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Suicides May Be Overreported and Accidents Underreported Among Fatalities Due to Dextropropoxyphene

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ABSTRACT: Among prescribed drugs in Sweden dextropropoxyphene (DXP) is the medical compound most frequently responsible for self-inflicted fatal poisonings. To analyze the process leading to the classification of the manner of death in cases of fatalities where DXP caused or contributed to death, a set of explicit and implicit operational criteria was applied retrospectively to fatal DXP poisonings among autopsy cases performed at one department of forensic medicine in Sweden during the six-year period from 1992 to 1997.

DXP fatality was found in 113 (2.6%) of the total 4306 autopsy cases. Suicide was recorded in 84 (74%) of these cases, and an undetermined manner of death in 24 (21%).

Explicit unambiguous expressions of the intent of the decedent were found in 29 (26%) of the 109 analyzed cases. (In four cases no analysis could be performed.) In 46 cases only implicit and no explicit criteria were found. The total number of implicit criteria in individual cases without explicit criteria never exceeded three and in 34 cases no criteria of any type were documented.

It is concluded that the classification of the manner of death at DXP fatalities was often based on very limited grounds when the operational criteria were used as a standard for comparison. Information from relatives, friends and others concerning the decedent was rarely accessible. The shortage of information probably led to deficiencies in the death statistics concerning DXP fatalities. Considerable underreporting of accidents and probable overreporting of suicides were found.

Failure to report DXP deaths as accidents may delay discovery of the high toxicity of this drug. This might be one of the reasons why the DXP fatality rate is still constantly high in Sweden, while both Denmark and Norway have managed to decrease their DXP death rates by vast restrictions, based on alarming reports of accidental DXP fatalities.

In order to guarantee valid death statistics concerning self-inflicted poisoning, the information base leading to classification of the manner of death has to be enlarged. This requires implementation of new routines, including interviews of relatives, acquaintances and significant others to get the information needed to assess the decedent's intention to die. Operational criteria may facilitate the difficult classification process by providing a structured standard, and the set of explicit and implicit criteria applied in this study is recommended.

KEYWORDS: forensic science, forensic pathology, forensic toxicology, dextropropoxyphene, fatal poisoning, manner of death, classification, criteria, death certificates

Among prescribed drugs in Sweden dextropropoxyphene (DXP) is the medical compound most frequently responsible for self-inflicted fatal poisonings (1), and the DXP fatality rate is constantly high (2). The characteristics of the fatal DXP cases differ from those of other drug fatalities. In the DXP cases death characteristically occurs rapidly, as little as one hour after ingestion of the drug and usually before hospital treatment can be initiated (3). Further, intoxication causing death may occur at dosages as low as twice the therapeutic level. If DXP is taken together with alcohol, even doses within the therapeutic level can be lethal (4,5).

The rapid death at DXP poisoning, the narrow margin between therapeutic and toxic doses and the potentiation of DXP when mixed with alcohol may lead to difficulties in assessing the intent of the deceased in cases of self-inflicted fatal poisoning, and in classifying death as accidental, suicidal or undetermined (6,7).

The revisions of the International Classification of Diseases (ICD) have included changes in the way in which self-inflicted deaths should be classified. According to the seventh revision, ICD-7 (1958), self-inflicted deaths were to be regarded as suicide if it could not be proved that the death was unintentional. When the eighth revision, ICD-8, was introduced in 1968 an ''undetermined'' manner of death was added as an alternative to suicide in the classification of self-inflicted deaths, which meant that self-inflicted death should not be considered as suicide unless the certifier was able to establish that death was intended by the decedent (8). ICD-9 and ICD-10 follow a similar approach.

According to Rosenberg et al. (9), most certifiers find it very difficult to establish the intent of the decedent in cases of self-inflicted death. For this reason they assembled a working group, comprising representatives from a number of interested organizations, to develop operational criteria for determination of suicide. These criteria were divided into explicit and implicit expressions of the decedent's intent to die. Unambiguous verbal and written statements made by the decedent showing his or her intent to die were regarded as explicit criteria, while statements from relatives, acquaintances and others formed the basis of the implicit criteria. Implicit evidence of the decedent's intention to die was summarized into eleven criteria—for example, expressions of hopelessness, a previous history of suicide attempts or suicide threats, a history of stressful events or significant losses, and a history of serious depression or a mental disorder.

In Sweden considerable differences have been found between the forensic medicine districts, and between individual physicians, in the way in which they classify fatal DXP poisoning (10). In order to analyze the basis of the process leading to classification of the manner of death in DXP fatalities in Sweden the operational criteria of Rosenberg et al. were retrospectively applied to a Swedish autopsy material examined during the six-year period from 1992 to 1997.

Method

Sweden is divided into six forensic medicine districts. These forensic medicine departments examine deceased persons at the

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request of the police or prosecution authorities when a death requires investigation. All unnatural deaths, including cases where fatal poisoning is suspected, are reported to the forensic departments, even those who die at hospitals.

Death certificates including the cause and manner of death are supplied by the physician performing the autopsy. The manner of death in cases of injury or fatal poisoning shall be classified as accident, suicide, homicide, undetermined or others. In the cases of self-inflicted injury and poisoning, the manner of death shall be designated as undetermined when it is impossible to establish whether death was the intent of the deceased or not. During the study years the manner of death in fatal poisoning was classified in accordance with ICD-9.

The investigated population was based on the autopsies made during the years 1992 to 1997 at one of the six departments of forensic medicine in Sweden (Uppsala). This department serves a rural district with 1.1 million inhabitants. A few large cities with populations of 50 000 to 150 000 are included in the district.

In the cases of suspected fatal poisonings blood samples are always sent to the national laboratory for toxicological analyses. In this study all drug analyses are based on peripheral blood tests.

The requirement for inclusion in the study was that DXP was found in the peripheral blood obtained at autopsy and that the cause of death according to the death certificate was fatal poisoning. Since DXP is potentiated by other drugs such as alcohol, even cases with blood DXP concentrations within the therapeutic levels were sometimes considered as cases where DXP contributed to death. The cases where DXP was certified as having caused or contributed to death were considered as DXP fatalities for this report.

During the six-year period 1992 to 1997, a total of 4306 autopsies were performed at the forensic medicine department. Among these deaths, 113 (2.6%) met the inclusion criteria of the study. The 113 autopsies were performed by a total of seven physicians.

In order to apply the operational criteria proposed by Rosenberg et al., one of the authors, a psychologist, analyzed the fatalities on the bases of the death certificates (113 cases), the police reports (109 cases), the autopsy protocols (109 cases), the toxicological findings (109 cases), and additional information, (e.g., hospital records (a few cases)), when these were kept in the medicolegal dossier. In four cases the dossier was not available, and the retrospective analysis was therefore based on 109 cases.

The operational criteria presented by Rosenberg et al. were applied unmodified while their recommended protocol was slightly adjusted to fit the retrospective design. Regarding intent, explicit as well as implicit information available in the dossier, was categorized according to the criteria. According to the routines at the department, all information concerning the decedent should be noted and kept in the dossier. Thus, we made the assumption that generally we would have access to the same information as the certifying physician.

Simultaneous occurrence of alcohol in the blood was considered in the analyses, and notes on alcoholism/drug addiction in the death certificates were regarded as diagnostic assessments.

Results

The distribution of the 113 cases of fatal DXP poisoning during the six years 1992 to 1997 is shown in Table 1. There is a peak in 1996, with 30 cases (27%).

The mean age was 47 years (range 16 to 89); 58% were men and 42% women. Figure 1 shows the distribution of the 113 DXP fatalities by age during the study period. Most cases, 57 (50%) occurred between the ages 30 to 49 years.

TABLE 1—*Distribution of fatal DXP poisonings during the six-year period 1992 to 1997.*

Year	No. of Autopsies Performed	No. of Fatal DXP Poisonings	%
1992	737	15	13
1993	739	19	17
1994	698	22	19
1995	739	13	12
1996	701	30	27
1997	692	14	12
Total	4306	113	100

Suicide was recorded in 84 (74%) of the 113 DXP fatalities and an undetermined manner of death in 24 (21%). In three of the cases death was judged to be accidental. Overdose of DXP was reported to be a contributory cause of death in two cases where chronic alcoholism was judged to be the primary cause.

Verbal explicit expressions of the decedent's intent to die were documented in three of the 109 analyzed cases and handwritten unambiguous notes in 28 cases (26%). In two of these the decedent had made both verbal and handwritten statements.

As seen in Table 2, expressions of hopelessness, previous suicide attempts, a history of stressful events or significant losses, and a history of serious depression or other mental disorder were most often documented among the implicit criteria (in 13, 14, 17, and 25 cases, respectively).

The total number of implicit criteria in the absence of explicit criteria never exceeded three in any case (Table 3).

Among the 84 cases classified as suicide, 52 (65%) lacked explicit criteria. In 15 of these 52 cases no implicit criteria were noted, in 20 there was one criterion, in 12 there were two, and in five there were three.

The manner of death in cases with only one implicit criterion is shown in Table 4. The death was classified as suicide in four of five cases where expressions of hopelessness were the only implicit criterion, in four of five cases where a history of stressful events or significant losses were the only such criterion, and in seven of nine cases where a history of serious depression was the only one.

The mean blood DXP concentration in the 109 cases where toxicological analyses were available was 3.33 μg/g. The mean blood DXP concentration was significantly higher (95% confidence interval) among the suicide cases (3.74 μg/g) compared with the undetermined (1.90 μg/g).

In 24 cases (22%) a blood DXP concentration within the therapeutic range was found while ten cases (9%) had a concentration at least ten times the reported upper limit of therapeutic range (the blood DXP level after a therapeutic dose is 0.05 to 0.75 μg/g). Three of the 15 suicide cases lacking both explicit and implicit criteria had a blood DXP level of >7.5 μg/g.

Alcohol was found in the blood in 62 (55%) of the 113 DXP fatalities and the mean concentration was 0.15% (range 0.01 to 0.50%). Among the 24 cases with blood DXP concentration within the therapeutic range, eleven had alcohol in the blood with the mean concentration of 0.16%. According to the death certificates 22 (19%) were alcoholics, and 13 (12%) were drug addicts, while six of them were denoted as both.

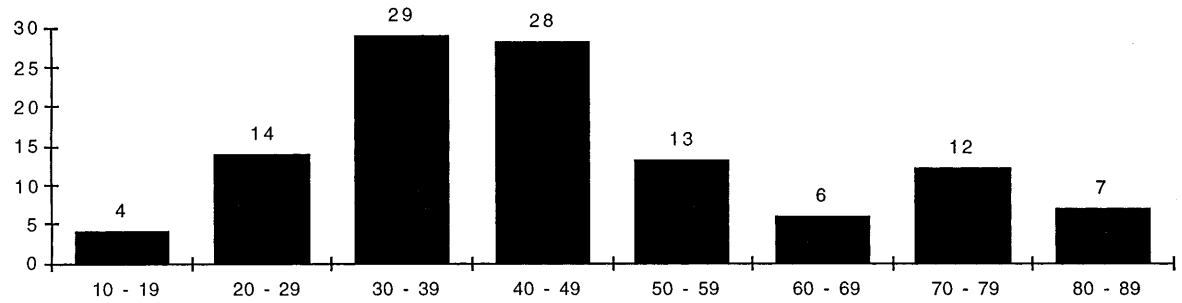

FIG. 1—*Distribution of the 113 DXP fatalities by age during the six-year period 1992 to 1997.*

TABLE 2—*Frequency of occurrence of the 11 implicit criteria of decedents' intent to die: the numbers of cases where explicit criteria were also found, the numbers with no explicit criteria, and the number in whom the criterion described was the only one. Total number of cases = 109.*

Criteria No.	Content of the Implicit Criteria	Explicit + Implicit Criteria $n = 29$	No Explicit Criteria $n = 46$	Total $n = 75$	The Only Implicit Criterion
1	Expressions of farewell, desire to die or acknowledgment of impending death	2	0	2	0
2	Expressions of hopelessness	3	10	13	5
3	Expressions of great emotional/physical stress	2	4	6	3
4	Expressions of awareness of the lethality of means of death	1	2	3	1
5	Efforts to prepare for death, inappropriate to the context of life	0	1	1	0
6	Efforts to learn about means of death or rehearse fatal behavior	2	7	9	0
7	Efforts to avoid being rescued	1	5	6	0
8	Previous suicide attempt	3	11	14	2
9	Previous suicide threat	3	2	5	2
10	History of stressful events/significant losses	9	8	17	5
11	History of serious depression/mental disorder	6	19	25	9

TABLE 3—*Number of cases with 0 to 3 implicit criteria in the absence of explicit criteria, and the distribution of the manner of death among cases with different numbers of implicit criteria.*

Implicit Criteria	*n*	%	Suicide, *n*	Undetermined, *n*	Accident, *n*	Alcoholism, *n*
0	34	42.5	15	14	3	2
1	27	33.5	20	7	0	0
2	13	16.5	12	1	0	0
3	6	7.5	5	1	0	0
Total	80	100	52	23	3	2

TABLE 4—*Manner of death in cases with only one implicit criterion, and with no explicit criteria.* n = *27.*

The Implicit Criterion	Suicide, *n*	Undetermined, *n*
Expressions of farewell, desire to die or acknowledgment of impending death	0	0
Expressions of hopelessness	4	1
Expressions of great emotional/physical stress	3	0
Expressions of awareness of the lethality of means of death	0	1
Efforts to prepare for death, inappropriate to the context of life	0	0
Efforts to learn about means of death or rehearse fatal behavior	0	0
Efforts to avoid being rescued	0	0
Previous suicide attempt	1	1
Previous suicide threat	1	1
History of stressful events/significant losses	4	1
History of serious depression/mental disorder	7	2
Total	20	7

Discussion

Before commenting upon the main findings in the study, attention should be drawn to its possible limitations. First, the analyses were based on the autopsies of only one of the six forensic medicine districts in Sweden, and the conclusions therefore have to be limited to that district, although we believe that many of the results are most likely valid for all Sweden.

Second, retrospective analyses generally involve inevitable restrictions, while the process leading to a certain decision might include variables that are impossible to reconstruct. However, we consider the size of the sample to be large enough to compensate for this weakness.

Third, as the operational criteria of Rosenberg et al. have not yet been validated, they are not to be seen as a strict ''gold standard.'' However, we considered the criteria to be of such empirical and scientific quality that they could serve as a useful comparative standard in our study.

Application of the operational criteria showed that explicit, unambiguous expressions of the decedent's intent to die were found in only 29 (26%) of the 109 analyzed cases. Thus, the certifying process seemed to depend on implicit criteria in most cases. However, in an additional 34 of the 80 cases with no explicit criteria, implicit criteria were also lacking, thus leaving 46 cases with implicit criteria. The total number of implicit criteria never exceeded three in any of these 46 cases, and in 27 cases only one criterion was documented.

The results indicate that the certifying physicians had to make their decisions on the basis of fairly limited sets of information, raising questions about the validity of the death statistics in cases of DXP fatalities.

Among the 34 cases where neither explicit nor implicit criteria were found, 15 were classified as suicide and 14 as undetermined, showing that suicide was chosen as often as an undetermined manner of death even though no criteria for this decision were available.

The analyses of the cases with only one implicit criterion revealed a tendency among the physicians to assess the manner of death more frequently as suicide than as undetermined. A previous study showed that the district studied in the present investigation had a significantly higher suicide rate (73%) among cases of fatal DXP poisoning than all the other forensic medicine districts in Sweden and that the rate of undetermined manner of death (22%) was considerably lower in this district compared with the other districts (10). Our present result shows that the rates are still of the same magnitude (74% and 21%, respectively).

The certifying physicians classified death as suicide if no evidence was found to contradict the intent of the deceased to commit suicide. This demonstrates that the physicians are still following the directives of ICD-7, which states that self-inflicted deaths are to be assessed as suicide if it cannot be proved that the death was unintentional.

The significantly higher blood DXP concentration among the suicidal cases compared with undetermined cases may indicate that a high concentration per se was seen as a criterion of suicide intent. Among the 15 suicide cases lacking any type of criteria, three had a blood DXP concentration more than ten times the upper limit of the therapeuic range. In four other cases gastric content or empty newly prescribed tablet tins indicated that a large amount of tablets were consumed within a short time interval. In the remaining eight cases no indication of intended overdose was found. The conclusion drawn is that suicides are probably overreported.

When it comes to addicts it is difficult to interpret drug concentrations, since development of tolerance and loss of control of the amount taken are important criteria of substance dependence (16). These dependence syndrome behaviors might lead to accidental fatalities, especially when DXP is the consumed drug.

A case where the DXP fatality was classified as suicide in a drug addict is presented to illustrate the difficulty in interpreting the blood DXP concentration.

Case 1

A man, aged 39, died of poisoning. A blood alcohol concentration of 0.05% and a blood DXP concentration of 4.5 μg/g were found. According to hospital records he was a known alcoholic and abuser of medical drugs, and treatment with the anti-alcoholic agent disulfiram had been withdrawn within the last two weeks.

The man died in the apartment of his wife's grandmother. He had gone there to use her telephone. He made some telephone calls, and suddenly the grandmother heard a sound, and found him lying on the floor, without any signs of life. On arrival of the emergency team he was dead.

The death was classified as suicide. This could instead be an example of an accidental death caused by a combination of DXP and alcohol. Since he was an abuser of medical drugs, his tolerance of DXP was probably increased, but when the disulfiram was withdrawn and he started to drink alcohol again, the combination became lethal.

The fact that only three of the DXP fatalities were classified as accidents during the six years was rather striking. This result is quite different from that, for example, of Kaa and Dalgaard (1989), who, in a Danish study, found that 49% of the analyzed DXP fatalities resulted from accidents, while 40% were suicide, and the rest undetermined (11). Accident rates of 25% and of one-third have been reported from other studies (7,12).

In order to see whether the accident rate in Uppsala differed from that in all Sweden we analyzed the classification rates for cases of fatal DXP poisoning during the years 1992 to 1996 for the whole country (the figures for 1997 were not yet available). The death was classified as accidental in only 49 (5%) of all the 956 DXP fatalities during the five-year period. Thus the low accident rate in Uppsala proved to be valid for the whole of Sweden.

Regarding the classification of self-inflicted deaths, underreporting of suicide is mostly claimed (8,13). According to our study this is not true among cases of fatal DXP poisoning, where suicide rather seems to be over-reported and accidents underreported. We suggest that there are probably some accidents hidden among the undetermined cases as well as among the suicides.

Two cases, typical of the undetermined deaths without explicit/implicit criteria, will be presented as examples.

Case 2

A man, aged 39, died at home of poisoning. According to the police report he was a known alcoholic, with daily drinking. The toxicological analysis showed a blood alcohol concentration of 0.5% and a blood DXP concentration of 2.5 μg/g. The manner of death was classified as undetermined.

Studies have shown that there is a high prevalence of accidental deaths by DXP poisoning among drug addicts (14). Since there were no indications of suicide at all in this case, an accidental death would probably have been a more valid classification than an uncertain suicide.

Case 3

A man, aged 29, died of poisoning. He had a blood alcohol concentration of 0.17% and a blood DXP concentration of 3.1 μg/g. The deceased had been on analgesic medication since a traffic accident in the past. According to the police report he was found by his father and brother. A bottle of water and a package of the prescribed analgesics were found on a table.

The day before, the deceased had been celebrating his mother's birthday with his parents. The parents gave him a lift home after the birthday party and according to the father the deceased was then moderately drunk.

The father stated that his son was in a very happy mood when they left him and that he had been very positive and pleased with life lately, and was planning to buy a house. He had no history of any diseases, and had been quite healthy apart from the relatively slight injuries he had sustained in the traffic accident.

The manner of death was classified as undetermined. In this case there were clear indications of an accident, with a young man who despite being on analgesic medication drank alcohol, probably because he lacked knowledge of the life-threatening risk of combining these two drugs.

To be able to assess the cases presented above with a higher degree of certainty, more information from family, friends, or others about the decedents' personalities and their behavior would be needed.

It seems as if the certifying physicians are more prone to classify death as undetermined rather than accidental in ambiguous situations. The question is whether this is a reflection of an office policy to routinely classify all nonsuicidal drug deaths as undetermined rather than of an inappropriate investigation/decision-making process. As no such office policy could be verified we suggest it is a result of the limited basis for classification.

Failure to report drug deaths as accidents may delay discovery of the toxicity of drugs. Concerning DXP, it is well known that its toxicity is high and that its effects are potentiated by alcohol, and it is therefore specially important to pay attention to the possibility of accidental DXP fatalities. The high simultaneous occurrence of DXP and alcohol (55%) in our study and the fact that 19% were classified as alcoholics and 12% as drug addicts support the suggestion that the low accidental rate is due to underreporting.

Perhaps this underreporting is one of the reasons why the prescription of DXP and the rate of DXP fatalities in Sweden are both constantly high, while they have decreased in both Denmark and Norway as a result of restrictions, based on alarming reports of accidental deaths due to DXP poisoning (6,14,15).

We conclude that the Swedish death statistics derived from death certificates is not accurate regarding the manner of death in DXP poisonings. In order to guarantee valid death statistics concerning cases of self-inflicted poisoning, as in our study of DXP fatalities, a psychological analysis is recommended, along with a practice of classifying death as accidental if suicide cannot be established.

Conclusion

It is concluded that the basis for classification of the manner of death in cases of DXP fatalities is often limited. Information from relatives, friends and significant others about the decedent were rarely available in the certifying process.

Probable overreporting of suicides and considerable underreporting of accidents were suggested by this study. We suggest that the underreporting of accidents might be one of the reasons why DXP prescriptions in Sweden are constantly high, leading to a constantly high DXP fatality rate, while other Scandinavian countries (Denmark and Norway) have managed to decrease the rate of DXP fatalities as a result of restrictions, based on alarming reports of fatal accidents involving DXP.

In order to guarantee valid death statistics, the amount of information constituting the basis of the certifying process has to be enlarged. This would require implementation of new routines, including interviews of relatives, acquaintances and significant others, for example psychiatrists, to obtain the information required to assess the decedent's intention to die. A set of operational criteria would facilitate the difficult certifying process, and the set of explicit and implicit criteria applied in this study is recommended by the authors.

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