

North Carolina Emergency Department Data: January 1, 2007-December 31, 2007

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Abstract

Background: The purpose of this paper is to describe patient characteristics and clinical conditions seen in North Carolina emergency departments (EDs) in 2007.

Methods: Data were analyzed from a static database of all 2007 ED visits in the North Carolina Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT). Data were captured from 80% of North Carolina EDs on January 1, 2007, and 93% as of December 31, 2007. ED visits were analyzed by age, sex, method of ED arrival, return and repeat ED visits, expected source of payment, and ED disposition. Data were also analyzed by selected disease and injury groups that were thought by the authors to be of epidemiologic or demographic importance to North Carolina.

Results: The first and second leading ED visit diagnosis groups in North Carolina were abdominal pain and chest pain. The top three disease groups resulting in ED visits were chest pain/ischemic heart disease (11.9% of all ED visits), substance and alcohol abuse or withdrawal (11.2%), and diabetes (7.8%). Falls were the most common cause of injury-related ED visits in North Carolina, almost twice as common as motor vehicle crashes.

Limitations: This study reports only on acute disorders resulting in ED visits. North Carolina legislation limits the types of data elements collected. All data depend on institutional coding practices.

Conclusions: Emergency department data can provide valuable information on the proportions and rates of ED visits for illness and injury statewide and can help identify vulnerable populations in the state.

Keywords: emergency department data, public health surveillance, descriptive epidemiology

This paper provides an overview of North Carolina emergency department (ED) data for the year 2007, which represent a total of nearly 4 million ED visits in the state. Data are analyzed by the North Carolina Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT), a near real-time statewide ED database which is funded by the North Carolina Division of Public Health. NC DETECT is developed and maintained by faculty and staff at the Carolina Center for Health Informatics in the Department of Emergency Medicine at the University of North Carolina at Chapel Hill, in collaboration with the North Carolina Division of Public Health. To date, NC DETECT is the most comprehensive and mature ED database in the United States. The purpose of this paper is to define the

patient characteristics and clinical conditions seen in North Carolina EDs in 2007 in order to better understand the statewide burden of acute illness and injury. These data are taken from the 2007 NC DETECT Annual Report.¹

Methods

In 2007, NC DETECT received data on an estimated 92% of all ED records from 24/7 acute care hospital-affiliated EDs in North Carolina. Psychiatric, military, and veteran's hospitals did not participate. Data were captured from 90 of 112 North Carolina EDs on January 1, 2007, and 103 of 111 EDs as of December 31, 2007. The ED data in NC DETECT are all secondary data. Hospitals extract their data in near real-time from their respective administrative and clinical

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electronic databases to allow timely statewide public health surveillance. Medical coding is done by each hospital for its own operational purposes. Each hospital standardizes the data elements (see Table 1) to Data Elements for Emergency Department Systems (DEEDS)² prior to transmission to a data aggregator. Data files are received securely by NC DETECT every 12 hours in Health Level-7 (HL-7)-like format. HL-7 is a widely recognized and implemented standard for the exchange and transmission of health care data.

For this report, an historical, static database of all ED visits in NC DETECT occurring in 2007 were analyzed by age, sex, method of arrival to the ED, return and repeat ED visits, expected source of payment, and ED disposition. Data are presented with proportions, rates, or both, as appropriate. Rates were determined using 2007 certified North Carolina population estimates which include institutionalized and

military populations.^a Because we estimate that only 92% of all 2007 ED visits were reported and since military, Veterans Administration, and prison hospital EDs are not included in NC DETECT, our reported rates are conservative;^a we did not adjust rates for underreporting. Data were further analyzed by diagnosis code groups and disease and injury groups. Diagnosis code groups were defined by selecting the primary ICD-9-CM diagnosis code in the NC DETECT dataset, following the National Hospital Ambulatory Medical Care Survey 2005 Emergency Department Data Summary Classification.³ We identified the top 20 diagnosis code groups statewide and by age group.

Data were also analyzed by select disease and injury groups thought by the authors to be of epidemiologic or demographic importance to North Carolina. Disease and injury groups were organized using pre-developed ICD-

Table 1.
Emergency Department Data Elements Sent to NC DETECT

DEEDS No.	Element Name	Description/Notes
1.01	Patient ID	Unique identifier permanently masked to prevent reidentification
1.04	Date of birth	Date/time
1.05	Sex	Male/female/unidentified
1.08	Address	City, state, county, zip
1.10	Visit ID	Unique identifier permanently masked to prevent reidentification
2.01	ED facility ID	Location where patient sought care
3.01	Insurance coverage or other expected source of payment	Entity or person expected to be responsible for patient's bill for this ED visit (numeric code)
4.01	Date/time first documented in ED	First date and time documented in patient's record for this ED visit (date/time)
4.02	Mode of transport to ED	Patient's mode of transport to ED (numeric code)
4.06	Chief complaint	Patient's reason for seeking care or attention, expressed in terms as close as possible to those used by patient or responsible informant
4.06a	Triage note	Supporting information for chief complaint
4.08	First ED acuity assessment	First ED assessment of patient's acuity by practitioner
4.18	First ED SBP	Systolic blood pressure (number)
4.20	First ED DBP	Diastolic blood pressure (number)
4.26	First ED temperature	Number
4.27	First ED temperature reading route	Number
5.04	Coded cause of injury	Encoded description of injury event that precipitated patient's ED visit; ICD-9-CM or E-code
6.02	ED procedure	ICD-9-CM codes and CPT codes for procedures
8.02	ED disposition	Patient's anticipated location or status following ED visit (numeric code)
8.23	ED disposition diagnosis description (repeats)	Practitioner's description of condition or problem for which services were provided during patient's ED visit, recorded at time of disposition
8.24	ED disposition diagnosis code(s)	ICD-9-CM code(s) assigned to ED disposition diagnosis

a. Tillman B. North Carolina State Demographics Branch. Written communication (email). North Carolina county population estimates. Office of State Budget and Management. September 2, 2008.

9-CM code sets and were reviewed by one author for face validity (see Table 2).⁴ Disease groups represented both a primary condition as well as comorbidities coded for that ED visit. Disease groups were assembled based on examination of up to 11 recorded ICD-9-CM codes received by NC DETECT that represented either a primary or comorbid diagnosis. Disease groups analyzed were: (1) chest pain and ischemic heart disease; (2) substance abuse/dependency (SAD) and acute intoxication or withdrawal (AIW); (3) diabetes mellitus; (4) psychiatric disorders; (5) asthma; (6) heart failure; (7) neoplasms; and (8) ischemic stroke and transient ischemic attacks (TIA). Injury groups were assembled by capturing the highest of five coded cause of injury (E-codes) captured for an ED visit. Injury groups analyzed were: (1) unintentional injury; (2) falls; (3) motor vehicle traffic crashes (driver or passenger); (4) motor vehicle non-traffic crashes; (5) pedal cyclist injuries; and (6) pedestrian injuries. Injury-related visits were defined as any one of 11 ICD-9-CM diagnosis codes received ranging from 800-999 or as an E-code that was present in any one of five coded cause of injury fields.

This work was reviewed by the University of North Carolina Biomedical Institutional Review Board (IRB). The IRB determined that this submission did not constitute human subjects research as defined under federal regulations [45 CFS 46.102 (d or f) and 21 CFR 56.102(c)(e)(1)] and did not require IRB approval.

Results

Total North Carolina Emergency Department Visits, Repeat Visits, ED Disposition, and Expected Method for ED Payment

In North Carolina, there were 3,853,740 ED visits reported to NC DETECT in 2007, with 70.2% of patients visiting the same ED only once (see Table 3, page 18) and 29.8% visiting the same ED more than once. Using the 2007 North Carolina population as a denominator (9,069,398), approximately 26.3% of North Carolina's population visited the same ED in North Carolina at least once.

The 2007 North Carolina ED visit rate was 424.9 visits per 100,000 total residents including military and institutionalized persons. Most patients were cared for at the initial hospital where they presented for care, with only about 1% of patients transferred to other general hospitals. Expected source of payment is highlighted in Table 3 (page 18). The proportion of ED visits categorized as 'self-pay' in North Carolina in 2007 was 24.1%. The proportion of North Carolina ED visits with the expected source of payment from federal or state sources was 43.5%.

About half of ED visits statewide were by persons ages 24-64. About 15% of ED visits were by those over 64 years of age. Statewide, the proportion of ED visits by women, 55.6%, was greater than visits by men, 44.4% (see Table 4, page 19). The majority of patients arrived at the ED using

Table 2.
ICD-9-CM Codes for Disease Group Aggregations^a

Disease Group	ICD-9-CM Codes Included
Asthma/wheezing	493.0, 493.1, 493.2, 493.8, 493.9, 786.07
Chest pain and ischemic heart disease	410-414, 426, 427, 786.5, 786.50-786.59
Diabetes	250.0, 250.1, 250.2, 250.4, 250.5, 250.6, 250.7, 250.8, 250.9, 251.0 (hypoglycemia) 357.2, 362.0, 648.0, 707.1 (excludes diabetes insipidus)
Heart failure	428, 518.4 (acute pulmonary edema; excludes due to fumes and vapors)
Ischemic stroke and TIA	433, 434, 435, 437.0, 437.1 (excludes subarachnoid hemorrhage, subdural and epidural hematoma, and intracerebral hemorrhage)
Neoplasms	140-239
Psychiatric disorders	290-312 but excluding 305, 292.0, 291.81, 291.0, 291.4, 980, 304
Substance abuse; drug dependence; acute intoxication; acute withdrawal	305; 304; 291.4, 980; 291.0, 291.81, 292.0
Injury	800-999
Unintentional injuries	E800-950, 969-980
Falls	E880-E888
Motor vehicle crashes—traffic	E810.0-819.0 (driver); E810.1-819.1 (passenger)
Motor vehicle crashes—non-traffic	E820.0-825.0 (driver); E820.1-825.1 (passenger)
Pedal cyclist	E810.6-E825.6, E826.1
Pedestrian injury	E826.2, 827.2, 828.2, 829.2

a. All ICD-9-CM codes received for an ED visit were included in these disease groups. This includes up to 11 diagnosis codes and up to 5 coded cause of injury/E-codes.

their own transportation (63.7%). Of the total of visits, 12.9% were transported by vehicular emergency medical services (EMS) and only 0.2% by helicopter or fixed-wing aircraft (data not shown). Method of ED arrival is one of the

most common missing elements in NC DETECT, with 21% of ED visits missing that information.

Diagnosis Code Groups Resulting in ED Visits

Table 3.
Statewide Emergency Department (ED) Visits, Return Visits, ED Disposition, and Expected Method of ED Payment^a

ED VISITS	
Total number of ED visits in 2007	3,853,740
Total number of people who visited an ED in 2007	2,385,033
ED RETURN VISITS (%)	
People who visited an ED only once	70.2
People who visited twice	17.0
People who visited 3 times	6.2
People who visited ≥4 times	6.6
Return visits ≤72 hrs after first visit	4.5
Return visits >3 days after first visit	95.5
ED DISPOSITION (%)	
ED visits discharged from ED	73.4
ED visits admitted to the same hospital ^b	12.4
ED visits transferred to a general hospital ^c	0.9
ED visits transferred to a specialty hospital ^d	0.5
ED visits transferred to skilled nursing facility or intermediate care facility, or discharged to home under care of home care provider	0.3
ED visits terminated w/o medical advice or AMA	2.8
ED visits transferred to observation unit	0.4
ED visits patient died	0.2
ED visits other unspecified discharge	0.3
ED visits missing disposition information	8.9
EXPECTED METHOD OF ED PAYMENT(%)	
Private insurance	27.4
Medicare	18.4
Medicaid	21.4
Worker's compensation	1.2
Other government	2.5
Self pay	24.1
Other (unspecified)	2.8
Missing payment method	2.3

- Military hospitals in PHRST 2 (Naval Hospital, Camp LeJeune) and PHRST 3 (Womack Army Hospital) do not report data to NC DETECT.
- Admissions to general hospital; excludes observation and death in ED.
- Transfers to another short-term general hospital.
- Transfers to psychiatric, substance abuse rehabilitation, rehabilitation, or veterans' hospitals and transfers to prisons or prison hospitals.

Table 5 (page 20) lists the top 20 diagnosis code groups statewide, based on the primary ICD-9-CM diagnosis code received for each ED visit. In 2007, the first and second leading diagnosis code groups in North Carolina were abdominal pain and chest pain. The top five diagnosis code groups in North Carolina together comprised 17.3% of all reported ED visits and were, in descending order: abdominal pain; chest pain; neck and back pain; upper respiratory infections (excluding pharyngitis); and skin contusions. When data were stratified by age group, fever and upper respiratory and ear infections were the most common diagnoses for preschool-aged children. Injuries increased in school-age children and continued as a major cause of ED visits through middle age. Chest pain appeared as an important diagnosis code group in young adulthood and increased with patient age (data not shown). For NC DETECT, about 12% of all ED visits were missing an ICD-9-CM diagnosis code. Of ED visits with a diagnosis code, about half of the visits had three or more different diagnosis codes (data not shown).

Selected Disease Groups Resulting in ED Visits

The authors selected disease groups based upon clinical experience and issues of public health importance. ED visits for the following disease groups (a primary or comorbid diagnosis identified in Table 2, page 17) were analyzed by age group: (1) asthma; (2) chest pain/ischemic heart disease; (3) heart failure; (4) ischemic stroke/TIA; (5) diabetes; (6) neoplasms; (7) substance abuse/dependence (SAD) and alcohol intoxication withdrawal (AIW); and (8) psychiatric disorders. These disease groups include all diagnosis codes, up to 11, assigned to a patient visit.

Table 6 (page 21) displays proportions and population rates for these disease groups in descending order. The top five disease groups resulting in ED visits were chest pain/ischemic heart disease; substance abuse/intoxication and withdrawal; diabetes; psychiatric disorders; and asthma. These proportions are not additive. Multiple ICD-9-CM diagnoses can be recorded for one ED visit. For example, one ED patient

visit could have diagnoses for both chest pain and diabetes.

Asthma

There were 49,076 ED visits for asthma as an acute or comorbid condition. Asthma represents 1.3% of all ED visits as a primary diagnosis and 4.4% as comorbid diagnosis. About half of ED visits with an acute or comorbid diagnosis of asthma were by individuals ages 25-64. About 20% of asthma-related ED visits were by children of elementary or high school age. Rates of ED visits for asthma are highest in the age group 0-9 years of age (data not shown).

Chest Pain/Ischemic Heart Disease

As a primary diagnosis, the percentage of ED visits for chest pain/ischemic heart disease was 5.2%, but increased to 11.9% as a comorbid diagnosis (see Table 7, page 21). Visits for chest pain/ischemic heart disease constituted the highest proportion of the cardiovascular disease groups selected for review in this report. As expected, those who were 65 years and older had the highest rate of ED visits for chest pain and ischemic heart disease as primary and comorbid diagnoses, at 175.2/1,000 person-years. ED visit rates increased markedly from age 45 upward—35.7/1,000 person-years for age group 25-44, and 63.0/1,000 person-years for age group 45-64. The proportions of women (53.6%) and men (46.4%) with chest pain and ischemic heart disease were similar to the statewide proportions for overall ED visits by women (data not shown).

Heart Failure

The statewide rate of ED visits with an acute or comorbid diagnosis of heart failure is much lower than that of chest pain/ischemic heart disease (see Table 7, page 21). The age group with the highest rate of ED visits for heart failure as a primary or comorbid diagnosis was the group 65 years and older, with a rate of 63.5 visits/1,000 person-years (data not shown).

Ischemic Stroke/Transient Ischemic Attacks

The pathophysiology of ischemic stroke/TIA and brain hemorrhage (subarachnoid, intracerebral, subdural, and epidural hemorrhage) are very different, so for purposes of this study, we report on ischemic stroke/TIA (see Table 2, page 17). Ischemic stroke/TIA as a primary diagnosis accounted for 0.4% of ED visits and for 0.8% of primary or comorbid diagnoses (see Table 7, page 21).

Table 4.
Proportion, Count, and Rate of Emergency Department (ED) Visits Statewide by Age Group and Sex, 2007

	ED Visits (%)	Count of Visits	Population Estimates	Rate Per 1,000 Person-Years
Age in Years				
≤1	5.2	199,961	243,570	820.96
2-4	4.1	157,629	363,565	433.56
5-9	4.2	161,747	617,120	262.10
10-14	3.7	143,574	599,307	239.57
15-18	5.1	197,983	497,966	397.58
19-24	11.0	423,563	817,614	518.05
25-44	30.6	1,178,431	2,565,520	459.33
45-64	20.9	806,374	2,277,294	354.09
≥64	15.2	584,036	1,087,442	537.07
Sex				
Male	44.4	1,711,380	4,477,900	382.18
Female	55.6	2,141,703	4,591,498	466.45

Diabetes

ED visits for diabetes, either as the primary or comorbid diagnosis, represented 7.8% of all ED visits, a statewide rate of 33.1/1,000 person-years, making diabetes the third highest disease group in these data (see Table 6, page 21). The rate of ED visits with diabetes increases dramatically beginning in the 25-44 year age group. Ninety-seven percent of ED visits with diabetes as a primary or comorbid diagnosis were made by those 25 years and older, and nearly 80% were by those 45 years of age or older (data not shown).

Neoplasms

Neoplasm as an ED visit diagnosis typically represents complications of treatment for cancer or problems with pain management in end of life care. Neoplasm as a primary or comorbid diagnosis comprised 1.4% of all 2007 ED visits, with an overall rate of 5.9/1,000 person-years. The rate was highest in the age group over 64 years. Three percent of ED visits with an acute or comorbid diagnosis of neoplasms were younger than 25 years (data not shown).

Substance Abuse/Dependence and Alcohol Intoxication/Withdrawal

The primary or comorbid diagnoses of substance abuse or dependence (SAD) and alcohol intoxication or withdrawal (AIW) represented 11.2% of all 2007 ED visits and a rate of 47.5/1,000 person-years (data not shown). The burden of SAD/AIW represents about 1,180 ED visits per day to North Carolina EDs.

The diagnoses SAD/AIW became evident in the age group 15-18 years (ED visit rate 29.7/1,000 person-years) and

Table 5.
Top 20 Diagnosis Code Groups Statewide, 2007

Top 20 Diagnosis Code Groups,^a All Ages Combined				
Diagnosis	Diagnosis Codes^b	Number of Records	Total Visits (%)	Rate per 1,000 Person-Years
Missing primary ICD-9-CM diagnosis code		469,481	12.2%	
Abdominal pain	789	165,622	4.3%	18.3
Chest pain	786.5	151,438	3.9%	16.7
Spinal disorder (neck and back pain)	720-724	119,209	3.1%	13.1
Acute URI, excl. pharyngitis	460-461;463-466	116,424	3.0%	12.8
Contusion, intact skin surface ^c	920-924	114,376	3.0%	12.6
Rheumatism, excl. back	725-729	79,257	2.1%	8.7
Open wound, excl. head ^c	874-897	78,573	2.0%	8.7
Sprains, strains, neck and back	846,847	74,576	1.9%	8.2
Cellulitis and abscess	681-682	65,615	1.7%	7.2
Pyrexia of unknown origin	780.6	62,438	1.6%	6.9
Heart disease, excl. ischemic	391-392.0;393-398; 402;404;415-416; 420-429	57,936	1.5%	6.4
Fractures, excl. lower limb ^c	800-819	57,303	1.5%	6.3
UTI, unspecified	599.0	52,624	1.4%	5.8
Open wound of head ^c	870-873	52,097	1.4%	5.7
Acute pharyngitis	462	47,276	1.2%	5.2
Sprains, strains, excl. ankle and back	840-844;845.1;848	47,114	1.2%	5.2
Asthma	493	46,001	1.2%	5.1
Otitis Media and eustacian tube disorders	381-382	45,338	1.2%	5.0
Pneumonia	480-486	37,018	1.0%	4.1
Superficial injuries ^c	910-919	36,961	1.0%	4.1
All other diagnoses ^d		1,877,063	48.7%	207.0
Total		3,853,740	100.0%^e	

a. Diagnosis code groups as used in the NHAMCS: 2005 Emergency Department Summary, #386, June 29, 2007.³

b. Groups do not include E-codes.

c. Injuries.

d. This group also includes injuries.

e. Column total greater than 100% due to rounding.

peaked in the age group 25-44 years (74.5 for ages 19-24; 77.5 for ages 25-44; 56.3 for ages 45-64, all in 1,000 person-years). For those older than 64, the rate is just below those aged 15-18, at 24.8/1,000 person-years (data not shown).

Psychiatric Disorders

Psychiatric disorders (which include dementia) as a primary or comorbid diagnosis accounted for 7.7% of ED visits in North Carolina in 2007, representing a rate of 32.9/1,000 person-years (see Table 6, page 21). The burden of psychiatric disorders begins in adolescence and continues through adulthood, but the rate rose dramatically in those over 64 years of age, to 82.3/1,000 person-years (data not shown).

Selected Injury Groups Resulting in ED Visits

Unintentional injuries comprised the vast majority (73%) of injuries treated in North Carolina EDs (see Table 8, page 22). Coded cause of injury (E-code) data were missing for 14.9% of visits identified as injury-related based on ICD-9-CM diagnosis codes.

Falls account for the greatest proportion of injuries, at 20.6%, or about 560 visits per day in North Carolina EDs. The rate of falls for all age groups combined was 22.5 per 1,000 person-years. The elderly experienced the greatest proportion of falls (27%) when compared to all other age groups and also had the highest rate of falls of any age group, 50.6/1,000 person-years (data not shown).

Motor vehicle crashes involving drivers and passengers accounted for 11.7% of all injury-related ED visits, or 2.5% of all ED visits, about 318 visits per day in North Carolina EDs (see Table 8, page 22). The rates of those aged 15-18 and 19-24 (20.7 and 21.7/1,000 person-years, respectively) were the highest of all age groups. Those aged 65 and older comprised 5.3% of all ED visits for injuries sustained in motor vehicle crashes involving driver and passengers, and those who were 65 years or older had the lowest rate of ED visits for these injuries of all age groups (data not shown). Statewide rates for motor vehicle traffic crashes, motor vehicle non-traffic crashes, pedal cyclist crashes, and pedestrian injuries are shown by age group in Table 9 (page 23).

Discussion

Importance of Statewide Emergency Department Data

The aggregation and analysis of North Carolina ED data are important because they represent the most comprehensive population-based data on acute illness and injury in the state. Even with the collection of a limited number of data elements and with privacy protections that include elimination of patient and hospital identifiers, ED data can provide valuable information on acute illness and injury across the state and can identify vulnerable populations for specific disorders. Hospital discharge databases track only those patients admitted to hospitals, about 12% of ED visits, therefore excluding about 88% of ED visits.³ Specialized registries are voluntary and typically capture data from a limited number of hospitals and for a defined subset of patients—most often patients admitted to the hospital. A statewide database such as NC DETECT has the potential to provide a closer approximation of population-based rates than do specialized registries because NC DETECT includes all ED visits, not just ED visits resulting in hospital admission, and can also identify ED visits by comorbid conditions.

The National Hospital Ambulatory Medical Care Survey (NHAMCS) Emergency Department Data Summary,³ a

Table 6.
Selected Disease Groups Resulting in Emergency Department Visits in North Carolina, 2007

Disorder	Statewide ED Visits (%)	Rate per 1,000 Person-Years
Chest pain/ischemic heart disease	11.9	50.5
Substance abuse/intoxication/withdrawal ^a	11.2	47.5
Diabetes	7.8	33.1
Psychiatric disorders	7.7	32.9
Asthma	4.4	18.5
Heart failure	2.7	11.3
Neoplasms	1.4	5.9
Ischemic stroke/TIA	0.8	3.2

a. ICD-9-CM codes for substance abuse/intoxication/withdrawal are those used by NHAMCS.³

retrospective national probability sample survey of visits to United States EDs, has been the gold standard for national ED data. However, data are typically available two years after collection and cannot be stratified by region, state, or county.⁵ Despite differences in methodology and data collection, NC DETECT ED visit data have face and content validity when compared to NHAMCS, are available in a timely fashion, and can be stratified by county.⁵

The proportion of the North Carolina population visiting the same ED in North Carolina at least once is an estimate (see Table 3, page 18), because North Carolina EDs in close proximity to the Virginia, South Carolina, Georgia, and Tennessee borders may have ED visits by individuals residing in these states, and North Carolina residents may have visited EDs in neighboring states. NC DETECT is only able to track repeat visits by patients visiting the same ED. If the patient visits a different ED, that patient is counted as a different individual. The proportion of admissions from the ED to the hospital in our data is similar to the national estimate of 12% (see Table 3, page 18).³

Table 7.
Proportions and Rates of Statewide Emergency Department Visits for Selected Cardiovascular Diseases, 2007

Disorder	Statewide ED Visits by Primary Diagnosis		Statewide ED Visits by Primary and Comorbid Diagnosis	
	Percent	Rate per 1,000 Person-Years	Percent	Rate per 1,000 Person-Years
Chest pain/ischemic heart disease	5.2%	22.3	11.9%	50.5
Heart failure	0.6%	2.5	2.7%	11.3
Ischemic stroke/TIA	0.4%	1.6	0.8%	3.2

Table 8.
Injury Related Visits Statewide, 2007

	All Injury Related Visits (%)	All ED Visits (%)	Category Total	Category of All Injury-Related Visits (%)
All injury-related visits^{a,b} (n=992,541)		25.8%		
Unclassifiable External Cause of Injury			147,816	14.9%
Only E-code is place of occurrence	0.2%	0.0%		
Missing or invalid coded cause of injury	14.7%	3.8%		
Unintentional Injuries			728,211	73.4%
Falls	20.6%	5.3%		
Motor vehicle traffic-related	11.7%	3.0%		
Struck against or struck accidentally by objects or persons	8.5%	2.2%		
Overexertion and strenuous movements	8.0%	2.1%		
Cutting or piercing instruments or objects	5.2%	1.3%		
Natural and environmental factors	3.8%	1.0%		
Poisoning by drugs, medicinal substances, biologicals, other solid and liquid substances, gases, and vapors	1.2%	0.3%		
Fire and flames, hot substance or object, caustic or corrosive material, and steam	1.0%	0.3%		
Machinery	0.4%	0.1%		
Pedal cycle, nontraffic and other	1.5%	0.4%		
Motor vehicle, nontraffic	0.2%	0.1%		
Other transportation	0.3%	0.1%		
Suffocation	0.1%	0.0%		
Firearm missile	0.2%	0.0%		
Drowning or submersion	0.0%	0.0%		
Foreign body	1.6%	0.4%		
Caught accidentally in or between objects	1.1%	0.3%		
Other and not elsewhere classified	1.8%	0.5%		
Mechanism unspecified	6.1%	1.6%		
Intentional Injuries			47,611	4.8%
Assault				
Unarmed fight or brawl, striking by blunt or thrown object	1.9%	0.5%		
Cutting or piercing instrument	0.3%	0.1%		
Firearms	0.1%	0.0%		
Other and unspecified mechanism	1.3%	0.3%		
Self-Inflicted				
Poisoning by solid or liquid substances, gases, and vapors	0.7%	0.2%		
Cutting and piercing instrument	0.2%	0.1%		
Suffocation	0.0%	0.0%		
Other and unspecified mechanism	0.1%	0.0%		
Other causes of violence	0.1%	0.0%		
Injuries of Undetermined Intent	0.4%	0.1%	3,850	0.4%
Adverse Effects of Medical Treatment	6.6%	1.7%	65,053	6.6%
TOTALS	100.0%^c	25.8%	992,541	100.0%^c

a. ED visit for injury: any one of 11 ICD-9-CM codes 800-999 or any one of 5 E-codes E800-999.

b. Injury classifications as used in the NHAMCS: 2005 Emergency Department Summary, #386, June 29, 2007.³

c. Columns may or may not add exactly to 100% due to rounding.

Disease Groups

We did not identify disease groups based on primary diagnosis (see Table 6, page 21) because many conditions, such as diabetes and other chronic illnesses, are not necessarily identified as a primary ED diagnosis if the reason for the ED visit is for an acute condition, such as chest pain, heart failure, or ischemic stroke. It is important, however, to acknowledge the presence of diabetes as a comorbid condition. As another example, a diagnosis of neoplasm will not necessarily be recorded as a primary diagnosis if the acute condition associated with the ED visit is intractable vomiting or dehydration from chemotherapy or febrile neutropenia.

Psychiatric Disorders and Substance Abuse/Dependence/Intoxication/Withdrawal

A total of 18.9% of ED visits were given a diagnosis code for SAD/AIW and/or psychiatric disorders (see Table 2, page 17). This group was based on ICD-9-CM code aggregations used in the 2005 Emergency Department Summary of the National Hospital Ambulatory Medical Care Survey and includes 'Tobacco Use Disorder' (305.1).³ Together, this set of disorders comprised the highest proportion of ED visits in North Carolina of all the diagnosis groups we examined. The epidemiology of these disorders is currently being analyzed by the authors, using the 2008 NC DETECT emergency department static dataset. Psychiatric disorders include a great many conditions, and dementias are included in the ICD-9-CM diagnosis code set 'Mental Disorders.' The demand for geriatric-psychiatric services will be expected to rise as the North Carolina population ages. Substance abuse and dependence is a public health problem not only in North Carolina, but also nationally, and treatment options typically lag behind need.⁶ This report provides additional evidence for prioritizing health policy system research to identify cost-effective intervention for substance abuse and psychiatric disorders.⁷ Our data also identify the ED as one of the key sites for population-based identification and intervention for these disorders.⁸

Injuries

Our data show that injury is a major cause of visits to North Carolina EDs during childhood and young adulthood. This age distribution, similar to that reported elsewhere, possibly represents participation of those age groups in athletic and driving activities.⁹ It also reflects that these age groups are

Table 9.
Statewide Rates/1,000 Person-Years of ED Visits for Motor Vehicle Crashes (MVC) Traffic (Driver and Passenger), MVC Non-Traffic^a (Driver and Passenger), Pedal Cyclist Crashes, and Pedestrian Injuries, by Age Group, North Carolina, 2007

Age Group	MVC, Traffic (Driver and Passenger)	MVC, Non-Traffic (Driver and Passenger)	Pedal Cyclist	Pedestrian
≤1	5.4	0.2	0.2	0.0
2-4	5.0	0.3	1.1	0.1
5-9	5.1	0.5	3.1	0.1
10-14	6.1	1.1	3.1	0.3
15-18	20.7	1.3	1.3	0.4
19-24	21.7	1.0	0.6	0.3
25-44	13.8	0.7	0.5	0.3
45-64	8.2	0.2	0.4	0.2
≥65	5.1	0.2	0.1	0.0

a. Crashes on private roads, driveways, parking lots, and off-road.²²

generally healthy in other respects, thus allowing participation in injury producing activities (e.g., sports) and limiting ED visits for other health conditions (e.g., heart disease).

The incidence, mortality, and morbidity from motor vehicle crashes have decreased with comprehensive trauma programs which include primary, secondary, and tertiary interventions and patient education.¹⁰ The next generation of injury prevention efforts should be directed to the public health problem of injuries from falls, especially among the elderly. Injuries from falls deserve a comprehensive approach including research and improvements in resource allocation, prevention, intervention, and rehabilitation.¹¹

While the United States annual death rate from motor vehicle crashes decreased by 90% from 1925 to 1997, the injury prevention job is not done.¹⁰ Certain populations— young drivers and passengers, alcohol and drug-intoxicated drivers—are at high risk for motor vehicle crashes.¹⁰ Pedestrian injuries continue to be newsworthy in North Carolina, and pedestrian injury is reported to be the second leading cause of unintentional injury-related deaths for children ages 5-14.¹²⁻¹⁸ Pedestrian injury rates deserve yearly reporting, especially as walking activities for health and fitness for all ages is encouraged.

Limitations

A primary caveat to the analysis is that our rate estimates are conservative because the denominator reflects the total North Carolina population, including those in the military and prison populations, while military and prison hospital EDs are not included in NC DETECT. Furthermore, we estimate that only 92% of civilian hospital ED visits were captured by NC DETECT in 2007.

Improvement in completion and recording of ICD-9-CM data elements is important to ensure the integrity and precision of NC DETECT data and is a limitation of a system such as NC DETECT, which relies upon each institution's coding and documentation practices.

According to national data, 90% of ambulatory care visits are made to physician offices or clinics, while 10% are made to an ED.¹⁹ Since there is presently no method for obtaining statewide information on North Carolina clinics, urgent care, or office visits, NC DETECT currently provides the best proxy for population-based acute care data in the state.

Analyses of NC DETECT data are limited by the obvious needs of personal and institutional privacy; legislative boundaries which limit the data elements collected; dependence upon institutional coding and electronic reporting practices; lack of standardization of some important data elements; and inherent limitations in the analyses of aggregated ED data.

Personal and Institutional Privacy Needs

Personal and institutional privacy is protected by the Health Insurance Portability and Accountability Act and by legislation permitting collection of ED data for public health surveillance in North Carolina.^{20,21} However, aggregated data without institutional or patient identifiers are still useful for public health surveillance and policy purposes.

Legislative Boundaries Limit the Data Elements Collected

NC DETECT is limited by North Carolina legislation to the collection of a specific set of data elements (see Table 1, page 16), and the inclusion of additional data elements would require legislative action.

Dependence Upon Institutional Coding and Electronic Reporting Practices

NC DETECT receives information from hospital administrative and clinical systems. Because NC DETECT captures secondary data, it has no control over local data input. While NC DETECT data are of high quality for most data elements collected, the system depends upon the continued cooperation, enthusiasm, and motivation of all of the hospitals in North Carolina.⁵

Lack of Statewide Standardization of Some Important Data Elements

Not all hospitals are able to provide key information, such as the free text 'triage note' which enables a more detailed assessment of the patient's reason for the ED visit. Lack of statewide standardization of some data elements, such as triage acuity and chief complaint, limits or prevents aggregation and analysis of these important items.

Inherent Limitations Restricting Some Analyses

There are a number of inherent limitations, which at present make it impossible to analyze emergency

department data for information on patterns of, and preferences for, ED usage, as well as information about other benefits of ED use for the individual and society. Analyses of North Carolina ED data do not allow for assessment of 'appropriate' or 'inappropriate' use of the ED based upon illness or injury acuity or whether there is timely access to other types of ambulatory care. Return visits to the same ED within 72 hours are tracked, but aggregate analysis does not allow for determining the quality of care for the first ED visit or whether a visit to a primary care physician could substitute for a return ED visit. NC DETECT emergency department data are unable to identify those visits directed to the ED by the primary care or specialist physician, or telephone health or help lines. Nor do aggregated ED visit data allow us to analyze visits in which important public health measures, such as health risk identification or disease and injury prevention education, are incorporated. Regardless of the patient's reasons for the ED visit, the ED can serve as a valuable hub to direct patients to appropriate resources for subsequent care which can be accessed in a timely fashion.

Conclusion

In 2007, the first and second leading emergency department visit diagnosis groups in North Carolina were abdominal pain and chest pain. Of those disease groups studied, the top three disease groups represented in ED visits in 2007 were chest pain/ischemic heart disease, substance and alcohol abuse or withdrawal, and diabetes. ICD-9-CM diagnosis codes for substance abuse/withdrawal/dependence and psychiatric disorders are the largest group of disorders (18.9%) seen in ED visits in North Carolina.

Falls are the most common cause of injury-related ED visits in the state and account for the largest single group of injuries resulting in ED visits, about twice as many as motor vehicle crashes. Twenty-seven percent of all fall injuries resulting in ED visits occur among the elderly.

Statewide emergency department data are a very useful resource for public health surveillance. This report indicates that aggregated static ED data can also provide valuable information on the proportions and rates of ED visits for illness and injury statewide and can identify vulnerable populations in the state. We hope that yearly reports such as this will inspire health policymakers, institutions, administrators, public health officials, and clinicians to continue to participate in the collection of NC DETECT data and to use the data to improve the health of North Carolina citizens. **NCMJ**

Data Source Information: For more information on accessing data for public health surveillance and research purposes, please visit <http://www.ncdetect.org/drequests.html>. The NC DETECT 2007 Annual Report from which this paper is derived can be accessed at www.ncdetect.org.

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