
2004 South Carolina Physician Survey of Tick, Spider and Fire Ant Morbidity

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Introduction

The Clemson University/Medical University of South Carolina (MUSC) Agromedicine Program is a statewide resource for agricultural medicine. Services are provided to the agricultural community, consumers and health professionals. Morbidity from insects is of concern to farm and forestry workers and inquiries to the Cooperative Extension Service frequently pertain to concerns about various forms of insect associated morbidity. The Agromedicine Program has been providing information to various community organizations in the form of lectures and literature for many years and has been tracking insect associated morbidity among state residents since 1986.

Three reports were published in *The Journal of the South Carolina Medical Association* between 1986 and 1991 concerning insect associated morbidity based on statewide surveys of primary care physicians.¹⁻³ These reports focused on morbidity from tick associated illnesses, spider bites and red imported fire ant (RIFA) stings since all are important to the agricultural community. Tick associated illnesses are responsible for significant morbidity ranging from flu like symptoms to heart block and even death.⁶ Although complications from

spider bites most commonly involve a localized reaction, both black widow and brown recluse bites can cause severe systemic effects ranging from hypertension and tachycardia to congestive heart failure.⁸ Fire ants are also known to cause various health problems ranging from local irritation to anaphylaxis. A 1989 survey attributed 80 deaths in the United States to anaphylactic reactions from fire ant stings⁹ and there have been recent reports of fire ant attacks on patients in nursing homes.⁵ Fire ants can also damage crops and decimate wildlife.⁴⁻⁵ The above noted morbidity associated with these conditions can be greatly reduced if the illnesses they cause are recognized early in their course and appropriate treatment is initiated.

Since initial diagnosis of these conditions is usually based on clinical judgment, it is important for physicians to be aware of the common presenting complaints for the conditions that are found in their location. In order to help physicians track which of these conditions are most prevalent in their part of the state, the Department of Health and Environmental Control (DHEC) has included the three tick associated illnesses in their list of reportable conditions.⁷ However, there has been no statewide data reported for either spider bites or RIFA stings since 1990. Since the Agromedicine Program serves to promote health of outdoor workers, a survey was sent to primary care physicians across the state to tabulate the incidence of insect associated illnesses in SC for 2004.

Methods

A total of 2,789 surveys were mailed to South Carolina primary care physi-

cians, including 1,221 family practitioners, 1,069 internists and 499 pediatricians. Sixty-four surveys were returned unopened from offices of physicians no longer practicing in the state. The list of physician addresses was based on the *State Board of Medical Examiners of South Carolina Directory of Physicians* with all full-time medical school faculty members excluded from this survey. Respondents were instructed to fax their completed questionnaires to the Agromedicine office with the fax number included on the survey form. Reminders were included in two issues of the South Carolina Medical Association's weekly *Alert* and in three issues of the monthly *Agromedicine Program Update*. The content of the survey included three basic sections.

Physicians were asked to estimate the number of cases they had seen in 2004 for tick associated illnesses (Rocky Mountain spotted fever [RMSF], Lyme disease and ehrlichiosis), black widow and brown recluse spider bites, and RIFA stings. Separate responses were obtained for those patients over and under fifteen years of age for each question. All sections asked for the total number of patients seen, number hospitalized and number of deaths. The tick associated illness section included the number of cases that were lab confirmed. (Laboratory confirmation was at the discretion of the reporting physician and no further information was obtained regarding the specific test performed.) The brown recluse section included questions pertaining to treatment of bites with either dapsone or surgical excision. The RIFA section also asked physicians to differentiate between patients seen in the emer-

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South Carolina Agromedicine Program
MUSC, PO Box 250805, Charleston, SC 29425-0805

Please estimate the number of patients you treated during 2004 for:

1. Rocky Mountain Spotted Fever

PATIENT AGE	TOTAL	HOSPITALIZED	LAB CONFIRMED	DIED
>15	_____	_____	_____	_____
<15	_____	_____	_____	_____

2. Lyme Disease (or Lyme disease-like illness)

PATIENT AGE	TOTAL	HOSPITALIZED	LAB CONFIRMED	DIED
>15	_____	_____	_____	_____
<15	_____	_____	_____	_____

3. Ehrlichiosis (any type)

PATIENT AGE	TOTAL	HOSPITALIZED	LAB CONFIRMED	DIED
>15	_____	_____	_____	_____
<15	_____	_____	_____	_____

4. Black Widow Spider Bites

PATIENT AGE	TOTAL	HOSPITALIZED	DIED
>15	_____	_____	_____
<15	_____	_____	_____

5. Brown Recluse Spider Bites

PATIENT AGE	TOTAL	HOSPITALIZED	SURGICAL EXCISION	DAPSONE
>15	_____	_____	_____	_____
<15	_____	_____	_____	_____

6. Red Imported Fire Ant Stings

PATIENT AGE	TOTAL	TREATED IN OFFICE	TREATED IN ER	HOSPITALIZED	ANAPHYLAXIS	REFER TO ALLERGIST	DIED
>15	_____	_____	_____	_____	_____	_____	_____
<15	_____	_____	_____	_____	_____	_____	_____

COUNTY OF PRIMARY PRACTICE LOCATION _____

Figure 1. OPCA Age-Adjusted Incidence (1997-2002) Rates per 100,000 in SC by Race and Gender

gency room versus their own clinics and included questions pertaining to allergic reactions from fire ant stings. Physicians were asked to identify the county where their primary office is located. A copy of the survey is included as Figure 1.

The state was divided into three regions, based on county. The upstate region refers to Abbeville, Anderson, Cherokee, Chester, Greenville, Greenwood, Laurens, McCormick, Newberry, Oconee, Pickens, Spartanburg, Union and York counties. The midlands region refers to Aiken, Allendale, Bamberg, Barnwell, Calhoun, Chesterfield, Clarendon, Darlington, Edgefield, Fairfield, Florence,

Lee, Lexington, Marlboro, Orangeburg, Richland, Saluda and Sumter counties. The lowcountry region refers to Beaufort, Berkeley, Charleston, Colleton, Dillon, Dorchester, Georgetown, Hampton, Horry, Jasper, Marion and Williamsburg counties.

Results

There were 514 total responses for an overall response rate of 19%. Eighty-seven percent of respondents reported treating at least one insect bite in the past year for a combined total of 9,895 cases. This increased from 66% of respondents who saw at least one insect bite in 1990.¹ Fifty-four percent of respon-

dents reported ten or fewer total cases, 75% reported 20 or fewer total cases and 2.3% reported 100 or more total cases. The mean number of cases per provider was 19.25 with a standard deviation of 30.5. Since a few practitioners saw a large number of cases, the median of ten is a better indicator for the average number of cases seen per provider. Sixteen percent of responding physicians saw at least one case of RMSF, 24% saw at least one case of Lyme disease and 5% saw at least one case of ehrlichiosis. Eleven percent of respondents saw at least one black widow bite, 44% saw at least one brown recluse bite and 73% saw at least one RIFA sting. There were no reported deaths from any of the insect bites or stings included in this survey. The average number of cases for each condition among providers who saw at least one case of that particular condition is presented in Table 1.

There were a total of 152 Rocky Mountain spotted fever cases reported by 80 different providers. Of these cases, 42% were confirmed by lab testing and 20% were hospitalized. Sixty-one percent of cases were reported in patients over 15 years of age. 67% of the RMSF cases were seen in the upstate region, 19% were from the midlands and 14% were from the lowcountry. The number of cases reported to SCDHEC in the same time period was: 24 confirmed, 42 probable and 66 total.¹² There were 64 cases of RMSF reported to the CDC from South Carolina in 2004.¹⁷ In 1990, Schumann and Caldwell reported 414 RMSF cases with 31% lab confirmed, 31% hospitalized and two deaths. They also reported 71% of cases from the upstate.¹

There were a total of 253 cases of Lyme disease reported by 123 providers. Of these cases, 29% were confirmed by lab testing and 1.6% were hospitalized. Seventy-seven percent of cases were reported in patients over the age of 15. The upstate region reported 42.5% of the Lyme disease cases, 34% were from the midlands and 23.5% were from the low-

country. The number of cases of Lyme disease reported to SCDHEC during the same time period was eight confirmed, five probable, and 13 total.¹² There were 22 cases of Lyme disease reported to the CDC from South Carolina in 2004.¹⁷ In 1991, Schumann and Caldwell reported 334 cases of Lyme disease with 45% lab confirmed, 8% hospitalized and no deaths. They reported an even distribution of Lyme disease throughout the state.¹

There were 83 cases of ehrlichiosis reported by 28 providers. Of these cases, 8% were confirmed by lab testing, 8% were hospitalized and 59% of cases were reported in patients over the age of 15. The upstate region reported 48% of the ehrlichiosis cases, 13% were from the midlands and 39% were from the lowcountry. The number of cases reported to SCDHEC in the same time period was: zero confirmed, four probable, and four total.¹² There were six cases of ehrlichiosis reported to the CDC from South Carolina in 2004.¹⁷ No 1990 data is available for ehrlichiosis incidence in South Carolina. A summary of tick associated illness reports is included as Table 2.

There were 97 black widow bites reported by 54 providers. Of these cases, 20% were hospitalized. The upstate region reported 46% of the black widow bites, the midlands reported 37% and the lowcountry reported 17%. The American Association of Poison Control Centers (AAPCC) maintains a database of self-reported exposures called the Toxic Exposure Surveillance System. This data is tabulated from phone calls received at poison control centers and includes information on both black widow and brown

Table 1. Mean Number of Cases for Each Insect Bite or Sting per Provider Reporting At Least 1 Case in 2004

	2004 Mean	1990 Mean
RMSF	1.9	2.5
Lyme	2.1	1.8
Ehrlichiosis	3.0	N/A
Black widow	1.8	2.2
Brown recluse	3.3	1.3
RIFA	11.2	11.3

recluse spider bites. The AAPCC reported a United States total of 2,720 black widow bites with 32% (860) treated in a health care facility during the same time period of our survey.¹⁴ Schumann and Caldwell reported 143 black widow bites with 35% hospitalized and two deaths during 1990.¹ The AAPCC had reported a national total of 2,420 black widow bites with 35% (851) treated in a health care facility and no deaths for 1990.¹⁴

There were 738 brown recluse bites reported by 226 providers. Of these cases, 4% needed to be hospitalized, 8% were treated with dapsone and 12% of patients required surgical excision. The upstate region reported 42% of the brown recluse bites, the midlands reported 28% and the lowcountry reported 30%. The AAPCC reported a national total of 2,859 brown recluse bites with 37% (1058) treated in a health care facility during the same time period.¹⁴ In 1990, Schumann and Caldwell reported 478 brown recluse bites, 6% hospitalized, 10% were treated with dapsone and 9% required excision. They also reported that the northwestern counties had seen the most spider bites.¹ The AAPCC had reported a U.S. total of 1,396 brown recluse bites with 55% (762) treated in a health care facility and no deaths during 1990.¹⁵ A summary of

spider bite reports is included as Table 3.

There were a total of 4,215 fire ant stings reported by 375 providers, 90% of these were seen in an office, 0.3% were hospitalized, 1% had anaphylaxis and 3% were referred to an allergist. Approximately equal numbers of adults and children were seen for fire ant stings. Approximately equal numbers of cases were seen in the upstate, midlands and lowcountry regions. In 1990, Schumann and Caldwell reported 4,975 cases, less than 1% hospitalized, 2.1% with anaphylaxis, 3.4% were referred to an allergist and one death occurred. They reported a higher incidence of RIFA stings in eastern and southern counties.¹ A 1998 *Agromedicine* publication reported 8,259 RIFA stings with 0.5% hospitalized, 2% with anaphylaxis, 3% referred to an allergist and two deaths based on a survey completed by over 1,200 physicians. They reported an increased incidence in the northern and western counties with a decrease in the southern and eastern counties versus 1990. A summary of fire ant stings is included as Table 4.

Conclusions

Rocky Mountain spotted fever cases decreased versus the 1990¹ study in both the overall number reported and the av-

Table 2. Numbers of Cases Tick Associated Illness as Reported to Agromedicine versus DHEC for 2004

Tick Associated Illness	Reported to Agromedicine			Reported to DHEC		
	Total	Lab Confirmed	Hospitalized	Total	Lab Confirmed	Probable
Rocky Mountain Spotted Fever	152	65	30	66	24	42
Lyme Disease	253	75	4	13	8	5
Ehrlichiosis	83	7	7	4	0	4

Table 3: Spider Bites and Treatments Reported to Agromedicine in 2004

	Total	Hospitalized	Treated with Dapsone	Required Excision
Brown recluse	738	30	58	86
Black widow	97	19	N/A	N/A

erage per provider. The percentage of cases that were hospitalized remained about the same while the percentage of lab confirmed cases increased. The incidence of RMSF has been reported to be higher in children,⁶ which is not consistent with our finding that the majority of cases were in adults. Although the overall number of Lyme disease cases decreased versus the 1990¹ study, the increase in the number seen per provider is consistent with the national trend.⁸ A disproportionate number of adult cases were reported as Lyme disease is believed to occur more frequently in children.⁸ The regional distribution of RMSF and Lyme remained similar to that described in 1990.¹ The majority of cases of ehrlichiosis were found in adults which is consistent with previously reported data.⁸ Compared to both CDC and DHEC data, there were over twice the number RMSF cases reported in this survey and 20 times more Lyme disease and ehrlichiosis cases.

The total number of black widow spider bites reported in this survey decreased versus 1990,¹ as did the average number of bites seen per provider and the percentage of cases hospitalized. The number of black widow bites reported to the AAPCC increased slightly during the same time period as did the number of bites treated in a health care facility. The number of bites reported to the AAPCC as treated in a healthcare facility includes outpatient offices, but this number also

includes emergency rooms, urgent care centers and all other healthcare facilities.^{14,15} Although our survey includes only primary care physicians, it is reasonable to compare our total number of bites to the AAPCC's number treated in healthcare facilities with the expectation that our number may be lower. In the case of black widow bites, the total number in our survey represents 11% of the US cases reported by the AAPCC as treated in healthcare facilities during the same time period.¹⁵

Total brown recluse spider bites increased versus 1990,¹ as did the average number of bites per provider, but the percentage of patients requiring hospitalization decreased. Compared to brown recluse bites reported by the AAPCC as treated in a healthcare facility, the total number of brown recluse cases that were reported in this survey would represent 71% of those reported nationally. Twenty percent of patients required excision or treatment with dapsone which is consistent with the percentage previously reported to develop necrotic ulcers.¹³ There was a slight decrease in the percentage of patients treated with dapsone compared to 1990.¹

There were fewer cases of RIFA stings reported overall versus 1990 and 1998. The average number per provider decreased from 11.2 in 1990 to nine in 1998, but the 2004 average was 11.3.^{1,10} Since there was a substantial difference

in the number of respondents versus previous years, the average per provider represents the best comparison method between years. An equal number of adults were seen for RIFA associated complaints in our study, but Kemp et al reported that fire ant stings occur more commonly in children.⁴ The incidence rate of RIFA anaphylaxis is consistent with that reported by Agromedicine previously^{1,10} and is also within the range of that reported elsewhere in literature.¹⁸ There had been deaths attributed to RIFA in both the 1990 (one death) and 1998 (two deaths) surveys,^{1,10} however, no deaths were reported for 2004.

Discussion

The response rate of this survey was lower than in the past, but this is consistent with what researchers have found when conducting mail surveys of primary care physicians. McAvoy sites several reasons for decreasing response rates to mail surveys, including volume and length of questionnaires and lack of interest or involvement in the research topic.¹¹ Some South Carolina physicians may view insect associated illness as more of a nuisance than a serious health problem and therefore would lack interest in this research topic. In order to have a sense of involvement in this topic, physicians would have to see patients with these conditions. Since the percentage of respondents who reported no cases of insect associated illness dropped from 44% in 1991 to 13% in 2004, it is reasonable to conclude that many physicians who did not see any cases simply did not respond to the survey.

The results of this study show that tick associated illnesses are underreported to DHEC and the CDC based on the disparity of lab confirmed cases between our study and reported DHEC/CDC data. Future research aimed at determining the reasons for this underreporting and development of strategies to increase reporting would be helpful. In addition, the cases that are not lab confirmed likely represent misdiagnosis in at least

Table 4. Fire Ant Cases Reported to Agromedicine in 2004

	Total	Outpatient	ER	Hospital	Anaphylaxis	Allergist
Under 15	2021	1765	156	6	25	66
Over 15	2194	2016	124	6	18	43
Total	4215	3781	280	12	43	109

some cases. A prospective study involving lab confirmation of diagnoses made on the basis of clinical criteria could help to better characterize the true extent of tick associated illness in the state. Laboratory confirmation was at the discretion of the reporting physician and no further information was obtained regarding the specific test performed. Although the greatest numbers of tick associated illnesses were reported from the upstate, this seems to be a statewide issue that all SC physicians should be aware of.

Since the range of the black widow includes all of North America,⁸ it is unlikely that 11% of the US cases requiring attention in a health care facility occurred in South Carolina. Instead, it is likely that some cases of black widow bites were mistakenly diagnosed and that a large number of black widow bites are not reported to national data bases. Our data also supports the claim that brown recluse bites are over diagnosed¹⁶ since it seems unlikely that South Carolina physicians would diagnose 71% of the total number of cases reported to the AAPCC from across the country. Although the percentage of patients receiving dapsona declined, it is now believed to have limited benefit for treatment of brown recluse bites and should probably be used only in cases of aggressive lesions.^{8,13} A prospective study aimed at assessing reported spider bites including identification of spider specimens whenever possible would be helpful in determining the true extent of spider envenomation in South Carolina. In the meantime, physicians should be aware that spider bites have been reported statewide, but caution should be used in making such a diagnosis at the expense of missing a more readily treated condition.

The total number of fire ant stings treated by primary care physicians has decreased since first reported by *Agromedicine*, but the number seen per provider has remained steady over the years. Earlier surveys suggested decreasing reports of stings as the duration

Table 5. Comparison of Four South Carolina Fire Ant Morbidity Surveys

Parameter	Survey Year			
	1986 ¹⁹	1990 ¹	1998 ¹⁰	2004
Respondents	1,012	940	1,286	514
Total Cases	7,585	4,975	8,259	4215
Cases/Provider	12.0	11.2	9.0	11.3
Treated in Office	5,469 (72%)	4,107 (83%)	6,750 (82%)	3781 (90%)
Treated in ER	1,994 (26%)	827 (16%)	1,454 (18%)	280 (7%)
Hospitalized	122 (1.6%)	27 (0.5%)	56 (0.7%)	12 (0.3%)
Treated for Anaphylaxis	190 (2.5%)	104 (2%)	176 (2%)	43 (1%)
Referred to Allergist	NA	170 (3%)	355 (4%)	109 (2.6%)
Deaths	0	1	2	0

NA indicates question was not asked

of RIFA infestation in the region of the state increased.¹⁰ At this point, the entire state has been infested for some time so a decline in reported incidents would have been expected. The steady maintenance of reported stings could be related to the continued migration of people into SC from areas outside of the current fire ant range who are not familiar enough with RIFA stings to be comfortable treating them. Although no deaths related to RIFA stings were reported in 2004, up to 100 Americans die each year from insect associated anaphylaxis.¹⁸ Since there were over twice as many referrals to allergists compared to cases of anaphylaxis, primary care physicians in SC seem to be aware of the importance of timely referrals. RIFA stings remain an important health concern throughout the state and SC physicians should treat potential anaphylaxis cases aggressively. Table 5 shows the reported fire ant stings from four different *Agromedicine* surveys.

Summary

A population of 2,789 South Carolina primary care physicians was surveyed by mail to estimate the number of cases of insect associated morbidity treated in 2004. A response rate of 19% was obtained. A total of 9,895 cases were reported and 87% of respondents treated at least one patient with an insect bite or sting. Cases totaled 152 for Rocky

Mountain spotted fever, 253 for Lyme disease, 83 for ehrlichiosis, 738 brown recluse bites, 98 black widow bites and 4215 fire ant stings. No insect associated mortality was reported. Since these counts were tabulated from a recall based mail survey, they do not necessarily reflect the true statewide totals.

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