



Rapid Surveillance and Data Integration for Targeted Injury Prevention:

A Syndromic Surveillance Description of Bicycle- Related Injuries in Boston

Marcus Rennick, MPH
Aileen Shen, MPH

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Background

- Late 90s: Interest in pedestrian and bike safety
- 2001: Boston Bicycle Plan
- 2007: Boston Bikes
- 2010: Communities Putting Prevention to Work (CPPW) Grant



What has happened?

- 122% increase in bicycle commuter ridership between 2007 and 2009
- Collaborative public health/safety task force initiated in 2010



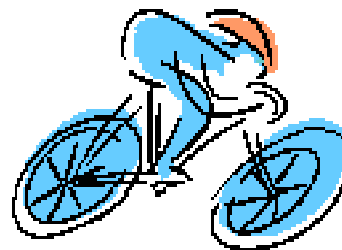
2010 Boston Safety Summit

- Boston Bikes
- Boston Public Health Commission
- Boston Police Department
- Boston Emergency Medical Services
- Boston Transportation Department
- Massachusetts Bay Transportation Authority
- Massachusetts Department of Transportation



Bicycle Injury Data Systems Project Workgroup

- Partners with BPHC:
 - Boston Police
 - Boston EMS
 - Boston Bikes
 - Boston **Transportation**
 - Boston Cyclist Union
 - Walk Boston
 - CDC/Johns Hopkins **APL**



Bike/ped Injury Data Systems Project

- Primary Purpose

- Develop a system that utilizes data on “hot spots” for car-related pedestrian and bicycle injuries to prioritize intersection and street redesign



- Other Purposes

- Evaluate helmet use data for potential helmet regulation
- Advocate for bike/pedestrian safety issues
- Provide targeted outreach about bike/pedestrian safety

Transportation Safety Principles: The Es

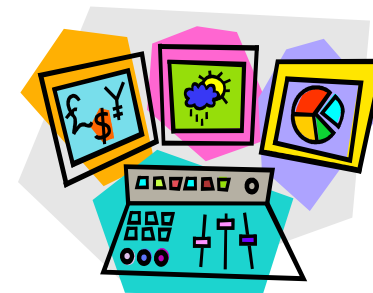
- Enforcement
- Engineering
- Education
- **Equity**





Boston Data Sources

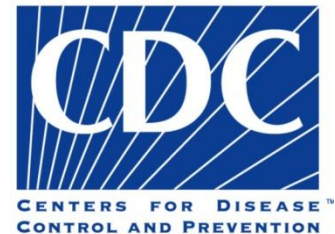
- Police Department (BPD)
 - Also includes pedestrian injuries
 - No identifiers
 - $n = 1,260$
- Emergency Medical Services (EMS)
 - $n = 582$
- Emergency Room Data





Syndromic surveillance for bicycle-related injuries in Boston, 2007-2010

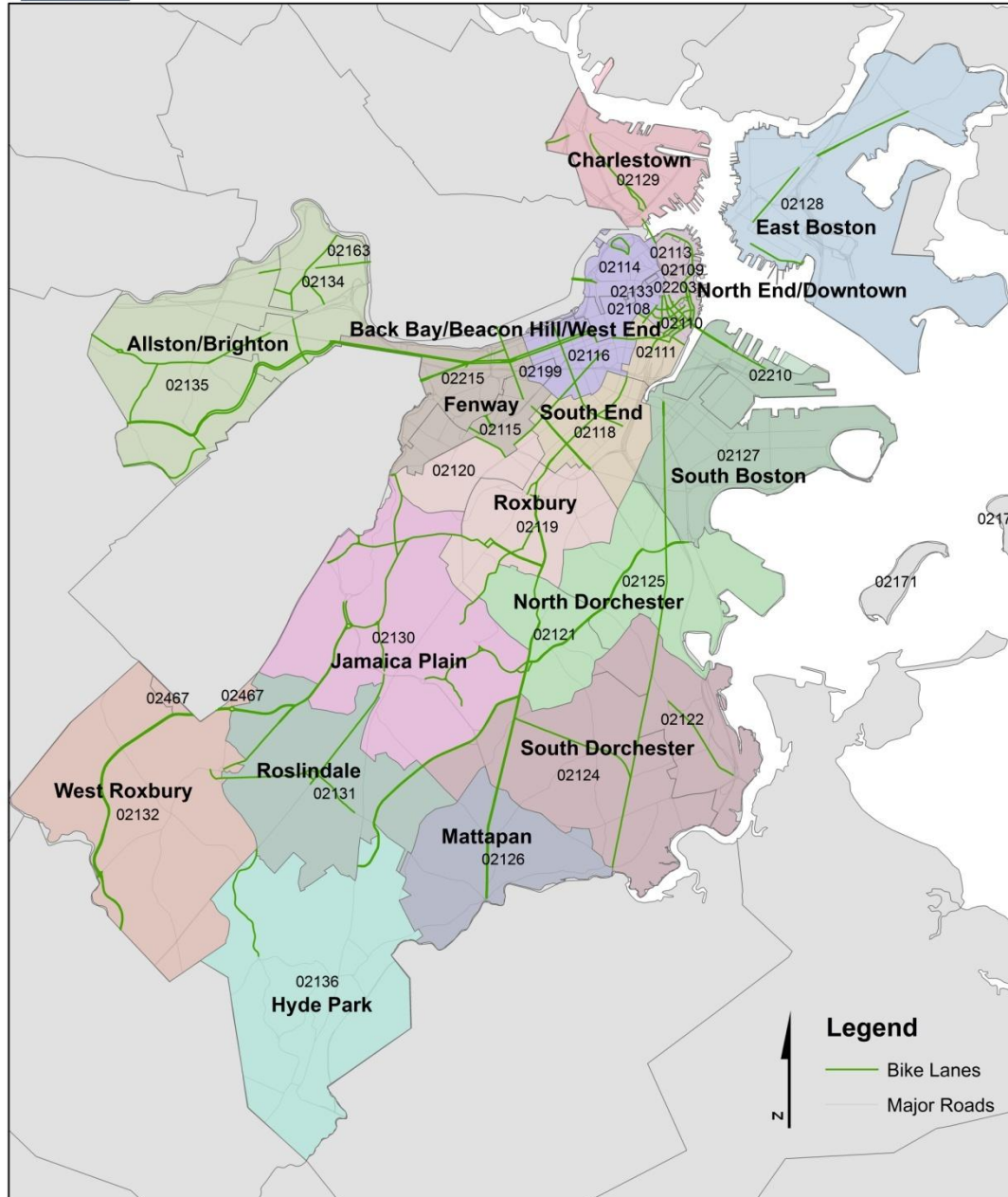
Marcus Rennick¹, Julia Gunn¹, Michael Donovan¹,
Snehal Shah¹, M. Anita Barry¹,
Howard Burkom², Soyoun Park^{2,3},
Peter Hicks², Stephen Benoit²



¹Boston Public Health Commission

²Centers for Disease Control and Prevention

³McKing Consulting





Objectives

To quantify the bike injury burden in Boston by age group, neighborhood, and other variables relevant to public health as represented in Boston ED data.

To characterize **bicycle-related injury (BRI) visits** at Boston emergency departments in order to explore and identify possible risk factors.



Data Sources

Primary: [Boston Syndromic Surveillance System](#)

- All (10) Boston acute care emergency department visits
- ED Visit data received every 24 hours
- Variables: unique visit identifier, visit date, age, gender, race, ZIP code of residence, hospital ID, chief complaint, and ICD-9 CM final diagnosis
- Disposition collected from 9 of 10 hospitals (since 2010)

Secondary: [BioSense Program](#)

- Routinely receive ED patient records from 2 of the 10 hospitals with disposition, plus radiology data

Data from all 10 hospitals analyzed collaboratively

BRI Syndrome definition:

combined classification of CC text & diagnosis codes

Chief Complaint

	Keyword
BICYCLE	BICYCEL, BICYCE, BICYLCE, BICYLCLE, BICYLE, BICCICLE, BICIYLE, BYCICLE BYCYCLE, VICYCLE, TRICYCLE, PEDAL CYCLE, FALL FROM BICY
BICYCLIST	BICYLIST, BICYLCLIST, BICYSLIST, BYCICLEST, BYCICLIST, BYCILIST, BYCLIST
BIKE	BKE ACC, BICK, BIKING, BIC ACC, BIC STRUCK, FALL OFF BIK
CYCLIST	CYCLLIST, CYCLE VS, CYCLE ACCIDENT UNKNOWN, S/P CYCLE ACCIDENT

ICD-9 CM

Injury	ICD-9 E code
Motor Vehicle - Traffic Accidents	E810-E819 .6 pedal cyclist
Motor Vehicle - Non-Traffic Accidents	E820-E825 .6 pedal cyclist
Pedal Cycle Accident	E826 .1 pedal cyclist
Bike Riding	E006.4



BioSense Subsyndromes

37 BioSense Subsyndromes		21 New BRI Subsyndromes added	
Abdominal pain	Hypertension	Ankle Injury	Leg Injury
Alteration of consciousness	Hypotension	Arm Injury	Mouth/Dental Injury/Pain
Anemia	Injury, NOS	Chest Injury	Shoulder Injury
Asthma	Localized Cutaneous Lesion	Elbow Injury	Spine/Back Injury
Cardiac Dysrhythmias	Mental disorders	Eye Injury	Toe Injury
Cerebrovascular disease	Motor vehicle traffic accidents	Face Injury	Wrist Injury
Chest pain	Myalgia	Finger Injury	Injury, Specified
Convulsions	Nausea and vomiting	Foot Injury	Intoxication
Death	Neurological	Hand Injury	Other Pain
Diabetes mellitus	Numbness	Head Injury	
Dizziness	Open wound	Hip/Pelvic Injury	
Dyspnea	Rash	Knee Injury	
Edema	Respiratory		
Falls	Respiratory Failure		
Fractures and dislocation	Skin infection		
Gastrointestinal	Sprains and strains		
Headache	Syncope and collapse		
Heart disease, ischemic	Visual impairment		
Hemorrhage			

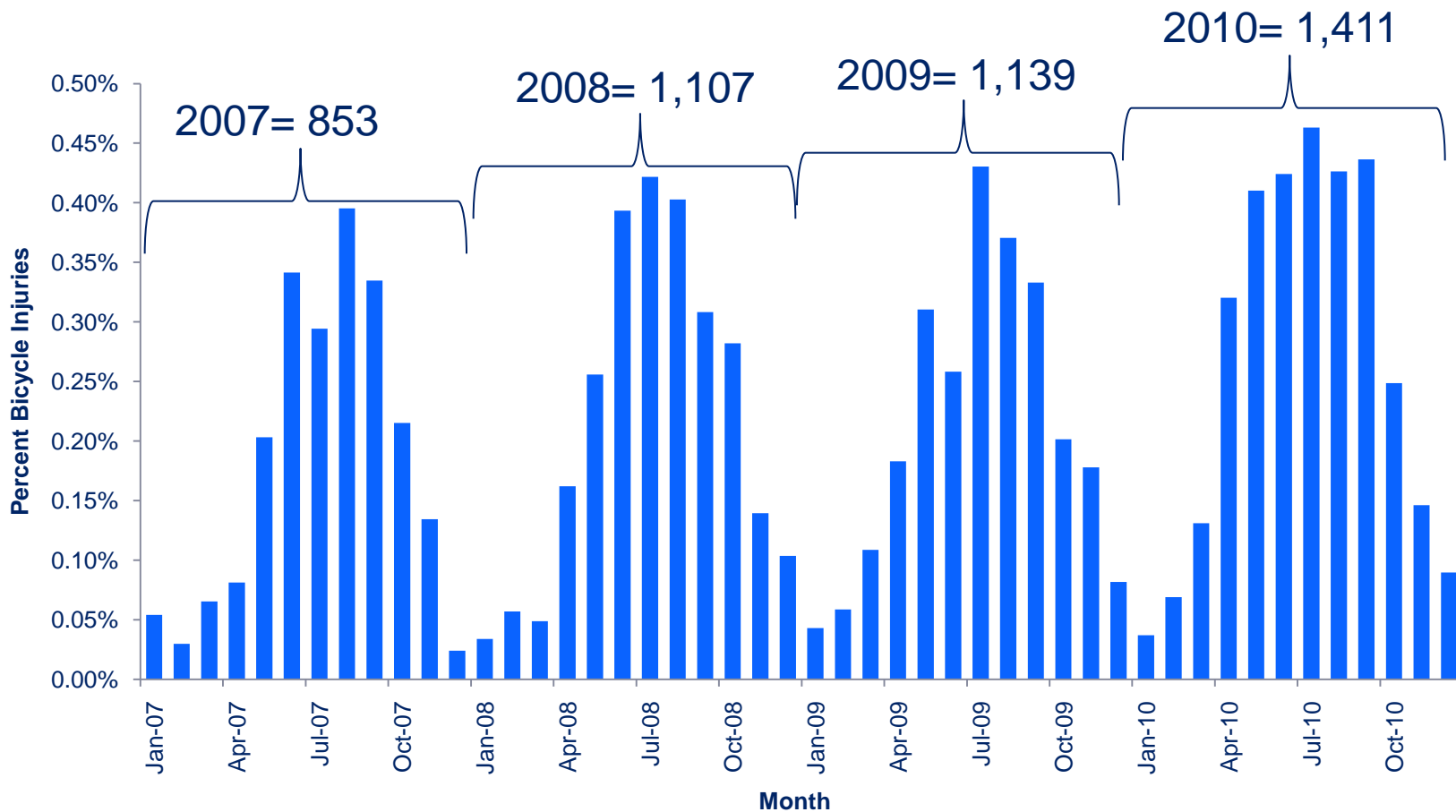
Methods

- 2007-2010: Full data set from all 10 Boston ED
- 2010: Disposition data for 9 out of 10 hospitals
- Data sample:
 - Over 2 million visits between 2007 and 2010.
- Residence categorized using a standard ZIP code of residence-to-neighborhood mapping.
- Results were stratified by: age, patient neighborhood of residence, race, gender, sub-syndrome, mechanism of injury, and disposition; analyzed over time.

Results

- 2,018,232 total visits for 4 year period
 - 4,510 were classified as BRI (**0.22%**)
- In 2010- 520,654 total visits including MA neighborhoods outside Boston, out-of-state ZIP codes:
 - 1,411 BRI (**0.27%**)
- In 2010- 280,804 total visits for Boston ZIP codes:
 - 768 BRI (**0.27%**)

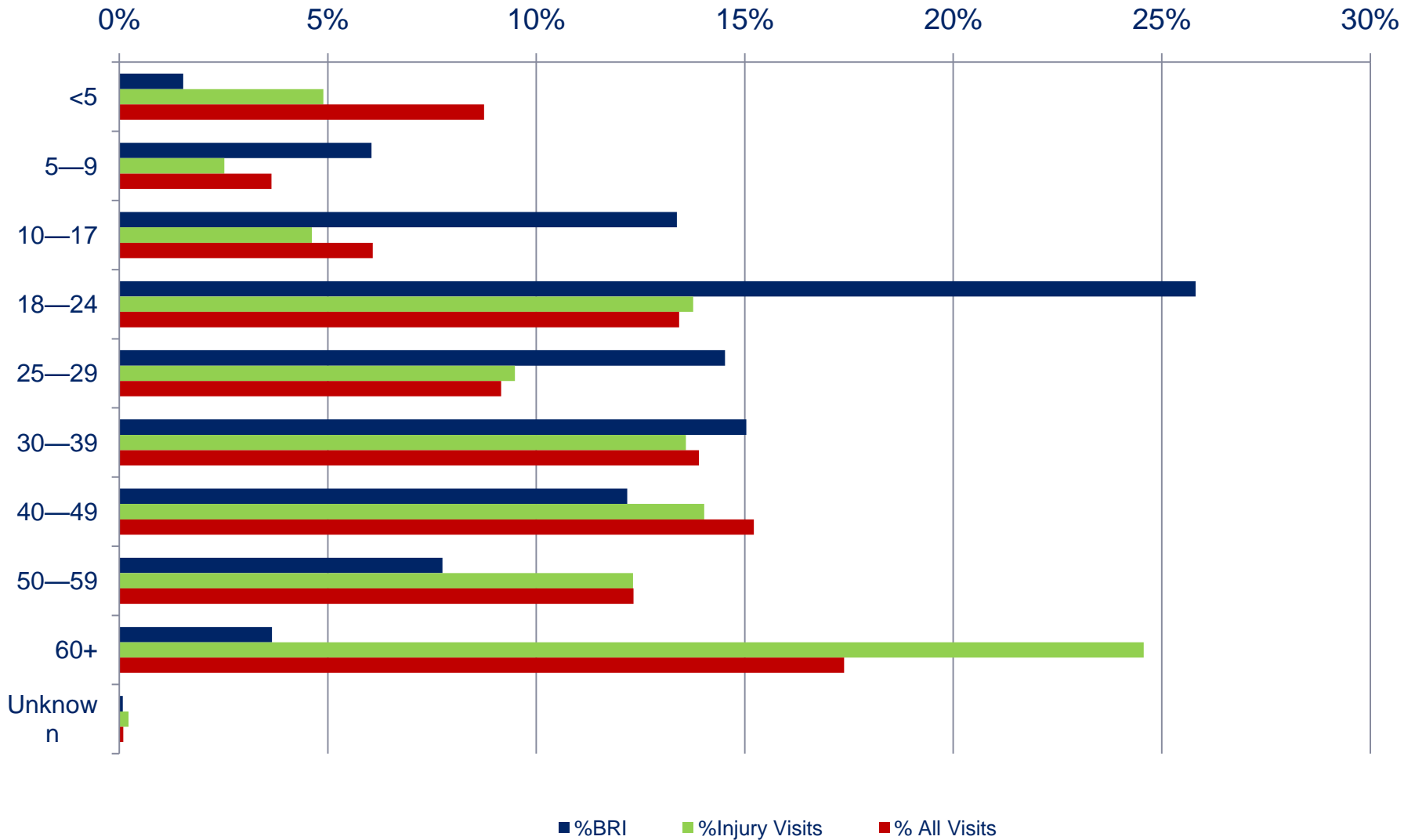
Percent BRI visits of all ED visits, by month, 2007-2010



Distribution of emergency department visits for BRI

Age Group	2007-2010			2010			2010- Boston Residents Only	
<5	57	1%	} 19%	19	1%		7	1%
5—9	230	5%		83	6%		42	5%
10—17	580	13%		144	10%		101	13%
18—24	1124	25%		362	26%		192	25%
25—29	632	14%	} 55%	205	15%		123	16%
30—39	683	15%		217	15%		116	15%
40—49	559	12%		171	12%		82	11%
50—59	414	9%		136	10%		80	10%
60+	226	5%		72	5%		25	3%
Unknown	5	0%		2	0%		0	0%
Total	4510			1411			768	

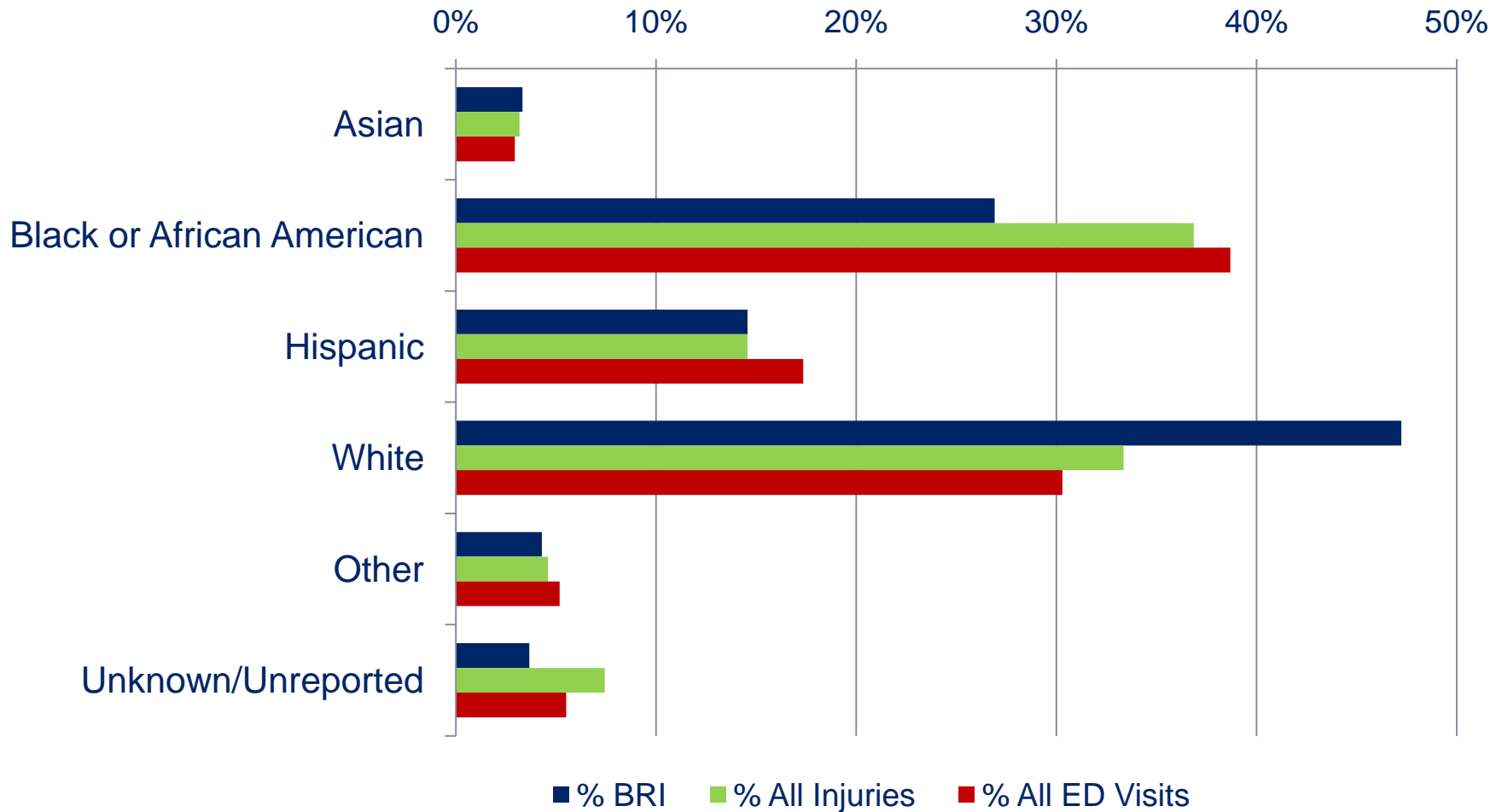
Percent visits by type and age, Boston Residents, 2007-2010



Distribution of emergency department visits for BRI

	2007-2010		2010		2010- Boston Residents Only	
Gender						
Female	1124	25%	381	27%	207	27%
Male	3364	75%	1030	73%	561	73%
Other	22	0%	0	0%	0	0%
Total	4510		1411		768	
Race						
Asian	159	4%	40	3%	23	3%
Black or African American	771	17%	234	17%	190	25%
Hispanic	524	12%	179	13%	114	15%
White	2705	60%	852	60%	375	49%
Other (Includes AMIN)	169	4%	44	3%	31	4%
Unknown/Unreported	182	4%	62	4%	35	5%
Total	4510		1411		768	

Percent visits by type and race, Boston Residents, 2007-2010

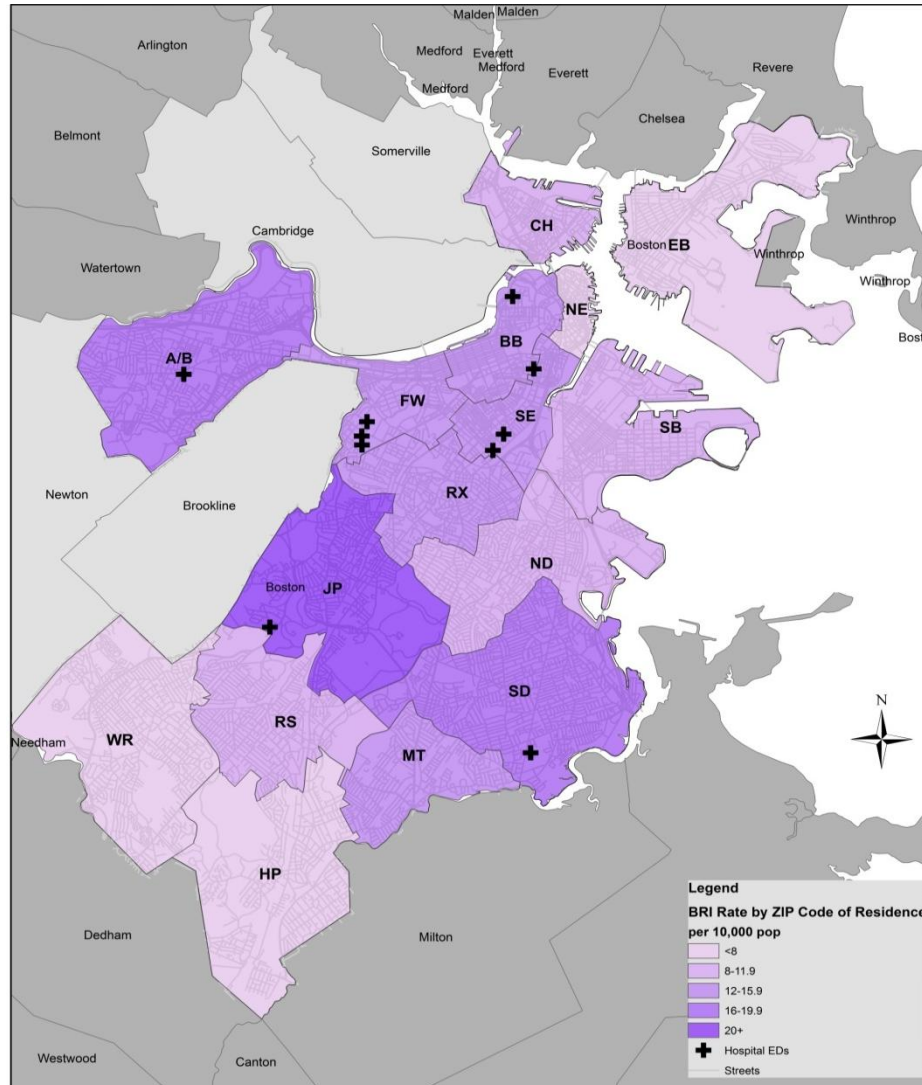




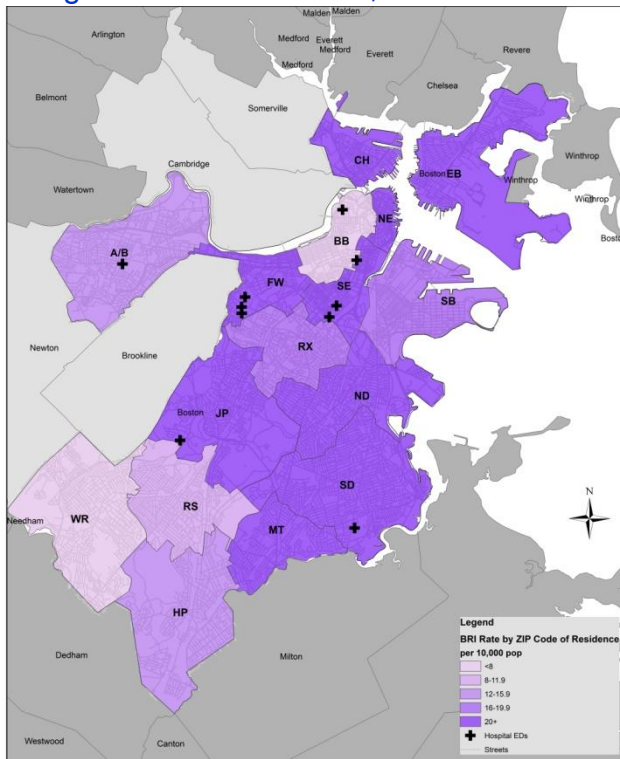
Rate of BRI Visits by Age Group and Boston Neighborhood, 2010

BRI per 10,000 Residents										
Neighborhood	Age group									Total
	<5	5—9	10—17	18—24	25—29	30—39	40—49	50—59	60+	
Allston/Brighton	4.1	6.7	12.9	38.4	19.2	9.1	11.7	13.0	2.5	16.8
Back Bay/ Beacon Hill/ West End	0.0	19.9	0.0	8.7	10.6	24.0	24.3	27.2	5.6	14.4
Charlestown	6.2	23.6	34.0	0.0	10.5	4.6	4.3	10.0	8.9	9.3
East Boston	0.0	13.4	22.3	2.5	3.4	4.4	4.9	4.2	0.0	5.0
Fenway	0.0	0.0	46.7	11.6	23.3	17.5	25.9	14.7	5.0	14.7
Hyde Park	0.0	9.6	12.2	18.9	0.0	10.7	1.9	4.0	1.6	6.2
Jamaica Plain	0.0	16.9	27.8	76.4	57.3	20.2	19.4	8.5	7.5	26.6
Mattapan	0.0	49.3	35.2	28.8	6.2	4.8	15.9	0.0	0.0	13.6
North Dorchester	3.5	13.7	21.4	15.6	12.7	7.0	6.2	13.7	3.1	10.8
North End	0.0	0.0	59.2	16.7	0.0	0.0	0.0	8.3	0.0	3.1
Roslindale	0.0	9.6	10.9	15.7	6.3	16.7	6.7	8.3	1.6	8.1
Roxbury	3.1	20.6	16.4	24.3	21.3	13.0	9.3	8.5	1.3	13.3
South Boston	0.0	17.1	18.8	56.0	7.7	4.8	8.9	13.1	0.0	10.2
South Dorchester	2.6	10.4	27.9	42.7	19.9	17.5	15.5	13.8	2.8	16.5
South End	0.0	44.6	32.6	13.9	1.4	9.2	20.0	31.8	7.6	14.0
West Roxbury	4.2	6.4	4.4	12.9	5.9	4.1	2.1	13.5	1.7	5.2
Total(Boston)	2.0	16.0	20.9	22.2	14.0	10.8	10.2	12.4	2.9	12.3

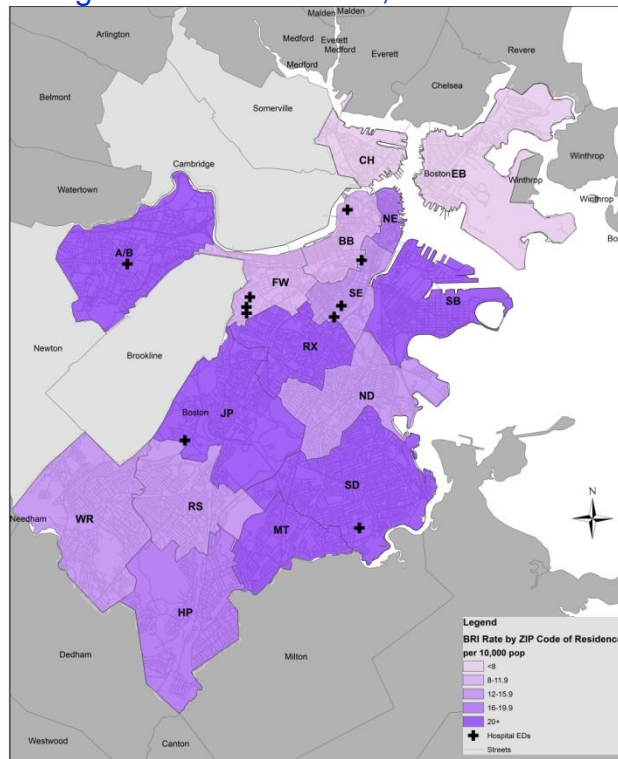
Neighborhood BRI Rates, All Ages, 2010



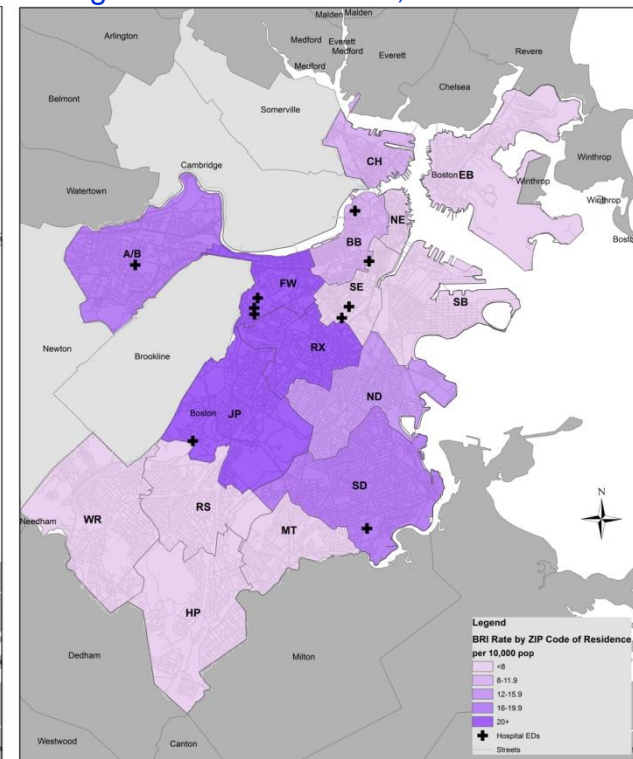
**10-17 year olds
Neighborhood BRI Rates, 2010**



**18-24 year olds
Neighborhood BRI Rates, 2010**

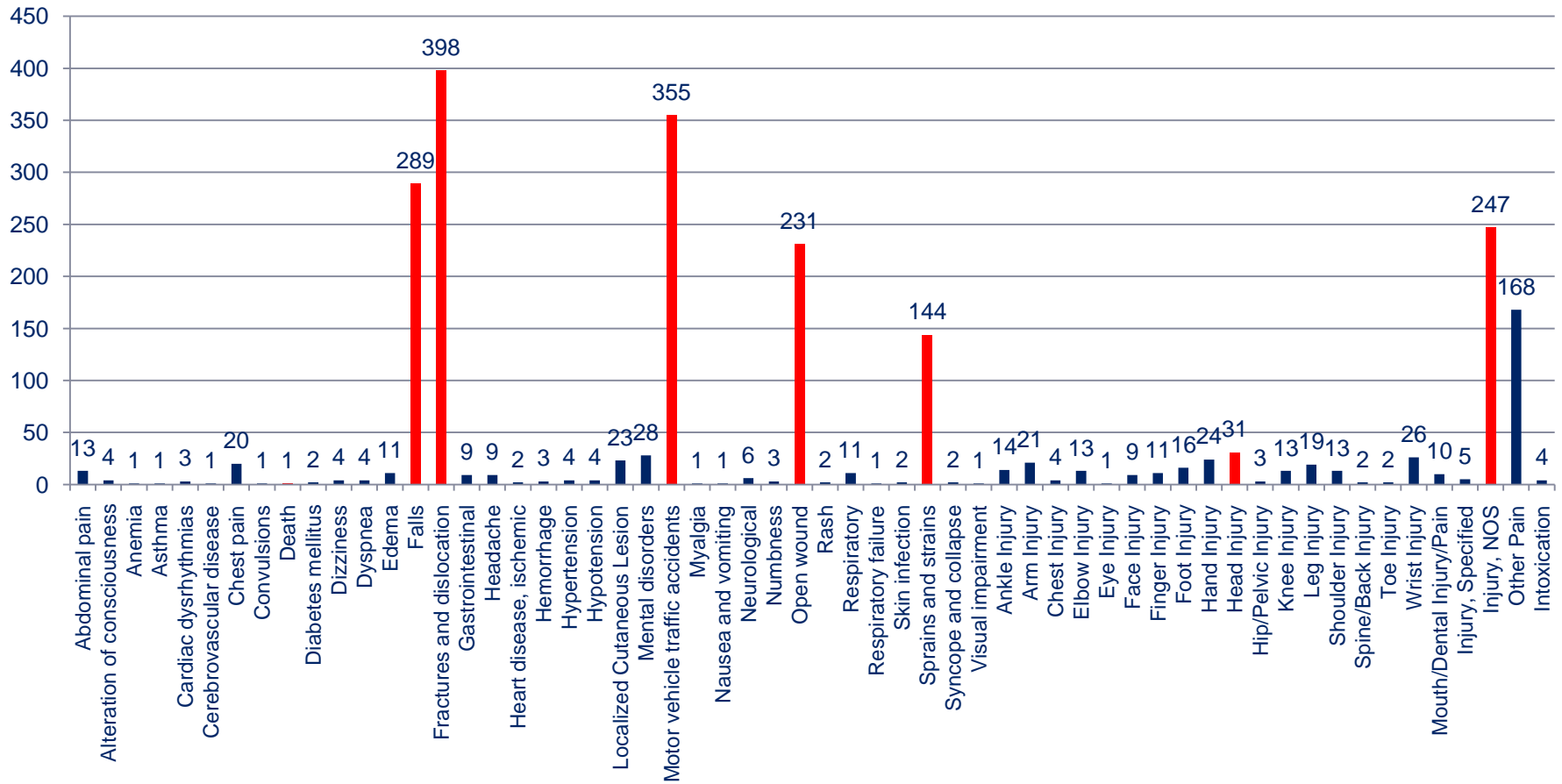


**25-29 year olds
Neighborhood BRI Rates, 2010**



Sub-syndrome Results

BRI visits by sub-syndrome, 2010





Sub-syndromes and disposition

BRI visits by sub-syndrome and disposition, 2010

Sub-syndrome	Disposition		
	Admitted	Not Admitted	% Admitted
Head Injury/Neurological	11	20	35.5%
Fractures and Dislocations	82	232	26.1%
MVA	61	211	22.4%
Open wound	18	164	9.9%
Falls	23	211	9.8%
Injury, NOS	16	188	7.8%
Sprains and Strains	1	111	0.9%

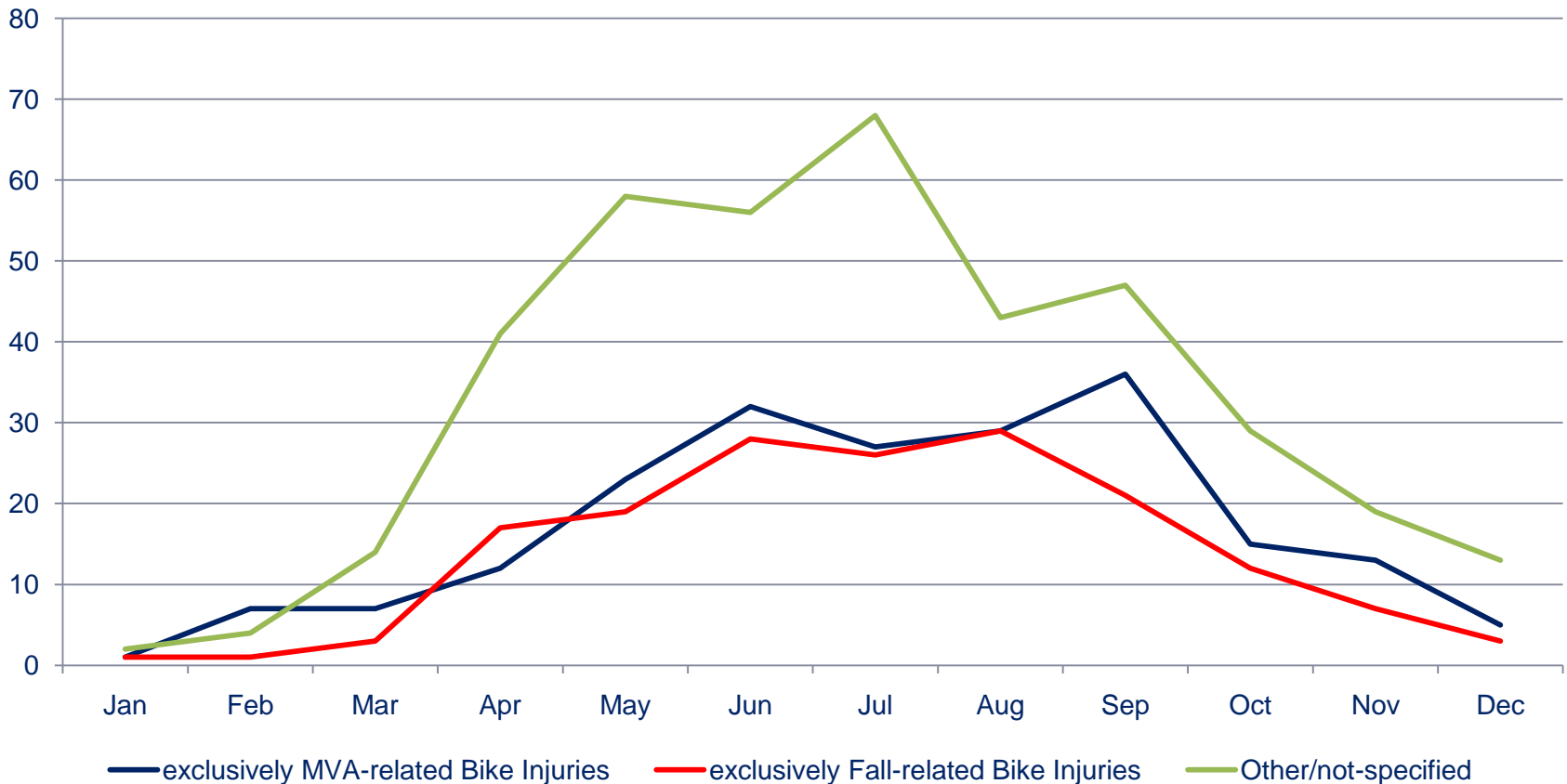
Disposition

BRI disposition by age group, 2010, Boston Residents

Disposition	Age Group									Total
	<5	5—9	10—17	18—24	25—29	30—39	40—49	50—59	60+	
Admitted	0	1	7	12	5	6	8	8	1	48
Not Admitted/AMA	7	41	93	180	118	110	74	72	24	719
Total	7	42	100	192	123	116	82	80	25	767
Percent Admitted	0.0%	2.4%	7.0%	6.3%	4.1%	5.2%	9.8%	10.0%	4.0%	6.3%

MVA vs Falls

Count of BRI related to Motor Vehicle Accidents, Falls and All Other, 2010, Boston Residents



Results- Preliminary Radiological Data

- Based on 2 hospitals Participating in BioSense.

BRI visits in 2010, Boston Residents

	Not Admitted	Admitted	Total
No Fracture	84	4	88
Fracture (ICD-CM)	21	5	26
Total	105	9	114



Summary

- 18-24 year olds make up 25% of all BRI visits; an overwhelming majority (75%) of all BRI visits were among males.
- Head injuries were associated with 2.2% (n=31) of BRI visits in 2010 and frequently resulted in admission (36%).
- In 2010, 11% (n=151) of BRI visits required hospitalization, most commonly for severe fractures and dislocations (n=82).

Conclusions for BRI ED Data

- Using syndromic surveillance to identify, monitor, and track BRI can provide population health information for targeted prevention activities such as education and outreach to select at-risk populations (i.e. college students).
- Access to information on the environmental context of injuries, such as the location of the accident (e.g. police and [EMS](#) data), is limited.
- Improved methods to combine syndromic surveillance, emergency medical service, and public safety information are needed to identify accident “hot spots”.

Limitations to Workgroup Data

- Data is geared towards more severe incidents
- Data Analysis of Open text fields
 - Time intensive to code and may be difficult to fit into a code
 - Inconsistent reporting
- Other types of incidents may be mixed in



Recommendations for Use of Data

- BPD data will primarily be used for date, time and location information
- EMS data will primarily be used to date, time, location, helmet use, age and gender information
- BPD incident reports, EMS notes will be analyzed once “hot spot” locations are identified



We've come a long way...



Next Steps

- Draft first quarterly report
- Coordinate overlapping data
- Explore software for analytics and reporting
- Finalize protocol for workgroup to receive, analyze and discuss data



Thank you.

Contact: Marcus Rennick
mrennick@bphc.org