Repetition of deliberate self-harm and subsequent suicide risk: long-term follow-up study of 11,583 patients

DANIEL LOUIS ZAHL and KEITH HAWTON

Background Repetition of deliberate self-harm (DSH) is a risk factor for suicide. Little information is available on the risk for specific groups of people who deliberately harm themselves repeatedly.

Aims To investigate the long-term risk of suicide associated with repetition of DSH by gender, age and frequency of repetition.

Method A mortality follow-up study to the year 2000 was conducted on 11,583 people who presented to the general hospital in Oxford between 1978 and 1997. Repetition of DSH was determined from reported episodes prior to the index episode and episodes presenting to the same hospital during the follow-up period. Deaths were identified through national registers.

Results Thirty-nine per cent of patients repeated the DSH. They were at greater relative risk of suicide than the single-episode DSH group (2.24; 95% CI 1.77–2.84). The relative risk of suicide in the repeated DSH group compared with the single-episode DSH group was greater in females (3.5; 95% CI 1.3–2.4) than males (1.8; 95% CI 2.3–5.3) and was inversely related to age (up to 54 years). Suicide risk increased further with multiple repeat episodes of DSH in females.

Conclusions Repetition of DSH is associated with an increased risk of suicide in males and females. Repetition may be a better indicator of risk in females, especially young females.

Declaration of interest None. Funding detailed in Acknowledgements.

Deliberate self-harm (DSH) is often repeated (Sakinofsky, 2000). Repetition increases the risk of further DSH (Wilkinson & Smeeton, 1987; Owens et al, 1994) and eventual suicide (Hawton & Fagg, 1988; Tejedor et al, 1999). A less-studied aspect is the pattern of repetition over time and how this relates to suicide risk. Between 15 and 25% of people who deliberately harm themselves repeat the self-harm within 1 year of an index episode and present to the same hospital (Bancroft & Marsack, 1977; Hawton et al, 1997; Owens et al, 2002). Few studies have examined repetition beyond 2 years of follow-up (Owens et al, 2002) and none has examined repetition over the long term. Little attention has been paid to how repetition influences risk in different age and gender subgroups. We have examined the short- and long-term risk of suicide in relation to repetition of DSH, including by gender, in a large sample of DSH patients, and also addressed the question of whether multiple repetition further increases the risk.

METHOD

Study sample The sample was identified from the Oxford Monitoring System for Attempted Suicide. Through this system information is collected about each individual who presents to the general hospital in Oxford with an episode of DSH (Hawton et al, 1997; Hawton et al, 2003). The study cohort consisted of those patients who had presented with an episode of DSH between January 1978 and December 1997. Patients were grouped by age and gender at index episode (first recorded episode presenting to the general hospital in the study period). The age groups used were: 10–24, 25–34, 35–54 and >55 years. Deliberate self-harm includes non-fatal self-poisoning and self-injury. The former is defined as the intentional self-administration of more than the prescribed dose of any drug, whether or not there is evidence that the act was intended to cause self-harm. It also includes poisoning by non-ingestible substances and gas, provided that the hospital staff consider that these are cases of DSH. Alcohol intoxication is not included unless accompanied by other types of self-poisoning or self-injury. Self-injury is defined as any injury recognised by hospital staff as having been deliberately self-inflicted (Hawton et al, 1997).

Repetition and mortality Patients were followed up until the end of December 2000; information regarding repetition and mortality was available for a potential maximum of 23 years.

Information on whether a patient had had an episode of DSH prior to the index episode was obtained through clinical interview. This was combined with data on episodes leading to referral to the same hospital during the follow-up period to allow all available data on repetition for each patient to be used, including the number of episodes and the distribution of episodes over time. For the purposes of this study, the repeated DSH group comprised patients who reported an episode of DSH prior to their index episode or who had a repeat episode of DSH during the follow-up period (or both). The single-episode DSH group comprised those with only an index episode of DSH. Those patients for whom there was no information on DSH history prior to the index episode were assumed to have no previous episodes.

Mortality status was determined by tracing the individual names and dates of birth against a national registry held by the Office for National Statistics (ONS) for England and Wales. The equivalent registries in Scotland and Northern Ireland were consulted for those found to have left the ONS register. Causes of death were obtained from death certificates supplied by the ONS.

Suicide was defined in line with current research practice (Adelstein & Mardon, 1975; Charlton et al, 1992) based on coroners’ verdicts of suicide (ICD code E950–E959), undetermined cause (E980–E989) or accidental poisoning (E850–E869). Patients who died from causes other than suicide, or who were alive at the end of the follow-up period, were included in a non-suicide group.
Statistical analyses
All patients traced by the ONS for any length of time from their first presentation were entered into survival analyses. Kaplan–Meier curves were plotted and log-rank tests were used to test for differences in suicide risk between genders and age groups by DSH repetition status. Cox’s regression models were fitted, testing for proportional hazards to estimate risk over time and according to gender and age at index episode.

The Kaplan–Meier curves shown in this paper are truncated at 15 years of follow-up time because numbers in some subgroups had fallen by then to <20% of the original sample (Pocock et al, 2002). Analyses were carried out using SPSS version 10.0 for Windows.

RESULTS

Patients and outcome
A potential total of 12,949 DSH patients was included in the investigation. Survival information was available on 11,583 patients and these were included in the analysis. Analyses reported elsewhere showed no difference between the untraced and traced in terms of age, gender or method of DSH (Hawton et al, 2003). Patients were followed up for an average of 11.4 years (range 1 day to 23 years). Three hundred (2.6%) had died by suicide and the remainder were either still alive at the end of the follow-up period (10,394, 89.7%) or had died from causes other than suicide (889, 7.7%).

At the time of the index episode, 2704 (23.3%) patients reported at least one previous episode (1043, 22.6% males; 1661, 23.9% females). During the follow-up period, 2666 patients (23.0%) repeated the DSH (1073, 23.2% males; 1593, 22.9% females). By combining information from episodes prior to the index episode was their first (log rank test: $\chi^2 = 27.06, P < 0.001$). Using our definition of repeated DSH (i.e. combining information on DSH repetition status at index episode with information about episodes during the follow-up period) showed a greater difference in risk between the repeated DSH group and the single-episode DSH group (log rank test: $\chi^2 = 54.54, P < 0.001$) (Fig. 1).

Survival analyses, using all data on repetition for the two genders separately, confirmed that those in the repeated DSH group were at significantly greater risk than those in the single-episode DSH group for

Repetition and suicide risk
Survival analysis showed that those who reported an episode of DSH prior to their index episode were at significantly greater risk of dying by suicide than those whose index episode was their first (log rank test: $\chi^2 = 27.06, P < 0.001$). Using our definition of repeated DSH (i.e. combining information on DSH repetition status at index episode with information about episodes during the follow-up period) showed a greater difference in risk between the repeated DSH group and the single-episode DSH group (log rank test: $\chi^2 = 54.54, P < 0.001$) (Fig. 1).

Survival analyses, using all data on repetition for the two genders separately, confirmed that those in the repeated DSH group were at significantly greater risk than those in the single-episode DSH group for
both males (hazard ratio 1.88, $P<0.001$, 95% CI 1.42–2.50) and females (hazard ratio 3.58, $P<0.001$, 95% CI 2.38–5.40) (Figs 2 and 3).

The risk of suicide within 1 year of the index episode of DSH (Table 1) was 0.6% (95% CI 0.5–0.8) for the single-episode DSH group and 0.9% (95% CI interval 0.6–1.2) for the repeated DSH group. The difference in risk between the two groups increased with time: after 15 years 1.9% (95% CI 1.5–2.3) of the single-episode DSH group and 4.7% (95% CI 3.9–5.4) of the repeated DSH group had died by suicide (relative risk=2.24; 95% CI 1.77–2.84).

Males in the repeated DSH group were at the greatest risk of suicide and females in the repeated DSH group had died by suicide compared with those in the single-episode DSH group. In fact, 25 (81%) out of 31 young females who died by suicide episode DSH group. In fact, 25 (81%) out of 31 young females who died by suicide at particularly increased risk of dying by suicide compared with those in the single-episode DSH group. In fact, 25 (81%) out of 31 young females who died by suicide were in the repeated DSH group.

### Table I Risk of suicide (based on Kaplan–Meier estimates) after 1, 5, 10 and 15 years of follow-up from index episode of deliberate self-harm (DSH), by repetition status and gender

<table>
<thead>
<tr>
<th>Gender and repetition status</th>
<th>$n^1$</th>
<th>1 year</th>
<th>Time since first presentation for deliberate self-harm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Suicides</td>
<td>Risk</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-episode DSH</td>
<td>2811</td>
<td>22</td>
<td>1.0</td>
</tr>
<tr>
<td>Repeated DSH</td>
<td>1811</td>
<td>27</td>
<td>1.2</td>
</tr>
<tr>
<td>Total</td>
<td>4622</td>
<td>49</td>
<td>1.1</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-episode DSH</td>
<td>4232</td>
<td>17</td>
<td>0.4</td>
</tr>
<tr>
<td>Repeated DSH</td>
<td>2729</td>
<td>18</td>
<td>0.7</td>
</tr>
<tr>
<td>Total</td>
<td>6961</td>
<td>35</td>
<td>0.5</td>
</tr>
<tr>
<td>Both</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-episode DSH</td>
<td>7043</td>
<td>44</td>
<td>0.6</td>
</tr>
<tr>
<td>Repeated DSH</td>
<td>4540</td>
<td>40</td>
<td>0.9</td>
</tr>
<tr>
<td>Total</td>
<td>11583</td>
<td>84</td>
<td>0.7</td>
</tr>
</tbody>
</table>

1. $n=$ number of patients for whom there was any period of follow-up.

### Multiple repetition

All data on repetition were used to look at the comparative risk of suicide between those with more than two episodes including...
Gender and type of repetition

<table>
<thead>
<tr>
<th>Gender and type of repetition</th>
<th>n</th>
<th>Suicides</th>
<th>Risk (%) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-episode DSH</td>
<td>24</td>
<td>1.4 (0.9–2.2)</td>
<td></td>
</tr>
<tr>
<td>Repeated DSH</td>
<td>31</td>
<td>1.8 (1.1–2.9)</td>
<td></td>
</tr>
<tr>
<td>Relative risk (95% CI)</td>
<td>1.2 (0.33–3.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-episode DSH</td>
<td>6</td>
<td>1.8 (0.5–3.3)</td>
<td></td>
</tr>
<tr>
<td>Repeated DSH</td>
<td>16</td>
<td>2.5 (1.0–6.5)</td>
<td></td>
</tr>
<tr>
<td>Relative risk (95% CI)</td>
<td>1.9 (0.5–7.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Both</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-episode DSH</td>
<td>30</td>
<td>2.2 (1.0–4.6)</td>
<td></td>
</tr>
<tr>
<td>Repeated DSH</td>
<td>25</td>
<td>4.7 (2.0–12.0)</td>
<td></td>
</tr>
<tr>
<td>Relative risk (95% CI)</td>
<td>1.9 (0.5–7.5)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The time between the date of the last recorded DSH episode during the study period and the date of suicide was at an increased risk of suicide compared with the single repetition group (log rank test: \( \chi^2=5.98, P=0.015 \)), but in males this was not so (log rank test: \( \chi^2=0.56, P=0.456 \)).

**DISCUSSION**

In a previous report of this long-term follow-up study of a large sample of DSH patients we showed that risk of suicide following DSH was greater in males than in females and that it increased with age.
(Hawton et al., 2003). The present study is an in-depth investigation into the association between repetition of DSH and suicide in the same cohort of patients. It is based on a consistent approach to the monitoring of DSH (Hawton & Fagg, 1992; Hawton et al., 1997, 2003).

Methodological issues
The number of repeat DSH episodes recorded will be an underestimate of the true number because only repeat episodes that resulted in presentation to the same general hospital as the index episode could be recorded. Episodes that presented to other hospitals and those that did not result in hospital presentation would not have been identified unless they occurred prior to the index episode.

Our method of identifying suicides by combining suicide verdicts with those of undetermined cause and accidental death due to poisoning was used because taking suicide verdicts alone underestimates the overall mortality from suicide (Charlton et al., 1992). The use of a national register to trace patients permitted an identification of outcome that was as accurate as possible because those who had changed names (especially females) and those who had moved away from Oxford during the follow-up period could still be traced. A drawback to the study is that it is based on patients presenting to only one general hospital. This hospital is, however, the main hospital for the catchment area. Also, the cohort size is very large compared with other studies. This permitted analyses by gender and age.

Repetition of DSH
The proportion of patients who had repeated the DSH at the time of the index episode (23.3%) is well within the wide range that has been reported elsewhere (Sakinofsky, 2000; Owens et al., 2002). There was little difference in the proportions of males and females who had repeated the DSH at index presentation. There was also little difference between the proportions of males and females who repeated the DSH during the follow-up period, which is consistent with the findings of other studies (Morgan et al., 1976; Bancroft & Marsack, 1977; Owens et al., 2002), although none has had access to such large cohorts.

Repetition and suicide risk
The results confirm that repetition of DSH is associated with increased risk of eventual suicide (Hawton & Fagg, 1988; Tejedor et al., 1999; Owens et al., 2002). The increased risk for those in the repeated DSH group in both the short and longer term compared with those in the single-episode DSH group suggests that detailed enquiry about previous DSH history is important in the assessment of risk. This should also include asking about episodes that have not resulted in presentation to hospital.

Although repetition of DSH may be one of the strongest risk factors for death by suicide (overall, it was confirmed in 59.9% of the suicides), it is also important to note that suicide occurred in a small minority of cases overall: 4.7% of those in the repeated DSH group died by suicide compared with 1.9% of those in the single-episode DSH group over 15 years. Attention to other risk factors (Sakinofsky, 2000) is also clearly necessary, although the difficulty in predicting the risk of suicide should not be underestimated (Hawton, 1987; Goldney, 2000). This is the first study known to us that has looked at the risk of suicide according to repetition of DSH over such a long time period (15 years). It appears that repetition of DSH, especially when account is taken of repeat episodes during follow-up, is associated with continuing suicide risk, whereas for those in the single-episode DSH group there is a levelling-off of risk. Of course, further repeat episodes are likely to indicate ongoing or recurrent psychiatric and psychosocial problems, which may explain why risk persists. Nevertheless, the recurrence of actual self-harm is clearly a poor prognostic sign with regard to possible future suicide.

Risk associated with repetition by gender, age and number of repeats
Although male DSH patients have a greater overall risk of suicide than female patients (Hawton et al., 2003), the relative risk in
the repeated DSH group compared with the single-episode DSH group is greater in females. Very young females in the repeated DSH group have a particularly high risk compared with those in the single-episode DSH group at the same age. Thus, information about repetition may be more informative about future suicide risk in females than in males, and may be particularly useful in young females.

Because this is the only study we are aware of that has examined the risk of suicide in relation to repetition of DSH by both gender and age group, there is little previous work with which to compare our findings. However, our findings are consistent with the direction of the findings reported by Bancroft & Marsack (1977).

Among all those in the repeated DSH group, those who engaged in multiple (more than two) episodes of DSH were at a significantly greater risk of suicide than those who repeated the DSH only once. The proportion of those with more than two episodes of DSH is consistent with that found elsewhere (Kreitman & Casey, 1988). However, the increased risk in the multiple repetition group of the present study was almost entirely accounted for by females, which suggests that multiple repetition of DSH is a better predictor of risk in females than it is in males.

A shorter time was found between the last episode of DSH and death for those in the repeated DSH group compared with those in the single-episode DSH group. This may simply represent the greater risk in the repeated DSH group. However, the gender difference in time between the last DSH and suicide in both the repeated DSH group and the single-episode DSH group may indicate a gender difference in the persistence of risk of suicide behaviour. This requires further investigation.

ACKNOWLEDGEMENTS

This study was funded by a grant from the National Health Service Executive for England. K.H. is also funded by the Oxfordshire Mental Healthcare Trust. We thank the staff at the Office for National Statistics for England and Wales, the General Register Office for Scotland and the Central Services Agency in Northern Ireland for their assistance with this project. We also thank Louise Harriss for her advice on the statistical analyses. Staff at the Department of Psychological Medicine at the John Radcliffe Hospital in Oxford assisted with original identification of the patients included in the study.

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BJP 2004, 185:70-75.
Access the most recent version at DOI: 10.1192/bjp.185.1.70

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