The Repetition of Suicidal Behavior: A Multicenter Cohort Study

Navneet Kapur, M.D., M.R.C.Psych.; Jayne Cooper, Ph.D.; Sarah King-Hele, M.Sc.; Roger Webb, M.Sc.; Martin Lawlor, M.Phil., M.R.C.Psych.; Cathryn Rodway, B.Sc.; and Louis Appleby, M.D., F.R.C.Psych.

Objectives: To determine the proportion of individuals who repeated nonfatal suicidal behavior within 12 months of an index episode, to investigate the timing of repetition, and to investigate risk factors associated with repetition and their population impact.

Method: We carried out a prospective cohort study (1997–2002) in 4 large hospitals in North West England. We included subjects aged 15 years and over who attended with "self-harm" (an act of intentional self-poisoning or injury irrespective of the apparent purpose of the act). Following the episode, a standard assessment form, which included detailed demographic and clinical data, was completed by a clinician.

Results: 9213 individuals presented during the study period. The incidence of repetition within 12 months of the index episode was 13.6% (95% CI: 12.9% to 14.4%). The median time to first repetition was 73.5 days (interquartile range, 20 to 187 days). One in 10 subjects repeated within 5 days of the index episode. Independent risk factors for repetition included previous suicidal behavior, psychiatric treatment, being unemployed or registered sick, self-injury, alcohol misuse, and reporting suicidal plans or hallucinations at the time of the index episode. The combined population attributable fraction (an indicator of the potential population impact) for these variables was 65%.

Conclusion: The repetition of suicidal behavior is common and occurs quickly. On a population level, our study suggests that the most important strategies to reduce repetition might include primary prevention of suicidal behavior, targeting psychiatric illness, and tackling social factors such as unemployment. Specific interventions may be required for individual subgroups.

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Corresponding author and reprints: Navneet Kapur, M.D., Centre for Suicide Prevention, Williamson Building, University of Manchester, Oxford Rd., Manchester, United Kingdom M13 9PL (e-mail: nav.kapur@manchester.ac.uk).

The prevention of suicide is a health priority in many countries.[1–4] A key risk factor for suicide is previous nonfatal suicidal behavior[5,6] (commonly referred to as *attempted suicide* or *parasuicide* in the United States and Europe and *self-harm* in the United Kingdom). Such behavior is associated with a 30- to 200-fold increase in the risk of suicide in the year after the episode compared to the risk in the general population.[5,6]

Nonfatal suicidal behavior is a major public health problem in its own right. In the United States, it has been estimated that 650,000 people per year attempt suicide.[7] The burden on health services is considerable, with approximately 412,000 emergency department visits per year in the United States[8] and 170,000 hospital attendances per year in the United Kingdom.[9]

Repeated suicide attempts are relatively common and are associated with an elevated risk of a fatal outcome[10,11] and increased resource use.[10] There is evidence that the

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incidence of repetition is increasing.[12] The repetition of attempted suicide is also important for its use as a proxy measure for suicide in intervention studies.[5]

Effective treatments for reducing the repetition of suicidal behavior remain elusive.[13,14] A recent study showed that, despite a substantial increase in treatment for emotional problems in the United States during the 1990s, the prevalence of suicide-related behaviors did not decrease.[15] Clinicians and service planners would benefit from accurate information about the extent of repetition and data to guide the timing and content of interventions.

A systematic review estimated that 15% of individuals repeat suicidal behavior within 1 year of an episode of nonfatal suicidal behavior.[5] Comparatively few studies have explored the timing of repetition in more detail. A small U.K. study in 1 center suggested that, for those who repeated within a year, the median time to repetition was 12 weeks.[16] There is a considerable literature on the risk factors for repetition. The most consistently reported risk factors include previous suicidal behavior, previous psychiatric care, alcohol and drug misuse, personality factors, and sociodemographic factors, such as social isolation and unemployment.[17–20]

However, previous research has had a number of methodological shortcomings. Studies have involved relatively small samples, leading to imprecise estimates of repetition rates and an inability to examine repetition in clinically important subgroups (for example, men and women, younger and older age groups, those with and without a previous history of suicidal behavior, those who self-poison, and those who self-injure). Larger studies have tended to use only limited measures on study participants. Some studies have included only those admitted to medical beds. This criterion is problematic since a substantial proportion of individuals are discharged home directly from the emergency department.[9] Few studies have accounted for differences in length of follow-up after the index episode by using survival analysis or fitted multivariate models to identify independent risk factors for repetition. No studies have attempted to estimate the population impact of risk factors.

We sought to overcome these difficulties in the current study by investigating the repetition of suicidal behavior in more than 9000 individuals over a 4-year follow-up period. We used detailed measures and identified subjects from emergency departments with defined catchment populations. We had 4 main objectives:

- To determine the proportion of individuals who repeated nonfatal suicidal behavior within 12 months of an index episode.
- To investigate the timing of repetition in relation to the index episode.
- To investigate risk factors associated with repetition by using univariate and multivariate survival analysis and estimate their potential impact at a population level.
- To compare the proportion of individuals repeating, the time to repetition, and the risk factors for repetition in predefined, clinically important subgroups.

METHOD

Case Ascertainment

The Manchester and Salford Self-Harm (MASSH) project is a collaboration between the University of Manchester and the 4 hospital trusts providing emergency care in the cities of Manchester and Salford in the United Kingdom. Detailed information is collected on individuals who present to these emergency departments as a result of attempted suicide and wait long enough to be seen by a health professional. Case definition is based on the term most often used to describe nonfatal suicidal behavior in the United Kingdom—*self-harm*. *Self-harm* is defined as "an act of intentional self-poisoning or injury irrespective of the apparent purpose of the act."[21] This is approximately synonymous with the terms *attempted suicide* and *parasuicide* used in other countries.[18,22,23]

Self-harm includes attempts regardless of the degree of suicidal intent or medical seriousness. Suicidal intent is continuously distributed in self-harming populations—the distribution is not bimodal, and there is no definitive cut-off to identify those who truly intended to take their own lives.[24] Restricting the sample to those with high suicidal intent would have been problematic since some individuals with apparently low intent make medically very serious attempts.[25,26] The MASSH project focuses on self-harm episodes in individuals that present to hospital because this is the group for whom the behavior has been shown to increase resource use and the risk of suicide.[10,11,21] The project does not seek to examine community episodes of self-harm.

The hospital catchment areas cover a predominantly deprived urban population of around 600,000 people. A more detailed account of service provision in the study area is given elsewhere.[27] In terms of management, approximately 40% of self-harm episodes receive a specialist psychosocial assessment, 30% of self-harm episodes result in admission to a medical bed, and 25% of episodes result in a referral for specialist follow-up. The MASSH project was ratified by the local research ethics committees and also has approval under Section 60 of the U.K. Health and Social Care Act 2001.

Measures

Following an episode of self-harm, a standard assessment form is completed by the emergency doctor and by psychiatric staff for those patients who receive a psychiatric assessment. The form includes detailed sociodemo-

graphic data, clinical data (such as previous suicidal behavior, past psychiatric treatment, alcohol or drug misuse), and episode-specific variables such as the main precipitating factors, circumstances of the attempt, and mental state at the time of assessment. The MASSH form was developed on the basis of existing clinical schedules for assessing self-harm, published research, and practice guidelines. A validation exercise involving a clinician blind to proforma responses (N.K.) showed excellent agreement between the information obtained from the form and the clinical case record (kappa ≥ 0.8 for individual variables).

The completion rate for assessment forms is monitored continuously and runs at approximately 80%. Limited information is collected on those for whom forms are not completed, but they are similar in terms of age (mean age = 31.6 years vs. 32.4 years) to those for whom we have forms. Those without forms are slightly more likely to be male (proportion male: 45% vs. 39%) and to have injured themselves (proportion injuring themselves: 19% vs. 13%) than those with forms. Those without forms are slightly less likely to have poisoned themselves (proportion poisoning themselves: 78% vs. 84%) and to present between the hours of 8 p.m. and 6 a.m. (proportion presenting during this time period: 50% vs. 54%) than those with forms.

Design

We conducted a prospective cohort study of subjects aged 15 years and over attending the 4 hospitals between September 1, 1997, and August 31, 2002. The *index episode* was defined as the first self-harm attendance by an individual during this time. Our main outcome measure was the occurrence of at least 1 repeat episode during the study period. Patients were tracked centrally in the catchment area using the MASSH database. A range of demographic and clinical information was recorded for each episode. A comprehensive, data-linking process was employed to identify repeat episodes. Initially, episodes were linked on name and date of birth. In cases for which there was doubt, additional linking criteria were used (hospital number, postal code of residence). Each individual was assigned a unique identifying number in the database.

The majority of deaths that receive an undetermined ("open") verdict at inquest are suicides, and such deaths are conventionally included as cases in research studies in the United Kingdom and in national statistics.[4,6] In the current study, deaths by suicide (ICD code E950–E959) and undetermined cause (E980–E989) (from hereon referred to as *deaths by suicide*) were rare during the follow-up period but were included as repeat episodes. These deaths were identified via linkage to the general population suicide database held by the National Confidential Inquiry Into Suicide and Homicide by People With Mental Illness (University of Manchester). For the purposes of the current study, we considered only suicide deaths that occurred during the study period.

Sample Size

We aimed to identify all episodes of suicidal behavior within the study period. The sample size was not determined by a power calculation, but the study was adequately powered. For example, using the observed numbers of male (N = 3991) and female (N = 5222) subjects, we estimated that the study cohort had > 99.9% power at a 2-sided p = .05 level of significance to detect a relative risk of repetition of 1.5 (if 15% of the male subjects repeated compared with 10% of the females). It had 85% power to detect a relative risk of 1.2 (12% vs. 10%).

Analysis

For all subjects for whom we had at least 1 year of follow-up data, we calculated the proportion (with 95% confidence interval [CI]) of individuals repeating within 12 months of the index episode of self-harm. The median time to first repetition and interquartile range (IQR) were calculated in days.

Potential risk factors for repetition were investigated using hazard ratios (HRs) generated by Cox's proportional hazards models. For these models, explanatory variables were categorized into the following domains: sociodemographic, clinical, precipitants, circumstances of index attempt, and mental state (see Table 1 for details). Initially, univariate associations were examined. We performed a total of 37 univariate analyses (Tables 1 and 2). Correction for multiple comparisons is controversial, with some arguing against such procedures because they may increase the risk of type II error.[28] We opted to present uncorrected significance tests. However, we have also indicated in the tables the p values that remained significant (p < .00135; i.e., .05/37) following Bonferroni correction for multiple testing.[29]

Multivariate models were generated within each domain using backward elimination procedures. The independent predictors from all the domain-specific models were then fitted in a final multivariate model. Explanatory variables were retained in the domain-specific and final models if the p value was less than .05. We performed a formal test of proportional hazards for the explanatory variables fitted in the multivariate model and found no evidence that the assumption was violated. The adjusted population attributable fraction (PAF) was then used to calculate the proportions of repetitions that were attributable to the risk factors in the multivariate model (assuming a causal relationship between risk factors and outcome).[30]

The analyses were then repeated for a number of subgroups. These subgroups were specified a priori and were selected on the basis of their clinical importance and their association with repetition in previous studies.[5,6,18,21–23,31] We compared the incidence, timing, and risk factors for

Table 1. Sociodemographic and Clinical Characteristics of Suicidal Behavior and the Risk of Repetition

Variable	Number of Individuals	Number Repeating Self-Harm	Hazard Ratio	95% CI	p Value
Social and demographic					
Sex					
Female	5222	891	1.00		
Male	3991	762	1.12	(1.02, 1.23)	.021
Age, y					
15–24	3245	503	1.00		
25–34	2672	520	1.26	(1.12, 1.43)	
35–44	1965	401	1.36	(1.20, 1.55)	
45–54	855	168	1.28	(1.08, 1.53)	
> 54	476	61	0.82	(0.63, 1.07)	< .001*
Housing status					
Living with a friend, relative, or child	6071	959	1.00		
Homeless	180	43	1.63	(1.20, 2.22)	
Living alone	1939	413	1.39	(1.24, 1.56)	
Living in a hostel/lodging	477	129	1.80	(1.49, 2.16)	
Other	229	42	1.20	(0.88, 1.64)	< .001*
Marital status					
Married/with partner	2688	419	1.00		
Single	4681	906	1.28	(1.14, 1.43)	
Separated/divorced	1377	245	1.13	(0.97, 1.32)	
Widowed	177	24	0.84	(0.56, 1.26)	< .001*
Employment status					
Employed	2569	317	1.00		
Registered unemployed	3661	778	1.77	(1.56, 2.02)	
Registered sick	926	230	2.17	(1.83, 2.57)	
Retired	239	34	1.16	(0.81, 1.65)	
Student	873	129	1.23	(1.00, 1.51)	
House person/carer/other	565	88	1.23	(0.97, 1.55)	< .001*
Ethnicity					
White	8205	1527	1.00		
Indian/Pakistani/Bangladeshi	383	39	0.55	(0.40, 0.75)	
Black	250	32	0.69	(0.48, 0.98)	
Other	133	18	0.76	(0.47, 1.20)	< .001*
Treatment and previous self-harm					
Current psychiatric treatment[a]					
None	5943	852	1.00		
Yes	2867	724	1.87	(1.69, 2.06)	< .001*
Previous psychiatric treatment[a]					
None	4852	598	1.00		
≤ 12 mo	2579	701	2.35	(2.10, 2.62)	
> 12 mo	1316	257	1.63	(1.41, 1.89)	< .001*
Previous self-harm					
No	4167	427	1.00		
Yes	4673	1154	2.62	(2.34, 2.93)	< .001*
Alcohol and drug misuse					
Alcohol misuse[b]					
No	6430	1054	1.00		
Yes	2124	495	1.49	(1.34, 1.66)	< .001*
Drug misuse					
No	7450	1315	1.00		
Yes	1093	220	1.17	(1.02, 1.35)	.03

[a]Includes primary care.
[b]Harmful use or > 7 units daily.
*When the Bonferroni correction for multiple testing is applied, only those p values of .0013 or less may be deemed significant at the 2-sided 5% level.

repetition by gender, age group, history of suicidal behavior, and method of harm. Differences in the proportion of individuals repeating self-harm were compared using the Pearson χ^2 test, and differences in the time to repetition were assessed using the Mann-Whitney 2-sample statistic. All analyses were carried out using Stata 8.0 (StataCorp, 2003, College Station, Tex.).

RESULTS

Sample Characteristics

The cohort consisted of 9213 individuals presenting with 12,492 episodes of self-harm from September 1, 1997, to August 31, 2002. The median age was 29.9 years (IQR, 21.9 to 39.2 years; range, 15 to 98.3 years), and

Table 2. Precipitants, Circumstances, and Mental State Variables of Suicidal Behavior and the Risk of Repetition

Variable	Number of Individuals	Number Repeating Self-Harm	Hazard Ratio	95% CI	p Value
Precipitants of index episode					
Abuse (as child or adult)					
No	7750	1338	1.00		
Yes	484	113	1.40	(1.16, 1.70)	< .001*
Bereavement					
No	7463	1320	1.00		
Yes	771	131	0.98	(0.82, 1.17)	.83
Bullying					
No	7907	1389	1.00		
Yes	327	62	1.12	(0.87, 1.44)	.39
Relationship problems with family					
No	6796	1195	1.00		
Yes	1438	256	1.03	(0.90, 1.18)	.68
Relationship problems with friends					
No	4242	868	1.00		
Yes	3992	583	0.69	(0.62, 0.76)	< .001*
Relationship problems with others					
No	7360	1285	1.00		
Yes	874	166	1.10	(0.93, 1.29)	.27
Physical health problems					
No	7606	1329	1.00		
Yes	628	122	1.15	(0.95, 1.38)	.16
Housing problems					
No	7605	1315	1.00		
Yes	629	136	1.32	(1.11, 1.57)	.003
Legal problems					
No	7896	1388	1.00		
Yes	338	63	1.08	(0.84, 1.40)	.54
Response to mental problems					
No	7293	1241	1.00		
Yes	940	209	1.39	(1.20, 1.61)	< .001*
Miscarriage (all)					
No	8114	1434	1.00		
Yes	74	5	0.35	(0.15, 0.84)	.005
Money					
No	7428	1329	1.00		
Yes	806	122	0.84	(0.70, 1.01)	.05
Victim of crime					
No	8005	1410	1.00		
Yes	229	41	1.02	(0.74, 1.39)	.92
Work problems					
No	7291	1318	1.00		
Yes	943	133	0.78	(0.65, 0.93)	.004
Circumstances of index episode					
Avoid discovery					
No	7593	1367	1.00		
Yes	1045	175	0.92	(0.79, 1.08)	.32
Premeditation					
No	6833	1168	1.00		
Yes	1882	394	1.24	(1.11, 1.39)	< .001*
Wanted to die					
No	3703	611	1.00		
Yes	4778	908	1.17	(1.06, 1.30)	.003
Suicide note					
No	7772	1404	1.00		
Yes	915	151	0.90	(0.77, 1.07)	.24
Method of self-harm					
Self-poisoning (medication)	7952	1361	1.00		
Self-poisoning (other)	80	8	0.53	(0.26, 1.06)	
Self-injury (cutting/piercing)	970	250	1.65	(1.44, 1.89)	
Other (eg, drowning, self-asphyxiation)	208	32	0.91	(0.64, 1.29)	< .001*

continued

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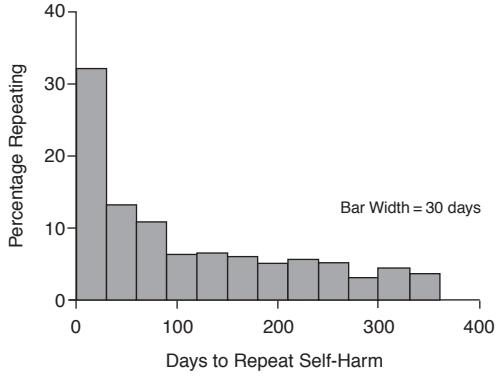
Table 2. Precipitants, Circumstances, and Mental State Variables of Suicidal Behavior and the Risk of Repetition (cont.)

Variable	Number of Individuals	Number Repeating Self-Harm	Hazard Ratio	95% CI	p Value
Mental state at index assessment					
Feels depressed					
No	2607	393	1.00		
Yes	6149	1163	1.28	(1.14, 1.44)	< .001*
Sleep disturbance					
No	3744	603	1.00		
Yes	4881	932	1.20	(1.09, 1.33)	< .001*
Appetite disturbance					
No	4854	804	1.00		
Yes	3716	726	1.22	(1.10, 1.34)	< .001*
Hopelessness					
No	5260	852	1.00		
Yes	3247	665	1.29	(1.17, 1.43)	< .001*
Suicidal thought					
No	5548	861	1.00		
Yes	3100	680	1.47	(1.33, 1.62)	< .001*
Suicidal plans					
No	7461	1234	1.00		
Yes	1118	296	1.69	(1.49, 1.91)	< .001*
Hallucinations					
No	7965	1352	1.00		
Yes	599	174	1.82	(1.56, 2.14)	< .001*

*When the Bonferroni correction is applied, only those p values of .0013 or less may be deemed significant at the 2-sided 5% level.

Figure 1. Timing of Repeat Self-Harm Within the First Year After the Index Episode (N = 1054)[a]



[a]Censored at 1 year: only those subjects with at least 1 year of follow-up included.

5222 (57%) were female. With respect to sociodemographic variables, 4681 subjects (51%) were single, 3661 (40%) were unemployed, and 8205 (89%) were of white ethnic origin. Previous suicidal behavior was reported by 4673 individuals (51%), 2124 subjects (23%) misused alcohol, and 1093 (12%) misused drugs. Just under one third of the sample was receiving psychiatric treatment at the time of the index episode (2867 subjects, 31%). The most common method of harm during the index episode was self-poisoning by drugs (7952 subjects, 86%). The substances most commonly ingested in overdose (categories not mutually exclusive) were acetaminophen (3779 cases, 48%), antidepressants (1878 cases, 24%), other analgesics (1629 cases, 21%), and benzodiazepines (1096 cases, 14%).

In total, 1653 individuals (17.9%, 95% CI: 17.2% to 18.7%) repeated suicidal behavior within the whole study period. Almost two thirds of these subjects (1041, 63%) repeated on a single occasion, but the number of repetitions ranged from 1 to 58. There were 80 deaths by suicide during the study period (46 suicide verdicts and 34 undetermined death verdicts).

Incidence of Repetition Within 12 Months

The proportion of individuals repeating within 12 months of an index episode of self-harm was calculated for the 7723 individuals for whom we had at least 1 year of follow-up data. In total, 1054 individuals repeated, giving a 1-year cumulative incidence of 13.6% (95% CI: 12.9% to 14.4%).

Timing of Repetition

Figure 1 shows the timing of repetition for those who repeated suicidal behavior within a year. The median time to first repetition was 73.5 days (IQR, 20 to 187 days; range, 1 to 365 days). One in 3 subjects who repeated within a year of the index episode did so within 1 month and 1 in 10 repeated within 5 days.

Univariate Models of Repetition

There were numerous associations between repeat suicidal behavior and sociodemographic characteristics, clinical factors, and the precipitants and circumstances of the index episode (Tables 1 and 2). We found that 75% of the univariate associations that were statistically signifi-

Table 3. Multivariate Cox Regression Model for Repetition of Suicidal Behavior

Variable	Hazard Ratio	95% CI	p Value	PAF %
Employment status[a]				
Unemployed	1.38	(1.20, 1.59)		13
Registered sick	1.42	(1.18, 1.71)		5
Retired	1.18	(0.81, 1.71)		0.3
Student	1.30	(1.05, 1.61)		2
House person/carer/other	1.17	(0.91, 1.51)	< .001	0.7
				20
Self-injury as method of self-harm	1.38	(1.19, 1.59)	< .001	5
Previous self-harm	2.11	(1.87, 2.40)	< .001	41
Current psychiatric treatment	1.42	(1.27, 1.59)	< .001	14
Alcohol misuse	1.30	(1.16, 1.45)	< .001	8
Suicidal plans	1.33	(1.16, 1.53)	< .001	5
Hallucinations	1.21	(1.02, 1.44)	.03	2
Total				65

[a]Employed comparison group.
Abbreviation: PAF = population attributable fraction.

cant at $p < .05$ were also significant at the Bonferroni-corrected level of $p < .00135$. Our results were therefore generally robust to multiple testing. The age categories in Table 1 were chosen because the hazard ratios for the ages 55–64 and 65 and over were homogeneous. The largest hazard ratios for repetition within each domain were living in a hostel or lodging, being registered sick, previous suicidal behavior, previous psychiatric treatment, specific precipitants, particularly abuse (either as a child or adult) and mental health problems, self-injury as a method of harm, and hallucinations at the time of assessment.

Multivariate Model of Repetition

Table 3 shows the final multivariate model for which the level of data completeness was 86%. The independent predictors of repetition were being unemployed or registered sick, employment status, self-injury as a method of harm, previous suicidal behavior, current psychiatric treatment, alcohol misuse, suicidal plans at the time of the episode, and hallucinations at the time of assessment. Previous self-harm was associated with an approximate doubling in the risk of repetition. The adjusted population attributable fraction for individual variables ranged from 2% (for hallucinations) to 41% (for previous self-harm). The overall adjusted population attributable fraction for the multivariate model was 65%.

Gender

The proportion of individuals repeating within 12 months of an index episode of nonfatal suicidal behavior was similar for males and females (proportion repeating: 14.4% vs. 13.1%, $p = .11$, Pearson χ^2 test). The time to repetition for those repeating within a year was slightly shorter for males than females, but this just failed to reach statistical significance (median time to first repetition [IQR]: 67.5 days [15.5 to 181.5] for males vs. 84 days [23.0 to 191.0] for females, $p = .057$, Mann-Whitney U test).

We examined interactions with gender for the univariate models. Drug misuse was a risk factor for repetition in women but not in men (HR [95% CI]: 1.4 [1.1 to 1.7] in women vs. 1.0 [0.8 to 1.2] in men, p value for interaction = .02). Reporting hallucinations at the time of assessment was a significantly stronger risk factor in women than men (HR [95% CI]: 2.2 [1.7 to 2.7] in women vs. 1.5 [1.2 to 1.9] in men, p value for interaction = .03).

Age

For the purpose of the subgroup analysis, we considered 3 age categories (15–24, 25–54, 55+ years). We did this for ease of presentation, because the hazard ratios were similar within these broad groupings and to maximize statistical power. The proportion of individuals repeating within 12 months of an index episode was highest in the 25–54-year age group (proportion repeating: 12.1% in those aged 15–24 vs. 14.8% in those aged 25–54 vs. 11.0% in those over 55 years, $p = .001$, Pearson χ^2 test). The time to repetition was shortest in the 25–54-year-old group, but this difference was not statistically significant (median time to first repetition [IQR]: 83 days [23.0 to 192.0] in those aged 15–24 vs. 70 days [18.0 to 185.0] in those aged 25–54 vs. 96.5 days [25.0 to 208.5] in those over 55 years, $p = .46$, Kruskal-Wallis test).

When we examined interactions with age for the univariate models, we found that drug misuse was a risk factor for repetition in the younger and older age groups but not in the group aged 25–54 (HR [95% CI]: 1.4 [1.1 to 1.7] in those aged 15–24 vs. 1.0 [0.8 to 1.2] in those aged 25–54 vs. 3.4 [1.1 to 10.9] in those over 55 years, p value for interaction = .04).

Previous Suicidal Behavior

The proportion of individuals repeating within 12 months of an index episode was higher for those with a lifetime history of self-harm than for those with no such history (proportion repeating: 18.9% vs. 7.4%, $p < .001$, Pearson χ^2 test). For those who repeated within a year, the time to repetition was longer in those with a previous history, but this did not reach statistical significance (median time to first repetition [IQR]: 78 days [21.0 to 191.0] vs. 68 days [14.0 to 177.0, $p = .076$, Mann-Whitney U test]).

We examined interactions with previous self-harm for the univariate models. Although there were modest statistical interactions with previous psychiatric treatment, these were inconsistent over time and were not clinically significant.

Method of Harm

Self-injury included cutting, piercing, and self-mutilation. We were particularly interested in the

self-injury group because previous work by ourselves and others has suggested that this method of harm is associated with a high risk of subsequent suicidal behavior.[6,32] The proportion of individuals repeating within 12 months of an index episode was higher for those who injured themselves than for those who used other methods of harm (proportion repeating 21.4% vs. 7.3%, $p < .001$, Pearson χ^2 test). For those who repeated within a year, the time to repetition was shorter in the self-injury group, but this did not reach statistical significance (median time to first repetition [IQR]: 56.5 days [15.0 to 168.0] for the self-injury group vs. 80 days [20.0 to 192.0] for all other methods of harm, $p = .12$, Mann-Whitney U test). However, for the sample as a whole, the time to repetition was significantly shorter for those who injured themselves (median time to first repetition [IQR]: 122.5 days [26.0 to 389.0] for the self-injury group vs. 160 days [36.0 to 448.0] for all other methods of harm, $p < .001$, Mann-Whitney U test).

We examined interactions with method of harm for the univariate models. Wanting to die at the time of the episode and current alcohol misuse appeared to be risk factors for other methods of harm but not for self-injury (HR [95% CI] wanting to die: 1.3 [1.2 to 1.5] in other method group vs. 0.9 [0.7 to 1.2] in the self-injury group, p value for interaction = .01; HR [95% CI] current alcohol misuse: 1.6 [1.4 to 1.7] in other method group vs. 1.09 [0.8 to 1.4] in the self-injury group, p value for interaction = .02).

None of the subgroup interactions described above were significant when entered into the multivariate model.

Fatal and Nonfatal Repetition

We also compared those who repeated with a fatal outcome during the study period (N = 80) with those who repeated with a nonfatal outcome (N = 1573), although a fatal vs. nonfatal outcome comparison was not one of the main objectives of the current study. We did not compare univariate and multivariate models of fatal and nonfatal repetition because of the great disparity in the size of the groups. Instead, we used descriptive statistics. Those with a fatal repetition had a longer time to first repetition than those who repeated with a nonfatal outcome (median time to first repetition [IQR]: 211.5 days [32.5 to 490] for the fatal repetition group vs. 153 days [35 to 436] for the nonfatal repetition group, $p < .001$, Mann-Whitney U test). Those with a fatal repetition were more likely to be male than those with a nonfatal repetition (64% vs. 45%, $p < .001$, Pearson χ^2 test) and were older (median age [IQR]: 35.2 years [28.1 to 46.1] for fatal repetition vs. 30.9 years [22.8 to 39.1] for nonfatal repetition, $p < .001$, Mann-Whitney U test). Marital status also differed significantly between the 2 groups (proportion married, single, separated/divorced, widowed: 24%, 47%, 24%, 5% in those with a fatal repetition vs. 26%, 57%, 15%, 1% in those with a nonfatal repetition, $p = .006$, Pearson χ^2 test). The 2 groups were similar with respect to the proportions in paid employment, ethnicity, method of self-harm, past history of suicidal behavior, alcohol misuse, and treatment history.

DISCUSSION

Main Findings

We found that the repetition of suicidal behavior was relatively common in the year after an index episode of self-harm, with 1 in 7 of our sample repeating during this time period. Repetition tended to occur quickly—almost half of individuals who repeated within 1 year did so within the first 2 months of their index episode and 1 in 10 repeated within 5 days.

Numerous sociodemographic, clinical and episode-specific variables were associated with repetition. Independent risk factors identified through multivariate analysis included previous suicidal behavior, psychiatric treatment, employment status, self-injury, alcohol misuse, and reporting of suicidal plans or hallucinations at the time of the index episode. In terms of the potential population impact of these risk factors, the 3 most important were previous suicidal behavior, psychiatric treatment, and current unemployment. If all the variables in the model were causally related to repetition, and we were able to completely eliminate the risk factors in question (which is unlikely), our findings suggest that up to two thirds of repeat episodes of suicidal behavior could be prevented.

We found important subgroup differences:

- Men tended to repeat more quickly than women.
- With respect to age, the highest rates of repetition were found in those aged 25 to 54.
- Previous suicidal behavior increased the incidence of repetition.
- Those who injured themselves were more likely to repeat, and they repeated more quickly.
- Comparing those with fatal versus nonfatal repetition, those with a fatal outcome were more likely to be male, were older, and were more likely to have experienced relationship breakdown or death of a partner.

We found few significant subgroup interactions for the univariate models, and the large number of interactions tested meant that type I error was a possibility. The interactions should therefore be interpreted cautiously. However, they do suggest that risk factors for repetition may be different in different subgroups.

Comparison With Previous Studies

The 1-year incidence rate for repetition in this study is similar to the 15% reported in a recent systematic review.[5] That review was not able to determine the 1-year repetition rate of an inception cohort (first-time self-harm cases)

because of a lack of suitable studies. We found that the 1-year cumulative incidence of repeat self-harm in this group was 7.4% (95% CI: 6.5% to 8.3%). Few previous studies have investigated the timing of repetition in detail. None to our knowledge have estimated the population impact of risk factors. Previous research has not considered such a broad range of variables in a large cohort of individuals. Individual studies have focused on more restricted groups of explanatory variables. The risk factors for repetition that we identified are broadly similar to those reported in previous research when these studies are considered collectively.[5,10,18,23] However, our large sample size meant that we were also able to examine the incidence, timing, and risk factors for repetition in clinically important subgroups.

Methodological Issues

We carried out a large multicenter cohort study of repeat suicidal behavior over a recent and comparatively short time period. The results should therefore be applicable to contemporary service provision. Database studies that allow for record linkage are a valuable tool in psychiatric epidemiology,[33] but such studies are difficult to carry out in noncentrally managed health care systems.

However, our study should be interpreted in the context of certain methodological limitations. Although we achieved a good response rate, males and those using cutting as a method of harm may have been slightly underrepresented in our study. However, the magnitude of the differences between subjects with and without forms suggests that this was probably not a major source of bias. We chose to focus on self-harm episodes in individuals that presented to hospital in this study because this is the group in whom repetition has been shown to increase resource use and the risk of suicide.[10,11] We did not examine community episodes of self-harm for which people did not seek health care. The prognosis for community self-harm is uncertain and should be the subject of future studies. Equally, we did not include episodes treated solely within primary care. Evidence suggests that the majority of individuals treated for episodes of suicidal behavior in the British Isles present to hospital—very few are seen by general practitioners.[22,34]

We did not obtain data on repeat self-harm episodes of individuals who subsequently attended nonparticipating hospitals. The study centers covered a geographically defined catchment population. A call for emergency medical assistance within this area would have led to patients being conveyed to the nearest of the study hospitals. However, in theory it would be possible for patients to travel themselves to another hospital outside the district if they so wished. We do not have a direct estimate of the size of this effect, but data from within the Manchester district suggest first repeat episodes result in presentation to the same hospitals as the index episodes in 80% to 90% of cases. We were unable to collect detailed data on those who did not wait long enough to be seen by a health professional, and our findings may not be applicable to this group.

We collected our data using a detailed clinical form completed as part of routine practice. There are differing views on the use of rating scales in the assessment of self-harm.[19] We chose not to include formal rating scales because of their relatively poor predictive value[19] and because we wished to investigate the relationship between individual variables recorded by clinicians and the repetition of self-harm.

We chose not to focus on diagnosis as an explanatory variable in the current study. In the United Kingdom, only a proportion of patients tend to be given a firm psychiatric diagnosis by clinicians following emergency department attendance for self-harm.[21] In the United States, the figure is about 55%.[8] In our service during the study period, 61% of those seen by specialist staff received a diagnosis (primary diagnosis: affective disorder, 25%; drug or alcohol dependence, 17%; anxiety and neurotic disorders, 13%; personality disorders, 3%; schizophrenia, 2%). The only diagnostic categories that were significantly associated with repetition (with "no psychiatric diagnosis" as the reference category) were drug and alcohol dependence (HR for repetition [95% CI]: 2.0 [1.6 to 2.3]) and personality disorder (HR for repetition [95% CI]: 2.2 [1.6 to 3.2]). However, these analyses are post hoc and should be interpreted cautiously.

The study centers were all located in predominantly urban areas in North West England. Although the sample characteristics were similar to those in previous U.K. investigations,[9,12] caution is needed in generalizing the findings to other settings. Interestingly, the age and sex composition in this study is very similar to that reported in a recent national study of emergency department visits for attempted suicide and self-inflicted injury in the United States.[8] In both samples, the majority of subjects were white and the majority of presentations occurred outside office hours. The incidence of hospitalization was similar in both studies as was the proportion of patients who had a detailed assessment of their mental state. However, there were also important differences. Self-poisoning as a method of harm was less common in the U.S. study (68% of episodes vs. 86% of episodes), and the substances taken in overdose differed—analgesic poisoning was much less common (25% of episodes in the U.S. study vs. over 60% of episodes in our study).

As in other major epidemiologic studies in this field,[35] our definition of suicidal behavior was a broad one, and we included attempts regardless of the degree of suicidal intent. We discuss the rationale for this definition in detail in our Method section. It is possible that our sample included, for example, some individuals who cut themselves to relieve tension but did not intend to die. How-

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ever, the clinical view that such behavior has limited implications for future suicidal acts is probably incorrect.[32] Self-cutting is associated with an increased risk of eventual suicide compared to other methods of self-harm.[6]

We investigated what are generally considered to be the 2 most important outcomes following self-harm (repetition and death by suicide).[21] We were not able to link with other causes of mortality in the current study. However, we plan to investigate mortality outcomes and other outcomes such as depression, hopelessness, loss of contact with services, quality of life, and user satisfaction in future studies.[36]

Implications for Practice and Research

This study suggests that the repetition of suicidal behavior is a major problem for health services. Based on our data, repeat episodes might account for an annual number of hospital attendances of 23,000 per year in the United Kingdom and 56,000 per year in the United States. Dedicated services for suicidal behavior might be more helpful than traditional models of care, which have led to highly variable service provision.[9,37] The repetition of suicidal behavior occurs quickly, so interventions should be provided as soon after the initial episode as possible. Unfortunately, this patient group may be difficult to engage, but providing treatment at home may improve compliance.[19]

What form should this intervention take? It is still unclear which treatments are effective in the treatment and prevention of suicidal behavior. Trials have generally been underpowered and have recruited highly selected samples. However, a recent U.S. study involving 120 subjects randomized to either 10 sessions of cognitive therapy or usual care found that the active treatment reduced the incidence of self-reported repeat attempts by possibly as much as 50%.[38] The treatment was relatively intensive, and participants needed to identify at least 2 verifiable contact persons to aid tracking. Other promising treatments include problem-solving therapy (a brief, problem-orientated, cognitively based treatment),[39] psychodynamic interpersonal therapy (which involves exploring interpersonal problems that cause or exacerbate psychological distress),[40] and very brief "emergency card"[41] or letter-writing type interventions.[42] Other treatments may be helpful for subgroups of patients (for example, dialectical behavior therapy for individuals with borderline personality disorder who self-harm repeatedly,[43] group therapy for adolescents[44]). However, whichever treatment modality is selected, delivering it to patients is dependent on the availability of trained therapists. Interventions can be delivered by therapists from a range of professional backgrounds. Unfortunately, currently aftercare may be determined more by local availability than by the patient's needs.[36]

Services could focus their efforts on factors that increase an individual's risk of repetition (for example, previous suicidal behavior, psychiatric treatment, employment status, self-injury, alcohol misuse, and reporting suicidal plans or hallucinations at the time of the index episode, which were identified as independent predictors of repetition in this study). However, there are problems with "high risk" approaches to prevention. They are unlikely on their own to have a significant impact on repetition.[45] Our population-attributable-fraction estimates suggest that the most important strategies to reduce repetition at a population level might include primary prevention of suicidal behavior, targeting psychiatric illness, and perhaps tackling social factors such as unemployment. However, empirical evidence for the effectiveness of such interventions is lacking, and the relationship between such societal factors as unemployment and suicidal behavior is complex.[46] The current study was carried out in an area with comparatively high unemployment (8.8% in 2001), so the findings may not be directly applicable to areas with a different employment profile. We found limited evidence that risk factors for repetition differed by gender, age, previous history of suicidal behavior, and method of harm. Specific interventions may well be required for individual subgroups. Those who repeat on multiple occasions may warrant the most intensive interventions. In patients with major depression, each suicide attempt incrementally increases the risk of suicidal behavior by as much as 30%.[47,48] There is some evidence that patients whose repeat self-poisoning episodes are of escalating severity are at higher risk of suicide.[10]

The majority of epidemiologic research in this area has been carried out in Europe. There is an urgent need for further work in other settings, particularly the United States, in order to improve the generalizability of research findings. Further large-scale randomized trials are also required to identify effective interventions for this global problem. Studies might take the form of very large trials of relatively low-intensity interventions (such as crises cards or letter-writing interventions) or smaller trials of much more intensive treatments (such as cognitive or interpersonal treatments).

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