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Patterns of self-harm methods over time and the association with methods used at repeat episodes of non-fatal self-harm and suicide: A systematic review

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HIGHLIGHTS

- One-third (33.3%) switched methods between episodes of self-harm, whilst almost one-half (42.1%) switched methods between the index episode of self-harm and suicide.
- Most studies included in this review categorised methods into self-injury and self-poisoning with little recognition of the diverse range of behaviours included within these broad categories and likely differences in potential lethality.
- Few studies investigated the role of alcohol and/or drug dependence in these presentations and the relationship between these disorders and self-harm method choice. An underassessment of the role of mental illness, and particularly depression, psychosis, and personality disorder, on self-harm method choice was also apparent.
- Switching between methods of self-harm is common. All patients should be routinely assessed for risk and needs irrespective of the method used at the index episode, consistent with clinical recommendations.

**Patterns of self-harm methods over time and the association with methods
used at repeat episodes of non-fatal self-harm and suicide: A systematic
review**

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ABSTRACT

Background: The risk of self-harm repetition and suicide may be influenced by self-harm method choice. However, there are mixed findings regarding whether there is a discernible pattern in self-harm methods over successive episodes of non-fatal self-harm, and if so, how these may be associated with self-harm repetition and/or suicide.

Methods: A systematic review of five electronic databases was undertaken until 31 May 2018 to identify cohort studies on patterns of self-harm methods and their association with methods used either repeat self-harm episodes and/or suicide.

Results: 15 studies were included reporting data on 127,371 participants. Over an average follow-up period of 2.8 years, one-third (33.3%) switched methods between episodes of self-harm, most commonly from self-injury to self-poisoning. For suicide, almost one-half (42.1%) switched methods over an average follow-up period of 11.2 years.

Limitations: Studies were characterised by a moderate study quality. Studies tended to group all methods into self-injury and/or self-poisoning with little consideration as to the diverse range of self-harm methods included within these broad categories and the likely differences in potential lethality between these methods. Few investigated the role of alcohol and/or drug dependence and mental illness on self-harm method choice.

Conclusions: Given the frequency of method switching observed, and the lack of discernible patterns over time, all patients should be routinely assessed for risk and needs irrespective of the method used at the index episode of non-fatal self-harm.

Keywords: self-harm; suicide; method; evolution; change.

INTRODUCTION

Self-harm, which includes intentional self-injury (i.e., self-inflicted destruction of one's own bodily tissue) and/or self-poisoning (including intentional drug overdose [IDO]) irrespective of type of motivation or degree of suicidal intent (Hawton et al., 2003), is frequently repeated. Internationally, approximately 16% of those presenting to hospital following an episode of non-fatal self-harm will re-present to hospital within a year (Carroll et al., 2014). However, this figure likely underestimates the risk of repeated self-harm as there may be further episodes of repeat self-harm occurring in the community that do not result in hospital presentation (Geulayov et al., 2018). In young people aged between 14 and 17 years, for example, less than one-quarter of those engaging in self-harm report seeking help from hospital-based services following an episode of self-harm (Ystgaard et al., 2009). Moreover, a recent review found that just over one-in-five (21.9%) patients report engaging in at least one further episode of self-harm over a one year period (Carroll et al., 2014).

Self-harm, and particularly frequent repetition of self-harm, is strongly associated with suicide. International figures suggest that between 1.6% and 3.9% of those presenting to hospital following a non-fatal episode of self-harm will die by suicide within one year (Carroll et al., 2014), making frequently repeated self-harm a major risk factor for suicide.

Emerging evidence suggests that the risk of self-harm repetition and suicide may be influenced by self-harm method, with rates of both appearing to be highest in those presenting to hospital following either self-injury alone (Carroll et al., 2014; Lilley et al., 2008), or combined self-injury and self-poisoning (Perry et al., 2012), as compared to self-poisoning alone. However, given that much of what is currently known about the risks of self-harm repetition and suicide is derived from work with hospital-treated populations, and that self-harm presentations to hospital most often involve self-poisoning, and particularly

IDO (Carroll et al., 2014), the use of this method has typically been assumed to be indicative of higher suicidal intent (Grandclerc et al., 2016; Haw et al., 2015), particularly where there are increases in the number of different substances ingested across successive episodes (Carter et al., 2005). As a consequence, those presenting to hospital following an episode of self-injury, and particularly self-cutting, are less likely to be admitted to hospital (Bennewith et al., 2005; Lilley et al., 2008; Madge et al., 2008), less likely to receive a full psychosocial risk/needs assessment (Gunnell et al., 2004; Kapur et al., 2008; Lilley et al., 2008), and less likely to be assessed by specialist mental health services (Cooper et al., 2013) despite being at greater risk of suicide as compared to those engaging in self-poisoning in some work (Bergen et al., 2012; Carroll et al., 2016; Runeson et al., 2010).

However, given recent findings that as many as one-third (34.3%) of patients who engage in self-harm switch between methods over successive episodes, attempts to allocate treatment resources on the basis of a specific method assessed at one point in time, for example at an index hospital presentation, may not be the best approach for reducing further risk (Owens et al., 2015). Indeed, for repeat presentations, it may be more appropriate to base treatment decisions on a patient's overall history of methods used across successive episodes of self-harm, in addition to their current psychosocial needs and psychiatric profile, as opposed to the characteristics of the self-harm method used at a single presentation.

Previous studies have produced mixed findings regarding whether there is a discernible pattern in evolution of self-harm methods over successive episodes of non-fatal self-harm and, if so, how these may influence an individual's risk of self-harm repetition and/or suicide (Birtwistle et al., 2017; Owens et al., 2015). Although some work suggests that self-harm method lethality increases with repetition (Reynolds and Eaton, 1986), a recent study found that as many individuals switched towards any one method of self-harm as switched away from that same method over an average follow-up period of 30 months,

suggesting that method switching may be largely unpredictable (Owens et al., 2015). However to date, there have been no systematic reviews examining the association between different methods of non-fatal self-harm and risk of self-harm repetition or suicide, meaning that there is limited evidence to guide clinical decision-making in this area. To address this gap we conducted a systematic review to specifically investigate: (1) method switching between the method planned and ultimately used within a single episode of self-harm; (2) method switching between successive episodes of non-fatal self-harm, and; (3) method switching between an index episode of self-harm and subsequent suicide.

METHODS

This systematic review was performed in accordance with the guidance contained in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2009).

Search Strategy

Five electronic databases indexing literature from medical sciences (EMBASE, Medline, PubMed), nursing (CINAHL), and psychology (PsycINFO) were systematically searched until 31 May 2018 to identify all studies investigating prospective associations between self-harm methods used at an index hospital presentation for non-fatal self-harm and further repetition of non-fatal self-harm and/or suicide.

A multi-stage search strategy was developed to identify relevant studies (Table 1). Keywords were combined with standard Boolean operators and were adapted to the specific requirements of each electronic database. Truncation and wildcards were also utilised, where

required, to increase the sensitivity and coverage of the search. We also screened the reference lists of prior reviews in this field to identify further relevant studies inadvertently missed by the broader electronic search.

**** INSERT TABLE 1 HERE ****

Inclusion and exclusion criteria

All cohort studies in which the association between methods used at an index episode of non-fatal self-harm and risk of repetition of self-harm and/or suicide at the individual level were considered eligible for inclusion. Studies were independently screened for inclusion by two review authors. Disagreements were resolved via consensus discussions between review authors. Only studies published in English were considered eligible for inclusion in this review as resource constraints meant we were unable to obtain translations of studies published in other languages.

Studies were excluded if: (1) the study did not report primary data (e.g., books, book chapters, commentaries, conference abstracts, editorials, and reviews); (2) the effectiveness of a risk prediction algorithm was investigated; (3) the study was a case report or case series; or (4) where the full text was unable to be located.

Data extraction

The primary focus of this review was two-fold: (1) to investigate findings regarding the association between types of self-harm methods at the index presentation and risk of either further self-harm repetition and/or suicide; (2) associations between self-harm

methods used at the index presentation and the methods used a further episodes of repeat self-harm and/or suicide; and (3) to describe the data capture mechanisms used in these studies to investigate individual-level changes in self-harm methods over time.

Given likely differences in methods used to categorise self-harm methods between studies, as well as differences in data capture mechanisms to determine repeat self-harm and/or suicide between studies (Birtwistle et al., 2017), we elected not to conduct meta-analysis. Instead, using a standard *pro forma*, the following information was extracted from each study: (1) study author and year; (2) country; (3) setting; (4) design; (5) recruitment period; (6) follow-up period; (7) information on the self-harm method(s) used at the index episode of self-harm; (8) information on the proportion of the sample engaging in a repeat episode of self-harm and/or suicide; (9) information on the method(s) used at the repeat episode of self-harm and/or suicide; and (10) information on the data capture mechanism used to ascertain self-harm and/or suicide.

Study quality

The overall quality of each included study was also investigated using the Newcastle-Ottawa Scale (NOS) (Wells et al., 2013). This tool consists of eight items which assess aspects of study design related to representativeness of the cohort exposure of interest (i.e., non-fatal self-harm), comparability between cohorts, and adequacy of the method used to ascertain the outcome of interest (i.e., repeated non-fatal self-harm and/or suicide). Each item is assigned one star (up to two for the comparability item) such that scores on this scale can range between zero and nine. Higher values are indicative of better study quality.

RESULTS

Using the strategy outlined in Table 1, 15,493 records were identified from the electronic search whilst a further eight were identified through ancestry searching. Given known limitations in terms of sensitivity and specificity for the automatic deduplication function within Endnote (Qi et al., 2013), we used a three-stage process to identify duplicates, consisting of the deduplication function in Endnote, followed by the deduplication function in Microsoft Excel, and manual identification as recommended (Kwon et al., 2015). Following the removal of duplicated records, the number of eligible records was reduced to 10,096. Following a review of their titles, 9,893 studies were excluded, and a further 188 were excluded following full text review. A total of 15 studies were therefore included in the present review, including a total of 127,371 participants (Figure 1).

**** INSERT FIGURE 1 HERE ****

Study characteristics

Detail on the characteristics of each included study is provided in Table 2. Briefly, all 15 studies had been conducted in high to middle income countries, most commonly the United Kingdom ($k=4$; 26.7%) (Bergen et al., 2012; Hawton et al., 2012; Mallon et al., 2015; Owens et al., 2015) or the United States of America ($k=4$; 26.7%) (Cugino et al., 1992; Miller et al., 2013; Miranda et al., 2014; Olfson et al., 2017), followed by Taiwan ($k=2$; 13.3%) (Huang et al., 2014; Wang et al., 2015). One study was conducted in each of the following: Austria (Deisenhammer et al., 2016), Greece (Paraschakis and Koutsafitis, 2014), Japan (Nishimura et al., 1999a), Norway (Hjelmeland, 1996), and Sweden (Brådvik, 2007).

Most studies ($k=8$; 53.3%) used a prospective design to investigate the association between the self-harm method used at the index episode and future risk of self-harm repetition and/or suicide (Bergen et al., 2012; Hawton et al., 2012; Huang et al., 2014; Miller et al., 2013; Miranda et al., 2014; Olfson et al., 2017; Owens et al., 2015; Wang et al., 2015). Six (40.0%) used a retrospective design (Brådvik, 2007; Cugino et al., 1992; Deisenhammer et al., 2016; Mallon et al., 2015; Nishimura et al., 1999b; Paraschakis et al., 2014). One study (2.9%) used both a prospective and retrospective design (Hjelmeland, 1996); however, for the present review only data relating to the prospective arm of this study were extracted and included.

For the majority of studies ($k=9$; 60.0%), cases were identified following presentation to hospital-based services (Bergen et al., 2012; Brådvik, 2007; Cugino et al., 1992; Deisenhammer et al., 2016; Hawton et al., 2012; Hjelmeland, 1996; Miller et al., 2013; Olfson et al., 2017; Owens et al., 2015), whilst for three (20.0%) retrospective studies, cases were identified from Coroner's records and/or from mortality registers (Mallon et al., 2015; Nishimura et al., 1999a; Paraschakis and Koutsaftis, 2014). For the remaining three community-based studies, cases were either identified from community-based registers of self-harm ($k=2$; 13.3%) (Huang et al., 2014; Wang et al., 2015), or from self-reported information ($k=1$; 6.7%) (Miranda et al., 2014).

**** INSERT TABLE 2 HERE ****

Study quality

Overall, the quality of the studies included in this review was moderate. Ten studies (66.7%) received between five and six stars on the NOS and were therefore rated as

being of adequate quality. Most commonly these studies used retrospective methods to investigate associations between changes in self-harm method choice between an index episode of self-harm and repetition and/or suicide (Brådvik, 2007; Cugino et al., 1992; Deisenhammer et al., 2016; Mallon et al., 2015; Nishimura et al., 1999b; Paraschakis et al., 2014). A number of these studies also included highly selected populations, such as psychiatric inpatients (Brådvik, 2007; Deisenhammer et al., 2016), those registered with a general practitioner (Mallon et al., 2015), those accessing treatment under the Medicaid scheme (i.e., without private health insurance) (Olfson et al., 2017), those using only certain methods of suicide (Nishimura et al., 1999b), or those without multiple episodes of self-harm prior to the index episode (Miller et al., 2013). One study was further downgraded owing to the use of self-reported information to ascertain cases and to determine self-harm repetition (Miranda et al., 2014).

Five studies (33.3%) received between seven and eight stars out of nine on the NOS. For these studies quality was typically downgraded as eligible participants were identified following a hospital presentation or admission following self-harm and/or repetition of self-harm and/or suicide was ascertained from hospital records (Bergen et al., 2012; Hawton et al., 2012; Huang et al., 2014; Owens et al., 2015; Wang et al., 2015). The samples included in these studies are therefore unlikely to be representative of those engaging in self-harming behaviour in the community.

Comparability of self-harm method classification between studies

For most studies, self-harm methods were grouped into self-poisoning and self-injury. One small retrospective study investigated associations for method switching between those methods characterised by the study authors as indicative of lesser violence (i.e.,

drowning, carbon monoxide gassing, and self-poisoning) as compared to more violent methods (i.e., all other forms of self-injury) (Brådvik, 2007), whilst one further retrospective study classified IDO and self-poisoning as “non-violent” methods which were compared with all other methods (defined as “violent”) (Deisenhammer et al., 2016).

With regards to those studies in which the association between self-harm method lethality and repetition of self-harm and/or suicide was evaluated (Huang et al., 2014; Miller et al., 2013; Miranda et al., 2014; Wang et al., 2015), lethality was defined as the potential lethality of the self-harm method used as informed by findings from epidemiological estimates. For one study, lethality was based on patient perceptions as to the likelihood the method would result in death, rather than from data derived from epidemiological sources (Miranda et al., 2014). One further study compared highly lethal methods (e.g., drowning, hanging, and jumping) with carbon monoxide gassing and with methods typically characterised by lower potential lethality (e.g., IDO and self-cutting) (Wang et al., 2015).

Method switching between self-harm planning and enactment

One study of 130 adult inpatients admitted to psychiatric services following an episode of self-harm investigated changes in the method planned, and ultimately used, within a single episode (Deisenhammer et al., 2016). In this study, IDO, self-poisoning, and drowning were classified as “non-violent” methods whilst all other methods of self-injury were classified as “violent”.

Over an average follow-up of 4.3 days, over one-quarter ($n=35$; 26.9%) used a different method of self-harm from that originally planned. For the majority ($n=27$; 77.7%), although a change in self-harm method was observed, the self-harm method ultimately used was within the same violence category to that planned. A greater proportion of those planning

to use a method characterised by the study authors as being violent (i.e., self-injury, excluding drowning) switched to use a method characterised by lesser violence (i.e., IDO, self-poisoning, and drowning) than the proportion of those initially planning to use a non-violent method switched to use a more violent method (12.3% vs. 9.3%).

Four factors appeared to be associated with the decision to use a different self-harm method from that originally planned in this study. Specifically, a greater proportion of those younger than 40 years, who had originally planned to use violent self-harm methods, and who had greater suicidal intent (as defined by a score of greater than 16 on the Beck Suicide Intent Scale) used a different method from that originally planned.

Method switching between episodes of non-fatal self-harm

Eight studies reported information on method switching between the index episode of self-harm and a repeat episode of self-harm (Cugino et al., 1992; Deisenhammer et al., 2016; Hjelmeland, 1996; Huang et al., 2014; Miller et al., 2013; Miranda et al., 2014; Owens et al., 2015; Wang et al., 2015). Overall, in these eight studies, one-third ($n=2,056$; weighted average: 33.3%) switched self-harm methods between the index and repeat episode over an average follow-up period of 2.8 years (range: one to six years).

A greater proportion of those engaging in self-injury at the index episode switched to self-poisoning at the repeat episode across a number of these studies (Cugino et al., 1992; Deisenhammer et al., 2016; Hjelmeland, 1996; Owens et al., 2015). In particular, there is some suggestion in two of these studies that those engaging in self-injurious methods characterised by higher potential lethality (typically drowning, gassing, firearms, hanging, and jumping) were more likely to switch self-harm methods at the subsequent episode of self-harm as compared to those engaging in methods characterised by lower potential lethality

(typically IDO and self-cutting) (Huang et al., 2014; Wang et al., 2015). However, one study of community dwelling adolescents suggested the reverse; in this study, a greater proportion of those engaging in self-cutting at the index episode switched self-harm methods as compared to those engaging in either self-poisoning or hanging/suffocation at the index episode of self-harm (Miranda et al., 2014) whilst in one further study there was no clear association between the likelihood of method switching between successive episodes of self-harm for those engaging in self-cutting at the index episode as compared to other methods (Miller et al., 2013).

Method switching between non-fatal self-harm and suicide

Nine studies reported information on method switching between the index non-fatal self-harm episode and subsequent suicide (Bergen et al., 2012; Brådvik, 2007; Hawton et al., 2012; Mallon et al., 2015; Miller et al., 2013; Nishimura et al., 1999b; Olfson et al., 2017; Paraschakis and Koutsaftis, 2014; Wang et al., 2015). Overall, almost one-half ($n=525$; 42.1%) used a different method for their suicide as was used at the index episode of non-fatal self-harm across these nine studies over an average follow-up period of 11.2 years (range: 1 to 42 years).

Where studies investigated risks of method switching for all forms of self-injury together as compared with self-poisoning alone, a greater proportion of those engaging in self-poisoning at the index episode switched to self-injury for their suicide as compared to the other way around (Hawton et al., 2012; Miller et al., 2013). However, recognising that self-cutting may confer a greater risk of suicide as compared with some other forms of self-injury, a number of studies disaggregated those engaging in self-cutting alone from those engaging in other forms of self-injury at the index self-harm episode. In those studies where

disaggregation was undertaken, those engaging in self-cutting at the index episode were found to be a greater risk of switching to a different method for their suicide as compared to those engaging in self-poisoning alone and those engaging in other forms of self-injury (Nishimura et al., 1999b; Olfson et al., 2017; Paraschakis and Koutsaftis, 2014).

One small retrospective study investigated associations for method switching between those methods characterised by the study authors as indicative of lesser violence (i.e., drowning, gassing, and self-poisoning) as compared to more violent methods (i.e., all other forms of self-injury), finding that a greater proportion of those using lesser violent methods at the index episode switching to more violent methods for their suicide (Brådvik, 2007).

One further study investigated method switching for those engaging in charcoal burning alone, as compared with methods associated with higher potential lethality (e.g., drowning, hanging, and jumping), and those associated with lower potential lethality (e.g., IDO and self-cutting) at the index episode, finding that those engaging in lower lethality methods at the index self-harm episode were more likely to switch methods for their suicide whilst those engaging in highly lethal methods at the index episode as well as those engaging in charcoal burning alone were less likely to switch methods for their suicide (Wang et al., 2015).

One study investigated associations between method switching and risk of suicide by self-injury alone or self-poisoning alone (Bergen et al., 2012). This study found that for suicide by self-injury, a greater proportion of decedents switched from self-poisoning at their index episode of self-harm to self-injury for their suicide. However, for suicide by self-poisoning, a greater proportion of decedents had used the same method at their index self-harm episode. Interestingly this study also found that, amongst those dying from IDO, a greater proportion of decedents consumed the same general class of medication as they had

consumed at the index self-harm episode. Specifically, one quarter (25.9%) of those dying from analgesic-attributable IDO also used analgesics at the index episode, 41.7% of those dying from antidepressant and/or tranquilliser-attributable IDO used the same substances at the index episode, and three-quarters (75.6%) of those dying from IDO by other medications classes and/or substances used the same substances at their index episode. However, it was unclear from the study report to what extent this result was explained by the consumption of a greater number of tablets at the fatal episode of IDO as compared to the index episode.

Factors associated with method switching

Few studies reported information on the factors associated with self-harm method switching between the index self-harm episode and either subsequent episodes of non-fatal self-harm and/or suicide. The likelihood of method switching between subsequent episodes of non-fatal self-harm appeared to be greater for males as compared to females (Huang et al., 2014; Owens et al., 2015), in those with greater suicidal intent (as determined by a score of 16 or greater on the Suicide Intent Scale) at the index episode (Deisenhammer et al., 2016), in those currently receiving in- or out-patient psychiatric treatment for any mental health problem (Owens et al., 2015), and those with a history of multiple episodes of self-harm predating the index episode (Owens et al., 2015). Factors such as alcohol intoxication at the index self-harm episode (Cugino et al., 1992; Owens et al., 2015), did not appear to be significantly associated with the likelihood of method switching in the studies identified by this review. For suicide, method switching was found to be more common amongst males, and particularly where the index episode involved the use of IDO and/or self-cutting (Brådvik, 2007).

The effect of age on self-harm method switching, however, was less clear. In one study, younger age (i.e., less than 40 years) was associated with an increased likelihood of switching from more violent methods (i.e., defined as all forms of non-drowning self-injury in the original study report), to drowning and IDO (Deisenhammer et al., 2016), whilst in a second, older age (i.e., over 50 years) was associated with switching from methods associated with greater potential lethality (e.g., charcoal burning, drowning, gassing, hanging, and jumping) towards those associated with lower potential lethality (e.g., IDO and self-cutting).

The length of time elapsed between the index episode of self-harm and subsequent self-harm and/or suicide also appeared to be related to the likelihood of method switching. A longer duration of time between the index and repeat episode of self-harm or suicide was associated with an increased risk of method switching in two studies (Bergen et al., 2012; Deisenhammer et al., 2016).

However, none of the included studies investigated the impact of substance use disorders or mental illness on the likelihood of switching self-harm methods between successive episodes.

DISCUSSION

We systematically reviewed the international literature on the association between self-harm method choice and subsequent risk of both non-fatal self-harm repetition and suicide. A total of 35 studies were identified and included in this review. One (2.8%) reported information on method switching within a single episode of self-harm (Deisenhammer et al., 2016), eight reported information on method switching between the index episode of self-harm episode and the repeat episode of self-harm (Cugino et al., 1992; Deisenhammer et al., 2016; Hjelmeland, 1996; Huang et al., 2014; Miller et al., 2013; Miranda et al., 2014; Owens

et al., 2015; Wang et al., 2015), and nine reported information on method switching between the index non-fatal self-harm episode and subsequent suicide (Bergen et al., 2012; Brådvik, 2007; Hawton et al., 2012; Mallon et al., 2015; Miller et al., 2013; Nishimura et al., 1999b; Olfson et al., 2017; Paraschakis and Koutsaftis, 2014; Wang et al., 2015). Overall, the quality of the studies included in this review was moderate with the majority of studies ($k=10$; 66.7%) receiving between five and six stars on the NOS.

Over an average follow-up period of 2.8 years, one-third ($n=2,056$; weighted average: 33.3%) of those included in these studies switched self-harm methods at least once between the index and repeat episode. Across a number of studies, we found that a greater proportion of those engaging in self-injury, particularly using methods associated with greater potential lethality (e.g., drowning, gassing, hanging, and jumping), at the index episode switched to self-poisoning at the repeat episode. However, over an average follow-up period of 11.2 years, we also found that almost one-half ($n=525$; weighted average: 42.1%) of patients used a different method for their suicide as was used at the index episode of non-fatal self-harm.

Limitations of the included studies

A number of limitations were common to the included studies, however. Firstly, most studies only included episodes of self-harm leading to hospital presentation. Relatedly, repetition of self-harm was also generally identified in these studies only if the individual re-presented to hospital and, in many cases, only if the individual re-presented to the same study hospital. However, only around 28.4% of those engaging in suicidal behaviour in the community present to hospital following an episode (De Leo et al., 2005). For adolescents, moreover, rates of presentation to hospital-based services may be even lower,

particularly among young females (Geulayov et al., 2018; McMahon et al., 2014). Instead, many more episodes of self-harm occur in the community and therefore do not come to the attention of hospital-based services.

The prevalence of self-harming behaviours in the community may also vary by method, with the lifetime prevalence of self-injurious behaviours almost five times that of IDO in both males and females in one recent German study (Müller et al., 2016); similar to patterns observed in other European community-based surveys of self-harm and suicidal behaviour in adolescents (Brunner et al., 2014; Madge et al., 2008). This stands in contrast to what is observed in hospital-treated populations where a number of studies have reliably found that the prevalence of self-poisoning, and particularly IDO, is higher in females as compared to males. Studies that rely exclusively on hospital-based data may therefore underestimate the true extent of self-harm repetition and, additionally, may confound associations between method switching given that those engaging in self-injurious methods, and particularly self-cutting, have been found to be less likely to present to hospital following an episode of self-harm (De Leo et al., 2005).

Studies also tended to focus either on the first recorded (i.e., “index”) episode of self-harm or the episode immediately preceding either a repeat episode of self-harm or suicide death. Given that much self-harm activity occurs in the community, for many of the participants included in these studies, the index presentation may not constitute their first-ever episode of non-fatal self-harm. Although the studies included in this review take the index episode as a starting point, and refer to any subsequent episode of self-harm as repeat episodes, the timing of the index episode is, in fact, arbitrary. Instead, it may be that this episode reflects the latest in a succession of episodes of self-harm beginning years earlier (Owens et al., 2015). Life course approaches may be preferable to track individuals over time to determine whether there are discernible patterns in changes in self-harm methods used

over time and whether it is the form of these patterns, and not just a change in self-harm method per se, that increases an individual's risk of future self-harm repetition and/or suicide.

Additionally, most studies included in this review categorised methods into self-injury and self-poisoning with little recognition of the diverse range of behaviours included within these broad categories and the likely differences in potential lethality. Examining case fatality ratios associated with self-harm method switching could help to assist with efforts to identify whether there is evidence of any escalation in self-harm method lethality over time, even within those continuing to use broadly self-injurious or self-poisoning methods. Even within categories of self-harm methods characterised by similar potential lethality, there may still be differences over successive episodes in terms of medical seriousness. Therefore, as well as taking into consideration likely differences in potential lethality for different methods of self-harm studies should also account for the role of medical seriousness when investigating whether there are discernible patterns in self-harm method choice within individuals over time.

Finally, to assist with providing clinically meaningful information on the factors associated with a greater likelihood of transitioning towards more potentially lethal methods of self-harm over time, we need to know more information on the demographic and clinical characteristics of those who switch towards methods typically associated with higher potential lethality. Few of the included studies provided this kind of information, however. Only one study investigated the degree to which method switching was associated with suicidal intent (Deisenhammer et al., 2016). Additionally, no studies investigated the role of alcohol and/or drug dependence in these presentations and the relationship between these disorders and self-harm method choice despite recent calls for work to unpick these associations to better understand the role of alcohol in self-harm and suicidal behaviour (Witt and Lubman, 2018). An underassessment of the role of mental illness, and particularly

depression, psychosis, and personality disorder, on self-harm method choice was also apparent in these studies.

Strengths and limitations of the review

Given the substantial differences between included studies in terms of case ascertainment, ascertainment of repetition of self-harm and/or suicide, and differences between studies in the categorisation of methods as constituting self-injury, self-poisoning, and potential lethality we were not able to undertake meta-analysis in this review. Despite this, a key strength of this review is that it is the first to synthesise the current knowledge base regarding method switching between successive episodes of self-harm and/or suicide, and the first to synthesise data on the factors that may increase an individual's likelihood of switching self-harm methods over time.

Implications for clinical practice

Taken together our findings suggest that all patients should be routinely assessed for risk and needs irrespective of the method used at the index episode of non-fatal self-harm (Bergen et al., 2012; Owens et al., 2015), consistent with recommendations from both the National Institutes for Clinical Excellence (NICE) in the UK (National Institute for Health and Clinical Excellence 2004), and the Royal Australian and New Zealand College of Psychiatrists' clinical practice guidelines for the management of self-harm (Carter et al., 2016). Regardless of the self-harm method used, everyone presenting to clinical services following an episode of self-harm should be provided with a comprehensive psychosocial needs-based assessment and should be provided with the support they require to develop

alternative methods to regulate their emotions and to cope with distress in order to reduce the risk of self-harm repetition and/or suicide.

Conclusion

Treatment and support offered by clinical services cannot be determined, in any part, solely by the self-harm method used, or the potential lethality of that method, at one point in time. Instead, our results suggest that switching between methods of self-harm is common. One-third (33.3%) switched methods at least once between successive episodes of self-harm over a 2.8 year follow-up period, whilst almost half (42.1%) switched methods between an episode of self-harm and suicide over an 11.2 year follow-up period.

FIGURE LEGENDS

Figure 1. PRISMA flow diagram depicting reasons for the exclusion of studies identified by the electronic search and ancestry searching.

TABLES

Table 1. Electronic search strategy and number of hits per electronic database.

Keywords	Number of Hits					
	CINAHL (EBSCO / OVID)	EMBASE (OVID)	Medline (EBSCO / OVID)	PsycINFO (OVID)	PubMed	Total
(chang* OR continu* OR remain* OR stay* OR switch* OR stable OR stabil* OR escalat* OR de\$escalat* OR choice OR choos* OR pattern OR trajet* OR maintain* OR mainten* OR repeat OR repetit*).ab,ti	816,772	1,239,385	816,183	178,879	542	3,051,761
exp Suicide/.ab,ti	56,906	54,045	56,867	25,846	-	193,664
exp Suicide, Attempted/.ab,ti	18,113	28,555	18,103	9,365	-	74,136
exp Self-Injurious Behavior/.ab,ti	63,974	15,369	63,931	4,964	-	148,238
exp Self Mutilation/.ab,ti	3,153	15,369	3,153	1,128	-	22,803
exp Drug Overdose/.ab,ti	9,682	22,370	9,671	1,427	-	43,150
exp Poisoning/.ab,ti	148,906	398,744	148,843	5,408	-	701,901
(suicid* OR auto\$mutil* OR self\$harm OR self\$injur* OR self\$destruct* OR self\$cut* OR self\$poison OR self\$inflict OR self\$wound OR self\$immolat*).ab,ti	60,110	88,050	60,062	56,766	17	265,005
2 OR 3 OR 4 OR 5 OR 6 OR 6 OR 8	234,487	505,072	234,360	66,769	-	1,040,688
1 AND 9	6,143	14,928	6,140	1,568	559	29,338
Limit 10 to humans	4,300	7,970	4,297	1,568	266	18,401
Limit 11 to English language	3,479	6,827	3,476	1,468	243	15,493

Table 2. Methodological details, main findings, and results of the risk of bias assessment for the studies included in this review.

Study	Country	N	Study Design	Recruitment Period	Follow-Up Period	Case Ascertainment	Effects on Repetition of Self-Harm	Effects on Suicide	Study Quality and Limitations
Bergen (2012)	United Kingdom	30,202	Prospective.	2000-2007. (8 years)	Up to 10 years. (Mean: 5.3 years; SD: not reported).	Patients admitted to one of six emergency departments following an episode of non-fatal self-harm.	<ul style="list-style-type: none"> • Not reported. 	<ul style="list-style-type: none"> • 378 (1.2%) died by suicide. • A significantly greater proportion of those using gassing at the index episode died by suicide ($n=8$; 6.8%), followed by traffic-related injury ($n=5$; 5.7%), hanging/asphyxia ($n=10$; 3.3%), all other self-injury (predominately drowning, jumping from a height, burning, and firearms) ($n=14$; 2.3%), self-cutting ($n=87$; 1.9%), and IDO ($n=254$; 1.0%). • For suicide by self-poisoning there was no significant difference in risk by method used at the index episode: self-poisoning alone ($n=104$; 0.4%), self-cutting ($n=20$; 0.4%), hanging/asphyxia ($n=9$; 0.0%), gassing ($n=1$; 0.8%), traffic-related injury ($n=1$; 1.1%), and all other self-injury ($n=2$; 0.3). • However, for suicide by self-injurious methods, a significantly greater proportion of those using traffic-related self-injury at the index episode died by suicide ($n=4$; 9.0%), followed by gassing ($n=7$; 5.9%), hanging/asphyxia ($n=10$; 3.3%), all other self-injury ($n=12$; 1.9%), self-cutting ($n=67$; 1.5%), and self-poisoning ($n=150$; 0.6%). • For suicide by IDO, a greater proportion of those who died stayed using self-poisoning than switched from self-injury at the index episode to self-poisoning at their suicide ($n=104$; 81.2% vs. $n=24$; 18.7%). • However, for suicide by self-injurious methods, a greater proportion switched from self- 	<p>7 stars</p> <p>Limitations: use of hospital presentation to ascertain cases.</p>

Brådvik (2007)	Sweden	98	Retrospective.	1956-1969.	Up to 42 years.	Patients admitted to the psychiatry department of one hospital following a suicide attempt.	<ul style="list-style-type: none"> • Not reported. 	<p>poisoning at the index episode to self-injury at their suicide than stayed using self-injurious methods on both occasions ($n=150$; 60.0% vs. $n=100$; 40.0%).</p> <ul style="list-style-type: none"> • Overall, 124 (32.8%) used different methods from their index self-harm episode to their suicide. • All (100.0%) died by suicide. • Of these, 28 (28.6%) had at least one prior episode of self-harm, and eight (8.2%) had two or more prior episodes. • 51 (52.0%) used non-violent (e.g., IDO, drowning, gassing), and 48 (49.0%) used violent methods (e.g., all others) for their suicide. • Overall, 36 (36.7%) switched methods from that used for their index episode as compared to that used for their suicide. • A greater proportion of those using non-violent methods at the index episode switched to a violent method for their suicide as compared to those switching from violent methods at the index episode to non-violent methods for their suicide ($n=29$; 29.6% vs. $n=7$; 7.1%). 	5 stars	Limitations: use of hospital presentation to ascertain cases. Additionally, only those admitted to inpatient facilities were included. Also, only those with a confirmed diagnosis of depression were included. Finally, data were captured retrospectively.
Cugino (1992)	USA.	21	Retrospective.	1983-1988.	Not reported.	Patients admitted to one teaching hospital following a suicide attempt.	<ul style="list-style-type: none"> • All patients (100.0%) engaged in at least one further episode of self-harm. • Overall, three (14.3%) switched methods. • A greater proportion of those engaging in self-injurious methods (including gassing) at the index episode switched to self-poisoning (i.e., IDO and/or poisoning with other substances) at the repeat episode than switched from self-poisoning to self-injury ($n=1$; 16.7% vs. $n=2$; 13.3%). • However, a greater proportion of patients engaged in the same method of self-harm than switched methods (Self-Injury: 	<ul style="list-style-type: none"> • Not reported. 	6 stars	Limitations: use of hospital presentation to ascertain cases and to determine self-harm repetition. Additionally, data were captured retrospectively.

							n=5; 83.3% vs. n=1; 16.7%; Self-Poisoning: n=13; 86.7% vs. n=2; 13.3%).		
Deisenhammer (2016)	Austria	130	Retrospective.	2004 to 2008.	Not reported.	Patients admitted to a hospital-based inpatient psychiatric unit following a suicide attempt.	<ul style="list-style-type: none"> 86 (66.2%) had at least one prior episode of self-harm. A greater proportion of these cases switched methods from their index episode to their repeat self-harm episode as used the same method ($n=46$; 53.5% vs. 40; 46.5%). Where different methods were recorded, methods changed from violent (i.e., all other methods) to non-violent (e.g., drowning, IDO) twice as often as from non-violent to violent ($n=11$; 23.3% vs. $n=5$; 11.6%). 	<ul style="list-style-type: none"> Not reported. 	5 stars Limitations: use of hospital presentation to ascertain cases and to determine self-harm repetition. Additionally, only those admitted to inpatient psychiatric facilities were included. Finally, data were captured retrospectively.
Hawton (2012)	UK	5,205	Prospective	2000-2007. (8 years)	Two years.	Patients admitted to one of six emergency departments following an episode of non-fatal self-harm.	<ul style="list-style-type: none"> 2,920 (27.3%) had a further episode of self-harm, 208 (28.6%) males and 793 (26.9%) females. Compared to those using self-poisoning at the index episode, those using self-cutting ($HR=1.5$), other forms of self-injury ($HR=1.5$), and combined self-poisoning and self-injury ($HR=1.4$) were at increased risk of self-harm repetition. 	<ul style="list-style-type: none"> 25 (0.5%) died by suicide. A greater proportion of these cases switched methods from their index episode to their suicide as used the same method ($n=17$; 68.0% vs. $n=8$; 32.0%). This varied by method used at the index self-harm episode. Specifically, a greater proportion of these using self-poisoning at the index episode switched to self-injury for their suicide ($n=13$; 92.8%) than switched from self-injury at the index episode to self-poisoning for their suicide ($n=3$; 30.0%). 	7 stars Limitations: use of hospital presentation to ascertain cases and to determine self-harm repetition
Hjelmeland (1996)	Norway	509	Prospective.	1988- (not reported)	One year.	Patients admitted to any general hospital, psychiatric hospital, and/or primary care clinic in one county following an episode of self-harm.	<ul style="list-style-type: none"> 85 (17.0) engaged in a repeat episode of self-harm. Those engaging in self-poisoning the index episode were more likely to engage in a further episode ($n=75$; 88.2% vs. $n=10$; 11.8%). A greater proportion of those with a repeat self-harm episode used the same method at both the index and subsequent episode of self-harm ($n=78$; 91.8% vs. $n=7$; 8.2%). Of those who switched methods ($n=7$), a greater proportion switched from self-injury at the index episode to self-poisoning at the repeat 	<ul style="list-style-type: none"> Not reported. 	6 stars Limitations: use of hospital presentation to ascertain cases and to determine self-harm repetition

Huang (2014)	Taiwan	2,070	Prospective.	2006 to 2010. (5 years).	1 year.	Consecutive registrations for non-fatal self-harm on a health surveillance system.	<p>episode than switched from self-poisoning to self-injury ($n=6$; 85.7% vs. $n=1$; 14.3%).</p> <ul style="list-style-type: none"> • 374 (18.1%) engaged in a further episode of self-harm. • Those using a highly lethal method (e.g., gassing, hanging, firearms, jumping, and other methods) at the index episode were less likely to engage in a further episode of self-harm ($HR=0.6$). • Of these, 71 (19.0%) switched methods between the index and repeat self-harm episode. • A greater proportion of those using highly lethal methods at the index episode switched to a less lethal method as compared to those using less lethal methods (e.g., self-poisoning and self-cutting) at the index episode ($n=15$; 36.6% vs. $n=56$; 16.8%). 	<ul style="list-style-type: none"> • Not reported. 	8 stars
Mallon (2015)	UK	403	Retrospective	2007 to 2009 (3 years)	Not reported	Suicide deaths as identified from Coroner's records.	<ul style="list-style-type: none"> • 159 (39.4%) had a history of at least one prior suicide attempt. 	<ul style="list-style-type: none"> • 93 (58.5%) switched from less lethal (undefined) methods for their suicide attempt to more lethal (undefined) methods for their suicide. • A slightly greater proportion of males as compared with females switched from less lethal to more lethal methods (Males: $n=72$; 61.5% vs. Females: $n=21$; 50.0%). 	<p>5 stars</p> <p>Limitations: only cases registered with a GP were included (this led to the exclusion of one in 10 (10.4%) otherwise eligible cases. Additionally, data were captured retrospectively.</p>
Miller (2013)	USA	3,600	Prospective	2003 (1 year).	Not reported.	Patients admitted to a general hospital following an episode of self-harm.	<ul style="list-style-type: none"> • 486 (13.5%) engaged in a further episode of self-harm. • Compared to those who engaged in IDO at the index episode, those who engaged in self-cutting/piercing were significantly more likely to repeat self-harm ($HR=1.3$). • Those who engaged in all other methods at the index episode were not significantly more likely to engage in a further episode of self-harm ($HR=1.1$). • Overall, a greater proportion used the same method at their repeat episode of self-harm as at the index episode ($n=360$; 10.0% vs. $n=163$; 4.5%). 	<ul style="list-style-type: none"> • 48 (1.3%) died by suicide. • Compared to those who engaged in IDO at the index episode, those who engaged in all other methods were significantly more likely to die by suicide ($HR=2.0$). • Those who engaged in self-cutting/piercing, however, were not at increased risk of suicide ($HR=1.7$). • Overall, a greater proportion used different methods at their suicide as compared to their index self-harm episode ($n=26$; 54.2% vs. $n=12$; 25.0%). • Switching was particularly 	<p>6 stars</p> <p>Limitations: use of hospital presentation to ascertain cases and to determine self-harm repetition. Additionally, those with a history of multiple episodes of self-harm in the three years preceding study recruitment were excluded.</p>

						<ul style="list-style-type: none"> This varied by method, however. Of those using IDO at the index episode, a greater proportion again used IDO at the repeat episode ($n=295$; 10.7% v. $n=81$; 2.9%). A slightly greater proportion of those using other methods at the index episode switched to other methods at the repeat episode (Switch: $n=31$; 8.3% v. Stay: 25; 6.7%). However, a similar proportion using self-cutting at the index episode stayed using self-cutting at the repeat episode as switched methods (Switch: $n=41$; 8.6% v. Stay: $n=40$; 8.4%). 	<ul style="list-style-type: none"> common for those using IDO at the index episode ($n=19$; 39.6% v. $n=5$; 10.4%), followed by cutting ($n=5$; 10.4% v. 1; 2.1%). Of those engaging in other methods at the index episode, however, use of the same method for suicide was more common than switching ($n=6$; 12.5% v. 1; 2.1%). Across multiple successive episodes, suicide was more common after a method switch ($n=32$; 66.7% v. $n=15$; 31.2%). 	
Miranda (2013)	USA	54	Prospective.	1991 to 1994 (4 years).	Up to six years.	<p>Adolescents who screened positive for lifetime suicide attempts as determined by either the Columbia Suicide Screen and/or to self-report.</p> <ul style="list-style-type: none"> 18 (33.3%) reported a further suicide attempt, 2 (18.2%) males and 16 (37.2%) females. Overall, a greater proportion used the same method as their index episode for their repeat episode as used the same method on both occasions than switched methods ($n=15$; 83.3% v. $n=3$; 16.7%). However, this varied by the method used at the index episode. All ($n=2$; 100.0%) using other methods (e.g., hanging, suffocation) at the index episode also used the same methods at the repeat episode, compared with ($n=11$; 92.0%) of those using self-poisoning at the index episode, and only half ($n=2$; 50.0%) using self-cutting at the index episode. 	<ul style="list-style-type: none"> Not reported. 	<p>5 stars</p> <p>Limitations: use of self-report information to ascertain cases and to determine self-harm repetition.</p>
Nishimura (1999)	Japan	416	Retrospective	1981 to 1997. (17 years).	Not reported.	<p>Suicide deaths as determined from autopsy records and inquest records, and where information on suicide method was clearly recorded.</p> <ul style="list-style-type: none"> Not reported. 	<ul style="list-style-type: none"> All (100.0%) died by suicide. Overall, a greater proportion used different methods for their suicide as used at the index episode ($n=135$; 68.4% v. $n=281$; 31.6%). However, this varied by method. 55 (78.6%) of those using hanging/strangulation at the index episode used the same method for their suicide, 	<p>6 stars</p> <p>Limitations: Only cases where the method of suicide was known were included. Additionally, data were captured retrospectively.</p>

							<p>compared with 13 (61.9%) of those using drowning, 19 (46.3%) using falling from a height, 9 (36.0%) using other methods, 15 (34.9%) of those using carbon monoxide poisoning, 12 (14.1%) using self-poisoning, and 12 (8.4%) using self-cutting.</p> <ul style="list-style-type: none"> The proportion changing method for suicide also differed according to the method used at the index episode with 130 (91.6%) using self-cutting at the index episode changing methods for their suicide, compared to 73 (85.9%) using self-poisoning, 28 (65.1%) using carbon monoxide poisoning, 16 (64.0%) using other methods, 22 (53.6%) using falling from a height, 8 (38.1%) using drowning, and 15 (21.4%) who used hanging/strangulation at the index episode.
Olfson (2017)	USA	61,297	Prospective	2001 to 2007 (7 years)	1 year.	<p>Presentations to any hospital services in any one of 45 states following an episode of self-harm as determined by the ICD-9 (codes E950-958).</p> <ul style="list-style-type: none"> 12,012 (19.7%) engaged in a further episode of self-harm, 8,094 (19.8%) of females and 3,917 (19.4%) of males. There was no significant difference in the risk of self-harm repetition between those using more violent methods (predominately firearms) and those using non-violent methods (predominately IDO and self-cutting) at the index episode. 457 (21.3%) of those using violent methods engaging in a further episode of self-harm compared with 10,544 (20.6%) of those using non-violent methods. A slightly greater proportion of those using firearms at the index episode were at risk of repeating self-harm. 150 (24.9%) of those using firearms repeated self-harm over the one year follow-up period, as compared with 9,093 (21.5%) using IDO, 307 	<ul style="list-style-type: none"> 243 (0.4%) died by suicide. 115 (0.3%) females and 127 (0.6%) males died by suicide. A greater proportion of those using violent methods at the index episode died by suicide as compared to those using non-violent methods or other methods ($n=54$; 2.4% vs. $n=173$; 0.3% vs. $n=9$; 0.1%). 139 (57.2%) used the same method for their suicide as at their index episode. However, this varied by method. A greater proportion of those using firearms at the index episode used the same method at their suicide ($n=29$; 93.6%), as compared with 20 (87.0%) using other violent methods, 87 (63.0%) using IDO, and 3 (8.6%) using self-cutting. 97 (39.8%) used a different method for their suicide as at their index episode, particularly those using other methods at the index episode <p>5 stars</p> <p>Limitations: use of hospital presentation to ascertain cases and to determine self-harm repetition. Additionally, only cases eligible for treatment under the Medicaid scheme for at least 180 days prior to the index episode of self-harm were eligible for inclusion.</p>

Owens (2015)	United Kingdom	21,255	Prospective.	2003 to 2007 (5 years)	Up to five years.	Patients admitted to one of six emergency departments following an episode of self-harm.	<p>(19.9%) using other violent methods (e.g., drowning, hanging, burning, and jumping or lying in front of vehicles), 1,451 (16.1%) using self-cutting, and 779 (13.5%) using other methods (predominately jumping or lying in front of a moving object, electrocution, and other unspecified methods).</p> <ul style="list-style-type: none"> 4,721 (22.5%) had a further episode of self-harm, 1,888 (21.6%) males and 2,820 (22.6%) females. Overall, 1,620 (34.3%) switched self-harm methods at least once; of these, 954 (58.9%) switched methods once, 399 (24.6%) twice, 108 (6.7%) thrice, and 159 (9.8%) four or more times. A greater proportion of those using combined self-poisoning and self-injury at the index episode switched methods ($n=201$; 93.0%), followed by less severe self-injury ($n=40$; 93.0%), severe self-injury ($n=51$; 77.0%), self-cutting ($n=441$; 64.0%), and self-poisoning ($n=881$; 24.0%). 	<p>($n=9$; 100.0%), followed by self-cutting ($n=32$; 91.4%), IDO ($n=51$; 37.0%), other violent methods ($n=3$; 13.0%), and firearms ($n=2$; 6.4%).</p> <ul style="list-style-type: none"> Not assessed. 	<p>7 stars</p> <p>Limitations: use of hospital presentation to ascertain cases and to determine self-harm repetition.</p>
Paraschakis (2014)	Greece	59	Retrospective.	2007 to 2008 (2 years).	Not reported.	Suicide decedents identified from Coroner's records with a recorded lifetime history of at least one prior suicide attempt.	<ul style="list-style-type: none"> All (100.0%) had at least one prior episode of self-harm. 	<ul style="list-style-type: none"> All (100.0%) died by suicide. Almost three-quarters ($n=44$; 74.6%) of suicide decedents switched methods between their last recorded suicide attempt and their suicide. A greater proportion of those using self-cutting at the index episode switched methods for their suicide ($n=9$; 100.0%), followed by self-poisoning ($n=32$; 94.1%), hanging ($n=1$; 25.0%), and jumping from a height ($n=2$; 16.7%). 	<p>6 stars</p> <p>Limitations: Psychological autopsy method used to determine method(s) used in previous episodes of non-fatal self-harm. Additionally, data were captured retrospectively.</p>
Wang (2015)	Taiwan	2,052	Prospective.	2006 to 2010 (5 years).	One year.	Consecutive registrations for self-harm as determined by a public health surveillance system.	<ul style="list-style-type: none"> 378 (18.2%) had a further episode of self-harm. Overall, a greater proportion used the same method as at their index episode than switched methods ($n=231$; 61.8% vs. $n=143$; 38.2%). This 	<ul style="list-style-type: none"> 50 (2.4%) died by suicide. Overall, a greater proportion switched to a different method for their suicide as compared with their index self-harm episode ($n=39$; 78.0% vs. $n=11$; 22.0%). However, this 	<p>8 stars</p>

varied by method, however,

- Specifically, a greater proportion of those using highly lethal methods (e.g., gassing, hanging, drowning, firearms, and jumping) at the index episode switched methods ($n=12$; 57.1%), as compared with charcoal burning ($n=10$; 50.0%), and methods characterised by lower lethality (e.g., self-poisoning and self-cutting) ($n=56$; 16.8%).
- Conversely, a greater proportion of those using lower lethality methods at the index episode used the same methods at the repeat episode ($n=277$; 83.2%), as compared with charcoal burning ($n=10$; 50.0%), and other high lethality methods ($n=9$; 42.9%).

varied by method.

- A greater proportion of those using other low lethality methods at the index episode used a different method for their suicide ($n=36$; 94.7%), compared with those using charcoal burning ($n=2$; 28.6%), and other highly lethal methods ($n=1$; 20.0%).
- Conversely, those using other highly lethal methods ($n=4$; 80.0%) and charcoal burning ($n=5$; 71.4%) were more likely to persist with these methods for their suicide as compared to those using lower lethality methods ($n=2$; 5.3%).

Table Notes: Study quality refers to the number of stars (out of a maximum of nine) the study received on the Newcastle-Ottawa Scale (NOS) whilst the limitations comment refers to the reason(s) study quality was downgraded.
HR: hazard ratio; ICD-9: International Classification of Disease, ninth edition; IDO: intentional drug overdose; SD: standard deviation.

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Contributions

KW had the idea for this review. All authors extracted information and assessed risk of bias for the included studies. KW and DL wrote the initial version of the review. All authors contributed to the interpretation of the results and revisions of the review and also approved the final version of the review for publication.

Conflict of Interests

We declare no competing interests.

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