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Death by Poisoning: A Ten-Year Survey of Dallas County

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ABSTRACT: From 1971 through 1980, 1115 deaths were ascribed by the Dallas County Medical Examiner's Office to poisoning of some type. An analysis of these deaths, with emphasis on the substances involved, is the purpose of this study. Relatively few agents or groups of agents accounted for 87% of these deaths: carbon monoxide, barbiturates, propoxyphene, narcotics, tricyclic antidepressants, ethyl alcohol, and inhalants (gases and solvents). Twenty-five percent of the deaths were classified as mixed intoxications, resulting from combinations of agents. Two major trends were observed: in the second five-year period, barbiturate-induced deaths decreased considerably (58%) and deaths from tricyclic antidepressants increased more than four times as compared with the first five-year period. Yearly statistics have been compiled for deaths from each agent.

KEYWORDS: toxicology, poisons, death

The Dallas County medical examiner system was established in 1969, with offices and toxicology laboratory located in Parkland Memorial Hospital. In 1972, a new facility was completed and occupied, including the toxicology laboratories and the County Criminal Investigation Laboratory. The law requires that all deaths occurring under unnatural circumstances, including accidents, homicides, and suicides, be reported to the medical examiner for investigation. All drug- or poison-related deaths are to be reported.

Throughout the ten-year period from 1 Jan. 1971 through 31 Dec. 1980, two of the authors (the toxicologist, Dr. Garriott, and the chief medical examiner, Dr. Petty) have remained in their positions in this system, while the third was present for nine of the ten years. Over this ten-year period, we have investigated and ascribed deaths to some form of poisoning in 1115 cases. All of these cases, approximately two thirds of the total number of cases investigated in this office, were subjected to toxicological analysis by screening, or analysis for the appropriate specific agents, or both, before cause and manner of death were assigned. In view of the consistency of supervisory personnel and of the system for investigation, it is felt that the number of deaths found to be due to toxicological circumstances over this period of time is accurate for this jurisdiction and is representative of trends in medicinal drug use and drug abuse occurring over the past decade in this community.

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During this decade, the annual percentage of cases where autopsy was employed has remained fairly consistent, from a minimum of 40.6% to a high of 51.3%, averaging about 46.5% of all cases (see Table 1).

The population of Dallas County has increased 17% in the same period, from 1 328 000 in 1970 to 1 557 000 in 1980[3] and, in fact, the number of cases accepted by the medical examiner per year increased 17%, as indicated by the 1971 and 1980 case totals (Table 1) [*1*].

The number of drug-poison related deaths per year has remained fairly consistent during this period, however. In fact, 8% fewer deaths were seen in the second half of this decade than in the first, largely resultant from a general decline in deaths from two of the major drug categories—narcotics and barbiturates.

All deaths from toxic agents that occurred during the ten years are listed in Table 2. For comparison of trends occurring during the decade, the table is divided into two five-year periods.

All agents implicated as primary causes for deaths are listed with the number of deaths in each year. Seven major agents or groups of agents are included first, since these seven groups accounted for the largest number of single-agent deaths. These were barbiturates, carbon monoxide, ethyl alcohol, narcotics, propoxyphene, tricyclic antidepressants, and volatile substances. These agents accounted for 61% of all the deaths, when considered as single-agent causes of death, although a more accurate representation of total deaths caused by these major groups would be 87%, when the mixed drug category is included (Tables 3 and 4).

The five major drug groups (barbiturates, propoxyphene, narcotics, tricyclic antidepressants, and alcohol), alone or in combination but excluding carbon monoxide and inhalants, accounted for 63% of all the deaths recorded.

Deaths were placed in the mixed drug category when toxicological analysis revealed the presence of two or more drug agents in significant quantity (indicative of overdose of these agents) or when three or more agents were present in low quantity but the death was considered to be due to a combined action.

Some interesting trends were noted relating to the individual groups of agents.

Barbiturates

The barbiturate-related deaths have changed remarkably during the decade. Formerly, barbiturates were popular as street drugs and also were extensively prescribed as sedative-hypnotics [*2,3*]. Perhaps because of more intense publicity and physician warnings about the dangers of addiction and overdose, use of barbiturates has been drastically curtailed. This is eminently reflected by the decline in barbiturate-related deaths. Whereas 52 deaths were counted in the first five-year period, only 22 occurred in the second—a 58% drop.

Carbon Monoxide

A total of 210 deaths occurred as a result of carbon monoxide poisoning. Although some increase occurred in the second half of the decade (31%), the number of deaths was fairly consistent from year to year, and no particular significance or trend is seen here. In general,

TABLE 1—*Medical examiner autopsies in Dallas County.*

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	Total
Cases	2739	2701	2788	2591	2723	2553	2729	3007	3040	3207	28078
Autopsies	1113	1169	1232	1219	1382	1308	1401	1290	1536	1549	13199

[3]Statistics from the Dallas Public Library, December 1981.

TABLE 2—*All deaths from toxic agents.*

	1971	1972	1973	1974	1975	Sub-total	1976	1977	1978	1979	1980	Sub-total	Total
Barbiturates	12	11	8	11	10	52	4	6	5	1	6	22	74
Carbon Monoxide	15	13	11	27	25	91	30	23	14	23	29	119	210
Ethyl alcohol	5	8	4	12	5	34	16	10	8	8	15	57	91
Narcotics													
Dilaudid	...	...	...	...	...	0	...	1	2	1	2	6	6
Heroin	10	28	8	9	3	58	14	3	8	5	5	35	93
Meperidine	...	...	1	2	...	3	...	...	...	2	...	2	5
Methadone	8	1	3	6	2	20	...	1	...	...	...	1	21
Morphine	...	1	...	...	1	2	1	...	...	...	...	1	3
Pentazocine	...	...	1	...	2	3	...	...	1	1	...	2	5
Propoxyphene	5	2	5	6	6	24	7	9	2	10	3	31	55
Tricyclic antidepressants													
Amitriptyline	1	3	3	1	...	8	2	6	4	11	9	32	40
Doxepin	...	...	...	1	...	1	2	...	...	2	4	8	9
Imipramine	...	1	2	...	...	3	2	...	2	3	5	12	15
Volatiles													
Freons®	3	2	4	2	2	13	1	2	...	1	...	4	17
Gasoline-kerosene	1	1	...	...	3	5	...	...	...	...	...	0	5
Methane-natural gas	2	1	1	1	...	5	1	...	3	...	1	5	10
Nitrous oxide	...	...	...	...	4	4	...	...	...	...	1	1	5
Nitrogen asphyxia	...	...	1	...	...	1	...	...	...	...	...	0	1
Paint	...	...	...	...	1	1	1	...	...	...	...	1	2
Paint thinner	2	...	...	...	...	2	...	...	...	1	...	1	3
Propane	...	...	...	...	...	0	2	...	...	...	...	2	2
Toluene (acute/chronic)	...	...	...	...	...	0	...	...	...	...	2	2	2
Trichloroethylene and trichloroethane	...	...	...	...	1	1	1	1	...	...	...	2	3
Varnish	...	1	...	...	...	1	...	...	...	...	...	0	1
Acetaminophen	...	...	...	...	...	0	...	1	...	...	...	1	1
Amphetamine-methamphetamine	...	...	...	1	1	2	...	...	...	...	...	0	2
Anticholinesterase pesticides	1	...	...	...	1	2	...	1	1	...	...	2	4
Arsenic	2	...	1	...	...	3	1	...	...	2	...	3	6
Benzalkonium chloride	...	...	...	...	...	0	1	...	...	...	...	1	1

Brake fluid	1	...	...	...	...	1	...	...	...	...	...	0	1
Caffeine	...	...	1	...	...	1	...	1	...	...	...	1	2
Carbon dioxide	...	...	...	2	...	2	...	...	...	...	...	0	2
Carbon tetrachloride	1	1	...	...	...	2	...	...	...	...	...	0	2
Chloral hydrate	...	...	1	2	...	3	...	...	...	...	...	0	3
Chlordane	...	1	...	...	...	1	...	...	...	...	...	0	1
Chlordiazepoxide	1	...	...	1	...	2	...	1	1	...	...	2	4
Chlorpromazine	1	...	...	...	...	1	...	...	...	2	...	2	3
Chlorprothixene	...	...	...	...	...	0	...	1	...	...	...	1	1
Cocaine	...	1	1	...	...	2	...	2	...	...	2	4	6
Colchicine	...	...	...	...	...	0	1	...	...	...	...	1	1
Cyanide	...	1	...	1	...	2	...	...	2	2	...	4	6
Cyclopropane	...	...	...	...	...	0	...	...	...	...	1	1	1
Digoxin	...	1	1	1	1	4	...	...	...	...	...	0	4
Diphenhydramine	...	...	...	...	...	...	...	...	...	2	...	2	2
Diphenoxylate	...	...	...	1	...	1	...	...	...	...	...	0	1
Ethchlorvynol	2	3	...	2	...	7	...	2	...	2	3	7	14
Ethoheptazine	1	...	...	...	...	1	...	...	...	...	...	0	1
Ethylene glycol	...	...	...	...	...	0	...	...	...	1	...	1	1
Flurazepam	...	...	...	...	...	0	...	1	...	...	1	2	2
Formaldehyde	...	...	...	...	1	1	...	...	...	...	...	0	1
Furniture polish	2	...	...	...	...	2	...	...	...	...	...	0	2
Germicidal skin cleanser	...	...	...	...	...	0	1	...	...	...	...	1	1
Glutethimide	3	...	...	...	1	4	...	3	...	1	...	4	8
Heparin	...	1	...	...	...	1	...	...	...	...	...	0	1
Insulin	1	...	...	1	...	2	...	...	...	1	...	1	3
Iron	...	...	...	...	...	0	...	...	1	...	...	1	1
Lead	...	...	...	...	...	0	...	...	...	...	1	1	1
Levodopa	1	...	...	...	...	1	...	...	...	...	...	0	1
Magnesium sulfate	...	...	...	...	...	0	1	...	...	...	...	1	1
Meclizine	...	1	...	...	...	1	...	...	...	...	...	0	1
Meprobamate	...	...	...	1	...	1	1	2	1	...	...	4	5
Methanol	...	...	...	1	1	2	...	...	...	...	...	0	2
Methapyrilene	...	...	...	1	...	1	...	...	...	...	...	0	1
Methaqualone	...	...	1	...	...	1	...	...	1	...	...	1	2
Methyl salicylate	...	...	...	1	...	1	...	...	...	...	...	0	1
Paraldehyde	...	...	1	...	...	1	1	...	...	...	...	1	2
Petroleum distillate/pyrethrins	...	...	1	...	...	1	...	...	...	...	...	0	1
Phenmetrazine	...	...	...	...	...	0	...	...	...	1	2	3	3

TABLE 2-(cont.)

	1971	1972	1973	1974	1975	Sub-total	1976	1977	1978	1979	1980	Sub-total	Total
Phenols	...	1	...	...	...	1	...	...	...	...	...	0	1
Phosphoric acid	...	...	...	...	...	0	...	1	...	...	...	1	1
Quinne-quinidine	1	...	...	...	...	1	1	...	...	...	...	1	2
Salicylic acid	2	1	3	2	3	11	2	3	1	3	3	12	23
Sodium hydroxide	...	...	...	2	...	2	...	...	...	...	...	0	2
Strychnine	1	...	...	...	1	2	1	...	...	...	1	2	4
Succinylcholine	...	...	...	...	...	0	...	...	...	1	...	1	1
Sulfuric acid	1	...	...	...	...	1	...	...	...	...	...	0	1
Thioridazine	...	...	...	...	...	0	...	...	1	1	...	2	2
Trichloroethylene	...	1	...	...	...	1	...	...	...	...	...	0	1
d-Tubocurarine	...	...	...	...	...	0	...	...	1	...	...	1	1
Mixed drug intoxication	25	54	19	24	50	172	21	23	31	17	24	116	288
Total	111	140	82	122	125	580	116	104	90	105	120	535	1115

TABLE 3—*Total deaths involving major agents.*

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	Total
Propoxyphene-involved deaths	14(15)[a]	13(10)	14(20)	14(15)	26(25)	13(15)	20(25)	11(14)	15(18)	12(13)	152(17)
Barbiturates	28(29)	43(34)	14(20)	22(23)	34(34)	15(17)	16(20)	14(18)	6 (7)	14(15)	206(23)
Tricyclic antidepressants	1 (1)	8 (6)	7(10)	5 (5)	5 (5)	12(14)	17(21)	16(21)	22(27)	26(29)	119(13)
Narcotics	18(19)	30(24)	13(18)	17(18)	8 (8)	15(17)	5 (6)	11(14)	9(12)	7 (8)	133(15)
Ethanol	5 (5)	8 (6)	4 (6)	12(13)	5 (5)	16(18)	10(12)	8(10)	8(10)	15(17)	91(10)
Total deaths involving drug-poison	111	140	82	122	125	116	104	90	105	120	1115
Carbon monoxide (% of total)	15(14)	13 (9)	11(13)	27(22)	25(20)	30(26)	23(22)	14(16)	23(22)	29(24)	210(19)
Total drug-involved deaths (excluding carbon monoxide)	96	127	71	95	100	86	81	76	82	91	905

[a]Percentages of total drug-involved deaths (excluding carbon monoxide) for each year are given in parentheses.

TABLE 4—*Most prominent agents in mixed drug deaths.*

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	Total
Propoxyphene	9(36)[a]	11(20)	9(47)	8(32)	20(40)	6(29)	11(48)	9(29)	5(29)	9(38)	97(34)
Barbiturates	16(64)	32(59)	6(32)	11(44)	24(48)	11(52)	10(43)	9(29)	5(29)	8(33)	132(46)
Diazepam	1 (4)	11(20)	3(16)	7(28)	20(40)	7(33)	12(52)	15(48)	4(24)	8(33)	88(30)
Ethanol	16(64)	20(37)	11(58)	5(20)	11(22)	4(19)	6(26)	10(32)	3(18)	8(33)	94(33)
Tricyclic antidepressants	0 (0)	5 (9)	3(16)	1 (4)	5(10)	6(29)	11(48)	10(32)	6(35)	8(33)	55(19)
Methaqualone	2 (8)	1 (2)	1 (5)	2 (8)	6(12)	5(24)	0	2 (6)	2(12)	3(13)	24 (8)
Codeine	1 (4)	1 (2)	1 (5)	4(16)	6(12)	4(19)	2 (9)	1 (3)	4(24)	3(13)	27 (9)
Meperidine	0	0	0	1 (4)	0	3(14)	2 (9)	2 (6)	1 (6)	0	9 (3)
Totals	25	54	19	24	50	21	23	31	17	24	288

[a]Percentages of cases with specified drug of the total mixed drug deaths in each year are given in parentheses.

we find about two thirds of the carbon monoxide-induced deaths are suicidal in nature, while the remainder are accidental. The most common source of carbon monoxide is automobile exhaust accumulating in a closed space such as a garage or the cab of a car. Faulty natural gas heaters and appliances also contribute to accidental deaths.

Ethyl Alcohol

Deaths from acute ethyl alcohol ingestion increased from 34 in the first to 57 during the second five-year period. The number of deaths from alcohol represents 8% of the total deaths from intoxication. It should be noted that the alcohol deaths are those resulting from acute overdose only, as evidenced by high blood concentrations. Those deaths from alcoholic liver disease or other alcohol-related syndromes are not included in these statistics. Since alcohol ingestion is such a well-ingrained social custom, and approximately 0.5 L (1 pt) of 100-proof whiskey (consumed in a short period of time) constitutes a potentially lethal dose, it is not surprising that alcohol is the third most lethal agent (surpassed only by carbon monoxide and heroin).

Narcotics

The narcotic drugs have been considered as a group, since use and overdose from these drugs usually fit a similar pattern. Those who abuse narcotics generally fall into a pattern of intravenous drug abuse, increasing addiction, and life styles centered on their addiction habit.

Pharmacologically, these drugs have as their prototype morphine, although its diacetyl derivative, heroin, is the agent principally responsible for narcotic addiction in our society. The other drugs in this category are either those few synthetic derivatives used as substitutes for heroin by addicts, as medicinal narcotics, or as substitute narcotics used to treat heroin addiction (such as methadone).

Methadone is, to date, the only derivative legally used to treat narcotic addiction. It is a long-acting, potent narcotic agent, with lesser euphoriant actions than heroin and, consequently, not as subject to abuse. Because of its long action, it is a dangerous narcotic when not used under careful medical supervision and leads to a progressive central and respiratory depression and death rather than the typical sudden collapse after injection of heroin.

During the first half of the decade, methadone deaths were not uncommon, a total of 20 occurring in five years. Eight of those occurred in a single year period, 1971. Case studies and toxicological results on these cases have been published [*4*]. At that time, street (illicit) sources were available for methadone. These sources dried up around 1975, perhaps because of stricter control of methadone programs, and the deaths ceased. Only one methadone death was recorded in the second half of the decade.

The heroin substitutes have consisted of meperidine (Demerol®), hydromorphone (Dilaudid®), and pentazocine (Talwin®). Dilaudid has appeared on the illicit market only in recent years, and all of the six Dilaudid deaths have occurred since 1977. It is a narcotic with roughly the same potency as heroin but effective when taken orally, whereas heroin must be taken intravenously to achieve the euphoric effect. The abusers of Dilaudid, therefore, do not have the typical needle-puncture sites of the extremities or the lung pathology as described for heroin addicts. Their detection depends almost exclusively on good toxicological evaluation.

Meperidine and pentazocine are both narcotic analgesics, which can be used as substitutes for heroin. However, both are generally restricted to medicinal sources and are not readily available to the drug abuser. Those cases involving deaths from these agents are often the result of abuse and addiction by medical personnel (nurses, physicians, pharmacists). Five deaths from each of these agents have been counted in the ten-year period.

Heroin abuse and heroin-related deaths have been widely publicized and politicized. The illicit market for heroin in this country has probably totaled billions of dollars. Because of this potential for marketing and the narcotic potency of heroin, a large number of deaths occur in this country each year. The narcotic drugs all elicit varying degrees of the following properties: euphoria, analgesia, respiratory depression, and addiction. The desired effect is euphoria, but along with this comes the danger of death from respiratory depression when unknown quantities of heroin are injected. With high addiction rates, some cities have reported death rates of up to 11 per 100 000 population [5].

In our county, the rates have usually been less than 1 per 100 000, excepting one year (1972), when 28 deaths (2 per 100 000) occurred. Heroin-related deaths were found to be readily confirmed by a combination of scene circumstances, lung pathology, and toxicologic analysis for morphine in blood, urine, bile, and sometimes kidneys [5,6].

The maximum number of deaths occurred in the first half of the decade, with a 40% decline in the number of heroin deaths since 1975. This correlates with a nationwide decline in heroin deaths and emergency room incidents beginning in 1976 [7].

Propoxyphene

Propoxyphene has been one of the leading causes of drug-related deaths throughout the past decade, having been first recognized as a major drug problem in the early 1970s [8,9]. A national survey including four years from 1972 through 1975 identified 1022 deaths involving propoxyphene with a frequency of 6.0 deaths per million population reached in 1974. Forty-six percent of these deaths were classified as suicide, 26% as accidents, and 21% as undetermined. It was thought that the number of suicidal deaths were underreported, however [9].

A more recent survey of the same population bases for the period 1975 through 1978 reviewed 1859 cases of propoxyphene-involved deaths [10]. This survey indicated a peak of such cases in 1977, followed by a decline in 1978 and 1979.

The data from Dallas County show a consistently high incidence of propoxyphene deaths, with a total of 152 overdose cases in which propoxyphene was involved, of which 55 were considered primary (not mixed drug) intoxications. No particular trends with propoxyphene deaths were seen in our survey of the last ten years, and propoxyphene continues to be a major source of drug-involved deaths. In our experience, 80 to 90% of the propoxyphene-related overdose deaths result from intentional ingestion for suicidal purposes. These cases are evidenced by high levels of propoxyphene, with usually lower levels of norpropoxyphene in the blood. Some of the deaths in the accidental category seem to result from repeated ingestion of relatively high doses for pain control, with consequent buildup of very high levels of propoxyphene and norpropoxyphene in the blood and tissue. These cases have 1½ to 5 times as much metabolite as propoxyphene and usually have a clear history of a painful medical condition, with analgesic drugs prescribed in large amounts.

Tricyclic Antidepressants

Perhaps the most dramatic change in drug-related deaths in the two five-year periods of the past decade was that involving the tricyclic antidepressants. The total number of deaths more than quadrupled in the second half of the decade (12 deaths through 1975, 52 deaths from 1976 through 1980).

During the period under consideration, the tricyclic antidepressants in use in the United States consisted essentially of three agents: amitriptyline, doxepin, and imipramine. The demethyl metabolites of amitriptyline and imipramine (nortriptyline and desipramine, respectively) are also used as therapeutic agents but can be considered virtually the same in effect as their respective primary agents, which are converted to the demethylated metabolites in the body. A few additional tricyclic agents are now in use, but no deaths from these were seen prior to 31 Dec. 1980.

As these drugs are not euphoriants and are not available on the illicit market, the dramatic increase in overdose deaths must be exclusively related to medicinal prescription practices. Since tricyclic antidepressants are prescribed for the relief of depression, and depression is the major factor leading to suicide, these drugs provide a readily available mechanism for death. High levels of the parent drug in the blood (usually greater than 2.0 mg/L) are diagnostic of fatal overdose with these agents, while much higher levels of the demethyl metabolites are indicative of chronic use of high doses.

Volatiles

The seventh most frequently encountered group of substances causing death was the volatile agents, accounting for 51 deaths. These agents included all gases and solvents excepting carbon monoxide, carbon tetrachloride (two cases), and one case involving cyclopropane. These latter agents were due to either suicidal or accidental exposure. The other 51 cases involved volatile agents, also referred to as inhalants, most of which were due to the practice of intentionally inhaling them for intoxication purposes. Inhalant abuse deaths in Dallas County through 1978 have been reviewed elsewhere with details of toxicology findings and case histories [*11*]. The most prominent agents in this category have been the various types of Freon® in spray cans, toluene (in spray paint or as a pure solvent), nitrous oxide, and natural gas, but many different gases or solvents may be involved. In some cases, the specific agent is not clearly evident, since paints, thinners, and other common products have multiple solvents.

Until their removal from the spray can market in 1975, largely because of environmental concerns, Freons were documented as the primary toxic agent in hundreds of "sniffing" deaths [*12*]. Freons and some other halogenated hydrocarbons are known to cause death by induction of cardiac arrhythmias [*13*].

Locally, toluene is now the most sought after agent for "sniffing," having replaced the Freons. However, this solvent rarely causes death, even when very high blood levels are achieved [*14*].

Agents such as nitrous oxide, nitrogen, methane, and propane probably induce death primarily by suffocation (anoxia), combined with central and respiratory depression. Of this group, all were diagnosed by toxicological analysis using gas chromatographic conditions specific for low molecular weight volatile substances [*15*].

Other Miscellaneous Agents

After these major groups, 54 separate agents accounted for at least one death each during this ten-year period. These 54 agents accounted for only 14% of the total deaths, however. The most frequently encountered of these was aspirin (salicylate), with 23 deaths. These deaths were equally divided between the two periods, indicating no change in number of deaths over the decade. This is to be expected, since aspirin is an over-the-counter medication and prescription trends do not have a bearing on its use. All of the 23 deaths occurred in adults, and all were suicidally motivated.

Of the 53 remaining agents, those causing five deaths or more in the ten years were arsenic (6), cocaine (6), cyanide (6), ethchlorvynol (14), glutethimide (8), and meprobamate (5).

Twenty-six separate agents caused only one death each in the ten-year period. These included some therapeutic agents like acetaminophen, chlorprothixene, diphenoxylate (Lomotil®), ethoheptazine, levodopa, methapyrilene, iron, tubocurarine, and succinylcholine. Many were chemicals or products not intended for human ingestion, such as brake fluid, ethylene glycol, formaldehyde, methyl salicylate, phosphoric acid, and sulfuric acid. The majority of these deaths were from intentional ingestion or administration. For example, the tubocurarine and succinylcholine deaths were from self-injection with the intent to commit suicide. The diphenoxylate and iron deaths were from accidental ingestion by children, however.

The "classic poisons," from antiquity to modern times, include such agents as strychnine, cyanide, arsenic and other heavy metals, and organic phosphate pesticides. In earlier times arsenic and strychnine were common homicidal poisoning agents and even today, most people think of these and other more modern poisons (usually in the class of pesticides) when the word "poisoning" is considered. Collectively, these accounted for 21 deaths (less than 2% of the total). With only two exceptions, these deaths were all believed to have been suicidally motivated.

One case of particular interest was a rare incident of fatal lead poisoning. This death resulted from a 1½-year-old embedded bullet, lodged near a knee joint. With no obvious source of lead poisoning, the diagnosis was missed during two months of care at the county hospital. At autopsy, blood lead levels of 250 μg/dL (normal, 0 to 40 μg/dL) were found, and the death was ruled a homicide [*16*].

Homicidal arsenic poisoning is a rare phenomenon today, largely perhaps because of the ease of detection in living patients or at autopsy. Of the six arsenic poisoning cases included here, three were from suicidal ingestion, one was an accidental ingestion by a four-year-old girl, and two were the result of homicidal administration by a woman to her husband and 1½-year-old child. The few pesticide (5), strychnine (4), and, cyanide (6) deaths were all from suicidal ingestion except for one case of cyanide intoxication by injection of a cyanide powder believed to have been cocaine.

Mixed Drug Intoxications

A significant number of the deaths (26% of the total) were placed in the mixed drug categories because of the lack of a specific single agent being involved. These deaths are further analyzed in Table 4. The drugs involved in most of these deaths are essentially the same as those seen as major single agent causes of death, including propoxyphene, barbiturates, tricyclic antidepressants, and ethyl alcohol. To a lesser extent, methaqualone, codeine, and meperidine also were involved, as indicated. Diazepam was frequently found. For example, propoxyphene was found in 34% of the 288 mixed-drug cases, barbiturates were found in 46%, diazepam in 30%, and ethyl alcohol in 33%.

It is a significant observation that two agents often involved in mixed-drug intoxications and in clinical intoxications are rarely listed as primary causes of death. These are diazepam and methaqualone. Diazepam is unquestionably the most commonly prescribed tranquilizing agent in this country, and in recent years has become one of the commonest of the illicit drugs, used for intoxication purposes in a manner similar to ethyl alcohol. The same applies to methaqualone, which has been recognized as one of the major drugs of abuse in many parts of the United States. Both are commonly detected in clinical overdoses and in drug abuse screening.

In this ten-year survey of 1115 deaths, no deaths were detected from diazepam alone, while only two deaths were from methaqualone. Both of the latter were from suicidal ingestion of huge doses. The lack of death from diazepam is consistent with a nationwide survey, with a population base of 79.2 million people. Out of 1239 deaths related to diazepam by toxicological detection at autopsy, only two could be substantiated as deaths resulting from diazepam alone [*17*]. Diazepam was found in 30% of the mixed-drug intoxication deaths in this survey, yet accounted for no deaths. Methaqualone was found in 24 cases, or 9% of the mixed intoxication deaths, but accounted for two primary deaths in the ten-year period.

Summary and Conclusions

In a ten-year period from 1971 through 1980, a total number of 28 078 deaths were seen and evaluated by the Dallas County Medical Examiner. Four percent (1115) of this total were deaths from exposure to drugs and other toxic substances.

The agents responsible for the deaths were determined in each case by toxicologic analyses, in conjunction with investigations by the medical examiner. The major agents involved were divided into seven groups:

(1) barbiturates, which were involved in 18% of all the toxic substances-related deaths,
(2) carbon monoxide—19%,
(3) ethyl alcohol—8%,
(4) narcotics—12%,
(5) propoxyphene—14%,
(6) tricyclic antidepressants—11%, and
(7) volatile substances and inhalants—8%.

Two major trends were observed. The barbiturate-induced deaths dropped sharply by 58% in the second five-year period, while those deaths from tricyclic antidepressants rose sharply in the second period, to more than four times the number seen in the first five-year period. Narcotic deaths, from heroin and methadone, decreased in the second five-year period, while six Dilaudid deaths occurred only in the second five-year period.

An additional 54 separate agents accounted for the remaining deaths, although these were only 14% of the total.

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