Clinical Predictors of Completed Suicide and Repeated Self-Poisoning in 8895 Self-Poisoning Patients

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Summary. The diagnoses of 8895 patients who were admitted for intentional self-poisoning with psychoactive drugs were studied in order to find predictors for subsequent completed suicide and repeated self-poisoning. Automated record linkage by means of the Swedish personal identification numbers was performed between the Stockholm County inpatient registry and the cause-of-death registry. With Cox regression models, several diagnostic predictors were identified although they were generally unspecific and insensitive. This may be due both to the low base rate of suicides, and to the omission of other more powerful non-clinical predictors, such as personality traits, hopelessness and social disruption. It is concluded that secondary psychiatric prevention may still be justified, although it will be applied to large numbers of patients who will not eventually commit suicide or repeat self-poisoning.

Key words: Self-poisoning – Suicide prediction – Record linkage – Secondary prevention

For the last 10 years, there have been 1600–1800 annual admissions in Stockholm County due to intentional drug self-poisoning. The aim of this study was to identify high-risk cases for subsequent completed suicide or repeated self-poisoning with psychoactive drugs by exploring clinical data available to the physician in charge.

Background

In the United Kingdom, 3 out of 1000 patients in general practice poison themselves with prescribed

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psychoactive drugs within a year (Skegg et al. 1983). Self-poisoners make up 5%–9% of emergency room and intensive care admissions (Vedin et al. 1972; Stern et al. 1984). Repeated self-poisoning occurs in 19%–29% (Vedin et al. 1972; Platt et al. 1988; Sundqvist-Stensman 1988). The rate of completed suicide following parasuicide with drugs or other means remains at 1%–2% annually, in spite of psychiatric support (Dahlgren 1945; Schmidt et al. 1954; Jansson 1962; Retterstöl 1970; Ettlinger 1978; Sundqvist-Stensman 1988).

Self-poisoning patients often have a prior self-destructive history, alcohol problems, depression or personality disorders, although 20%–25% are estimated to have no psychiatric illness (Kessel 1971; Stern et al. 1984). The majority of self-poisonings are not intended to lead to death (Kessel 1971). In two-thirds of the cases the act is impulsive, often triggered by a quarrel or lack of support from a key relative (Kessel 1971). Cynicism, resentfulness and being easily angered are character traits in self-poisoners, indicating high levels of hostility, directed both inwardly and outwardly (Farmer and Creed 1989). Among social factors, unemployment and overcrowding, crime, debts and divorce have been shown to be common among self-poisoners in the Edinburgh area (Holding et al. 1977; Kreitman and Casey 1988).

Repeaters exhibit antisocial personality, organic brain disorder, have previous suicide attempts and are alone (Bagley and Greer 1971; Kessel 1971).

The benzodiazepines are most commonly prescribed and most commonly ingested in self-poisoning in the United States, but account for very few deaths (Finkle et al. 1979). Most lethal cases in the United States today are due to tricyclic drugs (Litovitz and Veltri 1985), yet they account for only 9% of the drugs used in the Edinburgh area (Platt et al. 1988). An increase in salicylate and paracetamol poisoning has

been noted in England, accounting for 51% of self-poisonings in Oxford (Platt et al. 1988).

A 2-year follow-up of 1263 suicide attempters had little predictive power (Pallis et al. 1984). Extrapolated to the total British population, the optimal cutting line of this group's scale was able to identify correctly 788 prospective suicide cases, but misclassied 26000 other attempters as high-risk cases. The predictive power was low also in a sample of psychiatric patients with affective disorder (Clark et al. 1987). The low sensitivity and specificity of suicide prediction is basically due to the low base rate of suicides, even in high-risk populations (Murphy 1983; Bürk et al. 1985; Allebeck et al. 1988).

The principal aim of the current study was to identify clinical diagnoses of high-risk cases, to be at hand for the physician in charge of a self-poisoning patient. We hypothesized that the major risks were attached to substance abuse and personality disorders, in particular among women (Bagley and Greer 1971; Allgulander et al. 1987). Serious somatic illness with concomitant depression and hopelessness could be conducive to completed suicide in self-poisoning patients (Wetzel 1976; Louhivuori and Hakama 1979; Rorsman et al. 1982; Ebrahim et al. 1987). The type of drug used for self-poisoning was not expected to have predictive power with respect to subsequent suicide. Repeated admission for self-poisoning was also to be expected among those with substance abuse and personality disorder (Kessel 1971).

Materials and Methods

The population of Stockholm County is 1.5 million, with a flux of 5%–6% per year. All diagnoses among all inhabitants discharged from somatic and psychiatric inpatient care have been kept in computer files since 1969. Exempted are only one private hospital and municipal alcoholic units which admit only non-medical cases of drunkenness overnight. By means of individual ten-digit identification numbers, all persons in the county are accurately identified for the purpose of adding diagnoses, or combining with other person-based data sources, with negligible errors in programming (Allgulander, in press).

Between 1969 and 1985, there were 20674 admissions for intentional psychoactive drug self-poisoning (83% of all intentional drug self-poisonings), identified by their ICD diagnoses (E950, E980) and pharmaceutical code numbers (Fig. 1). An E-code was missing in less than 2% of all cases registered. By limiting the analysis to identifiable prescribed psychoactive drugs, the bias of erroneous ingestions and misclassification was minimized. Another reason for excluding non-psychoactive drugs was that they have little bearing on preventive aspects, such as regulating the availability of substances.

All subsequent suicides among these cases up to December 1985 were identified by means of the personal identification numbers in the national cause-of-death registry as definite cases, or where the degree of intent could not be ascertained (ICD E950–959, E980–989). The latter group includes a substantial portion (about 75%) of real suicides on closer scrutiny
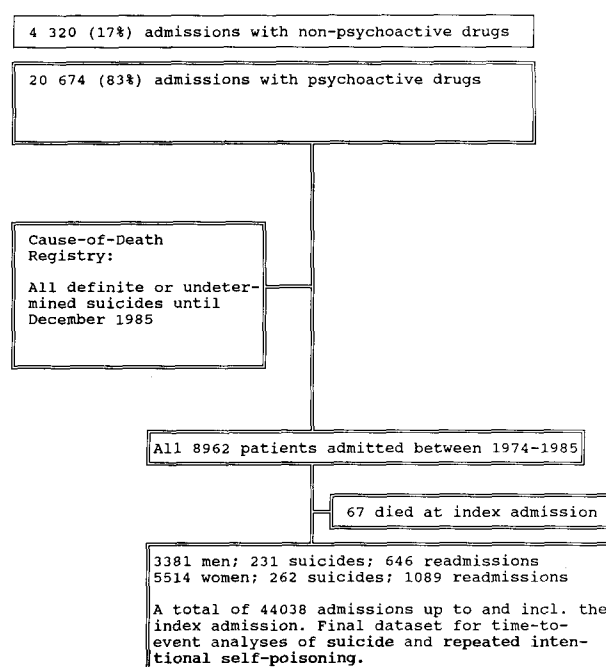

Fig. 1. All admissions with an ICD diagnosis of "overdose or wrong substance given or taken in error" (960–979) in Stockholm County 1969–1985, self-inflicted (E950–959), or undetermined whether accidentally or purposely inflicted (E980–989)

(Jacobsson, personal communication). The reliability of suicide diagnoses in Sweden is generally acceptable (de Faire et al. 1976).

A selection was made of the 8962 cases between 1974 and 1985. A new computer file was created containing all somatic and psychiatric diagnoses which were registered from 1969 for these patients, as well as the causes of death among those deceased. Of these, 67 (0.75%) died from their index poisoning. The drugs recorded in these fatal overdoses were barbiturates (7), neuroleptics (7), antidepressants (7), benzodiazepines (2) and others or combinations (44). The surviving 8895 cases became the final patient population for study (Fig. 1).

The end-points for study were completed suicide and repeated admission for self-poisoning, occurring up to the end of 1985. The file was analysed statistically to provide frequency distributions of all variables by subgroup and sex. To identify predictors of suicide and repeated self-poisoning, we used stepwise step-up Cox proportional hazards regression models (Kalbfleisch and Prentice 1980; Allgulander and Fisher 1986). The hazard function at each time is proportional to the probability of an event at that time, if one is alive at that time. For example, a flat hazard function means the risk of an event does not change with time.

Approvals were obtained from the Stockholm County Medical Health Care Administration in charge of the registry and from Statistics Sweden, thus meeting with current ethical practice for automated record linkage studies in Sweden.

Results

Of those 8895 cases surviving, 62% were women, 4.8% (262) of whom subsequently committed suicide,

Table 1. Frequency distribution by sex of baseline patient characteristics at the index admission for intentional self-poisoning

Patient characteristics at index admission	All cases		Subsequent suicides		Repeated self-poisoners	
	Men (n = 3381) %	Women (n = 5514) %	Men (n = 231) %	Women (n = 262) %	Men (n = 646) %	Women (n = 1089) %
Age (mean ± SD)	39 ± 15	39 ± 16	42 ± 15	44 ± 17	37 ± 13	38 ± 14
No. of hospital days (mean ± SD)	3 ± 8	4 ± 14	4 ± 10	8 ± 23	3 ± 8	4 ± 9
Prior suicide attempts	10.9	8.9	17.3	15.3	15.5	14.5
Psychiatric diagnoses						
Alcoholism	5.9	1.6	4.8	2.3	5.6	2.2
Neurotic/personality disorders	3.9	6.2	4.3	11.1	5.1	7.5
Street drug abuse	0.7	0.3	0.9	0.4	0.9	0.4
Prescription drug abuse	0.2	0.1	0.9	–	–	0.1
Psychosis	0.5	0.5	0.4	1.2	0.2	0.3
Schizophrenia	0.3	0.3	0.4	0.4	0.2	0.5
Affective disorder	0.4	0.8	0.9	2.3	0.5	0.7
Other psychiatric disorders	2.3	3.1	3.5	3.8	1.7	2.6
Any psychiatric diagnosis	13.9	12.3	14.7	20.2	13.3	13.6
Somatic diagnoses						
Cancer	0.4	0.4	0.9	0.4	0.3	0.3
Endocrine disorder	1.1	1.0	1.3	1.5	0.8	0.6
CNS disorder	1.0	0.7	1.3	2.3	1.4	0.6
Ischaemic heart disease	0.4	0.3	–	0.8	0.2	0.3
Stroke	0.3	0.3	–	0.4	0.2	0.4
Other somatic diagnoses	3.4	3.0	4.3	2.7	2.6	2.3
Any somatic diagnoses	5.8	4.9	6.9	7.3	4.6	3.6
Type of drug used						
Sedative-hypnotic	67.8	68.8	69.3	70.6	68.6	67.4
Neuroleptic	14.3	15.3	13.0	19.1	10.4	16.1
Antidepressant	6.8	8.4	8.2	7.3	8.1	9.6
Psychoactive + alcohol	11.2	7.5	9.5	3.1	13.0	6.9

Percentage given except where noted for age and number of inpatient hospital days

Table 2. Patient characteristics at index admission by sex, predictive of suicide, either univariately or in the final model from a step-up Cox analysis

Patient diagnoses and age	Univariate P value	Multivariate P value	Relative risk	95% Confidence interval
Women (n = 5514; 262 suicides)				
Age (risk per additional year)	<0.0001	<0.0001	1.021	(1.014–1.028)
Prior suicide attempt	0.0001	<0.0001	2.1	(1.5–2.9)
Neurotic/personality disorder	0.0032	0.0049	1.7	(1.2–2.6)
Affective disorder	0.0016	0.0213	2.6	(1.2–5.9)
Drug + alcohol self-poisoning	0.0069	0.0114	0.4	(0.2–0.8)
>1 month care at index admission	<0.0001	0.0108	1.17	(1.04–1.31)
CNS disease	0.0002			
Cardiac disease	0.0296			
Men (n = 3381; 231 suicides)				
Age (risk per additional year)	<0.0001	<0.0001	1.018	(1.010–1.027)
Prior suicide attempt	0.0006	0.0006	1.8	(1.3–2.6)
Prescription drug abuse	0.0004	0.0062	7.1	(1.7–28.6)
Cancer	0.0545			
>1 month care at index admission	0.0090			

and 20% (1089) of whom were readmitted for self-poisoning. Among the men, 6.8% (231) committed suicide during the follow-up period, and 19% (646) repeated the self-poisoning act. The mean follow-up period was 6 years (± 3.2 SD).

The median number of admissions up to the index admission was two among both men and women (range 0–65 and 0–71). The most common diagnoses among women were neurotic/personality disorders (Table 1). Among the men, alcoholism was the most frequent diagnosis, followed by neurotic/personality disorders. There were no prior psychiatric diagnoses in 88% of those up to 50 years of age, and in 84% of those older. Prior somatic diagnoses had not been made in 97% of those up to 50 years of age, and in 86% of those older. Of the suicide cases, 76% had no prior inpatient diagnoses at all up to their index admission. Two-thirds of the index self-poisonings were by means of sedative-hypnotic drugs, including the benzodiazepines.

The regression models for suicide in women yielded significant associations in the final multivariate model with increasing age, and with relative risks of 2.6 for affective disorder, 2.1 for prior suicide attempt(s) and 1.7 for neurotic/personality disorders (Table 2). Having used psychoactive drugs plus alcohol for the index

Fig. 2. Suicide hazard estimates. The hazard estimate is in 1-year intervals and is 10,000 times suicides/day. Total (+) and high-risk (—■—) group

self-poisoning reduced the risk of subsequent suicide somewhat, while a need for lengthier treatment increased the risk marginally. CNS and cardiac disease did not yield significant risks in the final model.

An idea of the predictive power of the model is given by constructing quintiles of the Cox model risk for those cases experiencing the end-point. If all women in the risk category are then analysed for end-point — in this case suicide — the estimated proportions committing suicide during the first 8 years for the quintiles (from low to high risk) were 2.6%, 3.5%, 7.0%, 7.3% and 9.7%.

In the final Cox model for suicide in men, prescription drug abuse was the diagnosis carrying the greatest relative risk of 7.1, but with a wide confidence interval (Table 2). Prior suicide attempt(s) implied a relative risk of 1.8. The risk increased with age, but only univariate associations were found with cancer and lengthier treatment at the index admission. The proportions of the quintile risk groups for males committing suicide within 8 years were estimated as 4.5%, 6.2%, 7.2%, 8.1% and 11.6%.

The suicide hazard estimates of the total and high-risk groups are given in Fig. 2. The last high-risk point is based on four cases with a very broad confidence interval.

Both the specificity and sensitivity of the predictive diagnoses were unsatisfactory, most probably owing to the low base rate of suicides. At least one of the suicide-predictive diagnoses was found in 27% of the women who committed suicide compared with 15% of the women who did not. At least one such diagnosis in men was found in 19% of the men who committed suicide compared with 11% of those men who did not.

In the Cox models for repeated self-poisoning, the women with a prior suicide attempt and a lower age at the index admission were at greatest risk (Table 3). Among the men, CNS disease and prior suicide attempts increased the risk for repeated self-poisoning, while lower age and neuroleptic drug overdose reduced the risk.
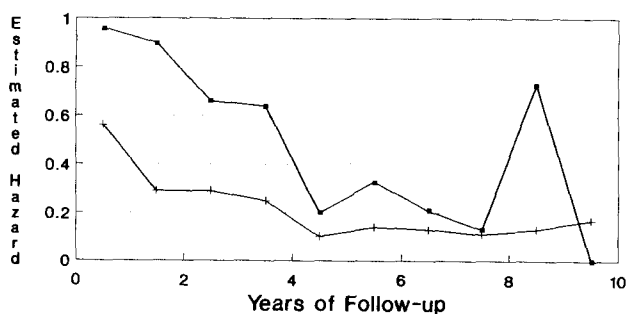
Table 3. Patient characteristics at index admission by sex, predictive of repeated self-poisoning, either univariately, or in the final model from a step-up Cox analysis

| Patient diagnoses and age	Univariate P value	Multivariate P value	Relative risk	95% Confidence interval
Women (n = 5514; 1089 readmissions)				
Age (risk per additional year)	0.0018	0.0025	0.994	(0.990–0.998)
Prior suicide attempt	<0.0001	<0.0001	1.9	(1.6–2.3)
Men (n = 3381; 646 readmissions)				
Age (risk per additional year)	<0.0001	<0.0001	0.988	(0.982–0.993)
Prior suicide attempt	<0.0001	<0.0001	1.6	(1.3–2.0)
Neuroleptic drug poisoning	0.0047	0.0023	0.7	(0.5–0.9)
CNS disease	0.1625	0.0380	2.0	(1.0–3.9)

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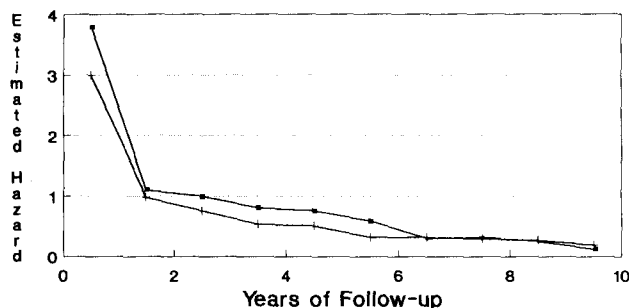
Fig. 3. Reintoxification hazard estimates. The hazard estimate is in 1-year intervals and is 10,000 times reintoxifications/day. Total (+) and high-risk (—■—) group

The repeated self-poisoning hazard estimates of the total and high-risk groups are given in Fig. 3. The hazard curves follow each other closely.

The specificity and sensitivity of the diagnoses predictive of repeated self-poisoning were lower for men than for women. At least one such diagnosis was found in 14.5% of the women who repeated the act of self-poisoning, compared with 7.6% of those women who did not. At least one such diagnosis was found in 86.5% of the male repeaters, compared with 90.7% of those men who did not repeat.

Discussion

The large number of patients in this study did not have the uniformity of diagnoses of a prospectively designed single institution study with carefully collected data. There was also an approximation in defining suicides to include some cases where the death may have been unintentional. The rate of readmission for self-poisoning was in keeping with other studies; this supports external validity, as did also the rate of subsequent suicide. The immediate mortality for those admitted alive was below 1%, in keeping with the Stockholm records (Thorstrand 1965). Kessel (1971) found no history of psychiatric illness in 26% of the men and 20% of the women, and Platt et al. (1988) no previous psychiatric treatment in about 40%. Since our lower rates came from inpatient diagnoses only, the discrepancy may be related to severity and availability of beds. The risk factors for completed suicide are generally in keeping with the findings by Hawton and Fagg (1988).

Life-table plots of different risk groups showed that the proportional-hazards assumptions were reasonable. Cox runs inserting interaction variables of age with the variables that entered the model did not have the interaction terms enter the model. Thus, we conclude that age was adequately dealt with as an independent explanatory variable.

To elucidate the strength of the E-code intent ratings, we ran models for 5390 patients including also those with no such E-code. We found a higher rate of prior inpatient treatment, in particular for substance abuse, and more somatic diagnoses conducive to suicide. We concluded that substance abusers more often are admitted intoxicated with both drugs and alcohol, but without ascertained suicidal intent. We also found that there were some spurious associations with drug adverse effects which had occurred in patients with somatic diseases. Excluding the cases rated as unintentional thus produced a more homogeneous population.

Neither psychoses nor alcoholism were predictive of any of the end-points. Affective disorders were predictive of suicide in women in keeping with the generally increased risk for suicide in affective disorder. The male prescription drug abusers were at risk for suicide, although there were only five men (0.2%) with such a diagnosis at baseline. This illustrates the self-destructive drive, or "chronic suicide", of addiction-prone prescription drug abusers, probably related to the severe underlying psychopathology (Allgulander et al. 1987). Traditional psychiatric treatment may be of little value for these patients (Bagley and Greer 1971; Urwin and Gibbons 1979). Alcoholism, although the most common diagnosis among the men, was not predictive. Among those frequently seen in the emergency room with an overdose, alcoholics did not have an increased risk. As in numerous other studies, prior suicide attempts were highly predictive of completed suicide and repeated self-poisoning in women and in men.

Men with cancer admitted with self-poisoning may be at some risk for suicide, which has also been indicated in a previous analysis (Louhivuori and Hakama 1979). It may be appropriate to assess men with potentially fatal disease who perform such acts for psychological support. The association with CNS disease and repeated self-poisoning among 33 men is less clearly explained; one would have to look at the types of diseases to formulate hypotheses about causation; with a P value of only 0.0380 another possibility is a chance occurrence (i.e. spurious finding), given the number of potential variables tested.

Neuroleptic overdose in men reduced the risk for a repeated overdose. Possibly the cognitive and other adverse effects of such an overdose may make such a patient refrain form a second attempt, or these patients are managed more carefully because of their psychotic disease.

The low risk of dying if admitted alive is notable. One may estimate that the risk for a lethal overdose among those admitted alive is 1% of 0.3% of the patients who receive prescriptions for psychoactive

drugs in primary care, i.e. 3 in 100000 treatments (Skegg et al. 1983). While 67 died in the hospital from their index self-poisoning, a total of 1403 persons died in Stockholm County from suicide with drugs or poisons, according to official statistics for this period. The risk of dying if not admitted appears to be substantial.

Since "only" 6% of the patients eventually died by suicide, our chances of finding useful predictors were small, as explained by Bayes' Theorem (Murphy 1983). The predictive diagnoses were found in only 23% of the suicide cases, as compared with 13% of those who did not commit subsequent suicide. Less than one in five of the suicide cases were identified as psychiatric cases at the time of the index self-poisoning. Thus, we failed to identify truly useful indicators for high-risk patients, as was the case with a recent field test (Clark et al. 1987). Our models for self-poisoning were not very useful either; only 14.5% of the women had at least one of the predictive diagnoses with low specificity, and there was no specificity among the men at all. Other dimensions than clinical diagnoses may more accurately reflect the prognosis, such as hostility (Farmer and Creed 1989), which in turn may be related to abnormal serotonin turnover (Roy and Linnoila 1988). One may also consider in this regard social disruption (Holding et al. 1977), chronic sleep disorder (Hawton and Fagg 1988), hopelessness (Wetzel 1976), and the threat of a potentially fatal disease (Ebrahim et al. 1987).

Primary prevention by proper prescribing is an immediate and effective means of reducing the rate of self-poisoning and subsequent hazards (Forster and Frost 1985; Platt et al. 1988). Secondary prevention remains ineffective for most patients, and is wasted on an overall majority of cases who will not repeat an attempt or commit suicide.

One may compare the preventative measures speculatively with the efforts to prevent cardiovascular morbidity with antihypertensive therapy. Although 20% of all Swedes of mature age receive such maintenance therapy, they can only count on a 20% reduction in hypertensive sequelae (Berglund et al. 1986). Deaths before age 65 years from ischaemic heart and cerebrovascular disease make up 5% of all deaths in Sweden. There is no scientific evidence for the risk reduction with antihypertensive drugs in women and men under 40 years of age or above 70. Considering the cost/benefit to society for such therapy (the drugs alone cost about 100 million dollars per year in Sweden), one could argue that more resources for measures to prevent suicide may be justified to eliminate some of the 2000 suicides annually in Sweden which constitue 2% of all deaths.

Conclusions

In our study of patients with self-poisoning, we identified several clinical predictors of subsequent suicide and repeated self-poisoning. Owing to the low rate of suicides, and possibly omission of more powerful non-clinical predictors, the diagnoses were generally unspecific and insensitive. Secondary psychiatric prevention may still be ethically motivated in high-risk cases, although efforts will be wasted on large numbers of patients who do not commit suicide or repeat the self-poisoning act. This is also true of many drugs used prophylactically, e.g. antihypertensive drugs.

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