2007). The scale displayed good internal reliability (Cronbach's α = 0.84).

2.2.3.4 Exposure to suicide. Participants were asked three items to establish whether they had friends or family who attempted or died by suicide (e.g., "Has anyone among your family attempted suicide?"). These items have been used in previous research (O'Connor et al., 2012) and have been shown to differentiate between those who think about suicide and those who attempt suicide (Dhingra et al., 2015).

2.2.4 Covariates: Demographic characteristics and mood

2.2.4.1 Demographic characteristics. We recorded the following demographic information: age, gender, marital status (married vs. not married), ethnicity (white vs. non-white) and economic activity (employed, inactive and unemployed).

2.2.4.2 Depressive symptoms. The Beck Depression Inventory-II (BDI-II; Beck et al., 1996) is a well-established measure tapping a range of depressive symptoms (e.g., self-dislike, loss of energy) containing 21 items. It has been shown to yield reliable, internally consistent, and valid scores in many different populations (e.g., Dozois et al., 1998), and in this study, it displayed high internal reliability (Cronbach's α = 0.95).

2.3 Statistical analysis

Data analysis was conducted using SPSS version 22. The missing data included items missed by participants and participants selecting 'would rather not say'. We used every participant's data as long as they had completed 75% or more of a psychological scale, this resulted in minimal missing data, <1% on any variable (range 0.31% to 0.86%; including those who had refused). These small amounts of missing data were checked against demographic characteristics and as there were no significant associations, expectation maximisation (EM) was applied to replace missing items for each scale. The multinomial regression model included only those who completed >75% of every measure (n=3330; 95% of total sample), with a small proportion of the data EM replaced. More information on the EM replacement method is included in the supplementary materials.

Additionally, the data were weighted to ensure that the attained sample based on the quota variables was in line with the population in the sample frame using rim weighting. Overall, as the quotas were almost always met (30-34 year olds, full-time students and full-time workers were slightly under-represented) the effect of the weights was small. All analyses and reporting of data were conducted with the weights on. More information on the rim weighting is included in the supplementary materials.

To investigate the respective influence of the motivational and volitional phase variables, initial univariate multinomal regression analyses were conducted. To control for the number of comparisons the Holm-Bonferroni correction method (Holm, 1979) was applied. In order to identify which variables independently distinguished between the groups, a multivariable multinomial logistic regression was performed. Specifically, demographic and mood variables were entered as covariates (age, gender, marital status, ethnicity, economic activity and depressive symptoms), followed by the motivational phase variables (defeat,

entrapment, perceived burdensomeness, thwarted belongingness, goal disengagement, goal reengagement, social support and resilience) and then the volitional phase variables (acquired capability, impulsivity, mental images, exposure to suicide death (family & friend), exposure to suicide attempt by friend, exposure to suicide attempt by family) were entered. Odds ratios (OR) indicating the likelihood of each variable's association with the higher risk group were reported (i.e., the ideation and attempt groups relative to the controls, and the attempt group relative to the ideation group), with those greater than one indicating increased risk and less than one decreased risk. To estimate the variance explained by the volitional variables in distinguishing between the suicide ideation and attempt groups, a binary logistic regression was conducted with only the volitional variables.

To better understand how well the volitional phase measures distinguish between those who have thought of suicide only and those who have made a suicide attempt at an individual level, the sensitivity (i.e., proportion of the sample high on a volitional phase variable that were correctly identified as having made a suicide attempt) and specificity (i.e., the proportion of the sample that were low on a volitional phase variables and had not made a suicide attempt) of each of the volitional phase variables is reported, along with their positive predictive value (i.e., the probability that the individual high on a volitional phase variable had attempted suicide) and negative predictive value (i.e., the probability that the individual low on a volitional phase variable had not attempted suicide). A cut-off score (mean +1SD) was created for the continuous variables to indicate those 'high' and 'low' on a particular volitional phase variable.

3. Results

3.1 Sample characteristics

In the primary analysis (n=3330), the majority of the sample had no suicidal history (n=2470; 74.6%), 14.3% (n=481) had experienced suicidal ideation in their lifetime but had never made a suicide attempt, and 11% (n=379) had attempted suicide in their lifetime. The descriptive statistics by group membership (i.e., ideation vs attempt vs control) and univariate differences for those who responded to the suicidal history questions (n=3435) are provided in Table 1. With demographics, the univariate multinomial regression analyses indicated that those with suicidal ideation were more likely to be male, not married and unemployed compared to controls, and those who had reported a suicide attempt were more likely to be female, older and unemployed than both the controls and those in the suicidal ideation group.

Members of the control group scored significantly lower on all of the psychological risk factors compared to those in the suicide ideation and suicide attempt groups; this included depressive symptoms, defeat, entrapment, acquired capability and impulsivity. Those in the suicide attempt group reported more frequent exposure to the suicidal behaviour of others, with almost 50% having been exposed to a friend making a suicide attempt, compared to just 16% for the control group. The control group reported higher levels of protective factors such as resilience and social support. A similar pattern emerged between the two suicidal history groups; those in the suicide attempt group more strongly endorsed the motivational and volitional phase risk factors compared to those in the suicide ideation group.

[Insert Table 1 about here]

3.2 Multivariable multinomial regression analyses

The results of the multinomial regression analyses are presented in Table 2. The model was statistically significant (χ2 (42) = 1528.60, p<0.001; pseudo R-square (Cox and Snell) = 0.37). Those in the control group were significantly lower than both suicidal history groups on a combination of motivational (defeat and burdensomeness) and volitional phase factors (acquired capability, mental images, exposure to suicide attempt by family or friend). Additionally, those in the suicide attempt group were more likely to be female, older, and higher on impulsivity than controls. Depressive symptoms did not distinguish between any of the groups when all motivational and volitional factors were accounted for.

Similarly, those who reported a suicide attempt were older (OR=1.07 [95% CI= 1.03-1.10]) and more likely to be female (OR=0.49 [95% CI= 0.36-0.67]) than those in the ideation group. However, consistent with the IMV model, the only psychological factors that distinguished those in the suicide attempt group from those in the suicidal ideation group were volitional phase variables; none of the mood or motivational phase variables significantly differentiated between these groups. In comparison to those in the suicidal ideation group, those who reported a suicide attempt scored significantly higher on levels of acquired capability (OR=1.10 [95% CI= 1.06-1.14]), impulsivity (OR=1.02 [95% CI= 1.01-1.04]), mental images about death (OR=1.07 [95% CI= 1.03-1.10]) and they were significantly more likely to have been exposed to a suicide attempt of a friend (OR=1.49 [95% CI= 1.09-2.06]). In a binary logistic regression, the volitional phase factors accounted for 11% of the variance in distinguishing between the suicide ideation vs the suicide attempt groups (Nagelkerke R Square = .112).

[Insert Table 2 about here]

3.3 Sensitivity and specificity of the volitional phase variables in differentiating between suicide ideation and suicide attempt groups

The findings of the sensitivity and specificity analyses are displayed in Table 3. Being high on acquired capability, impulsivity and mental images, as well as each of the exposure variables, identified those who had made a suicide attempt over half of the time, with acquired capability being the most sensitive (56.9% correctly identified). The specificity of the individual variables was higher overall (range 57.9 – 62.6%), indicating that being low on the volitional phase variables was more specific at identifying those who had not made a suicide attempt. All the volitional variables, when taken together, identified around 46% of those who had made a suicide attempt, and three quarters of those who had not. The positive predictive values (PPV) ranged from 37.1% - 54.5%, with mental imagery having the highest PPV. The negative predictive values (NPV; range 61.9%-77.4%) were higher; indicating being low on a volitional variable was a better predictor of who had not attempted suicide than being high was a predictor of those who had. The PPV increased when all volitional variables were taken into account, with approximately 60% of those predicted to have made a suicide attempt correct, with almost two-thirds for the NPV.

[Insert Table 3 about here]

4. Discussion

We tested a key premise of the integrated motivational-volitional model (IMV, O'Connor, 2011; O'Connor & Kirtley, 2018), namely that volitional phase factors are key to governing the transition from suicidal ideation to a suicide attempt. We hypothesised that i) motivational and volitional phase factors would differentiate non-suicidal controls from

those who had a history of suicidal ideation or suicide attempts, and ii) only volitional phase factors would differentiate between those who had a history of suicidal ideation and those who had attempted suicide in a multivariable analysis. Findings yielded clear evidence in support of both hypotheses. Specifically, a combination of motivational and volitional phase variables distinguished the control group from both the suicide ideation group and the suicide attempt group. Whereas, apart from some demographic differences (those in the attempt group being older and female), only volitional phase variables differentiated between those with a history of suicidal ideation and those who had reported a suicide attempt; with the latter group reporting higher levels of acquired capability, impulsivity, mental imagery about death and they were more likely to have been exposed to the suicide attempt of a friend.

This study adds to the growing literature highlighting the importance of the volitional phase factors within the IMV model (e.g., O'Connor et al., 2012; Dhingra et al., 2015) and the *ideation-to-action* framework more generally (Klonsky et al., 2017). It is also unique as it is the first study of its kind to investigate the role of volitional phase factors in a large, nationally representative sample. Although motivational phase variables, including key components of IPT (e.g., perceived burdensomeness) and the IMV model (e.g., defeat), are useful to identify who may think of suicide, they are not the key drivers of behavioural enaction. In light of the recent concerns that most risk factors do not distinguish between those suicidal individuals who are/are not at increased risk of making a suicide attempt (Klonsky and May, 2014), the present volitional phase findings are important as they address this dearth in the research literature. Crucially though, they highlight potential

targets for interventions and therapies, consistent with a recent call to action to identify better markers of suicide risk (Holmes et al., 2018).

Our study adds to the recent research on sensitivities and specificities in the context of risk assessments, showing that the latter fail to accurately predict suicidal behaviour over time (Quinlivan et al., 2017; Steeg et al., 2018). In the present study, the sensitivity of the volitional phase variables in differentiating between the suicide ideation vs suicide attempt groups was relatively low (46% correctly identified), therefore potentially limiting their utility in assessing risk at an individual level. However, given that our study design is investigating *lifetime* suicidal ideation and attempts, low sensitivities are not unexpected because the measures were assessed retrospectively; in many cases individuals had thought about suicide or attempted suicide many years before taking part in the study (indeed the overwhelming majority of participants had attempted suicide more than 12 months ago). Moreover, as our measures are not diagnostic tests nor were they designed as such (they are theoretically derived constructs), the utility of reporting sensitivities and specificities is at best only informative. Nonetheless, as noted above, the associations identify key parameters that could be targeted in interventions to reduce suicide risk.   One could also argue that the volitional phase variables are actually quite powerful as they still identify those who have attempted suicide compared to those who have thought about suicide years later (albeit that the effect sizes are low). Taking the findings in context, therefore, we believe that the volitional phase variables are important treatment targets which routinely should form part of a clinical formulation.

Consistent with previous findings (e.g., Dhingra et al., 2015; Mars et al., 2018), exposure to suicide in others, in particular to the suicide attempt of a friend, was most strongly

associated with belonging to the suicide attempt group. Contrary to our predictions, the other exposure variables of suicide attempt by family member or death by suicide of either a family member or a friend, did not significantly differentiate between those in the suicidal ideation and the suicide attempt groups. It would be useful to explore why these other types of exposure did not differentiate between the groups. Interestingly, Mars et al. (2018) found a dose response effect with adolescents, whereby exposure to self-harm in both family and friends was 5 times higher in their suicide attempt group compared to those reporting suicide ideation only.   A number of mechanisms have been suggested to explain this relationship; including that exposure to suicidal peers increases risk due to suicide modelling via social learning (Insel & Gould, 2008) and cognitive accessibility (Biddle et al., 2012). Contagion may also be more likely due to assortative relating processes whereby similar individuals are more likely to associate (Joiner, 2003), and there may even be evidence for a genetic basis to imitation (Brent and Melhem, 2008). Although further research is needed to better understand the mechanisms behind this phenomenon, ultimately the present study highlights the importance of exposure to suicide as a key risk factor for a suicide attempt.

Additionally, recent research suggests that exposure to suicidal or self-harming behaviours may act as painful and provocative life experiences which feed into acquired capability (Klonsky et al., 2017). Although measures of acquired capability were only weakly associated with suicide attempt history in a recent meta-analysis (Chu et al., 2017), the concept of having to override an innate instinct for survival appears important in understanding the transition to a suicide attempt (Klonsky and May, 2015). Specifically, having fearlessness about death and reduced pain sensitivity appear to be important mechanisms in increasing

the ability to act upon one's thoughts of suicide (Smith et al., 2010). Indeed, Kirtley and colleagues (2016) in a systematic review found a pervasive relationship between lower pain sensitivity and self-harm more generally but highlighted the dearth of research in this area (Kirtley et al., 2016). A better understanding of how capability for suicide develops requires urgent attention, in particular whether its effects can be buffered by protective interventions such as safety planning (Stanley and Brown, 2012).

Impulsivity could also increase acquired capability through more exposure to painful events (Anestis et al., 2014). Although impulsivity is an established risk factor, traditionally thought to facilitate suicidal behaviours by increasing the likelihood of enacting suicidal thoughts (Mann et al., 1999), more recent findings have questioned the nature of this relationship. As in this study, a meta-analysis found the relationship between trait impulsivity and suicidal behaviour was relatively small (Anestis et al., 2014). Arguably, the research fails to differentiate between state and trait impulsivity; as an individual high in trait impulsivity may plan a suicide attempt (and vice versa) (Gvion and Apter, 2011). Therefore, impulsivity remains a problematic concept that may be difficult to target in interventions; trait impulsivity may not accurately reflect the individual's suicidal intentions, but from a clinician's perspective it may be useful to be aware of this.

The finding that mental imagery related to death distinguishes those who have made a suicide attempt from those who have not is important and novel. It is consistent with Holmes et al. (2007) who found that 'flash forwards', defined as imagined future acts of suicide or self-harm are associated with suicide risk. They may be important targets for intervention, with evidence showing that a reduction in suicidal imagery is associated with less suicidal thoughts over time (Ng et al., 2016). However, to be effective, the key

mechanisms need to be explored further as there is competing evidence. For example, it has been suggested that imagery increases the cognitive availability of powerful images (Florentine and Crane, 2010), potentially leading to more distress (Holmes and Mathews, 2005); however, for some the images may also function as a deterrent for suicidal behaviour (Crane (Crane et al., 2012) et al., 2012). In contrast, it is also suggested that habituation may occur, whereby the fear of the (suicidal) act is reduced thereby facilitating behavioural enaction (Crane et al., 2012). In short, we need to advance our understanding of how experiencing suicide 'flash forwards' increases suicide risk, and then how best to intervene to reduce suicide risk.

Limitations

Although this study had many strengths, a number of potential limitations should be noted. First, the data were cross-sectional; therefore causality or directionality cannot be inferred. Second, as with much psychological research, the measures here are reliant on self-report, therefore they are subject to memory and reporting biases. Indeed, suicidal ideation in particular may be subject to mis-reporting (Mars et al., 2016), and as the former was assessed using a single item, we were not able to tap the intensity or severity of thoughts. Third, although the sample was representative of young people across Scotland, it may not be generalisable to other populations, in particular to clinical groups who are at increased risk of suicidal behaviour. Finally, and as noted earlier, the effect sizes of the volitional phase variables were relatively small but given the retrospective study design this is perhaps not surprising as many of the suicide attempts occurred several years ago. Therefore, future research should investigate the extent to which such factors predict suicide attempts over time. Furthermore, Prentice and Miller (1992) set out clear guidelines

when small effect sizes should be considered as important. This occurs under two conditions; (1) when the intervention is minimal or (2) when the outcome is difficult to influence. Here the outcome (suicidal behaviour) is relatively hard to predict or manipulate and the predictors here are minimal (scores on a scale). This is why within medicine when a minimal intervention (e.g., aspirin) that has a small (r = .034, which converts to an OR of 1.13) but significant effect in reducing a difficult to influence outcome (e.g., risk of future cardiovascular events) it has important public health implications (Steering, 1988). Thus while the effect sizes are small this does not necessarily negate their importance.

Despite these limitations, the current research is unique and represents the most robust test to date of the volitional phase of the integrated motivational-volitional model of suicidal behaviour (O'Connor and Kirtley, 2018). In the multivariable analyses, only volitional phase factors (acquired capability, exposure to a friend's suicide attempt, mental imagery and impulsivity) differentiated those who reported suicide ideation from those who reported a lifetime suicide attempt. It extends our understanding of the factors which aid the transition from suicidal thoughts to attempts and it provides strong support for the ideation-to-action framework (Klonsky et al., 2017). As highlighted, future research would benefit from more prospective studies with high-risk populations, as well as further exploration of how these particular volitional factors emerge, how best to incorporate them into risk assessment protocols and how to optimally target them in interventions.

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Figure 1: The integrated motivational-volitional model of suicidal behaviour (O'Connor, 2011; O'Connor & Kirtley, 2018)
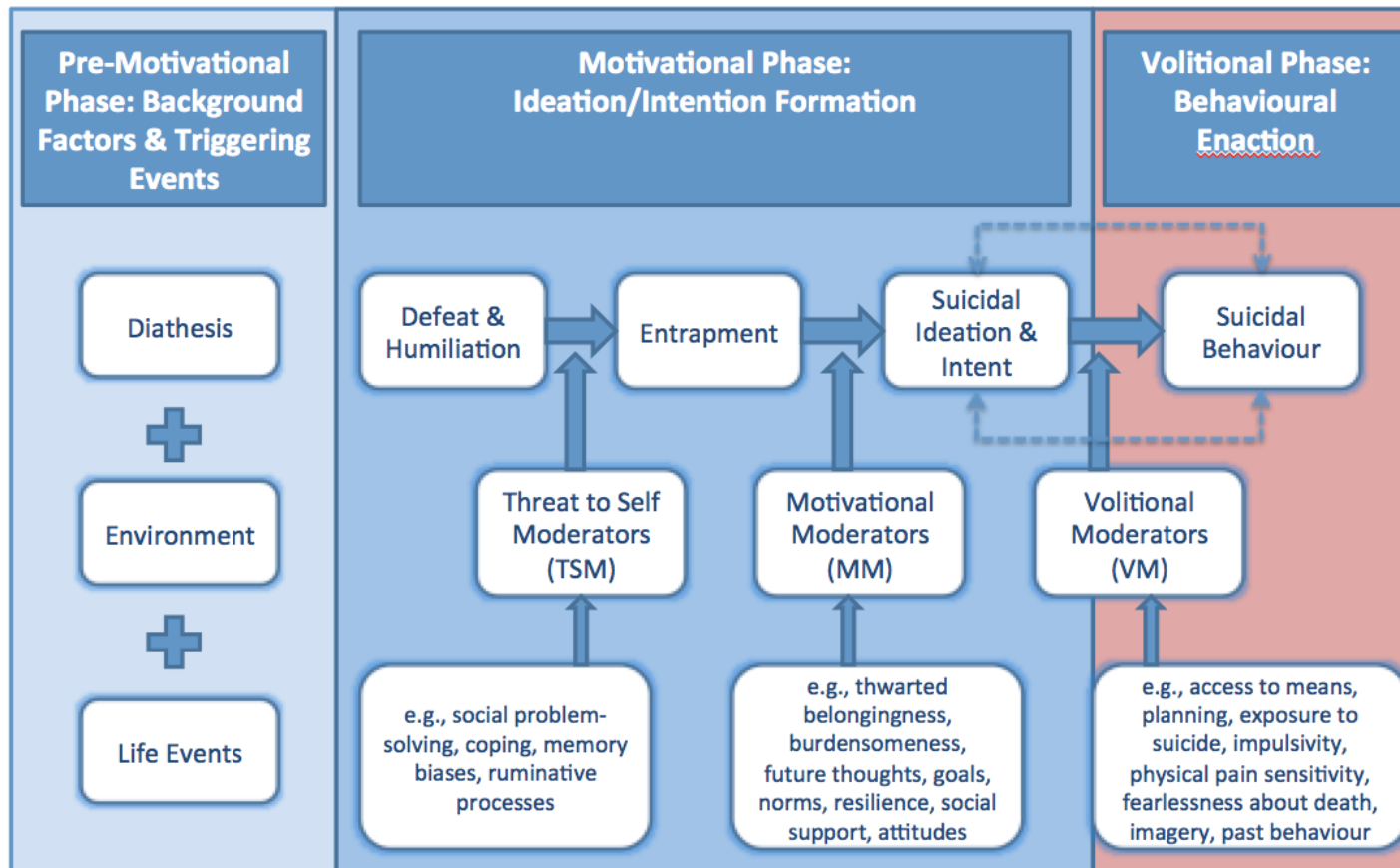
Table 1: Descriptive statistics and univariate multinomial regression analyses for non-suicidal control, suicide ideation and suicide attempts groups (n=3435)

	Total (n=3435)	Control (n=2534)	Ideations (n=498)	Attempts (n=403)	Chi-square (χ^2)	Significant differences (OR) [a]
Categorical Variables	%	%	%	%		
Gender[1] (female)	49.4	48.5	45.1	60.5	24.39***	C < I (1.16); C > A (0.62); I > A (0.53)
Ethnicity[2] (white)	93.8	93.6	93.5	95.1	1.61	
Marital status[3] (not married[b])	83.1	81.3	88.7	86.2	19.20***	C > I (0.56); I < A (1.30)
Economic activity[4][c] Employed Economically Inactive Unemployed	61.8 27.9 10.2	64.7 27.1 8.2	56.2 30.8 13.0	50.8 30.5 18.7	57.58***	C > I (0.56); C > A (0.35); I > A (0.63) C > A (0.54)
Exposure to suicide death (family & friend)	19.9	15.9	28.0	34.5	88.98***	C < I (2.05); C < A (2.77); I < A (1.35)
Exposure to suicide attempt (family)	20.9	15.7	31.3	40.6	149.15***	C < I (2.45); C < A (3.68); I < A (1.50)
Exposure to suicide attempt (friend)	22.0	16.0	32.9	46.0	196.05***	C < I (2.57); C < A (4.48); I < A (1.74)
Continuous Variables	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*		
Age	25.70 (4.86)	25.64 (4.90)	25.33 (4.70)	26.54 (4.70)	13.49	C < A (1.04); I < A (1.05)
Depressive symptoms	10.83 (11.23)	7.27 (7.58)	18.69 (12.09)	22.93 (15.20)	945.45***	C < I (1.11); C < A (1.14); I < A (1.02)
Defeat	16.24 (13.24)	11.95 (9.64)	26.39 (13.63)	29.98 (16.09)	982.74***	C < I (1.10); C < A(1.12); I < A (1.02)
Entrapment	10.27 (13.79)	5.94 (9.06)	20.64 (15.90)	24.32 (18.88)	889.45***	C < I (1.09); C < A(1.10); I < A (1.01)
Burdensomeness	13.81 (7.58)	11.48 (4.90)	19.24 (9.16)	21.31 (10.30)	862.23***	C < I (1.17); C < A(1.19); I < A (1.02)
Belongingness	11.56 (6.55)	10.06 (5.54)	15.26 (6.99)	16.17 (7.70)	473.47***	C < I (1.13); C < A (1.15); I < A (1.02)

Goal Disengagement	12.56 (3.20)	12.48 (3.15)	12.93 (3.26)	12.55 (3.37)	7.75*	C < I (1.04)
Goal Reengagement	14.10 (4.28)	13.73 (4.07)	14.81 (4.39)	15.56 (5.04)	78.77***	C < I (1.06); C < A (1.10); I < A (1.04)
Social Support	25.78 (4.59)	26.56 (3.91)	23.93 (5.39)	23.18 (5.72)	262.20***	C > I (0.89); C > A (0.87); I > A (0.98)
Resilience	28.22 (7.44)	29.60 (6.59)	25.40 (7.52)	23.43 (9.27)	320.31***	C > I (0.93); C > A (0.90); I > A (0.97)
Acquired capability	14.01 (4.26)	13.62 (4.08)	14.43 (4.24)	15.96 (4.75)	109.53***	C < I (1.05); C < A (1.14); I < A (1.09)
Mental Images	13.47 (5.18)	11.69 (3.51)	17.30 (5.08)	19.71 (6.56)	1255.37***	C < I (1.31); C < A (1.41); I < A (1.07)
Impulsivity	61.84 (10.86)	59.97 (10.14)	65.20 (10.93)	69.12 (11.27)	305.90***	C < I (1.05); C < A (1.08); I < A (1.03)

OR = Odds Ratio

*p<0.05, **p<0.01, ***p<0.001

† C = control, I = Ideations, A = Attempts

[1] Female as reference, [2] Not married as reference, [3] Non-white as reference, [4] Unemployed as reference

[a] Only statistically significant (p<0.05) associations reported, after Holm-Bonferroni sequential correction applied to each set of comparisons.

[b] not married includes single, separated, divorced and widowed

[c] Economic activity reduced to 3 categories based upon the APMS dataset; *'Employed'* are economically active people, *'Economically Inactive'* includes students, those looking after home, long term sick or disabled, or retired, *'Unemployed'* are those out of work but are available to start work.

Table 2: Multinomial logistic regression of variables associated with suicidal history group membership (n=3330)

Model variables	Ideation vs. Control[a]			Attempts vs. control[a]			Attempts vs. ideation[b]		
	B	OR	95% CI	B	OR	95% CI	B	OR	95% CI
Age	0.00	1.00	0.98 - 1.03	0.07	1.07***	1.04 - 1.10	0.06	1.07***	1.03 - 1.10
Gender[1]	0.07	1.07	0.84 - 1.37	-0.65	0.52***	0.39 - 0.70	-0.72	0.49***	0.36 - 0.67
Ethnicity[2]	-0.08	0.93	0.57 - 1.50	0.20	1.23	0.65 -2.31	0.28	1.33	0.69 - 2.54
Marital status[3]	-0.25	0.78	0.54 - 1.13	-0.10	0.91	0.60 - 1.44	0.15	1.16	0.74 - 1.83
Economic Activity[4]									
Employed[c]	0.03	1.03	0.69 – 1.52	-0.37	0.69	0.45 – 1.08	-0.39	0.68	0.44 – 1.04
Inactive	-0.14	0.87	0.57 – 1.33	-0.55	0.57	0.36 – 0.93	-0.42	0.66	0.41 – 1.06
Depressive symptoms	0.00	1.00	0.98 - 1.02	0.01	1.01	0.99 - 1.03	0.01	1.01	0.98 - 1.03
Defeat	0.04	1.04***	1.02 - 1.06	0.03	1.03**	1.01- 1.06	-0.01	0.99	0.97 - 1.02
Entrapment	0.00	1.00	0.98 - 1.01	-0.02	0.98	0.97 - 1.00	-0.01	0.99	0.97 - 1.00
Burdensomeness	0.06	1.06***	1.04 - 1.09	0.07	1.07***	1.04 - 1.10	0.01	1.01	0.99 - 1.03
Belongingness	0.01	1.01	0.98 - 1.04	0.00	1.00	0.97 - 1.04	0.00	1.00	0.96 - 1.03
Goal Disengagement	0.02	1.02	0.98 - 1.06	-0.02	0.98	0.93 - 1.02	-0.04	0.96	0.92 - 1.00
Goal Reengagement	-0.01	0.99	0.97 - 1.02	0.00	1.00	0.97 - 1.04	0.01	1.01	0.97 - 1.04
Social Support	0.01	1.01	0.98 - 1.04	0.02	1.02	0.98 - 1.06	0.01	1.01	0.97 - 1.05
Resilience	0.01	1.01	0.99 - 1.03	-0.01	0.99	0.97 - 1.02	-0.02	0.98	0.96 - 1.01
Acquired capability	0.03	1.03*	1.00 - 1.06	0.13	1.13***	1.10 -1.18	0.09	1.10***	1.06 - 1.14
Impulsivity	0.01	1.01	1.00 - 1.02	0.03	1.03***	1.02 - 1.05	0.02	1.02**	1.01 - 1.04
Mental Images	0.17	1.18***	1.15 – 1.22	0.23	1.26***	1.22 – 1.31	0.06	1.07***	1.03 – 1.10
Exposure to suicide death (family & friend)	0.11	1.12	0.83 - 1.51	-0.9	0.92	0.65 - 1.30	-0.20	0.82	0.58 - 1.17

Exposure to family attempt	0.43	1.54**	1.16 – 2.03	0.66	1.93***	1.40 – 2.66	0.23	1.26	0.91 - 1.73
Exposure to friend attempt	0.31	1.37*	1.04 – 1.80	0.71	2.04***	1.49 – 2.80	0.16	1.49*	1.09 – 2.06

OR = Odds ratio, B = unstandardised beta
* p < 0.05, ** p < 0.01, *** p < 0.001 (statistically significant (p<0.05) associations after Holm-Bonferroni sequential correction applied to each set of comparisons)
[a]control as reference, [b]ideation as reference
[c] Economic activity reduced to 3 categories based upon the APMS dataset; *'Employed'* are economically active people, *'Economically Inactive'* includes students, those looking after home, long term sick or disabled, or retired, *'Unemployed'* are those out of work but are available to start work.
[1] Female as reference, [2] Not married (including single, separated, divorced and widowed) as reference, [3] Non-white as reference, [4]Unemployed as reference.

Table 3: The accuracy of the volitional phase variables in identifying who have made a suicide attempt compared to those who have thought about suicide.

Volitional Factors	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Acquired capability	56.9	60.4	37.1	77.4
Impulsivity	55.3	60.1	37.8	75.4
Mental images	53.8	62.6	54.5	61.9
Exposure to suicide death (family & friend)	50.0	57.9	34.6	72.2
Exposure to family attempt	50.6	59.0	40.8	68.2
Exposure to friend attempt	53.1	60.6	46.0	67.1
All volitional factors	46.0	75.2	59.3	63.6

PPV = Positive Predictive Value, *NPV* = Negative Predictive Value

Supplementary materials

Weighting of the data

The Scottish Wellbeing Study uses quota sampling based on age, sex and working status. The data were then weighted to ensure that the achieved sample on the quota variables was representative of the population in the sample frame using random iterative method (rim) weighting. Rim weighting allows weighting of different sample characteristics simultaneously, by using an algorithm that slightly distorts the variables. This means the weighted data more closely resembles the target population across a number of characteristics. Overall, as the quotas were almost always met (30-34 year olds, full-time students and full-time workers were slightly under-represented in the unweighted profile compared to the target profile) the effect of the weights was small, with the weights ranging from 0·81 to 1·30. All analyses were conducted with the weights on, with SPSS applying the weights to the analyses.

Expectation Maximisation

The Expectation Maximisation (EM) algorithm was applied to replace missing items within the data set. The algorithm is a method of finding the *maximum-likelihood* estimates for the parameters of a statistical model when there are missing data points. EM is an iterative method that approximates the the *likelihood function* (an inference that draws conclusions from the data through proportion or frequency). EM selects random values for each missing data point, and then uses those to estimate a second set of data; the new values are then used to create a better estimate for the first set, with the process continuing until the algorithm converges on a fixed point. This is conducted in SPSS and the method has been shown to be suitable for this type of missing data (Tsikriktsis, 2005).