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LETHALITY OF SUICIDAL METHODS AND SUICIDE RISK: TWO DISTINCT CONCEPTS [1]

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ABSTRACT–Two objective measures of the lethality of 11 suicidal methods were defined: Mean Seriousness of suicidal incidents involving the method, and Probability of Death resulting from use of the method. The measures were found to be essentially interchangeable. Fourteen judges were asked to rank the same 11 methods according to the "probability of death resulting from use of the method in a suicide attempt." The judges' subjective estimates of lethality corresponded well with objective measures. The relationship between lethality and risk, or the probability of suicide at some future date, was examined. The two variables were clearly distinct. Rank correlation between lethality of, and risk associated with, the 11 suicidal methods was not significant. Moreover, when all incidents within a given lethality category were collapsed, and then risk associated with each lethality category evaluated, the most lethal attempts had a significantly lower risk of future suicide than the least lethal attempts.

In the suicide literature the term "lethality" originally referred to the deadliness of various suicidal methods (Tabachnick and Farberow, 1961). Over the years the concept was expanded to include the notion of suicidal potential, or "expected suicide risk based on past experience" (Litman, 1972). Such expansion of the concept was quite unfortunate, as it endowed this crucial term with a confusing dual meaning: a) the deadliness or relative seriousness of a particular past or present incident (cf., Tabachnick and Farberow, 1961; Worden and Sterling-Smith, 1972); b) the risk of suicide or self-injury at some future date (cf., Litman, 1972; Freeman, Wilson, Thigpen, and McGee, 1973).

The two meanings are not logically identical, nor are they empirically identical, as the present paper will show. In the pages to follow, use of the term "lethality" will be restricted to its original meaning of deadliness or seriousness of a particular suicidal incident. To refer to suicidal potential, the empirical probability of a subsequent suicide, the term "risk," rather than lethality, will be used.

Three questions form the scope of the present paper: a) Can an objective

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measure of the lethality of the most common suicidal methods be constructed? b) How do people's subjective estimate of lethality correspond with such objective measure? Do people in fact know the probability of death associated with the various suicidal methods? c) What is the relationship between the lethality of a past suicidal incident and risk of future suicide?

METHOD

The Data Base

The data to be discussed in the present paper include completed suicides occurring in Allegheny County, Pennsylvania, in the years 1966-1970, as well as suicidal attempts in the same area in the years 1969-1970. Attempts occurring outside the years 1969 and 1970 were included in the data base only if the individuals were already in our file, because of suicidal behavior in the covered years.

All data were collected second-hand, i.e., from the files of various health agencies in the County. The Coroner file was the main source of information on completed suicides; the Pittsburgh Police, various hospitals, and social service agencies provided information on suicide attempts. It is certain that many suicide attempts and even some completed suicides eluded our data gathering efforts, but there is no reason to believe that the data actually gathered are biased with respect to the variables to be analyzed here.

In all, 2729 cases made up the data base. Of these, 1039 had completed suicide; 1690 had attempted suicide at least once. Multiple suicidal incidents in the history of about 20% of the cases brought the number of attempt-incidents to 2442.

RESULTS

Objective Measures of Lethality

Eleven suicidal methods were scored for lethality. They were: Carbon Monoxide, Drowning, Hanging, Gas, Plastic Bag over head, Cutting, Poison, Drugs, Fire, Gunshot, and Impact. Two objective measures of lethality were computed and compared: a) Mean Seriousness, or the average medical response to incidents using each method; b) Probability of Death, or the proportion of suicidal incidents involving each method resulting in death. Table 1 presents the data on which the two measures were computed, the immediate outcome of the 2442 attempts and 1039 completed suicides, by method used in the incident. The outcome categories included six indices of medical response: 1) No treatment or Self-treatment; 2) Treated and released; 3) Detained for observation and treatment; 4) Admitted to Medical Unit; 5) Admitted to

Table 1. Outcome of 3,481 Suicidal Incidents, By Method Used

Method Used	Seriousness of Suicidal Incident [a]								
	Unknown Outcome	Psyc't. Admit.	1	2	3	4	5	6	Total Incidents
Carbon Monoxide	10	6	2	4	5	6	0	117	150
Drowning	5	8	0	2	0	0	0	30	45
Hanging	14	15	7	6	1	6	2	176	227
Gas	8	10	6	3	8	7	1	4	47
Plastic Bag over head	9	6	3	1	0	0	0	23	42
Cutting	125	74	21	176	65	72	5	23	561
Poison	6	8	5	15	13	21	5	22	95
Drugs	136	189	80	285	214	278	126	168	1476
Fire	8	3	2	1	0	3	0	9	26
Gunshot	5	6	5	1	2	11	2	349	381
Impact	31	47	17	23	9	19	4	107	257
Miscellaneous methods	4	2	7	0	3	4	0	1	21
Combination of methods	5	12	5	17	11	15	3	9	77
Unknown method	36	14	6	4	3	10	2	1	76

[a] The Seriousness codes, which also served as weights in the computation of Mean Seriousness were:

1. No treatment or self treatment
2. Treated and released
3. Detained for observation and treatment
4. Admitted Medical Unit
5. Admitted Intensive Care Unit
6. Dead

Intensive Care Unit; and 6) Dead by suicide—as well as two miscellaneous categories to which it was impossible to assign any seriousness weight: 1) Unknown outcome; and 2) Admitted to Psychiatric Unit.

Mean Medical Response (Seriousness) as an Index of Lethality

The first objective measure of lethality was the average seriousness of outcomes associated with use of the 11 suicidal methods. Weights ranging from 1 to 6 were assigned to the six medical response categories ranging from No treatment or Self-treatment (Weight = 1) to Dead by suicide (Weight = 6). Mean Seriousness (MS) for each method was then computed as the weighted average of all incident outcomes involving the method.

Table 2 gives the Mean Seriousness obtained for each of the 11 suicidal methods. MS scores ranged from a low of 2.81 for the least lethal method, Cutting, to a high of 5.84 for Gunshot, the most lethal method. Lethality ranks associated with each Mean Seriousness score are also given in Table 2.

Table 2. Three Measures of Lethality of Suicidal Methods

Method used	Objective Measures				Subjective Measure	
	Measure 1		Measure 2		Measure 3	
	Mean seriousness[a](MS)	Lethality rank	Per cent incidents ending in death[a](P)	Lethality rank	Mean rank assigned by 14 judges[b]	Lethality rank
Carbon Monoxide	5.60	4	78.00	2	4.07	2.5
Drowning	5.75	2	66.67	4	5.80	5
Hanging	5.62	3	77.53	3	4.27	4
Gas	3.21	10	8.51	10	7.07	8
Plastic Bag over head	5.30	5	54.76	5	7.60	9
Cutting	2.81	11	4.10	11	8.40	10
Poison	3.89	8	23.16	8	6.67	6
Drugs	3.51	9	11.38	9	9.00	11
Fire	4.67	6	34.62	7	6.93	7
Gunshot	5.84	1	91.60	1	2.13	1
Impact	4.63	7	41.63	6	4.07	2.5

Note: Lethality Ranks were not assigned to the non-specific method categories (Unknown, Miscellaneous, and Combination).

[a] See Table 1 for data on which these measures were computed.

[b] W, or Coefficient of Concordance = .41, $p < .001$

ρ (12) = .954, $p < .001$

ρ (13) = .718, $p < .05$

ρ (23) = .802, $p < .01$

Percentage of Incidents Resulting in Death as an Index of Lethality

As a check on MS, a second related measure was computed on the data given in Table 1. This second measure was the probability of death resulting from use of the method, defined operationally as (Number of deaths resulting from use of Method n divided by Number of all incidents using Method n).

Table 2 gives the probability of death (P) associated with each method. This probability ranged from a low of 4% for the least lethal method, Cutting, to a high of 92% for the most lethal method, Gunshot. Lethality ranks associated with P are likewise given in Table 2.

The two objective measures of lethality, Mean Seriousness and Probability of Death, did not essentially differ: ρ, the Spearman rank correlation coefficient computed on the two sets of ranks was .95, significant beyond the .001 level. We conclude that the two measures are, for all practical purposes, interchangeable. The second measure, Probability of Death, is simpler both conceptually and statistically, so we shall use P henceforth as our objective measure of lethality.

Here then are the 11 suicidal methods in descending order of lethality: Gunshot, Carbon Monoxide, Hanging, Drowning, Plastic Bag over head, Impact, Fire, Poison, Drugs, Gas, Cutting. It must be emphasized that this ordering does not mean that the less lethal methods such as Cutting cannot or do not kill or seriously injure. All we can conclude from our lethality ranking of the methods is that, statistically speaking, the less lethal methods do not result in as many deaths, proportionately speaking, as the more lethal methods.

Why is this so? We can only speculate. Certainly some qualities inherent to the methods themselves explain some of the variance in lethality, for example, the time lag before their destructive effects generally take place (the longer such lag, the greater the possibility of intervention and rescue). But this cannot be the only explanation for the variance. A person could shoot himself in the toe, or cut himself in the heart or abdomen. Most people, however, at least in this culture, choose not to hurt themselves in this manner. They shoot themselves in the heart or head, slash their bodies superficially in the wrist. Some socio-cultural and psychological mechanisms must, therefore, likewise come into play, variables such as cultural acceptance and intent to die.

Subjective Measure of Lethality

Whatever the reasons may be for objective differences in lethality of the various suicidal methods, are these differences facts that non-suicidologists are aware of? Do people, in fact, know the probability of death associated with the various methods?

To obtain subjective estimates of lethality, a questionnaire was distributed to 14 judges, all of whom were graduate students or faculty members at two area universities. The judges were asked to rank the 11 suicidal methods according to the "probability of death resulting from use of the method in a suicide attempt." The results of the survey are given in Table 2. The next-to-last column of Table 2 gives the mean ranks assigned to the 11 methods by the 14 judges. It must be noted that among themselves the judges agreed sufficiently with one another about these rankings: W, Kendall's coefficient of concordance among the 14 sets of rankings, was .41, $p < .001$.

How closely did the judges' subjective estimates of lethality agree with Measure P, the objective probability of death associated with each method? The last column of Table 2 gives the lethality ranks associated with the judges' mean lethality estimates. The Spearman rank correlation between this set of ranks and the ranks associated with Measure P was .80, $p < .01$. Examining the two sets of ranks more closely, we see that, if we define as significant a difference of more than two ranks, the judges misestimated the lethality of only two of the 11 methods. They underestimated the deadliness of Plastic Bag over head, and overestimated the lethality of Impact.

We conclude that the probability of death associated with each method is not some elusive property unknown before-the-fact to the non-suicidologist. This is not to say, of course, that the person about to injure or kill himself knows what risks he is taking. None of the 14 judges were suicidal, and we can only speculate about how one's judgment is impaired in times of crisis. Nevertheless the fact remains that even when we talk only in gross method categories such as Drugs, Gunshot, etc.–without going into details of type of drug, dosage, or position of gun–subjective estimates of lethality correspond well with objective measures.

Lethality vs. Risk

We have seen that an objective measure of the lethality of the most common suicidal methods can be constructed; we have also seen that people's subjective estimates of lethality correspond well with this objective measure. We turn now to the third and final concern of the present paper: the relationship, if any, between lethality and risk.

We shall continue using P, the probability of death on a particular incident, as our index of lethality. To measure risk, we create a new measure, PF, the probability of death by suicide at some future date.

What is the relationship between P and PF? If the two measures are strongly related, then a history of a serious suicide attempt would mean heightened suicidal risk, the more serious the prior attempt, the greater the risk of suicide at some future date.

Is this the case? Tables 3 and 4 present the data relevant to this issue. Table 3 gives the probability of future suicide as a function of method used in prior

Table 3. Probability of Subsequent Suicide as a Function of Method Used in Prior Suicide Attempt

Method used in previous attempt	*Attempts without subsequent suicide*	*Attempts Followed by Subsequent Suicide*		*Risk rank*	*Lethality rank, measure P*[a]
		Number	*Per cent*		
Carbon Monoxide	28	5	15.15	2	2
Drowning	13	2	13.33	3	4
Hanging	49	2	3.92	10	3
Gas	40	3	6.98	4	10
Plastic Bag over head	15	4	21.05	1	5
Cutting	512	26	4.83	8	11
Poison	68	5	6.85	5	8
Drugs	1250	58	4.43	9	9
Fire	17	0	0.00	11	7
Gunshot	30	2	6.25	6	1
Impact	141	9	6.00	7	6

[a] See Table 2

ρ (risk rank vs. lethality rank) = .264, N.S.

suicide attempt(s). The highest risk was associated with a prior attempt using Plastic Bag over head: four of the 19 (21%) people who had made prior attempts using this method went on to commit suicide at some date in the future. The lowest risk was associated with prior self-injury by Fire. None of the 17 people who survived an attempt with Fire went on to later kill themselves.

The next-to-last column of Table 3 gives the Risk ranks associated with the 11 suicidal methods. In descending order of future suicide risk, the methods are: Plastic Bag over head, Carbon Monoxide, Drowning, Gas, Poison, Gunshot, Impact, Cutting, Drugs, Hanging, and Fire. How does this ordering of the methods according to risk compare with the ordering according to lethality (Measure P) given in Table 2? The Spearman rank correlation coefficient between the two sets of ranks is only .264, which is not significantly different from zero.

We conclude that risk and lethality are two separate constructs, both conceptually and empirically. Thus the most lethal method, Gunshot, ranks only sixth as a predictor of future suicide. The best predictor of future suicide, Plastic Bag over head, is only the fifth most lethal suicidal method.

The empirical distinction between risk and lethality is supported by the data given in Table 4. Here the data are collapsed over all methods, and risk is given as a function of the medical seriousness of a prior suicide attempt. The relationship is negative (Spearman rank correlation coefficient = -0.50). Of the 150 attempts in our records resulting in near death (those requiring admission to an Intensive Care Unit) only four or 2.67% were followed by subsequent suicide. On the other hand, of the 166 attempts resulting in No treatment or Self-treatment, 18

Table 4. Probability of Subsequent Suicide as a Function of Seriousness of Prior Suicidal Attempt

Outcome of previous attempt	*Attempts without subsequent suicide*	*Attempts Followed by Subsequent Suicide*		*Risk rank*	*Lethality rank*
		Number	*Per cent*		
Admitted Intensive Care Unit	146	4	2.67	4	1
Admitted Medical Unit	420	32	7.08	2	2
Detained for observation and treatment	332	2	0.60	5	3
Treated and released	509	23	4.32	3	4
No treatment or self-treatment	148	18	10.84	1	5

ρ (risk rank vs. lethality rank) = −0.500, N.S.

or 10.84% were followed by subsequent suicide. Indeed from the data given in Table 4, it would appear that seriousness or lethality of a prior suicidal incident predicts future suicide in a negative manner!

The actual data suggest a curvilinear relationship between lethality and risk: Risk is highest at the lowest level of lethality of prior incident (No treatment or Self-treatment). It then declines to its lowest level at the middle lethality level (Treated and released; Detained for observation and treatment) and then rises again slightly at the high lethality levels (Admitted to Medical Unit; Admitted to Intensive Care Unit).

Two tantalizing implications appear to flow from the above findings. The first is that treatment does help the suicidal individual: by far the highest suicide rate was found among those who had received no treatment for their self-injuries. The second is that coming extremely close to death somehow purges many individuals' desire to die: a relatively low suicide rate was found among Intensive Care Unit admissions.

SUMMARY AND CONCLUSIONS

Two objective measures of the lethality of 11 suicidal methods were defined: Mean Seriousness (MS) of suicidal incidents involving the method, and Probability of Death (P) resulting from use of the method. The Spearman rank correlation between the two objective measures was .95, $p < .001$. The measures were thus shown to be essentially interchangeable; P was chosen as the objective measure of lethality because of its conceptual and statistical simplicity.

Fourteen judges were asked to rank the same 11 methods according to the probability of death resulting from use of the method in a suicide attempt. There was significant consensus among the judges about these rankings (W, or coefficient of concordance = 0.41, $p < .001$). The rank correlation between the

judges' mean ranks and the ranks obtained from objective Measure P was .80, $p < .01$. Non-suicidologists were thus shown to have a rather good idea of the lethality associated with suicidal methods.

The relationship between lethality and suicide risk, or the probability of suicide at some future date, was then examined. The two variables were clearly statistically distinct. Rank correlation between lethality of, and risk associated with, the 11 suicidal methods was 0.26, a non-significant value. Moreover, when all incidents within a given seriousness or lethality category were collapsed, and then risk associated with each seriousness category evaluated, the most lethal attempts had a significantly lower risk of future suicide than the least lethal attempts (2.67% vs. 10.84%).

Clearly lethality and risk are two separate variables and use of the first term to mean both lethality as well as risk represents an unfortunate turn of events in the suicide literature.

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