

Review

Taxonomies of Death by Suicide: A Review, with Proposals for Research and Policy, and a Challenge for Suicidology

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Abstract: *Background:* The establishment of typologies of deaths by suicide using numerical taxonomy of valid and reliable parameters has potential for both understanding suicide and its antecedent circumstances, and as an aid to public health programs of prevention. *Methods:* We searched the published literature for reports of taxonomic studies of death by suicide, using the methods of cluster analysis, but were only able to locate 12 studies. *Results:* Published research is sparse, and has produced varied findings, but distinct types of death by suicide clearly exist. Typologies differ between cultures, perhaps because of the varying dominance of fatal methods (e.g., gunshot, jumping from heights). *Limitations:* The small number of studies located makes generalizations difficult. *Conclusions:* Taxonomic studies of death suicide need to be undertaken regularly, in all world countries in which valid and reliable data are available, in order to describe changing patterns of suicide and its correlates, and to establish priorities for public health interventions. This need for such research is a challenge for suicidology.

Keywords: suicide deaths; taxonomy; measurement validity; public health; suicidology

1. Introduction

Good Data as a Prelude to Taxonomic Research on Deaths by Suicide

Thomas Ellis in 1988 [1], writing about the taxonomy of both attempted suicides and deaths by suicide, suggested that: “Perhaps we can anticipate a system that would allow a comprehensive, multidimensional formulation of suicidal patients, complete with treatment implications for each aspect of a given individual’s “profile”. In any event, the usefulness of a more complete and differentiated description of suicidal behavior can scarcely be overestimated” (p. 370). This recommendation by Ellis remains valid today, and it is surprising how little work has been undertaken on the numerical taxonomy of death by suicide, although some taxonomic work has been published on non-lethal suicidal behaviors [2]. Of course, theoretical taxonomies abound (e.g., those of Durkheim and his followers), but their utility for suicide prevention programs remains doubtful [1].

Potter, in a review of public health approaches to suicide published in 2000 [3], observed that: “(What is needed) . . . is an understanding of the causes of suicide that will allow us to develop and implement highly effective multisystem interventions for the prevention of suicidal behavior. This highlights the issue of taxonomy. In reviewing the literature on suicide very few studies use the same definitions. Variables and constructs that were used as predictors occupy a vast range, as do variables and constructs that actually measure some form of suicidal behavior. Thus while there have been limited efforts to articulate a taxonomy of suicide . . . we are left with a rapidly developing field of research that is struggling for better measurement of a broad set of variables”.

2. Methods

The original objectives of this review were to explore, through a scoping analysis of published literature, studies which have used numerical or statistical methods to cluster or classify deaths by suicide, in order to develop models of public health research and prevention, following the guidelines of Anderson and colleagues [4]. This type of review aims to contextualize existing knowledge, setting it within a practice and policy context, and making recommendations for health care service delivery and evaluation.

The review focuses on all published literature that has included the terms “suicide”, “classification”, “components” (as in “principal components analysis”), and “cluster/s”, published in English. Both electronic and hand-searching techniques were used.

Electronic searches: The electronic databases searched were PUBMED, Medline in progress, Embase, PsycInfo, Cochrane Library, and Scopus. The search included all publications indexed at any time. All studies located were then checked for relevance. Details of each study were analyzed using a standardized data extraction form, focusing on: study details (dates, any follow-up); study design; population details (numbers, characteristics); settings; context details; outcomes and findings; conclusions and recommendations.

The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement was applied, in attempting to arrive at an accurate and complete report of identified studies for a systematic review. We used the STROBE statement developed by Stevens and colleagues [5]. After inspection of title, abstract, and any keywords, the full text of selected studies were then assessed.

Only 12 articles were selected for final review, despite the original abstract database identifying more than 300 studies. Of these, 213 were not finally considered, since the term “cluster” identified a large group of studies which looked at suicidal behaviors occurring in a defined community of individuals, in which an original suicidal act led to contagion and imitation. This is an interesting and serious problem, but not one we are concerned with here. Further studies yielded an abstract only (e.g., conference papers), and these and others were rejected because of the numbers of decedents (<50, too small for a meaningful or reliable taxonomy); or because less than five clinical and demographic indicators were used in the analysis. Other studies not included used “taxonomy” in an intuitive or heuristic manner, yielding interesting but probably non-replicable results [6].

A final criterion for inclusion was that a study should consider at least 10 descriptors of the decedent, across a range of sociodemographic and clinical variables for completed suicide (not suicidal gestures or attempts). There are many publications reporting a much smaller number of variables associated with completed suicide, but these were not enough for any kind of classification to be undertaken. A decision then had to be made concerning what type of review should be undertaken, given the complexity of choosing a review type in the field of health [7]. We finally chose a relatively straightforward approach, that of a narrative review, giving fuller details of results than in a meta-analytical review [7], and discussing intuitively, rather than by statistical analysis, how the studies might be compared and generalized.

2.1. Available Studies on the Taxonomy of Individuals Who Complete Suicide

Numerical taxonomy of death by suicide (by principal component or cluster analysis, or a combination of both methods using factor scores of individuals for numerical taxonomy) requires data for analysis that is reliable and valid [8], a challenge not always met in research on “suicide” in its various forms and definitions. Since so few studies were located, we offer below a narrative rather than a meta-analytical overview, giving fuller details of each study than would be customary in an analytic review.

The pioneering work in classification studies using a comprehensive data set seems to be that of Shaffer (1974) [9], who used coroner’s data to study all adolescent suicides (numbering less than 200) in England for a seven-year period. Shaffer offers a heuristic typology based on statistical analyses, in which gender was a pivotal factor: girls experienced the internalized effects of crises in their lives,

sometimes reflecting a dysfunctional family life and previous suicidal gestures; but the picture for boys was more complex, with externalizing disorders that created crises such as school expulsion and problems with the law, as well as various psychiatric diagnoses.

So far as this review can discover, the first published work using methods of numerical taxonomy on data collected after death by suicide was a study conducted in Brighton, UK [10,11] using coroner's data files. In this study, suicidal deaths fell into three groups: (a) younger males with disrupted childhoods, leading sociopathic, criminal, drug-addicted, and marginalized lives, with several prior suicide attempts; (b) middle-aged males, many of whom expressed suicidal ideation, and only atypically had made an attempt—but who could not abide further episodes of acute depression and schizophrenia; and (c) elderly people of both sexes, with no history of previous attempts, currently plagued by infirmity, depression, pain, and poor sleep. Individuals classified within these groups tended to live in different areas of the city, according to ecological plotting, and this led social service teams to focus more resources on an inner-city area in which the younger, socially disorganized suicides tended to cluster [12]. Brighton was in fact “the end of the line” for a drifting population who tended to cluster in low-rent housing in the city center, and this unique characteristic may account for the failure of this group to emerge in the Northern Ireland study, outlined below (the drift then would be to cities such as Dublin, London, Liverpool, and Manchester).

The only UK replication of a suicide deaths taxonomy seems to be that of O'Connor, Sheehy, and O'Connor [13] in Belfast. This work did not support earlier English research [10–12], but did identify a large group of mainly men who were undergoing stress, but had not sought social or psychological help. These suicides occurred at the height of violent conflict between Catholics and Protestants, but perhaps because no data were available, the study did not record the religion of the deceased. However, the authors comment that: “This taxonomy offers a more complex picture of suicide than is often imagined. The majority of suicides do not conform to the traditional picture . . . the largest suicide subtype is characterized by a reluctance to seek help of any kind. Thus the study illustrates the changing profile of suicide” (p. 637) [13]. No further work on the taxonomy of suicide in the UK or Ireland was located in our literature review.

Some taxonomic work comes from a Canadian group who used carefully defined and measured clinical and social variables from the database of the Alberta Medical Examiner's Office [14–18]. In a youth cohort of 130 young people aged 10 to 20 years, six clear groups who had died by suicide were identified in 111 cases (19 cases could not be classified in any clear group), using principal component analysis, with component scores for individuals being used for subsequent cluster analysis. The model characteristics of the groups identified were: (1) males using hanging or gunshot; school failure or expulsion; disrupted family; often in care; had often made a previous attempt; (2) females using fatal overdoses of various medicines or substances; several previous gestures or attempts; school dropout or grade failure; separation from parents; prior sexual abuse or other maltreatment; being a commercially exploited sex worker; (3) males aged 18–20 years; using gunshot or vehicle exhaust method; break with girlfriend; recent job loss; use of drugs or alcohol; prior attempt; probable personality disorder; (4) males aged 10–14 years; using hanging or gunshot; delinquency and school dropout; mental illness/alcoholism in parent; (5) male or female aged 15–20 years; current depression or psychosis; little history of school dropout or service contact; (6) Native Canadians; drug, alcohol or solvent abuse; unemployed or school dropout; little known of family background.

In an adult cohort, 378 males aged 20 to 34 years were studied by the Canadian group. The ‘suicide types’ were:

Social stress in unstable younger males: Aged 20–24 years; unskilled; urban resident; no regular partner, but history of unstable relationships, and a recent broken relationship; CO ingestion; suicide in summer months; illegal drug use; recent contact with a helping agency or probation service.

Depression and psychosis: No specific age category; several prior attempts; previous psychiatric hospitalization; large majority had prior treatment for depression or psychosis; lack of any supportive partner or friend.

Alcohol abuse and chronic unemployment: Most aged 25–34 years; separated or no partner; all had history of alcoholism; overdose commonest method.

Native Canadians in Rural Areas: Predominantly male; method usually gunshot (hunting rifle); predominance in winter; high alcohol consumption; no contact with services.

Physical illness, pain, unemployment: Mostly aged 30–34 years; chronically unemployed and in financial trouble; 74% of these 50 men had a history of chronic pain or disability.

Sociopathic disorganization: Predominantly male; hanging or drowning were the most common methods; disrupted family life prior to the age of 16 years; series of unstable relationships and/or interpersonal aggression; history of criminality, but not recently drug-addicted.

These results suggest that analyzing populations separately by age and gender groups could facilitate strategies for treatment and prevention. A parallel study of the ecology of deviance in Calgary suggested that (as in Brighton, England) focusing services for at-risk groups identified through cluster analysis in particular areas of the city (and in certain schools) could have value [12,17].

The very high rate of suicide deaths in Native Canadians, for whom very little social background data was available to the medical examiner [18] was, and remains, a challenge to the affluent society of Canada, as indeed is the high rate of suicide in Native peoples in all of North America [19]. The final comment on this Canadian work is that replications are useful since they can show changes in the patterning and correlates of suicide over time, which present fresh challenges for treatment and prevention [14].

2.2. Further Studies of the Taxonomy of Suicide

Since this early Canadian work was completed, there has been surprisingly little work using taxonomic methods, although there is an ongoing literature on the taxonomy of suicidal ideation, gestures, and attempts, which will not be reviewed here. Of note is study by Sankey and Lawrence (2005) [20] of deaths by suicide in 187 American adolescents. Their analysis of data from medical examiners' files identified three groups; the first had experienced enduring difficulties in family and neighborhood, including child abuse and neglect, and chronic family dysfunction, with family members who also had many psychological and behavioral problems; the second group had no histories of family difficulty, but were facing crises of loss or of criminal charges; the third group were drinkers or drug takers, who engaged in "dangerous lifestyles" and actions which led to death such as collapsing unconscious on a busy highway.

The only other American study attempting a taxonomy of deaths by suicide which we can locate is that by researchers [21] of more than 28,000 cases of suicide reported to a central registry recording violent deaths for 11 U.S. states. Their study has, in our view, two weaknesses. First, there seemed to be problems of data reliability and validity, in routine reporting to a federal agency from many regional centers. Also, the classification technique used, latent class analysis, has not been particularly powerful in identifying meaningful clusters of variables associated with deaths by suicide. Nevertheless, the results did lead the authors to conclude that: "Most suicide decedents could be classified by patterns of risk factors. Furthermore, most classes revealed a need for more connected services across medical, mental health/substance abuse, and court/social service systems. Reducing fragmentation across these agencies and recruiting family, friend, and community support for individuals experiencing mental health problems and/or other stress might significantly reduce suicides" [21].

A complicating factor in comparing this typology with those found in studies from other cultures, was that nearly half of all the deaths by suicide in the U.S. used gunshot as the method, reflecting widespread access to handguns in the U.S. Thus, many individuals who would have been "suicide attempts" in low gun ownership cultures actually became deaths by suicide in America. (In the earlier Canadian work reported above [18], death due to "gunshot" almost always involved a hunting rifle, and not a handgun).

A more successful classification of deaths by suicide emerges from the Canadian study of Sinyor, Straffer, and Streiner [22], who subjected data on all suicides in Toronto, collected by the Office of the Chief Coroner for Ontario for the period of 1998–2010 (N = 2886), to numerical cluster analysis. Five distinct clusters emerged:

1. Higher percent female, nonviolent methods; all had prior treatment for depression or were judged to be currently depressed; many had made a previous gesture or attempt.
2. Higher percent with recent stressful events; all currently or previously “married”; all used a violent method (including jumping from a high building).
3. Mostly males aged 20–64 years; recent stress and/or mental illness history; often a history of substance abuse.
4. The youngest group; half had history of bipolar illness or schizophrenia; jumping from heights was a salient method.
5. Mostly unmarried; low proportion with prior mental illness; most likely of all groups to leave a suicide note.

Since Toronto is a city with many high-rise apartments, jumping from a high building was an option for many, and was almost always fatal. This could mean that cases which would have been “failed suicide” in other areas (e.g., because of resuscitation following overdoses) would become suicide deaths, as researchers found in work with Hong Kong adolescents, where jumping from a high building was often a method used by suicidal young people [23].

Jumping from a high building was one of the markers of a two-fold classification of deaths by suicide in Hong Kong put forth by Chen et al. [24]. This exceptional study is marked by a careful methodology, in which the validity and reliability of several measures was established premortem in a representative cohort of a large number of working-age adults, aged 20–59 years, some of whom were considered to be at risk of suicide [25]. Using these parameters, a group of 148 deaths by suicides were identified in follow-up work. Two main groups were identified. In the first group, the main cause of death was ingestion of charcoal fumes (a method local to Hong Kong and some other Southeast Asian countries); no severe psychiatric illness; a heavy financial debt burden; chronic general stress; and high prior scores on the Beck Suicidal Intent Scale. The second group’s main cause of death was jumping from a high building; they had high rates of psychotic illness; a history of intensive psychiatric interventions; acute situational stress; but low scores on the Beck SIS completed earlier. The authors summarize this valuable study as follows: “Classification of suicides is essential for clinicians to better identify self-harm with future suicidal risks ... suicidal prevention strategies may have to target potential subgroups with fresh scientific approaches” (p. 376) [24].

This last comment addresses the fact that the Beck Suicide Intent Scale (in its translated form) failed to identify a large number who later killed themselves, even though it was strongly validated against an established measure of depression [26]. We would comment, however, that the ethical requirements of the first population-based study [25] meant that individuals with high suicide intent scores would have to be offered psychiatric and social interventions, and this itself could have both diminished the incidence of subsequent deaths by suicide, and removed from the suicide deaths population, some individuals with originally high suicide intent scores.

In further work by the Toronto group referenced above, Schaffer et al. (2014) [27] identified 170 individuals with bipolar disorder who were known to psychiatric services, but who later killed themselves. Their cluster analysis of a range of variables derived from both clinical and medical examiner files established five different pathways to suicide (i.e., five distinct clusters) identified by age, gender, marital status, current family circumstances, past suicide attempts, current substance use, interpersonal and/or financial stressors, legal and/or criminal justice stressors, and method of suicide (jumping versus self-poisoning). The identification of subtypes showed both which groups needed the most input from psychiatric services, and what types of intervention might work best. This methodologically excellent study is a good example of how the cluster analysis of suicides can aid suicide prevention services.

Another study based on cluster analysis of a completed suicide group comes from this same group of Toronto researchers (Sinyor et al., 2016) [28], of 124 self-inflicted medical as the “oldest old”, seniors aged 80+ years. Cluster analysis divided them into three groups: first were individuals who were married, but had marked physical problems, and who were also clinically depressed; second were individuals

living alone, without a preponderance of physical health challenges, but who were markedly depressed; and third was a much smaller group who had a history of psychiatric illness, prior suicide attempts, and a severe concurrent psychiatric problem.

Finally, we refer to recent research on suicidal behaviors in the developing nation of Bangladesh [29]. This research identified a large sub-group of young women (by a narrative rather than by a cluster analysis method), most of them teenagers in situations of violent or forced marriages, who killed themselves at a rate exceeding 20 per 100,000—the highest recorded rate in the world for young females.

While there are relatively few cluster or taxonomic studies of completed suicide, the work available does point to the value of such work in leading to both meaningful clinical interventions, and to the conceptual basis for further studies. The problems of deaths by suicide in differing age groups need to be addressed, in all cultures, by numerical taxonomies based on reliable and valid parameters.

3. Conclusions

The lack of taxonomic studies of deaths by suicide based on the statistical analysis of data with some established reliability is puzzling. We suggest that such taxonomies that result can lead to public health interventions, including identifying which groups to target, in terms of the scarce resources available. In addition, such studies can offer guidance (when combined with ecological analysis) for which parts of a region or city to site preventive services. Both of these strategies can potentially be productive elements of a public health prevention model.

This review of available studies also underscores the fact that work needs to be done on establishing the reliability and validity of the data used for taxonomic analysis. We concur with the calls by De Leo [30], and Silverman and De Leo [31] for a better, more standardized, and comprehensive international database on deaths by suicide. Silverman and De Leo [31] ask, for example, whether death due to self-starvation should be included as a form of suicide. In acknowledging this call for the broadening and standardizing of the definition of suicide, we note the Canadian study [17], which in Canada created a category of “careless death” which was particularly relevant for Native Canadians—involving, for instance, wandering into a wilderness area when the temperature was 40 below. Broadening the definition of “suicide” to include open verdicts, self-inflicted medical conditions, and suspicious deaths should give a more accurate base for epidemiological, classification, and prevention strategies [31].

Different profiles of suicide deaths have emerged when the various studies located are compared; this could be due to the varying quality of the data used, and the different definitions and inclusiveness of the presumed suicidal act. Other factors influencing different suicide clusters emerging in various studies may be the different methods involved in different cultural settings—for example, the easy availability of lethal methods (e.g., handguns, high rise dwellings, charcoal stoves) may mean that cases which would have involved a “survivable” suicide method may be included in analyses of suicide deaths in different cultural settings.

There is also some evidence that repeating taxonomic analyses in the same culture may yield different results over time. This could mean that profiles of deaths by suicide are actually changing; or, the finding of “change” could be a reflection of a lack of reliability in the parameters employed. Whatever the reasons, there is a strong case for: (a) in each country or sub-region, for taxonomic studies of suicide deaths to be repeated every two years; and (b) for linked, parallel studies to be undertaken comparing countries to ensure that the reliability and validity of the data analyzed are also stable over time, and are reliable and valid measures. The results of these repeated analyses could form an important database for public health strategies concerned with suicide prevention.

One obvious database for repeated taxonomic studies of death by suicide would be the data collected annually by the U.S. Center for Disease Control. Although efforts to standardize reporting from States to the national CDC yield valid and reliable data for basic variables surrounding violent death (Paulozzi et al., 2004) [32], only one attempt at clustering these data has been published (Logan et al., 2014) [21]. A recent analysis of national U.S. reporting to the CDC on deaths

by suicide is welcome, but this analysis has focused on only a few covariates of suicide, such education, gender, ethnicity, and methods used (Diaz et al., 2017) [33]. CDC data should be subjected to a more detailed numerical cluster analysis, and the use of the psychological autopsy method to establish the clinical status of the decedent should be strengthened.

For world data on the establishment of typologies of deaths by suicide, much more work needs to be done. We note that the WHO ICD9 (International Classification of Diseases, 9th edition) has proved to be a generally reliable way of classifying suicidal deaths across cultures (Pearson et al., 2004) [34], and this should be used as the basis for the urgently needed cross-national studies. As with the CDC data, a standardized model of the psychological autopsy should be developed.

The challenge we offer for clinical psychology, psychiatry, and suicidology is this: the discipline of evidence-based medicine is based on accurate diagnoses, for which treatment of various kinds are proposed, and preventive public health strategies are designed. In the past 50 years, several thousand articles have been published in scholarly journals, and dozens of monographs have also appeared. However, less than a score of these publications have used the statistically-based clinical model of creating categories for “differential diagnosis” in which types of suicide death are classified. Without such differential diagnoses, both nationally and in international comparisons, progress in the field of suicidology and suicide prevention will be slow.

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