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FEBRUARY, 1963

ORIGINAL ARTICLES

ANALYSIS OF 460 FATALITIES FROM VENOMOUS ANIMALS IN THE UNITED STATES*

By HENRY M. PARRISH, M.D., Dr.P.H.

ASSOCIATE PROFESSOR OF COMMUNITY HEALTH AND MEDICAL PRACTICE,
UNIVERSITY OF MISSOURI SCHOOL OF MEDICINE, COLUMBIA, MISSOURI

VENOMOUS animals are found in every state of the continental United States. These include venomous snakes, lizards (Gila monster), toads, spiders, scorpions, centipedes, millipedes, caterpillars and Hymenoptera insects (bees, wasps, yellow jackets, hornets, ants). Among venomous marine animals are jellyfish, stingrays, sculpins, hydroids, sponges, segmented worms, echinoderms, mollusks, and venomous fishes (Essex¹⁰, Halstead¹³, Russell³⁰). Some of these animals are more injurious to human beings than are others. Therefore, it seemed worthwhile to discover what venomous animals in the United States cause human fatalities.

Venomous animals throughout the world cause more human deaths than most people suppose. It has been estimated that venomous snakes alone cause 30,000 to 40,000 deaths each year throughout the world (Swaroop and Grab³⁶). A preliminary study (Parrish²⁸) showed that there were 215 deaths from bites and stings by venomous animals in the United States from 1950 through 1954. This provided an average of 43 deaths per year, and an

average death rate of 0.28 per 1,000,000 population per year. The present study is a 5-year extension of the data in the preliminary study.

The purpose of this study is to analyze fatalities in the United States caused by venomous animals for the 10-year period, 1950 through 1959. There are very few studies which provide incidence rates, by state and region, for accidents resulting from bites and stings by venomous animals. Therefore, an analysis of fatal cases is used to measure the magnitude of this problem, to chart the geographical distribution of fatal cases, and to ascertain additional medical and epidemiological facts about these deaths.

Methods. Deaths due to, "accidents caused by bites and stings of venomous animals and insects," are grouped together under Category E927 in the "International Statistical Classification of Diseases, Injuries and Causes of Death." A list of Category E927 death certificates for the 10-year period, 1950 through 1959, was obtained from the National Office of Vital Statistics, U.S. Public Health Service, Washington, D.C. This list included the death certificate file number, the date of death, and the State in which death occurred. The State Health Officers

*This investigation was supported in part by PHS research grant GM 10426-01 from the Division of General Medical Sciences, Public Health Service.

of the various States in which these deaths occurred were requested to supply photocopies of the original death certificates. There was a 100% response to this request.

The death certificates provided the following information: the cause of death; the age, race, sex and occupation of the victim; the town, county and state where the accident occurred; the day, month and year of death; the kind of venomous animal inflicting the injury; in most instances, the place where the accident took place (farm, home, and others); and the interval of time between the injury and death.

Results. VENOMOUS ANIMALS. From 1950 through 1959 there were 460 deaths in the United States (excluding Alaska and Hawaii) from bites and stings by venomous animals (see Table 1). Hymenoptera insects (bees, wasps, yellow jackets, hornets and ants) killed 229 (50%) persons, poisonous snakes killed 138 (30%) persons and poisonous spiders killed 65 (14%) persons. Other venomous animals killing people were scorpions (8 deaths), coelenterata (1 death), stingray (1 death and unidentified animals or insects (18 deaths).

Rattlesnakes (*Crotalus sp.*) are by far the most deadly snakes in this country. Rattlesnakes killed 94 people,

cottonmouth moccasins killed 8 people, and coral snakes killed 2. Three individuals were killed by poisonous snakes which are not native to the United States. A professional snake handler and a night club entertainer were killed by cobras (*Naja sp.*) and an internationally renowned herpetologist was fatally bitten by an African boomslang. Two people died from bites by brown spiders (*Loxosceles reclusus*). The remaining spider-bite deaths were attributed to *Latrodectus* spiders. The following venomous animals did not kill anyone during the 10-year period: Gila monsters, centipedes, millipedes, copperhead moccasins, tarantulas, caterpillars and venomous fishes. While these animals produce toxic venoms, they do not frequently cause human fatalities in the United States.

The three most important groups of venomous animals in the United States are Hymenoptera insects, snakes, and spiders. They accounted for 432 (94%) of all fatal venenations. It is an astounding fact that bees kill more people in this country than any other venomous animal, including rattlesnakes. The score: bees 124 deaths ver-

sus rattlesnakes 94. the third most dead-
mals with 69 death-
spiders ranked four-
Because of their size
to the large size of
kill, Hymenoptera
thought of as "giant"

TABLE 2.—RACE AND

Year

1950

1951

1952

1953

1954

1955

1956

1957

1958

1959

Total

TABLE 3.—AGE AND SEX

Age at
Death, yrs.

0-4

5-9

10-19

20-29

30-39

40-49

50-59

60-69

70 & over

Total

TABLE 1.—VENOMOUS ANIMALS AND INSECTS RESPONSIBLE FOR FATAL BITES AND STINGS IN THE UNITED STATES, 1950-1959

Animal or Insect	No.	%
Hymenoptera insects	229	49.8
Bees	124	27.0
Wasps	69	15.0
Yellow jackets	22	4.8
Hornets	10	2.2
Ants	4	0.8
Poisonous snakes	138	30.0
Rattlesnakes	94	20.4
Cottonmouth moccasins	8	1.7
Coral snakes	2	0.4
* Cobras	2	0.4
* Boomslang	1	0.2
Unidentified snakes	31	6.7
Spiders	65	14.1
Scorpions	8	1.7
Coelenterata, unspecified	1	0.2
Stingaree (stingray)	1	0.2
Animal or insect, type unknown	18	3.9
Total	460	99.9

*Snakes which are not indigenous to the United States.

VICTIMS. There
deaths caused by ve-
the United States in
1959, an average of
and an average dea-
1,000,000 populatio-
shows that the num-
year ranged from a
a high of 61 in 1
female deaths to m-

with moccasins killed 8 people, snakes killed 2. Three individuals were killed by poisonous snakes not native to the United States. A professional snake handler and a club entertainer were killed by a (Naja sp.) and an internationally renowned herpetologist was bitten by an African boomslang. One died from bites by brown recluse (Loxosceles reclusus). The spider-bite deaths were attributed to Latrodectus spiders. The venomous animals did not die during the 10-year period: scorpions, centipedes, millipedes, and moccasins, tarantulas, catfish, and venomous fishes. While mammals produce toxic venoms, they do not frequently cause human deaths in the United States. Three most important groups of venomous animals in the United States are Hymenoptera insects, snakes, and spiders. They accounted for 432 of all fatal venomations. It is an interesting fact that bees kill more people in this country than any other venomous animal, including rattlesnakes. The score: bees 124 deaths ver-

RESPONSIBLE FOR FATAL VENOMATIONS, 1950-1959

	%	
229	49.8	
27.0		
15.0		
4.8		
2.2		
0.8		
138	30.0	
20.4		
1.7		
0.4		
0.4		
0.2		
6.7		
65	14.1	
8	1.7	
1	0.2	
1	0.2	
18	3.9	
460	99.9	

United States.

sus rattlesnakes 94 deaths. Wasps were the third most deadly venomous animals with 69 deaths, while poisonous spiders ranked fourth with 65 deaths. Because of their small size in relation to the large size of human beings they kill, Hymenoptera insects may be thought of as "giant killers."

2.8. This proved true for both whites and non-whites. That 2.8 times as many males as females were killed by venomous animals reflects the greater exposure of men to these accidents through out-of-doors occupations and recreational habits.

Table 3 lists the ages of victims of

TABLE 2.—RACE AND SEX OF VICTIMS OF VENOMOUS BITES AND STINGS IN THE UNITED STATES, 1950-1959

Year	Total Deaths	White		Non-white	
		Male	Female	Male	Female
1950	51	32	12	6	1
1951	49	29	10	6	4
1952	44	24	9	9	2
1953	35	21	9	2	3
1954	36	24	8	3	1
1955	52	31	12	6	3
1956	36	21	7	7	1
1957	50	33	9	7	1
1958	46	26	11	5	4
1959	61	42	12	6	1
Total	460	283	99	57	21

TABLE 3.—AGE DISTRIBUTION OF VICTIMS OF VENOMOUS BITES AND STINGS IN THE UNITED STATES, 1950-1959

Age at Death, yrs.	Insect or Animal				
	Snakes	Hymenoptera	Spiders	Others	Total
0- 4	27	11	14	10	62
5- 9	13	2	6	5	26
10-19	15	4	3	2	24
20-29	8	9	2	1	20
30-39	12	35	2	1	50
40-49	19	55	4	3	81
50-59	24	56	12	3	95
60-69	9	31	8	1	49
70 & over	11	26	14	2	53
Total	138	229	65	28	460

VICTIMS. There were 460 human deaths caused by venomous animals in the United States from 1950 through 1959, an average of 46 deaths per year, and an average death rate of 0.28 per 1,000,000 population per year. Table 2 shows that the number of deaths per year ranged from a low of 35 in 1953 to a high of 61 in 1959. The ratio of female deaths to male deaths was 1 to

fatal venomous bites and stings. Of 138 snakebite fatalities, 55 (40%) were among young people less than 20 years of age. Twenty-seven (20%) of the victims were less than 5 years of age! Snake venom poisoning is more serious in children than in adults because of the greater ratio of units of venom injected to the units of body weight. Furthermore, children are fre-

quent victims of snakebite accidents (Swartzwelder³⁷, Wood⁴²). A study of poisonous snakebites in Florida showed that 49% of all bites occurred in young people less than 20 years of age (Parrish²⁶). This reflects the curiosity of children and the fact that most children do not know snakes can be dangerous. Often they were bitten while handling poisonous snakes. Persons 50 years of age and older provided 32% of the fatal snakebite cases.

The age distribution of spider bite victims is similar to that of snakebite victims. Thirty-five percent of fatal spider bites occurred in youths less

(Foubert and Stier¹¹, Loveless and Fackler¹⁸, Mueller²⁴). One would expect children to be stung more frequently than adults by bees, wasps, yellow jackets and hornets. It is difficult to explain why there were not more fatal Hymenoptera stings among children. Perhaps this is related to the age of onset of venom allergy and to the interval of time between insect stings.

TIME INTERVAL TILL DEATH. It is a common belief that poisonous snakebites are followed by death in a few minutes or within an hour or two. Table 4 shows that only 6 (4%) of 138

TABLE 4.—INTERVAL BETWEEN BITE OR STING AND DEATH FROM VENOMOUS ANIMALS AND INSECTS, UNITED STATES, 1950-1959

Interval	Animal or Insect				Total
	Snakes	Hymenoptera	Spiders	Others	
0- 1 hr.	6	167	1	6	180
2- 5 hr.	17	24	1	3	45
6-11 hr.	27	1	4	4	36
12-18 hr.	29	—	3	1	33
19-24 hr.	14	—	8	—	22
25-48 hr.	18	5	11	2	36
3- 7 days	13	6	14	3	36
8-14 days	7	3	8	2	20
15 or more days	2	2	4	1	9
Not stated	5	21	11	6	43
Total	138	229	65	28	460

than 20 years of age and 52% were among persons 50 years of age and older. Published reports (Bogen^{7,8}, Kirby-Smith¹⁶, Wilson⁴¹) seem to indicate that less than 25% of spider bites occur in persons less than 20 years of age.

The age distribution of persons dying from stings by Hymenoptera insects was strikingly different from the age distribution of snake-bite and spider bite victims. Of 229 Hymenoptera deaths, only 17 (7%) were among persons less than 20 years of age; whereas 89% were among those 30 or more years of age. Most of these deaths resulted from insect allergy rather than from the toxic effects of the venom *per se*

snakebite victims died in less than one hour. Indeed, only 23 (17%) died in less than 6 hours. Eighty-eight (64%) of the snake venom poisonings were fatal 6 to 48 hours after the bite. This observation is in keeping with the fact that the venoms of North American pit vipers (rattlesnakes, cottonmouth moccasins and copperheads) are absorbed primarily through the lymphatics and tissue spaces. Usually it takes several hours following a snakebite before the full toxic effects of the venom become evident. Thus, there is a 60- to 120-minute period following most snake venenations when first aid and specific antivenin therapy may be used to best advantage in averting death. Failure

to seek prompt treatment is on causes of death poisoning (Parrish²⁶ of coral snake paralysis 4 and following the bite is primarily a allergic reaction which produces minimal symptoms. Frequent an hour or more bite before the venom becomes effective.

Hymenoptera victims with allergic reactions of these people 15 to 30 minutes physicians only these victims call for medical attention. The allergic reaction is often overpowering edema or anaphylaxis. Physicians certainly have written that "shock," "allergy," "local edema," "hectic reaction," "occlusion," or "stinging" or multiple sting reactions. Approximately from hundreds of the same individuals. The deaths are from overwhelming rather than from deaths from Hymenoptera. The interval of time between bite and death was known in less than one hour. The following measures as ways to help prevent and tragic deaths sensitize allergic patients to insect and antivenin. Semenov⁵, Foubert and Stier¹¹, Loveless and Fackler¹⁸ have constructed hypersensitivity tests for insect allergy, first (Barnard⁴, Thomas¹) patients to wear protective clothing when exposed to the insect and to use other protective measures suggested by entomologists.

Stier¹¹, Loveless and ller²⁴). One would expect to be stung more frequently by bees, wasps, and hornets. It is difficult to explain why there were not more Hymenoptera stings among the victims; this is related to the prevalence of venom allergy and to the long interval of time between insect

STILL TILL DEATH. It is a fact that poisonous snakebites result in death in a few minutes or an hour or two. That only 6 (4%) of 138

DEATH FROM SNAKEBITES, 1950-1959

Years	Total
1950	180
1951	45
1952	36
1953	33
1954	22
1955	36
1956	36
1957	20
1958	9
1959	43
Total	460

s died in less than one hour; only 23 (17%) died in less than 1 hour. Eighty-eight (64%) of the poisonings were fatal within the first hour after the bite. This observation is in keeping with the fact that the venom of North American pit vipers, cottonmouth moccasins, and copperheads are absorbed into the lymphatics and usually it takes several hours before the venom becomes evident. Here is a 60- to 120-minute interval following most snakebites before first aid and specific antivenom may be used to best effect in averting death. Failure

to seek prompt and vigorous medical treatment is one of the most important causes of death from snake venom poisoning (Parrish²⁷). The two victims of coral snakes died of respiratory paralysis 4 and 5 hours, respectively, following the bites. Coral snake venom is primarily a neurotoxin which produces minimal local signs and symptoms. Frequently there is a delay of an hour or more following a coral snake bite before the neurotoxic effects of the venom become evident.

Hymenoptera insects kill allergic patients with alarming suddenness. Most of these people died suddenly within 15 to 30 minutes, and were seen by physicians only after death. Many of these victims did not have time to summon medical aid, owing to the overpowering effects of laryngeal edema or anaphylactic shock, or both. Physicians certifying these deaths often wrote that the patient died from "shock," "allergy," "anaphylaxis," "laryngeal edema," "heart failure," "coronary occlusion," or "stroke" following a sting or multiple stings by Hymenoptera insects. Approximately 8 deaths resulted from hundreds of insect stings in the same individuals. These deaths resulted from overwhelming envenomation rather than from insect allergy. Of 208 deaths from Hymenoptera stings where the interval of time between the sting and death was known, 167 (80%) died in less than one hour and 191 (92%) died within 5 hours following the sting. The following measures are suggested as ways to help prevent these sudden and tragic deaths: 1) identify and desensitize allergic patients with appropriate insect antigens (Benson and Semenov⁵, Foubert and Stier¹¹, Loveless and Fackler¹⁸, Mueller²⁴); 2) instruct hypersensitive patients to carry insect allergy, first-aid kits with them (Barnard⁴, Thomas³⁹); 3) encourage patients to wear light colored clothing when exposed to the risk of a sting and to use other protective measures suggested by entomologists (Morse and

Ghent²³); and 4) the public should be informed of this potentially life-threatening medical problem by means of health education techniques.

Only 6 (11%) of 54 victims of spider venom poisoning, where the interval of time between the bite and death was stated, died in the first 12 hours. Twenty-two (41%) died 12 to 48 hours after the bite, and 14 (26%) died from the third to the seventh day. The remaining 12 patients expired after the first week following the bite. Black widow spider (*Latrodectus sp.*) venom is thought to be absorbed into the body by way of the lymphatic system. Usually, some local symptoms are present within the first 2 hours following the bite, but several hours may elapse before the full toxic effects of the venom are experienced. These symptoms may persist from one to 4 days (Baerg³, Blair⁶). Two people died from bites by brown spiders (*Loxosceles reclusus*). A 5-year-old child died 24 hours after a brown spider bite and a 74-year-old woman died of septicemia 25 days after the onset of necrotic arachnidism.

Eight people died from scorpionism in less than 12 hours following the sting. Two of these deaths were attributed to scorpion venom allergy producing anaphylactic shock. The stingray victim died 3 days after envenomation. The interval between the coelenterate sting and death was not recorded.

GEOGRAPHICAL DISTRIBUTION. Deaths caused by venomous animals were reported from 45 of the 48 states. New Hampshire, North Dakota, and South Dakota did not report any deaths from this cause. Table 5 shows that the states reporting the highest number of fatalities were Texas (67), Georgia (36), California (32), Florida (26), Alabama (25), North Carolina (21), and Kentucky (20). The average number of deaths per year caused by poisonous snakes, Hymenoptera and poisonous spiders respectively, and the

estimated 1955 population for each state and region were used to calculate the average death rates per 1,000,000 population.

The following states reported the largest number of snakebite deaths: Texas (24), Georgia (22), Florida (20), Alabama (14), and California (12). Snakebite deaths were reported from 22 states. However, the highest

average death rates from snakebites per 1,000,000 population were found in Arizona (0.63), Georgia (0.60), Florida (0.54), Alabama (0.45), South Carolina (0.31), and Texas (0.27). Figure 1 shows the geographical distribution of fatal poisonous snakebites in the United States. Note that most of these fatalities occurred in the southern half of the United States. In

TABLE 5.—DEATHS RESULTING FROM BITES AND STINGS OF VENOMOUS ANIMALS AND INSECTS, BY REGION AND STATE FOR THE UNITED STATES, 1950-1959

Region & State	Animal or Insect				Total Deaths, 1950-1959	Average Deaths/Yr.
	Snakes	Hymenoptera	Spiders	Others		
New England	-	15	-	-	15	1.5
Maine	-	2	-	-	2	0.2
New Hampshire	-	-	-	-	-	-
Vermont	-	1	-	-	1	0.1
Massachusetts	-	5	-	-	5	0.5
Rhode Island	-	2	-	-	2	0.2
Connecticut	-	5	-	-	5	0.5
Middle Atlantic	-	23	1	2	26	2.6
New York	-	11	-	1	12	1.2
New Jersey	-	5	1	-	6	0.6
Pennsylvania	-	7	-	1	8	0.8
East North Central	2	26	3	1	32	3.2
Ohio	-	9	1	-	10	1.0
Indiana	-	6	1	1	8	0.8
Illinois	2	2	1	-	5	0.5
Michigan	-	6	-	-	6	0.6
Wisconsin	-	3	-	-	3	0.3
West North Central	4	16	10	2	32	3.2
Minnesota	-	3	-	-	3	0.3
Iowa	-	2	-	-	2	0.2
Missouri	2	9	5	1	17	1.7
North Dakota	-	-	-	-	-	-
South Dakota	-	-	-	-	-	-
Nebraska	1	-	-	-	1	0.1
Kansas	1	2	5	1	9	0.9
South Atlantic	55	42	14	6	117	11.7
Delaware	-	1	-	-	1	0.1
Maryland	2	-	-	-	2	0.2
District of Columbia	-	-	-	-	-	-
Virginia	-	11	1	1	13	1.3
West Virginia	1	5	-	-	6	0.6
North Carolina	3	9	7	2	21	2.1
South Carolina	7	3	1	1	12	1.2
Georgia	22	9	4	1	36	3.6
Florida	20	4	1	1	26	2.6
East South Central	25	33	11	2	71	7.1
Kentucky	5	11	4	-	20	2.0
Tennessee	3	9	1	-	13	1.3
Alabama	14	7	3	1	25	2.5
Mississippi	3	6	3	1	13	1.3

TABLE 5.—DEATHS RESULTING FROM BITES AND STINGS OF VENOMOUS ANIMALS AND INSECTS, BY REGION AND STATE FOR THE UNITED STATES, 1950-1959

Region & State

West South Central
Arkansas
Louisiana
Oklahoma
Texas

Mountain
Montana
Idaho
Wyoming
Colorado
New Mexico
Arizona
Utah
Nevada

Pacific
Washington
Oregon
California

Total United States 15



Fig. 1.—Geographical

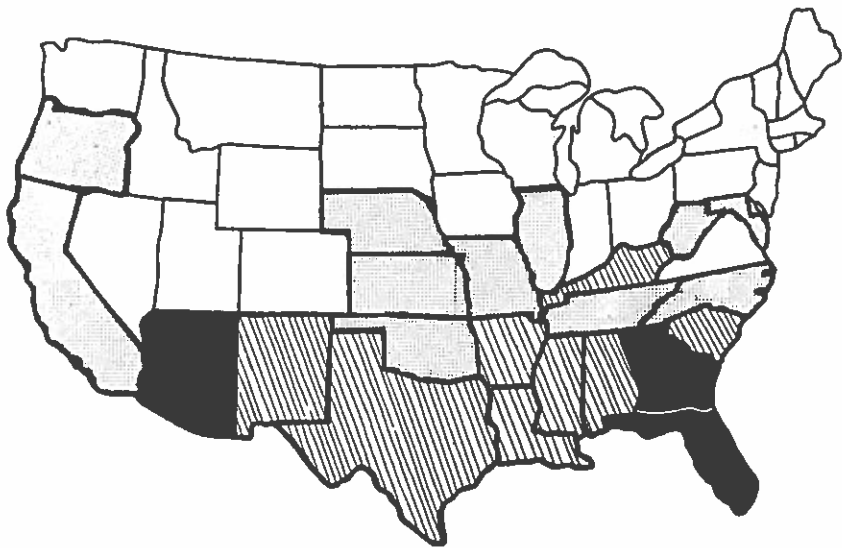
from snakebites
tion were found
Georgia (0.60),
uma (0.45), South
d Texas (0.27).
geographical dis-
sonous snakebites
. Note that most
occurred in the
United States. In

OF VENOMOUS
R THE UNITED

Total Deaths, 1950-1959	Average Deaths/Yr.
2	1.5
1	0.2
5	0.1
2	0.5
5	0.2
	0.5
12	2.6
6	1.2
8	0.6
	0.8
10	3.2
8	1.0
5	0.8
6	0.5
3	0.6
	0.3
3	3.2
2	0.3
17	0.2
	1.7
1	-
9	0.1
	0.9
1	11.7
2	0.1
	0.2
13	-
6	1.3
21	0.6
12	2.1
36	1.2
26	3.6
	2.6
20	7.1
13	2.0
25	1.3
13	2.5
	1.3

TABLE 5.—DEATHS RESULTING FROM BITES AND STINGS OF VENOMOUS ANIMALS AND INSECTS, BY REGION AND STATE FOR THE UNITED STATES, 1950-1959 (Continued)

Region & State	Snakes	Hymenoptera	Spiders	Others	1950-1959 Deaths, Total	Deaths/Yr. Average
	Animal or Insect					
West South Central	32	40	21	7	100	10.0
Arkansas	3	5	4	-	12	1.2
Louisiana	4	4	3	1	12	1.2
Oklahoma	1	2	5	1	9	0.9
Texas	24	29	9	5	67	6.7
Mountain	7	8	4	7	26	2.6
Montana	-	1	-	-	1	0.1
Idaho	-	2	-	-	2	0.2
Wyoming	-	1	1	-	2	0.2
Colorado	-	3	-	-	3	0.3
New Mexico	1	-	2	-	3	0.3
Arizona	6	-	-	6	12	1.2
Utah	-	1	-	1	2	0.2
Nevada	-	-	1	-	1	0.1
Pacific	13	26	1	1	41	4.1
Washington	-	3	-	-	3	0.3
Oregon	1	5	-	-	6	0.6
California	12	18	1	1	32	3.2
Total United States	138	229	65	28	460	46.0



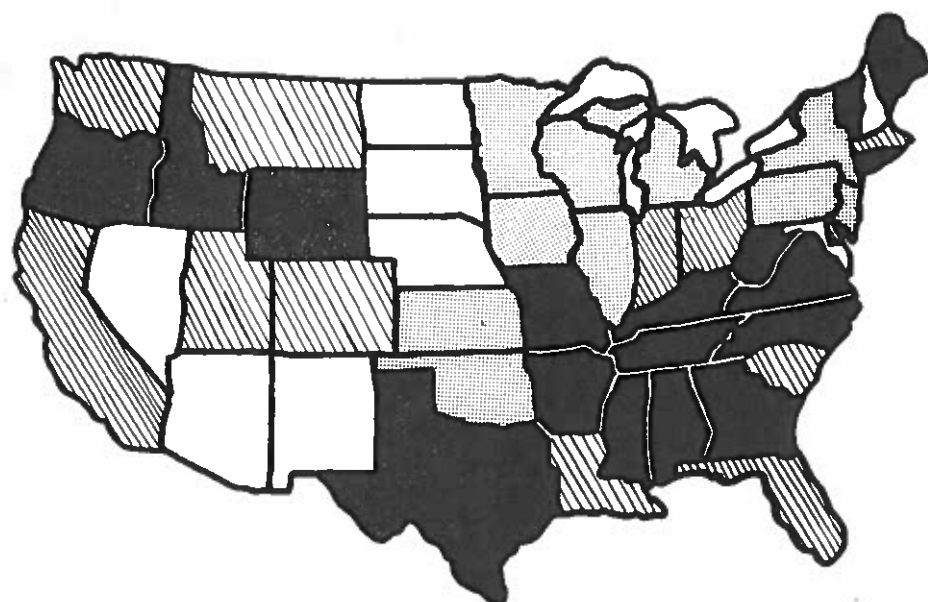
AVERAGE DEATHS PER 1,000,000 POPULATION PER YEAR



Fig. 1.—Geographical distribution of deaths from snake bites in the United States, 1950-1959.

keeping with this observation, the highest average death rates per 1,000,000 population by regions were South Atlantic (0.24), East South Central (0.22). These regions have an abundant supply of various species of poisonous snakes, especially deadly rattlesnakes (Stickel³⁵). Although no

Fatal Hymenoptera stings were reported from 40 of the 48 states and from every region in the United States. The states reporting the highest number of fatal stings were Texas (29), California (18), and Kentucky, Virginia and New York (11 each). The states with the highest average death



AVERAGE DEATHS PER 1,000,000 POPULATION PER YEAR



Fig. 2.—Geographical distribution of deaths from Hymenoptera insects in the United States, 1950-1959.

snakebite deaths were reported from the New England and Middle Atlantic regions and from numerous states, this should not be interpreted that poisonous snakebite accidents do not occur there. For example, no deaths were reported for Indiana, Connecticut, or Virginia, but nonfatal poisonous snakebites have been recorded from each of these states (Minton²², Parrish, Badgley and Carr²⁹, Wood⁴²).

rates per 1,000,000 population were: Kentucky (0.38); Texas, Idaho and Wyoming (0.33 each); Virginia (0.30); and Oregon and Mississippi (0.29 each). Figure 2 shows the geographical distribution of Hymenoptera deaths. Although the distribution of these deaths is nationwide, the highest average death rates can be pinpointed to the East South Central (0.29), the West South Central (0.26), and the

South Atlantic
optera insects
(Michener and
Venomous sp
23 states, and
New England.
from spider bi
bite deaths oc
North Carolina
sas, and Missou
tucky, Arkansas

TABLE 6.—SEAS
OF VENOMOU

Month

Jan.
Feb.
March
April
May
June
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most authorities (Thorp and Wood spiders (*Latrodectus* spiders in the U human deaths. *L. mactans*, the black *Latrodectus* geon tropical brown sp *Latrodectus curacavien* tions, all spiders thought to result

in the incidence of venomous bites and stings for various regions of the United States, these minor differences should not obscure the seasonal pattern for the entire country.

Fatal poisonous snakebites begin to increase in March, reach a peak during August, and then decline after the end of October. Thus, 131 (95%) of 138 fatal snakebites happened during the 8-month period from March through October. Very few snakebite deaths occur during the winter months. Contrary to popular belief, most snakebite accidents do not occur during the hunting season. A similar seasonal distribution has been reported for nonfatal poisonous snakebites in several regions of the United States (Minton²², Swartzwelder³⁷, and Wood⁴²). Venomous snakes are more active during the warmer months and man experiences greater exposure to the possibility of a snakebite at this time because of out-of-doors recreation and occupation.

The monthly distribution of deaths caused by Hymenoptera insects is similar to the distribution for snakebite deaths. Hymenoptera deaths begin to increase in April, reach a peak during July and August, and then decline sharply after October. Of 229 fatal Hymenoptera stings, 217 (95%) happened during the 7-month period from April through October. Usually hornets, wasps, yellow jackets, and bumble bees die during the colder months, with only the queen surviving the winter to start a new colony the following spring. While honey bees maintain their colony during the winter months, they are confined to their hives for the purpose of clustering to maintain warmth (Michener and Michener²¹). Only during the spring, summer, and early fall are there large numbers of active, stinging insects to come in contact with man. During this period of time, man experiences greater exposure to these insects from work and recreation in the yard, garden, farm and woods.

People died from spider bites during every month of the year. However, 42 (65%) of the 65 deaths from arachnidism happened during the 6-month period from May through October. Several investigators (Bogen^{7,8}, Kirby-Smith¹⁵) have found that most black widow spider (*Latrodectus mactans*) bites happened from May through October. This seasonal distribution of bites is consistent with the life history of the black widow spider. The female of the species is responsible for most cases of envenomation in humans. The female survives the winter, while most male spiders die. She lays her eggs the following spring and early summer, and the prevalence of young and mature black widows is greatest during the late summer and early fall (Baerg⁹, Thorp and Woodson⁴⁰).

Of 8 deaths from scorpionism, 3 occurred in April, 2 in September, one in December, one in January and one in February. This seasonal distribution of fatal scorpion stings differs from the usual seasonal incidence of nonfatal stings. In Arizona scorpion stings may occur during any month of the year, but they most frequently happen during the summer months (Stahnke^{38,34}). Both fatalities from venomous marine animals took place during July, when swimming was popular.

Discussion. While venomous animals cannot be considered a major health problem in most regions in the United States, they do cause considerable morbidity and mortality in the South Atlantic, East South Central and West South Central regions. Very likely they cause more morbidity and mortality than is indicated by the present study. This study showed that there were "at least" 460 deaths from venomous animals in the United States from 1950 through 1959. The phrase, "at least," is used because many deaths from venomous animals probably are certified as resulting from other causes of death. Some physicians and coroners are not familiar with the signs and symptoms

of envenomation of scorpions, insects. For example, a black widow spider fused with an "men" (Kirby-Smith) seems possible that deaths were attributed to conditions, and the operation may have death of these people sudden deaths, an allergy probably "coronary heart "heat strokes," as Swinney³⁸ cited an allergy which was certificate as due unknown." A single to an allergic patient to cause death. the sting, being noticed by the signing the death these victims are by a physician. not available. M among adults are. However, 29% of in children less than. Oftentimes a small an accurate history to him. This fact, a physician's unfamiliarity poisoning, probably correct diagnosis.

Mortality studies crude measure of venomous animal estimates of the number injured by venomous are probably far too only 55 spider bites reported in the literature covering over 200 Woodson⁴⁰). By spider bite deaths years in this study medical-literature grossly underestimated spider bite death hundred people are

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of envenomations by snakes, spiders, scorpions, insects, and marine animals. For example, arachnidism produced by black widow spiders is frequently confused with an "acute surgical abdomen" (Kirby-Smith¹⁵, Wilson⁴¹). It seems possible that some spider-bite deaths were attributed to abdominal conditions, and the added insult of an operation may have contributed to the death of these persons. Likewise, many sudden deaths resulting from insect allergy probably are certified as due to "coronary heart attacks," "strokes," "heat strokes," and "natural causes." Swinny³⁸ cited one death from insect allergy which was listed on the death certificate as due to "natural cause unknown." A single sting by an insect to an allergic patient may be sufficient to cause death. The local reaction to the sting, being minimal, may not be noticed by the physician or coroner signing the death certificate. Many of these victims are dead when first seen by a physician. A medical history is not available. Most snakebite deaths among adults are certified correctly. However, 29% of these deaths occurred in children less than 10 years of age. Oftentimes a small child cannot give an accurate history of what happened to him. This fact, coupled with a physician's unfamiliarity with snake venom poisoning, probably leads to an incorrect diagnosis in many instances.

Mortality studies provide only a crude measure of the extent of the venomous animal problem. Previous estimates of the number of people injured by venomous animals annually are probably far too low. For example, only 55 spider bite deaths were reported in the literature for a period covering over 200 years (Thorp and Woodson⁴⁰). By way of contrast, 65 spider bite deaths were reported in 10 years in this study. The review-of-the-medical-literature method of study grossly underestimated the number of spider bite deaths. Probably several hundred people are bitten by venom-

ous spiders annually. Sporadic but dramatic newspaper articles report sudden deaths from bee or wasp stings. It was not realized until recently that Hymenoptera insects kill more people in this country than do rattlesnakes. It is not known what proportion of the population have insect allergy, but this type of allergy probably is quite common. Klauber¹⁶ estimated that 1,500 people in this country are bitten by poisonous snakes every year. This estimate is probably low. At least 120 people a year are bitten by poisonous snakes in Florida alone (Parrish²⁶). One would expect that numerous snakebite accidents occur every year in the South Atlantic, East South Central and West South Central regions.

Mortality analyses reflect only the most serious injury (death) in the injury range of a disease. They do not measure the ill effects produced by nonfatal bites and stings. For example, 7 (17%) of 40 noncongenital, juvenile amputees seen by the Florida Crippled Children's Commission had an amputation because of a snakebite injury (McCollough²⁰). The near fatal allergic reactions to insect stings have been described (Mueller²⁴, Thomas³⁰). Epidemiological studies of injuries caused by various venomous animals are needed to define this problem in greater detail, to discover ways to prevent these injuries, and to improve methods of treatment.

Black widow spiders (*Latrodectus* sp.) are believed to be the only spiders in the United States capable of killing a human being. However, 2 people in this study died from bites by "brown spiders" (*Loxosceles reclusus*). These are thought to be the first deaths reported in this country from arachnidism produced by brown spiders. *Loxosceles reclusus* was first incriminated as the cause of necrotic arachnidism in Missouri in 1957 (Atkins, Wingo, Sodeman and Flynn^{1,2}). Brown spider arachnidism in this country is strikingly similar to cutaneous arach-

nidism or "gangrenous spot" caused by *Loxosceles laeta* in South America (Macchiavello¹⁹). There is a viscerocutaneous form of South American Loxoscelism characterized by hemolytic anemia and hematuria. Recently several cases of viscerocutaneous arachnidism, thought due to brown spider bites, have been reported in the United States (James *et al.*¹⁴, Nance²⁵). Perhaps careful study will show that other fatalities are caused by brown spiders.

Physicians should find out what venomous animals are native to their states and become acquainted with current concepts of therapy for bites and stings by venomous animals.

Summary. An analysis of deaths due to venomous animals showed that there were 460 fatalities from venomous animals in the United States during the 10-year period, 1950 through 1959. This provided an average of 46 deaths per year and an average annual death rate of 0.28 per 1,000,000 population.

Of 460 fatalities, Hymenoptera insects (bees, wasps, hornets, yellow jackets, and ants) killed 229 (50%)

persons, poisonous snakes killed 138 (30%) persons, and poisonous spiders killed 65 (14%). Other venomous animals causing fatalities were scorpions, coelenterata, stingrays and unidentified venomous animals. The leading venomous killers were bees (124 deaths), rattlesnakes (94 deaths), wasps (69 deaths) and spiders (65 deaths). Two spider deaths were caused by brown spiders (*Loxosceles reclusus*); whereas the remaining spider deaths were caused by *Latrodectus* spiders.

Usually several hours elapsed before people died from bites by venomous snakes and spiders. Most deaths from Hymenoptera insect stings took place within one hour and resulted from insect allergy.

Most fatal injuries by insects, snakes, and spiders occurred during the warmer months of the year, from April through October. This coincides with the reproductive and life-habits of venomous animals and with greater out-of-doors exposure of man through occupations and recreation.

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Analyse de 460 Morte

Un analyse del mortes personas habeva morite 10 annos ab 1050 ad 1959 per anno e un mortalitate De 460 mortes, 229 (50%) (ape, vespa, crabron, e fi per araneas venenose. A celenteratos, raia, e non- Le plus alte proportion (94), vespas (69), e ar brun (*Loxosceles reclusus* genere *Latrodectus*).

Generalmente le perso plure horas post le morsi de hymenopteros occurre le insecto.

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SUMMARIO IN INTERLINGUA

Analyse de 460 Mortes Causate per Animales Venenose in le Statos Unite

Un analyse del mortes causate per animales venenose ha demonstrate que 460 personas habeva morite ab iste causa in le Statos Unite durante le periodo de 10 annos ab 1050 ad 1959. Iste cifra corresponde a un valor medie de 46 mortes per anno e un mortalitate annual medie de 0,28 pro 1.000.000 personas.

De 460 mortes, 229 (50%) esseva causate per insectos del genere Hymenoptera (ape, vespa, crabron, e formica); 138 (30%) per serpentes venenose, e 65 (14%) per araneas venenose. Altere animales mortalmente venenose esseva scorpiones, celenteratos, raia, e non-identificates.

Le plus alte proportion de mortes esseva debite a apes (124 mortes), crotalos (94), vespas (69), e araneas (65). Duo mortes esseva causate per araneas brun (*Loxosceles reclusus*). Le altere mortes esseva causate per araneas del genere *Latrodectus*.

Generalmente le personas mordite per serpentes e araneas venenose mori plure horas post le morsura. Le majoritate del mortes causate per le aculeo de hymenopteros occurre intra un hora e es debite a allergia producite per le insecto.

Le plus grande numero de vulneres mortal per serpentes e araneas es observate durante le menses calide del anno, ab april ad octobre. Isto coincide con le cyclo reproductive e le habitudes del animales venenose e con le major exposition al ambiente exterior del homine per travallo o recreation.