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ORIGINAL RESEARCH

Snakebites Treated in North Carolina Emergency Departments, October 2013–September 2015

Katherine J. Harmon, MPH; Marilyn Goss Haskell, DVM, MPH; Courtney H. Mann, MD; Anna E. Waller, ScD

From the Department of Epidemiology, Gillings School of Global Public Health, The University of North Carolina at Chapel Hill, Chapel Hill, NC (Ms Harmon); the Division of Public Health, Communicable Disease Branch, North Carolina Department of Health and Human Services, Raleigh, NC (Dr Haskell); the Pediatric Emergency Medicine Fellowship, University of North Carolina at Chapel Hill, WakeMed Health and Hospitals, Raleigh, NC (Dr Mann); and the Carolina Center for Health Informatics and the Department of Emergency Medicine, University of North Carolina at Chapel Hill, Chapel Hill, NC (Dr Waller).

Introduction—North Carolina (NC) is home to more than 30 species of indigenous venomous and nonvenomous snakes. Snakebites can cause debilitating and potentially fatal injuries. However, there is a lack of current information available describing the incidence of snakebites in NC. Therefore, we performed this study of snakebites treated in NC emergency departments (EDs) using the statewide syndromic surveillance system, the North Carolina Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT).

Methods—This was a descriptive epidemiologic study characterizing NC ED visits collected by NC DETECT between October 1, 2013 and September 30, 2015 with an assigned International Classification of Diseases, 9th Revision, Clinical Modification code or keyword indicating a snakebite.

Results—Over the 2-year period, the absolute count of snakebite-related ED visits was 2080 visits with an incidence rate of 10.4 visits per 100 000 person-years (95% confidence interval: 10.0–10.9). The frequency of snakebite was highest during the summer months and evening hours. Men had higher incidence rates of snakebite-related ED visits than women, and residents of the Coastal Plain geographic region of NC had higher incidence rates than persons in other regions.

Conclusions—The current study indicated that snakebites are common injuries treated at NC EDs, with a strong seasonal and geographic component. Additional research is needed to further characterize the circumstances associated with snakebites for the development of preventive measures and public health education.

Keywords: snake venom, morbidity, public health surveillance, epidemiology

Introduction

Snakebites are a worldwide public health problem and a neglected tropical disease.[1,2] According to the World Health Organization, an estimated annual 1.2 to 5.5 million snakebites occur worldwide, resulting in up to 94,000 deaths.[3] Snake envenomations may cause severe pain, swelling, tissue necrosis, and systemic effects such as nausea and vomiting.[4] In severe cases, envenomations may lead to impaired limb function, amputation, and, in rare cases, death.[4–7] Even nonvenomous snakebites may result in medical complications.[8,9] Snakebites are a common cause of morbidity in the United States, with an estimated 10,000 snakebites treated at US emergency departments (EDs) per year.[10]

In North America, there are 2 families of venomous snakes: Viperidae and Elapidae.[11] North Carolina (NC) is home to 35 to 37 snake species, of which 6 species are venomous. Five of the 6 venomous species belong to the pit viper subfamily Crotalinae (family Viperidae): copperhead (*Agkistrodon contortrix*), cottonmouth/water moccasin (*Agkistrodon piscivorus*), Eastern diamondback rattlesnake (*Crotalus adamanteus*), timber/canebrake rattlesnake (*Crotalus horridus*), and Carolina pygmy rattlesnake (*Sistrurus miliarius*).[12,13] Of these 6 venomous species, the copperhead is the most widely distributed species in NC.[5,13] Two of the venomous snakes indigenous to NC, the Eastern diamondback rattlesnake and the Eastern coral snake, are

Corresponding author: Katherine J. Harmon, MPH, Department of Epidemiology, Gillings School of Global Public Health, The University of North Carolina at Chapel Hill; e-mail: kjharmon@email.unc.edu.

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extremely rare and, in the case of the Eastern diamondback rattlesnake, possibly extirpated from NC.[14]

Despite the widespread presence of venomous snakes in NC, there is little recent data characterizing the epidemiology of snakebite in the state. This study provides a much-needed descriptive epidemiologic profile of snakebites treated in NC EDs that will be useful to the clinical and public health community.

Methods

DATA SOURCE

We obtained ED visit data from the North Carolina Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT), a statewide syndromic surveillance system used for early event detection and public health surveillance that was established as part of a 2005 legislative mandate.[15,16] Although the NC DETECT includes data from all 24/7, acute-care, civilian hospital–affiliated NC EDs, the Carolinas Poison Center, the Pre-hospital Medical Information System, and select urgent care centers, this study examined only ED visit data. For the study period, NC DETECT included ED visit data from 124 NC EDs.[15]

STUDY POPULATION

The study population consisted of all snakebite-related ED visits identified in NC DETECT during the 2-year period between October 1, 2013 and September 30, 2015.

MEASURES

An ED visit was identified as being snakebite-related if it involved an International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM) External Cause of Injury code (E-code) of E905.0 (venomous snake/lizard bite) or E906.2 (nonvenomous snake/lizard bite) in any of 5 available E-code fields; an ICD-9-CM procedure code of 99.16 or Current Procedural Terminology code of J0840 (indicating the administration of antivenom) in 1 of 20 available procedure code fields; and/or a keyword indicating a snakebite or the administration of snake antivenom in the chief complaint (available for all ED visits) or triage note (available for 32.5% of ED visits in this study).[17] Table 1 displays the case definition for a snakebite-related ED visit.

The lead author reviewed the chief complaint and triage notes for additional information on the snakebite. These text fields were extremely limited (<250 characters) and relevant information about the bite was absent for most ED visits. Among ED visits with descriptive information, the type of information was limited to

Table 1. Case definition for snakebite-related emergency department visits in the North Carolina Disease Event Tracking and Epidemiologic Collection Tool

Criteria	*Description*
E-code	Assigned E-code of E905.0 (venomous snake/lizard bite) or E906.2 (nonvenomous snake/lizard bite) in any of 5 available E-code fields
Procedure code	Assigned procedure code of 99.16 or J0840 (indicating the administration of antivenom) in any of 20 available procedure code fields
Keyword	Any one of the following free-text keywords: "SNAKE BITE", "SNAKEBITE", "SNAKE BIT", "SNAKEBIT", COPPERHEAD, "COPPER HEAD", "RATTLE SNAKE", "RATTLESNAKE", "CROFAB", "SNAKE" +" ANTIVENOM", "CORAL SNAKE", "WATER MOCCASIN", "SNAKE" +" VENOM", "SNAKE" + "COTTONMOUTH", and "SNAKE" + "COTTON MOUTH" in the chief complaint and/or triage notes (where available).

E-code, external cause of injury code.

words or short phrases such as "copperhead bite" or "venomous snakebite–left big toe" or "patient reports copperhead bite while working in yard." Despite the limitations of the free-text data, we felt that the information contained in the chief complaint and triage notes contained useful information on the type of snake involved, the location of the bite, and, in a minority of visits, the circumstances of the bite. Because a single individual reviewed the more than 2000 ED visits that were captured in the study, there were no measures of data abstractor reliability. Although the ICD-9-CM codes refer to both snake and lizard bites, the manual review of the free-text fields identified no documented instances of lizard bite; therefore, we concluded that the vast majority of the ED visits were snakebite-related and referred to them as such.

The sociodemographic variables examined in this study were age, sex, and NC geographic region of residence. Age was classified into 9 age categories: 0–9, 10–19, 20–29, 30–39, 40–49, 50–59, 60–69, 70–79, and ≥80 years of age. NC geographic region was classified on the basis of patients' county of residence (Coastal Plain, Piedmont, Mountain, and out of state).

We also examined healthcare-related factors, including mode of transport to the ED, time and date of arrival at the ED, ED discharge disposition, and expected source of payment. Mode of transport was classified into the following 3 categories: arrival by walk-in after public, private, or law enforcement transport; arrival by air or ground ambulance; and arrival by other mode of transport. ED discharge disposition was classified into 6 categories: discharged home from the ED; admitted to the hospital, intensive care unit, or an observation unit; transferred to another healthcare facility; patient left without receiving medical advice; patient left against medical advice; and other ED discharge disposition. Expected source of payment was classified into one of the following categories: private insurance, Medicare, Medicaid, self-pay, workers' compensation, other type of government payment, and other type of payment.

Additional information was abstracted from the free-text fields when possible to describe the type of snake associated with the bite, the location of the bite, and the circumstances related to the bite. Type of snake was grouped into one of the following categories: copperhead, cottonmouth/water moccasin, rattlesnake, other/unspecified venomous snake, and nonvenomous snake. The location of the bite (toe/foot, distal to ankle; lower leg, distal to knee; upper leg including knee; unspecified lower extremity; trunk/torso; finger and hand, distal to wrist; lower arm, distal to elbow; upper arm including elbow; unspecified upper extremity; neck, face, and head; and multiple body sites involved) and the circumstances related to the bite were based on data abstracted from the chief complaint and triage note text.

STATISTICAL ANALYSES

Counts, proportions, and population-based incidence rates of snakebite-related ED visits were produced by sex, age, and NC geographic region. To protect the identity of the patients involved in the study, we suppressed all counts of <10 ED visits for regional and county analyses. The NC population used for the denominator in the calculation of all rates was obtained from the National Center for Health Statistics' United States Census Populations with Bridged Race Population Estimates.[18] Analyses were conducted using SAS software (version 9.4; SAS Inc., Cary, NC). The institutional review board at the University of North Carolina at Chapel Hill approved the study.

Results

During the study period from October 1, 2013 to September 30, 2015, NC DETECT captured 9.9 million ED visits, of which 2080 visits were identified as snakebite-related.

CHARACTERISTICS OF SNAKEBITE-RELATED ED VISITS

More than three fifths of the study population was male, and the median age was 39.0 years (Table 2). In the majority of snakebite-related ED visits, the patient arrived at the ED via walk-in using public or private transportation (72.4%). In less than one-fourth of ED visits, the patient arrived at the ED by ambulance (21.3%). The most common time of arrival at the ED was during the evening hours between 2000 and 2359 with a peak time of 2100. Nearly a third of snakebite-related ED visits occurred during the weekend (32.1%). Snakebite-related ED visits varied by season, with most occurring during the summer months of July, August, and September (50.7%); followed by the months of April, May, and June (37.8%); October, November, and December (10.0%); and January, February, and March (1.4%). July had the highest frequency of snakebite-related ED visits (21.0%). Figure 1 displays the annual counts of snakebite-related ED visits by calendar month.

The majority of snakebite-related ED visits were discharged home from the ED (77.0%), with another 13.7% admitted to the hospital or placed in an observation unit, 5.2% transferred to another hospital, 2.4% left the ED against medical advice, 1.5% left without receiving medical advice, and 0.2% had some other

Table 2. Frequency of snakebite-related ED visits, stratified by selected characteristics, in North Carolina between October 2013 and September 2015

Characteristic	*ED visits due to snakebites (n=2080)*
Age, years	
Median (IQR)	39.0 (23.0–54.0)
Age, years, n (%)	
0–9	172 (8.3)
10–19	261 (12.5)
20–29	283 (13.6)
30–39	328 (15.8)
40–49	369 (17.7)
50–59	311 (15.0)
60–69	217 (10.4)
70–79	106 (5.1)
≥80	33 (1.6)
Sex, n (%)	
Female	771 (37.1)
Male	1308 (62.9)
Missing	1
Time of day, n (%)	
2400–0359	114 (5.5)
0400–0759	58 (2.8)
0800–1159	270 (13.0)
1200–1559	408 (19.6)
1600–1959	482 (23.2)
2000–2359	748 (36.0)
Month of visit, n (%)	
January–March	30 (1.4)
April–June	787 (37.8)
July–September	1054 (50.7)
October–December	209 (10.0)
Discharge disposition	
Discharged	1500 (77.0)
Admitted/Observation unit	266 (13.7)
Transferred	102 (5.2)
Left against medical advice	47 (2.4)
Left without medical advice	29 (1.5)
Other[a]	4 (0.2)
Missing	132
Mode of transportation	
Walk-in	1249 (72.4)
Ambulance[b]	368 (21.3)
Other[c]	109 (6.3)
Missing	354
Expected source of payment	
Private insurance	617 (32.4)
Self-pay	420 (22.0)
Medicaid	309 (16.2)
Medicare	220 (11.5)
Workers' compensation	68 (3.6)
Other government payment	50 (2.6)
Other[d]	221 (11.6)
Missing	175
Total	2080

ED, emergency department; IQR, interquartile range.

[a] ED visits with a discharge disposition of "other"

[b] ED visits with a mode of transport of either air or ground ambulance

[c] ED visits with a mode of transport of "other"

[d] ED visits with an expected source of payment of "other"

discharge disposition (Table 2). When stratified by type of snake, (venomous vs nonvenomous), patients bitten by venomous snakes who visited the ED were more likely to be hospitalized or placed in an observation unit (16.6%) than patients bitten by nonvenomous snakes (2.5%). The most common expected source of payment was private insurance (32.4%), followed by self-pay (22.0%), Medicaid (16.2%), Medicare (11.5%), workers' compensation (3.6%), other type of government payment (2.6%), and other source of payment (11.6%).

POPULATION-BASED INCIDENCE RATES OF SNAKEBITE-RELATED ED VISITS

The average annual incidence rate of snakebite-related ED visits in NC was 10.4 visits per 100 000 person-years (95% confidence interval [CI], 10.0–10.9; Table 3). The incidence rate of snakebite-related ED visits between October 2013 and September 2014 was 10.9 ED visits per 100 000 person-years (95% CI, 10.3–11.6) and the incidence rate between October 2014 and September 2015 was 10.0 visits per 100 000 person-years (95% CI, 9.4–10.6).

The rates of snakebite-related ED visits varied by age group (Table 3). ED visit rates were highest among individuals aged 40 to 49 years (13.7 visits per 100 000 person-years; 95% CI, 12.4–15.2). Rates of ED visits were nearly twice as high among men (13.5 visits per 100 000 person-years; 95% CI, 12.8–14.2) compared with women (7.5 visits per 100 000 person-years; 95% CI, 7.0–8.1; Table 3).

Rates of snakebite-related ED visits also varied by geographic region (Table 3). Of the 1990 ED visits made by NC residents, the rate of snakebite-related ED visits was 10.8 per 100 000 person-years in the Coastal Plain region (95% CI, 9.9–11.6), 9.9 ED visits per 100 000 person-years in the Piedmont region (95% CI, 9.4–10.5), and 8.4 visits per 100 000 person-years in the Mountain region (95% CI, 7.4–9.7).

CIRCUMSTANCES OF SNAKEBITE-RELATED ED VISITS

More than two-thirds of snakebite-related ED visits contained some information about the type of snake involved in the incident. Among the 2080 snakebite-related ED visits, 58.2% were identified as venomous snakebites including copperhead (16.6%), cottonmouth/water moccasin (0.5%), rattlesnake (0.5%), and unspecified species (40.6%); 10.0% were due to a nonvenomous snake, and 31.8% were due to an unspecified type of snake (Table 4).

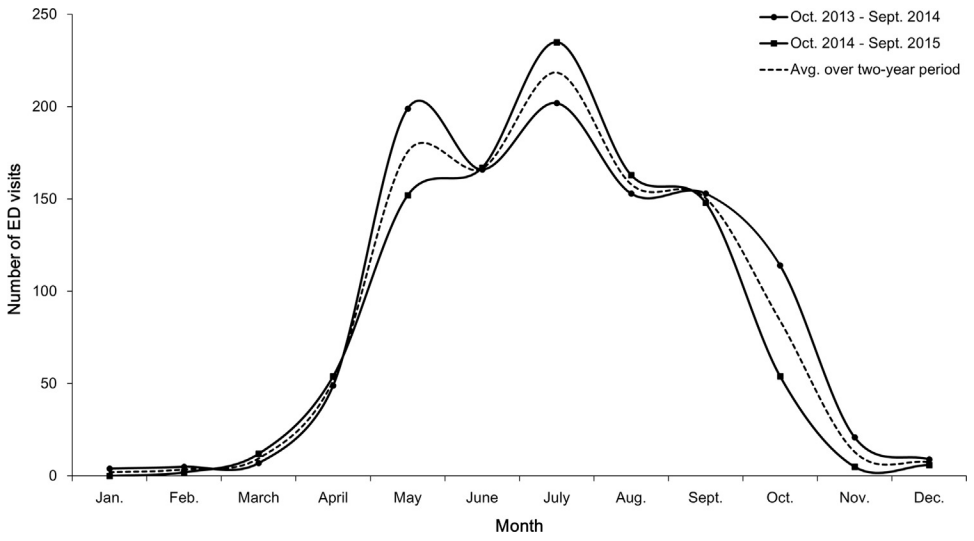

Figure 1. Number of snakebite-related ED visits by month of visit, October 2013 to September 2015. Avg., average; ED, emergency department.

Whenever possible, the location of the bite was classified according to body region. Most ED visits (60.7%) did not contain any information about the location of the snakebite; however, 39.3% of visits contained at least some information about the location of the body where the bite was located (Table 4). The 3 most common body regions specified in the chief complaint and/or triage notes were the finger/hand, distal to wrist (13.3%); toe/foot, distal to ankle (11.8%); and the lower leg above the ankle, distal to knee (7.5%).

Only 168 of the 2080 ED visits contained information about the circumstances preceding the snakebite in the chief complaint and/or triage notes. The 10 most common circumstances mentioned indicated that the snakebite occurred while 1) walking/hiking, 2) doing yard work/clearing brush, 3) intentionally handling the snake, 4) inside a residence, 5) playing outside in a yard, 6) gardening, 7) intoxicated, 8) at work for pay, 9) swimming or in water, and 10) performing building/construction/other property maintenance.

Discussion

This study is one of the first to use ED surveillance data to describe the epidemiology of snakebite and, to the best our knowledge, the first to describe the incidence of snakebite-related NC ED visits using data collected for the purposes of syndromic surveillance and event detection. Our study indicated that the incidence of snakebite-related ED visits in NC was 10.4 visits per 100 000 person-years (95% CI, 10.0–10.9).

One of the few publications to calculate population-based incidence rates using clinical data estimated that NC had the highest incidence of snakebite in the United States. This study examined survey data collected from hospitals and practicing physicians between 1958 and 1959. On the basis of survey responses, the study estimated that the annual incidence rate of snakebite was 3.7 bites per 100 000 person-years for the United States as a whole and 18.8 bites per 100 000 person-years for the state of NC, with only Arkansas, Texas, and Georgia having comparable rates of snakebite.[19] Although this study had a high response rate, the data are nearly 60 years old and the nation has undergone considerable demographic changes since the late 1950s.[19,20] This study, as well as a companion study comparing snakebite in children to snakebite in adults, have been cited as recently as 2016, perhaps due to the lack of more recent epidemiologic studies using hospital and ED data.[4,10,11,19,21–24]

A more recent publication using injury data from the National Electronic Injury Surveillance System–All Injury Program (NIESS-AIP) estimated a national incidence rate of 3.4 ED visits per 100 000 person-years between 2001 and 2004. Because NEISS-AIP ED visit data are based on a nationwide probability sample of US hospitals, estimates of snakebite-related ED visits could not be calculated.[10,25]

Other studies have estimated snakebite incidence using Poison Control Center (PCC) call data. One study of pediatric snakebite-related PCC calls determined that NC had one of the highest average annual rates of PCC calls among children ages 0 to 18 years between 2000 and 2013. Only Texas, Florida, and Georgia experienced

Table 3. Unadjusted population-based incidence rates (per 100 000 person-years) of snakebite-related emergency department visits stratified by age, sex, and geographic region of residence in North Carolina, October 2013 to September 2015

Characteristic	*Average annual rate per 100 000 person-years (95% confidence interval) (n=2080)*
Age, years	
0–9	6.8 (5.9–7.9)
10–19	10.0 (8.8–11.3)
20–29	10.3 (9.2–11.6)
30–39	13.0 (11.6–14.4)
40–49	13.7 (12.4–15.2)
50–59	11.4 (10.2–12.8)
60–69	9.9 (8.6–11.3)
70–79	8.6 (7.1–10.4)
≥80	4.8 (3.4–6.7)
Sex	
Male	13.5 (12.8–14.2)
Female	7.5 (7.0–8.1)
Missing	1
Geographic Region[a]	
Coastal Plain	10.8 (9.9–11.6)
Piedmont	9.9 (9.4–10.5)
Mountain	8.4 (7.4–9.7)
Missing	5
Total	10.4 (10.0–10.9)

[a] A total of 85 emergency department visits were made by out-of-state residents, which were not included in the rates of visits by geographic region in North Carolina.

Table 4. Frequency of snakebite-related emergency department visits, stratified by selected characteristics abstracted from free-text data in North Carolina, October 2013 to September 2015

Characteristic	*Emergency department visits due to snakebites (n=2080)*
Type of snake, n (%)	
Copperhead	345 (16.6)
Cottonmouth	10 (0.5)
Rattlesnake	10 (0.5)
Venomous snake, unspecified	845 (40.6)
Nonvenomous snake	209 (10.0)
Unspecified type of snake	661 (31.8)
Location of bite, n (%)	
Toe/Foot (distal to ankle)	246 (11.8)
Lower leg (distal to knee)	156 (7.5)
Upper leg (includes knee)	11 (0.5)
Lower extremity (unspecified)	53 (2.5)
Trunk/Torso	5 (0.2)
Finger/Hand (distal to wrist)	276 (13.3)
Lower arm (distal to elbow)	26 (1.3)
Upper arm (includes elbow)	9 (0.4)
Upper extremity (unspecified)	20 (1.0)
Neck/Face/Head	5 (0.2)
Multisite	10 (0.5)
Unspecified location	1263 (60.7)
Total	2080

higher call rates during this period.[21] However, PCC calls may represent an underestimation of the total number of statewide snakebites. A comparison of snakebite-related Missouri PCC calls and ED visit data found that only 18% of snakebite-related ED visits had a corresponding call to the state poison center.[26]

Although more than half of all patients treated in NC EDs for snakebite were male, this proportion was less than that observed in other studies. In addition, the patients in our study were somewhat older than populations described in prior studies.[5,10,27] In comparison with other studies, fewer NC ED visits had a discharge disposition of hospitalization, even when stratified according to venomous/nonvenomous type of snake.[5,10]

Many snakebites may be characterized as relatively mild (local pain and mild edema) or even dry (no envenomation). The severity of the bite is related to a number of factors, including the age of the snake, the size of the snake, fang morphology, the species of the snake, as well as physical barriers to venom injection, such as footwear or clothing.[28] Although copperheads, the most common snake species identified in our study, possess a venom of lower toxicity than other NC venomous snake species, many patients experienced prolonged pain and impaired limb function. These injuries often necessitate the administration of opioid analgesics with the concomitant risk of addiction.[5] Recent studies indicate that the administration of Crotalidae Polyvalent Immune Fab (Ovine; CroFab; FabAV; BTG International Inc, West Conshohocken, PA) may mitigate the long-term effects of copperhead envenomation.[29]

Although most of the patient visits in this study had an expected source of payment of private or governmental insurance, more than one-fifth had an expected source of payment of self-pay, suggesting a lack of insurance coverage. This is important due to the high cost associated with snakebite treatment, particularly snakebites treated with antivenom. Although the risk of severe side effects, such as serum sickness, restricted the use of horse serum–derived antivenom except in the most severe cases, the development of the much safer CroFab has led to an increase in the administration of antivenom for the treatment of snakebite.[30,31] The cost to the hospital for a single vial of CroFab is $2000 to $2900 US; the cost to the patient is assumed to be much higher. Most patients require 6 or more vials of

CroFab for treatment of snakebite.[29] Although CroFab is effective in preventing death and disability, the cost of modern antivenom treatment may be substantial for uninsured and underinsured patients.[29,30]

The majority of snakebite-related NC ED visits occurred during spring and summer. Although we were unable to obtain the time of the bite using NC DETECT ED visit data, the most common time of arrival at the ED was during the evening hours. Copperheads are active both during the day and at night. During the more temperate months of spring and fall, copperhead activity is highest during the daytime hours when temperatures are at their peak; however, during the summer months, copperheads are more active during the morning, evening, and nighttime hours.[13] The copperheads' predilection for being most active under low light conditions combined with their dark coloring, lack of a threat display prior to bite, and tendency to strike when threatened, increases the likelihood of incurring a copperhead snakebite during the evening hours.[13,32]

The highest incidence of snakebite was recorded in the Coastal Plain region of NC. The Coastal Plain is the only geographic region of NC where all species of venomous snakes are endemic.[13]

We were unable to obtain additional information about the circumstances leading up to the bite for most snakebites. Among visits with information in the free-text fields, we found that most snake interactions were unprovoked and involved outdoor activities such as walking, yardwork, gardening, and playing. These results are consistent with those from other studies that examined copperhead bites. However, a study of rattlesnake bites in the Western United States found a higher degree of provoked bites.[5,10,27]

Healthcare providers and public health officials should target preventive education and awareness to populations who are at risk, particularly people who are involved in outdoor occupations and recreational activities. Such efforts should include the identification of local venomous snake species, snakebite prevention, and seeking medical care. Although the preponderance of snakebites in NC are due to copperheads, the recognition of venomous snakes is important for avoidance and for reporting to a healthcare provider.

In addition, individuals should be advised to use caution when entering environments where snakes are common (eg, tall grass, leaf piles, and piles of wood and rocks). Personal protective equipment, including wearing long pants, tall boots, and leather gloves while working outside, may avert penetration of the skin if a bite occurs. Providers should also dispel common myths regarding the treatment of snakebites, such as the usefulness of snakebite suction devices or tourniquets in treating snake envenomations.[33,34]

Limitations

This study has several limitations. First, this study is limited to ED visit data and does not include snakebites treated at an outpatient clinic or not receiving medical attention. Therefore, the rates reported in our study likely underestimate the true population-based rates of snakebite in NC.

Second, we identified the snake species/type based on identification by medical personnel in the free-text fields. The majority of snake species could not be identified, although most could be classified as venomous/nonvenomous. According to a California study, the general public could identify whether a species of snake was venomous or nonvenomous in most instances; however, they were less successful at identifying the species.[35] Species identification may be less of an issue in NC, where an estimated 80% of venomous snakebites are due to copperheads.[5]

Third, our study examined data that are primarily administrative in nature. At the time of this study, NC DETECT ED visit data did not include detailed information about the circumstances leading up to the bite, patient occupation, patient race/ethnicity, other sociodemographic variables, and clinical care.

Conclusions

Venomous and nonvenomous snakebites are a common source of morbidity in NC, with an incidence rate of 10.4 visits per 100 000 person-years (95% CI, 10.0–10.9). Snakebites are more likely to occur during the summer months when people are likely to be involved in outdoor activities and snakes are more active. Compared with reports from other states, ED visits due to snakebite in NC include many nonvenomous snakebites and are less likely to result in hospitalization (18.9% ED visits resulted in either admission to a hospital or transfer to another hospital). With increased use of CroFab antivenom to treat copperhead bites, the expense of treating a snakebite may be a burden for many patients, particularly those who are underinsured or uninsured.

Although NC DETECT ED visit data are useful in describing the incidence of snakebite-related ED visits in the state, NC DETECT does not capture detailed narrative information. For a more thorough understanding of snakebite in NC, more research is needed to clearly identify the circumstances leading up to the bite, the species of snake involved, bite severity and symptomology, and medical treatment of the bite. Such information is key to developing and targeting effective snakebite prevention strategies.

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