

## **Original article**

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## **Title: Attempting to disentangle the relationship between impulsivity and longitudinal self-harm: Epidemiological analysis of United Kingdom household survey data**

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## Abstract

### Background

Impulsivity may be an important risk factor in terms of future self-harm. However, the extent of this, whether it may relate to self-harm that is new in onset and / or repetition of self-harm, and the detail of any interaction with mood instability and childhood sexual abuse requires detailed examination.

### Aims

We used the 2000 Adult Psychiatry Morbidity Survey and 18-month follow-up data to test hypotheses relating to the role of impulsivity, childhood sexual abuse (CSA), and mood instability (MI) in the inception and persistence of self-harm.

### Methods

We assessed associations of impulsivity with (i) suicidal self-harm (SSH), and (ii) non-suicidal self-harm (NSSH) at baseline and follow-up, controlling for confounders including MI. Finally we tested whether impulsivity mediated the relationship between CSA and self-harm.

### Results

8580 respondents were assessed at baseline and 2406 at follow-up as planned. Impulsivity significantly predicted emergence of new NSSH at 18 month follow-up even after adjustment for MI and other confounders. Impulsivity did not significantly predict repetition of NSSH, or repetition or new inception of SSH, even before inclusion of MI in the model. However, the absolute numbers involved were small. Cross-sectionally, impulsivity was a stronger mediator of the link between CSA and SSH (13.1%) than that between CSA and NSSH (4.8%).

### Conclusions

Impulsivity may increase the risk of future development of NSSH independently of MI, which is clinically important for risk assessment. The involvement of impulsivity in the

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3 repetition of self-harm generally appears less certain. However, impulsivity may have a role  
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5 in SSH in the context of previous CSA.  
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11 **Keywords:** (excluding words in title) suicidal ideation, affective instability, risk  
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14 assessment, impulsivity, epidemiology  
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## 1. Introduction

### 1.1 The public health importance of self-harm

Self-harm, physical harm to an individual by self-injury or self-poisoning irrespective of motivation (NICE, 2011) is the most important risk factor for future suicide (Carroll, Metcalfe, & Gunnell, 2014; Owens, Horrocks, & House, 2002). Suicide is the known cause of death for approximately 800,000 people around the world each year, and by 2020 it is predicted to comprise 2% of the global burden of disease (WHO, 2012).

### 1.2 Predicting self-harm – the role of personality factors?

Self-harm is best understood as a complex interaction between individual personality factors (such as impulsivity and mood instability (MI)), various clinical and social factors (such as current mental and physical state, employment difficulties, financial stress, and previous abuse), and socio-demographic variables (such as age, sex, culture) (Hawton & van Heeringen, 2009). The recognised poor predictive value of risk scoring systems based on the existing clinical, social and demographic “risk” factors associated with self-harm (Franklin et al., 2017; Quinlivan et al., 2016; Saunders, Brand, Lascelles, & Hawton, 2014) implies that research into individual-based factors may be one way of improving our ability to predict future self-harm (de Cates et al., 2016).

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8 1.3 Impulsivity, mood instability, and sexual abuse in childhood – understanding the  
9 links with self-harm risk

10 Reduced serotonin activity was one of the earliest and strongest biological links made to  
11 an increased risk of suicide (Asberg, Traskman, & Thoren, 1976; Roy, De Jong, &  
12 Linnoila, 1989). Poor control of impulsivity (rapid, unplanned reactions to internal or  
13 external stimuli without appropriately considering the negative consequences (Moeller,  
14 Barratt, Dougherty, Schmitz, & Swann, 2001)) emerged as a putative phenotype of this  
15 abnormal biology (van Praag et al., 1987). There is now a wealth of data assessing  
16 impulsivity and self-harm in individuals with various psychiatric diagnoses or none  
17 (Apter, Plutchik, & van Praag, 1993; Baca-Garcia et al., 2001; Mann, Waternaux, Haas,  
18 & Malone, 1999; Maser et al., 2002; Soloff, Lynch, Kelly, Malone, & Mann, 2000).  
19 However, the exact relationship between impulsivity and self-harm is unclear, including  
20 whether it relates to initiation of self-harm, repetition of self-harm, or both.  
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Mood instability (MI) has been proposed as interacting with high-risk symptomatology,  
such as self-harm (Peters, Balbuena, Baetz, Marwaha, & Bowen, 2015). The Diagnostic  
Statistical Manual of Mental Disorders 5 (DSM-5) refers to MI as a ‘marked reactivity  
of mood’, forming part of the diagnostic criteria of Borderline Personality Disorder  
(APA, 2015). However, it is also an important presence in other diagnoses, such as  
Bipolar Affective Disorder (Henry et al., 2001; Howes et al., 2011) and non-psychotic  
psychopathology in general (Marwaha, Parsons, Flanagan, & Broome, 2013). MI

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8 appears to be associated with recent suicidal thoughts, independently of psychiatric  
9 diagnoses but not with suicidal acts (MacKinnon et al., 2005; Marwaha et al., 2013).  
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11 However, due to its complex and interacting relationship with impulsivity, MI may yet  
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13 have an important role in prediction of future self-harm. Impulsivity appears to be  
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15 redundant in predicting future suicidal ideation if MI is taken into account (Peters,  
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17 Balbuena, Marwaha, Baetz, & Bowen, 2015). In the same manner, it is possible that any  
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19 link between impulsivity and future self-harm acts may be eliminated if mood  
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21 instability is present. There is thus uncertainty about whether impulsivity has a role  
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23 independent of mood instability in the context of self-harm and its repetition.  
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30 As a group, people with a history of childhood trauma, and especially childhood sexual  
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32 abuse (CSA), are more likely to make suicide attempts and have higher scores on  
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34 impulsivity and aggression scales (Brodsky et al., 2001). CSA may therefore be  
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36 considered an environmental risk factor for both impulsivity and self-harm (Brodsky et  
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38 al., 2001), and the relationship between these three factors requires further exploration.  
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#### 43 1.4 Lack of clarity in terms of importance of these factors and timing of future self-harm

44 Therefore, current evidence indicates that impulsivity may be an important individual-  
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46 based factor in terms of future self-harm, and that it should be analysed in the context of  
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48 mood instability considering their close relationship in terms of self-harm. A recent  
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8 epidemiological study using a large United Kingdom (UK) dataset has examined the  
9 effect of baseline mood instability and impulsivity on future non-suicidal self-harm  
10 (NSSH) (Peters, Baetz, Marwaha, Balbuena, & Bowen, 2016). However, there has been  
11 no epidemiological study of the inception and repetition of non-suicidal self-harm  
12 (NSSH) and suicidal self-harm (SSH) in the context of mood instability and  
13 impulsivity. Moreover, the role of child sexual abuse in these relationships has not been  
14 examined in detail.  
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### 26 1.5 Aims of the study

27 We used data from a large United Kingdom (UK) household survey. Our primary aims  
28 were to determine in a longitudinal analysis whether impulsivity predicted (i) onset of  
29 suicidal self-harm and non-suicidal self-harm and (ii) repetition of suicidal self-harm  
30 and non-suicidal self-harm, after controlling for socio-demographic variables,  
31 depression, mood instability (MI) and general mental and physical health. We  
32 hypothesised that impulsivity and any self-harm would be associated, but that this  
33 association would be removed by the presence of mood instability. A secondary aim  
34 was to determine if impulsivity has a role in the relationship between (i) CSA and  
35 suicidal self-harm, and (ii) CSA and non-suicidal self-harm, in a cross-sectional  
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## 2. Methods

### 2.1 Sample

Participants were respondents of the second Adult Psychiatric Morbidity Survey (APMS) conducted in the UK in 2000. The survey was designed to be representative of the British adult population. The 2000 survey was chosen as it also included an 18-month follow-up of a planned subset of participants. The sample constituted people aged 16 to 74 years living in private households in England, Wales and Scotland, randomly selected by a postcode sampling procedure. Data were weighted to account for survey design and response rates so that the results remained representative of the UK national household population. Full details of the survey and methods are given in the comprehensive APMS survey report (Singleton, Bumpstead, O'Brien, Lee, & Meltzer, 2001). Supplementary material tables 1 and 2 provide demographic details of respondents for certain groups (suicidal self-harm at T1 and T2, non-suicidal self-harm at T1 and T2, and impulsivity).

### 2.2 Measurements

Impulsivity was assessed using the question 'have you always done things impulsively? (Yes/No)', while mood instability (MI) was assessed using 'do you have a lot of sudden mood changes? (Yes/No)'. Both items formed part of the Structured Clinical Interview for DSM-IV (SCID). Experience of childhood sexual abuse (CSA) was reported by indicating on a card in the Stressful Life Events section of phase one interviews. This



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8 was defined as abuse in childhood (under the age of 16) involving sexual intercourse or  
9 related physical molestation. The Clinical Interview Schedule-Revised (CIS-R)  
10 provided questions in terms of suicidal self-harm (SSH) ('have you ever attempted  
11 suicide (Yes/No)'), non-suicidal self-harm (NSSH) ('ever deliberately harmed yourself  
12 but not with the intention of killing yourself (Yes/No)'), and depression (CIS-R  
13 depression score). Physical health status was determined from 'Health in general' (1:  
14 excellent, 2: very good, 3: good, 4: fair, 5: or poor?), and general mental health was  
15 determined from the question 'in last year have you consulted your GP about a mental  
16 health complaint? (Yes/No)'. Sociodemographic variables constituted sex (1 male, 2  
17 female), age in 10year bands, employment status (0 employed, 1 unemployed), marital  
18 status (0 married, 1 not married), ethnicity (0 others, 1 blacks).

### 34 2.3 Analyses

35 We used the Statistical Package for Social Sciences-20 (SPSS-20th edition for  
36 Windows) and STATA (version 14 for Windows) to perform statistical analyses.  
37 Descriptive statistics including frequencies, percentages, means and standard deviations  
38 were obtained to describe the sample.  
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47 We examined the construct validity of self-harm and impulsivity variables in relation to  
48 sociodemographic and significant life event variables using both the baseline and  
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8 follow-up data (detailed in supplementary material tables 1 and 2). This demonstrated  
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10 that the self-harm and impulsivity variables used in this analysis were associated with  
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12 factors previously shown to be linked to self-harm and impulsivity in a different UK  
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14 cohort (Lereya et al., 2013; Mars, Heron, Crane, Hawton, Kidger, et al., 2014; Mars,  
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16 Heron, Crane, Hawton, Lewis, et al., 2014) and other studies (Christiansen & Jensen,  
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18 2007; De Leo et al., 2001; Kreitman & Foster, 1991; Tejedor, Diaz, Castillon, &  
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20 Pericay, 1999). In this way, we corroborated the validity of the APMS assessments of  
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22 these constructs used in our analysis.  
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28 In order to test the role of impulsivity as a mediator between CSA and SH (divided into  
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30 SSH and NSSH), we used the Karlson Holm Breen (KHB) command in STATA. This  
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32 method of mediation analysis breaks down the total effect of a variable into direct and  
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34 indirect effects (Marwaha, Broome, Bebbington, Kuipers, & Freeman, 2014), and has  
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36 been used in previous analyses of data from the Adult Psychiatric Morbidity Survey  
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38 (Catone et al., 2015; Moffa et al., 2017).  
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43 Four logistic regression analyses (two for each self-harm outcome) were performed in  
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45 order to test the longitudinal association of impulsivity with the repetition and inception  
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47 of SSH and NSSH over the 18-month interval. All analyses were first performed  
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8 unadjusted and then controlled in ordered manner in four separate stages for socio-  
9 demographic variables, depression, MI, and general mental and physical health.  
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### 3. Results

#### 3.1 Cross-sectional analyses

Responses from 8580 respondents were available for cross-sectional analysis of the baseline dataset. Of these 8580, 1193 (13.9%) and 3715 (43.3%) endorsed impulsivity and mood instability (MI) respectively, while 346 (4%) indicated personal experience with childhood sexual abuse (CSA). Suicidal self-harm (SSH) and non-suicidal self-harm (NSSH) were reported respectively by 430 (5%) and 200 (2.3%). The sex and age of respondents in various groups can be found in supplementary tables 1 and 2.

In table 1, we analysed the extent to which impulsivity mediated the associations of CSA with self-harm (SSH and NSSH). The indirect route via impulsivity appeared more important for SSH than for NSSH: impulsivity explained 11% of the relationship between SSH and CSA, but only 4% of the relationship between NSSH and CSA.

#### 3.2 Longitudinal analyses

Responses were available from 2406 participants in the 18-month follow-up analyses. This was follow-up of a planned subset of the original cohort. Of these, 191 (7.9%, weighted) had experienced at least one episode of SSH at T1, and 22 at T2 (0.9%). 90

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8 (3.7%) answered positively for NSSH at T1, and 25 (1.0%) at T2<sup>1</sup>. For analysis  
9 purposes, 13 respondents had repetition of SSH at T2 (T1 + T2), and 3 had new  
10 inception of SSH at T2 (T2 only). 6 respondents endorsed SSH at T2, but equivalent  
11 data was missing at T1 and so they could not be included in analysis. Equally, 13  
12 respondents repeated NSSH at T2 (T1 + T2), and 12 had new NSSH at T2 (T2 only).  
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21 The longitudinal logistic regression analyses demonstrated that impulsivity predicts new  
22 NSSH at 18-month follow-up in individuals who at baseline had not reported previous  
23 NSSH (OR 11.73, 2.27-60.60,  $p < 0.005$ ) (table 3). This finding remained significant after  
24 controlling for socio-demographic variables, depression, MI, and general physical and  
25 mental health, although the odds ratio reduced (OR 6.42, 1.50-27.44,  $p < 0.012$ ) (table 3).  
26 However, impulsivity did not significantly predict new inceptions of SSH, or repetition  
27 of either NSSH or SSH. The full list of odds ratios (unadjusted and after controlling for  
28 factors in an ordered regression) is detailed in tables 2 and 3.  
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49 <sup>1</sup> Results from a validating analysis of our SSH and NSSH variables confirming participant numbers and  
50 construct validity of the self-harm variables and the impulsivity variable are displayed in supplementary  
51 material.  
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#### 4. Discussion

In this study, we assessed whether impulsivity may predict the inception and repetition of suicidal and non-suicidal self-harm, independently of mood instability (MI). We also examined whether impulsivity mediated the relationship between childhood sexual abuse (CSA) and self-harm.

Impulsivity did predict first onset but not necessarily repetition of self-harm independently of current and recent mood disturbances (specifically MI and depression), general mental and physical health, and background social and demographic factors. Our results resolve some of the uncertainty about impulsivity and prediction of self-harm, and begin to unpack the relationship between impulsivity and related factors such as MI in terms of self-harm. This has clinical relevance: awareness of the role of impulsivity may aid clinicians in managing future risk. Once self-harming behaviour has started, an “escalating disinhibition syndrome” of self-harm may develop in an individual (de Cates & Broome, 2016), such that protective factors such as self-censure are removed in terms of future episodes. However, although it may have an important role in development of the disinhibition syndrome, impulsivity may not be a significant factor in repetition of self-harm once this disinhibition syndrome is established, and at this point other factors may become more important. This

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8 complexity may explain some of the difficulties experienced by all researchers in  
9 teasing out the exact role of impulsivity in its relationship to self-harm.  
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14 We also found that impulsivity meets criteria for mediating the relationship between  
15 CSA and self-harm. This is consistent with previous evidence where college students  
16 who reported child maltreatment also demonstrated higher levels of impulsivity and  
17 higher rates of self-harm behaviours during adulthood (Arens, Gaher, & Simons, 2012).  
18 Arens and colleagues suggested that individuals with histories of childhood abuse may  
19 be more likely to engage in self-harm in order to reduce intense negative affect (Arens  
20 et al., 2012). In the current study impulsivity was particularly important in mediating  
21 more severe suicidal behaviour, in which the intent appeared to be completed suicide. A  
22 possible explanation, linking our cross-sectional and longitudinal results, might be that  
23 impulsivity is more important in first onset of self-harm than repetition (before the  
24 “escalating disinhibition syndrome” of self-harm develops), and that, once impulsivity  
25 has initiated the tendency for established self-harming behaviour, the threshold for  
26 repetition of this action is lowered. While these results provide suggestions about the  
27 importance of different individual factors in the mechanism and timing of self-harm as a  
28 pathological process, further clarification is required.  
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8 Our findings indicate that (perhaps outside of the context of CSA) impulsivity may be  
9 more relevant for initiation of NSSH as opposed to SSH. This could be considered  
10 particularly important considering the paucity of previous research examining both  
11 NSSH and SSH in this dataset in the context of impulsivity and mood instability (MI).  
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16 We encourage all researchers to include NSSH and SSH responses in using large  
17 datasets to analyse self-harm.  
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23 Our results could be considered to be consistent with psychological research in the US  
24 using this distinction. NSSH, suicidal behaviour, impulsivity and substance misuse were  
25 examined in a study of 93 adult inpatients. Anestis and colleagues (Anestis, Tull,  
26 Lavender, & Gratz, 2014) identified that NSSI appeared to explain the link between  
27 impulsivity and suicidal behaviour; they considered that NSSH may be a form of  
28 painful and / or provocative experience which acts as a mediator between impulsivity  
29 and suicidal behaviour according to the interpersonal-psychological theory of suicidal  
30 behaviour (Van Orden et al., 2010). Equally, there may be important differences in  
31 other longer-term outcomes between suicidal and non-suicidal self-harm: (i) both  
32 increase the risk of substance misuse and mental illness, but the odds are greater for  
33 SSH compared to NSSH, and (ii) SSH alone increases the future risk of poor long-term  
34 educational and occupational outcomes (Mars, Heron, Crane, Hawton, Lewis, et al.,  
35 2014). This appears to be the case even if the individual stops self-harming behaviour.  
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8 Therefore, separating self-harm according to intent appears to have some validity and  
9 purpose, although that purpose may not include determining the risk of future self-harm  
10 and suicide.  
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17 We note that our findings differ from a previous cohort analysis (of ALSPAC data)  
18 undertaken by Mars *et al.* (Mars, Heron, Crane, Hawton, Kidger, et al., 2014). In this  
19 study, cognitive impulsivity at age 10 using the Stop-Signal task was not predictive of  
20 future SSH or NSSH at 16. However, there may be several explanations for the  
21 discrepancy between the two findings: (i) ALSPAC used a cognitive measure of  
22 impulsivity whereas APMS used self-assessment, and it is not clear whether one or the  
23 other is more valid as a measure of impulsivity, or whether they measure different  
24 constructs, or different parts of the same construct (Broos et al., 2012; Gorlyn, 2005);  
25 (ii) the ALSPAC cohort recruited children who were followed up into adolescence,  
26 whereas APMS only assessed adults at both time points; (iii) the ALSPAC cohort study  
27 did not divide self-harm into inception and recurrence as seen in the APMS cohort. In  
28 their study of 185 participants, Evans and colleagues found that individuals with a  
29 history of repeat self-harm had significantly higher scores for self-reported  
30 impulsiveness than those presenting with self-harm for the first time. However, when  
31 examined in closer detail, those with first time self-harm had higher impulsivity scores  
32 than expected when compared with normative data after correcting for age and sex. This  
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8 indicates the complexity and difficulty when trying to tease out the relationship  
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10 between impulsivity and longitudinal self-harm.  
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14 There is also a certain amount of contrast between our results and Peters and  
15 colleagues' cohort analysis using the same APMS dataset. Their analysis demonstrated  
16 that any significant relationship between impulsivity and future suicidal thoughts  
17 became non-significant when MI was included in the logistic regression model (Peters,  
18 Balbuena, Marwaha, et al., 2015). In our results, MI did not fully explain the significant  
19 relationship between impulsivity and future NSSH. Furthermore, we did not find any  
20 significant relationship between impulsivity and future SSH. This difference may relate  
21 to Peters and colleagues use of the suicidal thoughts variable in the household survey,  
22 rather than actual self-harm as in our analysis; potentially the relationship between  
23 impulsivity and MI may be different when examining suicidal thoughts compared to  
24 self-harm episodes. There is also a possibility that our findings in terms of SSH  
25 episodes in particular may have been underpowered to find any significant relationship  
26 that may exist with impulsivity due to the small numbers involved at follow-up. Peters  
27 and colleagues have also undertaken further work using the longitudinal element of the  
28 2000 APMS where they examined impulsivity and MI at baseline and then NSSH at  
29 follow up after 18 months (Peters et al., 2016). In our paper, we have extended Peters  
30 and colleagues initial work to examine impulsivity and MI at baseline, and then SSH  
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8 and NSSH at baseline and follow up. In summary, Peters and colleagues have  
9 determined whether MI and impulsivity can be potential predictors of future NSSH,  
10 whereas we have more comprehensively studied all types of self-harm (NSSH and  
11 SSH), and repeat self-harm (maintenance of self-harm at baseline and follow-up). From  
12 our results, we agree with Peters and colleagues that onset of future NSSH at follow-up  
13 was predicted by impulsivity at baseline (Peters et al., 2016). However, our paper can  
14 place this finding in the wider context: impulsivity does not appear to predict future  
15 SSH, or any repetition of either NSSH or SSH. We do agree that the total numbers are  
16 small, and thus negative results in particular may be affected by inadequate power.  
17 However, although this positive finding from Peters and colleagues is important to note,  
18 when taken in context of multiple similar negative findings regarding future and repeat  
19 self-harm, the complexity of the data becomes clear and any immediate clinical  
20 relevance becomes less clear. We suggest that this topic requires further examination  
21 with datasets including greater total numbers for assurance in terms of any positive or  
22 negative findings.  
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43 Our approach of examining the potential predictive power of constructs, rather than  
44 diagnoses, in terms of future self-harm reflects the Research Domain Criteria (RDoC)  
45 project of the National Institute of Mental Health (NIMH) (Insel et al., 2010). The  
46 NIMH advocates researchers study constructs rather than discrete diagnoses and this  
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8 current analysis is consistent with those recommendations. Although objectively-  
9 measured data is usually preferable to self-report, the situation is more complicated for  
10 self-harm. For example there is some evidence that impulsivity may decrease the  
11 lethality of subsequent episodes of self-harm (Baca-Garcia et al., 2001), thereby  
12 enabling some episodes of repeat self-harm to be unrecorded and missed if repetition is  
13 only measured objectively. Therefore, using self-report self-harm in the APMS survey  
14 is likely to be more comprehensive than using hospital records alone. It has also been  
15 questioned whether using self-assessment measures of impulsivity may be unreliable  
16 due to recall bias, as participants are required to have insight into their own personality  
17 and to remember past thoughts, feelings and behaviours in an unbiased manner (Gorlyn,  
18 2005). It also could be argued that a single self-assessment question may be insufficient  
19 to cover all aspects of a multifaceted concept such as impulsivity. However, single-item  
20 scales are practical in large population surveys where multiple concepts need to be  
21 assessed as this prevents participant fatigue (which might lead to a higher error rate and  
22 drop out rate) (Konrath, Meier, & Bushman, 2014). There are several examples of  
23 validated single-item scales in use in psychology (Davey, Barratt, Butow, & Deeks,  
24 2007; Konrath et al., 2014; Robins, Hendin, & Trzesniewski, 2001). Furthermore, our  
25 validation analysis ensured that the APMS assessment of impulsivity and self-harm  
26 appeared valid in the context of previous research using other measures of these  
27 constructs. Finally, we are unaware of any other epidemiological big dataset analysis  
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8 that examines longitudinal self-harm in the context of impulsivity, MI and childhood  
9 sexual abuse.  
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14 The major finding that new onset of NSSH was predicted by impulsivity at baseline was  
15 highly significant. However, the confidence intervals were broad indicating poor  
16 precision due to the small numbers involved. This also means that potentially negative  
17 results need to be considered with caution as these could be falsely negative due to a  
18 lack of power. As our data spanned a follow-up period of 18 months, it is highly likely  
19 that the individuals involved may have had mental health professional or other agency  
20 input over this period of time if they had thoughts of, or had undertaken, self-harm.  
21 Some of this may have been recorded in the APMS survey, but a comprehensive record  
22 is unlikely due to the wide variety of biopsychosocial interventions on offer and the  
23 limited number of questions posed in the survey. Therefore, we were unable to input  
24 this data into our results. It is also important to note that there were missing data in the  
25 dataset particularly relating to SSH: in the follow up analysis there were 1823 values  
26 missing at T1 and 2197 missing at T2 relating to SSH. However, much fewer data were  
27 missing from NSSH data: in the follow up analysis there were 2 values missing at T1  
28 and 0 values missing at T2. The reasons for the missing data are unclear, and we  
29 therefore cannot exclude potential non-responder bias in this regard. It is possible that  
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8 these missing values may have impacted on the non-significant findings in terms of  
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10 SSH, essentially reducing the power of the SSH data.

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14 Mental health professionals will likely benefit from a more individualised approach to  
15 risk assessment for self-harm; that is, additional personalised factors to complement  
16 existing risk assessments based on predominately demographic and clinical factors. This  
17 analysis indicates that presence of impulsivity may predispose individuals to be at a  
18 higher risk of first-ever self-harm in times of crisis and psychological stress than those  
19 who are not impulsive. Our results also indicate that this may be more likely to be  
20 NSSH. However, it should be borne in mind that the future risk of suicide is similar  
21 regardless of the intent of an individual self-harm episode.  
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## 5. Conclusion

Impulsivity appeared to predict emergence of new non-suicidal self-harm at 18 month follow-up, even after adjustment for mood instability and other sociodemographic and clinical confounders. Impulsivity did not significantly predict repetition of non-suicidal self-harm, or new inception or repetition of suicidal self-harm. However, impulsivity may be more important in terms of suicidal self-harm in those individuals who have a personal history of childhood sexual abuse.

This personalised information may help to guide clinicians in terms of risk assessment and future management. Nonetheless, it should be borne in mind that past intent may not correlate with future suicide, and precision of significant outcomes and power in terms of non-significant outcomes may have been affected by the small numbers of participants in this large survey who repeated self-harm. Furthermore, we were not able to capture or factor in potential interventions that may have occurred to participants with self-harm behaviour between baseline and follow-up.

### **Data access**

Full details of the survey and methods are given in the comprehensive APMS survey report (Singleton et al., 2001).

### **Acknowledgements**

The authors would like to thank Dr Steven Marwaha for his support and advice in terms of the analysis and interpretation of results.

### **Funding**

Angharad de Cates was sponsored by a UK National Institute of Health Research Academic Clinical Fellowship when undertaking the majority of the work for this article.

### **Declaration of conflicting interests**

The authors declare that there is no conflict of interest.



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*Table 1:* Impulsivity as a mediator of the cross-sectional link between child sexual abuse and (i) suicidal self-harm (SSH) and (ii) non-suicidal self-harm (NSSH)

<b>SSH (n=430)</b>					
Effect	OR	Robust standard error	Z	P>z	95% CI
Total	2.40	0.46	4.95	0.000	1.73-3.59
Direct	2.21	0.41	4.28	0.000	1.53-3.18
Indirect	1.12	0.04	3.25	0.001	1.04-1.21
13.1% of the link is mediated by impulsivity					
<b>NSSH (n=200)</b>					
Effect	OR	Robust standard error	Z	P>z	95% CI
Total	8.48	1.63	11.11	0.000	5.81-12.37
Direct	7.65	1.55	10.05	0.000	5.14-11.38
Indirect	1.10	0.40	2.64	0.008	1.02-1.19
4.8% of the link is mediated by impulsivity					

**Table 2:** The effect of impulsivity on repetition and new onset of Suicidal Self-Harm (SSH)

<b>SSH repetition (T1 + T2) (n=13)</b>			
<b>Impulsivity</b>	<b>Odds ratio (95% confidence limits)</b>	<b>T</b>	<b>p&gt;t</b>
<i>Unadjusted</i>	1.04 (0.87-1.23)	0.46	0.647
<i>Controlling for sociodemographic variables<sup>a</sup></i>	0.98 (0.81-1.18)	-0.20	0.842
<i>Controlling for above plus depression</i>	1.00 (0.82-1.21)	0.01	0.993
<i>Controlling for above plus mood instability</i>	1.10 (0.55-2.18)	0.28	0.782
<i>Controlling for above plus physical and mental health</i>	1.05 (0.49-2.24)	0.13	0.899
<b>SSH new-onset at T2 (n=3)</b>			
<b>Impulsivity</b>	<b>Odds ratio (95% confidence limits)</b>	<b>T</b>	<b>p&gt;t</b>
<i>Unadjusted</i>	0.96 (0.70-1.33)	-0.19	0.848
<i>Controlling for sociodemographic variables<sup>a</sup></i>	1.03 (0.70-1.51)	0.18	0.861
<i>Controlling for above plus depression</i>	1.01 (0.70-1.43)	0.06	0.955
<i>Controlling for above plus mood instability</i>	1.28 (0.67-2.44)	0.76	0.451
<i>Controlling for above plus physical and mental health</i>	1.30 (0.68-2.51)	0.81	0.419

<sup>a</sup> sex, age, employment status, marital status, ethnic group

**Table 3:** The effect of impulsivity on repetition and new onset of Non-Suicidal Self-Harm (NSSH)

<b>NSSH repetition (T1 + T2) (n=13)</b>			
<b>Impulsivity</b>	<b>Odds ratio (95% confidence limits)</b>	<b>T</b>	<b>p&gt;t</b>
<i>Unadjusted</i>	0.77 (0.56-1.04)	-1.68	0.096
<i>Controlling for sociodemographic variables<sup>a</sup></i>	0.73 (0.52-1.02)	-1.85	0.069
<i>Controlling for above plus depression</i>	0.75 (0.55-1.02)	-1.85	0.068
<i>Controlling for above plus mood instability</i>	0.77 (0.29-2.05)	-0.53	0.600
<i>Controlling for above plus physical and mental health</i>	1.19 (0.48-2.92)	0.40	0.692
<b>NSSH new onset at T2 (n=12)</b>			
<b>Impulsivity</b>	<b>Odds ratio (95% confidence limits)</b>	<b>T</b>	<b>p&gt;t</b>
<i>Unadjusted</i>	11.73 (2.27-60.60)	2.95	0.003
<i>Controlling for sociodemographic variables<sup>a</sup></i>	13.30 (1.99-90.37)	2.68	0.008
<i>Controlling for above plus depression</i>	12.40 (1.66-92.22)	2.47	0.014
<i>Controlling for above plus mood instability</i>	7.52 (1.43-39.26)	2.40	0.017
<i>Controlling for above plus physical and mental health</i>	6.42 (1.50-27.44)	2.52	0.012

<sup>a</sup> sex, age, employment status, marital status, ethnic group

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3 **Supplementary material**  
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7 **de Cates AN, Catone G, Bebbington P, Broome MR.** Attempting to disentangle the relationship  
8 between impulsivity and longitudinal self-harm: Epidemiological analysis of United Kingdom  
9 household survey data  
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13 International Journal of Social Psychiatry  
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For Peer Review



Supplementary material table 1: Validating analysis for NSSH and SSH variables (i)

	T1 NSSH			T2 NSSH			T1 SSH			T2 SSH			IMPULSIVITY		
	no	yes	<i>p</i>	no	yes	<i>p</i>	no	yes	<i>p</i>	no	yes	<i>p</i>	no	yes	<i>p</i>
<i>Age in 10-yr age band</i>															
16-24	199	20	<0.001	212	7	0.003	43	21	0.737	28	3	0.501	410	373	0.001
25-34	454	31		477	8		88	52		36	8		877	786	
35-44	503	22		519	6		97	48		50	4		998	821	
45-54	489	8		494	3		83	32		40	3		879	629	
55-64	367	8		376	0		54	27		22	2		786	613	
65-74	302	1		303	1		27	11		11	2		723	493	
<i>Sex</i>															
<i>M</i>	992	31	0.113	1013	10	0.798	146	72	0.916	75	7	0.451	2082	1670	0.715
<i>F</i>	1322	59		1368	15		246	119		112	15		2591	2045	
<i>Marital status</i>															
married	1192	27	<0.001	1215	5	0.002	162	63	0.052	59	5	0.396	2517	1767	<0.001
not married	1122	63		1166	20		230	128		128	17		2156	1948	
<i>Employment status</i>															
employed	1421	47	0.091	1458	10	0.028	249	87	<0.001	85	8	0.381	2877	2336	0.182
unemployed	882	42		910	15		141	101		99	14		1785	1364	
<i>Drug misuse</i>															
no	1653	30	<0.001	1674	10	0.001	228	87	0.006	94	15	0.123	3726	2584	<0.001
yes	655	58		698	15		163	101		91	7		937	1130	
<i>Alcohol misuse</i>															
never	93	0	0.121	92	1	0.632	13	7	0.425	4	3	0.009	179	137	0.308
monthly	399	17		414	3		68	34		29	8		803	632	
two to four times a month	508	20		519	9		84	49		50	4		1118	890	
two to three times a week	670	19		682	7		119	43		47	3		1395	1121	
four or more times a week	432	22		450	4		69	31		34	3		754	680	

Supplementary material table 2: Validating analysis for NSSH and SSH as variables (ii)

	T1 NSSH			T2 NSSH			T1 SSH			T2 SSH			IMPULSIVITY		
	no	yes	p	no	yes	p	no	yes	p	no	yes	p	no	yes	p
<i>Educational</i>															
Degree	366	13	0.879	379	0	0.161	75	14	<0.001	24	1	0.395	789	440	<0.001
Teaching, HND, nurse	205	5		209	1		35	8		7	0		344	264	
A level	303	12		310	5		59	26		30	2		585	533	
GCSE A-C grades	555	25		575	5		103	57		51	7		1068	940	
GCSE D-F grades	249	9		254	4		36	23		22	2		493	435	
no qualifications	624	25		640	10		82	60		50	10		1383	1087	
<i>Violence at work</i>															
no	2208	80	0.005	2267	23	0.456	365	168	0.037	172	18	0.117	4529	3539	<0.001
yes	106	10		114	2		27	23		15	4		144	176	
<i>Violence at home</i>															
no	2056	60	<0.001	2099	19	0.063	316	119	<0.001	136	14	0.370	4387	3298	<0.001
yes	258	30		282	6		76	72		51	8		286	416	
<i>Sexual abuse</i>															
no	2176	65	<0.001	2221	21	0.067	341	140	<0.001	147	20	0.173	4550	3496	<0.001
yes	138	25		160	4		51	51		40	2		123	221	
<i>Expelled from school</i>															
no	2263	85	0.039	2326	24	0.577	377	179	0.185	175	20	0.635	4624	3623	<0.001
yes	51	5	1	55	1		15	12		12	2		49	92	
<i>Run away from home</i>															
no	2173	64	<0.001	2223	16	<0.001	342	148	0.003	145	17	0.977	4509	3428	<0.001
yes	141	26		158	9		50	43		42	5		164	287	
<i>Homeless</i>															
no	2190	73	<0.001	2247	18	<0.001	353	149	0.001	156	18	0.849	4529	3493	<0.001
yes	124	17		134	7		39	42		31	4		144	222	
<i>Physical assault</i>															
no	1552	41	<0.001	1585	9	0.001	250	79	<0.001	99	11	0.794	3493	2554	<0.001
yes	762	49		796	16		142	112		88	11		1180	1161	
<i>Problem with close friends</i>															
no	1854	56	<0.001	1901	11	<0.001	280	121	0.048	134	11	0.037	4034	3023	<0.001
yes	460	34		480	14		112	70		53	11		639	692	

<i>Institution to 16</i>															
no	2229	81	0.003	2290	21	<0.001	372	178	0.710	170	18	0.097	4569	3575	<0.001
yes	74	8	1	78	4		18	10		14	4		93	126	
<i>Local authority care</i>															
no	2232	70	<0.001	2293	19	<0.001	378	170	<0.001	170	17	0.021	4578	3573	<0.001
yes	70	9		74	6		12	18		14	5		83	128	
<i>Bullied</i>															
no	1811	48	<0.001	1849	12	<0.001	249	112	0.255	113	12	0.595	3947	2980	<0.001
yes	503	42		532	13		143	79		74	10		726	735	
<i>Mood instability</i>															
No	1814	39	<0.001	1847	6	<0.001	246	90	0.002	85	10	0.937	4222	2973	<0.001
Yes	467	48		499	17		143	92		97	11		451	742	