

Mortality from Snakebites, United States, 1950-54

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POISONOUS snakebites in the United States are by no means rare. However, few studies indicate the incidence of poisonous snakebites in a given region or State, and no studies give the actual death rate in this country resulting from poisonous snakebites alone.

The estimate by Githens, quoted by Porges (1) and others, of 2,000 to 3,000 snakebite accidents a year in the United States is based on such sources as news clippings and is possibly far too low.

Swaroop and Grab (2) pointed out the importance of snake venom poisoning throughout the world. They estimated that 30,000 to 40,000 deaths occur annually from this cause. The same authors estimated that there are from 10 to 20 deaths from snakebites in this country each year.

One of the major difficulties in a study of snakebite deaths is that the International Statistical Classification of Diseases, Injuries, and Causes of Death classifies snakebites under E927 with "accidents caused by bites and stings of venomous animals and insects." Included in this classification are the bites or stings of centipedes, scorpions, bees, wasps, snakes, and other venomous animals. The purpose of this study is to determine the death rate from poisonous snakebites in the various States, to discover what kinds of snakes cause most of the fatal bites, and to study other pertinent medical facts related to these deaths.

Two families of poisonous snakes inhabit the United States: the Crotalidae, or pit vipers, and the Elapidae, or coral snakes. Of the pit vipers, the genera found in this country are the

Crotalus, or rattlesnakes, the *Agkistrodon*, or moccasins (including the water, or cottonmouth, moccasin, and the copperhead, or highland, moccasin), and the *Sistrurus*, or ground rattlers. At least one species of poisonous snake has been reported to inhabit each State in this country.

Death Reports

A list of the deaths, 71 in all, resulting from the bites of poisonous snakes in the United States during the 5-year period 1950-54 was obtained from the National Office of Vital Statistics, Public Health Service. This list contained the number of the death certificate, the date of death, and the State in which death occurred. A copy of each death certificate was then obtained from the appropriate State health department. Since the death certificates did not record all the information considered important for this study, I mailed a followup letter with a questionnaire to each physician, coroner, or other official who signed the death certificate. Of the 71 mailed, 53 questionnaires were returned. This report is based on the analysis of the 71 certificates listing poisonous snakebite as the cause of death and the 53 questionnaires.

Projections from this small sample are of doubtful value, but they are offered for want of a better base. They indicate an average of approximately 14 deaths per year and an average death rate of 0.09 per 1,000,000 population for the entire country.

The number of fatal bites and the death rates for the individual States are shown in the table. The death rates, reported as deaths per 1,000,000 population, were highest in the following States: Arizona, 1.15; Florida, 0.65; Georgia, 0.63; Texas, 0.44; and Alabama, 0.32.

Of the 71 victims of poisonous snakebites, 53 were male and 18 female. The high proportion of deaths among males probably reflects their increased exposure owing to recreational habits and to occupations out of doors.

As shown in the following tabulation of deaths according to age, 39 percent of the deaths occurred in youngsters less than 15 years old. A study of the incidence of poisonous snakebites in Florida found that 49 percent of all

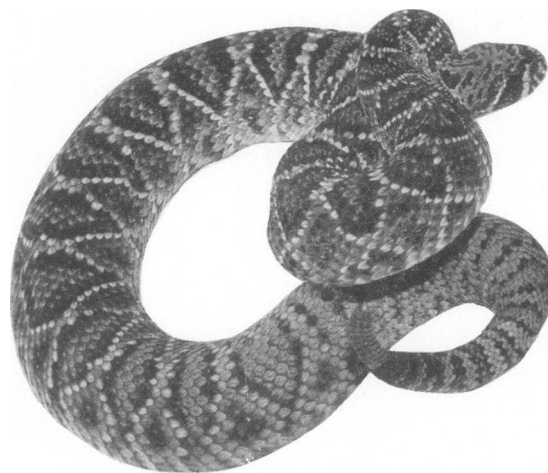
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the bites were experienced by children or youths less than 20 years of age (3). The large number of deaths in this age group is consistent with the observation that the ratio of units of venom injected to units of body weight is greater in children. Evidently, susceptibility to snake venom poisoning is greater in both extremes of life, for approximately 32 percent of the deaths were in persons 50 years old or more.

Age (years)	Number of deaths
0-4	16
5-9	7
10-14	5
15-19	3
20-29	3
30-39	7
40-49	7
50-59	15
60-69	4
70 and over	4

The occupational groups suffering most fatalities from snakebite were the following: agricultural workers, 25; other out-of-doors workers, including woodsmen, common laborers, and highway workers, 15; preschool children, 16; school children, 11; and housewives, 7. Closely related to the victim's occupation was his activity at the time of the fatal bite. Although the activity was not stated in 21 instances, of the other 50, 15 persons were bitten while working on a farm, 9 were bitten while engaged in other out-of-doors work, 16 children were bitten while playing near their place of residence, 8 persons were bitten while handling or trying to kill a snake, and only 2 were bitten while engaged in recreation. Of the 8 persons bitten while handling a poisonous snake, 5 were engaged in religious ceremonies in Kentucky and Alabama. The Kentucky State Board of Health reported 7 snakebite deaths resulting from religious snake handling between 1940 and 1955. Several of these victims refused treatment until it was too late.

The months during which fatal snakebites were most frequent were: June, 6; July, 10; August, 14; and September, 11. There was a gradual increase in the number of deaths beginning in March and reaching a peak during August and September. This seasonal distri-



Eastern diamondback rattlesnake (*Crotalus adamanteus*), one of the most dangerous snakes indigenous to the United States.

bution has been observed in other surveys of snakebites (3-5).

Crotalus species cause most of the fatal snakebites in the United States: Rattlesnakes accounted for 55 of the 71 deaths in this study. Cottonmouth moccasins were responsible for 2 deaths, and a coral snake caused 1. Two other deaths were attributed to unknown species of pit vipers. The offending reptile was not identified in the remaining 11 deaths. The large rattlesnake species and the cottonmouth moccasins more frequently produce cases of severe envenomation than do copperhead moccasins and ground rattlesnakes. Coral snakes, though quite poisonous, are not as aggressive as the pit vipers, and they have a much more limited geographic range.

Site of Bite

Snakes most frequently bite the extremities. In this study, 37 (52 percent) of the patients were bitten on the lower extremities, and 26 (37 percent) were bitten on the upper extremities. One patient was bitten on the face, and another was bitten on the thorax. For six patients, information about the site of the bite could not be obtained. Three patients suffered from two or more bites from the same snake. Physicians attending three other patients reported that the venom was injected directly into the blood stream through veins in the legs. This in-

travenous injection of the venom, rather than the usual lymphatic and subcutaneous spread, probably produced death despite heroic treatment. Four other patients were bitten on the proximal portion of an extremity, which allowed for more rapid dissemination of the venom into the body. The other fatal snakebite wounds did not differ from the majority of wounds reported in nonfatal snakebites (3, 4).

The interval between the time of the snakebite and the time of death is given below. Contrary to popular expectation, few patients died within the first hours following a bite. Thirty-five (49 percent) of the patients expired from 6 to 18 hours after becoming envenomated. In this period, the venom is absorbed into the body and exerts its maximum toxic effects. Of the patients who died 3 or more days following the bite, 3 died either from infection or gangrene, or both, and 1 died from a transfusion reaction.

<i>Time Interval</i>	<i>Number of deaths</i>
0-1 hours.....	3
2-5 hours.....	10
6-11 hours.....	19
12-18 hours.....	16
19-24 hours.....	6
25-48 hours.....	9
3 days.....	2
6 days.....	2
7 days.....	1
10 days.....	1
Unknown.....	2

Attending physicians were asked to check a list of remedies and measures used for treatment. In most instances, the treatment conformed to current recommended practices. It included the use of a tourniquet with incision and suction (6), and administration of antibiotics, tetanus antitoxin, and antivenom (7).

A factor which certainly cost many lives was the long interval between the time the patient was bitten and the time treatment was begun. The interval before treatment was less than 1 hour for 14 patients; from 1 to 4 hours for 19 patients; from 5 to 7 hours for 9 patients; from 8 to 10 hours for 3 patients; from 11 to 17 hours for 4 patients; from 18 to 24 hours for 2 patients; and more than 24 hours for 2 patients. Thus, approximately 36 percent of these 53 patients were seen 4 or more hours after the bite.

Information concerning the timelag before treatment was not available for 18 patients.

In my experience and from analyzing 241 nonfatal snakebites in Florida, approximately 65 percent of the patients were seen within 2 hours after the bite, and approximately 95 percent were seen within 4 hours. The lag before treatment in the fatal bites gives the venom ample time for absorption into the body and reduces the effectiveness of a tourniquet, incision, and suction. Failure to seek prompt medical attention is attributed to ignorance or religious bias. Many others, especially children, were vulnerable because they lacked boots, long trousers, or other protective clothing. The most important measure to prevent death from snakebite is prompt and vigorous treatment of the wound.

Summary

An analysis of 71 deaths from poisonous snakebites in the United States during the

Deaths from poisonous snakebites in the United States, 1950-54

State	Total deaths	Average deaths per year	Average deaths per 1,000,000 population ¹ per year
Arizona.....	5	1.0	1.15
Alabama.....	5	1.0	.32
Arkansas.....	2	.4	.22
California.....	7	1.4	.12
Florida.....	10	2.0	.65
Georgia.....	11	2.2	.63
Kentucky.....	2	.4	.14
Louisiana.....	1	.2	.07
Mississippi.....	2	.4	.19
Missouri.....	1	.2	.05
New Mexico.....	1	.2	.27
North Carolina.....	1	.2	.05
Oregon.....	1	.2	.12
South Carolina.....	2	.4	.18
Tennessee.....	1	.2	.06
Texas.....	18	3.6	.44
Nebraska.....	1	.2	.15
Total.....	71	14.2	?.09

¹ Estimated 1952 population for each State published by the U. S. Bureau of the Census in its Current Population Reports, Series P-25, No. 97, 1954.

² Based on total 1952 population for the United States.

period 1950-54 found the highest death rates in Arizona, Florida, Georgia, Texas, and Alabama.

The most frequent victims were under 15 or over 50 years of age. Most of the victims were workmen occupied out of doors or children playing around their residence. Rattlesnake species inflicted at least 77 percent of the fatalities, 90 percent of those for which the species was identified.

The bites of the wounds were predominantly on the extremities: 52 percent on the lower and 37 percent on the upper.

The most important factor in the failure of these patients to survive was the interval between the time of the bite and the time of medical treatment. Other important factors were the large number of rattlesnake bites, the age and weight of the victims, and the nature and location of the wounds.

Early and vigorous treatment of all severe cases of snake venom poisoning is recommended.

REFERENCES

- (1) Porges, N.: Snake venoms, their biochemistry and mode of action. *Science* 117: 47-51, Jan. 16, 1953.
- (2) Swaroop, S., and Grab, B.: Snakebite mortality in the world. *Bull. World Health Org.* 10: 35-76 (1954).
- (3) Parrish, H. M.: On the incidence of poisonous snakebites in Florida: Analysis of 241 cases occurring during 1954 and 1955. *Am. J. Trop. Med. & Hyg.* In press.
- (4) Swartzwelder, J. C.: Snake-bite accidents in Louisiana: With data on 306 cases. *Am. J. Trop. Med.* 30: 575-589, July 1950.
- (5) Wood, J. T.: A survey of 200 cases of snake-bite in Virginia. *Am. J. Trop. Med. & Hyg.* 3: 936-943, September 1954.
- (6) Jackson, D., and Harrison, W. T.: Mechanical treatment of experimental rattlesnake venom poisoning. *J. A. M. A.* 90: 1928-1929, June 16, 1928.
- (7) Watt, H. F., Parrish, H. M., and Pollard, C. B.: Repeated poisonous snakebites in the same patient. *North Carolina Med. J.* 17: 174-179, April 1956.

Study of Fallout Effects in Laboratory Animals

A method for duplicating and studying the effects of radiation fallout in laboratory animals has been developed by a Defense Department research team. Col. Carl F. Tessmer and Capt. Frank L. Jennings of the Armed Forces Institute of Pathology described this development as a further step in the study of these effects on humans, in a paper presented before the joint sessions of the American Society of Clinical Pathologists and the College of American Pathologists on October 4, 1957.

In their experiments, skins of pigs, which are closely similar to human skins, were exposed to large doses of electron beams from an atom smasher made available by the National Institutes of Health, Public Health Service. Resulting skin lesions, they reported, duplicated lesions produced by fallout, with early pigmentation of the skin followed by a breakdown in skin tissues.

The investigators used a segment of the electron beam from the atom smasher—two energies of the beta rays—that most nearly reproduces fallout in range and effects. They pointed out that this study should permit closer examination of both immediate and long-range effects of various radiation dosages.