Motor Vehicle Crash Injuries in Wake County, NC: Exploring available data sources and potential data linkages

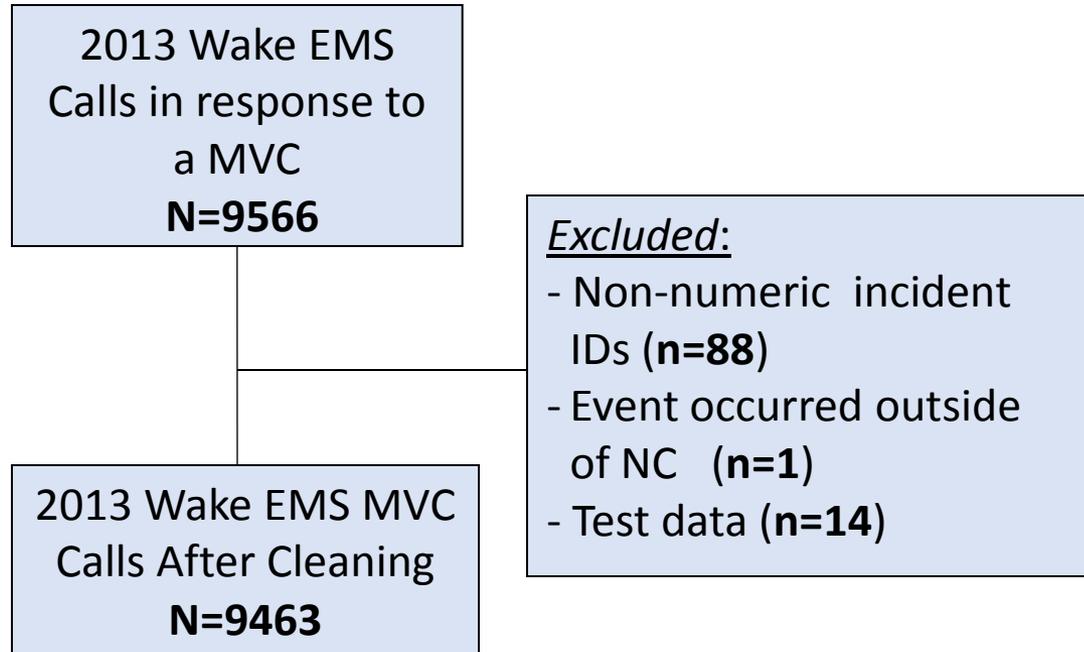**TRCC Meeting**

September 30, 2015

Year 1 Project Goals

➢ Identify and obtain sources of data for Wake County MVTC Injury

➢ Conduct descriptive analyses of each data source, resulting in a report that describes the picture of MVTC injury in Wake Country from each data source

Wake EMS Data

Wake EMS Data

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┌─────────────────────┐
│  2013 Wake EMS      │
│  Calls in response to│
│  a MVC              │
│  N=9566             │
└─────────────────────┘
          │                    ┌──────────────────────────┐
          │                    │ Excluded:                │
          │                    │ - Non-numeric incident   │
          ├────────────────────┤   IDs (n=88)             │
          │                    │ - Event occurred outside │
          │                    │   of NC   (n=1)          │
┌─────────────────────┐        │ - Test data (n=14)       │
│  2013 Wake EMS MVC  │        └──────────────────────────┘
│  Calls After Cleaning│
│  N=9463             │
└─────────────────────┘
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Case Definition:

All 2013 Wake EMS calls in which the primary Medical Priority Dispatch System (MPDS) code was in response to traffic or transportation events (e.g. Codes beginning with the prefix 29).

Summary of Wake EMS Data

- Over half of the calls resulted in a patient being taken to a hospital
  - 97% of the patients were taken to EDs located in Wake County
  - 48% of patients taken to WakeMed Main

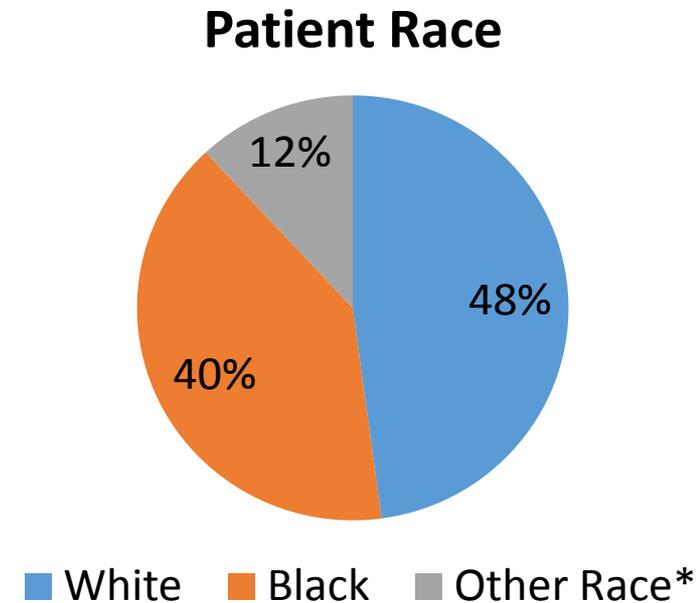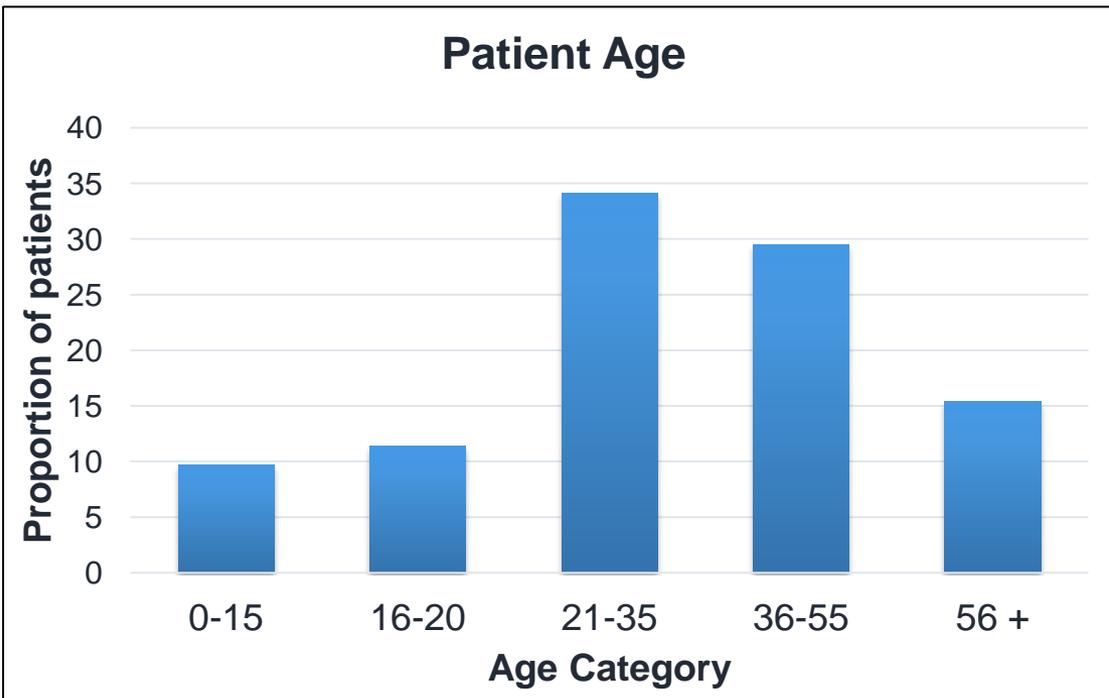- Patients were listed as injured in half of the events (n=4,746)

Disposition	N	%
Transported	5243	55.7
No trtment, no transport	2598	27.6
Trtment, no transport	365	3.9
No Pt Found	579	6.2
Did not Respond*	630	6.7
Missing	48	NA
Destination Hospital		
WakeMed Main	2536	48.28
Rex Health Plex	745	14.18
Cary-WakeMed	595	11.33
North-WakeMed	456	8.68
Duke Raleigh Hospital	341	6.49
Brier Creek Healthplex	149	2.84
Apex Healthplex	131	2.49
Garner Healthplex	121	2.30
Other†	179	3.41
Missing	4210	NA

* Call was cancelled in route, regarded as a false alarm, EMS on standby
† Other includes: Central Harnett Hospital, Clayton-Johnson Hospital, Duke Hospital, Franklin Regional, Granville Memorial, Maria Parham, Smithfield-Johnson, UNC Hospital, VA Medical Center, Wilson Medical Center

Patient Details

- Mean age: 36 years (range: 0-111)

- Slightly more female patients (54%) than male patients (46%)

- 78% of patients were residents of Wake County

- Most patients were identified as Non-Hispanic (90%)

Patient Age

Proportion of patients (y-axis: 0 to 40) vs Age Category (x-axis: 0-15, 16-20, 21-35, 36-55, 56 +)

Patient Race
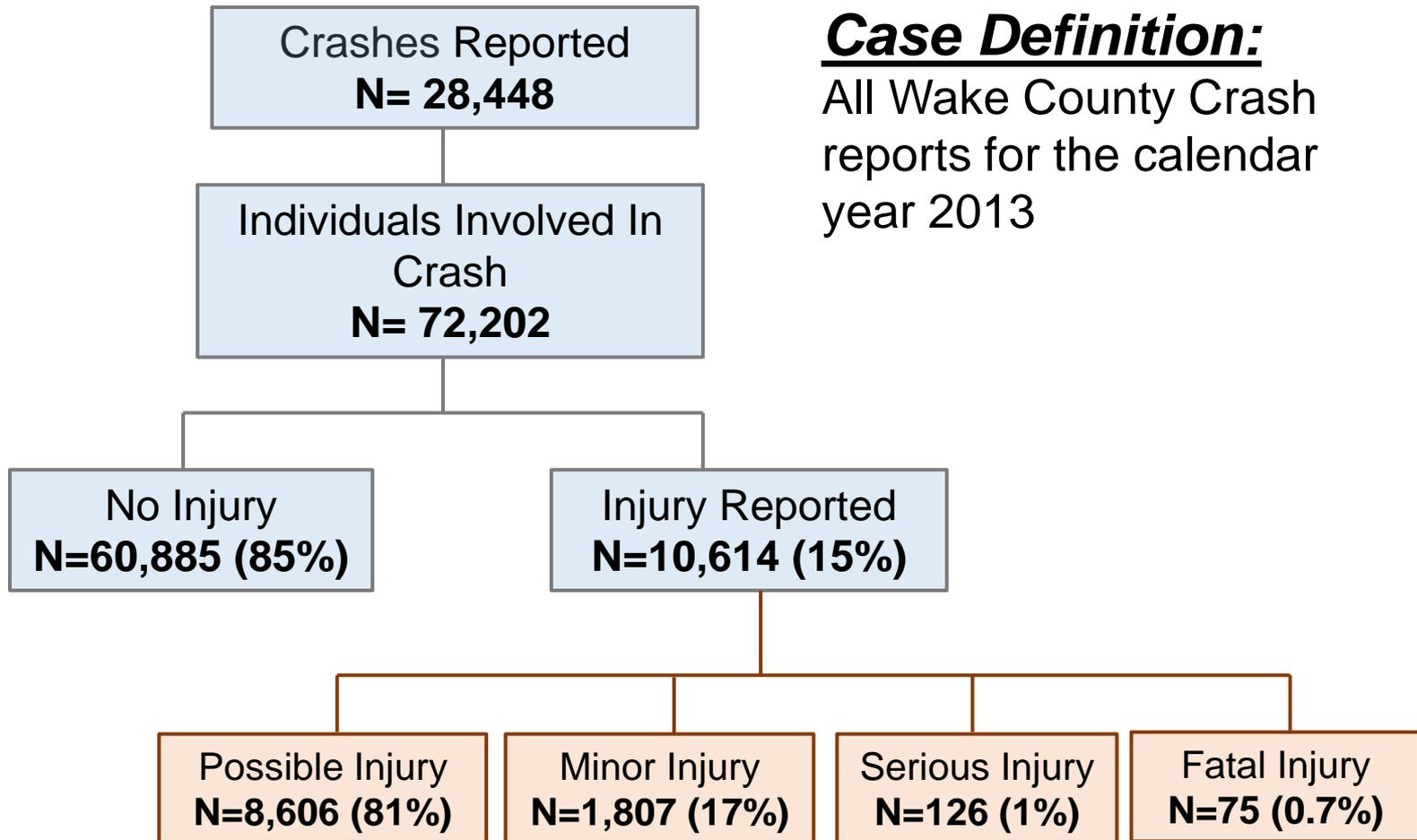
- White: 48%
- Black: 40%
- Other Race*: 12%

Crash Details

- Most crashes occurred on streets or highways (93%), on clear days (76%), in Wake County (99%), between the hours of 12 PM and 5:59 PM (42%)

- Almost all crashes were described as automobile crashes (94%)
    - Other cases included: motorcycle (2%), moped (2%), other (2%)

- Universal patient care was delivered at 80% of the events
    - Other forms of care includes: trauma protocols (6%), pain control (3%), spinal immobilization (3%)

- Most patients were in the first row of the vehicle (87%)

Crash Report Data

Crash Report Data

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┌──────────────────────┐
│  Crashes Reported    │
│  N= 28,448           │
└──────────────────────┘
           │
┌──────────────────────┐
│ Individuals Involved In │
│ Crash                │
│ N= 72,202            │
└──────────────────────┘
           │
     ┌─────┴─────┐
┌─────────────┐  ┌──────────────────┐
│ No Injury   │  │ Injury Reported  │
│ N=60,885    │  │ N=10,614 (15%)   │
│ (85%)       │  │                  │
└─────────────┘  └──────────────────┘
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Case Definition:
All Wake County Crash reports for the calendar year 2013

Possible Injury N=8,606 (81%)	Minor Injury N=1,807 (17%)	Serious Injury N=126 (1%)	Fatal Injury N=75 (0.7%)

Note: Injury status was unknown for 703 (<1%) individuals

Patient Characteristics

Mean Age: 34 (Range: 0-98)

	N	%
Age Group		
0-15	7952	11.13
16-20	9217	12.90
21-35	23601	33.03
36-55	20619	28.86
56+	10060	14.08
Missing	753	
Gender		
Male	36686	50.92
Female	35366	49.08
Missing	150	
Race		
White	39138	54.66
Black	21472	29.99
Hispanic	5967	8.33
Other	5032	7.03
Missing	593	
Seat Position		
Driver	51261	71.00
Passenger Front	10233	14.17
Second Row	8063	11.17
Third Row	684	0.95
Other	1536	2.13
Missing	425	0.59

Crash Details

- Most crashes occurred between 12 PM and 5:59 PM (47%) on clear days (71%)

- Mean TAD Score: 1.90 (STD:1.20)

- Most harmful events: rear-ends (39%), angle crash (15%), sideswipe in the same direction (11%), and left turns (8%)

- EMS were called to the scene in 10% of the crashes (n=7476)

Alcohol or drugs were suspected in 2% of individuals involved in a crash

Vehicle Type

3%
3%
2%
6%
9%
56%
21%

- Passenger car
- SUV
- Pickup
- Van
- Light Truck
- Bus
- Other
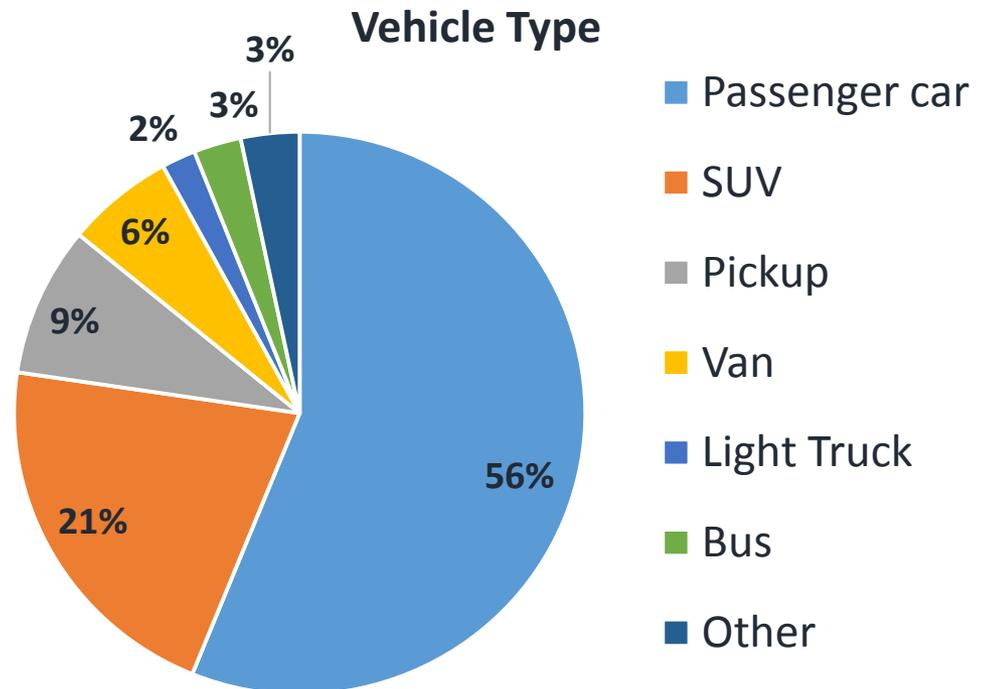
Factors that appear to impact injury outcomes:

➤ Type of person (e.g. drivers, pedestrian, bicyclist)
➤ Alcohol suspected in crash
➤ Weather at the time of the crash (foggy conditions)
➤ Location of the crash (e.g. rural, urban, mixed)
➤ Cause of crash (e.g. rollover, head-on collision, right turns)
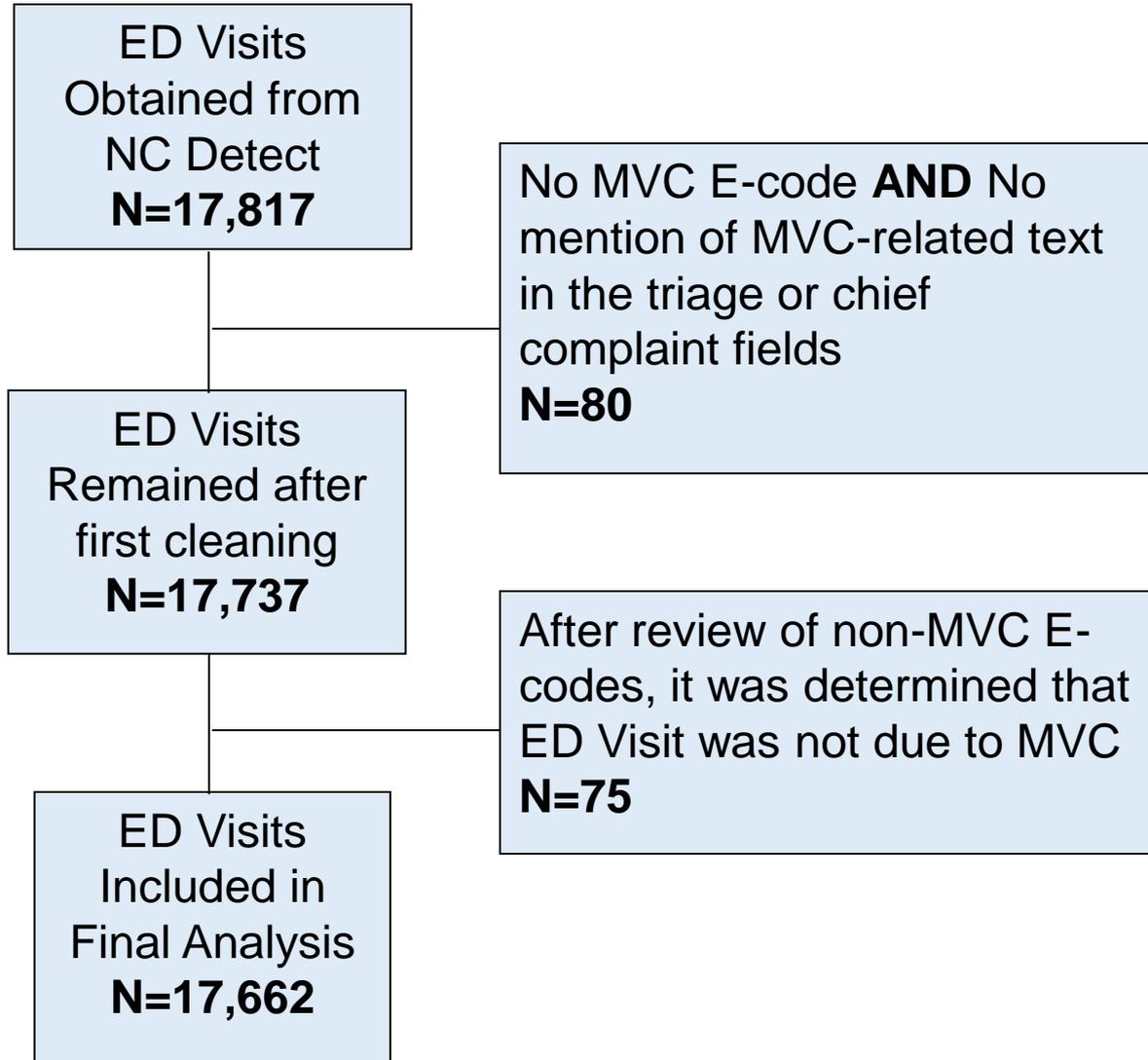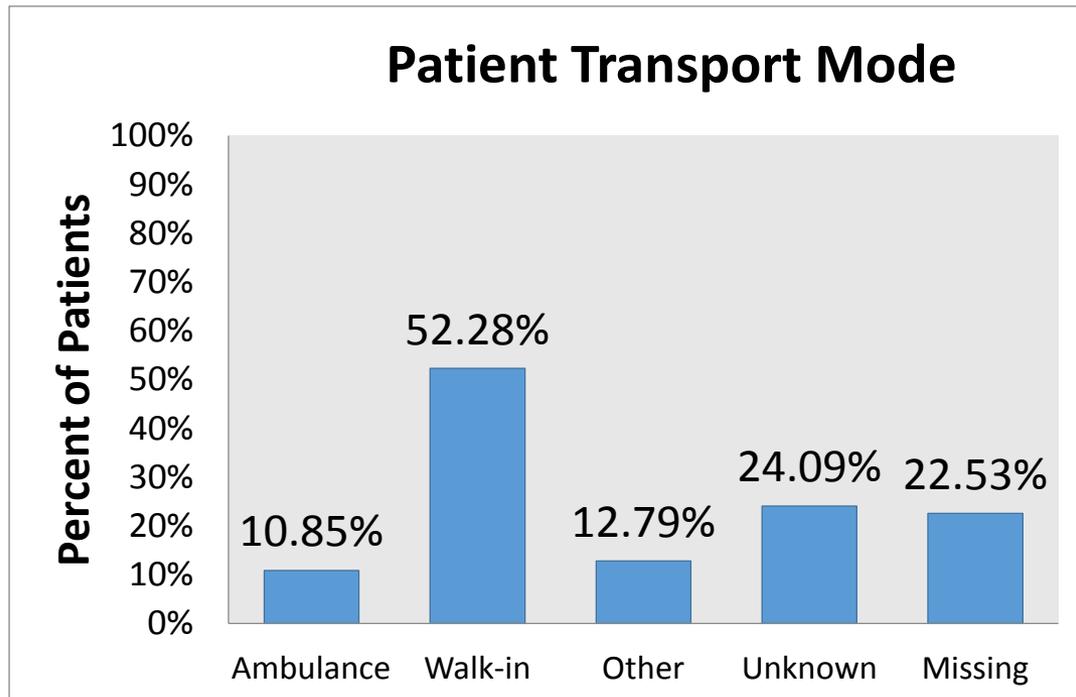➤ Number of vehicles involved in crash

ED Visit Data
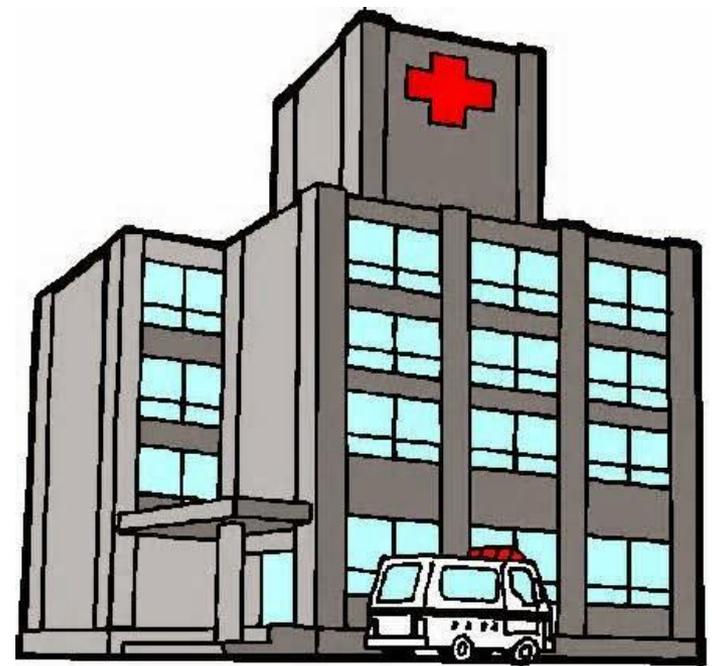
ED Visit Data

Case Definition:
All MVTC-related ED visits for the calendar year 2013 by Wake County residents AND all MVTC-related ED visits to EDs located in Wake County

ED Visits Obtained from NC Detect
N=17,817

No MVC E-code **AND** No mention of MVC-related text in the triage or chief complaint fields
N=80

ED Visits Remained after first cleaning
N=17,737

After review of non-MVC E-codes, it was determined that ED Visit was not due to MVC
N=75

ED Visits Included in Final Analysis
N=17,662

Patient Data

- Fairly even distribution by gender (46% male, 54% female)

- Mean Age: 34 yrs (STD: 17), Range: 0-107

- 84% of patients were Wake County residents

- 45% of patients listed 'self-pay' as the expected form of payment, 33% of patients had insurance, and 18% relied on Medicare or Medicaid

Patient Transport Mode

Percent of Patients

Ambulance 10.85%
Walk-in 52.28%
Other 12.79%
Unknown 24.09%
Missing 22.53%

Only 5% of patients were admitted to the hospital (n=949). The majority of patients were discharged home (91%, n=15796).

MVC Injuries Diagnosed in the ED

Most Common Types of Injuries*:
- Sprains (40%)
- Contusions (28%)
- Fractures (8%)
- Open Wounds (5%)
- Internal Injuries (4%)

Number of Injuries*

4% 1%

17%

28%

50%

- None listed
- 1
- 2
- 3
- 4 or more
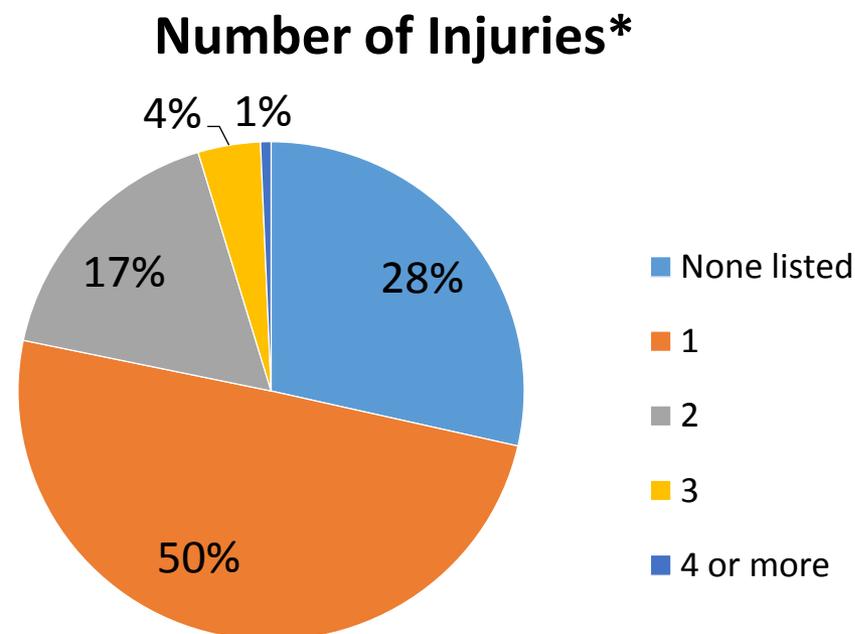
* Note: Injuries were categorized according to the CDC Barell Injury Matrix
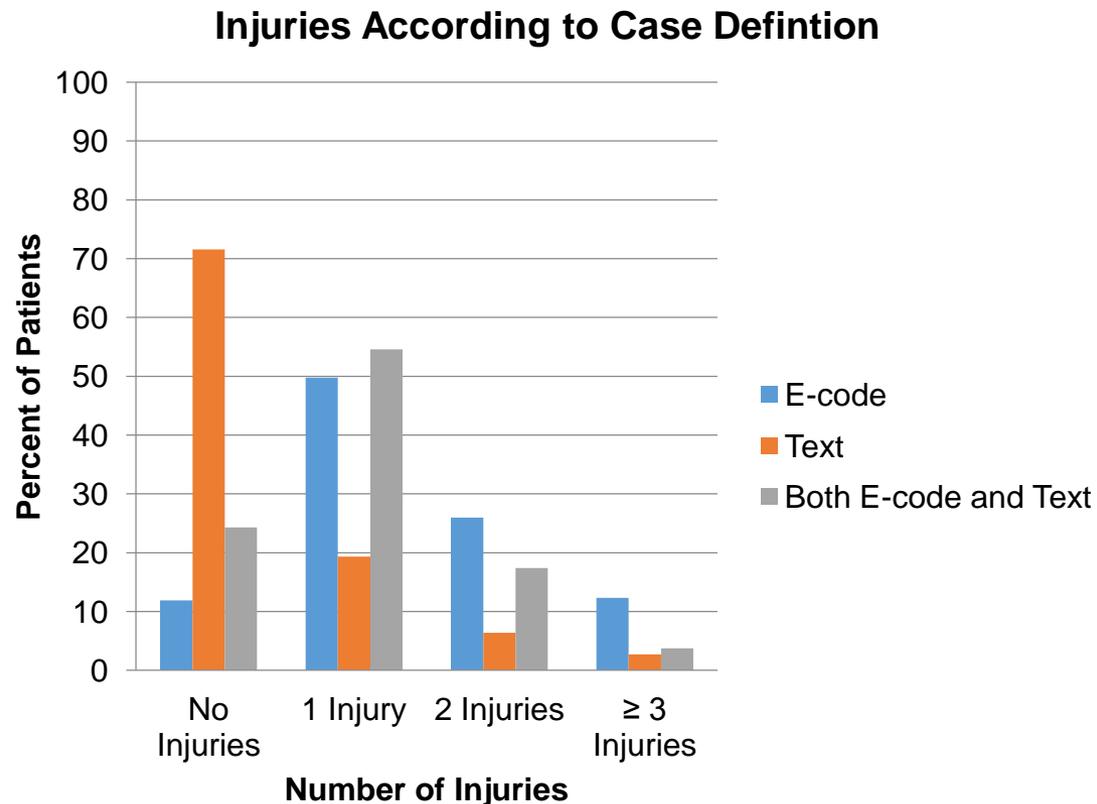
MVC Case Definitions

Definitions used to define MVCs:

1. MVC Ecodes: E810-E825 (12% of visits)

2. Text searches of triage notes or chief complaint (12% of visits)

3. Both MVC Ecodes and Text searches (76% of visits)

Visits identified using E-codes only were more likely to be: male, arrive by ambulance, and admitted to the hospital.

Choice of case definition appears to impact the picture of MVC injury severity.

Injuries According to Case Defintion

Bar chart — X-axis: Number of Injuries (No Injuries, 1 Injury, 2 Injuries, ≥ 3 Injuries); Y-axis: Percent of Patients (0–100). Legend: E-code, Text, Both E-code and Text.

Comparison of All Data Sources

Data Source	Strengths
Crash Reports	1. Captures detailed information about the crash (e.g. types of vehicle involved, vehicle damage, circumstances causing crash) 2. Collects demographics for all persons involved in crash (age, gender, race) 3. Examines possible alcohol and drug involvement of the individuals involved in the crash
EMS Data	1. First trained medical professionals to assess injury 2. Captures detailed timestamps of events 3. Captures location of crash and patient transport following the crash 4. Collects patient demographics (age, gender, race, and ethnicity)
ED Visit Data	1. Captures patient mode of transport to the ED (e.g. EMS, private vehicle, self transport) 2. Captures both acute, delayed, and chronic MVC injuries 3. Includes information related to billing (e.g. insurance, self-pay, workers' comp)

Comparison of All Data Sources

Data Source	Limitations
Crash Reports	1. No specific details in regards to patient injury 2. Limited information on patient outcomes (e.g. patient transport following the crash, hospital taken to, injuries resulting from crash) 3. May fail to capture non-visible injuries (e.g. internal injuries, fractures, sprains) or injuries with delayed symptoms (e.g. whiplash)
EMS Data	1. Limited to crashes in which EMS was called to the scene 2. May fail to capture non-visible injury (e.g. internal injuries, fractures, sprains) or injuries with delayed symptoms (e.g. whiplash)
ED Visit Data	1. Limited information about the cause of the crash (E-codes only) 2. Race and ethnicity are not well-captured 3. Sensitive to case definition used to identify MVCs (e.g. E-codes vs. text searches)

Table: Comparison of 2013 Wake MVCs based on data source			
Descriptive Variables	**Crash Report*** N=72,202	**ED Visit Data** N=17,662	**EMS Data** N=9,463
Gender			
Female	35,366 (49.08%)	9,491(53.74%)	4,417 (54.44%)
Male	36,686 (50.92%)	8,170 (46.26%)	3,696 (45.56%)
Missing	150	1	1,350
Age			
0-15	7,952 (11.13%)	1,806 (10.23%)	713 (9.65%)
16-20	9,217 (12.90%)	1,913 (10.83%)	843 (11.41%)
21-35	23,601 (33.03%)	6,533 (36.99%)	2,520 (34.1%)
36-55	20,619 (28.86%)	5,377 (30.44%)	2,177 (29.46%)
56 +	10,060 (14.08%)	2,033 (11.51%)	1,135 (15.37%)
Missing	753	0	2,075
Transported to Hospital Via EMS			
Yes	5,093 (7.05%)	1,564 (14.29%)	5,243 (55.70%)
No	67,109 (92.95%)	9,378 (85.71%)	4,172 (44.31%)
Missing	NA	6,720	48
Crash Variables			
Crash Time*			
12 AM – 5:59 AM	1,670 (5.87%)	1,190 (6.74%)	993 (10.49%)
6 AM – 11:59 AM	7,458 (26.22%)	3,944 (22.33%)	2,232 (23.59%)
12 PM – 5:59 PM	12,558 (44.14%)	6,796 (38.48%)	4,014 (42.42%)
6 PM – 11:59 PM	6,762 (23.77%)	5,732 (32.45%)	2,224 (23.49%)
Season*			
Winter (Dec- Feb)	7,175 (25.22%)	4,150 (23.49%)	2,281 (24.11%)
Spring (Mar – Apr)	6,973 (24.51%)	4,354 (24.64%)	2,292 (24.21%)
Summer (June- Aug)	6,543 (23.00%)	4,232 (23.95%)	2,308 (24.40%)
Fall (Sept – Nov)	7,757 (27.27%)	4,926 (27.89%)	2,582 (27.28%)

*28,448 crashes reported (denominator for crash time, season, and weather for crash reports)

Which data source should I use to answer my research question?

Can be answered by *ANY* of the data sources:
- ☐ What is the prevalence of MVC-related injuries?

ED VISIT DATA
- ☐ How do patients typically present to the ED following a crash?
- ☐ What are some of the long term effects of crashes?
- ☐ What are the most common types of injuries that results form a crash?

Can be answered by EMS *OR* Crash Report Data:
- ☐ Which intersections are the most dangerous for crashes?
- ☐ How many MVCs result in fatalities?

EMS DATA
- ☐ Which hospitals receive the most MVC patients?
- ☐ How much time passes between the initial call to report the crash and patient arrival at the hospital?

CRASH REPORTS
- ☐ How many bicyclists or pedestrians are involved in crashes each year?
- ☐ What percentage of crashes involve alcohol or drugs?
- ☐ What types of vehicles are most commonly involved in crashes?

Future Steps

➢ Attempt data linkage of Wake EMS and crash report data

➢ Attempt data linkage between crash reports, EMS data, and ED visit data

➢ Poster submitted to the International Society for Disease Surveillance Conference (Dec 2015) for a poster or lighting session talk

   Poster will highlight the importance of MVC case definitions when describing MVC surveillance using ED visit data

Thank you for all your help!!!