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ORIGINAL RESEARCH

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

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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

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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.