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Fatal and Non-Fatal Poisonings: A Statistical Survey

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FATAL AND NON-FATAL POISONINGS: A STATISTICAL SURVEY*

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Fatal and non-fatal poisonings present recurring problems of detection, diagnosis, and treatment in many fields of medicine. In forensic practice, criminal prosecution or civil action may frequently follow a poisoning incident. Few recent comprehensive studies (1-6) have been made of the incidence of poisonings or of the frequency with which the various toxic substances are encountered in legal medicine and forensic practice.

FATAL POISONINGS

Death caused by poison may be difficult to diagnose and document. The services of a skilled toxicologist are usually required to exclude the presence of poisons or to identify them quantitatively in the viscera and body fluids. Since these services are frequently not available, many deaths ascribed to poisoning are based on anamnestic and clinical data. There are relatively few communities in the United States in which the public agency for investigating unexplained and unnatural deaths is so constituted as to acquire reliable data concerning deaths by poisoning. A survey was undertaken of the records from the office of the Coroner or Chief Medical Examiner in three such communities, Cuyahoga County (Cleveland) Ohio, Los Angeles County, and the State of Maryland, to ascertain the incidence of fatal poisonings. The period chosen 1942 through 1950 was found to be adequate for the purpose of this study. For various reasons, death from anesthetic

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TABLE I

Cuyahoga County (Ohio) Coroner's Office

	Total Deaths	Coroner's Cases		Violent Deaths All Types			Poisonings All Types		
Year	A No.	B No.	%A	C No.	%A	%B	D No.	%C	%B
1943	13,925	1,428	10.2	626	4.4	43.8	74	11.9	5.2
1944	13,220	1,406	10.7	595	4.3	42.2	57	9.7	4.1
1945	13,091	1,465	11.2	653	4.9	44.4	79	12.1	5.5
1946	13,029	1,568	12.1	754	5.7	47.4	82	10.9	5.2
1947	13,954	1,882	13.4	746	5.3	39.6	78	10.4	4.1
1948	13,679	1,908	14.0	720	5.3	37.7	76	10.5	3.9
1949	13,814	1,989	14.4	727	5.3	36.5	80	11.1	4.0
1950	13,756	2,205	16.0	677	4.9	30.6	76	11.2	3.5
TOTAL	108,468	13,851		5,498			602		
8 year average	13,558	1,731	12.7	687	5.0	40.3	75	10.9	4.4

agents and deaths from ethanol poisonings were excluded from this study.

Although ethyl alcohol is a contributory factor in many violent deaths, it is rarely the sole cause of death (7, 8). Ethanol intoxication often renders an individual more vulnerable to death by disease or physical violence. Only by careful study of all the information, historical, anatomical, and chemical, can one determine whether poisoning occurred or whether alcohol was merely a contributory factor to the fatality. Private physicians are often loath to certify deaths as having resulted from acute alcoholism because of the attached social stigma. Instead the patient is said to have died of natural disease. A detailed study of the alcohol problem is beyond the scope of the present discussion.

STATISTICAL STUDIES

Tables I and II indicate the incidence of fatal poisonings in Cuyahoga County and Los Angeles County over an eight year period. In each area poisonings account for approximately 5% of all cases certified by the coroner's office. One of every nine violent deaths is due to a poisonous substance. The parallelism between the two sets of data is striking. However, over the eight year period fatal poisonings in Cuyahoga County show a downward trend of 33%, whereas in Los Angeles County there has been an increase of 29%. Moore, et al, (4) recently reported that poisonings contribute 3.5% of all cases seen by the Medical Examiners of Massachusetts. Data submitted by the Office of the Chief Medical Examiner of Maryland agree with Moore's figures.

TABLE II

Los Angeles County Coroner's Office

Year	Total Deaths A No.	Total Coroners Cases B No.	%A	Total Violent Deaths C No.	%A	%B	Total Poisonings D No.	%C	%B
1942	32,967	6,760	20.6	2,894	8.8	42.7	300	10.5	4.5
1943	34,717	6,831	19.8	2,517	7.3	36.7	232	9.3	3.4
1944	36,127	6,889	19.0	2,606	7.2	37.9	265	10.0	4.0
1945	36,555	7,715	21.2	2,891	7.9	37.3	302	10.5	3.9
1947	37,807	7,469	19.7	3,074	8.1	41.2	370	12.0	5.0
1948	38,656	7,789	20.2	3,000	7.8	38.5	367	12.2	4.8
1949	39,978	7,539	19.0	2,796	7.0	36.9	434	15.6	5.7
1950	38,047	7,774	20.3	2,802	7.4	36.1	461	15.8	5.8
TOTAL 8 year	295,654	57,366		22,580			2,731		
average	36,957	7,171	20.0	2,823	7.7	38.4	341	11.9	4.7

A popular misconception is that poisoning fatalities are predominantly homicidal. Actually they made up less than 0.5% of all homicides. One out of every four suicides and one out of every four home accidents in Cuyahoga County is due to poison. In Los Angeles County, two of every five suicides use poison and in Maryland one of every three.

Suicides account for 48% of all fatal poisonings in Cuyahoga County, whereas in Los Angeles County and Maryland they account for 63%. This difference may be due to a different basis for ruling the manner of death in each jurisdiction. The criteria for ruling death due to suicides are probably more stringent in Cuyahoga County.

Fatal industrial accidents are seldom due to exposure to hazardous

TABLE III

Frequency of Occurrence of Toxic Agents in Three Different Communities**

	Los Angeles No.	%	Cleveland No.	%	Maryland No.	%
Carbon Monoxide	962	35	276	46	451	67
Barbiturates	854	31	132	22	73	11
Mercury Compounds	36	1	43	7	14	2
Arsenic Compounds	266	10	11	2	9	1
Methyl alcohol	*		22	4	13	2
Alkaloids	105	4	12	2	15	2
Phenol, cresol, lysol	61	2	12	2	6	1
Fluoride	52	2	7	1	13	2
SUBTOTAL	2,336	85	515	86	594	88
All others	395	15	87	14	80	12
TOTAL***	2,731	100	602	100	674	100

*No data available.
**Eight years for Cleveland and Los Angeles, six years for Maryland.
***Substances contributing from 3-5% of the total include: Chlorinated hydrocarbons, salicylates, chloral, paraldehyde, volatile hydrocarbons.

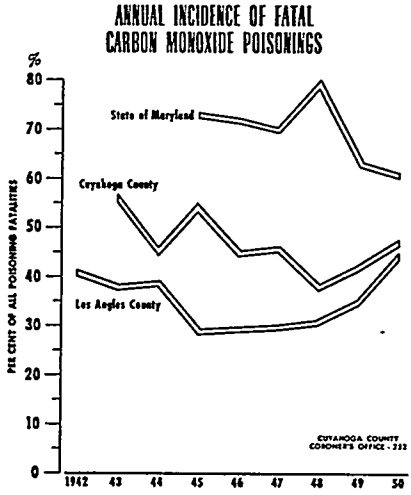

Figure 1a

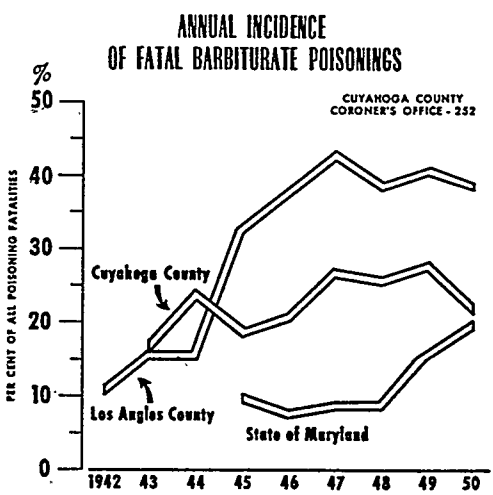

Figure 1b

chemicals. Accidents leading to fatality in Cuyahoga County's industries contribute 8% of the total violent deaths. Only 2% of these industrial fatalities were due to chemical poisons. Industrial accidents contributed 1.5% of the total poisoning fatalities in Cuyahoga County compared to 0.8% in Los Angeles County.

The frequency with which the various poisonous substances are encountered is of interest to the clinician, the toxicologist, and the coroner (medical examiner). Table III indicates that in the three areas under consideration, two substances, carbon monoxide and the barbiturates account for approximately 70% of all poisoning fatalities. Heavy metals contribute approximately 10%. Alkaloids, phenolics, methanol, volatile hydrocarbons and their chlorinated derivatives, paraldehyde, and fluorides, together contribute another 10%. It is significant that these few substances are responsible for 85% of the total poisoning fatalities.

Figures 1a, b, c, show the annual incidence of deaths due to the common toxic substance and indicate significant trends. In Baltimore, (except for 1948) there has been a progressive decrease in the per cent of poisoning fatalities due to carbon monoxide. This is probably due to the recent change over to natural gas. Los Angeles showed a similar trend up to 1948. Since that time there has been an alarming increase in carbon monoxide fatalities. The increase is due to a higher incidence of carbon monoxide suicides. In Cleveland, carbon monoxide accounts for 45% of all poisoning fatalities.

In Baltimore, there has been an upward trend in barbiturate poison-

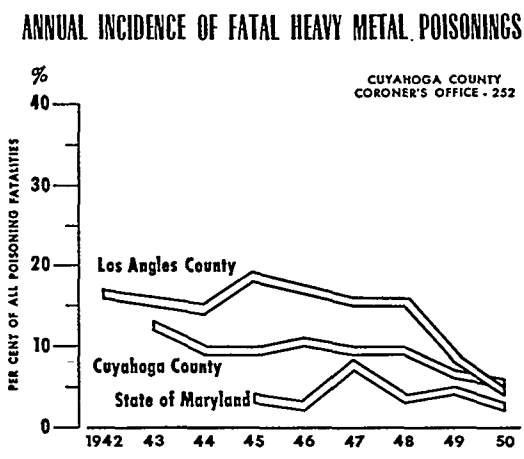

Figure 1c

ings within the last two years. Los Angeles showed a sharp rise which seems to have reached a plateau. In Cuyahoga County the incidence of barbiturate poisonings is fairly constant.

Heavy metal fatalities are on the decline in all three jurisdictions.

Admissions To Hospitals

There is a paucity of information on the incidence of poisoning admissions to general hospitals. Thus the hospital emergency room staff does not know how often they can expect to be faced with such a situation or what is the relative frequency of poisonings by any given toxic substance. The only available data are those which have accumulated in the hospital record rooms. These figures have rarely been either assembled or collated.

Hospital poisoning admissions can be evaluated only if all the hospitals in a given community contribute the necessary data. The cooperation of all the hospital record librarians in Cuyahoga County was secured. The information thus obtained was collated in Table IV. Some of the limitations of these data should be mentioned. Occasionally, poisoning incidents are not recorded because patients are seen only in the emergency room, treated, and sent home. Thus only those poisonings sufficiently serious to warrant hospitalization are represented in this study. Chronic alcoholism has been omitted because it is felt that the available data was incomplete and unreliable.

The barbiturates, the heavy metals, the "sulfonamides," and carbon monoxide account for approximately 70% of the total. Alkaloids, phenol, lysol, and cresol account for an additional 10%. Thus rela-

TABLE IV

Incidence of Poisoning Admissions to Cleveland, Ohio Hospitals

	1942	1943	1944	1945	1946	1947	1948	1949	1950	Total	Per Cent
Barbiturates	77	75	87	94	129	161	136	123	112	994	36.1
Mercury compounds	42	25	30	33	35	38	39	31	24	297	10.9
"Sulfa" drugs	55	71	48	47	24	20	20	11	8	304	11.1
Carbon monoxide	26	27	11	7	12	21	22	15	18	159	5.8
Opiates	9	13	7	10	7	12	17	20	9	104	3.8
Phenol, lysol, cresol	19	18	8	14	11	13	7	9	7	106	3.9
Digitalis	13	10	8	5	5	4	14	13	8	80	2.9
Alkaloids	4	4	6	7	14	6	12	16	13	82	2.9
Arsenic compounds	12	24	6	3	5	3	8	4	7	72	2.6
Lead compounds	15	8	9	4	3	8	5	8	12	72	2.6
Toxic food	6	12	9	4	4	10	7	3	5	60	2.2
Iodides	11	9	7	7	5	12	7	4	4	66	2.4
Other inorganics	3	5	6	1	8	7	12	9	12	63	2.3
Salicylates		5	4		3	5	15	9	21	62	2.2
Bromides	1	1	5	5	10	9	8	6	9	54	1.9
Gasoline, benzene	3	1	5		5	2	8	7	12	43	1.6
Halogenated hydrocarbons	2	1	5	3	3	3	3	3	4	27	4.3
Aniline, nitrobenzene	3	1	1	2	1	7	5	6	3	29	
Turpentine		2	2	2	5	1	5	3	3	23	
Other heavy metals (Zu, Cu, Al, Cd, Bi)	1	1	1	1		2	3	6	2	17	
Fluorides	1		2	1	1	1	1	2	2	11	
Phosphorus	1	1		2		1	4			9	
	304	314	267	252	290	346	358	308	295	2734	100.5

tively few substances account for a majority of the toxic agents responsible for hospital admissions.

The downward trend in admissions due to barbiturates in the last few years is noteworthy. A similar trend is noted for the sulfonamides. Hospital admissions due to ingestion of alkaloids have not increased significantly.

Discussion

Poisonings account for approximately 10% of all deaths due to unnatural or violent causes. The manner of death by poisoning is usually suicide. In Cuyahoga County the percentage of all suicides by poisoning appears to have decreased between 1942-1950, whereas in Los Angeles County there appear to have been a steady increase during the same period. Carbon monoxide, barbiturates, and heavy metals account for approximately 70% of all such deaths.

A study of the annual incidence of the various poisons implicated reveals a downward trend of deaths due to heavy metals and alkaloids in all the jurisdictions. This is a continuation of a similar downward trend that goes back over many years. The promiscuous use of arsenicals, mercurials, and alkaloids is a thing of the past. The use of BAL as an effective therapeutic agent has undoubtedly contributed to the decrease in fatalities due to ingestion of heavy metal salts.

The other substances responsible for fatal poisoning vary from year to year and show no continuous trend in any one direction. The upward trend (6) in barbiturate fatalities that has been reported for the past several years is not maintained in these three jurisdictions. In Los Angeles County and Cuyahoga County there is a definite plateau in the barbiturate curve and only in Maryland is there a continuous rise.

Poisonous substances which are most frequently used are those procured most easily. The public is informed of the effect of the various toxic agents from many sources. The correlation between publicity given a poisoning incident and subsequent similar events would be interesting to ascertain.

The marked downward trend in the incidence of "sulfa drugs" poisonings illustrated in Table IV is due to the use of "triple sulfa" preparation and their lower toxicity, and to other forms of antibiotic therapy which have supplanted the use of "sulfa drugs" to a significant extent.

If the hospital emergency rooms were equipped with a kit containing those therapeutic agents necessary to treat quickly barbiturate intoxi-

cation, diabetic coma, insulin shock, carbon monoxide exposure, heavy metals ingestion, most admitting room emergencies due to poisonings could be effectively handled. Simple rapid testing techniques are already available for the determination of blood sugar (10), creatinine (10), acetone in plasma or urine (11), carbon monoxide levels (9), ethyl alcohol (13) and heavy metals (12) in biological fluids and gastric washings. Use of these procedures in the emergency room would help establish clinical diagnosis. No simple test is presently available for the rapid emergency determination of alcohol or barbiturates.

SUMMARY

Poisoning fatalities constitute approximately 10% of all violent deaths. The majority of fatal poisonings are suicidal in origin. Carbon monoxide, barbiturates and heavy metals are responsible for 70% of all such deaths. This study discloses a steady and persistent decrease in the incidence of fatal heavy metal poisonings. The other substances involved in fatal poisonings show no similar trends in the several jurisdictions. Hospital admissions due to toxic chemicals are primarily due to barbiturates, heavy metals and carbon monoxide. There is a recent downward trend in the incidence of barbiturates poisoning and a continued downward trend in incidence of "intoxication" by sulfa drugs.

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