The roles of impulsivity and aggression in suicidality

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Chapter 1

Impulsivity, aggression, and suicide: a systematic review and meta-analysis

Prepared in accordance with the author requirements for *Clinical Psychology Review* (Appendix 1, p. 73)

Abstract

While impulsivity and aggression are included in multiple psychological models of suicide, the empirical literature is characterised by inconsistency in the nature of these relationships. We conducted a systematic literature review and meta-analysis of associations between impulsivity and aggression with suicidality. We included studies of adults which assessed both suicidality and psychometric measures of impulsivity and/or aggression (n = 77). We used random effects meta-regression to explore whether different measures of impulsivity and/or aggression, or suicidality, and/or the demographic composition of samples, moderated relationships. We found weak positive relationships between impulsivity and aggression with suicidality overall. Trait and behavioral impulsivity were stronger predictors than were state or cognitive measures. Impulsivity and aggression were stronger predictors of suicide risk than other measures of suicidality. Impulsive aggression was a stronger predictor of suicidality in non-clinical and older populations, and for measures of suicidal ideation. Our findings help to crystallise complex relationships between impulsivity, aggression, and suicidality by demonstrating the contextual and individual-level factors which influence the nature of the relationships.

Introduction

Despite research identifying population-level risk factors, we are poor at identifying individuals at risk of suicide (Large, 2016; Large et al., 2016, 2018; Runeson et al., 2017; National Confidential Inquiry into Suicide and Homicide by People with Mental Illness, 2018). Counting risk factors alone performs no better than chance in predicting suicide (Franklin et al., 2017), and actuarial risk assessment tools are wrong 95% of the time (Chan et al., 2016; Carter et al., 2017). This may be due to the diversity of populations and measures employed across the literature. Here we focus on two key psychological constructs - impulsivity and aggression - in order to identify any systematic variation in their relationship to suicidality on the basis of demographic or methodological differences.

Impulsivity is proposed to increase suicidality (Barzilay & Apter, 2014; Anestis et al., 2014; Brent and Mann, 2005, 2006) but has been operationalized in a variety of ways (Anestis et al., 2014; Gvion and Apter, 2011). Definitions include risk-taking, sensation-seeking, behavioral disinhibition, preference for small immediate rewards over large distal rewards, deficits in planning, and affective states such as urgency (Anestis et al., 2014). It is included in three of ten leading psychological models of suicide (Barzilay and Apter, 2014). In Beck et al.'s (1990) Cognitive Model, impulsivity is a dispositional trait which increases suicidality (see also Wenzel and Beck, 2008). Alternatively, in Baumeister's (1990) Escape Theory, suicidality increases when individuals can no longer resist impulsive urges to remove themselves from aversive self-awareness via increased behavioral disinhibition. In the Integrated Motivational Volitional Model (O'Connor, 2011; O'Connor and Kirtley, 2018), impulsivity acts as a volitional moderator between suicidal ideation and action.

Unsurprisingly, given the lack of theoretical consensus, tests of associations between impulsivity and suicidality yield conflicting results. From their meta-analysis of associations between trait impulsivity and suicidal behavior, Anestis et al. (2014) concluded that the association is weak at best and argued that impulsivity acts indirectly via exposure to painful experiences. Conversely, Gvion and Apter (2011) concluded from a systematic review that the relationship is well established across clinical and

non-clinical populations. Vast diversity in the definitions of both suicidal behavior and impulsivity are likely to contribute to such discrepancies (Gvion and Apter, 2011; Klonsky and May, 2010; Lockwood et al., 2017). A recent meta-analysis, for example, found cognitive impulsivity to be a stronger predictor of suicidality than behavioral impulsivity (Liu et al. 2017; see also McHugh et al., 2019).

Impulsivity may also interact with aggression (Gvion and Apter, 2011; Gvion and Levi-Belz, 2018). This, too, is defined and operationalized in multiple ways. Broadly, aggression is any behavior intended to harm another person (Gvion and Apter, 2011). Aggression, irritability, hostility, and anger are often used interchangeably, despite unique definitions. Specifically, anger is the experience of annoyance, hostility, and displeasure (Deffenbacher et al., 1996); irritability is sensitivity to provocation (Bettencourt et al., 2006); and hostility is cynicism, mistrust, and denigration (Miller et al., 1996). Aggression can also be conceptualized as reactive (a response to perceived threat that is impulsive and emotionally charged) or proactive (premeditated and controlled; Gvion and Apter, 2011). As with impulsivity, while there is evidence that aggression correlates with suicidality, the nature of the relationship is unclear (e.g. Orri et al., 2018; Gvion and Apter, 2011).

Impulsivity and aggression may also form part of a larger psychopathology (Gorenstein and Newman, 1980; Mann et al., 1999; Mann and Currier, 2010; Seroczynski et al., 1999). Brent and Mann (2005, 2006) argue that impulsivity, hostility, and aggression, are part of a disinhibitory psychopathology operationalized as *impulsive aggression*. They define this as "the tendency to respond to provocation or frustration with hostility or aggression" (pp. 2720). Aggression appears in Wenzel and Beck's (2008) update of Beck et al.'s (1990) Cognitive Model in the same role as impulsivity (a dispositional trait which increases vulnerability to suicidality), and they argue that aggression and impulsivity are components of a larger disinhibitory psychopathology which increases suicidality. Impulsive aggression also plays a role in Brent and Mann's (2005) Clinical-Biological Model and in Plutchik, van Praag, and Conte's (1989) Two Stage Model. In the former, impulsive aggression is a familial trait which mediates between psychopathology and suicidality. In the latter, aggressive impulses are triggered by

stress, and the likelihood of them being expressed against the self is increased when coupled with psychiatric symptoms.

That impulsivity and aggression are conceptualised and measured as both states and traits may further contribute to complexity. In the models above, they are viewed as dispositional traits (Beck et al., 1990; Wenzel and Beck, 2008; Anestis et al., 2014; Brent and Mann, 2006), state responses to adversity and stress (Plutchik et al., 1989; McHugh et al., 2019), or a combination of the two (Baumeister, 1990; O'Connor, 2011). This distinction is relevant as trait and state measures of impulsivity correlate weakly with one another (Bagge et al., 2013; Cyders and Coskunpinar, 2012; Peters and Büchel, 2011; Reynolds et al., 2008; Wu et al., 2009) and differ in their relation to self-harm (Glenn and Klonsky, 2010). Furthermore, Liu et al. (2017) found time between a suicide attempt and the assessment of impulsivity moderated the relationship (the relationship was strongest when there was less than one month since a suicide attempt).

Here we investigated the extent to which different operationalizations of impulsivity and aggression are associated with suicidality. We also sought to determine whether relationships are moderated by demographic characteristics (sex, age, clinical or non-clinical). Specifically, we asked: (1) To what extent do impulsivity, aggression, and/or impulsive aggression, predict suicidality?, and (2) Are these relationships moderated by (a) the demographic composition of the sample, (b) the measure of impulsivity, aggression, or impulsive aggression, or (c) the measure of suicidality? As such, we sought to contribute to understanding of the nuanced pathways by which impulsivity and aggression influence suicidality.

Method

Search strategy and eligibility criteria

Eligibility criteria, search strategy, data collection, and analytic strategy were registered as a review protocol to the PROSPERO international prospective register (CRD42020160631). The review was conducted in accordance with PRISMA guidelines (Moher et al., 2015).

We excluded studies without published, validated, psychometric measures of impulsivity and aggression, or measures of suicidality. We excluded those which assessed non-suicidal self-harm or where suicidal intent was unknown as, although non-suicidal self-harm may develop into suicidality, they can have distinct aetiologies and functions (e.g. Willoughby et al., 2015; Hamza et al., 2015; Lohner and Conrad, 2006). Studies that included participants under the age of 16, for which an English language version was not available, reviews, and case studies, were excluded. We did not specify a start date for publications in our search and did not exclude publications on the basis of geographic location.

The search terms were agreed by the study authors based on expertise in psychological predictors of suicidality and a scoping review of operationalizations of impulsivity, suicide, and aggression. The search string was: ("impuls*" OR "disinhib*" OR "inhib*" OR "risk taking" OR "risk-taking" OR "behav* control" OR "adventuresomeness" OR "sensation seeking" OR "sensation-seeking" OR "novelty seeking" OR "novelty-seeking" OR "urgency" OR "premeditation" OR "perseverance" OR "response inhib*" OR "distractor interference" OR "proactive interference" OR "delay* response" OR "delay* discount*" OR "distortions in elapsed time" OR "inattention") AND ("aggress*" OR "ang*" OR "hostil*" OR "irritabil*" OR "violen*") AND ("suicid*"). The search was conducted on 4/6/21 using EMBASE, MEDLINE, PsychINFO, CINAHL, PubMed, Cochrane Library, PsychInfo, PsychArticles, and Web of Science.

The search returned 10,298 items. FM screened titles and removed duplicates and studies outside the area of interest, reviews or theoretical reports, case studies, or

those that specified participants under 16 (n = 9573). FM screened the abstracts of the remaining 725 articles in accordance with eligibility criteria and the Joanna Briggs Checklist for Analytical Cross-Sectional Studies (Moola et al., 2017). There was no instance where a study met eligibility criteria but scored below 67% on the checklist. HM evaluated a sub-set of 10% of the abstracts, with concordance of 98% and two discrepancies which were discussed and agreed. Forward and backwards searching of reference lists of all eligible studies identified one additional item. Seventy-seven studies from 75 samples were included in the review. See Figure 1 for a summary of the selection process.

To minimise file-drawer bias (Rosenthal, 1979), we emailed authors where further information was required to assess eligibility, if the relevant statistics were not reported, or where male and female participants were included but results were combined. Cases where additional data were supplied are noted in Appendix 2 (p. 84).

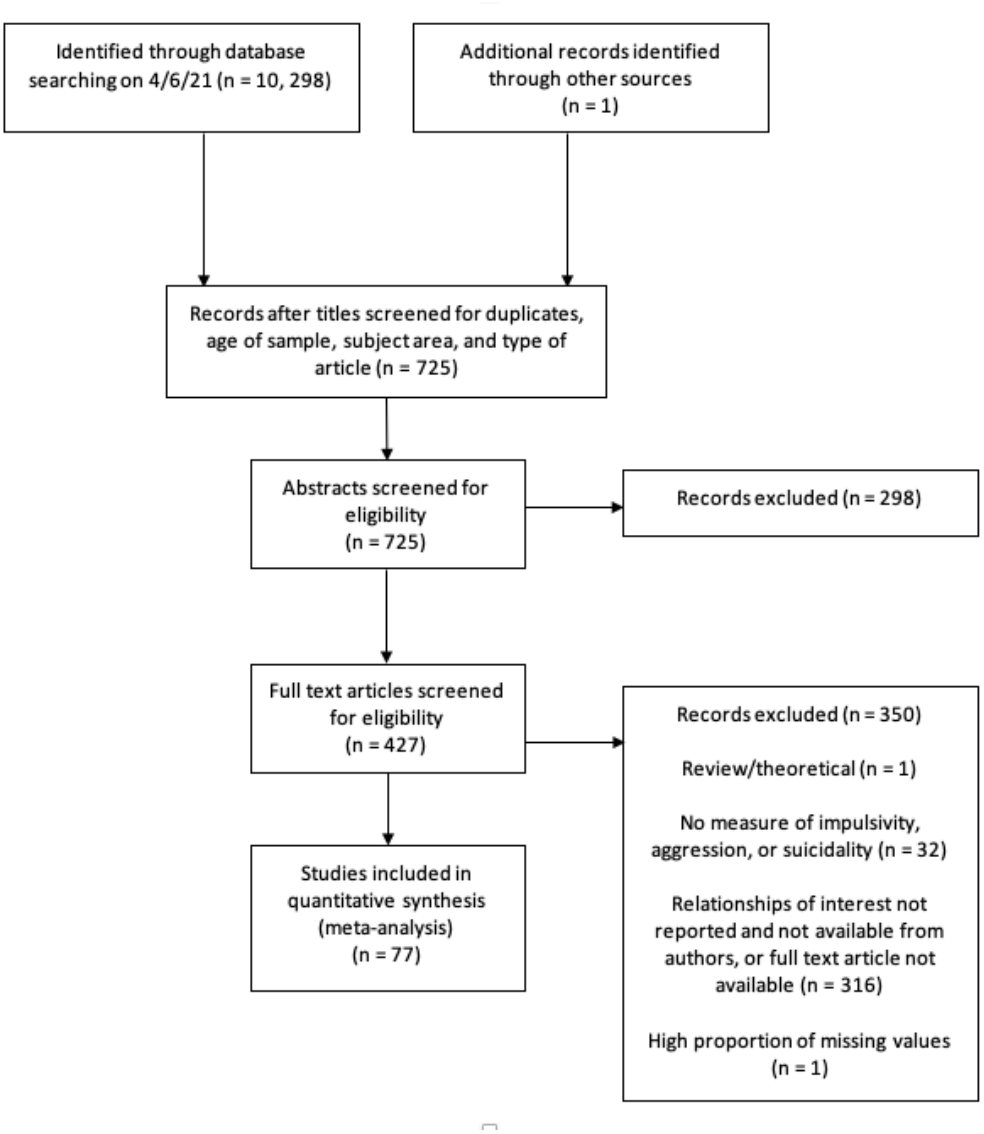

Figure 1 Screening and selection of articles

Data extraction

From each article which met eligibility criteria we extracted effect sizes, or statistical information required to calculate effect sizes, for associations between measures of impulsivity and aggression with measures of suicidality. We recorded the following study characteristics to be tested as moderators in analyses: population (clinical or non-clinical), age, sex, and measures of impulsivity, aggression, and suicidality. Where some effect sizes were reported and others were missing (n = 5 studies), we followed the Cochrane Handbook for Systematic Reviews of Interventions (2019). In all instances,

missing data were for outcomes that failed to reach statistical significance. In four (Margari et al., 2014; Perroud et al., 2013; Gvion et al., 2014; and Kotler et al., 1993), the proportion of missing values was relatively small (all < 39%). For one (Lewitzka et al., 2017), we considered the proportion of missing values to be too high (73%) and excluded the study.

Data analysis

We used Pearson's Correlation Coefficient (r) as our measure of effect size since various research designs were included in our sample (e.g. comparison of impulsivity in groups with and without a history of suicide attempt, or correlational tests of relationships between suicidal ideation and impulsivity). We adhered to Cohen's (1988) classification of small (r = 0.1), medium (r = 0.3), and large (r = 0.5) effect sizes. Where r was not reported, we calculated it from statistical information available in the article (or provided by authors). For clarity, non-significant effect sizes for which confidence intervals crossed '0' were not reported.

We used random effects models to incorporate subject and sampling error, as samples were not derived from the same population. We first assessed the pooled weighted effect sizes for associations between all measures of impulsivity, aggression, and impulsive aggression, across samples. As there were multiple results for each sample, the unit of analysis was the average effect size for each sample. Heterogeneity was assessed using I^2, Cochrane's Q, and confidence intervals.

Sex was coded such that samples with > 50% female composition were treated as 'female', and those with < 50% were treated as 'male'. Where there were equal numbers of men and women, or sex ratio wasn't reported, we coded the sample as 'both'. Age was treated as a continuous variable (estimate of central tendency from mean, median, or range). Population was coded as clinical (patients and deaths by suicide), non-clinical (community), or both.

For suicidality, we grouped outcome measures into the following categories: history of suicide attempt, current or previous suicidal ideation, number of lifetime suicide

attempts, age at first suicide attempt, suicide risk, lethality of suicide attempt(s), and cause of death.

We categorised measures of impulsivity in two ways. First, we treated self-report measures as 'trait' and neuropsychological measures as 'state' (McHugh et al., 1999; Liu et al., 2017). An exception was the Impulsivity Rating Scale (Lecrubier et al., 1995) which assesses self-reported impulsive behaviors in the past week and was treated as 'state'. Second, we grouped outcomes by broad domains of impulsivity. Recent reviews suggest that impulsivity can be meaningfully categorized as either cognitive or behavioral (e.g. Liu et al., 2017). Cognitive impulsivity is the inability to weigh the consequences of proximal and distal events in order to delay gratification, and behavioral impulsivity is deficits in response inhibition (Hamilton et al., 2015a,b). The two facets are weakly correlated and underpinned by distinct neural pathways (Hamilton et al., 2015a).

Measures of aggression were grouped as either state (in the past week) or trait (across the lifespan), and broad domain. Domains were classified as general aggression, anger, hostility, irritability, physical aggression, verbal aggression, and premeditated aggression. Finally, we included a category for impulsive aggression.

Each moderator was tested separately using meta-regression. Here, all results were included for each study to allow us to detect moderation by measures of impulsivity, aggression, and suicidality for which there were frequently multiple measures per study. While this approach has traditionally been advised against due to non-independence of multiple results from the same study, there is now consensus that modern methods of meta-regression are robust to this independence (Tipton et al., 2018; Gliner, Morgan, and Harmon, 2003). To correct for repeated sampling and reduce risk of Type 1 error we used the Hartung-Knapp correction (Tipton et al., 2018). Where a level of a moderator was reported in less than three studies we excluded those studies from moderation analyses.

Publication bias was visualised using funnel plots and assessed using Duval and Tweedie's Trim and Fill method. All analyses were conducted with Comprehensive Meta-Analysis Version 3 (Biostat, 2014).

Results

Seventy-seven publications reporting 501 results from 75 samples were included in analyses. Table 1 summarises sample characteristics. For articles included in analyses, see Appendix 2 (p. 84).

Table 1: Characteristics of the 77 studies included in analyses

Publication Year	Region	Clinical/non-clinical	Sex	Age
1990-1999 n = 8 2000-2009 n = 16 2010-2019 n = 49 2020-2021 n = 4	Africa n = 2 Asia n = 13 Australasia n = 2 Europe n = 12 North America n = 47 Multicenter n = 1	Both n = 15 Clinical n = 54 Non-clinical n = 8	Female biased n = 34 Male biased n = 24 Both n = 19	Range = 16-81

Appendices 3-5 describe measures of suicidality (p. 146), impulsivity (p. 149) and aggression (p. 155) reported across articles, and the number of studies employing each measure.

Impulsivity, aggression, and suicidality

The mean pooled effect size across all 75 samples was small, positive, and significant ($r = 0.21$ [95% CI: 0.17-0.25], $z = 9.57$, $p < 0.001$). There was significant heterogeneity ($I^2 = 96.96$, $Q(74) = 2432.15$, $p < 0.001$). Duval and Tweedie's Trim and Fill estimate of publication bias identified 8 studies to be missing to the right of the mean. When these

were imputed, the effect size increased to 0.24 (95% CI: 0.2, 0.28). For funnel plots see Appendix 6 (p. 160). Across all 501 results, psychological construct (impulsivity, aggression, impulsive aggression) did not moderate the relationship with suicidality ($F(2,498) = 1.74$, $p = 0.1765$, R^2 analog = 0.09).

Impulsivity and suicidality

The mean pooled effect size for relationships between impulsivity and suicidality (n = 71 samples) was small, positive, and significant (r = 0.19 [95% CI: 0.15-0.22], z = 9.91, $p < 0.001$; see Figure 2). There was significant heterogeneity ($I^2 = 95.37$, $Q(70) = 1512.14$, $p < 0.001$). Duval and Tweedie's Trim and Fill method estimated four studies to be missing from the right of the mean. When these were imputed, the effect size decreased to 0.14 (95% CI: 0.11, 0.19).

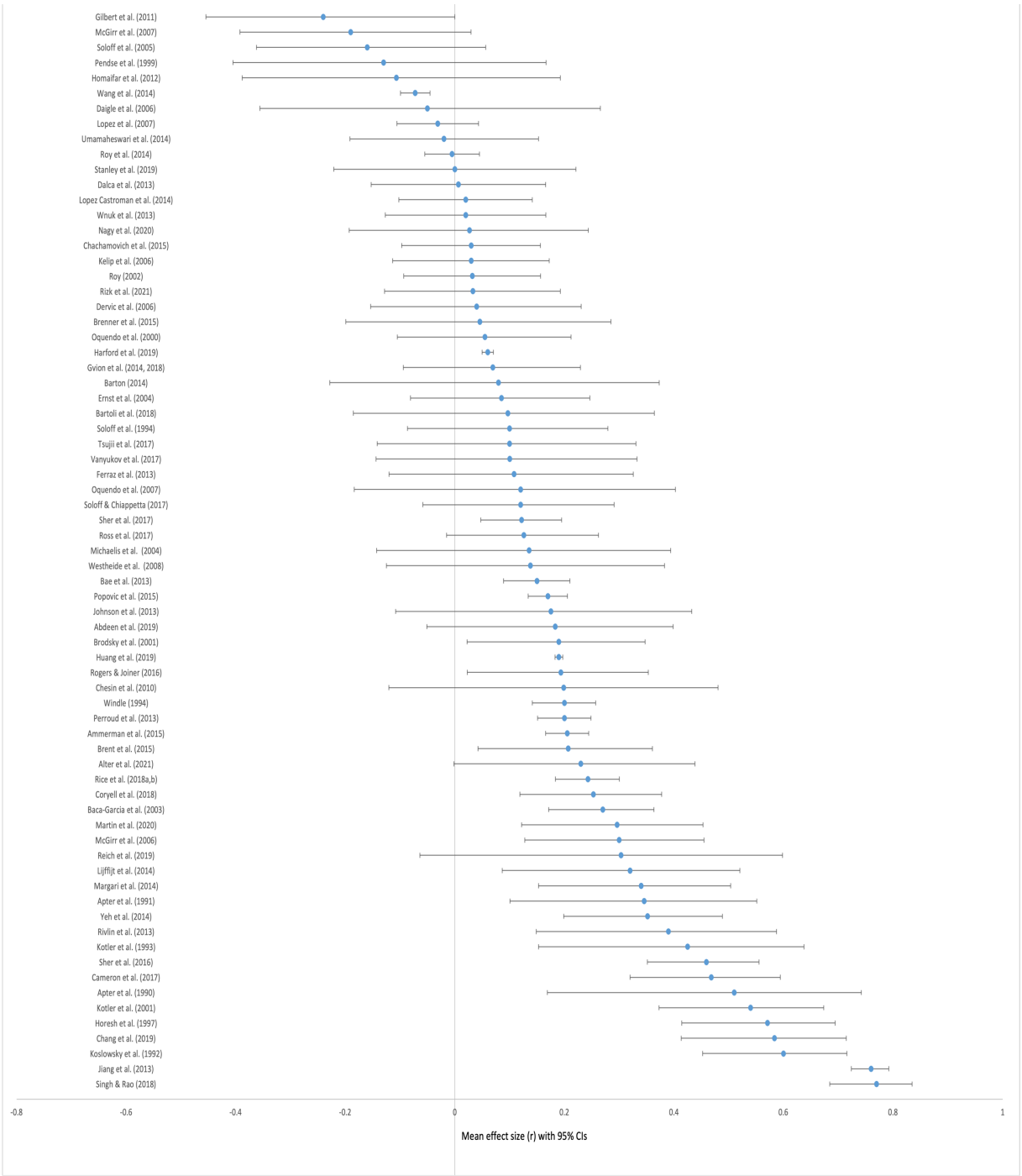

Figure 2 Forest plot showing mean and 95% CI of effect sizes for impulsivity in relation to suicidality

Measure of impulsivity (state or trait) moderated the relationship ($F(1,199) = 9.31$, $p = 0.0026$, $Tau^2 = 0.04$, $I^2 = 96.9\%$, R^2 analog < 0.01). The relationship between suicidality and (a) state impulsivity was small, negative, and non-significant and (b) trait impulsivity

was small, positive, and significant (r = 0.17 [95% CI: 0.14, 0.2], p < 0.0001, n = 184). See Figure 3.

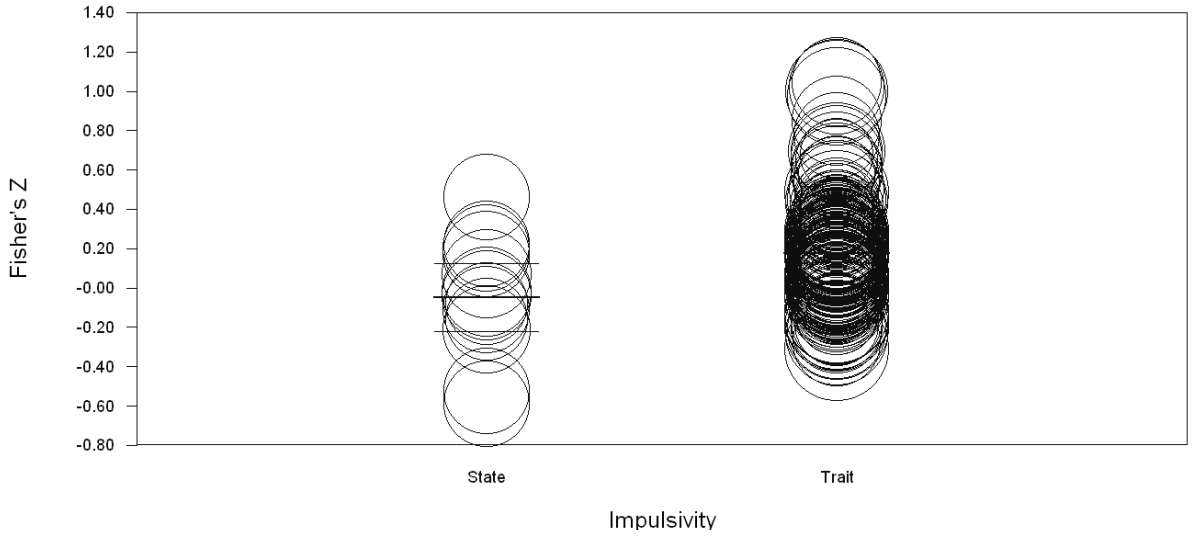

Figure 3 State and trait impulsivity as a moderator of the relationship with suicidality

Type of impulsivity (cognitive, behavioral, or both) moderated the relationship (F(2,197) = 9.58, p = 0.0001, Tau^2 = 0.02, I^2 = 93.3%, R^2 analog = 0.49; see Figure 4). The relationship between suicidality and (a) behavioral impulsivity was small, positive, and significant (r = 0.23 [95% CI: 0.19, 0.27], p < 0.0001, n = 54), (b) cognitive impulsivity was small, positive, and non-significant, and (c) both types of impulsivity was small, positive, and significant (r = 0.17 [95% CI: 0.14, 0.21], p < 0.0001, n = 102).

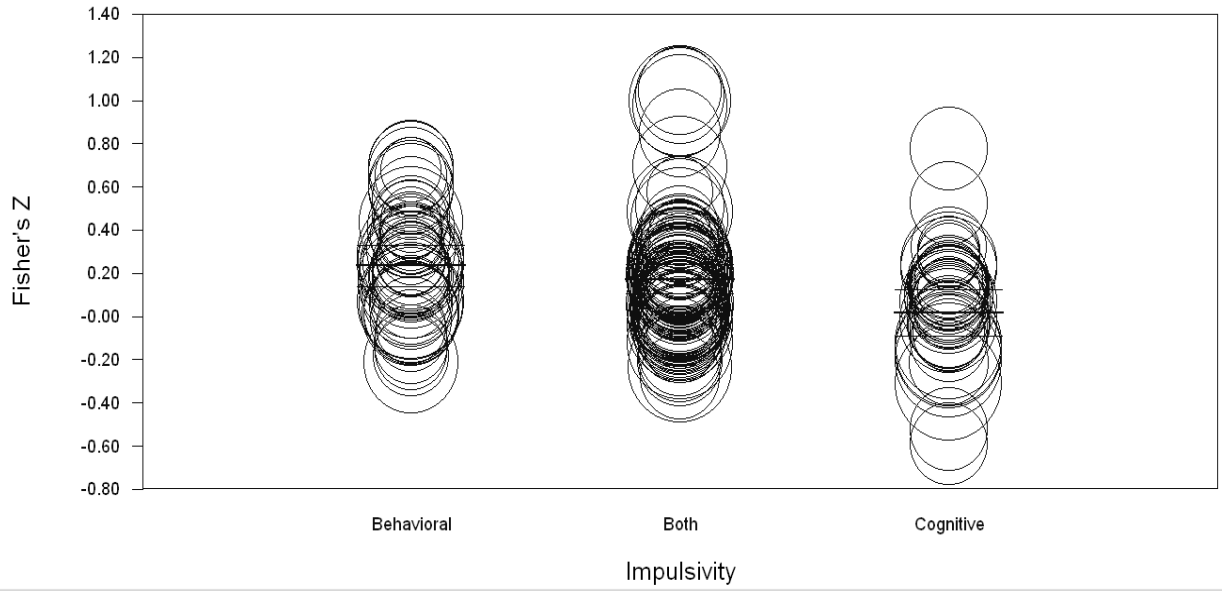

Figure 4 Type of impulsivity (cognitive, behavioral, or both) as a moderator of the relationship with suicidality

Measure of suicidality moderated the relationship ($F(6,193) = 4.39$, $p = 0.0003$, $Tau^2 = 0.05$, $I^2 = 96.69\%$, R^2 Analog < 0.01; see Figure 5). The relationship between impulsivity and (a) suicidal ideation was small, positive, and significant (r = 0.1 [95% CI: 0.03, 0.17], p = 0.005, n = 38), (b) lethality was small, positive, and significant (r = 0.08 [95% CI: 0.01, 0.15], p = 0.03, n = 19), (c) number of suicide attempts was small, positive, and significant (r = 0.13 [95% CI: 0.07, 0.2], p < 0.0001, n = 14), (d) suicide risk was medium, positive, and significant (r = 0.35 [95% CI: 0.26, 0.43], p < 0.0001, n = 23), (e) cause of death was small, positive, and non-significant, and (f) history of suicide attempts was small, positive, and significant (r = 0.18 [95% CI: 0.12, 0.23], p < 0.0001, n = 92). Age at first suicide attempt was excluded from this analysis (n = 2). Population (clinical, non-clinical, or both), age, and gender, did not moderate the relationship (all p > 0.05).

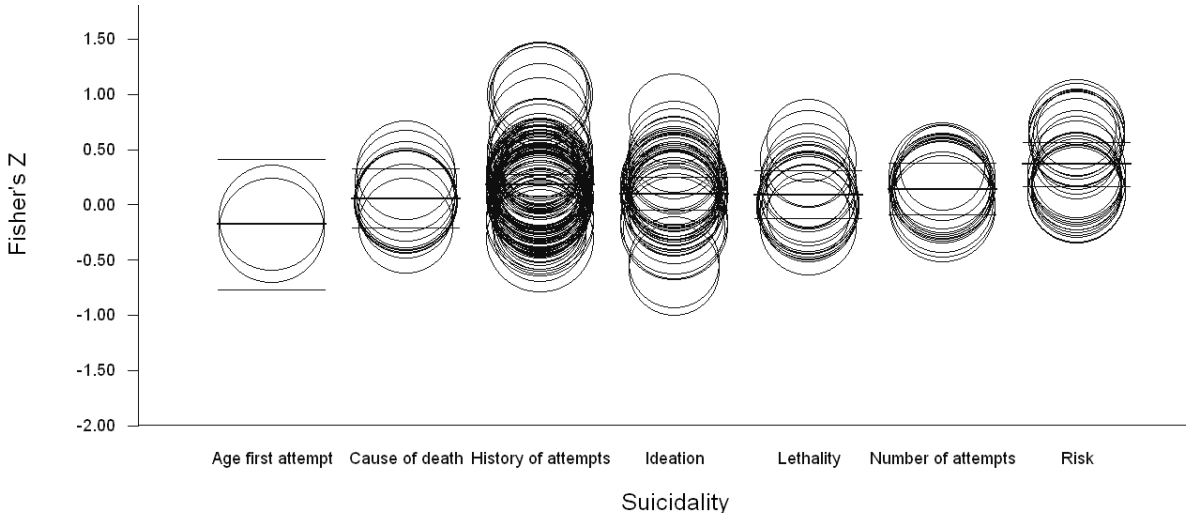

Figure 5 Measure of suicidality as a moderator of the relationship with impulsivity

Aggression and suicidality

The mean pooled effect size (r) for the relationship between aggression and suicidality across 65 samples was small, positive, and significant (0.23 ([95% CI: 0.17, 0.29], Z(62) = 7.17, $p < 0.0001$; see Figure 6). There was significant heterogeneity ($I^2 = 98.65$, Q (62) = 4581.53, $p < 0.0001$). Duval and Tweedie's Trim and Fill method estimated 26 studies to be missing from the right of the mean. When these were imputed, the effect size increased to 0.39 (95% CI: 0.33, 0.45).

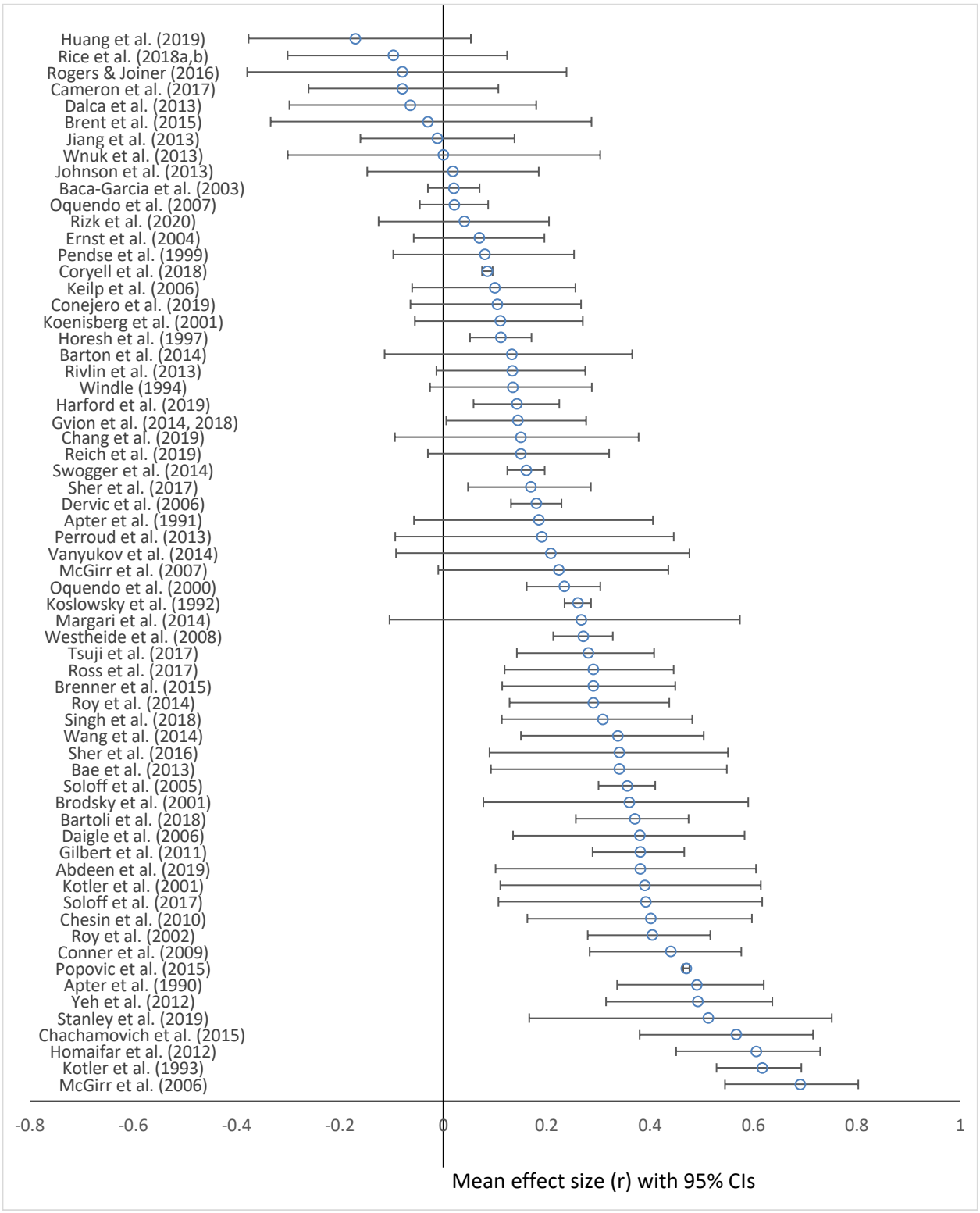

Figure 6 Forest plot showing mean and 95% CI of effect sizes for aggression in relation to suicidality

Measure of suicidality moderated the relationship across 211 results ($F(7,204) = 8.16$, $p < 0.0001$, $Tau^2 = 0.04$, $I^2 = 97.15\%$, Analog $R^2 = 0.15$; see Figure 7). The relationship between aggression and (a) age at first suicide attempt was small, negative, and significant (r = -0.1 [95% CI: -0.13, 0.07], p < 0.0001, n = 3), (b) suicidal ideation was small, positive, and significant (r = 0.24 [95% CI: 0.16, 0.31], p < 0.0001, n = 38), (c) lethality was small, positive, and significant (r = 0.1 [95% CI: 0.06, 0.15], p < 0.0001, n = 23), (d) number of suicide attempts was small, positive, and non-significant, (e) suicide risk was medium, positive, and significant (r = 0.46 [95% CI: 0.36, 0.56], p < 0.0001, n = 17), (f) cause of death was small, positive, and significant (r = 0.16 [95% CI: 0.06, 0.26], p = 0.002, n = 12), and (g) history of suicide attempts was small, positive, and significant (r = 0.21 [95% CI: 0.17, 0.25], p < 0.0001, n = 100).

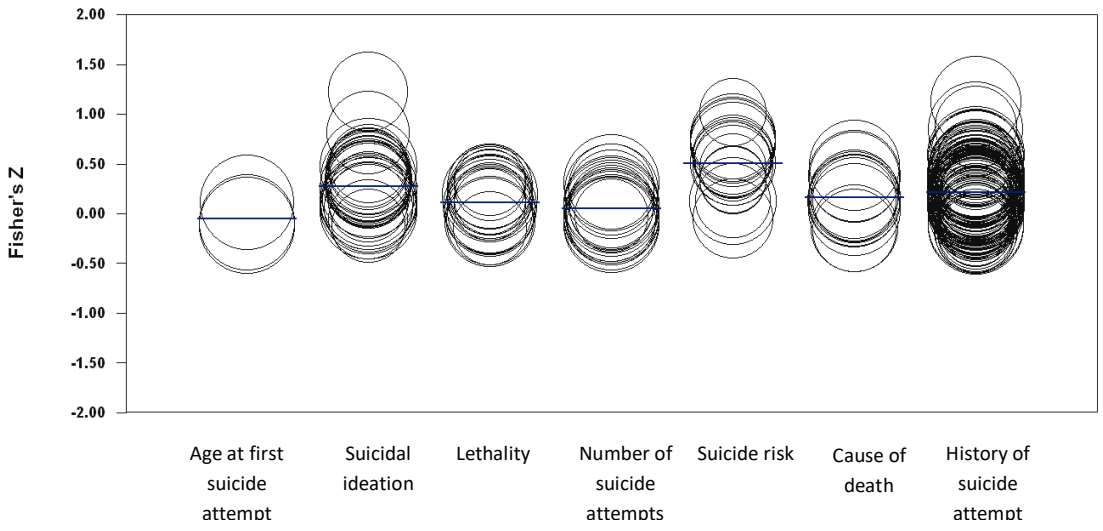

Figure 7 Measure of suicidality as a moderator of the relationship between aggression and suicidality

Population (clinical, non-clinical, or both), age, gender, and state or trait aggression did not moderate the relationship between aggression and suicidality (all p > 0.1).

Impulsive aggression and suicidality

The mean pooled effect size (r) for the relationship between impulsive aggression and suicidality across 28 samples was small, positive, and significant (0.16 [95% CI: 0.1, 0.22], ($Z(27) = 4.96$, $p < 0.0001$; see Figure 8). There was significant heterogeneity ($I^2 = 84.38$, $Q\ (27) = 166.41$, $p < 0.001$). Duval and Tweedie's Trim and Fill method estimated one study to be missing from the left of the mean. When this was imputed, the mean effect size dropped to 0.15 (95% CI: 0.09, 0.21).

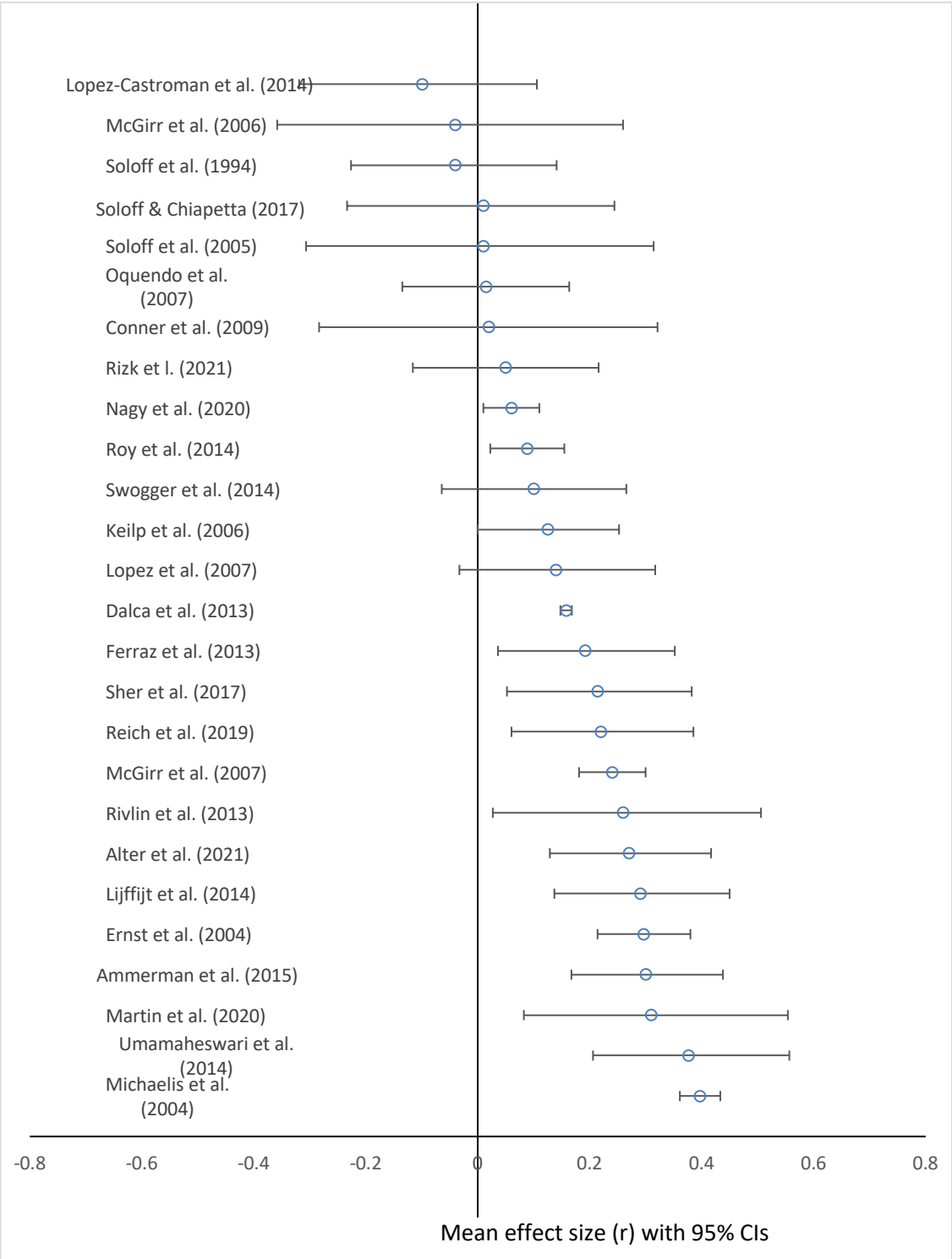

Figure 8 Forest plot showing mean and 95% CI of effect sizes for impulsive aggression in relation to suicidality

The relationship was moderated by population across 89 results (F(3,87) = 3.84, p = 0.0252, Tau^2 = 0.01, I^2 = 81.85%, R^2 analog = 0.18). The relationship between impulsive aggression and suicidality was (a) small, positive, and significant across studies with samples drawn from clinical populations (r = 0.18 [95% CI: 0.13, 0.23], p < 0.001, n = 63); (b) small, positive, and significant in those studies whose samples were drawn from non-clinical populations (r = 0.27 [95% CI: 0.2, 0.34], p < 0.001, n = 6), and (c) small, positive and significant in those studies whose samples were drawn from both (r = 0.09 [95% CI: 0.07, 0.11], p < 0.0001, n = 21; see Figure 9).

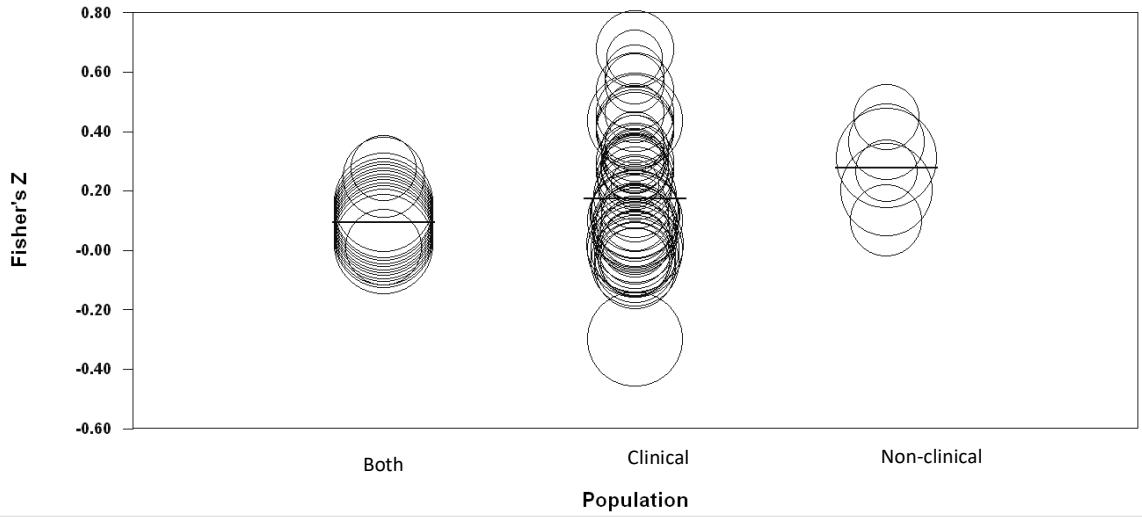

Figure 9 Population as a moderator of the relationship between impulsive aggression and suicidality

The relationship was moderated by age (F(1,57) = 8.26, p = 0.006, Tau^2 = 0.01, I^2 = 83.46%, R^2 analog = 0.04; see Figure 10). The relationship between impulsive aggression and suicidality increased with age profile of sample.

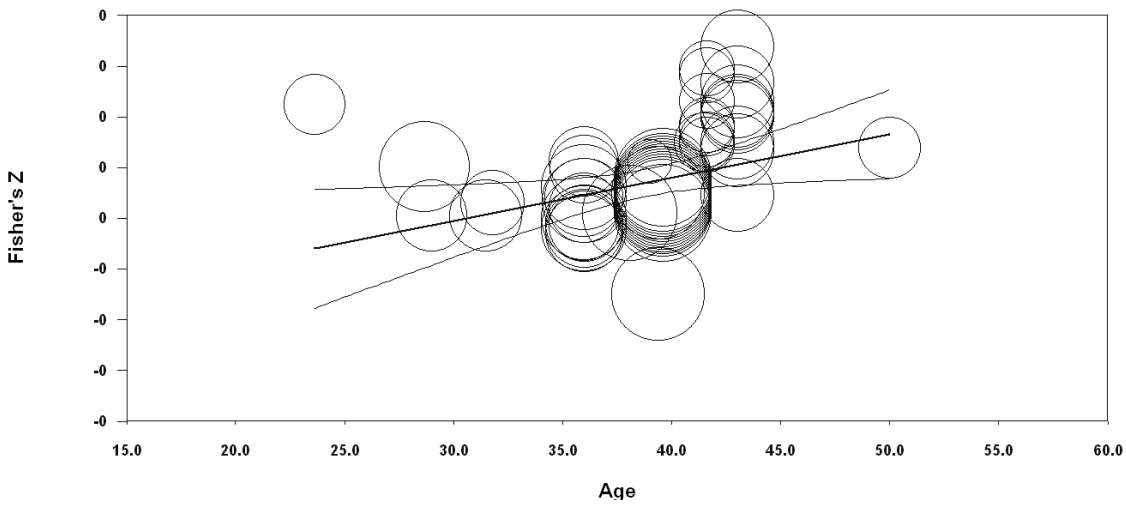

Figure 10 Shows moderation of the relationship between impulsive aggression and suicidality by age

Measure of suicidality moderated the relationship ($F(5,81) = 7.33$, $p < 0.0001$, $Tau^2 = 0.01$, $I^2 = 81.43\%$, Analog $R^2 = 0.24$). Suicide risk was excluded due to small sample size ($n = 2$). The relationship between impulsive aggression and (a) suicidal ideation was small, significant, and positive ($r = 0.27$ (0.17, 0.37), $p < 0.0001$, $n = 16$), (b) lethality was small, non-significant, and negative, (c) number of suicide attempts weak, significant, and positive ($r = 0.18$ (0.05, 0.15), $p < 0.0001$, $n = 15$), (d) cause of death was weak, significant, and positive ($r = 0.17$ (0.1, 0.24), $p < 0.0001$, $n = 8$), and (e) history of suicide attempts was weak, significant, and positive ($r = 0.18$ (0.14, 0.21), $p < 0.0001$, $n = 40$). See Figure 11.

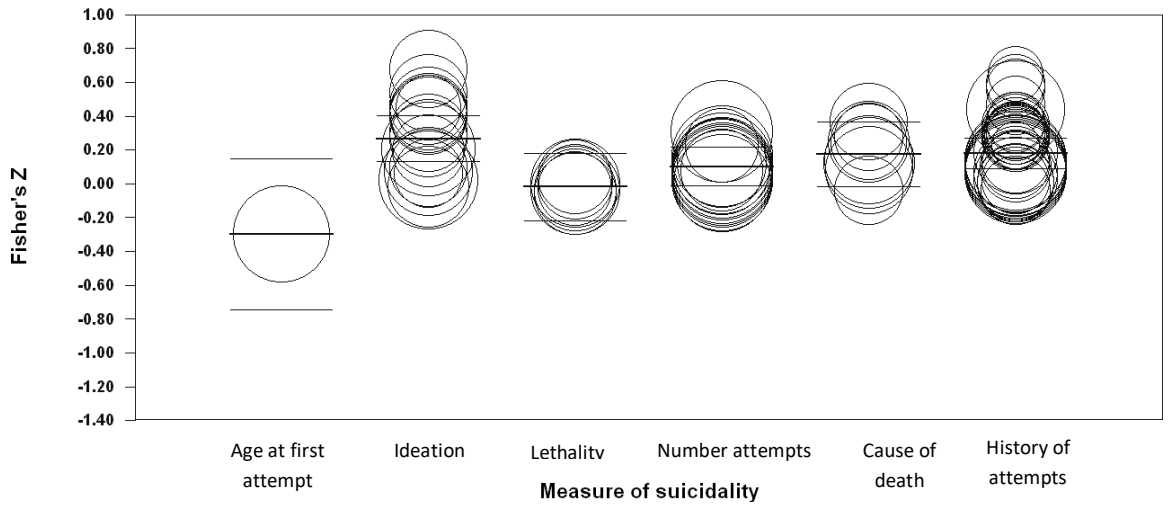

Figure 11 Measure of suicidality as a moderator of the relationship between aggression and suicidality

Discussion

In the largest meta-analysis to date, we found small positive relationships between impulsivity, aggression, and impulsive aggression, with suicidality. There was also significant heterogeneity, some of which was explained by demographic and methodological moderators.

Trait impulsivity was a stronger predictor of suicidality than state. This is consistent with models in which trait impulsivity serves as a distal risk factor for increased vulnerability to suicide (e.g. Beck et al., 1990; Wenzel and Beck, 2008; Anestis et al., 2014; Brent and Mann, 2006; O'Connor, 2011; O'Connor and Kirtley, 2018), and contrasts with those in which impulsivity increases risk when elevated under stress (Plutchik et al., 1989; McHugh et al., 2019; Liu et al., 2017). We could not, however, control for length of time between suicidality and assessment of impulsivity. The state-based tasks which assess impulsivity at one time-point may not correlate with past suicidality. There were no prospective studies of state impulsivity and suicidality, which would be the strongest test of this relationship. Furthermore, although the relationship between state and trait impulsivity is weak (Bagge et al., 2013; Cyders and Coskunpinar, 2012; Peters and Büchel, 2011; Reynolds et al., 2008; Wu et al., 2009), the ways in which an impulsive disposition translates to state impulsivity and suicidality during times of distress is unknown. We argue that, while our results support a role of trait impulsivity in suicidality, further work is required to determine how this relates to state impulsivity and suicidality under distress.

The relationship between impulsivity and suicidality was stronger for behavioral than cognitive impulsivity. This is in contrast with Liu et al. (2017; see also McHugh et al., 2019). Liu et al. (2017) analysed only neuropsychological measures of impulsivity, whereas we included these and self-reported assessments. Self-report may be less objective than neuropsychological assessments (Liu et al., 2017) and, as there were significantly more results for self-report than neuropsychological assessments in our sample (70 and 7, respectively; Appendix 4, p. 149), it is possible that we encountered a Type 1 error. Given the number of results testing both behavioral (n = 54) and cognitive (n = 43) impulsivity, however, we are confident that our finding has some

validity and argue that behavioral impulsivity (particularly when assessed through self-report) could be incorporated into models of suicidality.

The relationship between aggression and suicidality was not moderated by demographic factors or by measure of aggression. Unlike impulsivity there were no differences between state and trait measures of aggression, meaning that it is not possible to conclude with which psychological model of aggression and suicide our findings fit. For both aggression and impulsivity, the relationship was moderated by measure of suicidality such that, in both cases, the relationship was strongest for measures of suicide risk. Two measures of suicide risk were employed (SPS; Cull and Gill, 1982; SRS; Plutchik et al., 1989). Both include items that assess aggression (e.g. 'Have you ever been so angry you that you felt you might kill someone?'; Plutchik et al., 1989; 'When I get mad I throw things'; Cull and Gill, 1992), therefore we are cautious in interpreting a link between aggression and suicide risk using these measures. Furthermore, nearly all studies which assessed suicide risk were based on psychiatric inpatient samples and participants provided answers to risk measures as part of a clinical interview. We question, therefore, whether these populations are representative of links between suicidality, impulsivity, and aggression more broadly. For example, given evidence that risk assessment tools perform worse than chance (Chan et al., 2016; Carter et al., 2017), these relationships may reflect cultural or organizational beliefs about the contribution of impulsivity and aggression to suicidality, erroneously conflating the three and inflating clinician's ratings of risk. Furthermore, it would be insightful to know whether self-report assessment of risk correlates with clinician assessments (e.g. based on clinical interviews) and/or whether these relationships differ depending upon the population of interest. Aggression may be interpreted and treated differently in forensic psychiatric versus community populations, for example. In light of this, meta-analysis of standardized regression coefficients which control for demography and mental health would be desirable. In our dataset, however, there was insufficient consistency in the ways in which demography and mental health were assessed to facilitate this.

The relationship between suicidality and impulsive aggression was moderated by population, such that it was stronger in studies of non-clinical populations. This may,

again, reflect differences in the ways in which individuals rate or report their own suicidality compared to clinician judgement or objective measures such as cause of death. Clinical samples were more likely to include clinician-completed ratings of risk or lethality, or cause of death, than were non-clinical populations which relied more heavily on self report. The magnitude of the relationship also increased with age, suggesting that impulsive aggression becomes a stronger risk factor across the lifespan. McGirr et al. (2008) reported on a sample of cases of deaths by suicide aged 11 to 87 in which impulsive aggression was inversely correlated with age at death. It is possible that, while age may reduce the association between impulsive aggression and suicidality in young people, the pattern may differ – as demonstrated by our results – when focusing on an adult sample.

While we excluded studies which did not include reliable, validated, psychometric measures of impulsivity and aggression, we have relatively less confidence in the quality of measures of impulsive aggression. Furthermore, we would argue on the basis of our review of the literature that the theoretical underpinnings of models operationalizing impulsivity and linking it to suicide are more concrete than those of aggression. Furthermore, the majority of studies which measured impulsive aggression did so with the BDHI (1957), which was developed as a measure of hostility and there is, to our knowledge, no convincing evidence that it provides a valid or reliable measure of impulsive aggression. Contributing to this is a lack of consensus regarding the definition of the construct. It is unclear from our review of the relevant theory and data, for example, whether we should predict individuals high in impulsive aggression to be highly aggressive and highly impulsive, or to be highly impulsive in the expression of aggression specifically. Is it, as argued by Brent and Mann (2005, 2006), a hostile reaction to provocation? Is it reactive, rather than proactive, aggression? Is aggression a distinct variable that sits alongside impulsivity under a disinhibition psychopathology? While we did not find evidence that impulsivity, aggression, or impulsive aggression, differed in their relation to suicidality, perhaps supporting the existence of a disinhibition psychopathology, it is unclear what underlying constructs were being assessed by measurements of 'impulsive aggression'. Without more precisely

delineated parameters, measurement, and understanding of the clinical relevance of the construct, we have been unable to answer these questions.

Finally, we argue that a strength of our review and analysis here is that we have been able to crystallize patterns in the literature to date. One limitation is that we included only those studies which measured both impulsivity and aggression (i.e. rather than all studies that included impulsivity or aggression). This may have introduced some systematic bias in, for example, the theoretical framework underpinning hypotheses or reporting of results in the subset of studies we have included. However, that we didn't find strong or consistent findings linking impulsivity and aggression to suicidality, despite our large sample, promotes the importance of identifying gold standard definitions and measures of impulsivity and aggression in relation to suicidality and determining how these relate to risk across groups, rather than continuing to conduct research which may increase our sample sizes for meta-analysis but fails to contribute to clarity.

In conclusion, we have shown impulsivity (particularly behavioral and trait impulsivity) and aggression to predict suicidality. We argue that both constructs should be included in theoretical and practical formulations of suicide risk. While our results are consistent with a model in which impulsivity and aggression form part of a wider psychopathology or relevance to suicidality, we argue that greater clarity on the definition, clinical relevance, and measurement of impulsive aggression is required. Given these findings, and the considerable heterogeneity in the relationships we have reported here, we argue that future research which takes a person-centered approach to understanding the ways in which these psychological constructs interact with distal and proximal, and static and dynamic, risk factors in the lives of individuals will contribute to greater precision in predicting risk, and in understanding the mechanisms by which individual circumstances translate into suicidality (e.g. Bermann and Silverman, 2014).

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Chapter 2

Impulsivity, aggression, and impulsive aggression in suicidality

Prepared in accordance with the author requirements Archives of Suicide Research (Appendix 7, p. 162)

Plain Language Summary

Impulsivity, aggression, and impulsive aggression in suicidality

Background: Despite a large body of research identifying population-level risk factors for suicide, we are poor at identifying individuals at risk. Identifying measurable psychological constructs, and the ways in which they contribute to the development of suicidal behaviour, can help us to better identify who is at risk of suicide.

Aims & Questions: The aim of the research was to investigate the nature of associations between three key psychological constructs (impulsivity, aggression, and impulsive aggression) with suicidal thinking and behaviour. Derived from leading psychological models of suicidal behaviour, the research addressed three questions: (1) Do impulsivity, aggression, and impulsive aggression, correlate with suicidal ideation and suicidal behaviour?; (2) Does impulsive aggression account for the relationship between the experience of stressors and suicidal ideation and behaviour?; (3) Is impulsivity higher in those who have attempted suicide than in those who have experienced suicidal feelings but who have not attempted suicide?

Methods: Impulsivity, aggression, impulsive aggression, and history of suicidal ideation and behaviour were assessed via an online survey in 624 male and female adult participants. Based on their responses, we grouped participants as those who (1) had no history of suicidal feelings or behaviour, (2) those with a history of suicidal feelings but not of suicidal behaviour, and (3) those with a history of suicidal behaviour.

Main findings and conclusions: Impulsivity, aggression, and impulsive aggression were each associated with increased suicidality overall. Second, they were each associated with an increased likelihood to move from suicidal feelings to behaviour.

Key applications: Informing suicide risk assessment and intervention. Helping mental health professionals to be better able to identify people at risk and to support them.

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Abstract

Objective: Identifying measurable psychological constructs associated with suicide risk can contribute to the development of interventions. Impulsivity and aggression have received considerable attention in the literature in this respect. The findings, however, are often conflicting and it has been argued that impulsivity and aggression may act together to influence suicide risk. The aim of the research was to investigate the nature of associations between impulsivity, aggression, and impulsive aggression, and suicidal ideation and behavior. *Method:* Impulsivity, aggression, impulsive aggression, and suicidal ideation and behavior, were assessed in 624 participants (aged 16 years and over) via an online survey advertised on social media. Participants were categorized based on their suicidal history into three groups: those with (1) no history of suicidal ideation or suicide attempts, (2) a history of suicidal ideation but not of suicide attempts, and (3) a history of suicidal ideation and suicide attempts. *Results*: Two pathways involving impulsivity, aggression, and an 'impulsive aggression' factor, were associated with suicide risk. First, all three constructs were associated with increased suicidality overall. Second, they were each associated with an increased likelihood to move from suicidal ideation to action. *Conclusion*: The results will contribute to development of suicide risk formulation by demonstrating how key psychological constructs contribute to the development of suicidal behavior.

Introduction

The identification of phenotypes associated with suicide risk is essential to the development of targeted psychological interventions (McHugh et al., 2019). Two psychological variables proposed to influence suicidality are impulsivity and aggression (e.g. Barzilay & Apter, 2014; Anestis et al. 2014; Brent & Mann, 2005, 2006). Both, however, have been defined and operationalized in a variety of ways, as has suicidality, leading to complex and contradictory findings (Anestis et al. 2014; Gvion & Apter, 2011; Moore et al., under review). Impulsivity and aggression may also be part of a larger psychopathology characterized by disinhibition (*'impulsive aggression',* Brent & Mann, 2005, 2006). Clarity around the contribution of impulsivity, aggression, and impulsive aggression, to suicidality will inform suicide risk assessment and intervention.

Impulsivity plays a role in several leading psychological models of suicide (Barzilay & Apter, 2014). In their Cognitive Model of Suicidal Behavior, Beck et al. (1990, 2008) treat impulsivity as a dispositional trait which increases vulnerability to suicide. Anestis et al. (2014) similarly propose impulsivity to be a distal risk factor, but argue that it elevates risk specifically through exposure to painful life experiences. In Baumeister's (1990) Escape Theory, suicidality increases when individuals can no longer resist impulsive urges to remove themselves from aversive self-awareness via increased behavioral disinhibition. Finally, in the Integrated Motivational Volitional Model (O'Connor, 2011; O'Connor & Kirtley, 2018), impulsivity more broadly plays a similar role to that of behavioral disinhibition proposed by Baumeister (1990), by acting as a volitional moderator bridging the gap between ideation and action.

It is difficult to interpret empirical findings across the literature to date in the context of the models described above as there is substantial variation in operationalizations of the construct (Gvion & Apter, 2011; Klonsky & May, 2010; Lockwood et al., 2017). For example, 'impulsivity' can be cognitive (i.e. the inability to weigh the consequences of proximal and distal events in order to delay gratification), mood-based (i.e. emotional states such as urgency), or behavioral (i.e. deficits in response inhibition; Anestis et al., 2014; Hamilton et al., 2015a,b). Furthermore, state and trait impulsivity appear to be conceptually and quantitatively distinct (Bagge et al., 2013; Cyders and Coskunpinar,

2012; Peters and Büchel, 2011; Reynolds et al., 2008; Wu et al., 2009; Glenn and Klonsky, 2010) and the way in which impulsivity is measured (e.g. using neuropsychological tests versus self-report responses to questionnaires) may also influence relationships. This diversity perhaps explains the lack of consistency in the strength and direction of relationships linking impulsivity to suicidality. While one review, for example, demonstrated the association to be weak at best (Anestis et al., 2014), another found it to be consistent across psychiatric and non-clinical populations (Gvion & Apter, 2011). Anestis et al. (2014) focussed on trait impulsivity assessed through self-report or behavioral measures and included only studies which looked at the presence or absence, or frequency, of suicidal behavior. Gvion & Apter (2011), on the other hand, used broader definitions of both, perhaps increasing the number of studies that used cognitive or mood-based, or state, measures of impulsivity, included in their analyses. In support of this, in a review of associations between impulsivity and self-harm in adolescents, Lockwood et al. (2017) reported that cognitive impulsivity distinguished suicidal ideation from action. Similarly, Liu et al. (2017) found cognitive impulsivity to be a stronger predictor of suicidality than behavioral impulsivity in a review (see also McHugh et al., 2019). In contrast, however, in a recent meta-analysis, we found trait and behavioral impulsivity to be stronger predictors of suicidality than were state or cognitive measures (Moore et al., under review). Again, this may be due to differences in methodologies employed across the literature: while Liu et al. (2017) limited their studies to those that employed neuropsychological measures, we included neuropsychological and self-report methods. All that is clear, then, is that further work is required to better understand the multiple dimensions of impulsivity, and the ways in which they relate to suicidality across populations.

Adding a further layer of complexity is evidence that impulsivity may interact with aggression. Gvion & Apter's (2011) review, for example, demonstrated them to be related to each other and to suicide, although the patterns of these relationships were complex and contradictory. In addition, a recent systematic review concluded that both impulsivity and aggression were risk factors for serious suicide attempts (Gvion & Levi-Belz, 2018). As for impulsivity, however, there are multiple definitions of aggression. Some define it as behavior intended to harm another person who is motivated to avoid

being harmed, and others as reactive (i.e. a response to perceived threat that is impulsive and emotionally charged) or proactive (i.e. premeditated and controlled) (Gvion & Apter, 2011). There is emerging meta-analytic evidence to support positive associations between dimensions of aggression with suicidality, however these are dependent upon the measures of aggression and suicidality, and population. Orri et al. (2018), for example, reported positive associations between irritability and suicidal ideation and action in community, but not psychiatric, samples. In our recent meta-analysis we found aggression to be correlated weakly and positively with suicidality across clinical and non clinical samples (Moore et al., under review).

Some have pointed to potential overlap between aggression and impulsivity and argued that they should be treated as a single phenotype in relation to suicide (e.g. Mann et al., 1999; Mann & Currier, 2010; Seroczynski et al. 1999). Brent & Mann (2005, 2006), for example, have argued that impulsivity, hostility, and aggression are all part of an overarching *disinhibitory psychopathology* operationalised as *impulsive aggression*. They defined this as "the tendency to respond to provocation or frustration with hostility or aggression" (pp. 2720). Wenzel & Beck's (2008) update of Beck et al.'s (1990) Cognitive Model includes aggression in an equivalent role to impulsivity (i.e. a dispositional trait that increases suicide risk) and argue both may be components of a larger disinhibitory psychopathology (e.g. Gorenstein & Newman, 1980; Mann et al. 1999). The impulsive aggression construct plays a role in Brent & Mann's (2005) Clinical-Biological Model of Suicidal Behavior and in Plutchik, van Praag, & Conte's (1989) Two Stage Model of Outward and Inward Directed Aggression. In Brent & Mann's (2005) model, impulsive aggression is viewed as a familial trait mediating between psychopathology and suicidal behavior (Mann & Currier, 2009). In Plutchik, van Praag, & Conte's (1989) model, aggressive impulses are triggered by stress, and the likelihood of expression against the self is increased when coupled with recent depression. In support of an overarching impulsive aggression construct, we found relationships between impulsive aggression and suicidality to be consistent with those of impulsivity and aggression alone. We argued, however, that the impulsive aggression construct remains poorly defined and measures of the construct lack validity and reliability (Moore et al., under review).

Impulsivity, aggression, and impulsive aggression, then, appear in multiple psychological models of suicide and are proposed to predict risk via a number of pathways. A useful way of structuring these competing hypotheses is to include them as testable pathways in an overarching theoretical framework. As impulsivity and aggression are viewed variously as dispositional traits (Beck et al., 1990; Brent & Mann, 2006), state responses to adversity and stress (Plutchik et al., 1989), or as some combination of the two (Baumeister, 1990; O'Connor, 2011), a stress-diathesis model is most appropriate. O'Connor's (2011, 2018) Integrated Motivational Volitional Model of Suicidal Behavior incorporates three stages, spanning the emergence of suicidal ideation and suicidal acts. As shown in Figure 12 below, this model allows testable pathways corresponding to each of the proposed roles of impulsivity, aggression, and impulsive aggression. Pathway A corresponds to Beck et al.'s (1990) proposal that impulsivity and aggression, and to Brent & Mann's (2006) that impulsive aggression, are dispositional traits which increase vulnerability to suicide. Pathway B corresponds to Plutchik et al.'s (1989) proposal that stress increases aggressive impulses which, when combined with depression, are more likely to be directed towards the self. Finally, Pathway C corresponds to O'Connor's (2011, 2018) and Baumeister's (1990) proposition that impulsivity moderates the relationship between suicidal ideation and suicidal behavior (although note that Baumeister's (1990) model focusses specifically on disinhibition rather than impulsivity more broadly).

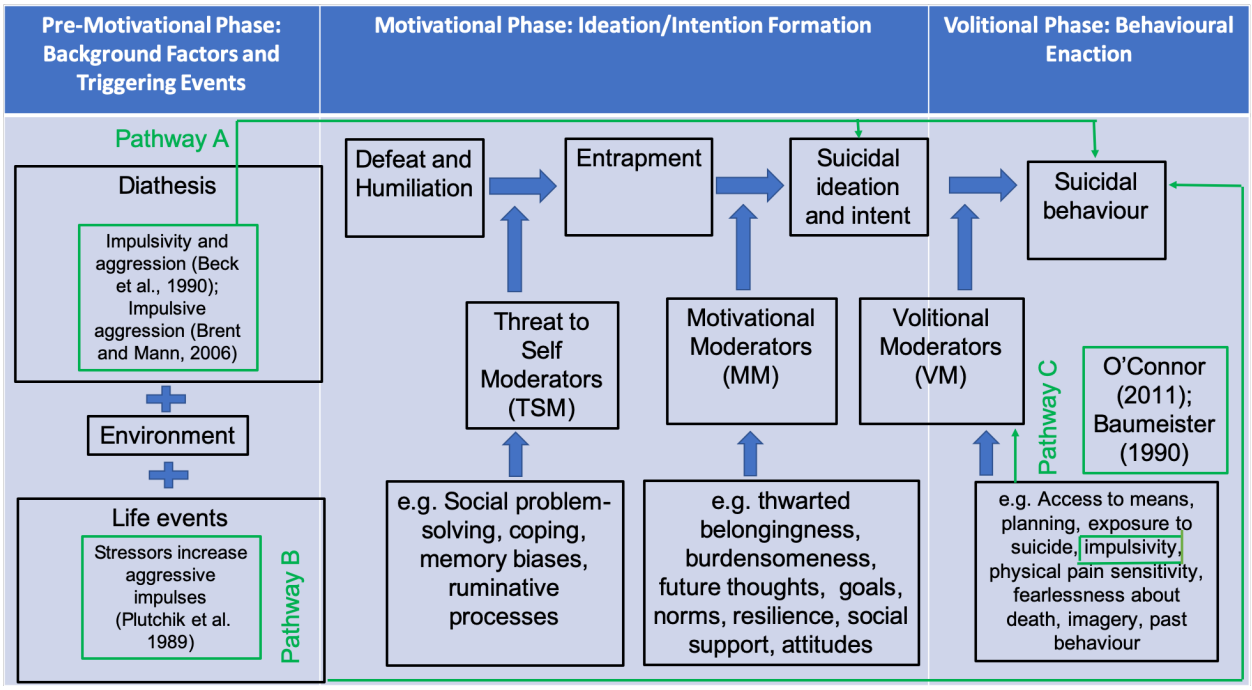

Figure 12 The adapted Integrated Motivational Volitional Model of Suicidal Behavior (O'Connor & Kirtley, 2018) with proposed pathways between impulsivity and aggression and suicidal behavior added in green.

Predictions stemming from Pathway A are that trait impulsivity and aggression (Beck et al., 1990) and impulsive aggression (Brent & Mann, 2005) will be significantly higher amongst participants with a history of suicidal ideation/behavior than those without such a history. Predictions stemming from Pathway B are that impulsive aggression will mediate the relationship between stress and suicidal behavior, in interaction with depression (Plutchik et al. 1989). Specifically, impulsive aggression will be most strongly positively related to suicidal behavior in those who report depression. The prediction stemming from Pathway C is that impulsivity will be higher in those who have attempted suicide than those who have experienced suicidal ideation but have not attempted suicide (O'Connor, 2011; O'Connor & Kirtley, 2018). Please note that, although impulsivity is described as a volitional moderator in the IMV model, for the purpose of our analyses moderation analysis is not required to determine whether or not it contributes to the presence or absence of a history of suicidal action.

Materials and Methods

Participants

Six hundred and twenty-four participants completed an online survey advertised on social media (female n = 452 (72.4%); age range = 16-81 years, mean = 41.87 (13.47)). Three hundred and seventy-five (60.19%) were in a relationship. Five hundred and six (81.1%) were from Scotland (the remainder were from the rest of the UK). Eighty-eight participants (14.1%) reported no suicidal ideation or action, 299 (47.9%) reported suicidal ideation, and 237 (38%) reported suicidal ideation and action. The study was approved by the University of Glasgow Research Ethics Committee, and all participants gave informed consent. The study was conducted in accordance with EQUATOR Network guidelines on conducting and reporting quantitative research in Psychology (Applebaum et al., 2018).

Measures

Demographic variables

Participants were asked to report their age, gender, relationship status ("are you currently in a committed relationship?"; yes or no), and country of residence (free text response).

Stress

Stress was assessed using Cohen's (1995) Perceived Stress Scale. This 10-item validated scale (Cronbach's $\alpha = 0.78$; Cohen & Williamson, 1988) assesses experience of stress in the last month (e.g. how often have you felt that you were unable to control the important things in your life?)

Impulsivity

Participants completed the Barrett Impulsiveness Scale (BIS-11; Patton et al., 1995), a well-validated and widely used measure of trait impulsivity (Cronbach's α = 0.8; Reise et al., 2013). This 30-item scale (e.g. 'I do things without thinking') assesses impulsive behaviors and preferences that fall into three domains (attentional, motor, and non-planning impulsivity).

Participants also completed the UPPS-P-S Impulsive Behavior Scale (UPPS; Whiteside & Lynam, 2001; Lynam, 2011). This 20-item scale assesses general impulsivity as well as positive and negative urgency, lack of premeditation, lack of perseverance, and sensation seeking (Cronbach's α = 0.87). An example item is 'I have trouble controlling my impulses'.

Aggression

Aggression was assessed with the Buss-Perry Aggression Scale (BPAS; Buss & Perry, 1992). This 29-item scale assesses general aggression as well as physical aggression, verbal aggression, anger, and hostility (Cronbach's α = 0.78; Harris, 1997; Samani, 2008). An example item is 'Some of my friends think I am a hothead'.

Impulsive aggression

Brent & Mann (2005, 2006) describe impulsive aggression as a hybrid of impulsivity, aggression, and hostility. Plutchik, van Praag, & Conte (1989) describe an 'aggressive impulse' which is conceptually distinct from aggressive behavior and represents an underlying propensity for impulsive aggression which can be directed towards the self or others depending upon context. Here, impulsivity and aggression measurements were entered into an exploratory factor analysis to determine the structure of inter-correlations between the constructs with the aim of extracting a factor which incorporates dimensions of impulsivity and aggression.

Depression

Depression was assessed using the PHQ-9 (Spitzer et al., 1999). This 9-item measure assesses symptoms of depression in the last 2 weeks (Cronbach's α = 0.89; Kroenke et al., 2001) . An example item is, 'Over the last two weeks, how often have you been bothered by any of the following problems? E.g. Little interest or pleasure in doing things?'.

Suicidality

Suicidal ideation and suicidal behavior were assessed with the following items: (1) "Have you ever thought of taking your life, even though you would not actually do it?" and (2) "Have you ever made an attempt to take your life, by taking an overdose of tablets or in some other way?" (taken from the Adult Psychiatric Morbidity Survey (self-completion version), 2014). Response options are "no", "yes", and "would rather not say". Responses were used to allocate participants to 3 groups: (1) no history of suicidal ideation or suicide attempts, (2) experienced suicidal ideation but has never attempted suicide, and (3) has attempted suicide.

Finally, suicidal ideation was further assessed using the 8-item suicidal ideation subscale of the Suicide Probability Scale (Cronbach's α = 0.93; Cull & Gill, 1989). An example item is 'I think of things too bad to share with others.'

Analysis

Exploratory factor analysis with Varimax rotation determined the structure of inter-correlations between impulsivity (BIS-11, UPPS) and aggression (BPAS), to extract an 'impulsive aggression' factor.

Univariate three-way anova was used to test for differences in impulsivity, aggression, and impulsive aggression, between groups who did and did not report experiencing

suicidal ideation and attempts (Pathway A). Significant differences were followed up with between groups t-tests. Moderated mediation analysis determined whether impulsive aggression (alone and in interaction with depression) mediates between the experience of stressors and suicidal ideation (binary coded as history of suicidal ideation or not) or attempts (binary coded as history of suicide attempts or not) (Pathway B). Univariate binary logistic regression was used to determine whether impulsivity, aggression, and impulsive aggression, predict whether participants who had experienced suicidal ideation had also attempted suicide or not (Pathway C). All significant predictors were entered simultaneously into multiple regression to determine their independent contributions. In all cases, total scores for scales were first entered into analyses. Where these were significant, analyses of sub-scales were conducted. Analyses were conducted using IBM SPSS v27. Where data for an item included in an analysis was missing (or required for calculation of a scale or subscale), that participant was excluded from that analysis.

Results

Table 2. Descriptive statistics for total sample, and for groups of participants who reported no history of suicidal ideation or suicide attempts, a history of suicidal ideation and no suicide attempts, and a history of suicidal ideation and suicide attempts

	Mean (+- SD) n = 624	No suicidal ideation or suicide attempts (mean +-SE) n = 88	Suicidal ideation and no suicide attempts (mean +- SE) n = 299	Suicidal ideation and suicide attempt(s) (mean +- SE) n = 237
Age	41.87 (13.47)	45.74 (14.57)	41.59 (13.46)	40.76 (12.84)*

Gender	Female: n = 452 (72.4%)	Female: n = 57 (64.8%)	Female: n = 207 (69.2%)	Female: n = 188 (79.3%)**
Suicide Probability Scale	18.44 (6.78)	8.59 (0.6)	13.83 (0.33)	19.17 (0.37)**
PHQ-9	16.52 (7.71)	4.74 (0.76)	12.04 (0.41)	17.22 (0.46)**
Perceived Stress Scale	22.44 (4.5)	19.39 (0.44)	21.3 (0.24)	22.74 (0.27)**
BIS-11 total impulsivity	72.87 (12.68)	60 (1.25)	66.54 (0.68)	73.47 (0.78)**
BIS-11 attentional impulsivity	20.32 (4.67)	15.15 (0.46)	18.14 (0.23)	20.58 (0.28)**
BIS-11 motor impulsivity	25.17 (5.24)	22.11 (0.51)	22.95 (0.28)	25.23 (0.31)**
BIS-11 non planning impulsivity	27.38 (5.85)	22.73 (0.59)	25.44 (0.32)	27.66 (0.38)**
UPPS total impulsivity	48.47 (10.17)	39.81 (0.97)	43.7 (0.53)	48.76 (0.59)**
UPPS negative urgency	11.86 (3.24)	8.44 (0.33)	10.46 (0.18)	12.08 (0.2)**
UPPS positive urgency	9.46 (3.46)	6.74 (0.33)	7.97 (0.18)	9.56 (0.3)**

UPPS sensation seeking	9.76 (3.4)	9.41 (0.34)	9.23 (0.18)	9.66 (0.21)
UPPS (lack of) premeditation	9.16 (3.02)	7.28 (0.27)	8.09 (0.15)	9.27 (0.17)**
UPPS (lack of) perseverance	8.23 (2.39)	7.93 (0.25)	7.96 (0.14)	8.25 (0.15)
Total aggression	78.89 (16.42)	68.67 (1.68)	78.04 (0.91)	83.74 (1.02)**
Physical aggression	24.61 (4.79)	23.03 (0.51)	24.64 (0.27)	25.37 (0.31)**
Verbal aggression	13.24 (4.43)	11.56 (0.47)	13.07 (0.25)	14.07 (0.28)**
Anger	22.05 (4.14)[c]	19.4 (0.43)	21.95 (0.23)	23.16 (0.26)**
Hostility	18.91 (7.2)	14.67 (0.74)	18.38 (0.4)	21.15 (0.45)**
Impulsive aggression factor	0 (1)	-0.56 (0.85)	-0.14 (0.85)	0.39 (1.01)**

* univariate 3-way ANOVA (chi-square for gender) $p < 0.05$, ** $p < 0.01$.

All pairwise comparisons were significant with the exception of age between suicidal ideation and no suicide attempts compared with suicidal ideation and suicide attempts; BIS-11 total score between no suicidal ideation and no suicide attempts compared with suicidal ideation and no suicide attempts; and physical aggression between suicidal ideation and no suicide attempts compared with suicidal ideation and suicide attempts.

Factor analysis of impulsivity and aggression

Subscale scores for BIS-11, UPPS, and BPAS, were entered into a factor analysis with Varimax rotation, from which three factors with eigenvalues > 1 were extracted (see Table 3). Of these, we treated the factor with the greatest eigenvalue (4.72) and which accounted for the most variance (39.31%) as our measure of 'impulsive aggression'.

Table 3. Loadings for 'impulsive aggression' factor (the factor loadings of variables interpreted as being included on the factor are highlighted in bold).

Variable	Factor 1 (*Impulsive aggression*) Eigenvalue = 4.72 % variance = 39.31	Factor 2 Eigenvalue = 1.7 % variance = 14.13	Factor 3 Eigenvalue = 1.31 % variance = 10.89
BIS-11 attentional impulsivity	**0.71**	0.26	0.19
BIS-11 motor impulsivity	**0.7**	0.26	-0.22
UPPS negative urgency	**0.8**	0.11	0.05
UPPS positive urgency	**0.59**	0.41	0.25
UPPS sensation seeking	**0.64**	0.36	-0.17

UPPS (lack of) premeditation	0.19	0.23	-0.74
UPPS (lack of) perseverance	**0.84**	0.13	-0.02
Physical aggression	**0.57**	-0.2	0.04
Verbal aggression	0.1	0.84	-0.19
Anger	0.07	0.89	0.01
Hostility	0.25	0.34	0.7

Pathway A: Impulsivity, aggression, and impulsive aggression will be positively correlated with suicidal ideation and suicide attempts

There were significant differences between groups of participants (suicidal ideation and suicide attempts > suicidal ideation and no suicide attempts > no ideation or attempts) for BIS-11 and all subscales, UPPS total and the negative and positive urgency and lack of premeditation subscales, BPAS and all subscales, and the impulsive aggression factor (see Table 2). Post-hoc independent samples t-tests revealed significant differences between all three groups on each of these variables (all $p < 0.01$).

Pathway B: Impulsive aggression, and its interaction with depression, will mediate the relationship between stress and suicide risk

We conducted moderated mediation analysis to determine whether impulsive aggression in interaction with depression mediated the relationship between stress and suicidality using Hayes (n.d.) PROCESS macro for SPSS v3.5.

There was no evidence of significant moderated mediation of significant relationships between stress and suicidal ideation (beta = 0.12, $p < 0.001$) or suicidal action (beta =

0.1, p < 0.001), by the interaction of impulsive aggression and depression (all p > 0.05). See Figure 13.

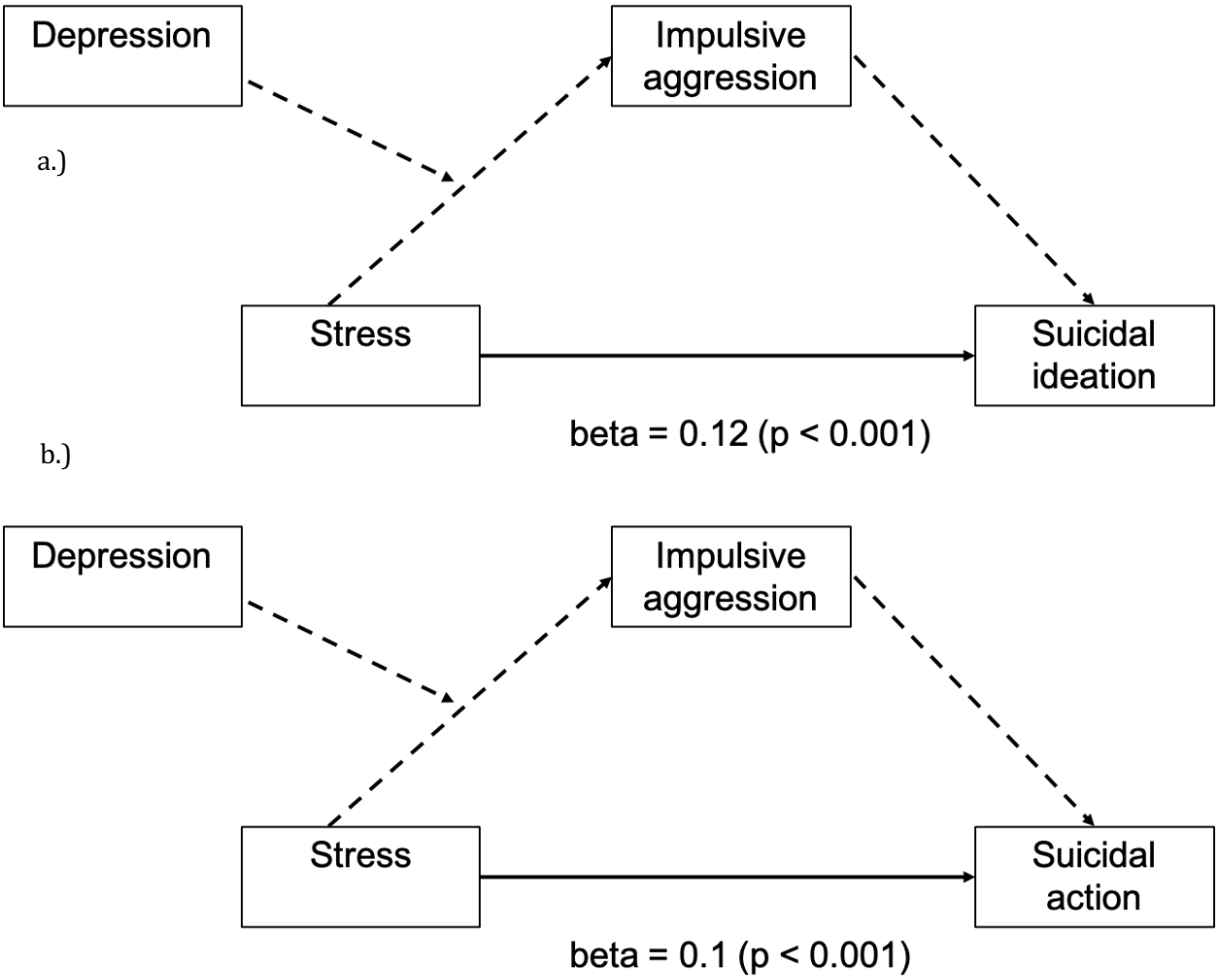

Figure 13. Path diagram showing no evidence of significant mediation, or moderated mediation, of relationships between stress and history of suicide ideation or attempts by impulsive aggression and depression

Pathway C: Impulsivity and aggression will moderate transition from suicidal ideation to action

For the subsample of participants who reported suicidal ideation with or without suicide attempts (n = 536), univariate binary logistic regression models revealed that BIS-11

(beta = 0.05, OR = 1.05, p < 0.001), UPPS (beta = 0.06, OR = 1.07, p = 0.009), BPAS (beta = 0.02, OR = 1.02, p < 0.001), and impulsive aggression (beta = 0.53, OR = 1.87, p < 0.001) predicted whether participants had experienced suicidal ideation with and without suicide attempts (see Table 2 for descriptive statistics).

We then conducted univariate binary logistic regression models to determine whether sub-scales of each measure predicted whether participants with a history of suicidal ideation had a history of suicide attempts or not. BIS-11 attentional impulsivity (beta = 0.13, OR = 1.13, p < 0.001), BIS-11 motor impulsivity (beta = 0.1, OR = 1.1, p < 0.001), BIS-11 non-planning impulsivity (beta = 0.08, OR = 1.08, p < 0.001), UPPS negative urgency (beta = 0.17, OR = 1.19, p < 0.001), UPPS positive urgency (beta = 0.16, OR = 1.18, p < 0.001), UPPS (lack of) premeditation (beta = 0.18, OR = 1.2, p < 0.001), BPAS physical aggression (beta = 0.04, OR = 1.04, p = 0.05), BPAS verbal aggression (beta = 0.05, OR = 1.05, p = 0.008), BPAS anger (beta = 0.08, OR = 1.08, p < 0.001), and BPAS hostility (beta = 0.06, OR = 1.06, p < 0.001), significantly predicted a history of suicide attempts.

UPPS sensation seeking (beta = 0.04, OR = 1.05, p = 0.109) and (lack of) perseverance (beta = 0.06, OR = 1.07, p = 0.082), did not significantly predict a history of suicide attempts.

In multiple binary logistic regression including total impulsivity and aggression scores (the impulsive aggression factor was excluded due to low tolerance to multicollinearity (< 0.4), BIS-11 (beta = 0.03, OR = 1.03, p = 0.007) and UPPS (beta = 0.03, OR = 1.03, p = 0.033) maintained significance, and BPAS lost significance (beta = 0.01, OR = 1.01, p = 0.3).

Discussion

Here we reported support for two pathways by which impulsivity and aggression are proposed to increase suicide risk. First, several measures of impulsivity and aggression, and our impulsive aggression factor, were positively correlated with suicidality, supporting Pathway A (Beck et al. 1990; Brent and Mann, 2006). This suggests that trait impulsivity and aggression act as temperamental dimensions which increase vulnerability to suicidality. Second, impulsivity, aggression, and impulsive aggression, differentiated between those with a history of suicidal ideation with and without history of suicide attempt(s), supporting Pathway C (O'Connor, 2011; O'Connor & Kirtley, 2018). That is, impulsivity, aggression, and impulsive aggression, acted as volitional moderators from suicidal ideation to action in accordance with the IMV Model (O'Connor, 2011; O'Connor & Kirtley, 2018). We did not find support for Pathway B, that impulsive aggression in combination with depression mediates relationships between stress and suicide risk (Plutchik et al., 1989). Our results, then, suggest a dual role of impulsivity and aggression in suicide risk: as traits associated with increased vulnerability to suicidality, and which increase the likelihood of moving from suicidal ideation to action. We suggest that impulsivity, aggression, and impulsive aggression are psychological targets for suicide interventions.

Scores on both measures of impulsivity (BIS-11 and UPPS) varied between groups with presence and absence of suicidal ideation and action. This was also the case for all BIS-11 subscales (attentional, motor, and non-planning impulsivity) and for the UPPS subscales of negative and positive urgency, and lack of premeditation. The UPPS subscales of sensation seeking and lack of perseverance did not differ on the basis of history of suicidality. Urgency is typically treated as a measure of mood-based impulsivity, sensation seeking as behavioral, and lack of premeditation and perseverance as cognitive. Therefore, our findings do not consistently support either model described in the Introduction in which cognitive (e.g. Liu et al., 2017) or behavioral (Moore et al., under review) impulsivity are stronger predictors of suicidality. Here, however, we only used self-report measures of impulsivity and it would be interesting to determine whether the same patterns extend to neurobehavioral and neurocognitive measures.

We are cautious in extrapolating our results to operationalizations of suicidality beyond those we have measured here. In their systematic review of associations between impulsivity and self-harm in adolescents, for example, Lockwood et al., (2017) reported different relationships depending upon the operationalization of both self-harm and impulsivity (e.g. mood-based measures of impulsivity were positively correlated with non-suicidal self-harm, whereas cognitive dimensions distinguished current from past self-harm). Finally, here we employed only trait-based measures of impulsivity and aggression. While our meta-analysis showed trait impulsivity to be more strongly correlated with suicidality than state impulsivity, Liu et al., (2017) found the associations to be stronger when the suicide attempt was more proximal to the measure of impulsivity. Better understanding of the roles of state and trait impulsivity, then, and the ways in which these influence mood, coping, and suicidality under distress, is required.

Our results are consistent with a model in which impulsivity, aggression, and 'impulsive aggression', contribute to suicidality. In all cases, the contribution of impulsivity, aggression, and impulsive aggression were equivalent. As with impulsivity, however, aggression is defined and operationalised in multiple ways and here we included four dimensions (physical, verbal, anger, and hostility) all of which contributed to suicidality. Our factor analysis demonstrated that physical aggression correlated with measures of impulsivity, whereas verbal aggression, and hostility and anger, grouped on separate factors. 'Impulsive aggression' may refer specifically to physical aggression. Interestingly, hostility did not load on our impulsive aggression factor despite being included in the disinhibitory psychopathology model proposed by Brent and Mann (2005, 2006).

While our results are consistent with models in which physical aggression and impulsivity are treated as a single phenotype in relation to suicide (e.g. Mann et al., 1999; Mann & Currier, 2010; Seroczynski et al., 1999), and we argue that impulsive aggression could act as a target in suicide intervention, further work is required to delineate the structure and function of an impulsive aggressive phenotype. In relation to assessment of suicide risk, it is important to flag here the very small effect sizes for impulsivity and aggression when predicting whether participants with a history of

suicidal ideation had a history of suicide attempt(s). In our systematic review and meta-analysis (Moore et al., under review), we found that the measure of suicidality to correlate most strongly with impulsivity and aggression was clinician-rated risk of suicide. We argued that, since most such measures included items which assessed impulsivity and aggression, suicide risk and impulsivity and aggression may be arbitrarily conflated in institutional and professional cultures. This is important as, in light of our failure to accurately assess suicide risk in individuals, clinicians cannot afford to make assessments based on variables which are not clinically relevant. Our results suggest impulsivity and aggression alone should not be treated as clinically meaningful predictors of suicide risk, and that impulsive aggression requires further exploration in order to delineate its parameters and relation to suicidality.

While we were able to recruit a large sample of participants, the population was limited to those with access to the internet, and the interest required to complete a survey. It is possible, then, that our self-selected sample was biased towards those with an interest in understanding suicide, perhaps due to lived experience. Further research is required to determine whether our results replicate in other populations.

In conclusion, we have reported roles of impulsivity, aggression, and impulsive aggression, as traits which increase suicidality and the likelihood of moving from suicidal ideation to action. Impulsivity and aggression are promising psychological targets for suicide prevention, but future research should seek to improve the clarity with which we understand the ways in which these multidimensional constructs relate to one another over time in individuals and so contribute to suicidality.

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Appendix 1

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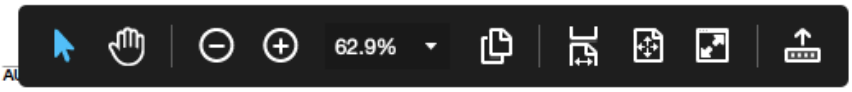

Appendix 2: Sample characteristics and direction of results for all studies included in analyses

Authors	Year	n	Country	Design	Sample	% female	Mean age (SD)	Covariates	Suicidality measure	Impulsivity	Impulsivity	Aggression	Aggression	Additional data
Abdeen et al.	2019	120	Egypt	Correlational	Patients hospitalised for SA (medium or high on BSIS)	50	29.62 (11.83)		Suicide risk (SPS)	BIS-11 total and subscales	Positive relationships	SPS hostility subscale	Positive relationship (negative in females only)	Separated by sex
Alter et al.	2021	72	USA	Comparison of SA with NSA	Military with affective disorders	16.5	Range: 18-80		SA or NSA (CHSF)	BIS-11 total	SA > NSA	BDHI	SA > NSA	No

Ammerman et al.	2015	2295	USA	Comparison of SA with NSA	Students	61	20.94 (3.42)		SA or NSA (SBQR)	UPPS urgency subscales	SA > NSA	STAXI - 2 trait anger	SA > NSA	No
Apter et al.	1990	60	USA	Correlational; comparison of SA with NSA	Psychiatric patients	50	~30		SA or NSA (interview/admission report) SRS	ICS	Positive relationships	MAI PFAV	Positive relationships	No
Apter et al.	1991	28	USA	Correlational	Prisoners	0	Range: 18-64		Suicide risk (SRS)	ICS	Positive relationships	MAI PFAV	Positive relationships	No
Baca-Garcia et al.	2004	359	Spain	Comparison of SA with NSA	SA: clinical sample; NSA: non-	69.9	36.8 (14.5)		SA or NSA (interview/admission report)	BIS-11 total	SA > NSA	BGAI	SA > NSA	No

					clinical sample									
Bae et al.	2013	1000	Korea	Correlational	Community	50	39.6 (11.6)	Age and sex	BSIS total	BIS-11 total	Positive relationship	STAXI-2 total	Positive relationship	No
Bartoli et al.	2018	99	Italy	Correlational	Major affective disorder inpatients	56	45 (12.2)		CSSR	BIS-11 total	Positive relationship	MOAS	Positive relationship	Coefficients for relationships of interest
Barton	2014	87	Australia	Comparison of SA and/or DSH with	Prisoners	100	34.78 (11.59)		Local risk assessment protocol	BIS-11 total and subscales	SA > NSA	STAXI-2 total and subscales	SA > NSA (except for anger	No

				NSA and/or DSH									control in and out, SA < NSA)	
Brenner et al.	2015	133	USA	Comparison of SA with NSA	Veterans with and without traumatic brain injury	10.5	~52	Sex, medication, diagnosis, age, education	SA or NSA (LSASII)	IMT/DMT commission errors IGT total net score	SA > NSA (except IMT commission errors in those with traumatic brain injury,	STAXI-2 state, trait, and expression index	SA > NSA	No

											for whom SA < NSA)			
Brent et al.	2015	488	USA	Comparison of SA with NSA	Affective/mood disorders	88	~45		SA or NSA (CHSF)	BIS-11 total	SA > NSA	LHA	SA > NSA (except for males only; SA < NSA)	Coefficients for relationships between proband SA history, LHA and BIS-11 provided

														(overall and by sex)
Brodsky et al.	2001	136	USA	Comparison of SA with NSA	Psychiatric patients	64	~36		SA or NSA (CHSF)	BIS-11 total	SA > NSA	BGAI	SA > NSA	No
Cameron et al.	2017	115	UK	Comparison of SI with NSI	Community sample and patients hospitalised for suicide attempt	Both (numbers of male and female not given)	Range: 18-55		SI or NSI (BDI and EPQ) SA or NSA (hospital admission report)	BIS-11 total	SA > SI/NSA > NSI/NSA	BPAQ	SA > SI/NSA > NSI/NSA	No

Chachamovich et al.	2015	240	Canada	Comparison of deaths by suicide with living controls	Deaths by suicide and community sample	17.5		Marital status, occupational status, psychiatric diagnosis, substance misuse, victim of abuse	Coroner's report registered death as by suicide, or living control	BIS-11 total (by proxy)	Death by suicide > living controls	LHA (by proxy)	Death by suicide > living controls	No
Chang et al.	2019	78	USA	Comparison of SA, SI but NSA,	Psychiatric inpatients with SA or SI;	43	22.8 (3.4)		CSSR	BIS-11 total	SA > SI/NSA > NSI/NSA	BPAQ	SA > SI/NSA > NSI/NSA	No

				and NSI + NSA	Community sample for healthy controls									
Chesin et al.	2010	40	USA	Correlational	Suicide attempters who meet diagnostic criteria for Borderline Personality Disorder	72.5	Median = 26		Number of SAs (CHSF) Intent at most recent attempt (BSIS Objective Planning Factor)	SIB-Impulsivity Subscale	Positive relationships	LHA	Negative relationships	No

									Lethality of most recent attempt (LRS)					
Conejero et al.	2019	539	France	Correlational	Suicide attempts with Attention Deficit Hyperactivity Disorder diagnosis	66.4	Range:18-83		Age at first suicide attempt; lethality of suicide attempts; number of suicide attempts (CHSF)	BDHI			Positive relationships	No
Conner et al.	2009	878	USA	Comparison of SA with NSA, and of	Patients with substance misuse disorder	29.2	38.1 (10.2)		SA or NSA (NCS) SI or NSI (NCS)	IPAS IA	SI > NSI	IPAS PA	SA > NSA	No

				SI with NSI										
Coryell et al.	2018	22	USA	Comparison of multiple SA with NSA	Patients with Bipolar or Major Depressive Disorder	70.5	~35		Multiple SA or NSA (CSSR)	BIS (total + 3 subscales)	SA > NSA	MAOS (total + 4 subscales)	SA > NSA	No
Daigle et al.	2006	40	Canada	Comparison of SA with NSA	Forensic (prison) population	100			SA or NSA (LSARS)	ICS	Negative relationship	HDHQ (in, out, and total)	HDHQ in: positive relationship HDHQ out and total: negativ	No

													e relationships	
Dalca et al.	2013	328	Canada	Comparison of deaths by suicide with living controls	Patients with Major Depressive Disorder	24.4	~40		Deaths by suicide or living controls	BIS-11 total	Total sample and males only: death by suicide > living controls Females only: deaths by	BDHI & LHA	Deaths by suicide > living controls	No

											suicide < living controls			
Dervic et al.	2006	116	USA	Comparison of SA with NSA	Psychiatric patients with affective /mood disorders	74.8	36.8 (11.5)		SA or NSA (CSHF)	BIS-11 total	SA > NSA	BGAI	SA > NSA	No
Ernst et al.	2004	162	Canada	Comparison of deaths by suicide with living	Deaths by suicide and living controls (both				Deaths by suicide (Coroner's reports) and living controls	BIS-11 total	Deaths by suicide > living controls	BDHI and BGLHA	Deaths by suicide > living controls	No

				controls	with and without Axis 1 disorders)								(except for BGLHA for participants without Axis 1 disorders, where the direction was reversed)	
Ferraz et al.	2013	76	Spain	Comparison of	Outpatients with Borderli	78	30.3 (8)		SA or NSA (clinical interview)	BIS (total + 3	Total, motor, and	BDHI (total + 8	SA > NSA	No

				SA with NSA	ne Personality Disorder					subscales)	attentional impulsivity SA > NSA Non planning impulsivity SA < NSA	subscales)		
Gilbert et al.	2011	67	USA	Comparison of SA and NSA	Outpatients and inpatients with Bipolar Depression	44.8	42.2 (11.5)		History of SA and lethality of most serious attempt (CHSF)	BIS-11 total IGT total	BIS-11 & IGT: SA < NSA Negative	BPAQ	SA < NSA Relationship between BPAQ	No

											relationship between BIS-11 and lethality Relationship between IGT and lethality not reported		and lethality not reported	
Gvion	2018	97	Israel	Correlational	Patients admitted	33	39.78 (13.3)		Number and medical	ICS	Positive relation	STAXI (5	Positive relation	No

					to psychiatric hospital 2-5 years ago				severity of follow up suicide attempt (medical records)		ship with medical severity of follow up SA Relationship with number of follow up attempts not reported	subscales) PFAV	ships between medical severity and STAXI-2 expression out and PFAV Positive relationships between number of SA	

													and STAXI-2 expression out and PFAV Relationships between medical severity and number of SAs and STAXI-2 trait,	

													state, expression in, and anger control not reported	
Gvion et al.	2014	196	Israel	Correlational	Suicide attempters	36.73	Range: 16-71		LRS BSIS (Objective Planning subscale)	ICS	Positive relationship with lethality Negative relation	STAXI-2 anger expression in and out PFAV	Positive relationships between lethality and STAXI-2 anger express	

											ship with objecti ve plannin g		ion out and PFAV Negativ e relation ship betwee n STAXI-2 anger express ion in Positive relation ship betwee	

													n objecti ve plannin g and STAXI-2 anger express ion in Negativ e relation ships betwee n objecti ve plannin	

													g and STAXI-2 anger expression out and PFAV	
Harford et al.	2019	36309	USA	Correlational	Community	56	18 and older		Number of SAs (interview)	DSM-V BPD impulse control criteria	Positive relationship	DSM-V BPD intense anger criteria	Positive relationship	Authors provided additional data (separated by sex), however this

														was only available as comparisons of groupings by self-harm no harm/ other directed harm
Homaifar et al.	2012	47	USA	Comparison of	Veterans with traumati	6	51.2 (9.8)		SA or NSA (CHSF)	IGT total	SA < NSA	LHA	SA > NSA	No

				SA with NSA	c brain injury					net score IMT/DMT commission errors				
Horesh et al.	1997	92	Israel	Correlational	Psychiatric patients with and without suicidal ideation, and healthy controls	51.1	31.64 (11.12)		Risk (SRS)	ICS	Positive relationship	MAI	Positive relationship	No

Huang et al.	2019	6790	China	Correlational	Students	63.1	19.28 (1.36)		SI (SSI)	BIS-11 total	Positive relationship	BPAQ	Positive relationship	No
Jiang et al.	2013	594	China	Comparison of SA with NSA	Medically serious suicide attempters and matched healthy controls	74	33.2 (14.6)		SA or NSA (medical records and clinical interview)	BIS-11 total	Positive relationship	BPAQ	Positive relationship	No
Johnson et al.	2013	127	USA	Correlational	Students	72.4	18.77 (1.9)		Suicidality index based on local interview (from ideation, to medically serious SA)	Factor analysis of various measures of	Positive relationships (negative relationship for	BPAQ (4 subscales)	Positive relationships	Data separated by sex

										impulsivity	‘Factor 2: lack of follow through’ among men)			
Kelip et al.	2006	188	USA	Comparison of SA with NSA	Patients with affective /mood disorders	56.5			SA or NSA	BIS-11 total	SA > NSA	BDHI BGLHA	SA > NSA	No
Koenisberg et al.	2001	140	USA	Correlational	Patients with Borderline Personal	56	37.2 (10.2)		Suicidal behaviour (DSM-3 Borderline Personality	Impulsive aggression factor			Positive relationship	No

					ity Disorder				Disorder) diagnostic criteria)					
Koslowsky et al.	1992	94	Israel	Correlational	Military	0			Risk (PVFB)	ICS	Positive relationship	MAI	Positive relationship	No
Kotler et al.	1993	88	USA	Correlational	Psychiatric patients	47			Risk (SRS)	ICS	Positive relationship	MAI	Positive relationship	No
Kotler et al.	2001	50	Israel	Correlational	Patients with affective /mood disorders or Post Traumatic Stress Disorder and	24	~41		Risk (SRS)	ICS	Positive relationship	MAI	Positive relationship	No

					healthy controls									
Lijffijt et al.	2014	67	USA	Comparison of SA with NSA	Patients with Bipolar Depression	100	Range: 18-65		SA or NSA (CSHF)	BIS-11 total	Positive relationship	BDHI	Positive relationship	No
Lopez et al.	2007	259	Canada	Comparison of deaths by suicide with living controls	Patients with affective /mood disorders	14.29			Death by suicide or living control	BIS-11 total	Death by suicide > living control	BDHI BGLHA	Death by suicide > living control	No
Lopez Castroman et al.	2014	693	France	Correlational	Suicide attempers	Both (numbers	Median = 39.4		Number of SAs and age at first	BIS-11 total	Number of attemp	BDHI	Number of attemp	No

					admitted to hospital	of males and females not reported)			attempt (CSHF)		ts: SA > NSA Age at first attempt: SA < NSA		ts: SA > NSA Age at first attempt: SA < NSA	
Margari et al.	2014	208	Italy	Correlational	Patients with and without chronic pain	37.9	~62		SI (HDRS)	BIS-11 total	Positive relationships	OAS (total + 4 subscales)	All relationships positive	No
Martin et al.	2020	441 and 69	USA	Correlational	Military (Study 1) and civilians (Study 2)	15.9 (S1) and 76 (S2)	28.67 (8.19) (S1) and		SI (BSIS)	UPPS-negative urgency	Positive relationships	BDHI	Positive relationships	No

							23.63 (8.16) (S2)							
McGirr et al.	2006	81	Canada	Comparison of deaths by suicide with living controls	Patients with schizophrenia				Deaths by suicide or living controls	BIS-11 total	Deaths by suicide < living controls	BDHI and BGLHA	Deaths by suicide < living controls	No
McGirr et al.	2007	120	Canada	Comparison of deaths by suicide with living	Patients with Borderline Personality Disorder	29			Deaths by suicide or living controls	BIS-11 total	Deaths by suicide > living controls	BDHI and BGLHA	Deaths by suicide > living controls	No

				controls										
Michaelis et al.	2004	52	USA	Comparison of SA with NSA, and of single with multiple suicide attempts	Patients with affective /mood disorders	55	41.65 (11.14)		SA or NSA; single or multiple SAs (SAD)	BIS-11 (total and all sub-scales)	SA > NSA (except for BIS-11 Motor Impulsivity, where SA < NSA) MSA>SSA	BDHI (total and all subscales)	SA>NSA MSA>SSA	No

Nagy et al.	2020	81	Africa	Correlational	Patients with OCD	44.4	31.8 (8.1)		Ideation (SSI)	BIS-11	Positive relationships	SPS	Positive relationships	No
Oquendo et al.	2007	314	USA	Comparison of SA with NSA	Patients with affective /mood disorders	58.6	Range: 18-75		SA or NSA (CSHF)	BIS-11 total	SA > NSA	BDHI BGLHA	SA > NSA	No
Oquendo et al.	2000	44	USA	Comparison of SA with NSA	Patients with affective /mood disorders	61.36	Range: 18-75		SA or NSA (CSHF)	BIS-11 total	SA > NSA	BDHI BGLHA	SA > NSA	No
Pendse et al.	1999	46	Sweden	Comparison of SA with NSA	Patients with Seasonal Affective	87	Range: 18-54		SA or NSA (admission report)	KSP impulsivity	SA < NSA	KSP aggression and	SA > NSA	No

					Disorder and non-seasonal Major Depressive Disorder							subscales		
Perroud et al.	2013	1922	France and Switzerland	Comparison of SA with NSA	Psychiatric patients and subsample of community NSA	Both (numbers of men and women not reported)	Age not reported		Number of SAs, age at first SA, severity, and violence of most serious SA (self report)	BIS-11 total	SA > NSA Positive relationship with number of SAs Negative	STAXI-2 (5 subscales) LHA	SA > NSA Positive relationships between number of attempts and	No

											relationship with age at first SA Relationships with violence and severity not reported		STAXI-2 trait, state, and expression out. Negative relationships with STAXI-2 control and LHA. Relationship with STAXI-2	

													expression in not reported Negative relationships between age at first attempt and STAXI-2 trait and express	

													ion in and out. Relationships with STAXI-2 state and control and LHA not reported Positive relationship	

													between LHA and violence of attempt Relationships between all other measures with violence and severity of	

													attempt not reported	
Popovic et al.	2015	2811	Multicentre	Comparison of SA with NSA	Patients with Major Depressive Disorder	69	18 and older		SA or NSA (local case history form)	DSM-V diagnostic criteria for (hypo) mania – impulsivity item	Positive relationship	DSM-V diagnostic criteria for (hypo) mania – aggression (verbal or physic	Positive relationship	No

												al) item		
Reich et al.	2019	28	USA	Comparison of patients with bipolar depression with and without SA, and healthy controls with NSA	Patients with Bipolar Depression and community sample of healthy controls	57.1	Range: 18-60		SA or NSA (CSHF)	UPPS-P (total + 5 subscales) BIS-11 (total + 3 subscales)	Positive relationships	IPAS (2 subscales)	Positive relationships	No

Rice et al.	2018a	1000	Canada	Correlational	Community sample	0	18 and older		SI in past month (self report)	MDRS – risk taking subscale	Positive relationships	MDRS – anger and aggression subscale	Positive relationships	No
Rice et al.	2018b	As for Rice et al. (2018a)					49.63 (13.52)		SAor NSA in past month (self report)	MDRS – risk taking subscale	Positive relationships	MDRS – anger and aggression subscale	Positive relationships	No
Rivlin et al.	2013	59	UK	Comparison of	Prisoners	0	18 and older		Near lethal SA and NSA (medical	ICS	Positive relationships	LHA BDHI	Positive relationships	No

				SA with NSA					records and self report)					
Rizk et al.	2021	320	USA	Correlational	Psychiatric patients	~60	~36		Ideation (SSI), number of suicide attempts and lethality of most recent and most serious attempt (CHSF)	BIS-11	Positive and negative relationships	BDHI BGLHA	Positive and negative relationships	Provided coefficients for whole sample and separately for males and females
Rogers & Joiner	2016	229	USA	Correlational	Psychology	62.7	26.05 (10.08)		BSIS total	PID-5 impulsivity	Positive relationships	PID-5 hostility	Positive relationships	Provided coeffici

					outpatients				Number of SAs				(with exception of number of SAs in total sample for which the relationship was negative)	ents separately for males and females
Ross et al.	2017	194	Australia	Comparison of deaths by	Sudden deaths	0	25-44		Cause of death (suicide or sudden	BIS-11 total (by proxy)	Positive relationships	OAS (by proxy)	Positive relationships	No

				suicide with case controls (sudden death by other causes)					death by other cause, from Coroner's reports)					
Roy et al.	2002	246	USA	Comparison of SA with NSA	Patients with substance misuse disorders	12.6			SA or NSA (clinical interview)	BIS-7B subscales	SA > NSA (except interpersonal and sensory impulsivity,	HDHQ	SA > NSA	No

											where SA < NSA)			
Roy et al.	2014	1537	Italy	Comparison of SA with NSA	Prisoners	0	39.6 (10.7)		SA or NSA Lifetime number of suicide attempts (clinical interview)	BIS-10	Positive relationships	LHA BDHI (total + 8 subscales) STAXI-2 (5 subscales)	Positive relationships, except for number of suicide attempts with STAXI-2 control, in, out, and trait, and	No

													SA/NSA with STAXI-2 control	
Sher et al.	2016	435	USA	Comparison of patients with BPD diagnosis with SA and NSA, and healthy controls	Patients with Borderline Personality Disorder and healthy controls	84	~ 31		SA or NSA (self report)	BIS-11 total	Positive relationship	LHA	Positive relationship	No

Sher et al.	2017	683	USA	Comparison of SA, NSA and multiple SA	Patients with Depression	47.5	~35		SA or NSA (CSHF)	BIS-11 total	MSA > SA > NSA	BDHI BGLAI	BDHI: MSA > SA > NSA BGLAI: MSA > SA > NSA	No
Singh & Rao	2018	177	India	Comparison of SA with NSA	Community	42.9	Range: 15-70		SA or NSA (CSSR)	BIS-11 total	SA > NSA	MOAS	SA > NSA	No
Soloff et al.	1994	84	USA	Comparison of SA with NSA	Patients with Borderline Personal	72.62			SA or NSA (SAD)	BIS-10	SA < NSA	BDHI	SA < NSA	No

					ity Disorder									
Soloff et al.	2005	113	USA	Comparison of participants with and high or low lethality suicide attempts	Patients with Borderline Personality Disorder	71.7	29 (8.3)		High or low lethality attempt (MLS)	BIS-11 total	HL > LL	BDHI BGLHA	BDHI: HL > LL BGLHA: HL < LL	No
Soloff & Chiappetta	2017	123	USA	Comparison of SA with NSA in	Patients with Borderline	76.4	Range: 18-45		SA or NSA (MHCRCSB)	BIS-11 total	SA > NSA	LHA BDHI	SA > NSA	No

				last 8 years	Personality Disorder									
Stanley et al.	2019	72	USA	Comparison of SA with NSA	Patients with mood/affective disorders	79	31.88 (10.22)		SA or NSA (CSHF)	BIS-11 total	SA > NSA	LHA	SA < NSA	No
Swogger et al.	2014	96	USA	Comparison of SA with NSA	Prisoners	24	34.9 (11.1)		SA or NSA (NCS SA item)	IPAS-IA	SA > NSA	IPAS-PA	SA > NSA	No
Tsujii et al.	2017	108	Japan	Comparison of patients with Major Depres	Patients with Major Depressive Disorder	64.7	~38		SA or NSA (self report and medical records)	BIS-11 total	SA > NSA	BPAQ	SA > NSA	No

				sive Disorder with SA and NSA, and matched healthy controls	and healthy controls									
Umamaheswari et al.	2014	130	India	Correlational	Patients with Bipolar Depression	33.8	43.04 (11.96)	Groups matched for: age, gender, socioeconomic status,	BDI (item 9)	BIS-11 total	Negative relationship	BDHI (total + 8 subscales)	Positive relationships	No

								and duration of illness						
Vanyukov et al.	2017	159	USA	Comparison of healthy controls, and depressed patients who were non-suicidal, had SI, had SA, and SAs	Patients with Depression and healthy controls	43.4	~64		LRS BSIS BSSI	BIS-11 total	Controls < No SA/SI < SI < SA < serious SA	ARS	Controls < No SA/SI < SI < SA < serious SA	No

				of high lethality										
Wang et al.	2014	5233	China	Comparison of NSA/SI, SI, and SA	Students	48.9	21.3 (2.2)		NSA/SI, SI, SA (PHQ-9)	BIS-11 (3 subscales)	Cognitive and non-planning impulsivity: NSA/SI > SI > SA Motor impulsivity: NSA/SI	BPAQ (5 subscales)	NSA/SI < SI < SA	No

											< SI < SA			
Westheide et al.	2008	58	Germany	Comparison of psychiatric patients with and without SI, and healthy controls without SI	Psychiatric patients and healthy controls		Range: 19-58		SI or NSI (BSIS)	BIS-11 (total and subscales) GNG commission errors IGT commission errors	SI > NSI (except non planning impulsivity and IGT errors SI < NSI) SI > HC (except IGT	FAF and subscales	SI > NSI (except FAF total and inhibition: SI < NSI) SI > HC	No

											errors SI < HC)			
Windle	1994	1061	USA	Comparison of SA with NSA	Military	0			Comparison of SA with NSA (interview)	MMPI	SA > NSA	CMHS	SA > NSA	No
Wnuk et al.	2013	179	USA	Correlational	Patients with Borderline Personality Disorder	86	30.36 (9.9)		LSASII	ZAN-BPD	Positive relationship	STAXI-2 anger out subscale	Negative relationship	Coefficients for relationships provided by authors
Yeh et al.	2012	243	Taiwan	Comparison of SA with	Suicide attempters	67.1	41.5 (13.2)		NSA, SA (single and multiple)	IRS	NSA < SA	BPAQ	NSA < SA	No

				NSA, and single SA with multiple SA	admitted to hospital and case control non-attempters from psychiatric clinics				assessed as part of development of an assessment for risk of repeated SA (the Assessment for Repeated Suicide)		Single SA < multiple SA		Single SA < multiple SA	

Degrees of freedom used to calculate individual effect sizes may differ from that of the total sample; For abbreviations, please see Appendices 3-5.

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Appendix 3: Suicide outcome measures and grouping by categories included in analyses

Suicide outcome measure	Measures	N
History of suicide attempt	Hospital admission records, local file review, or self-report Assessment for Repeated Suicide (Yeh et al., 2011) Columbia History of Suicide Form (Mann et al., 1992) Columbia Suicide Severity Rating Scale (Posner et al., 2011) Lethality of Suicide Attempt Rating Scale (Smith et al., 1984) Lifetime Suicide Attempt Self-Injury Interview (Linehan et al., 2006) The National Comorbidity Survey (Kessler et al., 1999) Paykel Suicide Items (Paykel et al., 1974) Schedule for Affective Disorders (Endicott and Spitzer, 1978)	41
Suicidal ideation	Beck Depression Inventory (Beck et al., 1996) Beck Suicide Intent Scale (Beck et al., 1974) Columbia Suicide Severity Rating Scale (Posner et al., 2011) The Eysenck Personality Questionnaire (Eysenck and Eysenck, 1984)	9

	The Hamilton Depression Rating Scale (Hamilton, 1967) The National Comorbidity Survey (Kessler et al., 1999) Local risk assessment, file review, or self-report Patient Health Questionnaire-9 (Kroenke and Spitzer, 2002) Scale of Suicidal Ideation (Gosling et al., 2011)	
Number of suicide attempts	Beck Suicide Intent Scale (Beck et al. 1974) Columbia History of Suicide Form (Mann et al., 1992) Lifetime Suicide Attempt Self-Injury Interview (Linehan et al., 2006) Local risk assessment, file review, or self-report Paykel Suicide Items (Paykel et al., 1974) Suicide Behavior Questionnaire-Revised (Osman et al., 2001)	14
Cause of death	Cause of death (suicide compared to living controls or sudden deaths by other cause) from Coroner's reports	7
Lethality of suicide attempt	Columbia History of Suicide Form (Mann et al., 1992) The Lethality Scale (Beck et al., 1975) Lethality of Suicide Attempt Rating Scale (Smith et al., 1984)	8

	Local risk assessment, file review, or (clinical) interview/questionnaire	
Suicidal intent	Beck Suicide Intent Scale (Beck et al., 1974)	1
Age at first suicide attempt	Columbia History of Suicide Form (Mann et al., 1992) Local risk assessment, file review, or self-report	3
Suicide risk	Suicide Probability Scale (Cull and Gill, 1982) Suicide Risk Scale (Plutchik et al., 1989)	6

Appendix 4: Measures of impulsivity reported across articles, number of articles employing each measure, and grouping used in analyses

Measure	Description	State or trait	Cognitive, behavioral or both	N
The Barratt Impulsiveness Scale 11 (BIS -11; Patton et al., 1995) The Barratt Impulsiveness Scale 7B (BIS-7B; Barratt, 1993) The Barratt Impulsiveness Scale 10 (BIS-10; Barratt, 1965)	BIS 11: Assessment of trait impulsivity with 3 subscales: • Attentional (BIS-11)/cognitive (BIS-7B,10) impulsivity (lack of focus on a task) • Motor impulsivity (acting without thinking) • Nonplanning impulsivity (orientation to present rather than future) In addition, 7B assesses sensory stimulation, interpersonal impulsivity, and risk taking	Trait	Total score/sensory/interpersonal: both Attentional/cognitive subscales: cognitive Motor subscale: behavioral Nonplanning subscale: cognitive Risk taking subscale: behavioral	49
The DSM-V diagnostic criteria for Borderline Personality	Impulsivity must be reported in at least two areas from spending, sex, substance abuse, reckless driving, binge	Trait	Both	1

Disorder (APA, 2013)	eating (not including self harm)			
Go/No Go task (Donders, 1969)	Participants are required to respond to some stimuli not others. Number of commission errors (making a response on trials that do not require a response), is treated as a proxy of prepotent response inhibition	State	Behavioral	1
The Impulse Control Scale (Plutchik and Van Praag, 1986, 1989)	Measures engagement in behaviors which indicate a loss of contro	Trait	Behavioral	9
The Iowa Gambling Task (Bechara et al., 1994)	A task in which participants are asked to pick a series of 100 cards from 4 decks Participants start with a nominal 'loan' of $2000, with each card either adding or subtracting from the loan Decks A and B are disadvantageous (provide small	State	Cognitive	4

	immediate rewards, but larger losses over time) in comparison to decks C and D which produce smaller immediate gains, and smaller losses and, ultimately, greater profit over time Total net $ at the end of the task provides a measure of planning, with lower amounts corresponding to riskier decision making			
The immediate and delayed memory test (Dougherty, Marsh, and Mathias, 2002)	Performance based assessment of impulsive behavior in which participants are presented with a sequence of numbers and asked to respond when the current number matches the immediately preceding number (IMT) or with matching numbers separated by a filler sequence (DMT) Included in both are 'catch sequences' which	State	Behavioral	2

	are nearly identical to the target sequence Non-target responding to catch sequences, or 'commission errors', is interpreted as evidence of more impulsive responses			
Impulsivity Rating Scale (Lecrubier et al., 1995)	Evaluates day to day impulsivity, based on the behavior during the last week	State	Both	1
Male Depression Risk Scale (Rice et al., 2013)	Includes a risk-taking subscale	Trait	Both	2
Minnesota Multiphasic Personality Inventory (Hathaway and McKinley, 1951)	Includes a 'Behavioral Inhibition' subscale	Trait	Behavioral	1
Johnston et al., (2013)	Factor analysis of various measures of impulsivity	Trait	Both	1

Research-based diagnostic criteria for a mixed state depression (Perugi et al., 2015)	Contains an item concerning impulsivity	Trait	Both	1
The Schedule for Interviewing Borderlines (Baron, 1980)	A clinician-administered instrument used to diagnose schizotypal and borderline personality disorders which contains an impulsivity subscale	Trait	Both	1
The Impulsive Behavior Scale (Whiteside and Lynam, 2001)	Assessment of 5 dimensions of impulsivity: • Negative and positive urgency (the tendency to act impulsively when experiencing intense negative or positive emotions) • Lack of premeditation (the	Trait	Total score: both Urgency subscales: behavioral Lack of premeditation subscale: cognitive Lack of perseverance: cognitive	3

	tendency to act without thinking) • Lack of perseverance (the tendency to lose focus) • Sensation seeking (the tendency to seek out thrilling experiences)		Sensation seeking: behavioral	
The Zanarini Rating Scale for Borderline Personality Disorder (Zanarini, 2003)	A semi-structured interview to assess severity of severity of BPD domains based on DSM-4 diagnostic criteria Includes an impulsivity score comprised of self-damaging impulsive behaviors	Trait	Behavioral	1

Appendix 5: Measures of aggression reported across studies, number of studies employing each measure, and grouping employed in meta-analyses

Measure	Description	State or trait	Outcome	N of studies
Buss-Durkee Hostility Inventory (Buss and Durkee, 1957)	Assesses hostility and guilt	Trait	Hostility Has been treated as a proxy of impulsive aggression across the literature	25
Brown-Goodwin Aggression Inventory (Brown and Goodwin, 1986)	Assessment of aggression across the lifetime	Trait	General aggression	4
The Brown-Goodwin Lifetime History of Aggression (Brown et al., 1979)	Assesses expression of aggression (verbal and physical) across lifetime	Trait	General aggression	21
The Buss-Perry Aggression Questionnaire (Buss and Perry, 1989)	Assesses trait aggression, as well sub-scales: • Physical aggression • Verbal aggression • Anger	Trait	Total = general aggression Physical aggression	10

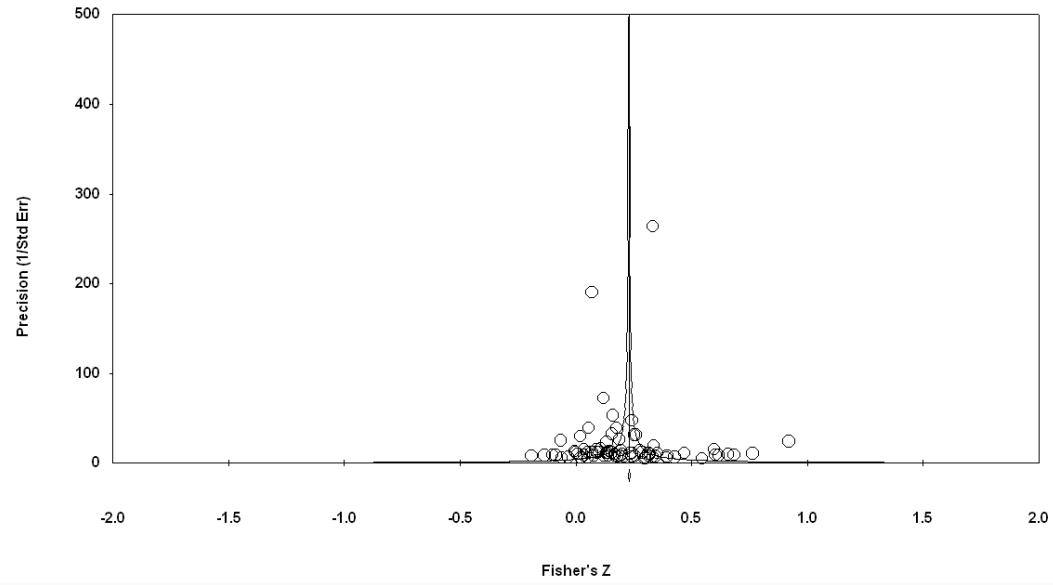
	• Hostility		Verbal aggression Anger Hostility	
The DSM-V diagnostic criteria for Borderline Personality Disorder (APA, 2013)	Includes a scale assessing intense anger	Trait	Anger	1
Hostility and direction of hostility questionnaire (Caine et al., 1967)	Assesses inwardly and outwardly directed hostility	Trait	Hostility	3
Impulsive aggression (Koenisberg et al., 2001)	A factor assessing impulsive aggression	Trait	Impulsive aggression	1
Impulsive Premeditated Aggression Scale (Stanford et al., 2003)	Assesses impulsive and premeditated aggression	Trait	Impulsive aggression Premeditated aggression	3
Karolinska Scales of Personality (Schalling et al., 1983)	Assesses vulnerability to different pathologies, with subscales: Indirect aggression, verbal aggression, irritability,	Trait	Indirect aggression = other Verbal aggression =	1

	suspiciousness, guilt, and inhibition of aggression		verbal aggression Irritability = irritability Suspiciousness = other Guilt = other Inhibition of aggression = general aggression	
Multidimensional Anger Inventory (Siegal, 1986)	Assess dimensions of anger	Trait	Anger	6
The Male Depression Risk Scale (Rice et al., 2013)	Assessment of broad externalizing domains, including aggression	Trait	General aggression	2
The Overt Aggression Scale (OAS; Silver and Yudifsky, 1989) and the modified version (MOAS; Margari et al., 2005)	Monitors frequency and severity of verbal and physical, autoaggression and aggression against property (designed for use in inpatient settings over the last week) Subscales: • verbal aggression	State	Total score = general aggression Verbal aggression sub-scale = verbal aggression Physical and aggression against	5

	• aggression against property • autoaggression • physical aggression		property = physical aggression Autoagression = other	
Past Feelings and Acts of Violence (Plutchick and Van Praag, 1990)	Assesses risk of engaging in violence based on past violence	Trait	Physical aggression	4
Past Violent Feelings and Behavior Scale (Plutchik and van Praag, 1986)	Includes items to assess history of violence	Trait	Physical aggression	1
Research-based diagnostic criteria for a mixed state depression (Perugi et al., 2015)	Items about physical and verbal aggression	Trait	General aggression	1
Suicide Probability Scale (Cull and Gill, 1982).	Screening measure of suicide risk in outpatient settings; includes items concerning hostility	Trait	Hostility	2
State and Trait Anger Expression Inventory (Speilberger, 1988)	Assesses anger with 11 subscales: • State anger • Trait anger	Both	Anger	9

	• Experience of anger • Verbal expression of anger • Physical expression of anger • Angry temperament • Angry reaction • Outward expression of anger • Inward expression of anger • Control of outward anger • Control of inward anger • Anger expression index			

Appendix 6: Funnel plots showing precision estimates



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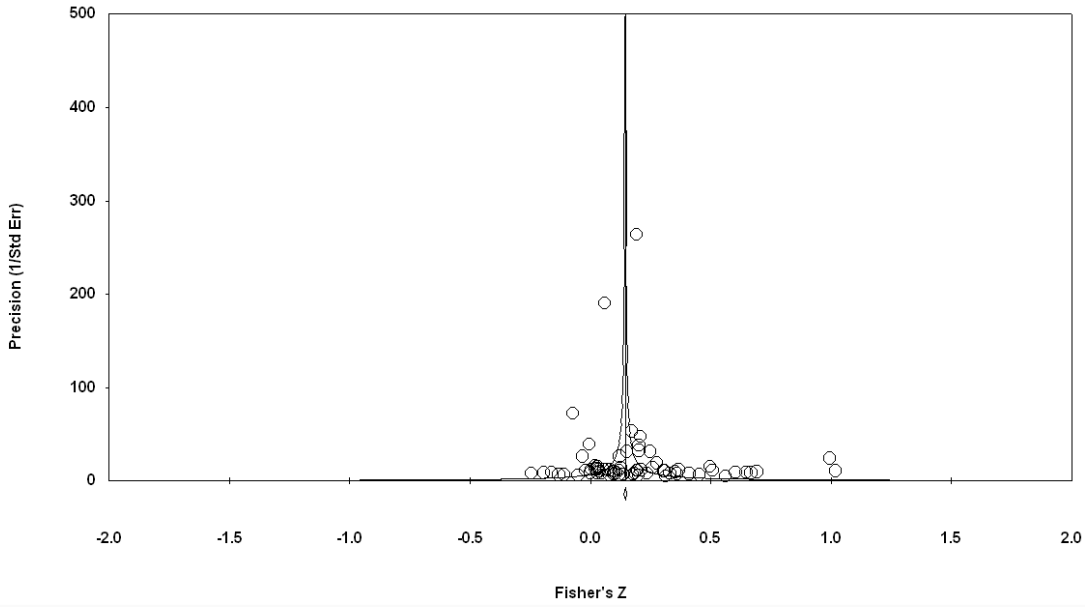

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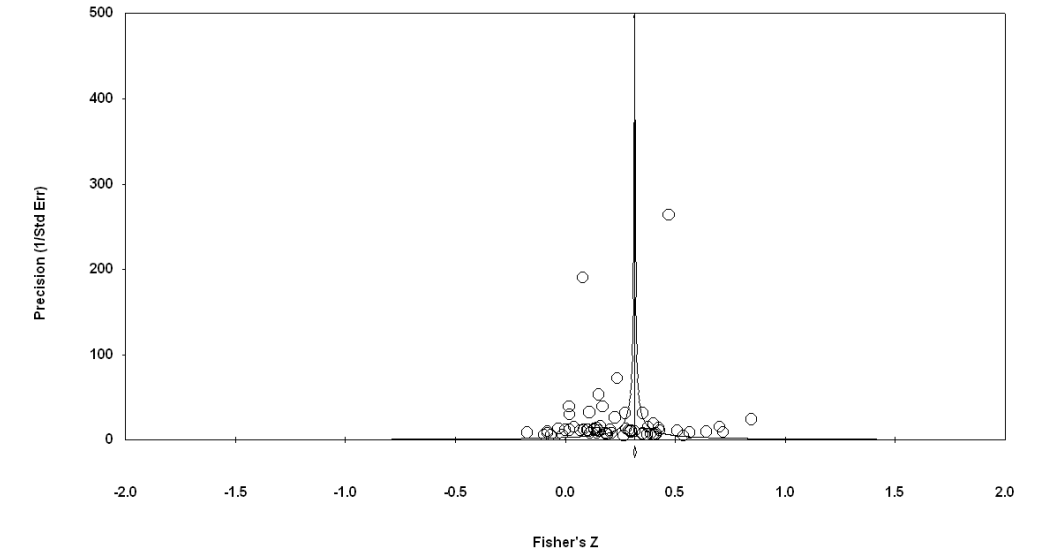

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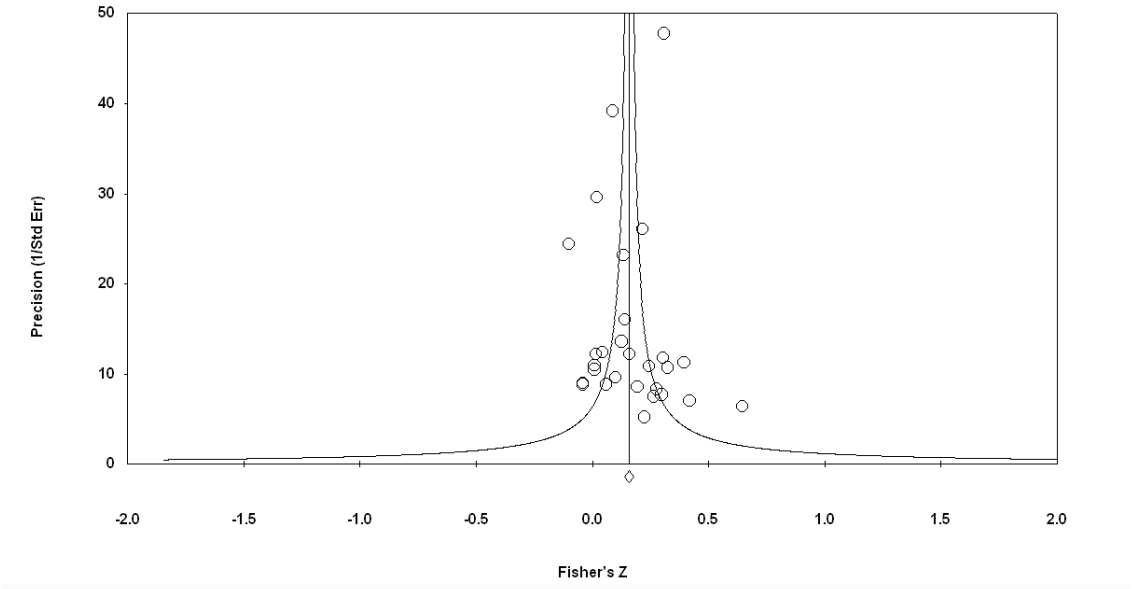

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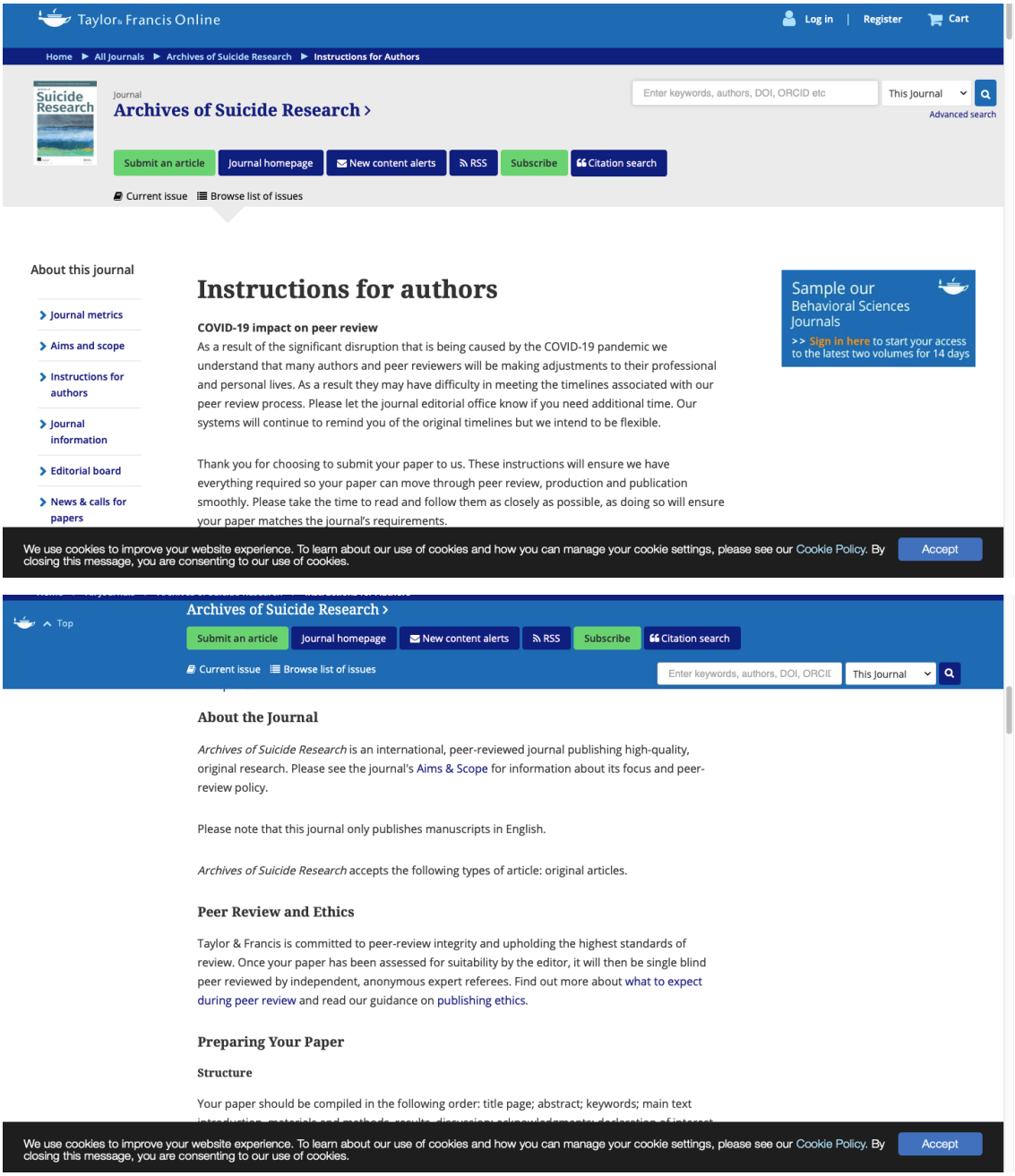
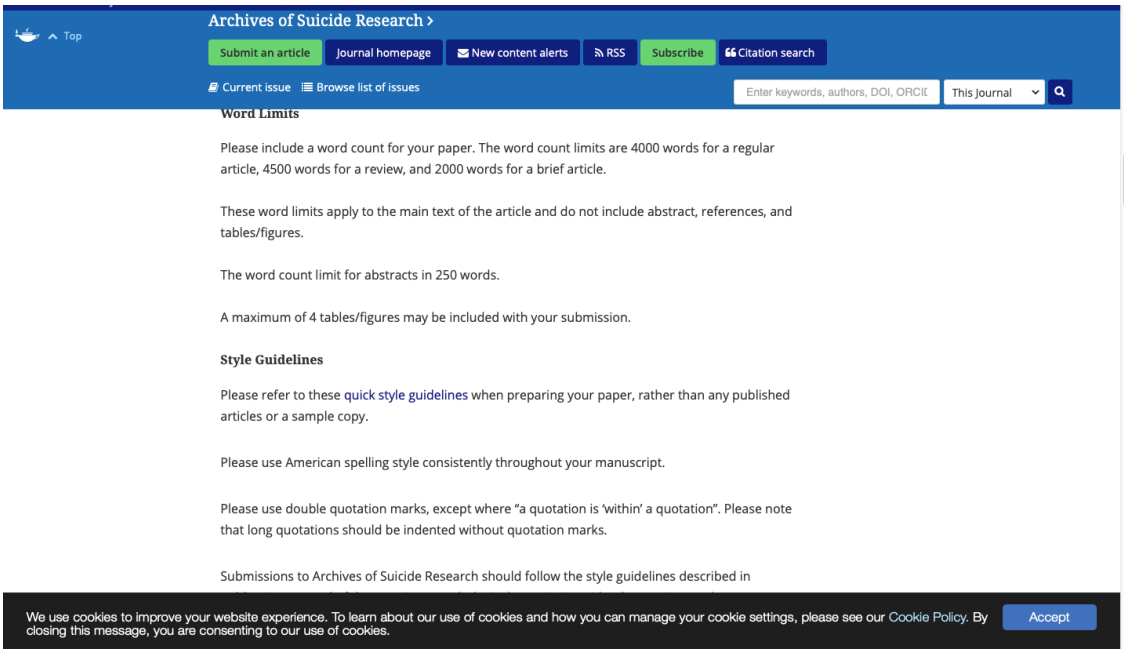
Appendix 7: Instructions for authors for Archives of Suicide Research

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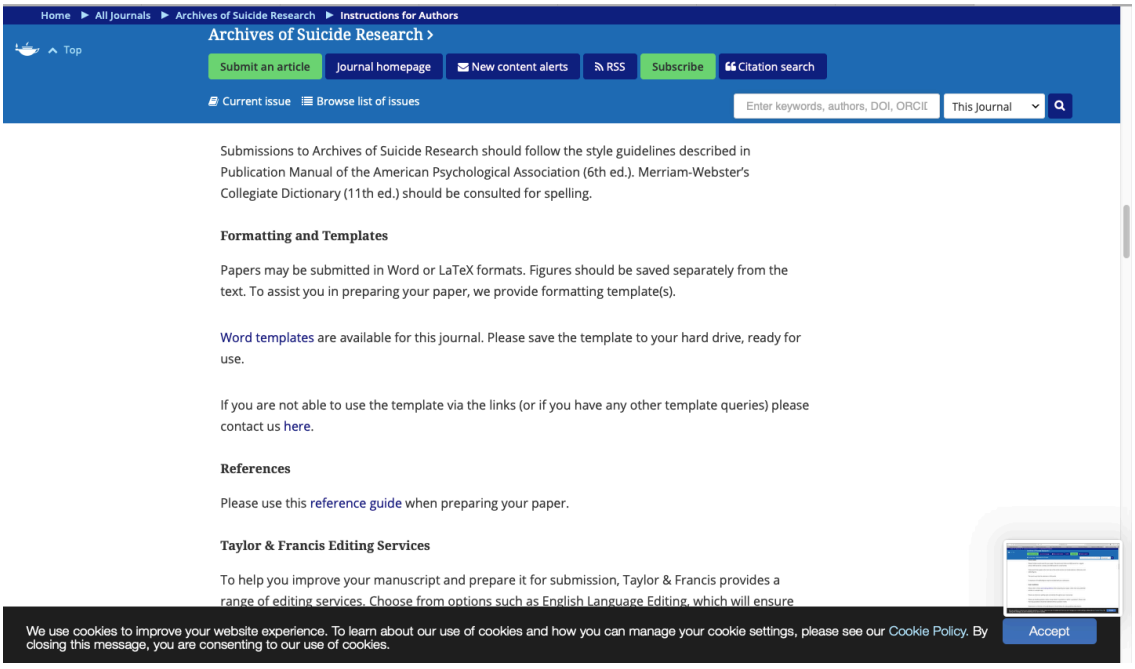
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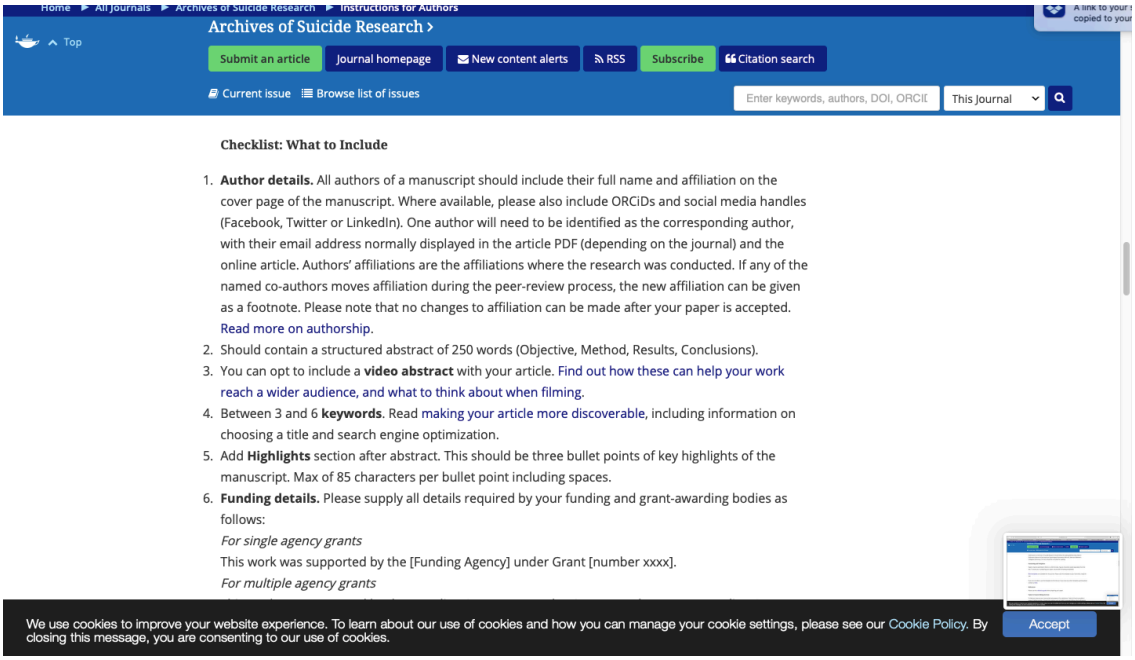
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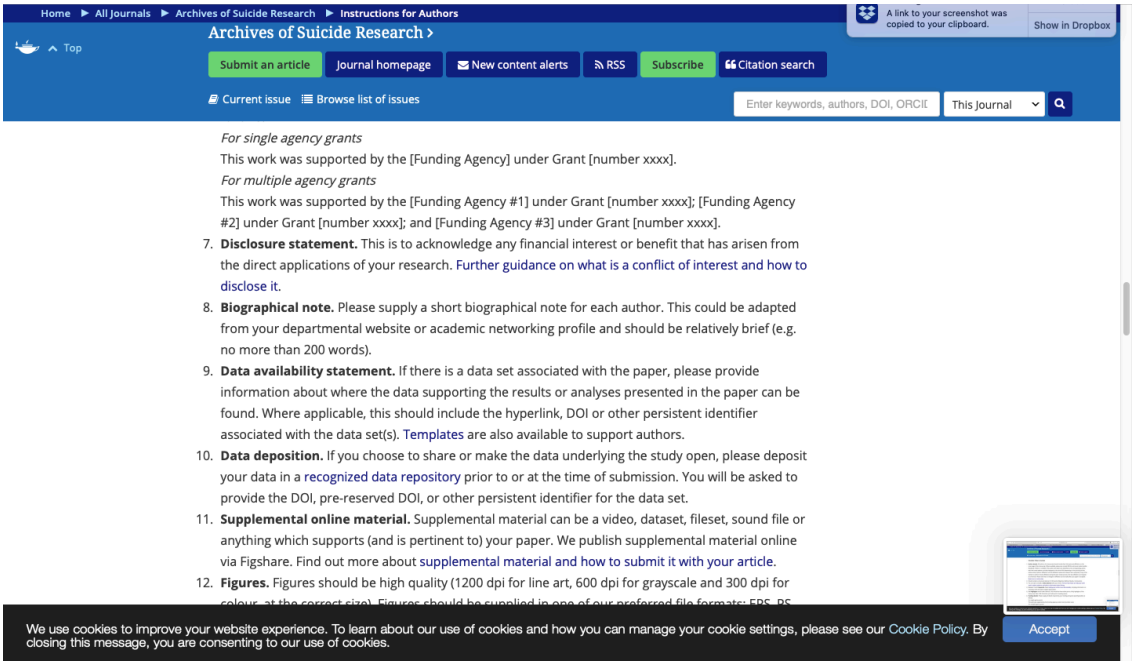
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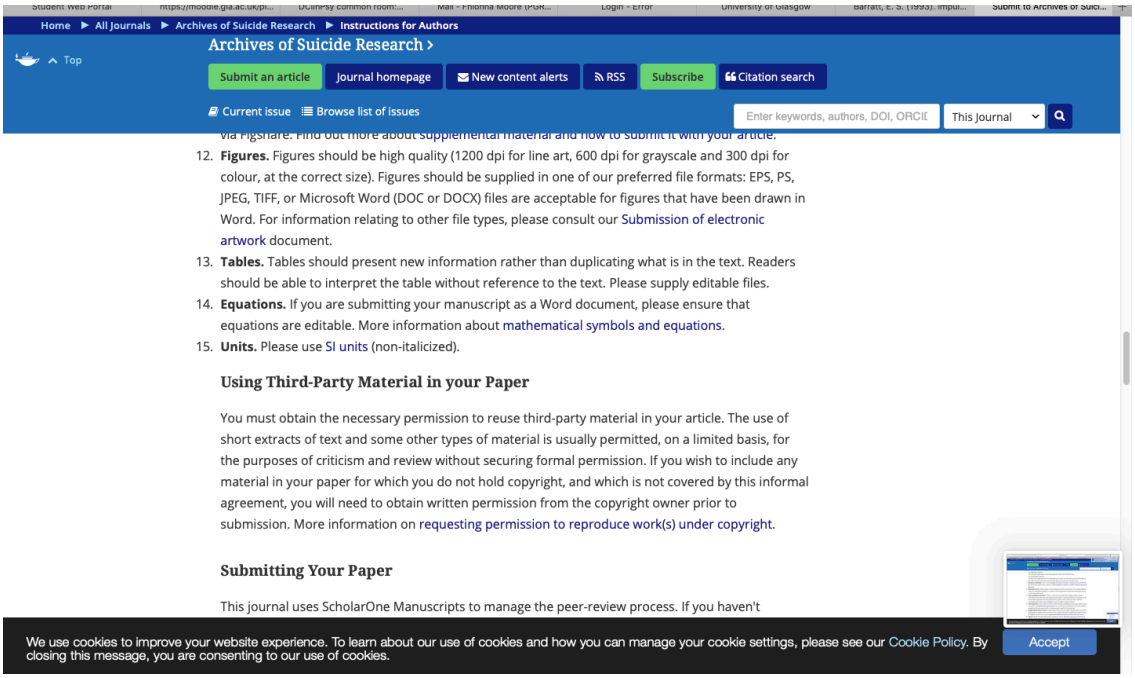
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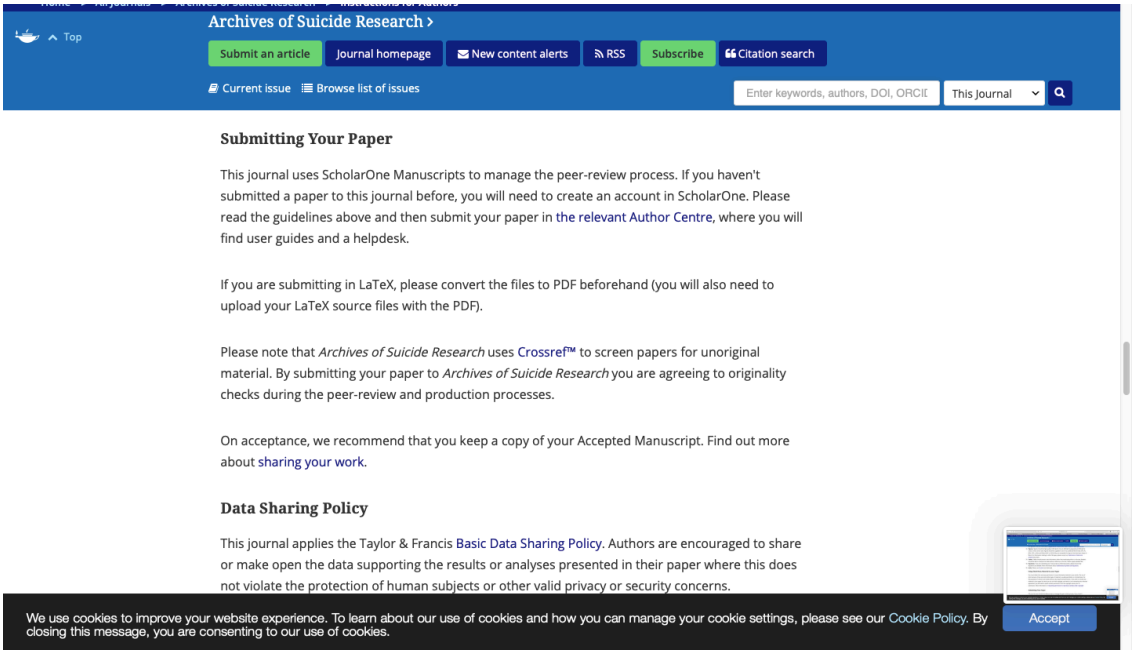
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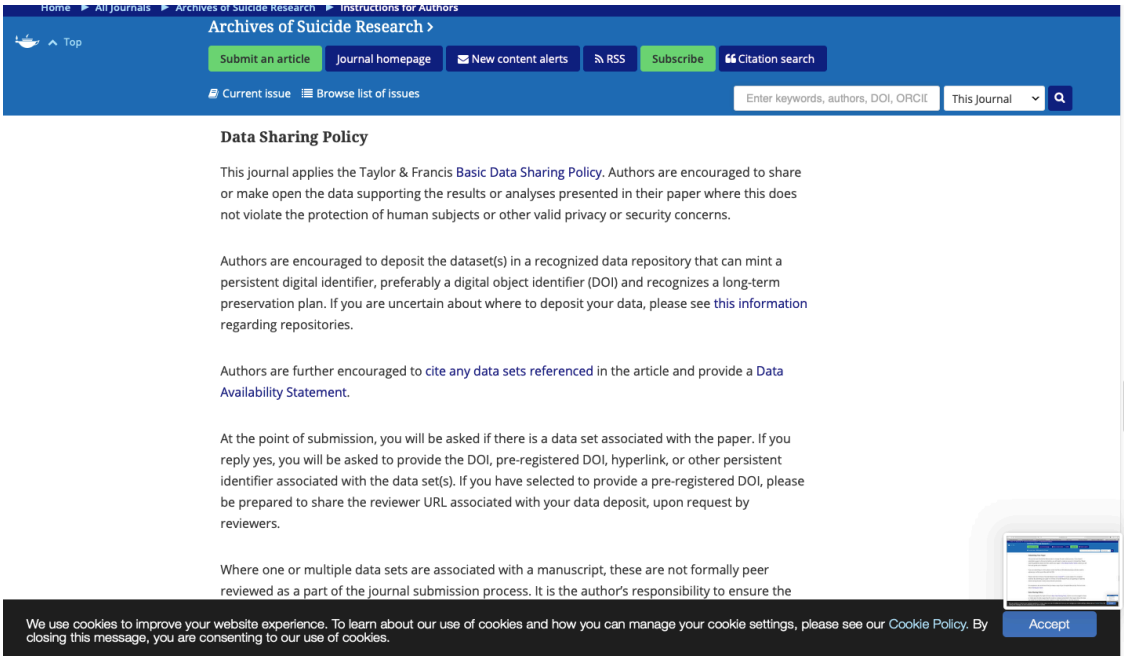
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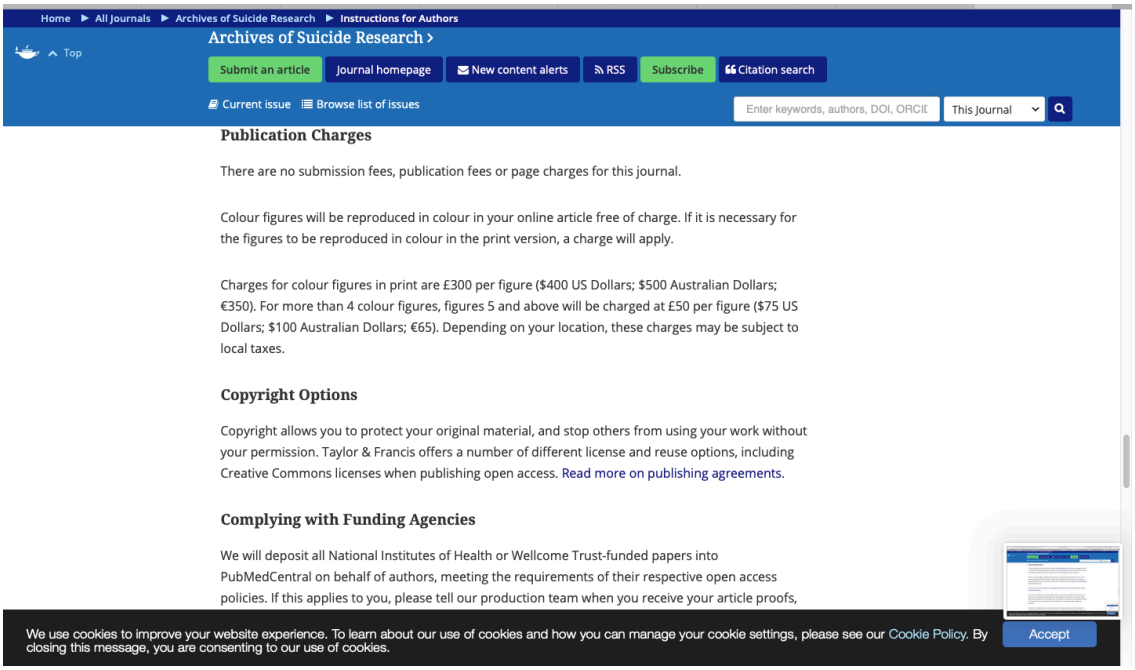
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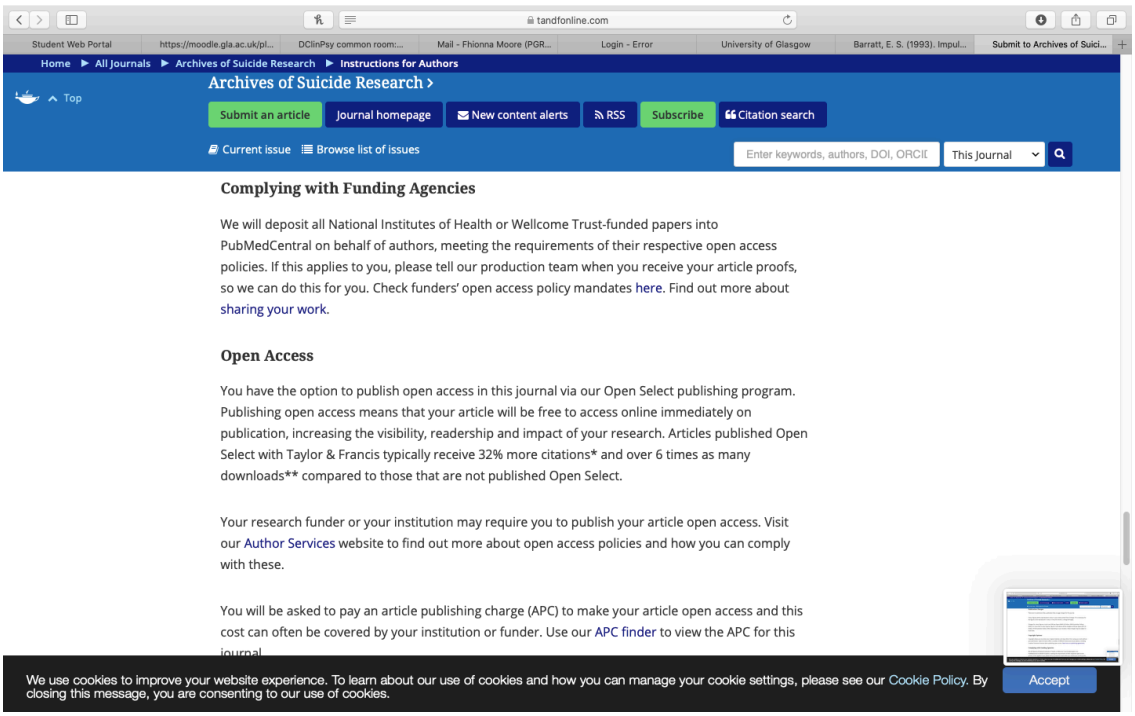
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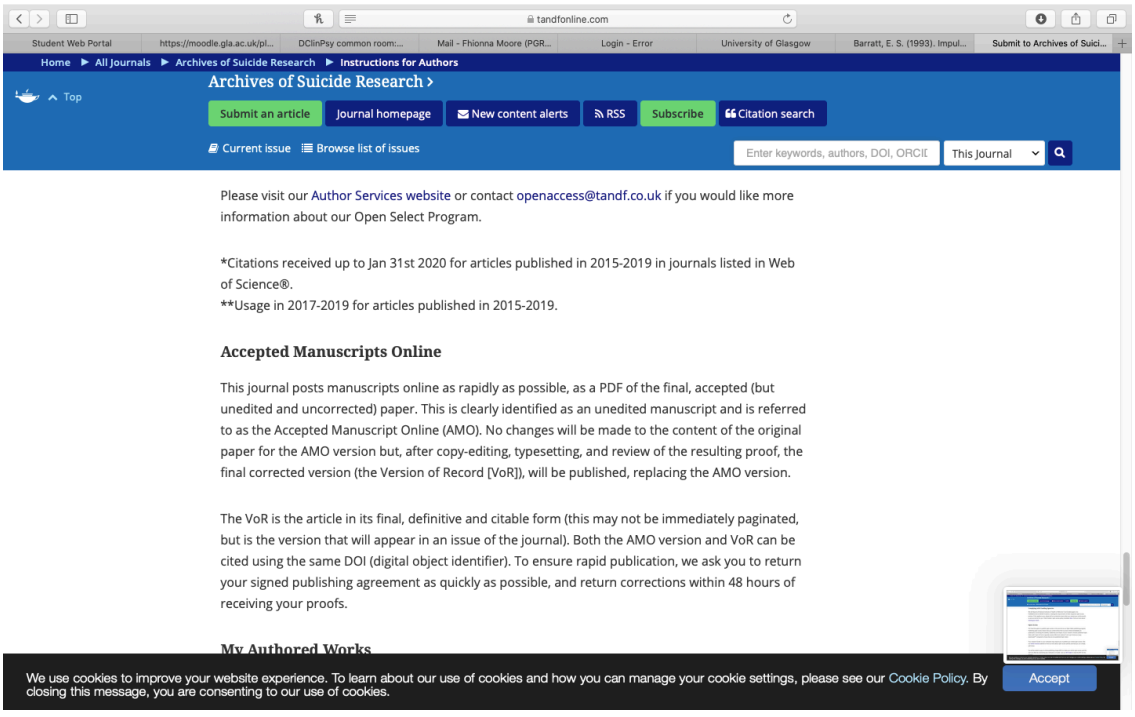
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Appendix 8: Final Approved MRP Proposal

Impulsivity and aggression in suicide risk

Word count: 3072 words; Maximum word count: 3000 words

Version 4, 22/4/20

Abstract

Background: Despite a large body of research identifying population-level risk factors for suicide, risk assessment of individuals based on these factors performs poorly. Risk formulation, which interprets risk factors in the context of the individual, has been proposed as a more fruitful approach to assessing risk of suicide. Identifying measurable psychological constructs and the ways they contribute to the development of suicidal behaviour can add to the knowledge base to inform the development of risk formulation methodology. *Aim:* To investigate the nature of association between impulsivity, aggression, and impulsive aggression and suicidal thinking and behaviour. *Methods:* Impulsivity, aggression, 'impulsive aggression', and suicidal ideation and behaviour will be assessed in a minimum of 300 participants via an online survey advertised on social media. The survey will be open to all, and based on responses participants will be categorised as those who (1) have no history of suicidal ideation or behaviour, (2) those with a history of suicidal ideation but not of suicidal behaviour, and (3) those with a history of suicidal behaviour. Path analysis will be conducted to test competing predictions of the roles of impulsivity, aggression, and aggressive impulsivity in suicidal thinking and behaviour. *Applications:* The results will inform the development of suicide risk formulation by demonstrating how key psychological constructs contribute to the development of suicidal behaviour.

Introduction

Suicide represents a major public health concern worldwide, with at least 800, 000 people dying by suicide each year (WHO, 2014). Despite a large body of research identifying population-level risk factors, risk assessment tools based on counting these risk factors perform poorly at identifying individuals at risk (Large, 2016; Large et al., 2016, 2018; Runeson et al., 2017; National Confidential Inquiry into Suicide and Homicide by People with Mental Illness, 2018). Counting risk factors alone performs worse than chance in predicting suicidal thoughts and behaviour (Franklin et al., 2017), and actuarial risk assessment tools are wrong 95% of the time with many cases erroneously categorised as 'low risk' (Chan et al., 2016; Carter et al., 2017). While we

are relatively good at identifying population-level risk factors, then, this does not translate to accurate assessment of individual risk. Recent research has provided support for suicide risk formulation as a more effective therapeutic, and more accurate predictive, approach than risk assessment (e.g. Silverman & Berman, 2014a,b). Here, longitudinal and recent, and static and dynamic, risk factors are discussed and assessed in the context of the individual. Identifying measurable factors and their role in predicting suicidal behaviour, then, can add to the nuance and accuracy of our formulations. Here, I will focus on the psychological constructs of impulsivity, aggression, and impulsive aggression as they appear in multiple psychological models of suicidal behaviour, and a large body of existing literature provides a grounding for identifying appropriate empirical measurements and potential mechanisms in the development of suicidal behaviour (e.g. Brent & Mann, 2005, 2006; Gvion & Apter, 2011; Anestis et al. 2014).

Impulsivity is a broad and multi-dimensional construct that is conceptualised, defined, and measured in diverse ways (e.g. Lynam & Miller, 2004). Definitions range from risk-taking and sensation-seeking, preference for small immediate rewards over large distal rewards, deficits in planning, and affective states such as urgency. Despite its heterogeneity, impulsivity is incorporated as a predictive variable in 3 of the 10 key psychological models of suicide (Barzilay & Apter, 2014). Baumeister's (1990) 'Escape Theory' proposes that suicide risk increases when individuals can no longer resist impulsive urges to remove themselves from aversive self-awareness via increased behavioural disinhibition. In Beck et al.'s (1990; see also Wenzel & Becks, 2008) Cognitive Model of Suicidal Behavior, impulsivity is viewed as a dispositional trait which increases vulnerability to suicidality. Finally, in the Integrated Motivational Volitional Model (O'Connor, 2011; O'Connor and Kirtley, 2018), impulsivity acts as a volitional moderator – bridging the gap between suicidal thoughts and actions.

Recent meta-analyses and reviews of associations between impulsivity and suicide, however, have yielded conflicting conclusions. Anestis et al. (2014) presented results of a meta-analysis of the association between trait impulsivity and suicidal behaviour and concluded that any association was weak or non-existent. Conversely, Gvion & Apter (2011) reported the results of a systematic literature review demonstrating that

impulsivity is highly correlated with suicide risk across both psychiatric and non-clinical populations. Vast diversity in the definitions of both suicidal behaviour and impulsivity are likely to contribute to these discrepancies (e.g. Lockwood et al., 2017; Gvion & Apter, 2011). Anestis et al. (2014), for example, focussed on trait impulsivity assessed through self-report or behavioural measures, and included only studies which looked at the presence or absence, or frequency, of suicidal behaviour. Gvion & Apter (2011), on the other hand, used broader definitions and – despite their conclusion that the two are closely linked – argued that the literature is complex and often contradictory due to the variety of operationalisations. Furthermore, there is evidence that impulsivity may not act as an independent predictor in its own right but may interact with various psychological or behavioural variables. Aggression has received the most attention in this context, and Gvion & Apter's (2011) review demonstrated that impulsivity and aggression are related both to each other and to suicide, although the patterns of these relationships are complex and contradictory.

Aggression is also conceptualised and operationalised in multiple ways. In Psychology, it is broadly defined as any behaviour intended to harm another person who is motivated to avoid being harmed although aggression, violence, irritability, and anger are used interchangeably in the literature (Gvion and Apter, 2011). Brent & Mann (2005, 2006) have argued that impulsivity, hostility, and aggression are all part of an overarching construct that could be conceptualised as a disinhibitory psychopathology and operationalised as 'impulsive aggression'. They defined this as 'the tendency to respond to provocation or frustration with hostility or aggression' (pp. 2720).

Aggression appears in Beck et al.'s (1990) Comprehensive Cognitive Model in the same role as impulsivity: as a dispositional trait which increases vulnerability to suicidality. Impulsive aggression plays a role in Brent and Mann's (2006) Clinical-Biological Model of Suicidal Behavior and in Plutchik, van Praag, and Conte's (1989) Two Stage Model of Outward and Inward Directed Aggression. In Brent and Mann's (2006) model, 'impulsive aggression' is viewed as a familial trait which is at least partly genetic, and mediates between psychopathology and suicidal action. In Plutchik, van Praag, and Conte's (1989) model, aggressive impulses are triggered by stress, and the likelihood of them being expressed against the self is increased when coupled with depression and/or recent

psychiatric symptoms. Interestingly, here trait impulsivity is seen as increasing the likelihood of aggression directed towards others, rather than towards the self.

To summarise so far, impulsivity, aggression, and 'impulsive aggression' appear in multiple psychological models of suicidal behaviour and are proposed to predict suicidal behaviour via a number of different pathways. A useful way of structuring these competing hypotheses is to include them as testable pathways in an overarching theoretical framework for the development of suicidal behaviour. As impulsivity and aggression are viewed variously as dispositional traits (Beck et al., 1990; Brent & Mann, 2006), state responses to adversity and stress (Plutchik et al., 1989), or as some combination of the two (Baumeister, 1990; O'Connor, 2011), a stress-diathesis model is most appropriate. O'Connor's (2011) Integrated Motivational Volitional Model of Suicidal Behaviour incorporates 3 stages, based on the theory of planned behaviour, which describe the ways in which stress and diathesis can lead to motivation (e.g. suicidal ideation) and that moderating factors can increase the likelihood of ideation becoming action (see also O'Connor & Kirtley, 2018). As shown in Figure 1 below, this model allows testable pathways corresponding to each of the proposed roles of impulsivity, aggression, and 'impulsive aggression' derived from the psychological literature. Pathway A corresponds to Beck et al.'s (1990) proposal that impulsivity and aggression, and to Brent and Mann's (2006) that 'impulsive aggression', are dispositional traits which increase vulnerability to suicidal feelings. Pathway B corresponds to Plutchik et al.'s (1989) proposal that stress increases aggressive impulses and, when in combination with depression, these are more likely to be directed towards the self. Finally, Pathway C corresponds to O'Connor's (2011) and O'Connor and Kirtley's (2018) and Baumeister's (1990) proposals that impulsivity moderates between suicidal ideation and behaviour.

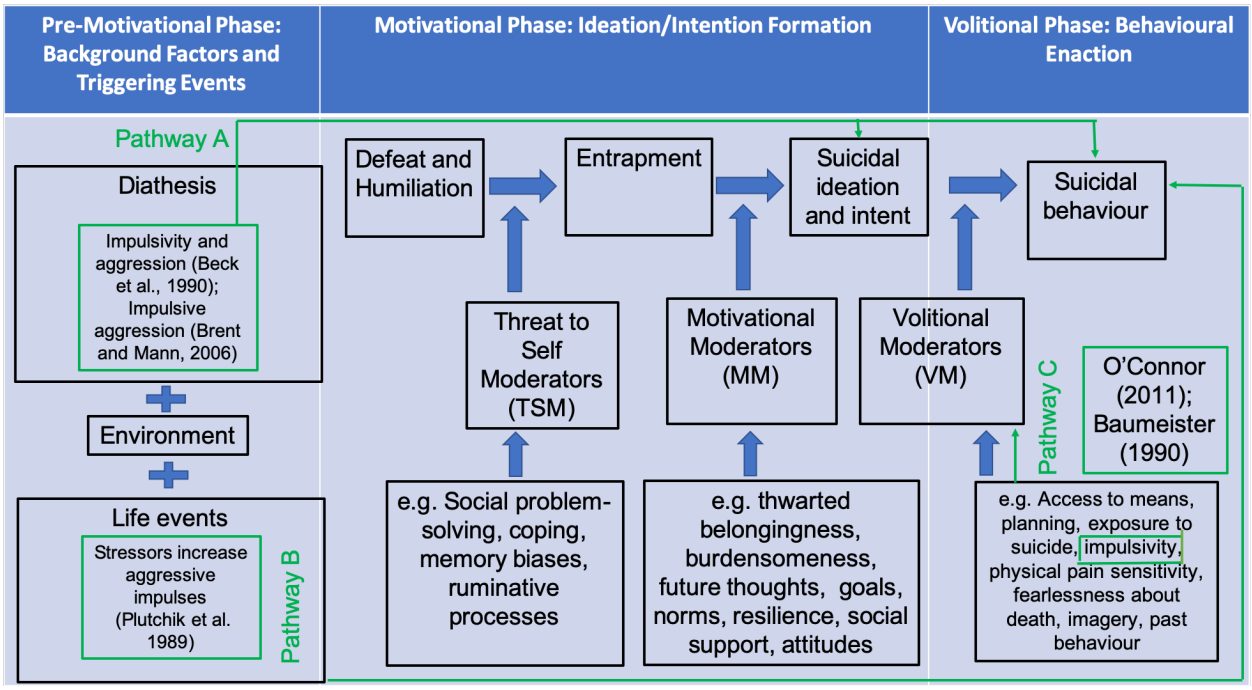

Figure 1 The adapted Integrated Motivational Volitional Model of Suicidal Behaviour (O'Connor & Kirtley, 2018) with proposed pathways between impulsivity and aggression and suicidal behaviour added in green.

Aim and research question

The aim of the proposed research is to investigate relationships between impulsivity, aggression, and 'impulsive aggression' and suicidal behaviour. The research question is 'do impulsivity, aggression, and 'impulsive aggression' contribute to suicidal behaviour?'. This will be achieved by testing pathways A, B, and C. As the pathways are set in the context of the Integrated Motivational Volitional Model of Suicidal Behaviour (O'Connor, 2011; O'Connor & Kirtley, 2018), analyses will be conducted in the context of key pre-motivational (psychiatric diagnoses, socioeconomic status, stress), and motivational (defeat and entrapment) variables (e.g. Dhingra, Boduszek, & O'Connor, 2016).

Hypotheses

The pathways are derived from conceptually distinct models of the roles of impulsivity, aggression, and 'impulsive aggression', in suicidal behaviour, and therefore generate unique and testable predictions. Predictions stemming from Pathway A are that trait impulsivity and aggression (Beck et al., 1990) and 'impulsive aggression' (Brent & Mann, 2006) will be positively related with suicidal ideation and suicidal behaviour. Predictions stemming from Pathway B are that 'impulsive aggression' will mediate the relationship between stress and suicidal behaviour, in interaction with depression and recent psychiatric symptoms (Plutchik et al. 1989). Specifically, 'impulsive aggression' will be most strongly positively related to suicidal behaviour in those who report depression or recent psychiatric symptoms. The prediction stemming from Pathway C is that impulsivity will be higher in those who have exhibited suicidal behaviour than those who have experienced suicidal ideation but have not exhibited suicidal behaviour (O'Connor, 2011; O'Connor & Kirtley, 2018). Furthermore, as all pathways will be tested in the context of key pre-motivational, motivational, and volitional factors shown in Figure 1, there is an exploratory element to the work in which any mediation or moderation of pathways A, B, and C by these factors will be identified.

Practical applications of the work are the potential to identify measurable psychological constructs which are predictive of suicidal behaviour risk, and their mechanisms of action, in order to inform suicide risk formulation methodology.

Plan of investigation

Participants

Participants will be recruited to an online survey which will be advertised on social media. The University of Glasgow's Suicidal Behaviour Research Lab (SBRL) use this method of recruitment routinely. Inclusion criteria are that the participants must be aged 16 or above. Advertising for participants from Scotland allows use of a well-validated measure of socioeconomic deprivation (the Scottish Multiple Deprivation Index, 2016) and reduces any noise which may be introduced via socioecological and

cultural variation across nations. Participants are required who have (a) not experienced suicidal ideation or enacted suicidal behaviour, (b) experienced suicidal ideation but not enacted suicidal behaviour, and (c) experienced suicidal ideation and enacted suicidal behaviour. The maximum number of variables that will be included in any single model will be 4 (i.e. when testing whether the interaction term of 'impulsive aggression' with either depression or recent psychiatric symptoms predicts suicidal behaviour alongside covariates of socioeconomic deprivation, psychiatric diagnoses, and stress). The required sample size in order to detect relationships between 4 predictor variables and 1 criterion variable, based on a small effect size (e.g. a beta of 0.02 in multiple logistic regression was reported for the relationship between impulsivity and suicidal intent versus action; Wetherall et al., 2018) is 107 (G*Power). In order to allow analyses of pathways in sub-groups on the basis of demographic variables (e.g. gender), the target sample size will be a minimum of 300. It is desirable, however, to recruit as many participants as possible in addition this target sample size as this may enable more fine-grained analysis of mediating and moderating roles of motivational and volitional variables. A sample of 300 will also be sufficient to conduct an exploratory factor analysis (see Analysis section below)

Design

The design will be correlational. It will utilise a convenience sample.

Procedures

Participants will be asked to complete self-report validated scales of all measures described below, presented in random order via an online survey. It is estimated that it will take 20-30 minutes to complete the survey.

Measures

(1) Demographic variables

Participants will be asked to report their age, gender, relationship status ("are you currently in a committed relationship?" yes or no), sexual orientation (free text response), and country of residence (free text response).

(2) Pre-motivational stage variables

Participants will be asked to select 'yes' or 'no' in response to 'Do you have a diagnosed mental health condition?'. If they respond 'yes', they will be asked to enter their diagnosis into a free text box. They will then be asked to rate the severity of their symptoms in the last year and the last month (1 = no symptoms, 7 = extremely severe symptoms).

Participants will be asked to report the first half of their postcode, from which socioeconomic deprivation can be assessed using the Scottish Index of Multiple Deprivation (2016).

Stress will be assessed using Cohen's (1995) Perceived Stress Scale. This 10-item scale assesses experience of stress in the last month.

(3) Motivational stage variables

Defeat will be measured using the Griffith, Wood, Maltby, & Taylor's (2015) 'Short Defeat and Entrapment Scale'. This self-report measure assesses perceived failed struggle and loss of rank in the last 7 days.

Entrapment will be measured using the 'Short-Form Entrapment Scale' (de Beurs et al. 2020). This 4-item measure assesses perceived inability to escape from unbearable situations, thoughts and feelings.

(4) Impulsivity

In order to assess all the various operationalisations of impulsivity, multiple measures will be taken.

First, the Barrett Impulsiveness Scale (Patton et al. 1995) is a well-validated and widely used measure of trait impulsivity. This 30-item scale assesses impulsive behaviours and preferences that fall under 3 sub-scales (attentional and motor impulsivity and non-planning).

The UPPS-P-S Impulsive Behavior Scale (Lynam, 2013) is a 20-item scale which assesses positive and negative urgency, lack of premeditation, lack of perseverance, and sensation seeking.

Risk-taking will be assessed using the Domain-Specific Risk-Taking Scale (Blais & Weber, 2013). This 30-item scale assesses self-reported level of risk taking and attitudes towards perceived risk in ethical, financial, health/safety, social, and recreational domains.

(5) Aggression

Trait aggression will be assessed with the Buss-Perry Aggression Scale (Buss & Perry, 1992). This 29-item scale assesses physical aggression, verbal aggression, anger and hostility.

(6) Impulsive aggression

Brent & Mann (2005, 2006) describe impulsive aggression as a hybrid of impulsivity, aggression, and hostility. Plutchik, van Praag, & Conte (1989) describe an 'aggressive impulse' which is conceptually distinct from aggressive behavior and represents an underlying propensity for impulsive aggression which can be directed towards the self or others depending upon context. In order to assess impulsive aggression, impulsivity and aggression measurements will be entered into an exploratory factor analysis to determine the structure of inter-correlations between the constructs. If a factor emerges which incorporates dimensions of impulsivity, hostility, and aggression, this will be used as a measure of impulsive aggression. If no clear factor emerges, a composite score of impulsive aggression based on scores on impulsivity, hostility, and aggression will be computed.

(7) Depression

Depression will be assessed using the PHQ-9 (Spitzer et al.1999). This 9-item measure assesses symptoms of depression in the last 2 weeks.

(8) Outcome measures

Suicidal ideation/intent and enactment of suicidal behaviour will be assessed with the following items: (1) “Have you ever thought of taking your life, even though you would not actually do it?” and (2) “Have you ever made an attempt to take your life, by taking an overdose of tablets or in some other way?” (taken from the Adult Psychiatric Morbidity Survey (self-completion version), 2014). Response options are “no”, “yes”, and “would rather not say”. Responses will be used to allocate participants to 3 groups: (1) no history of suicidal ideation or enactment of suicidal behaviour, (2) experienced suicidal ideation but has never enacted suicidal behaviour, and (3) has enacted suicidal behaviour in the past.

In addition, those who have responded ‘yes’ to (2) will be asked the following questions from the Adult Psychiatric Morbidity Survey (2014): (a) When did you last attempt to take your own life? (the past week, the past year, longer ago, would rather not say) and (b) How many times have you made an attempt to take your life (free text response).

Finally, suicidal ideation will be assessed using the 8-item suicidal ideation subscale of the Suicide Probability Scale (Cull and Gill, 1989).

Analysis

Exploratory factor analysis will be conducted to determine the structure of inter-correlations between impulsivity and aggression. This will allow the identification of any naturally occurring impulsive aggression factor which will be used in further analyses. If a clear factor structure doesn’t emerge, a composite of impulsivity, aggression, and hostility scores will be computed (e.g. the sum of total items for each relevant scale).

Linear regression analyses will be used to test for relationships between impulsivity, aggression, and impulsive aggression, and suicidal ideation/intent and suicidal behaviour (Pathway A). Moderated mediation analysis will be used to determine

whether impulsive aggression (alone and in interaction with depression or recent psychiatric symptoms) mediates a relationship between the experience of stressors and suicidal behaviour (Pathway B). Binary logistic regression will be used to determine whether impulsivity can predict whether participants have who have enacted suicidal behaviour or have experienced suicidal ideation but have not enacted suicidal behaviour (Pathway C).

All analyses described above will also be conducted with the addition of key covariates identified from the pre-motivational and motivational stages shown in Figure 1. Here, hierarchical multiple linear regression, binary logistic regression, and mediation and moderation analyses will be conducted.

Ethical issues

The study will be reviewed by the MVLS University of Glasgow Research Ethics Committee. The full purpose and indicative content of the survey will be presented in the study information. Participants will provide informed consent to take part once they have read this information and agreed that they understand that their data will remain anonymous (and therefore cannot be removed once they have completed the survey), that data are confidential and available only to the research team (e.g. stored on password protected servers and if included in any publications will not be identifiable), that diagnoses of mental health conditions cannot be made by the research team, that participation in voluntary, and that they can omit to answer any question or withdraw from the survey at any time without penalty.

The survey will be open to anyone aged 16 years and over. The nature of the survey means that it will target participants who may have experienced suicidal ideation and who may have enacted suicidal behaviour. Participants may also have psychiatric diagnoses. As the content of some survey items relate to suicidality and mental health, it is possible that completing the survey may induce distress in some participants. For this reason, the areas that will be covered in the survey will be made clear in the introductory invitation and study information, as will the right for participants to omit

to answer any question without penalty, and to end the survey at any point. The debrief at the end of the survey will include links to national support organisations (e.g. Samaritans, NHS-24 Breathing Space). If participants make contact expressing distress or seeking help, they will be referred to these support organisations. None of the previous similar studies conducted in the Suicide Behaviour Research Laboratory have resulted in any distress in any of our participants, to our knowledge.

Timescale

An ethics proposal will be submitted to the MVLS University of Glasgow Research Ethics Committee in March 2020. Data collection will commence in June 2020 and run until December 2020. Preliminary data analyses will be conducted during this time. Full analyses will be conducted in January-February 2021. The project will be written in March-May 2021.

Financial costs

Two hundred pounds are requested for miscellaneous costs for xocial media advertising via Facebook Ad Manager tool. The cost includes creation of an advertising post via the Ad Manager tool (£45), then a weekly budget of £10 per week for circulation to a specified audience for 5.5 weeks (£100). Participants will also be entered into a prize draw for gift vouchers (£100).

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Appendix 1: Plain English summary

Impulsivity and aggression in suicidal behaviour

Background: Despite a large body of research identifying population-level risk factors for suicide, risk assessment of individuals based on these factors performs poorly. Risk formulation, which interprets risk factors in the context of the individual, has been proposed as a more fruitful approach to assessing risk of suicide. Identifying measurable psychological constructs and the ways in which they contribute to the development of suicidal behaviour can help to better identify who is at risk of suicide.

Aims & Questions: The aim is to investigate the nature of the association between impulsivity, aggression, and impulsive aggression and suicidal thinking and behaviour. Derived from leading psychological models of suicidal behavior, this research will address three questions: (1) Do impulsivity, aggression, and impulsive aggression correlate with suicidal ideation and suicidal behaviour; (2) Does impulsive aggression account for the relationship between the experience of stressors and suicidal ideation and behaviour?; (3) Is impulsivity higher in those who have engaged in suicidal behaviour than in those who have experienced suicidal ideation but who have not attempted suicide?

Methods: Impulsivity, aggression, impulsive aggression, and suicidal ideation and behaviour will be assessed via an online survey advertised on social media in Scotland and online. The survey will be open to all, and based on responses participants will be categorised as those who (1) have no history of suicidal ideation or behaviour, (2) those with a history of suicidal ideation but not of suicidal behaviour, and (3) those with a history of suicidal behaviour. Statistical analysis will be conducted to test competing predictions of the roles of impulsivity, aggression, and aggressive impulsivity in suicidal behaviour.

Key applications: Informing suicide risk assessment and intervention. Helping mental health professionals to be better able to identify people at risk and to support them.

Key ethical issues: The aim and indicative content of the survey will be presented in the study information. Participants will provide informed consent once they have read this

information and agreed that they understand that their data will remain anonymous (and therefore cannot be removed once submitted), data are confidential and available only to the research team (e.g. stored on password protected servers and non-identifiable), that diagnoses of mental health conditions cannot be made by the research team, that participation is voluntary, and that they can omit to answer any question or withdraw from the survey at any time without penalty.

The survey will be open to anyone aged 16 years and over. The nature of the survey means that it will target participants who may have experienced suicidal ideation and behaviour or have psychiatric diagnoses. As the content of some survey items relate to suicidality and mental health, it is possible that completing the survey may induce some distress. Therefore, as noted above, participants will be informed that they do not have to answer any questions that they do not want to. All participants will be provide a list of national support organisations (e.g. Samaritans, NHS-24 Breathing Space) they can contact if they feel distressed.

References:

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Appendix 2: Health and Safety

HEALTH AND SAFETY FOR RESEARCHERS

1. Title of Project	Impulsivity and aggression in suicide
2. Trainee	Fhionna Moore

3. University Supervisor	Rory O'Connor
4. Other Supervisor(s)	Claire Allott
5. Local Lead Clinician	Claire Allott
6. Participants: (age, group or sub- group, pre- or post-treatment, etc)	Age 16 years and over. No other inclusion/exclusion criteria.
7. Procedures to be applied (eg, questionnaire, interview, etc)	Online questionnaire
8. Setting (where will procedures be carried out?) i) General	Online
ii) Are home visits involved	N
8. Potential Risk Factors Identified see chart	None (online)

9. Potential Risk Factors Considered (for researcher+participant safety): 1. i) Participants 2. ii) Procedures 3. iii) Settings	Participants: We will be recruiting participants who have experienced suicidal feelings and behaviour. Participants will be directed to appropriate support services at appropriate points of the survey consistent with all other online research conducted within the SBRL (participant information sheet (PIS), debrief sheet). At the end f the survey all participants will be given a list of support services. Procedures: The procedures in the study are same/similar to those used by clinical psychologists with these participants and are not normally associated with production of significant distress. The questionnaire has the propensity to cause some level of frustration and/or distress. For example, the questionnaire will take 20-30 minutes to complete, so may cause frustration. Participants will be informed (in the PIS and on each page of the survey) that they may omit to answer any questionnaire and withdraw without penalty at any point. Distress may be induced due to the nature of questions about mental health, life stressors, and suicidality. Participants will be provided with contact information for appropriate support services in the PIS and debrief. Settings: NA – online.

Appendix 3: Equipment and cost form

APPENDIX 8.6 RESEARCH COSTS & EQUIPMENT

RESEARCH EQUIPMENT, CONSUMABLES AND EXPENSES Trainee Fhionna Moore **Year of Course** 2. **Intake Year** 2018. Please refer to latest stationary costs list (available from student support team)

Item	**Details and Amount Required**	**Cost or Specify if to Request to Borrow from Department**
Stationary		Subtotal:
Postage		Subtotal:
Photocopying and Laser Printing		Subtotal:
Equipment and Software		Subtotal:
Measures		Subtotal:
Miscellaneous	Social media advertising Prize draw	Subtotal: 200
Total		200

For any request over £200 please provide further justification for all items that contribute to a high total cost estimate. Please also provide justification if costing for an honorarium:

Trainee Signature. ... Date. 30/11/19 Supervisor's Signature ..... Date .....

Appendix 9: Ethical Approval Letter

University of Glasgow

Dear Professor Rory OConnor

MVLS College Ethics Committee
Project Title *Impulsivity and aggression in suicide risk*
Project No: *200190160*

The College Ethics Committee has reviewed your application and has agreed that there is no objection on ethical grounds to the proposed study.

We are happy therefore to approve the project, subject to the following conditions.

- Project end date as stipulated in original application.
- The data should be held securely for a period of ten years after the completion of the research project, or for longer if specified by the research funder or sponsor, in accordance with the University's Code of Good Practice in Research: (http://www.gla.ac.uk/media/media_227599_en.pdf)
- The research should be carried out only on the sites, and/or with the groups defined in the application.
- Any proposed changes in the protocol should be submitted for reassessment, except when it is necessary to change the protocol to eliminate hazard to the subjects or where the change involves only the administrative aspects of the project. The Ethics Committee should be informed of any such changes.
- For projects requiring the use of an online questionnaire, the University has an Online Surveys account for research. To request access, see the University's application procedure at https://www.gla.ac.uk/research/strategy/ourpolicies/useofonlinesurveystoolforresearch/.
- You should submit a short end of study report to the Ethics Committee within 3 months of completion.

Yours sincerely

Dr Terry Quinn

Terry Quinn
FESO, MD, FRCP, BSc (hons), MBChB (hons)
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Appendix 10: Participant Information and Consent Forms

University of Glasgow | College of Medical, Veterinary & Life Sciences

1. **Study title**

Impulsivity and aggression in suicidal risk

2. **Invitation paragraph**

You are being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being conducted and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information.

3. **What is the purpose of the study?**

The aim of this study is to test the relationship between impulsivity and aggression and suicidal feelings and behaviour.

4. **Why have I been invited to participate?**

You have been invited to take part in this study because you are 16 years or older. We are looking for men and women of all ages and backgrounds to take part, to give us as a wide a view as possible. You do not have to have experienced suicidal feelings or behaviour to take part, but we also welcome those who have.

5. **Do I have to take part?**

No, it is up to you to decide whether or not to take part. If you decide to take part, you are still free to withdraw at any time and without giving a reason.

6. What will happen to me if I take part?

Approximately 300 participants will complete the study.
The study will be carried out online.
It is a questionnaire that will take 20-30 minutes to complete, and you can take part from anywhere with an internet connection by clicking on the link on the following page.
We will use participants' answers to the questionnaire items to look for relationships between various psychological variables (e.g. mental health, impulsivity, aggression) and whether or not they have experienced suicidal feelings and behaviour.
In order to achieve this, the questionnaire contains items designed to measure, for example, your mental health (e.g. whether or not you have a mental health diagnosis, your experience of feelings of depression, defeat, and entrapment), your experience of stress, your levels of impulsivity and aggression, and whether or not you have ever considered or attempted suicide. You will also be asked some questions about your gender and age, and also for the first half of your postcode. This information cannot be used to identify you, and is only required so that we can control for where people live in our analyses.
The answers you provide will be stored in a password protected database on a secure University of Glasgow server. They will only be accessed by the research team. The data will be stored securely for 10 years and will then be securely destroyed.
We will not be able to identify you from the answers you provide, as the data will be anonymous and stored confidentially. You may provide your email address if you wish to be entered into the prize draw for £100 of gift vouchers (e.g. for Amazon or a local retailer of your choice). This will be stored separately from the rest of your data and cannot be linked to your answers.
Please note that, as your answers are stored anonymously, they cannot be removed from the database.

Please click here to view the Privacy Notice for this study.

7. What are the possible disadvantages and risks of taking part?

It is possible that answering some of these questions may cause you some distress. For example, they may cause you to think about difficult feelings or experiences you have had. Should this happen, we have provided contact details for some support services at the end of this form. You are also not required to answer any question which you would prefer to leave blank, and you can choose to end the survey at any time without penalty.
Even though you may choose to provide answers about your mental health, the research team are not able to make a diagnosis based on your responses, or to provide advice on your mental health. If you have any concerns about your mental health, please consider contacting your GP and/or one of the following support

services: Samaritans (116 123), NHS24 (111) or, if you are in Scotland, Breathing Space (0800 83 85 87).

8. What are the possible benefits of taking part?

You will receive no direct benefit from taking part in this study. The information that is collected during this study will give us a better understanding of some of the psychological variables which could be targeted in assessing and intervening in suicide risk

9. Will my taking part in this study be kept confidential?

All information which is collected about you, or responses that you provide, during the course of the research will be kept strictly confidential. Your email address will be stored separately from the rest of your data, so they cannot be linked.

10. What will happen to my data?

Data will be stored on a secure, password protected file on University of Glasgow servers. You will not be identifiable from the data you provide. Your email address will be stored separately from the rest of your data and will be used only for the purpose of entry into the prize draw should you choose to do so.
The data will be stored in archiving facilities in line with the University of Glasgow retention policy of up to 10 years. After this period, further retention may be agreed or your data will be securely destroyed in accordance with the relevant standard procedures.
Your rights to access, change or move the information we store are limited, as the data are stored anonymously so cannot be linked to you. If you withdraw from the study, we will keep the information about you that we have already obtained. To safeguard your rights, we will use the minimum personally-identifiable information possible. You can find out more about how we use your information from Fhionna Moore (2428482m@student.gla.ac.uk).
Researchers from the University of Glasgow collect, store and process all personal information in accordance with the General Data Protection Regulation (2018).
Your data will form part of the study result that will be published in expert journals, presentations, student dissertations/theses (if applicable) and on the internet for other researchers to use. Your name will not appear in any publication.

11. What will happen to the results of the research study?

The results of the study will form the basis of Fhionna Moore's Doctoral Thesis in partial fulfilment of a Doctorate in Clinical Psychology. This will be published on the University of Glasgow's research repository (Enlighten) in 2021. The results are also likely to be published in a scientific journal. If you wish to read the thesis or publication, please contact the lead researcher on .....
You will not be identifiable from these publications.

12. Who is organising and funding the research?

The research is organised and funded by the University of Glasgow.

13. Who has reviewed the study?

The project has been reviewed by the College of Medical, Veterinary & Life Sciences Ethics Committee.

14. Contact for Further Information

If you have any questions or require any further information, please contact Dr Fhionna Moore on .....

Thank you for reading the participant information sheet.

Impulsivity and aggression in suicide risk – Consent Form

Name of Researcher(s):	Dr Fhionna Moore, Professor Rory O'Connor, Dr Claire Allott

By clicking on the link below to begin the survey you are agreeing that you:

Have read and understood the Participant Information Sheet

Have had the opportunity to think about the information and ask questions, and understand the answers I have been given.

Understand that your participation is voluntary and that you are free to withdraw at any time, without giving any reason, without your legal rights being affected.

Confirm that you have read the associated Privacy Notice for this study and agree:

- to the way your data will be collected and processed
- that data will be stored for up to 10 years in University archiving facilities in accordance with relevant Data Protection policies and regulations;
- understand that all data and information you provide will be kept confidential and will be seen only by study researchers and regulators whose job it is to check the work of researchers.
- agree that the data described in the information sheet will be kept for the purposes of this research project.

- understand that if you withdraw from the study, your data collected up to that point will be retained and used for the remainder of the study.

Agree to take part in the study.