For European Psychiatry

Title: Clinical and neuropsychological aspects of non-fatal self-harm in schizophrenia

Authors: Graham Pluck, Nicoletta P. Lekka, Sugato Sarkar, Kwang-Hyuk Lee, Peter A. Bath, Owais Sharif, Peter W.R. Woodruff

Contact details for all authors: Academic Clinical Psychiatry, University of Sheffield, The Longley Centre, Norwood Grange Drive, Sheffield S5 7JT, United Kingdom, Tel: + 44 (0)114 226 1509, Fax: + 44 (0)114 226 1522, email: b.nesbitt@sheffield.ac.uk

Corresponding Author: Dr Graham Pluck, Academic Clinical Psychiatry, University of Sheffield, The Longley Centre, Norwood Grange Drive, Sheffield S5 7JT, United Kingdom, email g.pluck@sheffield.ac.uk

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Abstract

Purpose: To investigate demographic, clinical and neuropsychological aspects of self-harm in schizophrenia and identify which are independently predictive of and therefore the most relevant to clinical intervention.

Subjects and methods: Eighty-seven patients with schizophrenia were interviewed regarding substance misuse, depression, hopelessness, negative/positive symptoms and illness insight. Neuropsychological assessment included premorbid IQ, continuous performance test, cognitive-motor and trait impulsivity. A prospective three-month review of medical records was also undertaken.

Results: Fifty-nine patients (68%) reported past self-harm (including attempted suicide). Those with past self-harm, compared to those without, were significantly more likely to report depression, hopelessness, impulsivity, a family history of self-harm, polysubstance abuse and had higher premorbid IQ. Logistic regression revealed that depression, higher premorbid IQ and polysubstance abuse were independently linked to self-harm. Five participants attempted self-harm during the 3-month prospective follow-up period. These all had a history of past self-harm and were significantly more likely to have been depressed at the initial interview than those who did not go on to self-harm.

Discussion and conclusions: Independent predictors of self-harm in schizophrenia are premorbid IQ and polysubstance abuse. In addition, depression was both independently associated with past self-harm and predictive of self-harm in the follow-up period.

Key words:

Schizophrenia; self-harm; depression; substance abuse; IQ; suicide

1. Introduction

Self-harm is defined as 'self poisoning, or self injury, irrespective of the apparent purpose of the act' [35]. It therefore includes behaviours that are also described by various other terms, such as self-poisoning, self-mutilation, parasuicide or attempted suicide. Self-harm in schizophrenia is a major clinical and public health concern. People with schizophrenia are about 12 to 16 times more likely to die from suicide than the general population [14, 29]. Approximately 11% of patients with schizophrenia self-harm between the onset of psychosis and first presentation to mental health services [18]. The presence of self-harm among people with schizophrenia is a clinically significant risk factor for later completed suicide [36, 42]. Exact figures on the lifetime prevalence of self-harm associated with schizophrenia are difficult to ascertain because much of the evidence is based upon studies of completed suicides. However, one study followed a group of young schizophrenia patients over 14-17 years and reported that overall self-harm prevalence during the period was 48% [37]. One meta-analytic study suggested that the risk of death by suicide amongst people with schizophrenia is about 5% [39]. Self-harm therefore appears to be a significant aspect of schizophrenia.

Clinical features associated with schizophrenia patients who self-harm, compared to similar patients who do not, include suicidal ideation, previous self-harm, past depression, substance abuse, and past psychiatric admissions [20]. Clinical predictors of completed suicide include previous self-harm, substance abuse, preserved illness insight, depression, delusions and hallucinations [22, 23]. However, in one large UK regression study of demographics and symptoms within the first year of psychosis

onset, no specific symptom profiles were associated with later completed suicide, though a cumulative effect of symptoms was [13].

Compared to those who do not self-harm, people with schizophrenia who self-harm may have higher cognitive functioning. In a study comparing those with and those without a history of suicide attempts among patients with either schizophrenia or schizoaffective disorder, better attention and executive functions were observed in the suicide group [33]. Better insight into their illness has also been demonstrated in groups of schizophrenia patients who attempt suicide, when compared to patients that do not [45]. They may also be more impulsive [24]. Other factors associated with an increased risk of self-harm include being male [18], and being relatively well educated [42].

We wished to ascertain the relative importance of these multiple associations. We aimed to identify the contribution of several key factors associated with past self-harm in schizophrenia and calculate which factors are independently linked to the occurrence of self-harming behaviour. In addition we followed-up participants for three months to investigate which factors are predictive of future self-harm.

2. Subjects and methods

2.1 Subjects

We recruited 87 patients meeting DSM-IV criteria for schizophrenia from the community and from hospital wards in the South Yorkshire region of the UK. The patients' diagnoses of schizophrenia had been determined by their clinical teams. The diagnoses were verified by the interviewing psychiatrist who had access to the patients' full notes. This sample size had the power to detect, using a Chi^2-test, a medium-sized difference with one degree of freedom (α=0.05; β=0.80) [10]. The final sample contained 78 male and 9 female patients and the mean duration of illness was 16.9 years (SD = 11.7). The sample had a mean of 11.4 years of education (SD = 2.4).

2.2 Assessments

The patients were interviewed individually by one of three psychiatrists. Demographic and clinical information was recorded, including duration of illness, family history of mental illness and history of substance misuse. Individual past history of self-harm was recorded with the Deliberate Self-harm Inventory, a schedule that records a range of common self-harmful behaviours that the individual does not class as suicidal [16]. Our enquiries included an open ended item to record any forms of self-harm not featured in the main items of the inventory. In addition, any history of events that the patient considered to be suicide attempts were elicited and recorded using a published schedule [47]. This data was used to classify patients into those with, or without, past histories of self-harm based on a standard definition [21].

The clinical researcher then administered the Calgary Depression Scale [1]. Insight into illness was assessed using the Schedule for the Assessment of Insight [11] and a

general clinical assessment with the Global Assessment of Functioning Scale from the DSM-IV-TR [4]. The patients completed the self-report Barratt Impulsiveness Scale-11 [40] and Beck Hopelessness Scale [8]. The Scale for the Assessment of Negative Symptoms (SANS) [5] and the Scale for the Assessment of Positive Symptoms (SAPS) [6] were administered.

All the cognitive assessments were administered by a neuropsychologist following the clinical interview. Premorbid IQ was estimated with the National Adult Reading Test [34]. The Trail Making Test [41] was used to assess frontal executive function. Sustained attention and vigilance were assessed with a computerised auditory Continuous Performance Test [28]. Cognitive-motor impulsivity was assessed with a computerised visual Go/No-Go reaction time task (240 Go stimuli and 60 No-Go stimuli).

2.3 Procedure

The research protocol was approved by both the South Sheffield and South Yorkshire Research Ethics Committees. All patients gave informed consent and were interviewed in a private room. The entire procedure took approximately two and a half hours; breaks were given and the sessions were spread over two or more occasions if the patient became fatigued. A payment of £10 (approximately US$16) was given to each patient.

2.4 Data analysis

The deliberate self-harm inventory or any behaviour that appeared to be a past suicide attempt revealed in the clinical interview was used to classify patients into those with,

or without, past histories of self-harm according to a standard definition [21]. For the continuous variables, the normality of the distributions was analysed using Kolmogorov-Smirnov one-sample tests. The two groups were compared using one-way Analysis of Variance (ANOVA), or using Mann-Witney tests if non-normally distributed. Scores on the Calgary Depression Scale were used to categorise individuals as probable current clinical depression based on the standard cut-off score of >6 [1]. Substance misuse history was summarised using two variables, whether or not the patient reported ever having been an injector of illicit substances (as a measure of 'hard' drug use), and the total number of classes of substances that the patient had ever abused (as a measure of polysubstance abuse).

For the Trail Making Test the time taken to complete trails B minus A was used giving a statistic that controls for non-specific motor slowness. For the continuous performance test, a signal detection analysis was performed on the accuracy of responses to calculate d', a measure of sensitivity. On the Go/No-Go task, the proportions of commission errors were calculated. This gives a measure of cognitive-motor impulsivity, controlled for general level of performance.

Categorical data were compared using Chi^2 tests (with continuity correction) with 2x2 tables for group membership and binary categorical variables. All tests were two-tailed, and criterion level of p was $\leq .05$. Further analyses involved regression of all the variables that differed significantly between the groups with $p \leq 0.1$. Independent variables were entered stepwise, using a probability of F to enter at ≤ 0.05 and a probability of F to remove at ≥ 0.10. The dependent variable was the presence or absence of past self-harm.

2.5 Prospective follow-up

All 87 participants were followed-up via searches of their on-line medical records. Data were collected on acts of self-harm that had required medical attention in the three month period starting when they participated in the last research interview. This involved all available clinical correspondence in the three month period and additional secondary automated text searchers for the keywords (+wildcard) of 'self-harm*', 'mutilat*', 'overdose*', 'cut*' and 'suicid*'.

3. Results

Fifty-nine patients (68%) reported some form of past self-harm. Patients were dived into those with and those without past self-harm and the results are summarised in Table 1. The group that reported lifetime self-harm reported current higher levels of hopelessness, were more likely to be depressed than those without a history of self-harm, and were more likely to report a family history of self-harm. The self-harm group reported significantly higher levels of lifetime polysubstance abuse, trait impulsivity and had significantly higher estimated premorbid IQs than the group without a history of self-harm. There were no significant differences between the groups on the other neuropsychological measures or SANS/SAPS scores, global functioning or illness insight scores. The self-harm group, compared to the no self-harm group, were significantly more likely to have a family history of self-harm. However, there were no significant differences between groups for any of the other demographical variables collected (i.e. age, sex or education).

TABLE 1 About here

The data presented in Table 1 were used to indentify candidate variables for the regression analyses. The percentage of patients who had been intravenous drug users was not entered because despite being statistically significant at $p \leq 0.1$, the data overlapped with the polysubstance abuse variable, which was selected as it had a lower p value. The variables entered into the regression were therefore: family history of self-harm, depression, hopelessness, polysubstance abuse, estimated premorbid IQ, cognitive-motor impulsivity and trait impulsivity.

The results are shown in Table 2. Five variables were included in the final model, these were estimated premorbid IQ, depression, polysubstance abuse, family history of self-harm and trait impulsivity. Of these five, three were independently associated with the occurrence of past self-harm; current depression (p=0.019), estimated premorbid IQ (p=0.011) and lifetime polysubstance abuse (p=0.017). People with current depression were more likely to have previously self-harmed. In addition, each increment in the estimated premorbid IQ and in the number of substances used was associated with an increased likelihood of self-harm.

TABLE 2 about here

SANS and SAPS total scores were not found to be related to self-harm, however, it is possible that specific symptom profiles would be. To explore this, we performed an additional logistic regression analysis entering all of the SANS and SAPS subscale scores as covariates and group membership as the dependent variable. None of the SANS or SAPS subscale scores were found to be significantly related to self-harm.

3.1 Prospective follow-up

Acts of self-harm were recorded in the records of 5 of the 87 original participants in the 3-month follow-up period. This indicates a 3-month incidence of approximately 5.7%. All 5 cases were classified at the original clinical interview as members of the group of 59 individuals with past histories of self-harm. However, due to the low power, this association is not statistically significant (Fisher's exact test, p=.173).

Those five who were known to have self-harmed in the follow-up period were compared to the 82 who were not known to have self-harmed. For this we used all the key variables identified in the retrospective analysis described above (i.e. those independent variables with $p \leq 0.1$ in Table 1). The only factor with a statistically significant difference between groups was the presence of depression (Fischer's exact test, $p=.046$). Four of the five patients (80%) who self-harmed during the follow-up period had been categorised as depressed at the original research interview. This compares to those who were not known to have self-harmed in the follow-up period, of whom only 26/82 (32%) were categorised as depressed at the original research interview.

4. Discussion

We found a high rate of self-harm in our sample of people with schizophrenia. Using a wide definition [21] that includes any self-poisoning or non-fatal behaviour intended to cause self-harm, we found that over two thirds of our sample reported such past behaviour. It has been estimated that the prevalence of self-harm in nonclinical populations is between about 4% [26] and 11% [21]. Our finding of a prevalence of 68% highlights the seriousness of this medically dangerous aspect of schizophrenia.

Patients with self-harm were more likely to report a family history of self-harm. Furthermore, those in our sample with past self-harm were more likely to be depressed than those with no history of self-harm. This in itself is not surprising; self-harm has been clearly linked to negative mood, including depression in general [15], and to the occurrence of self-harm in schizophrenia, including completed suicide [9, 31]. In addition, reported levels of hopelessness were also raised in those of our sample who had self-harm histories. Again, this is not surprising as hopelessness underlies a range of psychiatric disorders and be a direct risk for self-harm [8], particularly in those who suffer from depression [8] and has been linked to suicide among people with schizophrenia [46].

Neither positive nor negative symptoms were linked to self-harm. This seems to imply that self-harm occurs relatively independently of the core features of schizophrenia. However, self-harm was found to be closely linked to depressive symptomology. It may be that depression occurs in schizophrenia independently of the classical positive and negative symptom profiles [27]. If this is correct, then the

prevention of self-harm in schizophrenia will not be well addressed by treating only the core symptoms of the disease.

In the literature on suicide by psychiatric patients in general, personality disorder is a significant risk factor [30]. One study of self-harm by patients presenting to a general hospital found that 46% had personality disorders, 92% had psychiatric disorders and comorbidity of the two was 44% [19]. Indeed, DSM-IV axis I and II comorbidity conveys a significant risk of suicide, and overall the presence of a DSM-IV personality disorder conveys a seven fold risk of suicide [44]. This is less of an issue in individuals with schizophrenia, in which suicide is not as closely linked to either personality or psychiatric comorbidity [31]. For the sake of brevity Axis-II disorders were not studied in this research. Nevertheless, our observed high rate of self-harm indicates that personality disorder may be a factor and perhaps should be considered in future research.

Our findings partially support the past observations that individuals with schizophrenia and self-harm history have relatively preserved neuropsychological functions [33]. In our study self-harm was associated with relatively higher premorbid IQ, but not with other measures of cognitive function. However, other researchers have failed to find such associations. In one study, suicide attempters with schizophrenia did not differ significantly from non-attempters on a range of neurocognitive measures, and in fact were significantly worse at inhibitory control [7].

It is of particular interest that high premorbid IQ may be linked to self-harm in schizophrenia, as the converse is found in other samples selected solely on the occurrence of self-harm. In such groups, it is low premorbid cognitive function that is usually associated with self-harm. For example, studies of military conscripts in Denmark and Sweden have shown that low cognitive function at enlistment is predictive of later life suicide and self-harm [25, 38]. Furthermore, an Australian study has shown that lower actual IQ at age 14 predicts suicide thoughts, plans and attempts at age 21 [3].

We suggest that the reason premorbid IQ is linked to self-harm in schizophrenia maybe that those with high IQ premorbidly experience a greater sense of personal decline. There may be a greater mismatch between the earlier life aspirations and current lifestyles in those patients with higher premorbid IQ, which could drive self-harm behaviour. Support for this comes from the finding that completed suicide is associated with higher educational achievement of people with psychiatric illness in general [2, 30] as well as those with schizophrenia [42]. Furthermore, illness insight is itself closely linked to preserved cognitive function in schizophrenia [12]. Higher premorbid IQ may therefore have a protective effect on awareness of impairment, which is also linked to self-harm [45].

The result of the regression analysis was the identification of three main factors; these were the presence of current depression, lifetime polysubstance abuse and relatively high premorbid IQ. While the Odds Ratio for premorbid IQ is close to 1, each unit increase in IQ score is associated with a 6% increase in the risk of self-harm. IQ is a scale measurement with an estimated population mean set at 100, so each increment is

relatively small; however, the increased risk of self-harm across a wider range of scores (e.g., a ten-point difference in IQ) is correspondingly higher (e.g., 60%).

The current design is primarily a cross-sectional study, and only included a minor longitudinal aspect. This is a limitation. In particular, it should be noted that those who were eligible to be included in the study may have been different to those who are no longer in the local population of patients. Individuals in the catchment area who had completed suicide, for example, would not feature in the data set. Indeed, suicide is most common shortly after first contact with psychiatric services, both for psychiatric patients in general [36], and for those with schizophrenia [39]. This may limit the generalisability of our findings. In contrast, a common criticism of medical research is that it often does not present results that are directly of use to those working with patients. This is often caused by reporting on samples that are not representative of the patients seen day-to-day [43]. However, cross sectional studies such as this do in fact present a relatively realistic sample of the patients which will be seen in the clinic. An example of this is that the male:female ratio in our sample was 9:1, despite the global incidence rate of schizophrenia amongst males and females being around 1.4:1 [32]. However, remission of schizophrenia is much more common in women [17], consequently, there are in fact far more male than female schizophrenic individuals in contact with psychiatric services.

All patients were followed up by analysis of their medical records for three months. There were five cases of self-harm recorded as requiring medical attention in the follow-up period. Past history of self-harm was 100% accurate at predicting these events, highlighting the clinical significance that should be placed on self-harm

history in people with schizophrenia. We also found that depression was a statistically significant predictor of future self-harm.

The size of the group studied was based on a sample size estimation for the retrospective part of the research. The prospective follow-up found self-harm in only 5 of the original 87 group members. This therefore limits interpretation of the results. Nevertheless, the analysis based on retrospective allocation to groups was sufficiently powered and was able to identify lifetime polysubstance abuse, premorbid IQ and current depression as independent risk factors for the occurrence of self-harm.

An alternative explanation for our findings of self-harm being particularly linked to depression could be made. It could be argued that those individuals who were depressed were more likely to recall past self-harm than those who were not depressed, irrespective of the actual true past history of self-harm. In this case depressive cognitions would distort the allocation to either the past self-harm or no self-harm groups. A related issue is that higher premorbid IQ could be linked to better recall of past self-harm (irrespective of true self-harm history). Again, this could distort the statistical allocation of individuals to groups. Thus, our findings should be interpreted cautiously as it is a mainly a retrospective design, susceptible to sampling bias. Nevertheless, our prospective follow-up data show that current depression predicts future self-harm, which accords with previous prospective research showing that depression strongly predicts later suicide plans and attempts [9].

5. Conclusion

This study indicates the clinical importance of three factors identified as being independently linked to self-harm: lifetime polysubstance abuse, high premorbid IQ and current depression. Of these, depression is of particular interest for psychiatrists working with patients as it was also predictive of future self-harm. Self-harm among patients with schizophrenia should be considered as an ongoing high risk rather than being exceptional. Clinicians treating individuals with schizophrenia should be aware of the signs that are significantly associated with risk of self-harm. An individual history of polysubstance abuse and high premorbid cognitive function imply that these patients are at increased risk of self-harm. In addition, depressive symptoms are a clear sign of self-harm risk and our data suggest that they are more indicative of risk than the core symptoms of the disease. It would be advisable therefore that those professionals who assess risk and treat patients with schizophrenia concentrate on the factors that we have identified, in particular the mood state of patients.

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Table 1

Table 1. Comparison between schizophrenia patients with, and without, past self-harm for demographic, clinical and neuropsychological variables

Variable	Self-harm	No Self-harm	Significance
Demographic			
Age	40.1 (11.0)	39.3 (12.7)	F=.10, p=.75
Male	53 (90%)	25 (89%)	χ^2=.01, p=1.0
Education	11.3 (2.3)	11.8 (2.7)	Z=-.61, p=.11
Family history of self-harm	21 (36%)	3 (11%)	χ^2=4.7, p=.03
Clinical			
Duration of illness	17.6 (1.5)	15.4 (2.3)	F=.67, p=.42
GAFS	44.5 (14.0)	49.3 (10.7)	Z=-1.6, p=.11
SANS	8.6 ()	8.4 ()	F=.05, p=.81
SAPS	6.0 (2.9)	5.5 (3.4)	Z=-.84, p=.40
SAI	8.1 (3.5)	7.4 (4.0)	F=.56, p=.46
CDS	27 (46%)	3 (11%)	χ^2=8.83, p<.01
BHS	10.4 (5.6)	6.3 (4.3)	F=12.03, p<.01
Injected drugs	12 (20%)	1 (4%)	χ^2=2.9, p=.08
Polysubstance	3.4 (2.9)	1.6 (2.1)	Z=-2.89, p<.01
Neuropsychological			
NART IQ	99.5 (15.5)	90.0 (13.0)	F=7.34, p<.01
TMT	115.6 (111.2)	185.2 (192.2)	Z=-1.65, p=.10
CPT d’	3.7 (1.1)	3.5 (1.4)	F=.65, p=.42
Go/No-Go	40.0 (21.1)	31.5 (19.5)	F=2.92, p=.09

BIS-11	77.4 (11.6)	70.1 (10.7)	F=7.97, p<.01

For the past self-harm group, n=59, for the no self-harm group, n=28. Age, education and duration of illness are given in years. GAFS=Global Assessment of Function Scale, SANS=Scale for the Assessment of Negative Symptoms, SAPS=Scale for the Assessment of Positive Symptoms, SAI=Schedule for the Assessment of Insight, CDS=Calgary Depression Scale, BHS=Beck Hopelessness Scale. Polysubstance is the total number of classes of illicit drugs ever used. TMT=Trail Making Test, trails B-A in seconds is shown. CPT=Continuous Performance Test, the d' statistic from a signal detection analysis is given. For the Go/No-Go task the proportion of all errors that were commissions is shown. BIS-11=Barratt Impulsiveness Scale. For continuous data the mean total score + (SD) is shown, with ANOVA F values if normally distributed and Mann-Whitney Z scores if not. For the nominal 'yes-no' variables (male, family history of self-harm, CDS positive for depression, ever injected drugs), the actual number and percentage positive for the feature is given with the continuity correction of the Chi^2 statistic.

Table 2

Table 2. Results of the stepwise logistic regression analyses to identify predictors of previous self-harm

Variables included in final model (reference category)	Self-harm	No Self-harm	Odds ratio (95% Confidence Interval)	p-value
Estimated Premorbid IQ	99.5 (15.5)	90.0 (13.0)	1.06 (1.01,1.10)	0.011
Depressed (No)	27 (46%)	3 (11%)	7.04 (1.37,36.20)	0.019
Polysubstance abuse	3.4 (2.9)	1.6 (2.1)	1.40 (1.06,1.86)	0.017
Family history of self-harm (No)	21 (36%)	3 (11%)	3.83 (0.75,19.69)	0.108
Trait Impulsivity	77.4 (11.6)	70.1 (10.7)	1.06 (1.00,1.13)	0.065

For category variables, the actual number in the sample (+%) is shown. For continuous variables the mean (+SD) is given.

Cover Letter

Dr Gary Donohoe

email: gary.donohoe@tcd.ie

Tel: +353 1 896 2467

Fax: +353 1 896 3405

Department of Psychiatry,

Trinity Centre for Health Sciences,

St. James Hospital,

James's Street,

Dublin 8

Ireland

Professor Keith Hawton

Email: keith.hawton@psych.ox.ac.uk

Tel: +44 (0)1865 738585

Fax: + 44 (0)1865 793101

Centre for Suicide Research

University of Oxford

Department of Psychiatry

Warneford Hospital

Headington

Oxford

OX3 7JX

United Kingdom

Dr Herbert Fliege

Email: herbert.fliege@charite.de

Tel: 450-553002

Fax: 450-553900

Address:

Department of Psychosomatic Medicine and Psychotherapy

Charité Universitätsmedizin

Berlin

Germany