



Review article

Impulsivity in fatal suicide behaviour: A systematic review and meta-analysis of psychological autopsy studies

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ABSTRACT

Our aim is to review and perform a meta-analysis on the role of impulsivity in fatal suicide behaviour. We included papers who used psychological autopsy methodology, assessed adult death by suicide, and included assessment of impulsivity. We excluded papers about assisted suicide, terrorist suicide, or other cause of death other than suicide or postmortem diagnosis made only from medical records or database. 97 articles were identified. 33 were included in the systematic review and nine in the meta-analysis. We found that people who die by suicide with high impulsivity are associated with younger age, substance abuse, and low intention to die, whereas those with low impulsivity were associated with older age, depression, schizophrenia, high intention to die and low social support. In the meta-analysis, suicide cases had higher impulsivity scores than living controls (Hedges' $g = 0.59$, 95 % CI [0.28, 0.89], $p = .002$). However, studies showed heterogeneity ($Q = 90.86$, $p < .001$, $I^2 = 89.0$ %). Impulsivity-aggressiveness interaction was assessed through meta-regression ($\beta = 0.447$, $p = .045$). Individuals with high impulsivity would be exposed to a higher risk of fatal suicide behaviour, aggressiveness would play a mediating role. People who die by suicide with high and low impulsivity display distinct characteristics, which may reflect different endophenotypes leading to suicide by different pathways.

1. Introduction

Suicide is one of the most important public health problems worldwide, affecting all ages, sexes, and geographical regions (World Health Organization, 2021). Impulsivity has been extensively studied in relation to suicide behavior (Brezo et al., 2006; Gvion and Apte, 2011; Rimkeviciene et al., 2015).

In the past, it has been proposed that impulsivity bears a direct causal relation with fatal suicide behaviour (Mann, 2003). However, there is a growing consensus that suicidal behaviour is influenced by the interaction of multiple factors, indicating that individuals predisposed to suicide interact with precipitating events. These models conceptualize impulsivity as personality trait (McHugh and Balaratnasingam, 2018). Impulsive traits in suicide have been associated with greater prevalence of mental disorder, cumulative effects of negative life stressors and familial factors (Turecki, 2005).

In suicide research, impulsive and aggressive traits often appear to be

closely intertwined, to the extent that they are sometimes used interchangeably as part of the same dimension of impulsive aggression (Gvion and Apte, 2011; Koyama et al., 2020; Stanley et al., 2019). Impulsivity and aggression have been proposed to feedback each other: impulsivity would increase the likelihood of engaging in various risk behaviours, including aggression, while aggression would function as a catalyst for heightened impulsivity, exposing the individual to head injuries during the lifetime (Mann, 2003). However, there are instances of clinical data where aggression, rather than impulsivity is associated with increased suicidality, as it is the case with suicide attempts in the context of major depressive disorder (Keilp et al., 2006). This differential role might be shaped by culture, as this effect is found in samples from some countries such as USA and Italy but not Spain (Lopez-Morinigo et al., 2021). Additionally, it has also been considered that there could be different pathways leading to fatal suicide behaviour, impulsive and non-impulsive, representing distinct endophenotypes (Oquendo, 2015; Turecki, 2005).

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Most of the data assessing impulsivity in suicidal behaviour is derived from patients who have either attempted suicide or experienced suicidal ideation (McHugh et al., 2019). Its significance as a risk factor for suicide ideation and attempts has been well-established (Huber et al., 2019). In contrast, research on fatal suicide behaviour is proportionately rarer due to the methodological barriers it presents. This is an important shortcoming of suicide research as people who have attempted suicide and those who have died by suicide may not necessarily share the same endophenotype. These populations exhibit some shared risk factors but also possess distinct protective and risk factors (Giner et al., 2016; O'Connor and Nock, 2014).

Methodologies for studying fatal suicidal behavior include prospective and retrospective approaches (Turecki and Brent, 2016). Although prospective studies are generally preferred, they come with certain disadvantages. Firstly, since lethal suicidal behavior is a phenomenon of low occurrence, even in samples where a high risk is assumed, the number of suicide cases resulting from a cohort study is often too small for a meaningful analysis. Secondly, there exists a sampling bias inherent in longitudinal studies focusing on suicidal behavior, as they typically target samples at high risk of suicide. This often results in prospective studies centered on samples collected in clinical settings, despite the fact that not all suicide cases are linked to mental pathology or necessarily involve individuals seeking healthcare assistance. Furthermore, prospective studies have yielded conflicting results regarding impulsivity. For instance, one review found that within the context of a major depressive episode, impulsivity predicted suicide deaths when associated with drug use and previous attempts, while in other studies, impulsivity was related solely with aggression (Oquendo et al., 2006).

Another avenue for exploring this issue involves retrospective methods such as the psychological autopsy (PA). PA entails interviews with proxy respondents, aiming to gather information on the circumstances surrounding the death of a person (Conner et al., 2011). PA studies directly collect data on suicide cases occurring in given study area. This allows the examination of fatal suicide behaviour in large community samples. Although data collected through this method are susceptible to various sources of bias, such as time bias, recall bias, and is also influenced by the relationship of the interviewees with the deceased and the characteristics of the interviewers (Knoll, 2009; Pouliot and De Leo, 2006; Zhang et al., 2018), research have supported the validity of PA in obtaining information in post-mortem research (Conner et al., 2021; Fang and Zhang, 2010; Zhang et al., 2018). In particular, the assessment of impulsivity through proxies in the context of suicide has been validated in both Western (An et al., 2010) and Eastern samples (Sanz-Gómez et al., 2023) although necessarily in living population.

Given the significance of impulsive traits in suicide, multiple studies have utilized PA methods to explore these traits in deaths by suicide. Consequently, our objective is to conduct a comprehensive review and meta-analysis concerning the role of impulsivity on death by suicide as examined through PA studies. Our hypothesis is that impulsive traits will be significantly associated with fatal suicide behaviour (H1). However, this association will be partly mediated by the role of aggression (H2). In addition, other variables such as mental disorders and previous history of suicide behaviour will act as confounding factors (H3).

2. Methodology

This study was registered on PROSPERO under the ID CRD42021283704.

2.1. Study identification

We adhered to the PRISMA methodology (Moher et al., 2010). As an initial step in identifying original articles assessing impulsive behaviour through PA methodology, we conducted searches in four databases.

Firstly, we searched the Pubmed database using the terms “psychological autopsy AND (personality traits OR impulsivity)”. Secondly in the Scopus database, we utilized the terms “(psychological AND autopsy AND ((personality AND traits) OR impulsivity))”, limited the search to articles written in English. Finally, we explored Ovid Medline and Web of Science databases, employing the terms “psychological autopsy and (personality traits or impulsivity)”. The primary identification phase was performed on May 4th, 2021. Additionally, six other studies were identified through alternative searches.

2.2. Study selection

We commenced by defining a priori inclusion criteria for study selection: 1) Utilization of PA methodology, 2) examination of adult deaths by suicide, and 3) inclusion of assessment of impulsivity.

The following exclusion criteria were employed for screening studies: 1) inclusion of cases of assisted suicide, terrorist suicide or other cause of death other than suicide; 2) studies not written in English; 3) articles categorized as letters, editorials, or unrelated topics; 4) studies relying solely on postmortem diagnosis obtained from medical records or databases (without utilizing the PA method).

For the meta-analysis we implemented more specific criteria: 1) the comparison of two groups, comprising a group of adult deaths by suicide with an equivalent control group, which could be either community living controls or patient controls, and 2) mean and standard deviation data for impulsivity measures for each group was either reported or could be calculated.

Systematic literature searches were conducted by three of us (S-SG, C-VV, and M-PG), who identified, selected, and evaluated the studies. Each database registry was reviewed by all three researchers. In case of disagreement, an additional researcher (A-AC) would cast the decisive vote.

During the initial selection phase, studies were screened based on their title and relevance to the objective of our systematic review. Subsequently, in the second selection phase, the abstract of each study was assessed to ensure that the articles fulfilled the inclusion and exclusion criteria.

2.3. Quality assessment

Quality assessment of the included studies was conducted by two independent researchers (S-SG and M-PG) using the Newcastle-Ottawa scale for case-control studies (Zeng et al., 2015). This scale measures quality in three areas: sample selection, comparability, and exposure, resulting in an individual score for each paper ranging from zero to nine points. A third researcher (A-AC) would cast the decisive vote in the case of inter-rater disagreement. Agreement between the two independent raters was calculated using intra-class correlation (ICC). We used the two-way mixed effects model with the absolute agreement definition (Koo and Li, 2016). According to the criteria of Portney and Watkins (Portney, 2020), ICC showed moderate agreement between the two raters (ICC = 0.527; 95% CI [.439, 0.606]).

2.4. Data extraction

A standardized spreadsheet was developed to capture the following data points: authors, publication date, publication data range, title, total N size, male percentage, age mean, impulsivity scales included in the study, suicide group(s) N size, control group(s) N size, mean and standard deviation for each impulsivity measure by group and, potential cofounders described in individual studies (such as presence of mental disorders, history of previous suicide attempts and aggressiveness scores).

2.5. Data analysis

Pooled effect size for impulsivity scores was determined through restricted maximum likelihood (REML) random effects model (Veroniki et al., 2016). We used Knapp-Hartung adjustments (Knapp and Hartung, 2003) to calculate the confidence intervals. Between-study heterogeneity was assessed through the Cochran's Q statistics, prediction interval and Higgins I^2 (IntHout et al., 2016). When heterogeneity was high, outlier diagnostics and influence analysis were performed to detect individual studies that could be altering this heterogeneity (Viechtbauer and Cheung, 2010). Effect sizes were determined using Standardized mean differences (SMD).

Publication bias was assessed through funnel plots and Egger's test. Analysis was performed using the compound symmetry covariance structure, which accounts for the dependence between effect sizes (Musekiwa et al., 2016). All analysis were performed using R.3.7.2 (R Core Team, 2014).

3. Results

3.1. Systematic review

Initially, a total of 297 articles were collected. During the screening phase duplicate citations in the databases were eliminated. Based on title and abstract screening, we selected 78 articles that met inclusion criteria. Subsequently, from the 78 publications deemed as potential studies, a total of 33 articles were included in the systematic review (Fig. 1).

For the meta-analysis, 25 papers were excluded due to sample overlapping between studies from the same research group or project. Sample overlapping was identified by the authors and further confirmed upon request to the corresponding authors involved. One additional paper (Giner et al., 2013) was excluded as it compared suicide cases with a sample people who attempted suicide, rather than with a community control group or an equivalent clinical control sample. Consequently, a total of nine papers were included in the meta-analysis.

3.1.1. Study description

We identified 33 articles from six different research groups that assess impulsivity by the PA method: China [16], Canada [13], Australia [1], Iran [1], Hong Kong [1] and Spain [1]. While the psychiatric diagnosis was conducted using the Structured Clinical Interview for DSM Mental Disorders (SCID) I and II (First et al., 1994, 2002), various approaches were employed to assess impulsive and aggressive behaviour as traits.

The most widely used scale among the identified studies was the Barratt Impulsivity Scale (BIS-11), which was employed in its English version (Patton et al., 1995), Chinese version (Lu et al., 2012) and Spanish versions (Oquendo et al., 2001). The BIS-11 comprises a list of 30 items rated on a 4-point Likert scale. According to factor analysis, this scale allows for the measurement of three types of impulsivity: motor (acting without thinking), attentional (inability to focus or concentrate) and non-planning (lack of "futuring" or forethought), in addition to the total score (Stanford et al., 2009). The BIS-11 was utilized in 19 original articles across eight different samples of suicide cases worldwide.

The Dickman Impulsivity Inventory (DII) was the second most used scale, utilized in its Chinese version (Gao et al., 2011) and Persian version (Ekhtiari et al., 2008). The DII differentiates between functional impulsivity (tendency to respond quickly and accurately when this style is optimal) and dysfunctional impulsivity (tendency to respond quickly and inaccurately when this style is a source of difficulty) (Dickman, 1990). These two traits have been proved to independent factors with low correlation with each other (Claes et al., 2000; Dickman, 1990). The DII was used in 13 original works spanning three samples.

In the only one study from Hong Kong, they used the Impulsivity Rating Scale (IRS) (Lecrubier et al., 1995).

On aggression, the Canadian group used the Buss-Durkee Hostility Inventory (BDHI) (Buss and Durkee, 1957), and the Brown-Goodwin History of Aggression (BGHA) (Brown and Goodwin, 1986). The Australian group used the Overt Aggression Scale (OAS) (Yudosky et al., 1986).

Characteristics and main conclusions of each individual study are reported in Table 1.

3.1.2. Impulsivity traits and fatal suicide behaviour

Among the 33 articles identified, 21 specifically explored the relationship between impulsivity and fatal suicide behaviour through a case-control design. In 17 of these articles an statistically significant association was reported (Chachamovich et al., 2015; Dumais, et al., 2005a; Gao et al., 2011; Law et al., 2014; Lin et al., 2016, 2019; Liu et al., 2018; Lu et al., 2012; McGirr et al., 2007; Niu et al., 2020; Ross et al., 2017; Sun and Zhang, 2015; Zhang et al., 2010, 2012; Zhang and Lin, 2014, 2015). Of the remaining four, two reported higher scores in the suicide than in the control group, although the association did not reach statistical significance (Ernst et al., 2004; Rasouli et al., 2019). In the other two articles, no notable differences were reported. It is important to highlight that in these two articles both cases and controls were matched by specific disorders such as major depressive disorder (Dalca et al., 2013), and schizophrenia and other disorders from the psychotic spectrum (McGirr, Tousignant, et al., 2006).

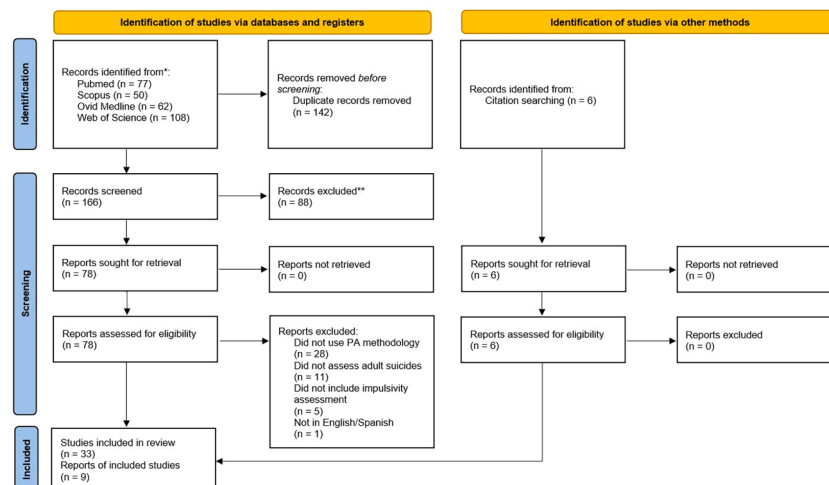


Fig. 1. PRISMA flow diagram of study selection.

Table 1
Results from systematic review.

Author, year	City, Country	Design	N suicide cases (male%) Age (mean, SD)	Control group	Impulsivity scales	Results	Quality Assessment
Ernst et al., 2004	Montreal, Canada	Case-control	16 suicides with no axis I pathology 93.8 % male 35.7 SD 13.7 52 suicides with axis I pathology 94.2 % male 36.1 SD 13.1	Sex and age-matched community living controls	BIS-11	More impulsive and aggressive traits were found in suicide deaths than in those who do not die by suicide. Suicide deaths both with and without axis I pathology were associated with greater aggression according to BDHI measures than controls.	S: ++ C: ++ E: ++ T: ++++++
Dumais et al., 2005a	Montreal, Canada	Case-control	310 suicides (242 with violent method; 68 with non violent method) 88.3 % male 39.45 SD 13.91	Suicide deaths with non-violent methods	BIS-11	Violent method was associated with a higher level of lifetime aggression and a higher level of impulsivity. In addition, violent method was associated with lifetime substance abuse or dependence and psychotic disorders.	S: ++++ C: E: ++ T: ++++++
Dumais et al., 2005b	Montreal, Canada	Case-control	104 suicides 100 % male 40.6 SD 14.4	Living men with depression	BIS-11	Impulsive personality disorders and alcohol abuse/dependence were two independent predictors of suicide in major depression. Impulsive and aggressive behaviors seem to underlie these risk factors	S: +++ C: + E: ++ T: ++++++
McGirr et al., 2006a*	Montreal, Canada	Case-control	288 male suicides 42.32 SD 14.32 63 female suicides 41.74 SD 13.68	Community living controls	BIS-11	Female suicide cases were less impulsive, yet similar proportion of highly impulsive males and female suicide cases were reported. Impulsivity was associated with alcohol abuse irrespective of gender. High levels of impulsivity and alcohol abuse were risk factors for suicidality of both sexes.	S: +++ C: + E: ++ T: ++++++
McGirr et al., 2006b	Montreal, Canada	Case-control	45 suicides with schizophrenia or psychotic disorder 80 % male 34.45 SD 11.61	Living controls with schizophrenia and other chronic psychotic disorders	BIS-11	Impulsivity do not play a role in schizophrenic and chronic psychotic disorder suicide.	S: +++ C: + E: ++ T: ++++++
Zouk et al., 2006	Montreal, Canada	Case-control	50 impulsive suicides 90 % male 37.18 SD 1.86	50 non-impulsive suicides 84 % male 44.68 SD 2.12	BIS-11	Impulsive suicide cases were characterized for 6-month prevalence of substance abuse/dependence and aggressive traits, after controlling for other variables such as age, and childhood abuse.	S: ++++ C: ++ E: ++ T: +++++++
McGirr et al., 2007	Quebec, Canada	Case-control	70 suicides with BPD 82.9 % male 37.68 SD 10.72	Living controls with BPD	BIS-11	Impulsive and aggressive traits associated to cluster B comorbidity differentiates people with BPD who die by suicide from those who do not.	S: +++ C: ++ E: ++ T: +++++++
McGirr et al., 2008	Quebec, Canada	Case-control	645 suicides 83.7 % male 38.75 DS 15.38 11 to 87 years	Suicide deaths clustered by age groups	BIS-11	Impulsive and aggressive traits are linked to suicidality, with decreasing importance with increasing age	S: ++++ C: ++ E: ++ T: +++++++
McGirr et al., 2008	Quebec, Canada	Case-control	154 suicides 84.4 % male 115 with single MDE 41.86 SD 13.95 years	39 suicide deaths with at least 1 previous MDE 43.08 SD 11.16 years	BIS-11	Aggressive but no impulsive traits differentiated suicide cases with MDD who died during their first depressive episode compared to those who died in further episodes.	S: ++++ C: + E: ++ T: ++++++
Zhang et al., 2010	16 rural counties of three provinces in China	Case-control	392 suicides 54.6 % male 26.84 SD 6.37 15–34 years	Sex and age-matched community living controls	DII	Impulsivity was significantly higher for suicide cases than for controls. Two thirds of suicide cases were categorized as having high impulsivity, whereas two thirds of controls were categorized as having low impulsivity.	S: ++++ C: ++ E: ++ T: +++++++
Gao et al., 2011	16 rural counties of three provinces in China	Case-control	392 suicides 54.5 % male 26.8 SD 6.4 15–34 years	Sex and age-matched community living controls	DII	Suicide cases had higher dysfunctional impulsivity and lower functional impulsivity than controls.	S: ++++ C: ++ E: ++ T: +++++++
Zhang and Li, 2011	16 rural counties of three provinces in China	Case-control	392 suicides 54.6 % male 26.84 SD 6.37 15–34 years	Sex and age-matched community living controls	DII	Suicide cases with mental disorders had lower levels of dysfunctional and functional impulsivity, higher intent to die and were more likely to choose	S: ++++ C: ++ E: ++ T: +++++++

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Table 1 (continued)

Author, year	City, Country	Design	N suicide cases (male%) Age (mean, SD)	Control group	Impulsivity scales	Results	Quality Assessment
Lu et al., 2012*	25 towns of three counties of Shandong province in China	Case-control	200 suicides 57.5 % male ≥ 60 years 55 % <60 years 45 %	Sex and age-matched community living controls	BIS-11	a violent method (particularly women). Suicide cases had higher impulsivity scores as measured by the Chinese version of the BIS-11	T: ++++++++ S: +++++ C: ++ E: ++ T: ++++++++
Zhang et al., 2012	16 rural counties of three provinces in China	Case-control	392 suicides 54.6 % male 26.84 SD 6.37 15–34 years	Sex and age-matched community living controls	DII	Higher values of impulsivity, hopelessness and anxiety in suicide cases to controls. In suicide cases, impulsivity was not correlated with hopelessness, anxiety or social support.	S: +++++ C: ++ E: ++ T: ++++++++
Chachamovich et al., 2013	Nunavut, Canada	Case-control	120 suicides 82.5 % male 23.4 SD 9.13	Community of origin, sex and age-matched community living controls	BIS-11	Suicide cases had higher scores in impulsive and aggressive traits compared to controls. Results show that the PA method can be effectively used in Inuit populations.	S: +++++ C: ++ E: ++ T: ++++++++
Dalca et al., 2013	Montreal, Canada	Case-control	201 suicides with MDD 79.6 % male 41.39 SD 12.61	Living controls with MDD	BIS-11	Suicide cases with MDD had higher levels of hostility and more extensive histories of aggression. In female suicide cases with MDD, aggression, cluster B personality disorders and low impulsivity was associated with suicidality. In male counterparts, suicidality was associated with high impulsivity, aggression, and cluster B personality disorders.	S: ++ C: + E: ++ T: +++++
Giner et al., 2013	Seville, Spain	Case-control	190 suicides 77.3 % male 55.8 DS 19.6 18 or older	Living survivors of suicide attempts	BIS-11	Impulsivity was greater among the suicide attempts group than among suicide cases in both sexes. Suicide cases are more likely to be male, suffer from alcohol abuse, health problems and narcissistic personality disorder.	S: +++++ C: ++ E: ++ T: ++++++++
Zhang and Lin, 2014	16 rural counties of three provinces in China	Case-control	392 suicides 54.6 % male 26.84 SD 6.37 15–34 years	Sex and age-matched community living controls	DII	Suicides cases by pesticide ingestion did not differ in impulsivity traits to those who died by other means.	S: +++++ C: ++ E: ++ T: ++++++++
Law et al., 2014	Hong Kong	Case-control	63 employed suicides 69.8 % male 39.1 15 and older	Sex and age-matched community living controls	IRS	Suicide cases showed higher level impulsivity than controls. Impulsivity was found to be a mediator between work problems and suicidality.	S: + C: + E: ++ T: +++
Lyu and Zhang, 2014	16 rural counties of three provinces in China	Case-control	38 suicides with schizophrenia 39.5 % male 29.03 SD 5.59	Suicide deaths with and without other psychiatric disorders	DII	Suicide cases with psychiatric disorders scored lower on impulsivity measures than those without psychiatric disorder.	S: +++++ C: + E: ++ T: ++++++++
Zhang and Lin, 2014	16 rural counties of three provinces in China	Case-control	392 suicides 54.6 % male 26.84 SD 6.36 15–34 years	Sex and age-matched community living controls	DII	Suicide cases had higher dysfunctional impulsivity and lower functional impulsivity than controls. Impulsivity acted as a moderator between negative life events and suicide.	S: +++++ C: ++ E: ++ T: ++++++++
Chachamovich et al., 2015*	Nunavut, Canada	Case-control	120 suicides 82.5 % male 23.41 SD 9.13	Community of origin, sex and age-matched community living controls	BIS-11	Suicide deaths were associated with impulsive and aggressive traits, as well as MDD, after controlling for working status, substance abuse disorders and personality disorders.	S: +++++ C: ++ E: ++ T: ++++++++
Sun and Zhang, 2015	16 rural counties of three provinces in China	Case-control	386 suicides 54.7 % male 26.83 SD 6.33 15–34 years	Sex and age-matched community living controls	DII	Impulsive suicide completers were more likely to have low intent to die.	S: +++++ C: ++ E: ++ T: ++++++++
Zhang and Lin, 2015	16 rural counties of three provinces in China	Case-control	392 suicides 54.6 % male 26.84 SD 6.36 15–34 years	Sex and age-matched community living controls	DII	High impulsivity was correlated with death by suicide in individuals with high social support. In contrast, among those with low social support, low impulsivity was related to increased suicidality.	S: +++++ C: ++ E: ++ T: ++++++++

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Table 1 (continued)

Author, year	City, Country	Design	N suicide cases (male%) Age (mean, SD)	Control group	Impulsivity scales	Results	Quality Assessment
Lin et al., 2016*	6 counties in Liaoning Province in China.	Case-control	162 suicides 56.1 % male 26.19 SD 6.0 15–35 years	Sex and age-matched community living controls	DII	Suicide cases had higher dysfunctional and lower functional impulsivity compared to controls. Impulsivity, mental disorders, and negative life events contributed to suicidality, whereas educational attainment and functional impulsivity were protective factors.	S: ++++ C: ++ E: ++ T: ++++++
Lin and Zhang, 2017*	16 rural counties of three provinces in China	Case-control	392 suicides 54.6 % male 26.84 SD 6.36 15–34 years	Sex and age-matched community living controls	DII	Dysfunctional impulsivity was a significant risk factor for suicide regardless of mental disorder in rural China.	S: ++++ C: ++ E: ++ T: ++++++
Ross et al., 2017*	Queensland, Australia	Case-control	126 suicides 100 % male 25–44 years	Sudden deaths	BIS-11	Impulsivity did not differentiate between suicide cases and sudden death controls. However, suicides with psychiatric diagnosis had higher impulsivity. Aggression was increased in suicide cases with and without psychiatric diagnosis.	S: ++++ C: + E: ++ T: ++++++
Liu et al., 2018	25 towns of three counties of Shandong province in China	Case-control	190 suicides 56.8 % male ≥ 60 years	Non-elderly suicides (<60 years)	BIS-11	High impulsivity was a risk factor for suicidality in both the elderly and non-elderly. When adjusting for other variables (negative life events, family history of suicide, social support), impulsivity was a risk factor only for the non-elderly.	S: ++++ C: ++ E: ++ T: ++++++
Lin et al., 2019	16 counties of three provinces in China	Case-control	308 suicides 55.2 % male 15–34 years	High / Low impulsivity suicide deaths	DII	Impulsive suicide cases had less social support, less approach coping, more avoidance coping, and less depression. They also had less suicide intent.	S: ++++ C: ++ E: ++ T: ++++++
Zhu et al., 2019*	12 counties of three provinces in China	Case-control	242 suicides 55.8 % male > 60 years	Suicide deaths without pesticides	BIS-11	The method for suicide (pesticides vs other) was not related to the level of impulsivity but to the availability of the method.	S: ++++ C: + E: ++ T: ++++++
Rasouli et al., 2019*	Tehran, Iran	Case-control	40 suicides 80 % male 39.4 SD 16 > 18 years	Community living controls	DII	Impulsivity was increased in the suicide group, but it was not statistically significant.	S: ++++ C: ++ E: ++ T: ++++++
Niu et al., 2020	12 counties from three provinces in China	Case-control	242 suicides 51 % male > 60 years	Sex and age-matched community living controls	BIS-11	Impulsivity was significantly associated with death by suicide among both men and women, but not when adjusted for severity for depressive symptoms and hopelessness.	S: ++++ C: ++ E: ++ T: ++++++

* Studies included in meta-analysis

BDHI: Buss-Durkee Hostility Inventory; BIS-11: Barratt Impulsiveness Scale; BPD: Borderline Personality Disorder; DII: Dickman Impulsivity Inventory; IRS: Impulsivity Rating Scale; MDD: Major Depressive Disorder; MDE: Major Depressive Episode; PA: Psychological Autopsy

Note: Quality Assessment through Newcastle-Ottawa rating scale. Case-control studies. S: selection; C: comparability; E: exposure; T: total.

Articles that captured impulsive traits through the Dickman inventory found that people who died by suicide exhibited higher dysfunctional impulsivity and lower functional impulsivity compared to living control groups (Gao et al., 2011; Lin et al., 2016; Lin and Zhang, 2017; Zhang and Lin, 2014). Regarding suicide attempts, people who had attempted suicide showed greater impulsivity compared to those who have died by suicide. This difference was observed in both men and women (Giner et al., 2013). Additionally, females who died by suicide exhibited lower levels of impulsivity compared to men, even though the proportion of highly impulsive individuals was similar between sexes (McGirr, Séguin, et al., 2006).

In essence, a series of distinct characteristics were identified in both impulsive and non-impulsive people who died by suicide. These findings are elaborated in following sections and summarized in Table 2.

3.1.3. Impulsive-aggressive interaction and fatal suicide behaviour

Articles examined do not provide a consensus on which aspects of the

impulsive-aggressive dimension ultimately play a role in suicide, with some studies finding that aggression rather than impulsivity is related to death by suicide (Dalca et al., 2013; Ernst et al., 2004). Two studies that conducted multivariate analysis found that, although impulsivity was associated with suicide, this relation was not significant when adjusted for the measure of aggression, which appeared to be independently associated with suicide (Chachamovich et al., 2015; Ross et al., 2017). It is possible that aggression plays a role in particular forms of suicides such as impulsive suicide (Zouk et al., 2006), suicide involving a violent method (Dumais et al., 2005b) or suicide in the context of a depressive disorder (Dalca et al., 2013; Dumais et al., 2005b). Moreover, higher levels of impulsive-aggressive traits play a greater role in suicide occurring among young people, with this importance decreasing with increasing age (Liu et al., 2018; McGirr et al., 2008).

3.1.4. Mental disorders and impulsive traits

Mental disorders are linked to suicide (Ernst et al., 2004; Rasouli

Table 2
Characterization of impulsive and non-impulsive suicide cases as identified through systematic review.

	Impulsive suicide cases	Non-impulsive suicide cases
Age^a	Younger (Liu et al., 2018; McGirr et al., 2008)	Older (Liu et al., 2018; McGirr et al., 2008)
Psychopathological profiling^b	Substance-related disorders (McGirr et al., 2008; McGirr et al., 2006), Cluster B personality disorder (McGirr et al., 2007)	Depression (Dalca et al., 2013; McGirr et al., 2006; Niu et al., 2020), Schizophrenia spectrum disorders (Lyu and Zhang, 2014; McGirr et al., 2006)
Intent to die	Low (Lin et al., 2019; Sun and Zhang, 2015)	High
Coping style	Avoidant coping (Gao et al., 2011; Lin et al., 2019)	Approach coping
Risk factors	Recent negative life event (Zhang and Lin, 2015), work problems (Law et al., 2014), lower personal income (Lin et al., 2016)	Health problems (Giner et al., 2013) ^c
Protective factors	Social support is not a protective factor (Zhang and Lin, 2015)	Social support (Law et al., 2014; Zhang and Lin, 2015)

^a In the meta-regression analysis, impulsivity was found to be independent of age.

^b Understood as increased likelihood of specific psychopathological disorders.

^c The control group for this work is a sample of cases of suicide attempts.

et al., 2019; Zhang et al., 2010; Jie Zhang and Lin, 2014). One study even reports the presence of mental disorders as a mediator between work problems and suicide (Law et al., 2014). However, regarding the interaction between mental disorder and impulsive traits results are controversial, with some studies finding lower impulsivity in people who die by suicide with mental disorders (Lyu and Zhang, 2014) and other higher impulsivity scores (Ross et al., 2017).

Moreover, the interaction between mental disorders and impulsive traits could vary depending on the specific mental disorder assessed. A study based in Canada found that increased BIS scores differentiated people with borderline personality disorder (BPD) who died by suicide from those who did not (McGirr et al., 2007). Research by the same group reported that only in schizophrenia and chronic psychosis, impulsive behaviours did not play a role in suicide (McGirr, Tousignant, et al., 2006). Another study based in China also found that people with schizophrenia who die by suicide had lower impulsivity scores than people who die by suicide without mental disorders (Lyu and Zhang, 2014).

3.1.4.1. Depressive disorders. Death by suicide during a major depressive episode was characterized by elevated levels of aggression rather than impulsivity (Dalca et al., 2013; Dumais et al., 2005b; McGirr et al., 2008). In fact, a study conducted within the Inuit population in Nunavut reported that the association between impulsivity and suicide ceased to be significant when adjusted by presence of depression and aggression (Chachamovich et al., 2015). Furthermore, another investigation found that individuals with a diagnosis of depression who died by suicide tended to exhibit lower impulsivity scores (Lin et al., 2019). Suicides in the context of a major depressive disorder are more likely to occur during the first episode, which could be related to higher levels of aggressive traits (McGirr et al., 2008).

In men who died by suicide and had a diagnosis of depression, impulsive aggressive behaviours were associated with cluster B and alcohol abuse (Dumais et al., 2005b). Conversely, among women who died by suicide and had a diagnosis of depression, there was an association with aggressive traits and cluster B, and lower levels of impulsivity compared to men (Dalca et al., 2013). When adjusting for other

sociodemographic, psychological, and social factors, only moderate to severe depression was associated to suicidality in women, whereas for men, even mild depression constituted a risk factor (Niu et al., 2020).

3.1.4.2. Substance-related disorders. Except for one study (Niu et al., 2020), alcohol and/or drug use disorders were linked to increased suicidality (Chachamovich et al., 2015; Rasouli et al., 2019). Suicide featuring impulsive traits was associated with the presence of alcohol and/or drugs use disorders, both in the lifetime and in the six months preceding death (Dumais et al., 2005b; Zouk et al., 2006). Among people with BPD, alcohol dependence was independently associated with suicide (McGirr et al., 2007). It is noteworthy that the prevalence of substance abuse disorders decreased with age, in the same fashion as impulsivity (McGirr et al., 2008).

3.1.5. Other mediating factors

3.1.5.1. Social factors. Relations were reported between suicide and both annual family income (Gao et al., 2011; Zhang et al., 2012; Lu et al., 2012) and personal income (Zouk et al., 2006). Annual family income was not found to be correlated with impulsivity in people who died by suicide (Gao et al., 2011). However, impulsive individuals who died by suicide had a lower personal income and were less likely to have been major income providers (Zouk et al., 2006). The same study also reported that impulsive adults who died by suicide had worked for fewer years compared to their non-impulsive counterparts, although this relation was not controlled for age. It is noteworthy to highlight distinct effects of income by gender: in China, high family income appeared as a protective factor for men but not for women (Zhang et al., 2010). In Western countries, males who died by suicide had lower socioeconomic status than women who died by suicide (Giner et al., 2013), and were more susceptible to unemployment (Chachamovich et al., 2015; Giner et al., 2013; McGirr, Séguin, et al., 2006).

In addition to lower income, people who died by suicide were found to have lower social support (Law et al., 2014; Zhang and Lin, 2014) as well as fewer social problem skills (Law et al., 2014). Among individuals who died by suicide and had lower impulsivity scores, high social support was observed to have a protective effect (Zhang and Lin 2015). Low impulsivity was also associated with approach coping, while high impulsivity was associated with avoidance coping style (Lin et al., 2019).

3.1.5.2. Negative life events. The triggering of a negative life event within a week preceding the suicide has been associated with suicide in individuals with impulsive personality traits opposed to those without impulsive personality traits (Zouk et al., 2006) in both men and women (Zhang and Lin, 2014). People who died by suicide with high impulsivity had greater likelihood of experiencing childhood abuse, such as experiences of indifference, rejection, or neglect from either parent. However, in the same study, although the prevalence of psychological, physical and sexual violence was more prevalent in the suicide group with impulsive traits, these differences were not statistically relevant (Zouk et al., 2006).

3.1.5.3. Choice of method, lethality and intent to die. High levels of impulsive and aggressive traits were associated with more violent suicide methods (Dumais et al., 2005b), but also to low intent of death as measured by Beck's Suicide Intent Scale (Sun and Zhang, 2015) and, in the context of BPD, with greater lethality (McGirr et al., 2007). In rural China, no relation was found between impulsivity and the use of pesticides as a method for suicide (Zhang and Li, 2011; Zhu et al., 2019)

3.2. Meta-analysis

3.2.1. Study description

Nine original studies were included in the meta-analysis, comprising a total of 1571 people who died by suicide and 1279 living controls. Five of the studies collected their sample in different regions of China, including Hong Kong, two in Canada, one in Australia and one in Iran.

3.2.2. Impulsivity and death by suicide

The results of the meta-analysis are depicted in Fig. 2. Higher impulsivity scores were reported for suicide deaths than for living controls (Hedges'g = 0.59, 95 % CI [0.28; 0.89], p = .002). However, studies show high heterogeneity (Q = 90.86, p < .001, I² = 89.0 %). Additionally, the 95 % prediction interval includes 0 (-0.43; 1.60). Funnel plot (see supplementary material) showed a symmetric distribution (Egger's test = -1.98, p = .078) indicating the absence of publication bias.

We carried out outlier detection analysis and identified the male sub selection of McGirr et al. (2006b) and Lin et al. (2016) as outliers. Sensitivity analysis after removing these studies showed similar results (Hedges'g = 0.56, 95 % CI [0.24, 0.88], p = .004) with no significant changes in heterogeneity (Q = 50.78, p < .001, I² = 84 %). Forest plot and funnel plot of this analysis is in supplementary material.

Meta-regressions were performed, showing no significant effects for sex (F_{1,9} = 0.037, p = .852), age (F_{1,9} = 11.292, p = .227), the scale used for assessing impulsivity (BIS, DII or IRS; F_{1,9} = 3.777, p = .070), presence/absence of mental disorders (F_{1,9} = 2.472, p = .200), and history of previous suicide attempts (F_{1,9} = 0.304, p = .865).

Meta-regressions were carried out again removing outliers, yielding similar results for sex (F_{1,7} = 0.199, p = .669), age (F_{1,7} = 8.051, p = .347), utilized scales for assessing impulsivity (F_{1,7} = 2.023, p = .213), presence of mental disorders (F_{1,7} = 1.424, p = .410), history of previous suicide attempts (F_{1,7} = 0.295, p = .868).

An equivalent meta-analysis was run for aggressiveness scores, incorporating measures from five of the identified studies using BGHA or OAS scales. These studies encompassed a total of 597 suicide cases and 311 controls. However, the relation was not found to be significant (Hedges'g = 0.51, 95 % CI [-0.24, 1.26], p = .013). An additional meta-regression was performed assessing the relationship between impulsivity and aggressiveness, revealing a statistically significant positive correlation (β = 0.447, p = .045).

4. Discussion

4.1. Main findings

In this systematic review we found higher impulsivity traits in people who died by suicide compared to community living controls or equivalent patient control groups. This was further confirmed in the meta-

analysis, in which suicide cases had higher levels of impulsivity than living controls as measured by proxy reports of the BIS, DIS or the IRS. It is important to underscore that most case-control studies included in the meta-analysis demonstrated robust designs. Most control samples consisted of community living controls matched by sex and age, except for McGirr et al., 2006 and Rasouli et al., 2019, which were unable to match their controls samples). The study by Ross et al., 2017 stood out as the sole study to utilize a sudden death control sample. Its inclusion may have skewed the results, as people who die by sudden death may share overlapping factors with those who die by suicide, particularly in terms of impulsive traits, and may have overshadow its effect in the meta-analysis. In any case, the findings support hypothesis 1, suggesting that impulsivity is indeed associated with fatal suicide behavior.

Regarding hypothesis 2, which posted that aggression would mediate the relation between impulsivity and fatal suicide behavior, our analysis support this notion. Aggressive traits, as measured by the BGHA and OAS, were indeed identified as a mediator.

Finally, evidence regarding hypothesis 3, which anticipated the presence of confounding factors, such as mental disorders or previous suicide attempts, presents a mixed picture. The association between impulsivity and fatal suicide behaviour was in fact independent of several potentially confounding variables such as sex, age, selected impulsivity scale, presence of mental disorders, and previous suicide attempts. With respect to history of suicide attempts, results are striking as it is extensively linked with both impulsivity traits and death by suicide. However, it may be that the relation between non-lethal and lethal suicide attempts is only effective for specific clinical sub-samples such as people with personality disorders and young adult women with affective or substance abuse disorders, as identified in other works (Goñi-Sarriés et al., 2018) that were under-represented in this work.

In any case, the results of the systematic review highlight the nuanced role of impulsivity in suicide across different mental disorders. While impulsivity is associated with increased suicidality in the context of BPD and substance use disorders, it appears to be unrelated in schizophrenia spectrum disorders, and in the context of depression, its predictive power on fatal suicide behavior is influenced by various factors including sex, aggressive traits, comorbid personality disorders and the severity of the depression. Discrepancies between the findings in the systematic review and meta-analysis likely stem from the way mental disorders were categorized in the articles included in the meta-analysis. In these articles, the presence or absence of mental disorders was recorded following broad categories (such as substance abuse disorders, personality disorders, or just any form of mental disorder). This approach led to significant heterogeneity in the data, making it challenging to discern the specific effects of individual disorders. Consequently, the role of impulsivity in relation to specific disorders or spectra was better elucidated through the synthetic analysis provided by the systematic review.

During the systematic review, additional mediators in the

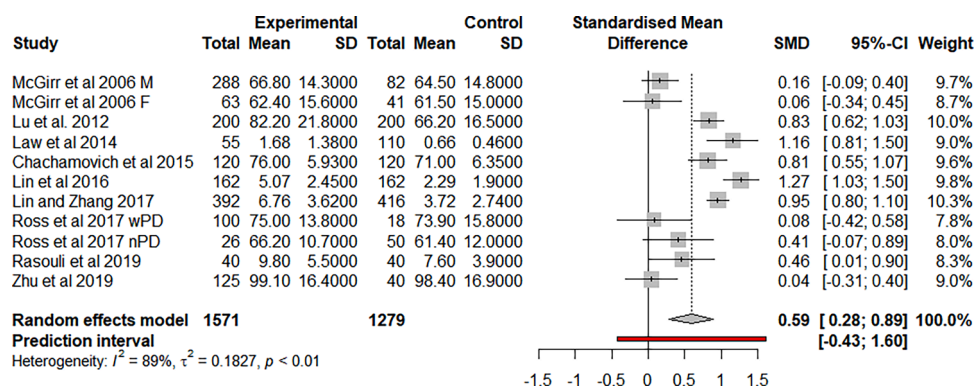


Fig. 2. Forest plot of studies included in the meta-analysis.

relationship between impulsivity and fatal suicide behaviour were identified. Personal income, but not family income, emerged as a risk factor for suicidality among people with high impulsivity. It seems that the association between income and suicidality is influenced by the interaction of both sex and cultural factors. Other factors correlated with suicide in people with high impulsivity included childhood abuse, recent experience of a negative life event, avoidant coping style and low intent to die.

It is notable that more than half of studies identified were based in Eastern countries such as China and Iran. Cultural disparities between Eastern and Western countries are numerous. In these Eastern countries, there is an equivalent male to female ratio concerning death by suicide (below 2:1 in China or Iran) whereas in Western countries the ratio is typically higher (between 2 and 4:1 in countries such as Australia, Canada or Spain) (World Health Organization 2021).

As the relation of impulsivity with lethal suicide behavior is gender and culture-sensitive, these variations in male to female ratios may have obscured the effect of impulsivity in one gender over the other in the meta-analysis. Evidence from studies such as Dalca et al., 2013 suggest this, as impulsivity was increased in men with MDD who died by suicide, but not in women.

4.2. Fatal suicide behaviour in impulsive and non-impulsive personalities

It is intriguing to highlight certain associations linked to impulsivity traits and death by suicide. According to the findings, suicide cases with high impulsivity traits exhibit several characteristics: younger age (Liu et al., 2018; McGirr et al., 2008), increased alcohol consumption (McGirr et al., 2008), higher prevalence of BPD (McGirr et al., 2007); as expected as impulsivity is among its core symptoms), lower lethal intent (Lin et al., 2019; Sun and Zhang, 2015), recent negative life events (Zhang and Lin, 2015) and an avoidant coping style (Gao et al., 2011; Lin et al., 2019). Conversely, suicide cases with low impulsivity traits would display a different profile of risk factors: older age (Liu et al., 2018; McGirr et al., 2008), higher lethal intent (Lin et al., 2019; Sun and Zhang, 2015), greater presence of depressive (Dalca et al., 2013; McGirr et al., 2006; Niu et al., 2020) and psychotic spectrum disorders (Lyu and Zhang, 2014), higher likelihood of health problems (Giner et al., 2013) and an approach coping (Gao et al., 2011; Lin et al., 2019). Moreover, in contrast to suicide cases with high impulsivity traits, social support would act as a protective factor (Law et al., 2014; Zhang and Lin, 2015; Table 2).

It is worth noting that only two studies (Niu et al., 2020 and Zhang et al., 2010) categorize groups based to high or low impulsivity scores. Most of these findings arise from comparisons of impulsivity scores among groups with and without specific variables (i.e. a mental disorder), or from correlation analyses. In these analyses, a positive correlation implies an association with a high impulsivity group, while a negative correlation suggests a relationship with a low impulsivity group.

It is important to consider that age did not appear to influence the relationship between impulsivity and suicide in the meta-regression. This finding aligns with the study by Zouk et al. (Zouk et al., 2006), where age lost predictive value on suicidality after controlling for substance abuse disorders and aggressive traits. Therefore, the lower presence of young people among non-impulsive suicide cases may not necessarily be attributed to a decline of impulsivity with age (Chamorro et al., 2012), but rather to the reduced prevalence of aggressive traits and substance use in older age groups. These characteristics distinguishing impulsive and non-impulsive people who die by suicide have already been similarly observed in suicide attempts. Conner et al. (Conner, 2004) suggested that impulsive people engaging in suicide attempts exhibit low lethality, decreased levels of depression and hopelessness, and an increased likelihood of attempting suicide following negative life events. Similar findings have been reported by other research groups: a prospective study of suicide attempters

documented an inverse association between impulsivity and lethality of the suicide attempt (Baca-García et al., 2001). Childhood abuse has also been identified as a risk factor for shifting from non-fatal to fatal suicide behaviour among people with impulsive personalities (Wojnar et al., 2009) as well as alcohol abuse disorders (Spokas et al., 2012). In addition, there is extensive evidence that people with high impulsive and aggressive traits exhibit an increased response to cortisol (Alacreu-Crespo et al., 2022; Stanley et al., 2019). Impulsivity has also been posed as catalyst, precipitating suicide attempts during periods of stress, while aggression appears to be more closely associated with attempts of higher lethality (Brokke et al., 2022).

What about suicides in individual of low impulsivity? In our systematic review, this group would be characterized by older age, chronic health problems, depressive symptoms, and lower social support. These characteristics resemble the profile of individuals who pursue euthanasia. A study carried out in Belgium showed that most people with health problems requesting physician assisted suicide were over 60 years old and usually reported a variety of depressive symptoms (Rurup et al., 2005). Similarly, among patients with psychiatric disorders who requested euthanasia, depression, anxiety, and psychotic disorders are commonly observed (Kim et al., 2016). A recent systematic review confirmed that people who request euthanasia share commonalities and risk factors with people who die by suicide (Calati et al., 2021). It is plausible that these commonalities extend specifically to people with low impulsivity who die by suicide.

All these evidence suggests that the presence or absence of impulsivity traits significantly influences the way and timing in which a person engages in suicidal behaviour. Understanding the typologies of suicide between impulsive and non-impulsive individuals has clinical implications when managing individual cases. Impulsive and non-impulsive personalities may represent distinct endophenotypes that lead to death by suicide through different pathways, as it has been previously proposed (Oquendo, 2015; Turecki, 2005). Therefore, further research efforts should be directed towards the overlooked suicide cases in which impulsivity is not a prominent factor, to gain a comprehensive understanding of the diverse mechanisms underlying suicidal behavior.

4.3. Strengths and limitations

The present study examines a less-scrutinized issue in suicidology research, namely the role of impulsivity in the specific case of fatal suicide behaviour. It focuses on research conducted over a wide range of time and brings together samples from four continents worldwide. By focusing exclusively on studies conducted through psychological autopsy, it enhances comparability and increases the statistical power of individual analyses.

However, this study is not without limitations. First, the majority of the articles examined draw from the same datasets. This is due to the considerable expense associated with psychological autopsy studies, which require extensive collaboration between national health, law enforcement or justice institutions to identify suicide deaths, along with cooperation from their bereaved family members and specialized health professionals trained in the method. Consequently only few research groups have been capable of conducting such systematic research.

Second, psychological autopsy protocols used by different research groups showed substantial heterogeneity. While this diversity is understandable given the need for adaptation to national contexts, it restricts the scope of analysis that can be conducted with the available data. This heterogeneity is evident in the formulation of hypotheses, the identification of variables related to impulsivity in suicide, and the statistical analyses chosen to test these hypotheses. Consequently, numerous pertinent findings from certain studies remain unexamined by others, hampering conclusions about their generalizability. Thus, the comprehensive exploration of these associations in further research becomes pivotal.

Lastly, the conclusions drawn in this report are subjected to the same

bias of any psychological autopsy study: on the one hand, bias from the informant such as recall bias or social desirability bias; on the other hand, bias from the method itself, that is necessarily validated on living subjects. Longitudinal studies examining variations in the testimony of proxy informants before and after a person's death are costly, scarce, and limited to specific instruments.

4.4. Conclusions

This systematic review has shed light on the role of impulsivity on fatal suicide behaviour. This topic has been subject to less attention than impulsivity in other behaviours of the suicidal spectrum, mostly due to the methodological barriers that it entails. We found that impulsivity as a trait plays a role in deaths by suicide. Individuals with high impulsivity traits who die by suicide exhibit distinct characteristics such as younger age, substance abuse and low intent to die, whereas non-impulsive people who die by suicide tend to be older age, experience depression or schizophrenia and have high intent to die. Social support is not a protective factor for death by suicide in people with high impulsivity which poses challenges for suicide prevention in this population.

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6. Author contributions

Sergio Sanz Gómez contributed to study design, data analysis and interpretation of data, and wrote the first draft. Constanza Vera Varela contributed to study design and data collection. Adrián Alacreu-Crespo contributed to study design, data analysis and interpretation of data. María Isabel Perea González contributed to data collection. Julio Antonio Guija contributed to study design. Lucas Giner contributed to study design and interpretation of data. All authors revised the article and approved the final version to be published.

Data availability

Data availability is not applicable to this article as no new data were created or analysed in this study.

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CRedit authorship contribution statement

Sergio Sanz-Gómez: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Constanza Vera-Varela:** Writing – review & editing, Methodology, Investigation, Data curation, Conceptualization. **Adrián Alacreu-Crespo:** Writing – review & editing, Validation, Supervision, Software, Methodology, Data curation, Conceptualization. **María Isabel Perea-González:** Writing – review & editing, Investigation, Formal analysis, Data curation. **Julio Antonio Guija:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Lucas Giner:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare no conflict of interest.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.psychres.2024.115952](https://doi.org/10.1016/j.psychres.2024.115952).

References

- Alacreu-Crespo, A., Hidalgo, V., Girod, C., Olié, E., Courtet, P., 2022. The impulsiveness level influences the salivary cortisol response and social stress sensitivity in suicidal patients. *J. Psychiatr. Res.* 156, 159–167. <https://doi.org/10.1016/j.jpsychres.2022.10.008>.
- An, J., Phillips, M.R., Conner, K.R., 2010. Validity of proxy-based reports of impulsivity and aggression in Chinese research on suicidal behavior. *Crisis*. <https://doi.org/10.1027/0227-5910/a000019>.
- Baca-García, E., Diaz-Sastre, C., Basurte, E., Prieto, R., Ceverino, A., Saiz-Ruiz, J., de Leon, J., 2001. A prospective study of the paradoxical relationship between impulsivity and lethality of suicide attempts. *J. Clin. Psychiatr.* 62 (7), 560–564. <https://doi.org/10.4088/jcp.v62n07a11>.
- Brezo, J., Paris, J., Turecki, G., 2006. Personality traits as correlates of suicidal ideation, suicide attempts, and suicide completions: a systematic review. *Acta Psychiatr. Scand.* 113 (3), 180–206. <https://doi.org/10.1111/j.1600-0447.2005.00702.x>.
- Brokke, S.S., Landrø, N.I., Haaland, V.O., 2022. Impulsivity and aggression in suicide ideators and suicide attempters of high and low lethality. *BMC Psychiatry* 22, 1–9. <https://doi.org/10.1186/S12888-022-04398-W/TABLES/3>.
- Brown, G.L., Goodwin, F.K., 1986. Cerebrospinal fluid correlates of suicide attempts and aggression. *Ann. N. Y. Acad. Sci.* 487 (1), 175–188. <https://doi.org/10.1111/j.1749-6632.1986.tb27897.x>.
- Buss, A.H., Durkee, A., 1957. An inventory for assessing different kinds of hostility. *J. Consult. Psychol.* 21 (4), 343–349. <https://doi.org/10.1037/h0046900>.
- Calati, R., Olié, E., Dassa, D., Gramaglia, C., Guillaume, S., Madeddu, F., Courtet, P., 2021. Euthanasia and assisted suicide in psychiatric patients: A systematic review of the literature. *J. Psychiatr. Res.* 135, 153–173. <https://doi.org/10.1016/j.jpsychres.2020.12.006>.
- Chachamovich, E., Haggarty, J., Cargo, M., Hicks, J., Kirmayer, L.J., Turecki, G., 2013. A psychological autopsy study of suicide among Inuit in Nunavut: methodological and ethical considerations, feasibility and acceptability. *Int. J. Circumpolar Health* 72 (1). <https://doi.org/10.3402/ijch.v72i20.20078>.
- Chachamovich, E., Kirmayer, L.J., Haggarty, J.M., Cargo, M., McCormick, R., Turecki, G., 2015. Suicide among Inuit: results from a large, epidemiologically representative follow-back study in Nunavut. *Canadian J. Psychiatr.* 60 (6), 268–275. <https://doi.org/10.1177/07067437150600605>.
- Chamorro, J., Bernardi, S., Potenza, M.N., Grant, J.E., Marsh, R., Wang, S., Blanco, C., 2012. Impulsivity in the general population: a national study. *J. Psychiatr. Res.* 46 (8), 994–1001. <https://doi.org/10.1016/j.jpsychres.2012.04.023>.
- Claes, L., Vertommen, H., Braspenning, N., 2000. Psychometric properties of the Dickman impulsivity inventory. *Pers. Individ. Dif.* 29 (1), 27–35. [https://doi.org/10.1016/S0191-8869\(99\)00172-5](https://doi.org/10.1016/S0191-8869(99)00172-5).
- Conner, K.R., 2004. A call for research on planned vs. unplanned suicidal behavior. *Suicide Life Threat. Behav.* 34 (2), 89–98. <https://doi.org/10.1521/suli.34.2.89.32780>.
- Conner, K.R., Beautrais, A.L., Brent, D.A., Conwell, Y., Phillips, M.R., Schneider, B., 2011. The next generation of psychological autopsy studies: part I. Interview content. *Suicide Life Threat. Behav.* 41 (6), 594–613. <https://doi.org/10.1111/j.1943-278X.2011.00057.x>.
- Conner, K.R., Chapman, B.P., Beautrais, A.L., Brent, D.A., Bridge, J.A., Conwell, Y., Falter, T., Holbrook, A., Schneider, B., 2021. Introducing the psychological autopsy methodology checklist. *Suicide Life Threat. Behav.* 51 (4), 673–683. <https://doi.org/10.1111/sltb.12738>.
- Core Team, R., 2014. *R: a Language and Environment for Statistical Computing* [Computing Software]. R Foundation for Statistical Computing.
- Dalca, I.M., McGirr, A., Renaud, J., Turecki, G., 2013a. Gender-specific risk factors for suicide in major depressive disorder. *J. Clin. Psychiatr.* 74 (12), 1209–1216. <https://doi.org/10.4088/JCP.12m08180>.
- Dickman, S.J., 1990. Functional and dysfunctional impulsivity: personality and cognitive correlates. *J. Pers. Soc. Psychol.* 58 (1), 95–102.
- Dumais, A., Lesage, A.D., Alda, M., Rouleau, G., Dumont, M., Chawky, N., Roy, M., Mann, J., Benkelfat, C., Turecki, G., 2005a. Risk factors for suicide completion in major depression: a case-control study of impulsive and aggressive behaviors in men. *Am. J. Psychiatr.* 162 (11), 2116–2124. <https://doi.org/10.1176/appi.ajp.162.11.2116>.
- Dumais, A., Lesage, A.D., Lalovic, A., Séguin, M., Tousignant, M., Chawky, N., Turecki, G., 2005b. Is violent method of suicide a behavioral marker of lifetime aggression? *Am. J. Psychiatr.* 162 (7), 1375–1378. <https://doi.org/10.1176/appi.ajp.162.7.1375>.
- Ekhtiari, H., Safaei, H., Djavid, G.E., Atefvahid, M.K., Edalati, H., Mokri, A., 2008. Reliability and validity of Persian versions of Eysenck, Barratt, Dickman and Zuckerman questionnaires in assessing risky and impulsive behaviors. *Iranian J. Psychiatr. Clin. Psychol.* 14 (3), 326–336.
- Ernst, C., Lalovic, A., Lesage, A., Seguin, M., Tousignant, M., Turecki, G., 2004. Suicide and no axis I psychopathology. *BMC Psychiatr.* 4, 1–5.
- Fang, L., Zhang, J., 2010. Validity of proxy data obtained by different psychological autopsy information reconstruction techniques. *J. Int. Med. Res.* 38 (3), 833–843. <https://doi.org/10.1177/147323001003800310>.

- First, M.B., Spitzer, R.L., Gibbon, M., Williams, J.B.W., & others. (2002). Structured clinical interview for DSM-IV-TR axis I disorders, research version, patient edition.
- First, M.B., Spitzer, R.L., Gibbon, M., Williams, J.B.W., Benjamin, L., 1994. Structured Clinical Interview For DSM-IV-TR Axis II Personality Disorders (SCID-II) Version 2.0. Biometrics Research Department, New York State Psychiatric Institute, New York.
- Gao, Q., Zhang, J., Jia, C., 2011. Psychometric properties of the Dickman Impulsivity Instrument in suicide victims and living controls of rural China. *J. Affect. Disord.* 132 (3), 368–374. <https://doi.org/10.1016/j.jad.2011.03.002>.
- Giner, L., Blasco-Fontecilla, H., De La Vega, D., Courtet, P., 2016. Cognitive, emotional, temperament and personality trait correlates of suicidal behavior. *Curr. Psychiatr. Rep.* 18 (11) <https://doi.org/10.1007/s11920-016-0742-x>.
- Giner, L., Blasco-Fontecilla, H., Mercedes Perez-Rodriguez, M., Garcia-Nieto, R., Giner, J., Guija, J.A., Rico, A., Barrero, E., Luna, M.A., De Leon, J., Oquendo, M.A., Baca-García, E., 2013. Personality disorders and health problems distinguish suicide attempters from completers in a direct comparison. *J. Affect. Disord.* 151 (2), 474–483. <https://doi.org/10.1016/j.jad.2013.06.029>.
- Goni-Sarriés, A., Blanco, M., Azcárate, L., Peinado, R., López-Goni, J.J., 2018. Are previous suicide attempts a risk factor for completed suicide? *Psicothema* 30 (1), 33–38. <https://doi.org/10.7334/psicothema2016.318>.
- Gvion, Y., Apte, A., 2011. Aggression, impulsivity, and Suicide behavior: a review of the literature. *Arch. Suicide Res.* 15 (2), 93–112. <https://doi.org/10.1080/13811118.2011.565265>.
- Huber, R.S., Hodgson, R., Yurgelun-Todd, D.A., 2019. A qualitative systematic review of suicide behavior using the cognitive systems domain of the research domain criteria (RDoC) framework. *Psychiatr. Res.* 282 (May), 112589 <https://doi.org/10.1016/j.psychres.2019.112589>.
- Int'Hout, J., Ioannidis, J.P.A., Rovers, M.M., Goeman, J.J., 2016. Plea for routinely presenting prediction intervals in meta-analysis. *BMJ Open* 6 (7), e010247. <https://doi.org/10.1136/bmjopen-2015-010247>.
- Keilp, J.G., Goryn, M., Oquendo, M.A., Brodsky, B., Ellis, S.P., Stanley, B., Mann, J.J., 2006. Aggressiveness, not impulsiveness or hostility, distinguishes suicide attempters with major depression. *Psychol. Med.* 36 (12), 1779–1788. <https://doi.org/10.1017/S0033291706008725>.
- Kim, S.Y.H., De Vries, R.G., Peteet, J.R., 2016. Euthanasia and assisted suicide of patients with psychiatric disorders in the Netherlands 2011 to 2014. *JAMA Psychiatr.* 73 (4), 362–368. <https://doi.org/10.1001/jamapsychiatry.2015.2887>.
- Knapp, G., Hartung, J., 2003. Improved tests for a random effects meta-regression with a single covariate. *Stat. Med.* 22, 2693–2710. <https://doi.org/10.1002/SIM.1482>.
- Knoll, J.L., 2009. The psychological autopsy, part II: toward a standardized protocol. *J. Psychiatr. Pract.* 15 (1), 52–59. <https://doi.org/10.1097/01.pra.0000344920.36157.95>.
- Koo, T.K., Li, M.Y., 2016. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *J. Chiropr. Med.* 15 (2), 155–163. <https://doi.org/10.1016/j.jcm.2016.02.012>.
- Koyama, E., Zai, C.C., Bryushkova, L., Kennedy, J.L., Beitchman, J.H., 2020. Predicting risk of suicidal ideation in youth using a multigene panel for impulsive aggression. *Psychiatr. Res.* 285 (August 2019), 112726 <https://doi.org/10.1016/j.psychres.2019.112726>.
- Law, Y.W., Yip, P.S.F., Zhang, Y., Caine, E.D., 2014. The chronic impact of work on suicides and under-utilization of psychiatric and psychosocial services. *J. Affect. Disord.* 168, 254–261. <https://doi.org/10.1016/j.jad.2014.06.031>.
- Leclubier, Y., Braconnier, A., Said, S., Payan, C., 1995. The impulsivity rating scale (IRS): preliminary results. *Eur. Psychiatr.* 10 (7), 331–338. [https://doi.org/10.1016/0924-9338\(96\)80333-6](https://doi.org/10.1016/0924-9338(96)80333-6).
- Lin, L., Zhang, J., 2017. Impulsivity, mental disorder, and suicide in rural China. *Arch. Suicide Res.* 21 (1), 73–82. <https://doi.org/10.1016/j.physbeh.2017.03.040>.
- Lin, L., Zhang, J., Zhou, L., Jiang, C., 2016. The relationship between impulsivity and suicide among rural youths aged 15-35 years: a case-control psychological autopsy study. *Psychol. Health Med.* 21 (3), 330–337. <https://doi.org/10.1080/13548506.2015.1051555>.
- Lin, L., Zhao, S., Zhang, J., 2019. Impulsivity kills some who did not plan to die by suicide: evidence from Chinese rural youths. *Omega* 79 (4), 446–460. <https://doi.org/10.1177/003022818786417>.
- Liu, B.P., Qin, P., Jia, C.X., 2018. Behavior characteristics and risk factors for suicide among the elderly in Rural China. *J. Nerv. Ment. Dis.* 206 (3), 195–201. <https://doi.org/10.1097/NMD.0000000000000728>.
- Lopez-Morinigo, J.D., Boldrini, M., Ricca, V., Oquendo, M.A., Baca-García, E., 2021. Aggression, impulsivity and suicidal behavior in depressive disorders: a comparison study between New York City (us), Madrid (Spain) and Florence (Italy). *J. Clin. Med.* 10 (14) <https://doi.org/10.3390/jcm10143057>.
- Lu, C.F., Jia, C.X., Xu, A.Q., Dai, A.Y., Qin, P., 2012. Psychometric characteristics of Chinese version of Barratt impulsiveness scale-11 in suicides and living controls of rural China. *Omega* 66 (3), 215–229. <https://doi.org/10.2190/OM.66.3.b>.
- Lyu, J., Zhang, J., 2014. Characteristics of schizophrenia suicides compared with suicides by other diagnosed psychiatric disorders and those without a psychiatric disorder. *Schizophr. Res.* 155 (1–3), 59–65. <https://doi.org/10.1016/j.schres.2014.02.018>.
- Mann, J.J., 2003. Neurobiology of suicidal behaviour. *Nat. Rev. Neurosci.* 4 (10), 819–828. <https://doi.org/10.1038/nrn1220>.
- McGirr, A., Paris, J., Lesage, A., Renaud, J., Turecki, G., 2007. Risk factors for suicide completion in borderline personality disorder: a case-control study of cluster B comorbidity and impulsive aggression. *J. Clin. Psychiatr.* 68 (5), 721–729.
- McGirr, A., Renaud, J., Bureau, A., Seguin, M., Lesage, A., Turecki, G., 2008a. Impulsive-aggressive behaviours and completed suicide across the life cycle: a predisposition for younger age of suicide. *Psychol. Med.* 38 (3), 407–417. <https://doi.org/10.1017/S0033291707001419>.
- McGirr, A., Renaud, J., Séguin, M., Alda, M., Turecki, G., 2008. Course of major depressive disorder and suicide outcome: a psychological autopsy study. *J. Clin. Psychiatr.* 69 (6), 966–970.
- McGirr, A., Séguin, M., Renaud, J., Benkelfat, C., Alda, M., Turecki, G., 2006a. Gender and risk factors for suicide: evidence for heterogeneity in predisposing mechanisms in a psychological autopsy study. *J. Clin. Psychiatr.* 67 (10), 1612–1617.
- McGirr, A., Toussignant, M., Routhier, D., Pouliot, L., Chawky, N., Margolèse, H., Turecki, G., 2006b. Risk factors for completed suicide in schizophrenia and other chronic psychotic disorders: a case-control study. *Schizophr. Res.* 84 (1), 132–143. <https://doi.org/10.1016/j.schres.2006.02.025>.
- McHugh, C., Balaratnasingam, S., 2018. Impulsivity in personality disorders: current views and future directions. *Curr Opin Psychiatr.* 31 (1), 63–68. <https://doi.org/10.1097/YCO.0000000000000383>.
- McHugh, C.M., Chun Lee, R.S., Hermens, D.F., Corderoy, A., Large, M., Hickie, I.B., 2019. Impulsivity in the self-harm and suicidal behavior of young people: a systematic review and meta-analysis. *J. Psychiatr. Res.* 116 (May), 51–60. <https://doi.org/10.1016/j.jpsychires.2019.05.012>.
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., 2010. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Int. J. Surg.* 8 (5), 336–341. <https://doi.org/10.1016/j.ijsu.2010.02.007>.
- Musekiwa, A., Manda, S.O.M., Mwambi, H.G., Chen, D.G., 2016. Meta-analysis of effect sizes reported at multiple time points using general linear mixed model. *PLoS One* 11 (10), 1–13. <https://doi.org/10.1371/journal.pone.0164898>.
- Niu, L., Jia, C., Ma, Z., Wang, G., Sun, B., Zhang, D., Zhou, L., 2020a. Loneliness, hopelessness and suicide in later life: a case-control psychological autopsy study in rural China. *Epidemiol. Psychiatr. Sci.* 29 <https://doi.org/10.1017/s2045796020000335>.
- Niu, L., Ma, Z., Jia, C., Zhou, L., 2020b. Gender-specific risk for late-life suicide in rural China: a case-control psychological autopsy study. *Age Ageing*. <https://doi.org/10.1093/ageing/afaa036>.
- O'Connor, R.C., Nock, M.K., 2014. The psychology of suicidal behaviour. *Lancet Psychiatr.* 1 (1), 73–85. [https://doi.org/10.1016/S2215-0366\(14\)70222-6](https://doi.org/10.1016/S2215-0366(14)70222-6).
- Oquendo, M.A., 2015. Impulsive versus planned suicide attempts: different phenotypes? *J. Clin. Psychiatr.* 76 (3), 293–294. <https://doi.org/10.4088/JCP.15f09866>.
- Oquendo, M.A., Baca-García, E., Graver, R., Morales, M., Montalvan, V., Mann, J.J., 2001. Spanish adaptation of the Barratt impulsiveness scale (BIS-11). *Eur. J. Psychiatr.* 15 (3), 147–155.
- Oquendo, M.A., Currier, D., Mann, J.J., 2006. Prospective studies of suicidal behavior in major depressive and bipolar disorders: what is the evidence for predictive risk factors? *Acta Psychiatr. Scand.* 114 (3), 151–158. <https://doi.org/10.1111/j.1600-0447.2006.00829.x>.
- Patton, J.H., Stanford, M., Barratt, E.S., 1995. Factor structure of the Barratt impulsiveness scale. *J. Clin. Psychol.* 51, 768–774. [https://doi.org/10.1002/1097-4679\(199511\)51:63.0.CO;2-1](https://doi.org/10.1002/1097-4679(199511)51:63.0.CO;2-1).
- Portney, L.G. (2020). Foundations of clinical research: applications to evidence-based practice. In *Foundations of Clinical Research: Applications to Evidence-Based Practice*, 4e.
- Pouliot, L., De Leo, D., 2006. Critical issues in psychological autopsy studies. *Suicide Life Threat. Behav.* 36 (5), 491–510. <https://doi.org/10.1521/suli.2006.36.5.491>.
- Rasouli, N., Malakouti, S.K., Rezaeian, M., Saberi, S.M.M., Njomi, M., Leo, D., Ramezani-Farani, D., 2019. Risk factors of suicide death based on psychological autopsy method; a case-control study. In: *Arch. Acad. Emergency Med.*, 7.
- Rinkeviciene, J., Ogorman, J., De Leo, D., 2015. Impulsive suicide attempts: a systematic literature review of definitions, characteristics and risk factors. *J. Affect. Disord.* 171, 93–104. <https://doi.org/10.1016/j.jad.2014.08.044>.
- Ross, V., Kölves, K., De Leo, D., 2017a. Beyond psychopathology: a case-control psychological autopsy study of young adult males. *Int. J. Soc. Psychiatr.* 63 (2), 151–160. <https://doi.org/10.1177/0020764016688041>.
- Rurup, M.L., Onwuteaka-Philipsen, B.D., Jansen-Van Der Weide, M.C., Van Der Wal, G., 2005. When being "tired of living" plays an important role in a request for euthanasia or physician-assisted suicide: patient characteristics and the physician's decision. *Health Policy (New York)* 74 (2), 157–166. <https://doi.org/10.1016/j.healthpol.2005.01.002>.
- Sanz-Gómez, S., Alacreu-Crespo, A., Guija, J.A., Giner, L., 2023. Reliability and validity of proxy reports of impulsivity and aggression: An evidence-based assessment approach to psychological autopsy methods. *Spanish J. Psychiatry Ment. Heal.* <https://doi.org/10.1016/J.SJPMH.2023.10.003>.
- Spokas, M., Wenzel, A., Brown, G.K., Beck, A.T., 2012. Characteristics of individuals who make impulsive suicide attempts. *J. Affect. Disord.* 136 (3), 1121–1125. <https://doi.org/10.1016/j.jad.2011.10.034>.
- Stanford, M.S., Mathias, C.W., Dougherty, D.M., Lake, S.L., Anderson, N.E., Patton, J.H., 2009. Fifty years of the Barratt Impulsiveness Scale: an update and review. *Pers. Individ. Dif.* 47 (5), 385–395. <https://doi.org/10.1016/j.paid.2009.04.008>.
- Stanley, B., Michel, C.A., Galfalvy, H.C., Keilp, J.G., Rizk, M.M., Richardson-Vejgaard, R., Oquendo, M.A., Mann, J.J., 2019. Suicidal subtypes, stress responsivity and impulsive aggression. *Psychiatr. Res.* 280 (July), 112486 <https://doi.org/10.1016/j.psychres.2019.112486>.
- Sun, L., Zhang, J., 2015. Characteristics of Chinese rural young suicides who did not have a strong intention to die. *Compr. Psychiatr.* 0, 73–78. <https://doi.org/10.1038/jid.2014.371>.
- Turecki, G., 2005. Dissecting the suicide phenotype: the role of impulsive-aggressive behaviours. *J. Psychiatr. Neurosci.* 30 (6), 398–408.
- Turecki, G., Brent, D.A., 2016. Suicide and suicidal behaviour. *Lancet* 19 (387), 1227–1239. [https://doi.org/10.1016/S0140-6736\(15\)00234-2](https://doi.org/10.1016/S0140-6736(15)00234-2).
- Veroniki, A.A., Jackson, D., Viechtbauer, W., Bender, R., Bowden, J., Knapp, G., Kuss, O., Higgins, J.P., Langan, D., Salanti, G., 2016. Methods to estimate the between-study

- variance and its uncertainty in meta-analysis. *Res. Synth. Methods* 7 (1), 55–79. <https://doi.org/10.1002/jrsm.1164>.
- Viechtbauer, W., Cheung, M.W.-L., 2010. Outlier and influence diagnostics for meta-analysis. *Res. Synth. Methods* 1 (2), 112–125. <https://doi.org/10.1002/jrsm.11>.
- Wojnar, M., Ilgen, M.A., Czyz, E., Strobbe, S., Klimkiewicz, A., Jakubczyk, A., Glass, J., Brower, K.J., 2009. Impulsive and non-impulsive suicide attempts in patients treated for alcohol dependence. *J. Affect. Disord.* 115 (1–2), 131–139. <https://doi.org/10.1016/j.jad.2008.09.001>.
- World Health Organization. (2021). Suicide worldwide in 2019: global health estimates.
- Yudofsky, S.C., Silver, J.M., Jackson, W., Endicott, J., Williams, D., 1986. The overt aggression scale: an operationalized rating scale for verbal and physical aggression. *Am. J. Psychiatr.* 143 (1), 35–39.
- Zeng, X., Zhang, Y., Kwong, J.S.W., Zhang, C., Li, S., Sun, F., Niu, Y., Du, L., 2015. The methodological quality assessment tools for preclinical and clinical studies, systematic review and meta-analysis, and clinical practice guideline: a systematic review. *J. Evid. Based Med.* 8 (1), 2–10. <https://doi.org/10.1111/jebm.12141>.
- Zhang, J., Lamis, D.A., Yuanyuan, K., 2012. Measuring Chinese psychological traits and social support with western developed instruments in psychological autopsy studies. *J. Clin. Psychol.* 68 (12), 1313–1321. <https://doi.org/10.1002/jclp.21907>.
- Zhang, J., Li, Z., 2011. Suicide means used by chinese rural youths: a comparison between those with and without mental disorders. *J. Nerv. Ment. Dis.* 199 (6), 410–415. <https://doi.org/10.1097/NMD.0b013e31821d3ac7>.
- Zhang, J., Lin, L., 2014. The moderating effects of impulsivity on chinese rural young suicide. *J. Clin. Psychol.* 70 (6), 579–588. <https://doi.org/10.1002/jclp.22039>.
- Zhang, J., Lin, L., 2015. The moderating effect of social support on the relationship between impulsivity and suicide in Rural China. *Community Ment. Health J.* 51 (5), 585–590. <https://doi.org/10.1007/s10597-014-9811-y>.
- Zhang, J., Wang, Y., Fang, L., 2018. How to integrate proxy data from two informants in life event assessment in psychological autopsy. *BMC Psychiatr.* 18 (1), 1–7. <https://doi.org/10.1186/s12888-018-1698-7>.
- Zhang, J., Wiecezorek, W., Conwell, Y., Tu, X.M., Wu, B.Y.W., Xiao, S., Jia, C., 2010. Characteristics of young rural Chinese suicides: a psychological autopsy study. *Psychol. Med.* 40 (4), 581–589. <https://doi.org/10.1017/S0033291709990808>.
- Zhu, R.T., Ma, Z., Jia, C., Zhou, L., 2019. Suicide means used by the older adults in rural china: a comparison between those using pesticides and other means. *J. Geriatr. Psychiatr. Neurol.* 32 (6), 319–326. <https://doi.org/10.1177/0891988719862625>.
- Zouk, H., Tousignant, M., Seguin, M., Lesage, A., Turecki, G., 2006. Characterization of impulsivity in suicide completers: clinical, behavioral and psychosocial dimensions. *J. Affect. Disord.* 92 (2–3), 195–204. <https://doi.org/10.1016/j.jad.2006.01.016>.