Brit. J. Psychiat. (1967), **113**, 313-319

The Ecology of Suicidal Behaviour

By J. W. McCULLOCH, A. E. PHILIP and G. M. CARSTAIRS

For over a decade the Maudsley Monograph *Suicide in London* (Sainsbury, 1955) has been the most authoritative source of information about the contribution of certain social factors to the incidence of suicide in a British urban population. Sainsbury's investigation tested the hypothesis "that where social mobility and social isolation are pronounced, community life will be unstable, without order or purpose, and that this will be reflected to a greater or less degree in the suicide rates". Much of his work stems from the pioneer work of Durkheim (1897). Using a combination of sociological and psychiatric methods he correlated rates of suicide and indices of social characteristics for London Boroughs derived from a social survey, the 1931 Census and other studies (Burt, 1944). He found significant differences in suicide rates among the boroughs, which remained consistent over 30 years despite considerable changes in the composition of their populations. Comparing suicide rates with other social factors he found significant correlations with social isolation, social mobility, divorce and illegitimacy. He suggested that suicide tended to be higher in the middle class and to diminish with poverty, but found no correlation with unemployment and overcrowding. He stated that suicide rates increased with age, particularly among males, there being a preponderance of over 55 year olds in his sample. A seasonal variation was observed, with the peak incidence in May. In his sample there were twice as many men as women. Six per cent. of his group were definitely alcoholic. Nine per cent. had made a previous attempt at suicide. Almost half of the group were seen to be psychiatrically ill or abnormal in personality.

Subsequent investigations have accepted and drawn freely from Sainsbury's work (Lewis, 1956; Carstairs and Brown, 1958; Rook, 1959; Carstairs, 1961; Stengel and Cook, 1961; Kessel, 1962; Kessel and Lee 1962; Dublin, 1963; Gardner, Bahn and Mack, 1964; Walsh and McCarthy, 1965; Stengel, 1964).

While accepting most of Sainsbury's findings, Stengel (1964) added further associated variables. These were childlessness, high population density and broken homes.

In Edinburgh there has been much research into non-fatal suicidal behaviour resulting in admissions to the Poisoning Treatment Centre at the Royal Infirmary of Edinburgh. The psychiatric and medical characteristics of this population have been described by Kessel (1965), while a social follow-up study of 511 patients was reported by McCulloch (1965). A study by Philip and McCulloch (1966) showed that high rates for attempted suicide were positively associated with certain social indices, including juvenile delinquency, children taken in care, overcrowding, absences from school for reasons other than sickness, referrals to the R.S.S.P.C.C. and type of housing. Some of these variables had been noted by Sainsbury and Stengel. Kessel and McCulloch (1966) however, pointed out that those of the follow-up cohort who killed themselves differed in age and sex ratio from Sainsbury's sample. Up to the present time 20 of these 511 patients have killed themselves. This prompted us to re-examine the relationship between completed suicide and the social variables described in previous studies. To this end we considered 216 consecutive suicides occurring in Edinburgh during the years 1963 to 1965. We also looked again at the relationship between this group of people and those who indulged in suicidal behaviour which did not result in death.

Method

In the course of the follow-up study conducted by McCulloch (1965) access was obtained to an official register of death by suicide in the city

https://doi.org/10.1192/bjp.113.496.313 Published online by Cambridge University Press

of Edinburgh. These lists are still being perused in a continuing follow-up of McCulloch's cohort. All suicides which occurred in Edinburgh during the period January 1963 to December 1965 were noted and included in the present study. In this manner information was obtained on 216 persons. A limited number of facts were available for these persons; age, sex, date of death, method of suicide and address. We then checked the records of the Poisoning Treatment Centre to ascertain whether any of these suicides had, in the preceding 10 years, been admitted following an act of self-poisoning or self-injury. We could not of course, know about previous episodes leading to admission elsewhere or not leading to admission at all, nor could we ascertain the possible admissions to the Poisoning Treatment Centre of females who, because of marriage, changed their names. In consequence, our findings on this point will be a conservative estimate of the number of people who had made previous suicidal attempts. For the 20 suicides in the follow-up cohort much fuller information was available. An attempt was made to obtain as much information as possible about the social characteristics of each of the Electoral Wards which might be relevant to differences in suicide rates. It was found that rates of occurrence of 32 such variables could be ascertained (Table I) and these rates were severally compared with the suicide rates for each Ward.

TABLE I

Social Variables Used and Source of Information

Variables	Source
Overcrowding (over 1·5 persons per room)	All from 1961 Census
Owner occupier housing	
Council Housing	
Tenement Housing (unfurnished)	
Furnished Accommodation	
One person dwellings	
Density of population per acre	
Old age pensioners	
Visitors from outside Scotland	
Commonwealth and Irish residents	
Resident Aliens	
Divorced Persons	
Valuation assessment	All from Edinburgh Corporation Departments
Children taken into care	
Eviction notices	
Peace warnings	
Rent arrears	
School absences (not sickness)	
Infant Mortality	
Stillbirths	
Road Fatalities	
Road Accidents (persons)	
Road Accidents (place)	
Suicide	
Three indices of telephone vandalism	G.P.O., Edinburgh
Adolescent psychiatric referrals	Medical Research Council Unit for Research on the Epidemiology of Psychiatric Illness File
Adolescent self-poisoning and self-injury	
All ages self-poisoning and self-injury	
Repeat self-poisoning	
Juvenile delinquency	Jackson (1966)
Cruelty to children	R.S.S.P.C.C.

https://doi.org/10.1192/bjp.113.496.313 Published online by Cambridge University Press

It can be seen that, while our sources of data are similar to those available to Sainsbury, the range of social behaviours covered is more extensive. In a previous study (Philip and McCulloch, 1966) a method of clustering variables has been described. For this paper, however, it will suffice to use Spearman rho correlations to demonstrate the relationships between suicide and the social variables.

Results

Age and Sex Distribution

Of the 216 consecutive suicides, 104 were men and 112 were women, giving a male : female ratio of 0·93 : 1·0 and rates of 16 and 15 per 100,000 men and women respectively. The mean age of the men was 48·35 years (S.D. 14·23) and this did not differ significantly from that of the women which was 50·93 years (S.D. 16·25).

For each method there is no difference between the age distributions of the sexes as measured by the Kolmogorov-Smirnov test (Siegel, 1956). Drugs and coal gas poisoning were the main methods of suicide, drugs being slightly more common.

Since no differences in the sexes were observed for age distribution, and since the sex ratio was almost at parity, we felt free to treat the sample as a whole.

Age and Method

There is a significant relationship between age and method of suicide ($\chi^2=13\cdot62$, d.f.$=4$, $p<\cdot01$). Inspection of the table showed that people in the 15 to 34-year-old group used coal gas poisoning relatively more often and drugs less often than did the entire sample. The middle age group showed a reverse pattern with fewer gassings and more death by drugs. The old people showed no excess of any one method over any other.

Previous Episodes

There were 53 persons known to have had a previous episode of suicidal behaviour. They form 24·5 per cent. of the total sample.

Table IV shows that there is no difference in method used by those who had a previous episode compared with the rest of the group.

Table II

Age, Sex and Method of Suicide

Method	Sex	*Cumulative Age Distribution*							
		15–24	25–34	35–44	45–54	55–64	65–74	75–84	85–94
Coal gas poisoning	M	3	11	17	27	35	39	41	41
	F	4	11	15	24	36	40	43	45
		(Kolmogorov-Smirnov D = ·125 ns)							
Drugs	M	2	5	19	38	46	51	51	51
	F	2	6	20	35	48	57	59	59
		(Kolmogorov-Smirnov D = ·152 ns)							
Other methods*	M	0	2	3	7	9	10	12	12
	F	2	2	2	4	6	8	8	8
		(Kolmogorov-Smirnov D = ·250 ns)							

* Other methods include Cutting (2M), Hanging (4M, 1F), Drowning (1M, 4F), Poison (1M, 1F), Polythene bag (1M, 1F), Jump (1M, 1F), Gunshot (1M) and Electrocution (1M).

https://doi.org/10.1192/bjp.113.496.313 Published online by Cambridge University Press

TABLE III

Relationship between Age and Method

		Age 15–34 fo	fe	35–54 fo	fe	55–94 fo	fe	
Method	Gas	22	14·73	29	39·02	35	32·25	(86)
	Drugs	11	18·84	62	49·91	37	41·25	(110)
	Other	4	3·43	7	9·07	9	7·5	(20)
		(37)		(98)		(81)		(216)

$\chi^2 = 13 \cdot 62$ d.f. $= 4$, $p < \cdot 01$

TABLE IV

Relationship between Method and Known Previous Episodes of Self-Poisoning

	People having had a previous episode	People having had no previous episode	
Gas ..	18	68	(86)
Drugs ..	31	79	(110)
Other ..	4	16	(20)
	(53)	(163)	(216)
Per cent. of Total	24·5	75·5	100·0

$\chi^2 = 1 \cdot 48$, d.f. $= 2$, ns.

Seasonal Distribution

There are two months of peak incidence, April and November. These months between them yielded 25 per cent. of the annual total.

TABLE V

Seasonal Distribution of Suicides for both Sexes

	No. of cases	Percentage
January	21	9·72
February	19	8·79
March	16	7·41
April	30	13·89
May	18	8·33
June	10	4·63
July	12	5·55
August	14	6·48
September	16	7·41
October	19	8·79
November	26	12·03
December	15	6·94
	216	99·97

Relationships with Other Social Variables

When the rates for suicide in the Wards were compared with the rates for the other 32 social variables considered, 12 of the Spearman rho correlations were significant. These variables are shown in Table VI.

TABLE VI

Significant Correlations between Suicide and Other Social Variables based on City Ward Rates

		Spearman Rho
Significant correlations ($p < \cdot 05$)		
High suicide rate and:	High density of population	·507
	Many children in care	·523
	Many school absences	·503
	Many tenement houses (private unfurnished)	·487
	Few owner-occupied houses	·418
High, significant correlations ($p < \cdot 01$)		
High suicide rate and:	High rate of divorced persons	·687
	Low rate of adolescent psychiatric referral	·612
	High rate of juvenile delinquency	·606
	Many R.S.S.P.C.C. referrals	·594
	High rate of adolescent self-poisoning and self-injury	·576
Very high, significant correlations ($p < \cdot 001$)		
High suicide rate and:	Much overcrowding	·725
	High rate of all cases of self-poisoning and self-injury	·709

https://doi.org/10.1192/bjp.113.496.313 Published online by Cambridge University Press

Discussion

We have found approximately equal numbers of men and women in our survey, a finding which is at variance with figures quoted by Sainsbury (1955) and others (Carstairs and Brown, 1958; Stengel, 1964). Stengel has demonstrated that the rate for females has increased steadily since 1951 while the male rate has remained relatively constant. Indeed he reports that in recent years females have been in the majority among the suicides in several English cities. The change in rates has also been commented on in a report of the U.S. Department of Health, Education and Welfare (1965) entitled, *Changes in Mortality Trends in England and Wales, 1931-1961*. Perhaps our figures, covering as they do the period 1963-1965, can be explained as a continuation of this trend.

Authors are generally agreed that the incidence of suicide increases with increasing age. Farberow and Shneidman (1961) report a modal age of 42 years for both sexes, but add that for each decade after 50 years the rate increases. Carstairs and Brown (1958) reported that the majority of their suicides were over the age of 45 years, and they quote evidence for an increasing incidence of suicide with age in many cultures. Stengel's statement (1964) that the average age for his group was the late fifties is at odds with both Farberow and Shneidman (1961) and the present study.

As in all analyses of statistics of suicide a primary consideration must be to examine the possibility that the findings may be biased by systematic errors of reporting.

It is probably impossible to find any society in which suicides are recorded with 100 per cent. accuracy. The records on which our study is based are those compiled by the local authority Department of Public Health. We believe them to be as complete a record of suicides in this population as is currently obtainable, and we have been unable to detect any indication of age or sex bias in their compilation. Our confidence in their completeness has been strengthened by the following indirect evidence. Using the separate bodies of data available for suicides and for those patients admitted to the Poisoning Treatment Centre and followed up by McCulloch (1965), Kreitman (1966) attempted to assess the accuracy of the figures reported in this paper. We have shown in Table IV that 24·5 per cent. of our cases had a history of a previous suicidal attempt. McCulloch (1965) has shown that there were 8, 5 and 4 completed suicides respectively for each of the first three years of follow-up. Kreitman suggested that if the intake to the Poisoning Treatment Centre remains constant in numbers and subsequent behaviour to that shown by McCulloch's group then, after three years and for each year thereafter, 17 of these patients will kill themselves. This figure represents 23·6 per cent. of the average number of suicides per year in the City. This hypothetical figure is remarkably similar to our observed figure of 24·5 per cent.

Ettlinger (1964) has shown that when follow-up studies on attempted suicide are carried out over lengthy periods, more suicide appears. McCulloch's (1965) study bears out this statement; 8 suicides in a group of 511 cases of self-poisoning and self-injury occurring by the end of one year and 20 by the end of 3½ years. Sainsbury's estimate that 9 per cent. of his suicides had had a previous episode is very low indeed.

Our seasonal distribution is essentially in agreement with that of Stengel (1964), although our incidence in autumn is somewhat greater.

The findings which we consider to be most important are those relating to the social correlates of suicide. As can be seen from Table VI the highest correlations with suicide are *overcrowding* and *acts of self-poisoning and self-injury*. Philip and McCulloch (1966) have shown that each of these two items form the nuclei of clusters of variables in which the other significant correlates in Table VI have a place. That is, in addition to being related to suicide, these variables are related to each other in an orderly way (McQuitty, 1957).

In Edinburgh, overcrowding is a feature of two kinds of area. One is a local authority scheme typified by four or six family blocks inhabited by immediate pre-war slum clearance and post-war resettlement tenants. The second area consists of densely populated ageing tenement dwellings in the old town of Edinburgh. It is in these same areas that the rates for

https://doi.org/10.1192/bjp.113.496.313 Published online by Cambridge University Press

attempted suicide are highest, both for single and for multiple episodes.

We suggest that there are two socially distinguishable groups of suicides. One group consists of persons relatively old, often divorced or widowed and commonly living alone in ageing tenement property. The younger group, living in new Council houses, are characterized by the following features. They have high rates of non-fatal suicidal behaviour which they often repeat, live in overcrowded conditions and have, as adolescents, low rates of psychiatric referral but high rates of juvenile delinquency. Their early life is spent in areas where grossly disturbed family settings are common, as shown by high rates of intervention by officers of the Royal Scottish Society for the Prevention of Cruelty to Children, by high rates for children taken into care and for absences from school for reasons other than sickness (Philip and McCulloch, 1966).

Disturbed home backgrounds have been found characteristically in the histories of delinquents and adults with severe personality disorders. Some of our suicides share the social attributes of patients admitted to the Poisoning Treatment Centre following acts of self-poisoning and self-injury. Kessel (1965) has shown these latter acts to be characterized by heavy drinking and impulsiveness. The 20 suicides about whom we have full information (McCulloch, 1965) were also characterized by impulsiveness and habituation to drink or drugs. The increased rates of suicide at younger ages, and especially for women, may therefore partly be attributable to a "spill-over" effect from the apparently sharp increase in attempted suicides in recent years to which the ready availability of drugs under the National Health Service has undoubtedly contributed (Kessel, 1965). Kessel has drawn attention to the steep rise since 1948 in the recourse to barbiturates and, since 1955, psychotropic drugs as agents for self-poisoning; half the suicides in the group here reported were killed by drugs.

It is customary in discussing suicide (or any other manifestations of social pathology) to cite the influence of changing social conditions—a concept easier to invoke in the abstract than to define in precise terms. The increased affluence of working class society and particularly of its younger members does appear to have been associated with an increase in drinking—perhaps especially noticeable in Scotland among young women who are no longer deterred by social taboos from entering drinking premises which were formerly a male preserve. Affluence of itself cannot, however, explain the incidence of suicide; we found no relationship between suicide rates and incidence of high socio-economic standing such as the proportion of owner-occupied houses in the several city wards.

It is tempting to ascribe the rising female suicide rate (which has some parallels in certain populations in a narrowing of the gap between male and female rates for lung cancer and coronary heart disease) to the changing role of women in our society (Carstairs, 1963), but in order to test this hypothesis we should have to demonstrate that "emancipated" women have contributed disproportionately to the rise in the female rates. One thing at least is clear; some of the demographic and social correlates which Sainsbury so convincingly demonstrated for suicides in London just over ten years ago do not appear to hold for Edinburgh in the 1960's.

Whether the differences are attributable to the lapse of time or to differences in personal and social circumstances in the metropolis and in the northern capital is a question which can be answered only by further investigation.

Summary

From official records it was ascertained that 216 persons had killed themselves in Edinburgh in the three years from 1963 to 1965. In the preceding 10 years, 53 of these suicides had had a previous episode of suicidal behaviour. We have presented the personal and social characteristics of our group of suicides, in so far as such data were available. These features are found to differ in some important respects from the findings on London suicides reported by Sainsbury (1955) whose work on the ecology of suicide is often quoted. Suicides in the present sample are shown to be drawn principally from two contrasting groups of the population of Edinburgh.

https://doi.org/10.1192/bjp.113.496.313 Published online by Cambridge University Press

Addendum

Since completing this paper we have seen the publication of a similar study of suicide in Dublin by McCarthy and Walsh (1966) who report that a scrutiny of the Coroners' Courts records for that city revealed twice as many suicides as are reported in the official suicide rates. Surprisingly, they pronounce themselves satisfied that this scrutiny yields an accurate final total, which is still much lower than that of other countries in Europe. They show excess rates (especially for men) in the over-60 age group, which contrasts with the lower mean ages found in our study; there is also a remarkable difference in the methods used in these two populations—the waters of the Liffey appear to exercise a greater attraction than do those of the Firth of Forth, and there appears to be much more recourse to drugs in Edinburgh. While these differences, together with the probability of a significantly lower overall rate in Dublin, point to cultural and environmental differences in the two cities, it is interesting to note that these workers also note a narrowing in the gap between the male and female rates, indicating an aspect of social change which both communities are experiencing.

References

Burt, C. (1944). *The Young Delinquent*, 4th ed. Bickley. Univ. London Press:

Carstairs, G. M. (1961). "Characteristics of the suicide prone." *Proc. Roy. Soc. Med.*, **54**, 262–264.

—— (1963). *This Island Now*. London: The Hogarth Press.

——, and Brown, G. W. (1958). "A census of psychiatric cases in two contrasting communities." *J. ment. Sci.*, **104**, 72–81.

Dublin, L. I. (1963). *Suicide: A Sociological and Statistical Study*. New York: The Ronald Press.

Durkheim, E. (1897). *Le Suicide*. Paris: Alcan.

Ettlinger, Ruth (1964). "Suicide in a group of patients who had previously attempted suicide." *Acta psychiat. Scand.*, **40**, 363–378.

Farberow, N. L., and Shneidman, E. S. (1961). *The Cry for Help*. New York: McGraw-Hill.

Gardner, E. A., Bahn, Anita K., and Mack, Marjorie (1964). "Suicide and psychiatric care in the aging." *Arch. gen. Psychiat.*, **10**, 547–553.

Jackson, N. (1966). Private communication.

Kessel, W. I. N. (1962). "Attempted suicide." *Med. World.*, Oct.

—— (1965). "Self-poisoning." *Brit. med. J.*, *ii*, 1265–1270: 1336–1340.

—— and Lee, Elizabeth McC. (1962). "Attempted suicide in Edinburgh." *Scot. med. J.*, **7**, 130–135.

—— and McCulloch, J. W. (1966). "Repeated acts of self-poisoning and self-injury." *Proc. Roy. Soc. Med.*, **59**, 89–92.

Kreitman, N. (1966). Personal communication.

Lewis, A. (1956). "Statistical aspects of suicide." *Can. med. Ass. J.*, **74**, 99–104.

McCarthy, P. D., and Walsh, D. (1966). "Suicide in Dublin." *Brit. med. J.*, *i*, 1393–1396.

McCulloch, J. W. (1965). *The Social Consequences of Acts of Deliberate Self-poisoning and Self-Injury*. Unpublished M.Sc. dissertation, Edin. Univ. Library.

McQuitty, L. L. (1957). "Elementary linkage analysis for isolating orthogonal and oblique types and typal relevancies." *Educ. psychol. Measmt.*, **17**, 207–229.

Philip, A. E., and McCulloch, J. W. (1966). "The use of social indices in psychiatric epidemiology." *Brit. J. prev. soc. Med.*, **20**, 122–126.

Rook, A. (1959). "Student suicides." *Brit. med. J.*, *i*, 599–603.

Sainsbury, P. (1955). *Suicide in London*. London: Chapman & Hall.

Siegel, S. (1956). *Nonparametric Statistics for the Behavioral Sciences*. New York: McGraw-Hill.

Stengel, E. (1964). *Suicide and Attempted Suicide*. Harmondsworth: Penguin.

—— and Cook, Nancy G. (1961). "Contrasting suicide rates in industrial communities." *J. ment. Sci.*, **107**, 1011–1019.

U.S. Department of Health, Education and Welfare (1965). *Changes in Mortality Trends: England and Wales 1931-1961*. U.S. Public Health Service:Washington.

Walsh, D., and McCarthy, P. D. (1965). "Suicide in Dublin's elderly." *Acta psychiat. Scand.*, **41**, 227–235.

J. W. McCulloch, M.Sc., A.A.P.S.W.

A. E. Philip, M.A., Dip.Clin. Psychol.

G. M. Carstairs, M.A., M.D., F.R.C.P.E., D.P.M.

The Medical Research Council Unit for Research on the Epidemiology of Psychiatric Illness, Edinburgh University Department of Psychiatry, Royal Edinburgh Hospital, Morningside Park, Edinburgh, 10

(*Received 6 June, 1966*)

https://doi.org/10.1192/bjp.113.496.313 Published online by Cambridge University Press