

# Lies, Damned Lies, and Statistics

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# Objectives

- Provide a brief overview of the descriptive statistics used to summarize large amounts of data
- Describe the components of the Virginia EMS Patient Care Information System:
  - Virginia Pre Hospital Information Bridge (VPHIB)
  - Virginia Statewide Trauma Registry (VSTR)
- Review Virginia EMS data trends for 2007 through 2013

# Lies and Statistics

- *“There are three kinds of lies: lies, damned lies, and statistics.”*
  - Attributed to Benjamin Disraeli
  - Now believed to have been coined by Mark Twain
- Phrase is sometimes used
  - To describe the use of statistics to bolster weak arguments
  - By those distrustful of the presenter’s and/or analyst’s motives

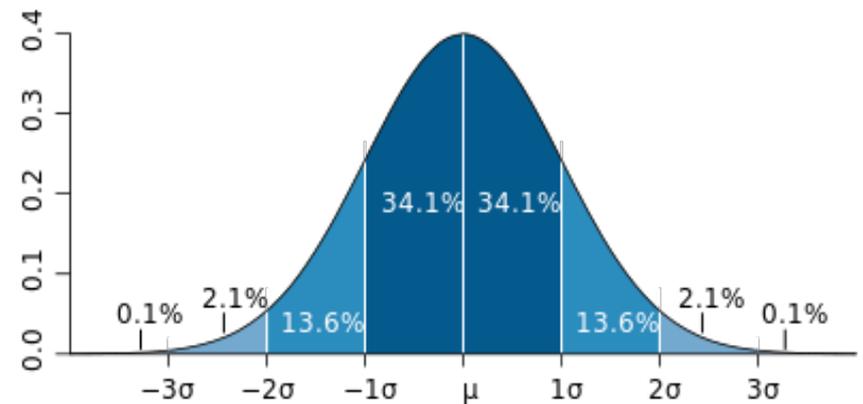
# What is (are) Statistics?

- Statistics *IS* a discipline
  - Study of the collection, organization, analysis, interpretation, and presentation of data
- Statistics *ARE* numbers calculated from a set of data
  - Mean (average), standard deviation
  - Minimum, median, maximum
  - Many others . . .
- To prevent statistics from becoming lies, one must:
  - Use proper descriptions of the data being studied
  - Avoid bias when using samples of the whole

# Numbers are Numbers - NOT!

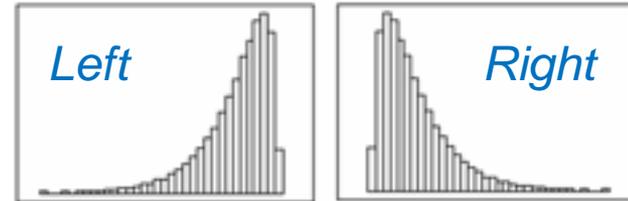
- Groups of numbers (*distributions* or *probability distributions*) don't always look the same
- “Bell shaped curve” or *Normal distribution*
  - Very common
  - Not the only way numbers like to congregated!
- MANY other distributions exist, but you don't need to know about them *BUT* . . .
  - You should be aware of two other common distributions, *left skewed* and *right skewed*

# Normal Distribution



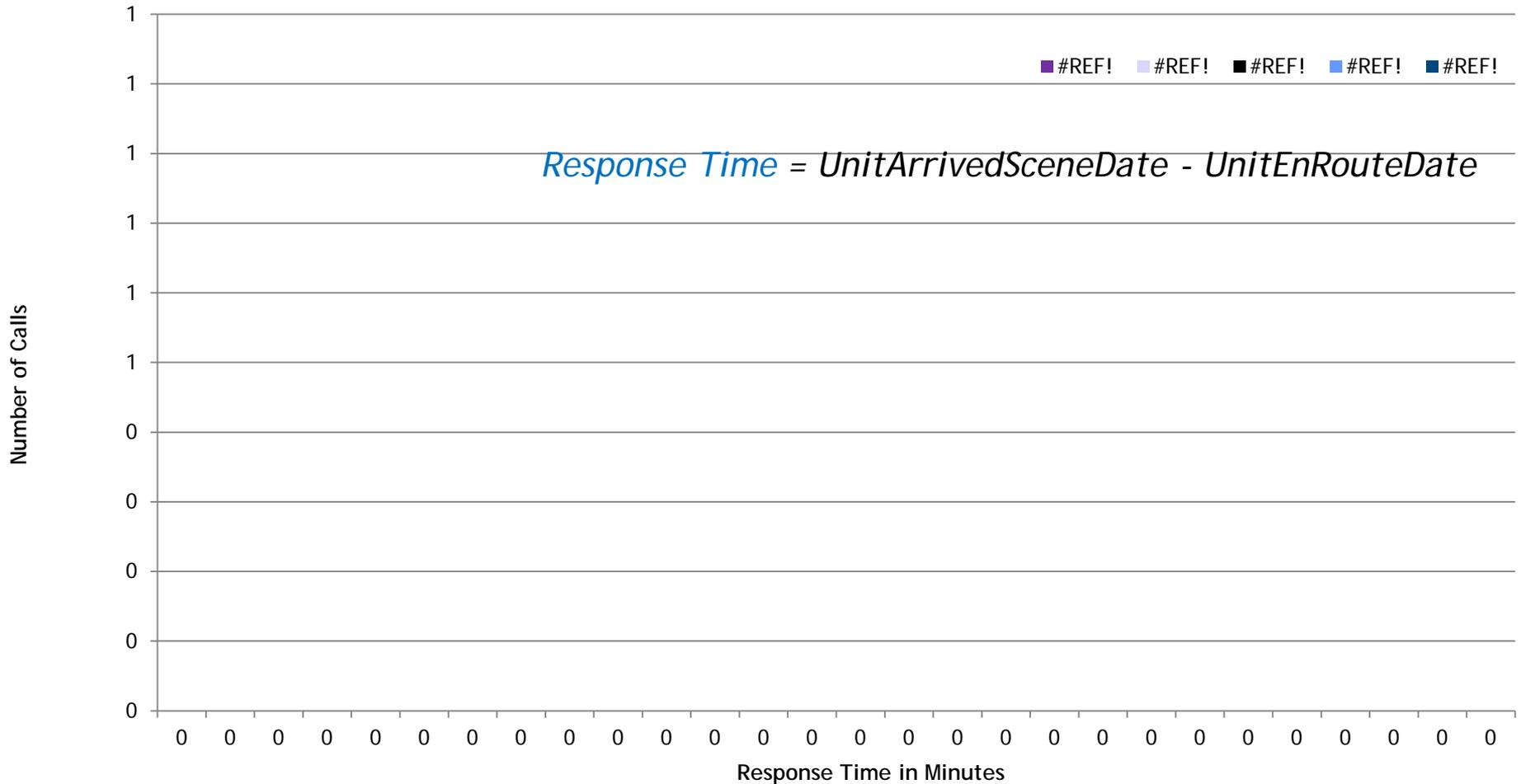
- Life would be easy (but boring) if all numbers grouped themselves in the familiar “bell shaped curve”
  - Characterized by *symmetry*
  - Measure of *central tendency* (middle) = *mean ( $\mu$ )*
  - Measure of *spread* (variability) = *standard deviation ( $SD$ ,  $Std Dev$ , or  $\sigma$ )*
    - $SD$  is ~ average distance of observed values from the mean
    - Large standard deviations
      - Often occur with small groups of numbers
      - *Can indicate data that do not follow the normal distribution!*

# Skewed Distributions



- *Skewness* is a measure of asymmetry
  - Named for the location of the *tail* of the distribution
- Right skewed data are very common in health care
  - Characterized by *asymmetry*
  - Measure of *central tendency* (middle) = *median*
  - Measure of *spread* (variability) = *inter-quartile range (IQR)* represents middle 50% of the data
    - 75<sup>th</sup> percentile value - 25<sup>th</sup> percentile value
- Let's apply our new found knowledge to some actual Virginia EMS data . . .

# Example: Distribution of VPHIB Data\*



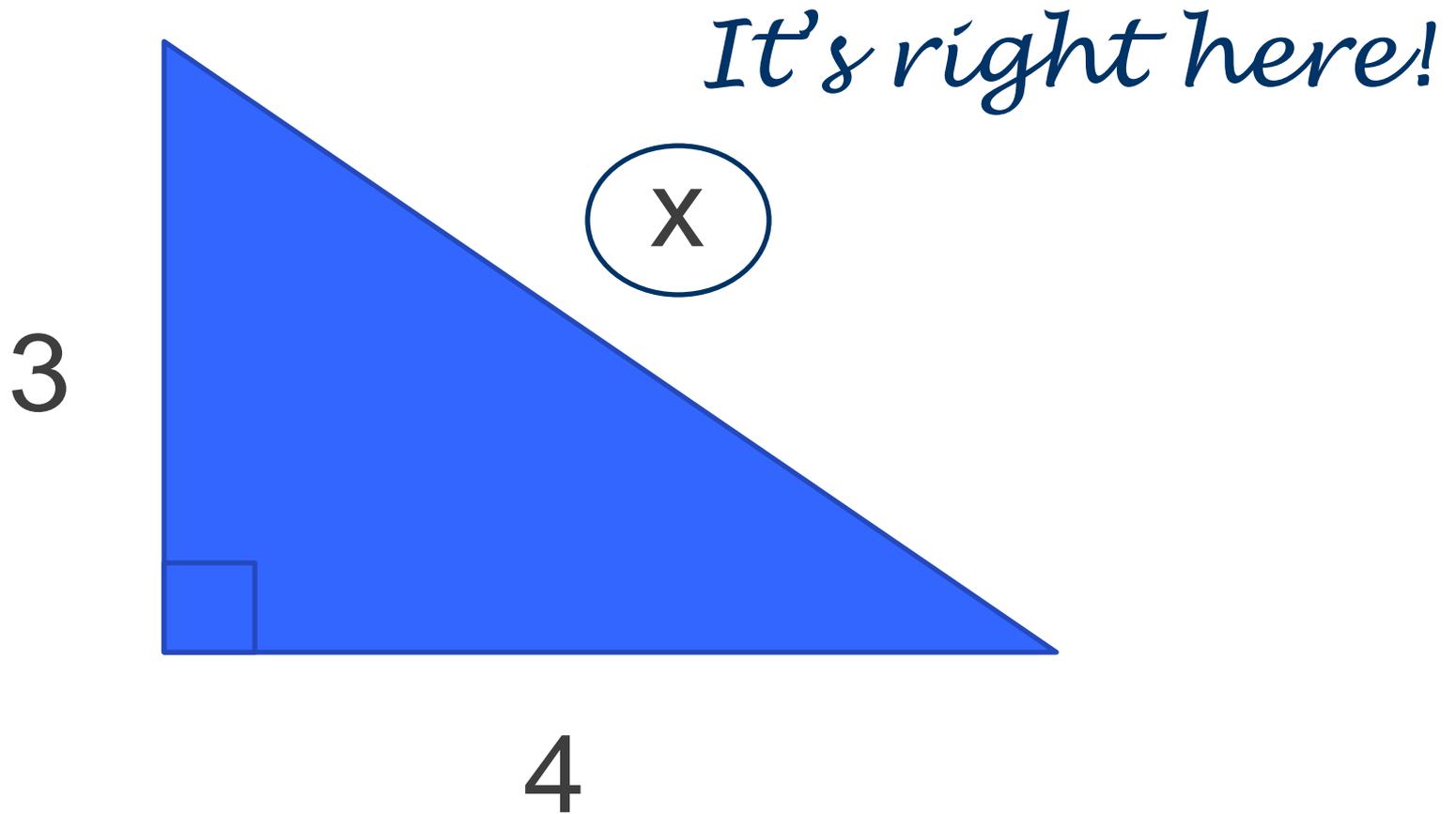
\* Includes all reported calls, regardless of call type or destination

# Example: Statistics for VPHIB Data\*

Response Time in Minutes (UnitArrivedSceneDate - UnitEnRouteDate)					
	2007	2008	2009	2010	2011
N Calls	860,368	885,636	842,018	910,883	1,054,323
N Missing Values	63,197	71,742	79,339	60,132	76,995
Minimum	-1,439.0	-1,439.0	-525,585.0	-4,733,277.1	-527,032.0
01st Percentile	0.0	0.0	0.0	0.0	0.0
05th Percentile	1.0	1.0	1.0	0.9	1.0
10th Percentile	2.0	2.0	2.0	2.0	2.0
25th Percentile	3.0	3.0	3.0	3.0	3.0
<b>Median</b>	<b>5.0</b>	<b>5.0</b>	<b>5.0</b>	<b>5.0</b>	<b>5.0</b>
75th Percentile	8.0	8.0	8.0	8.7	9.0
90th Percentile	13.0	13.0	13.0	15.0	16.0
95th Percentile	18.0	18.0	17.0	21.0	24.0
99th Percentile	34.0	33.0	31.0	46.3	55.0
Maximum	1,439.0	1,439.0	1,471.0	3,682,086.2	4,207,687.5
Average	7.5	5.8	4.9	16.3	18.8
Standard Deviation	63.7	77.5	577.3	6,696.8	5,327.8

\* Includes all reported calls, regardless of call type or destination

Find  $x$ :



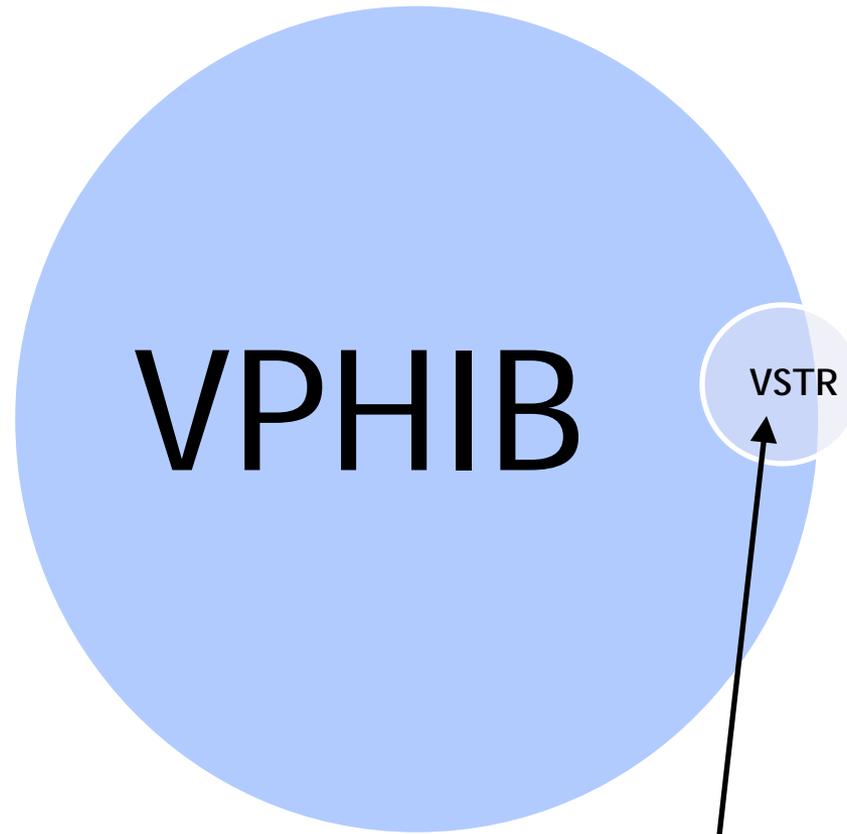
# Virginia Pre Hospital Information Bridge

- EMS data submission is mandated by the Code of Virginia § 32.1-116.1 and EMS regulations
- Current minimum dataset (VPHIB) was officially adopted on February 6, 2010 by the State Board of Health
- All EMS responses are required to be submitted to OEMS *WITHIN 30 DAYS* in the format prescribed by OEMS
- Agencies may submit above and beyond this minimum dataset if desired to collect further information on an agency, locality, or regional level

# Virginia Statewide Trauma Registry

- Virginia Statewide Trauma Registry (VSTR) was mandated by the state legislature in Virginia as of July 1, 1987
- The Code of Virginia statute §32.1-116.1 outlines the reporting procedure for the Trauma Registry through establishment of the Emergency Medical Services Patient Care Information System (EMS PCIS)
- ALL licensed hospitals which render emergency medical services shall participate in the Trauma Registry
- OEMS determines the format for reporting data which must be submitted *WITHIN 60 DAYS FROM THE END OF THE QUARTER*

# Relationship between VPHIB and VSTR



Trauma patients brought to a Virginia hospital by a Virginia EMS agency



# Definitions for Call Type

## Type of Service Requested

## Call Type

911 Response (Scene) (Default)

Flagdown/Walk-in Emergent

Interfacility Transfer (unscheduled)

Mutual Aid

Rendezvous/Intercept

*Emergency*

Flagdown/Walk-in Non-emergent

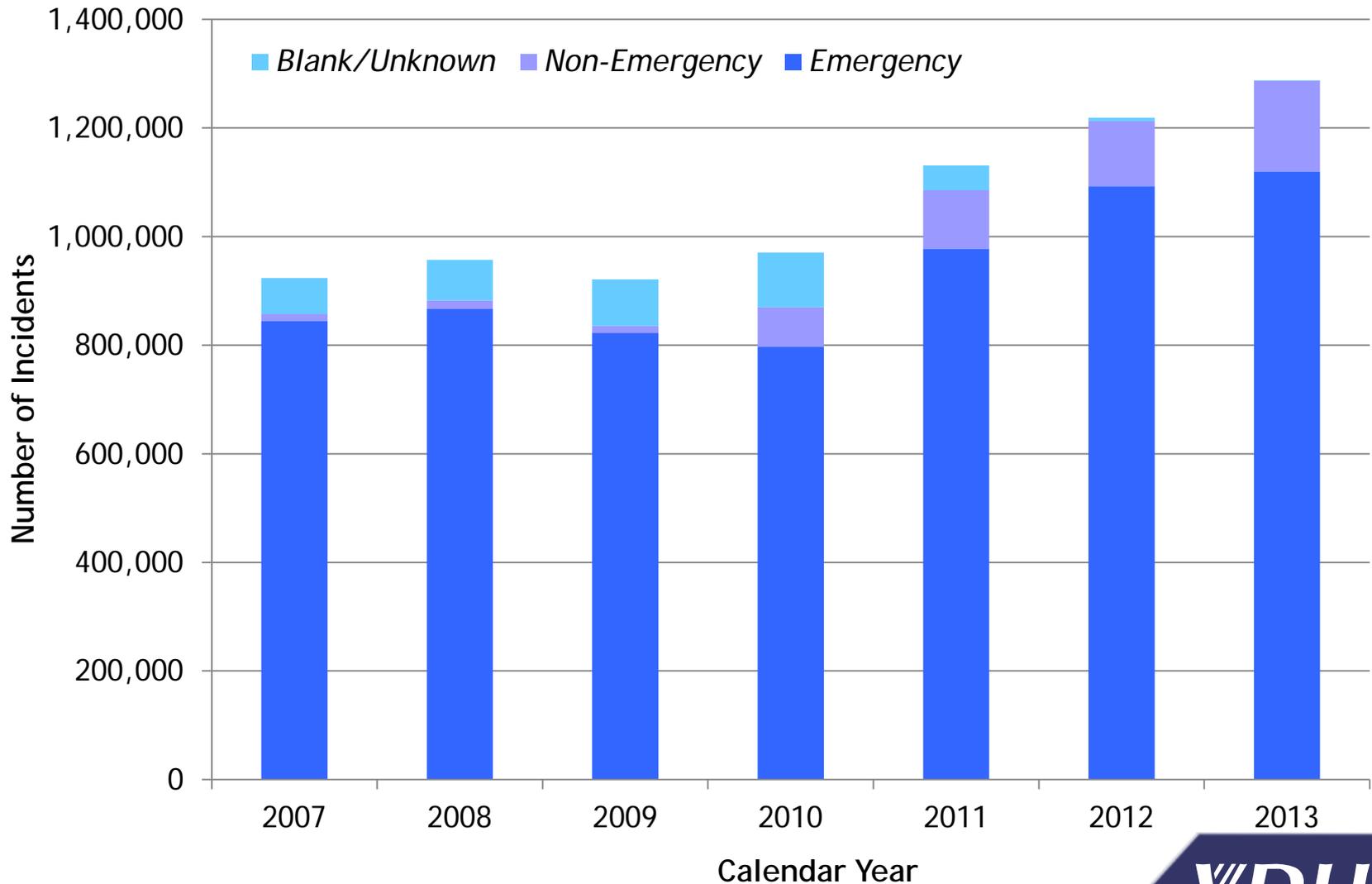
Interfacility Transfer (scheduled)

Medical Transport

Standby

*Non-Emergency*

# Figure 1. Incidents by Call Type



# Definitions for Disposition

## Incident/Patient Disposition

## Disposition

Treated and Released

Treated, Referred to Law Enforcement

Treated, Transferred Care

Treated, Transported by EMS

Treated, Transported by Private Vehicle

Dead at Scene

No Treatment Required

Patient Refused Care

No Patient Found

Standby Only - No Patient Contacts

Cancelled

Treated

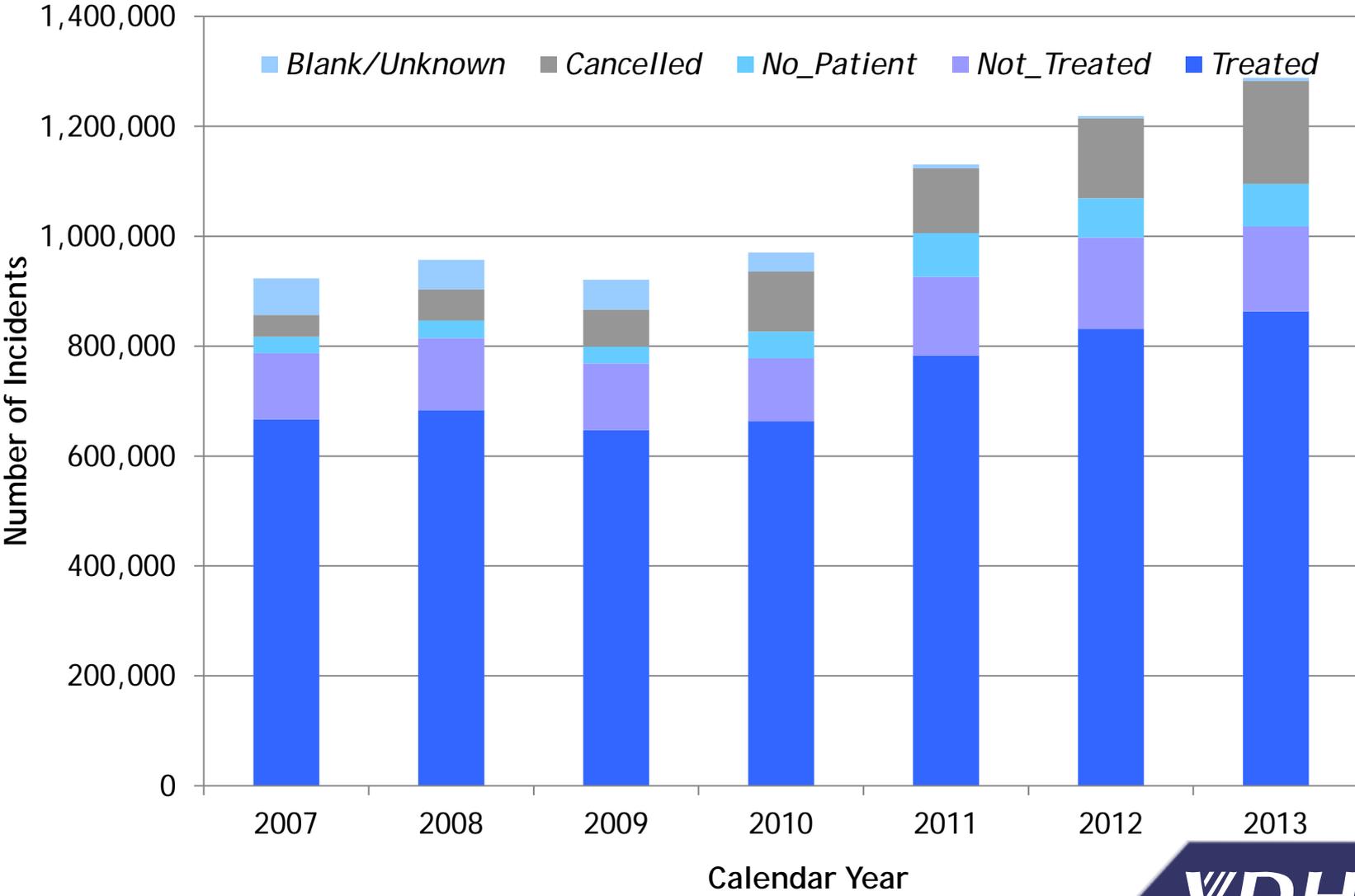
Not\_Treated

No\_Patient

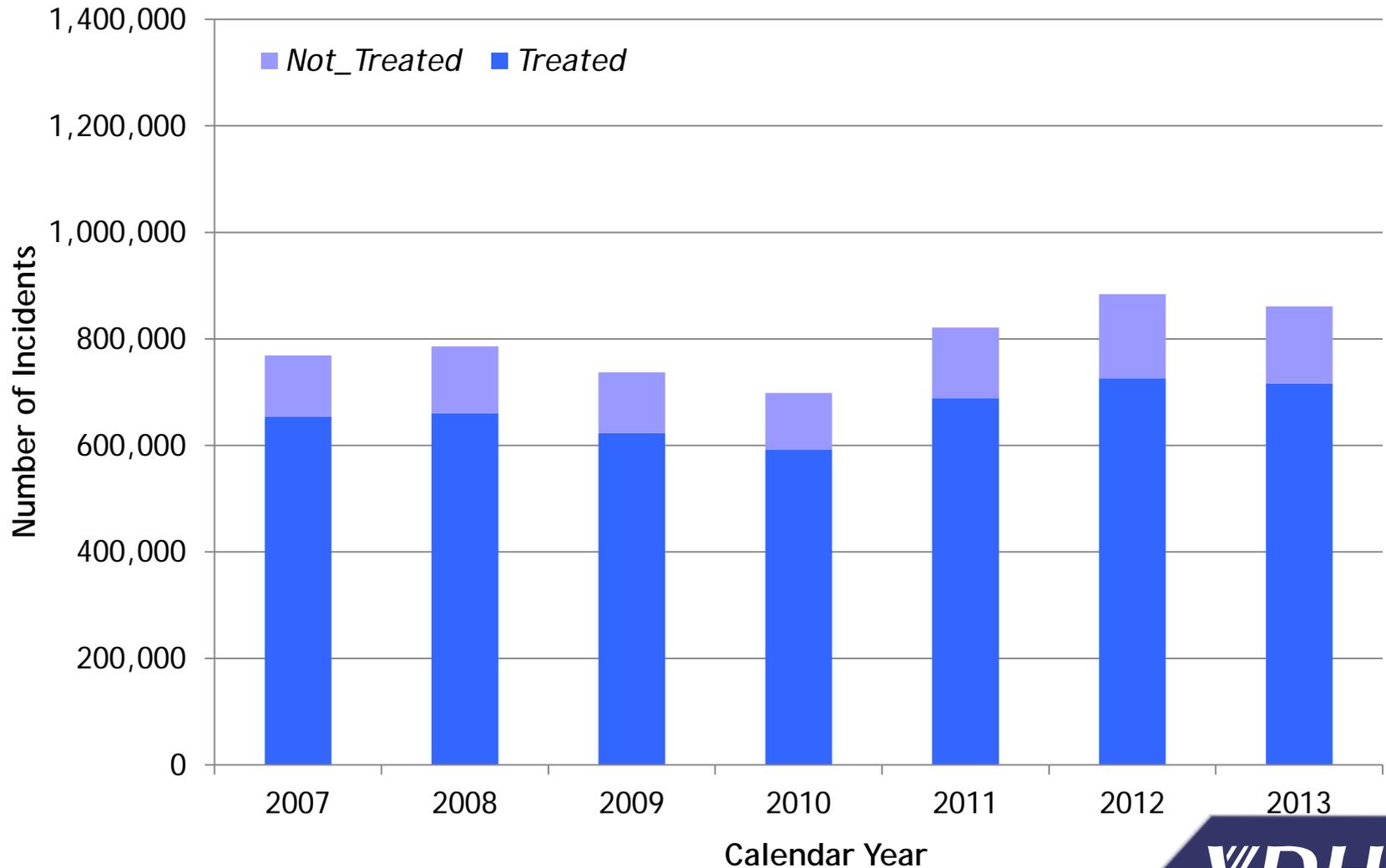
Cancelled

*Assessed = Treated + Not\_Treated*

# Figure 2. Incidents by Disposition



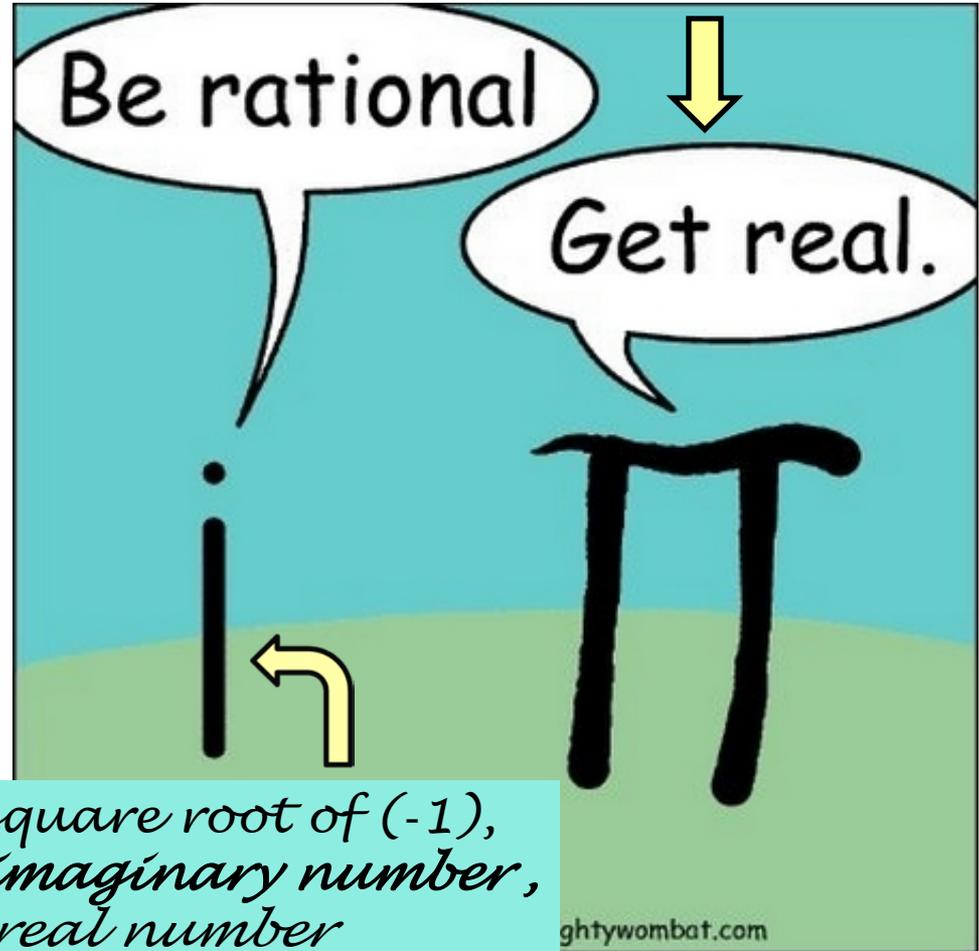
# Figure 3. Emergency Calls Where The Patient Was Assessed



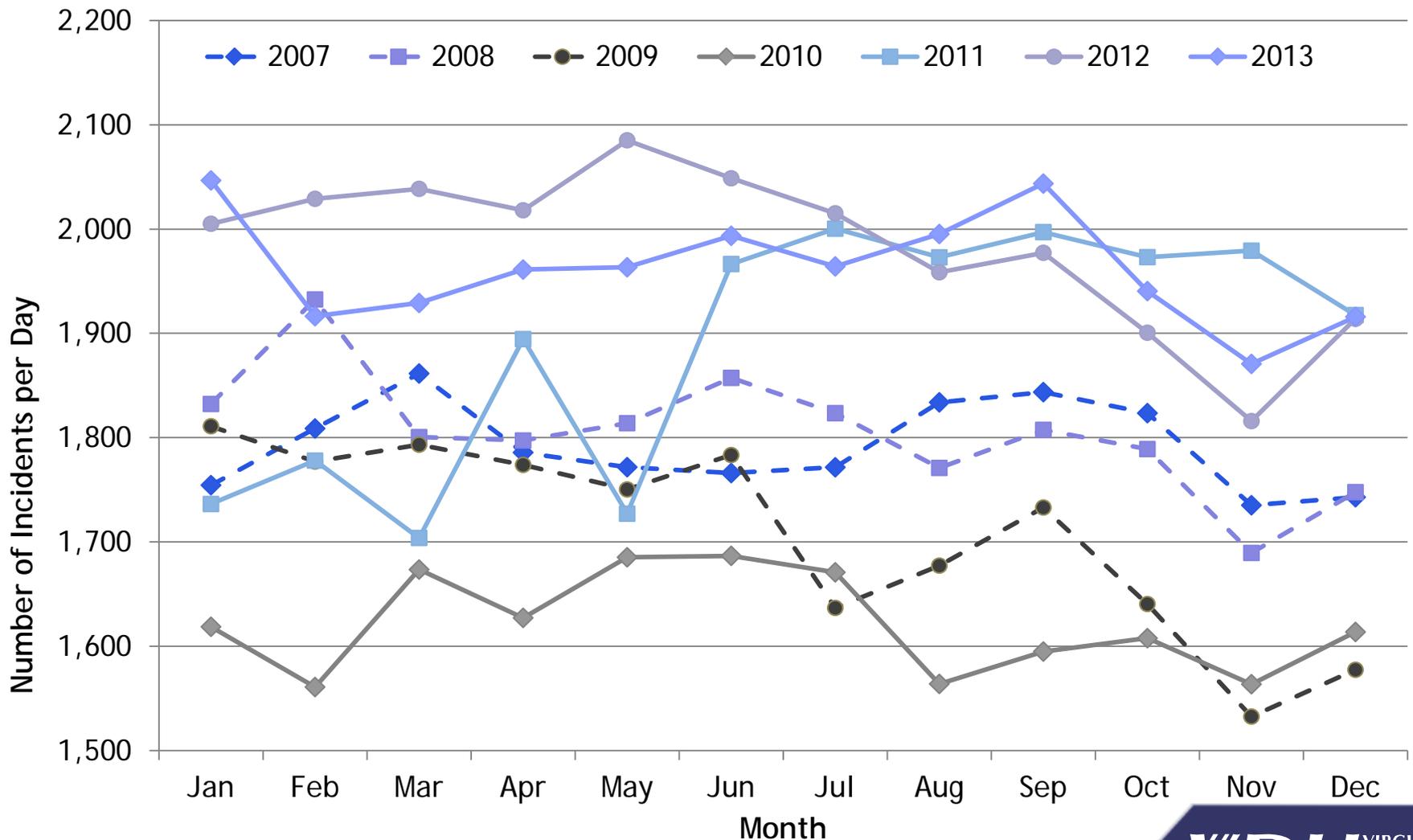
# Please Note:

All Figures from this point forward include incidents that were emergency dispatches in which the patient received treatment

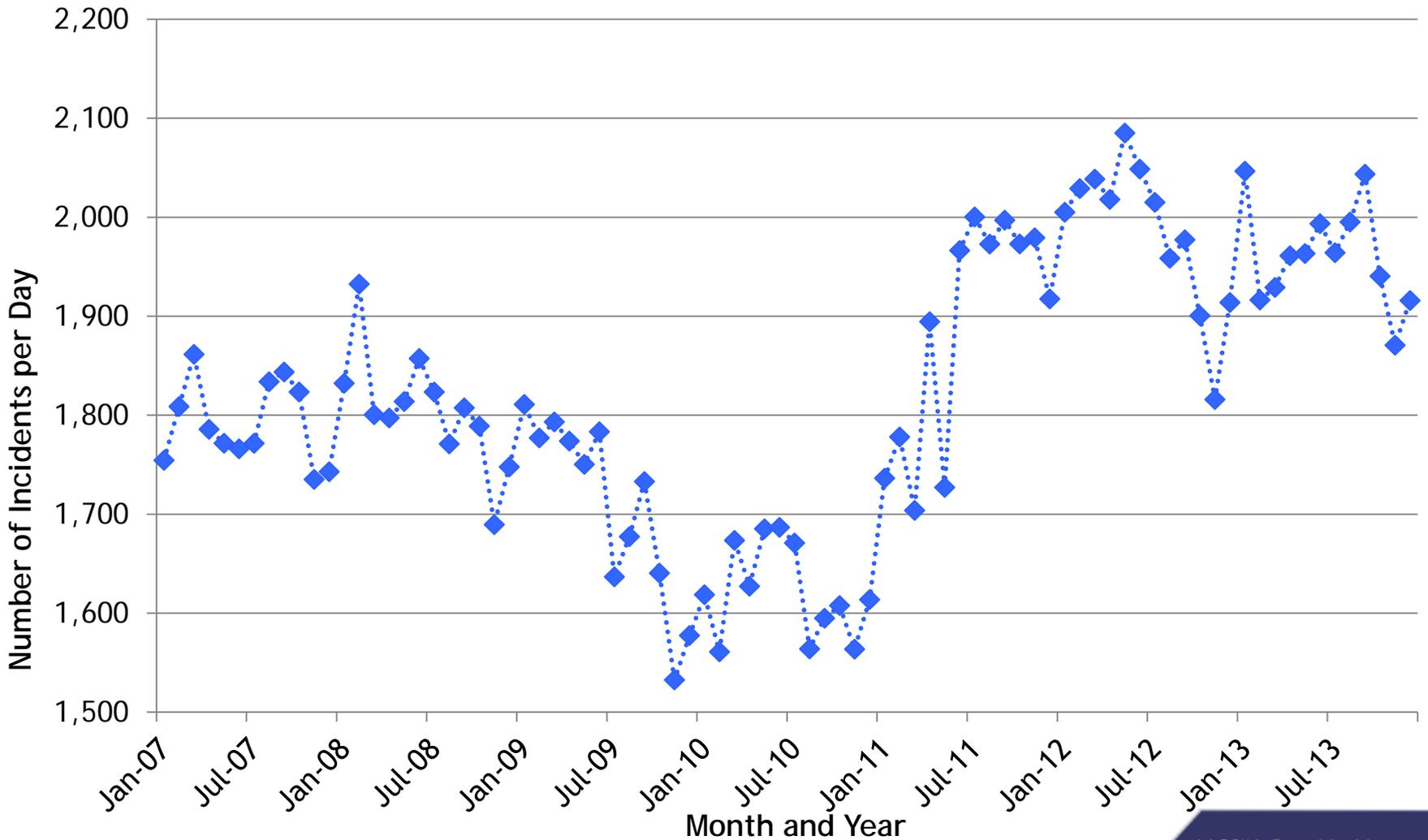
$\pi$ , the ratio of the diameter to the circumference of a circle, is an irrational number



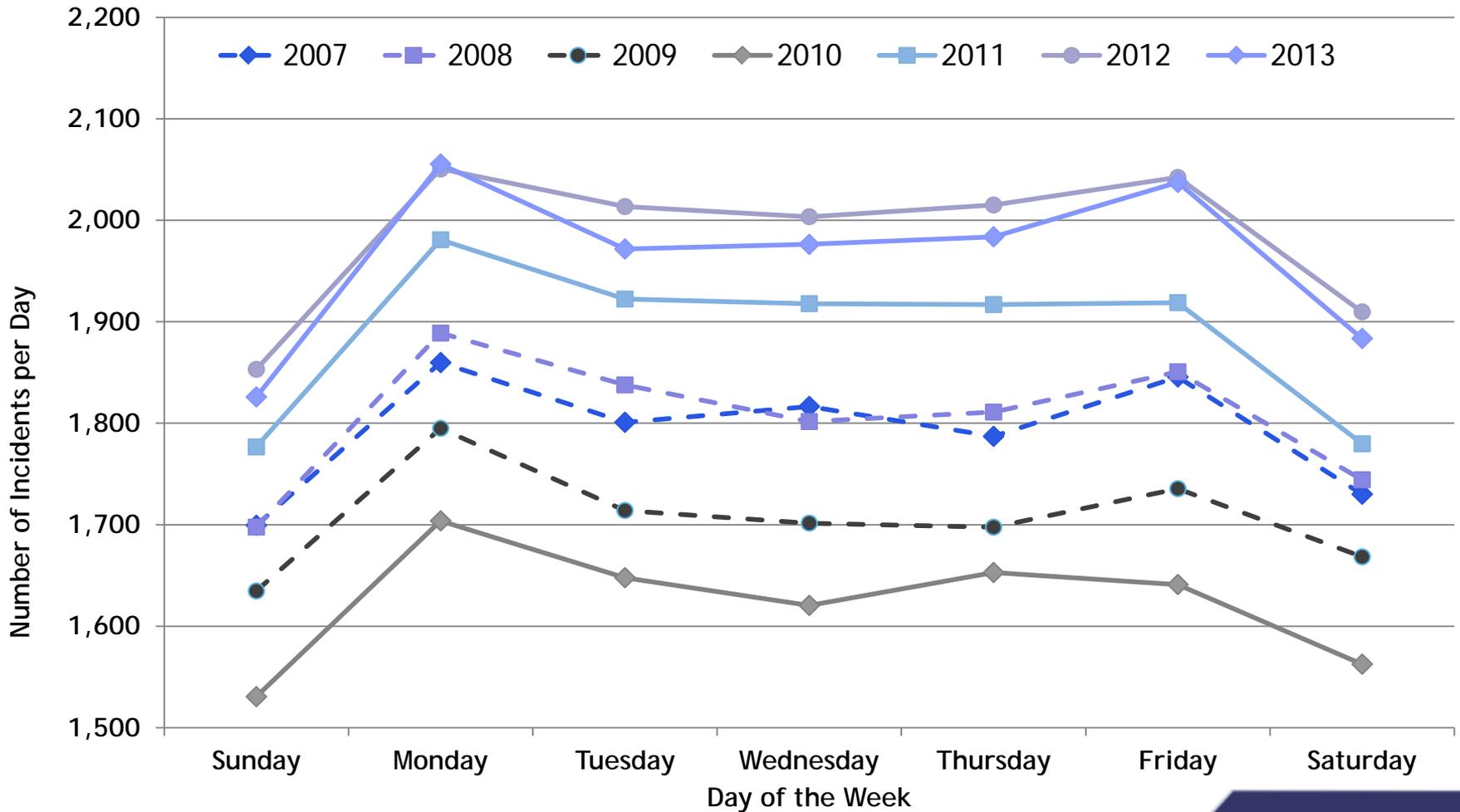
# Figure 4a. Incidents per Day by Month



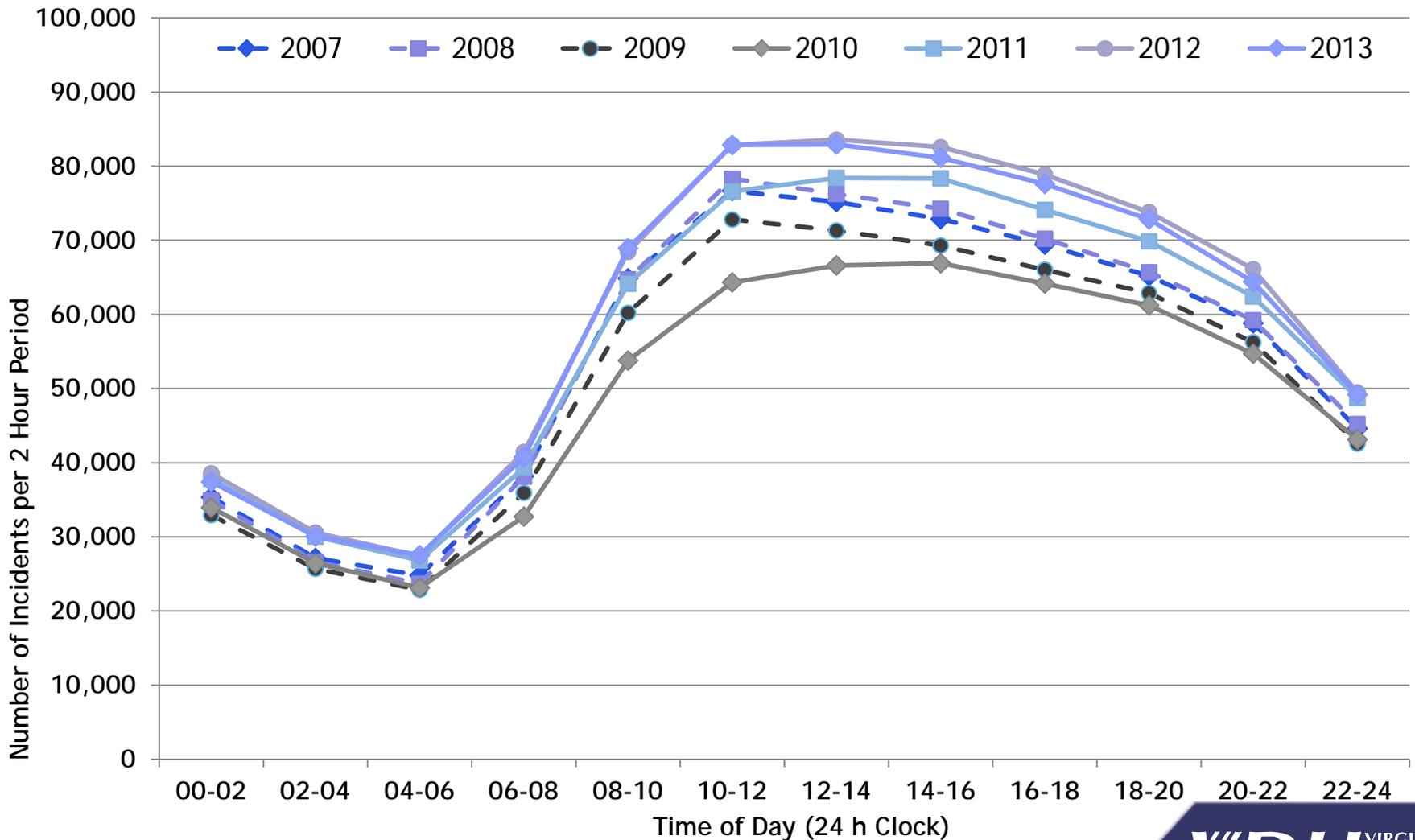
# Figure 4b. Incidents per Day by Month



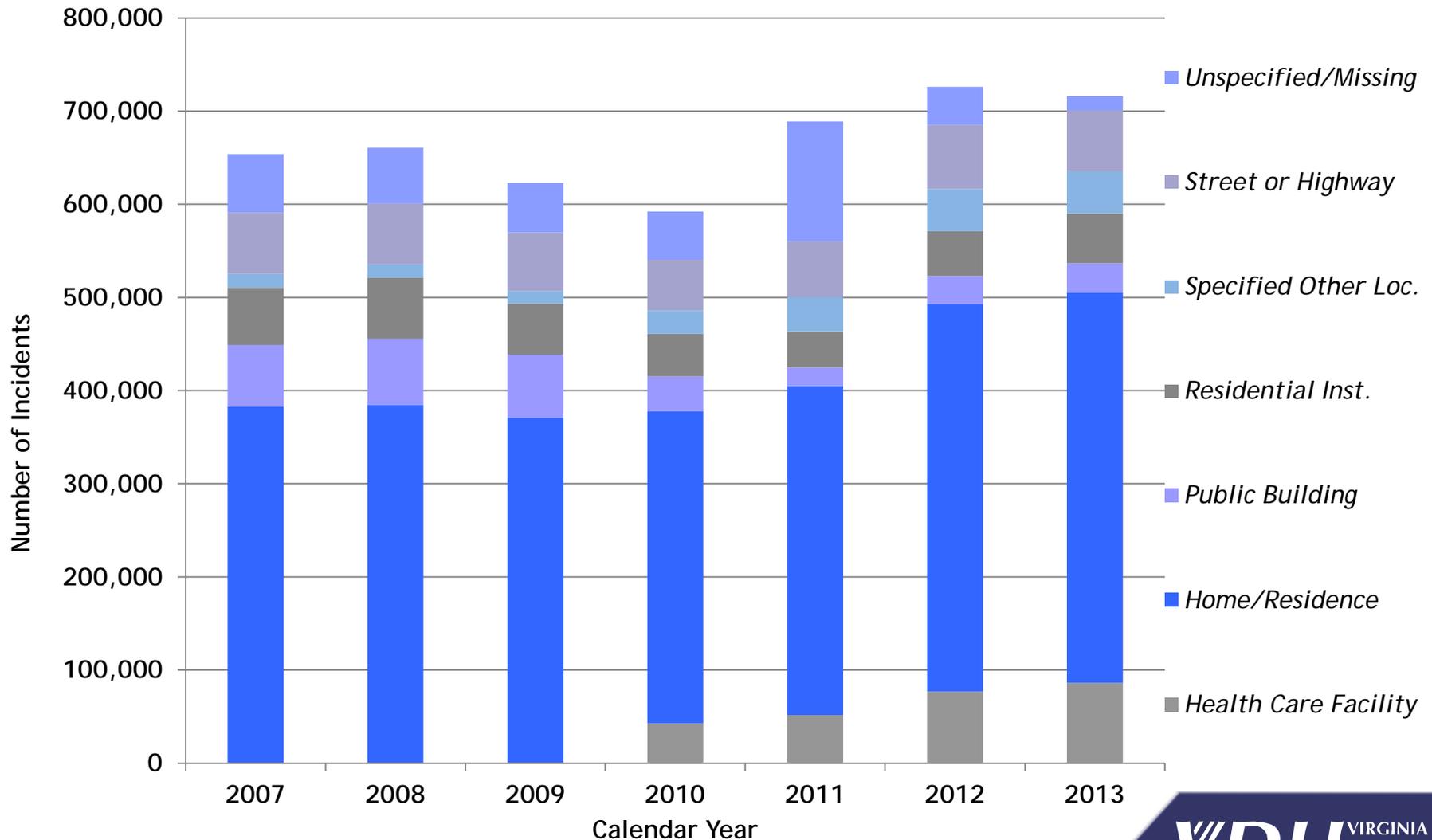
# Figure 5. Average Incidents per Day of the Week



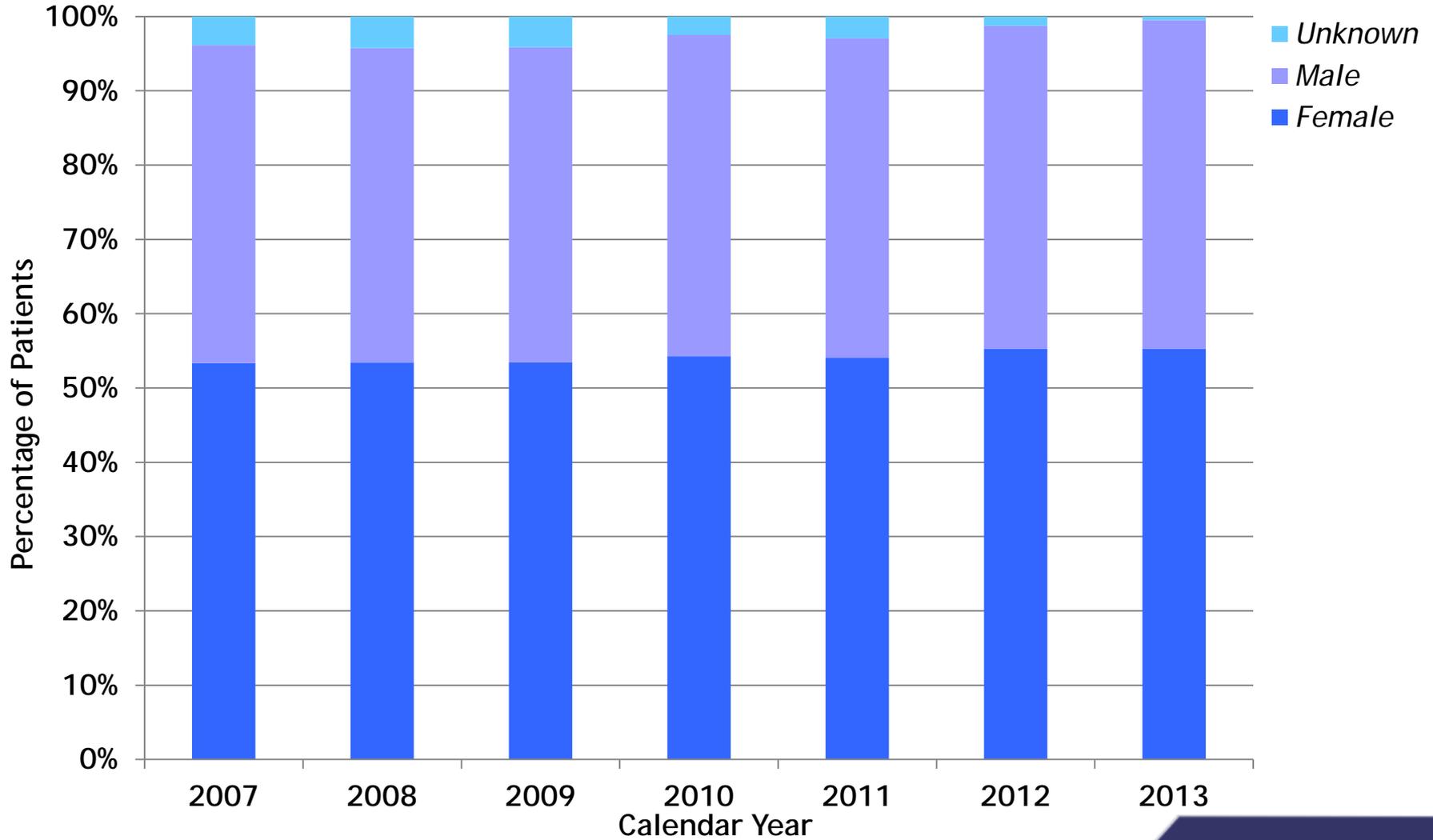
# Figure 6. Incidents per Hour



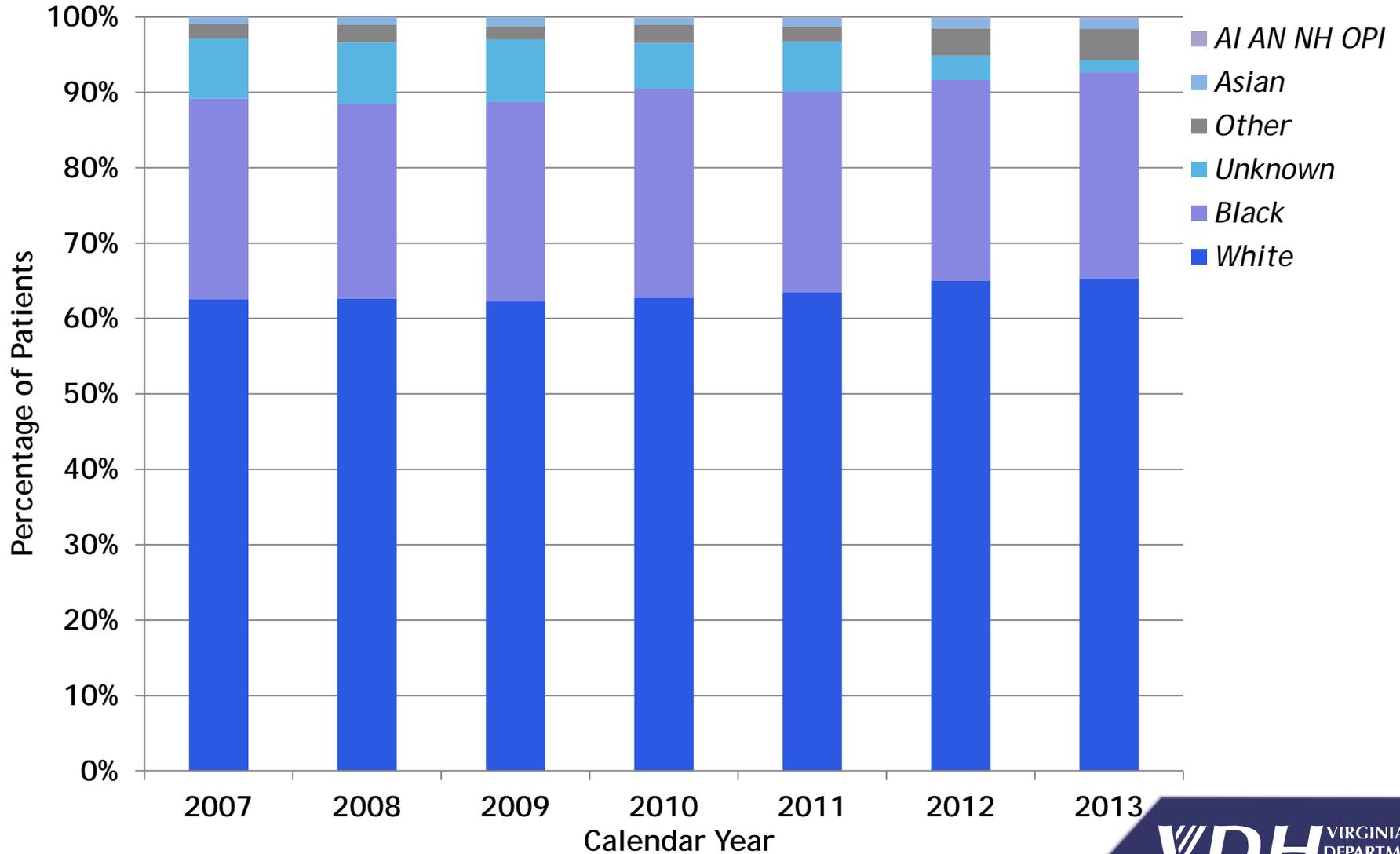
# Figure 7. Incident Location Type



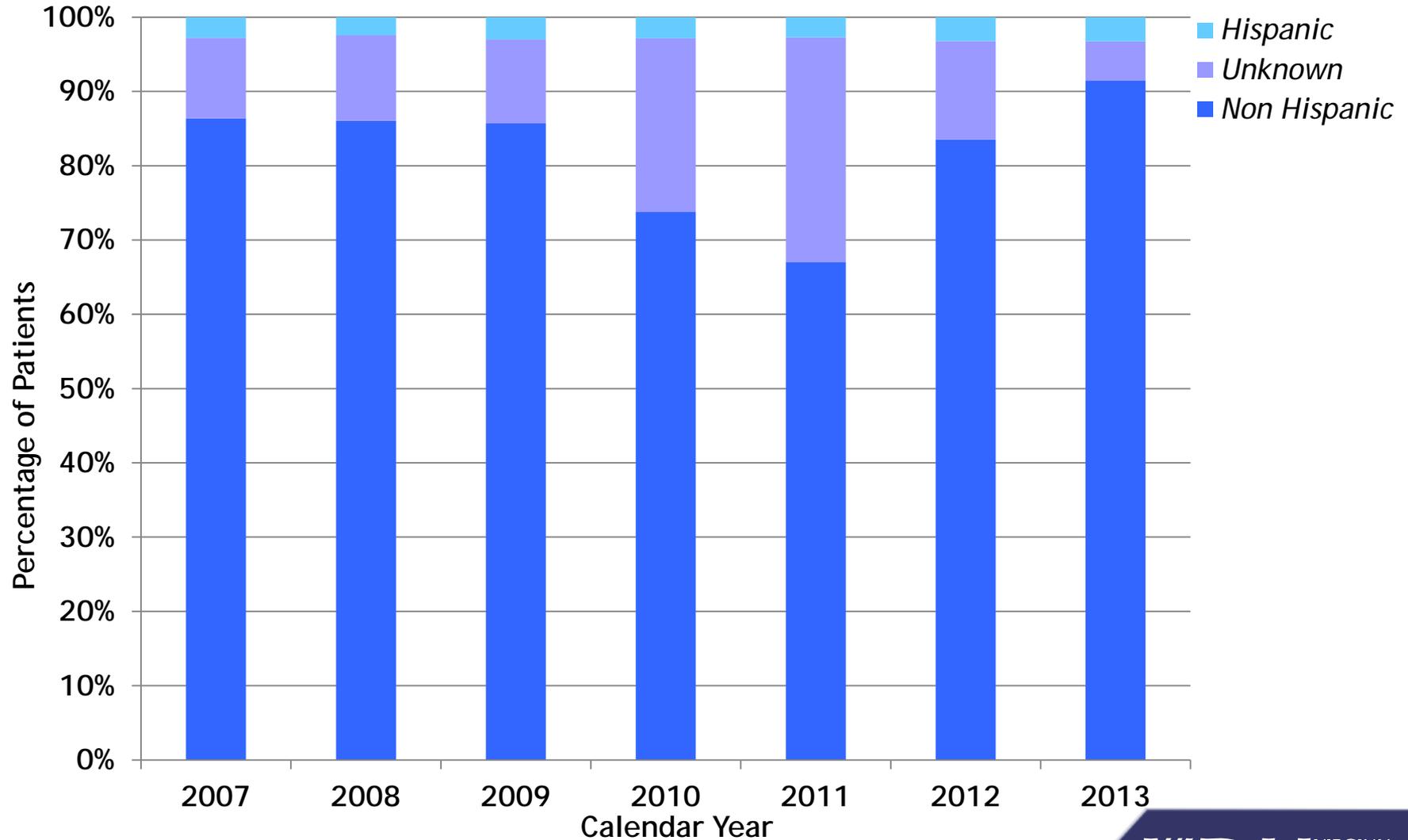
# Figure 8. Patient Gender by Incident



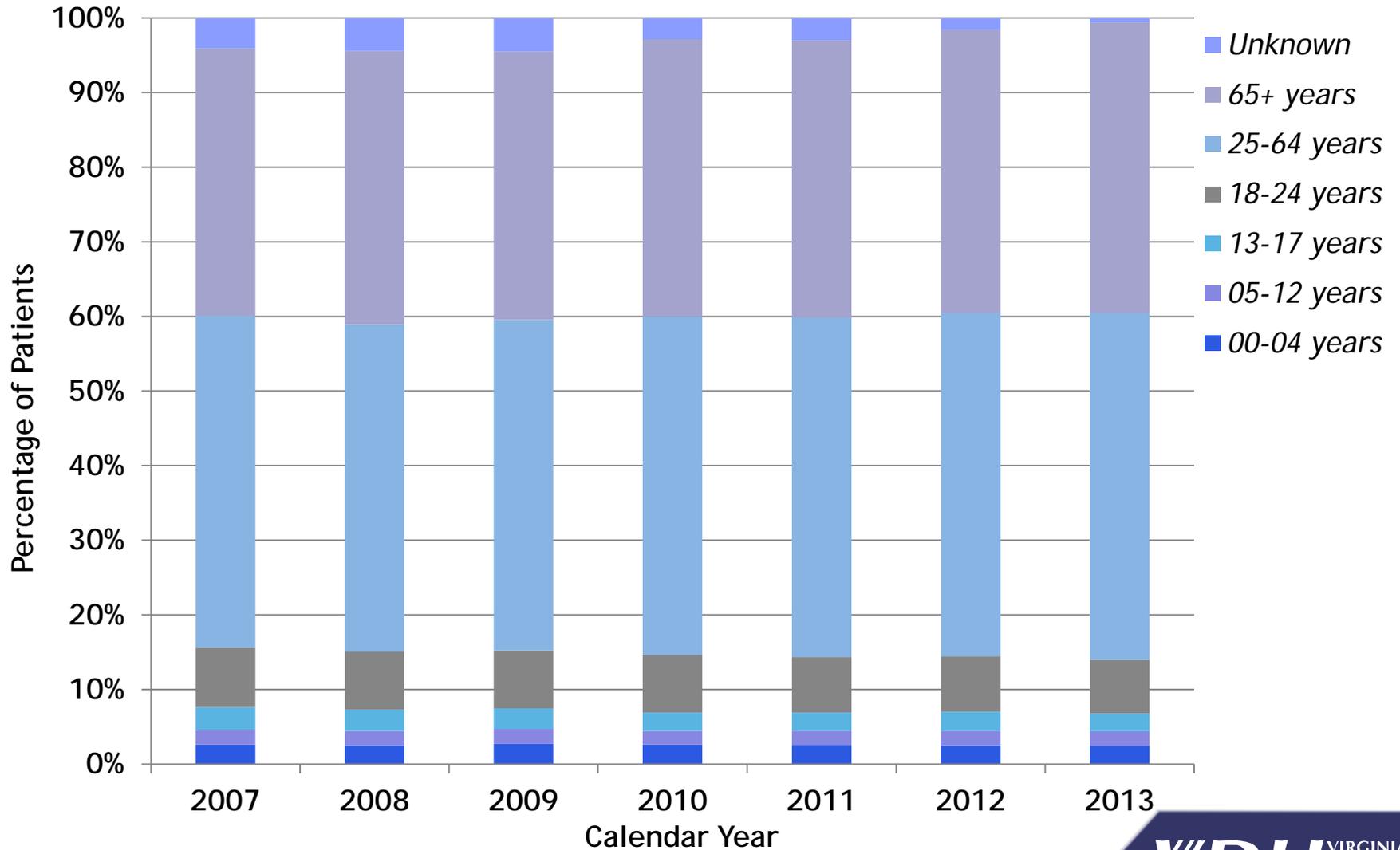
# Figure 9. Patient Race by Incident



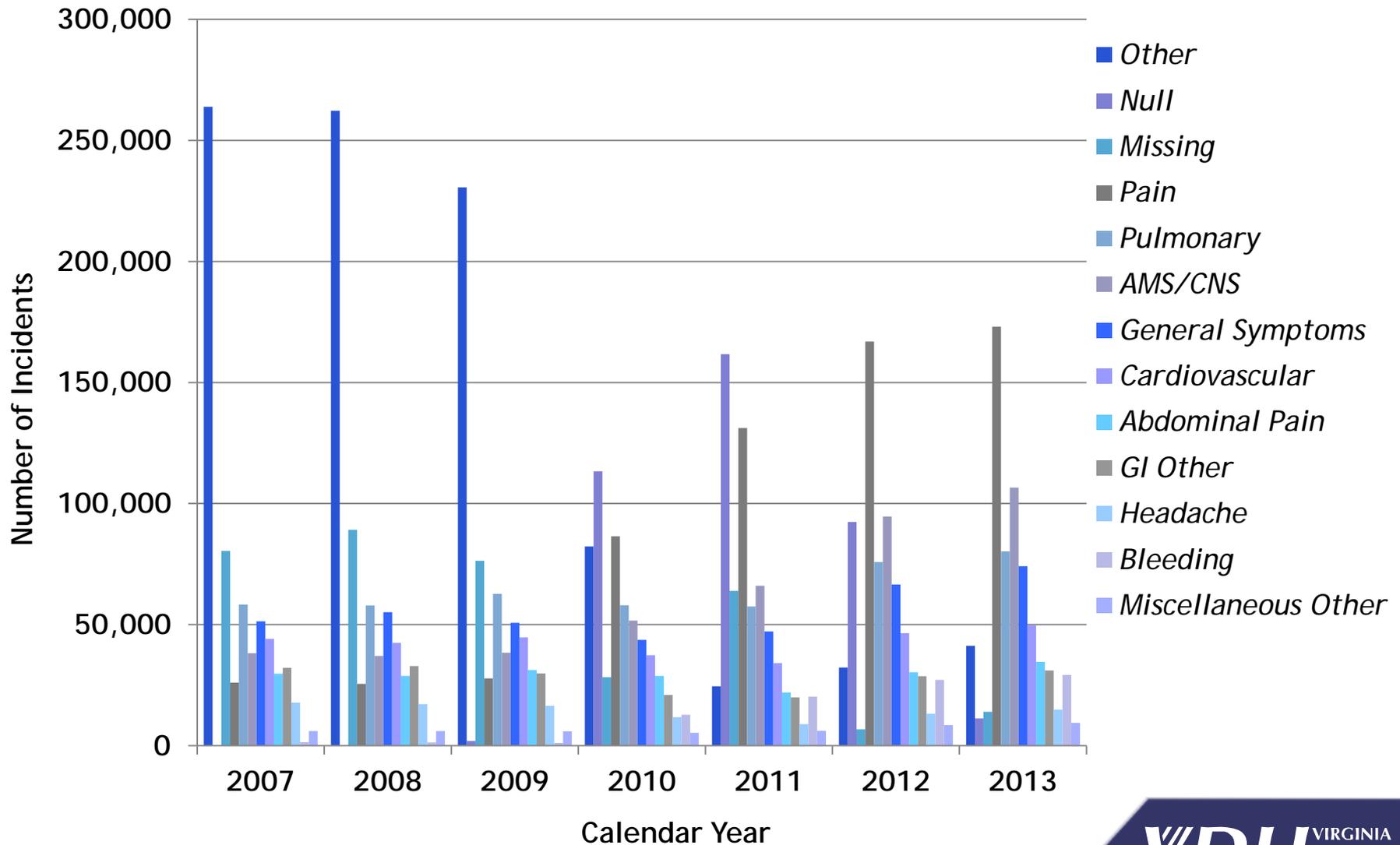
# Figure 10. Patient Ethnicity by Incident



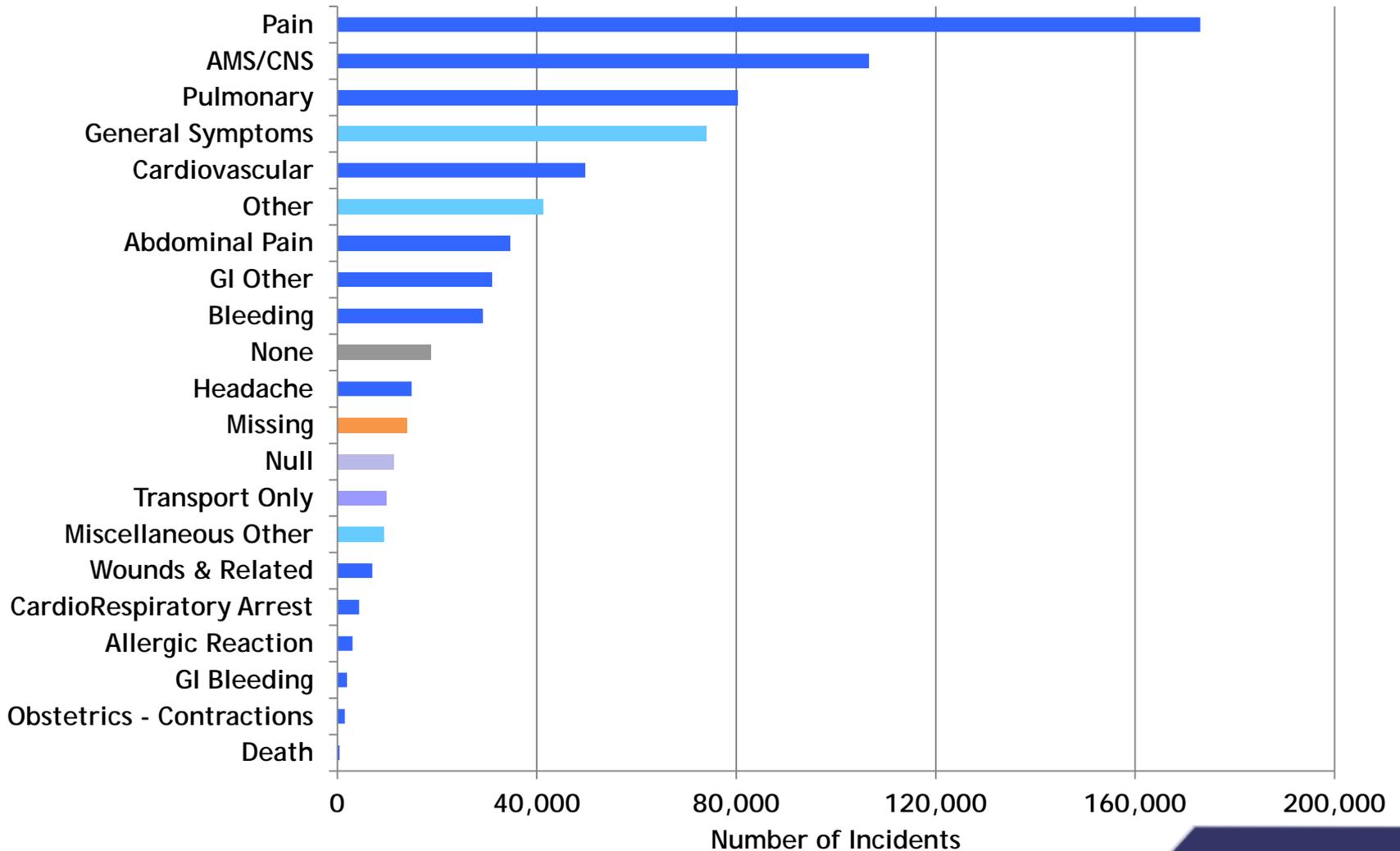
# Figure 11. Patient Age by Incident



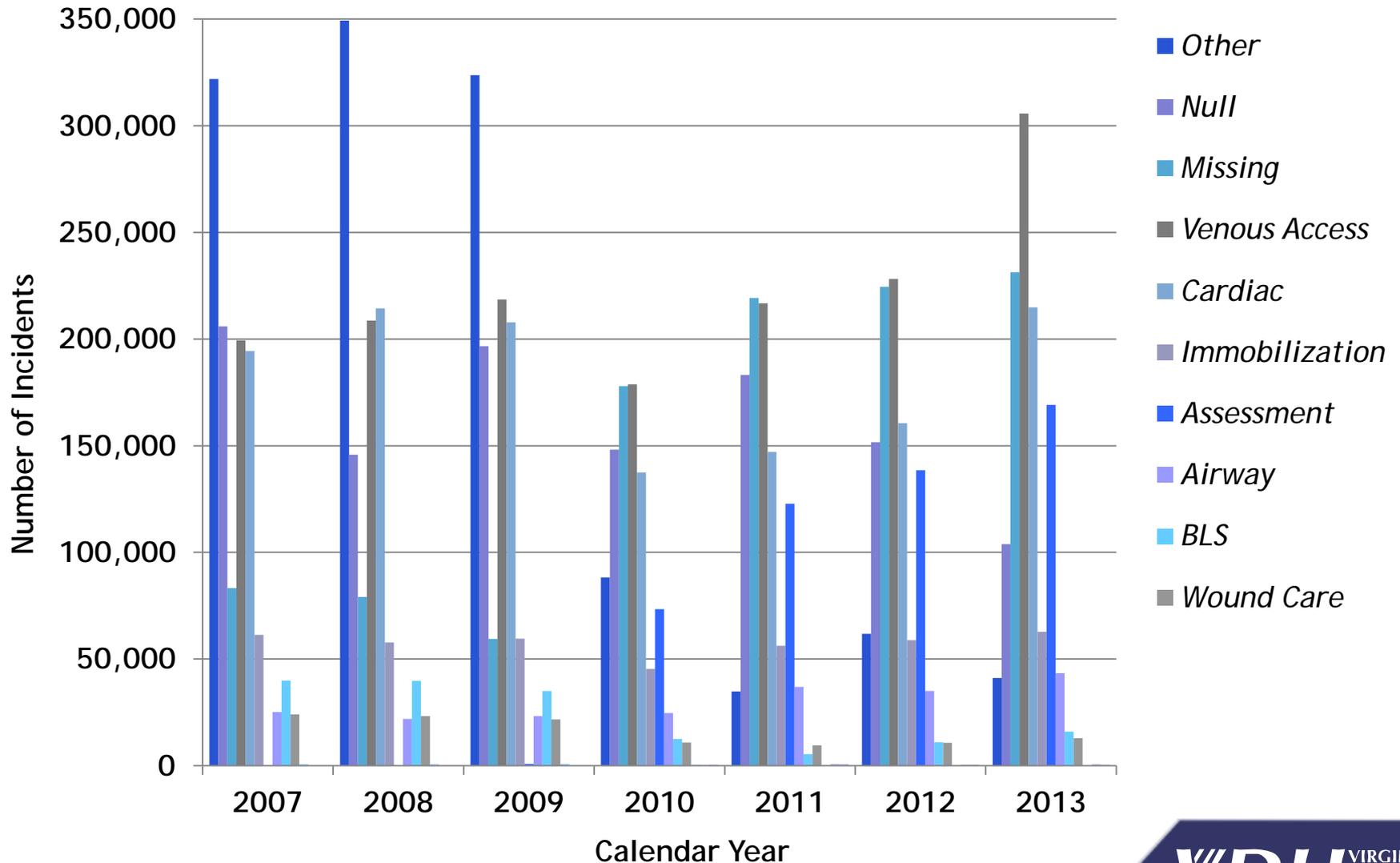
# Figure 12a. Primary Symptoms - Trend



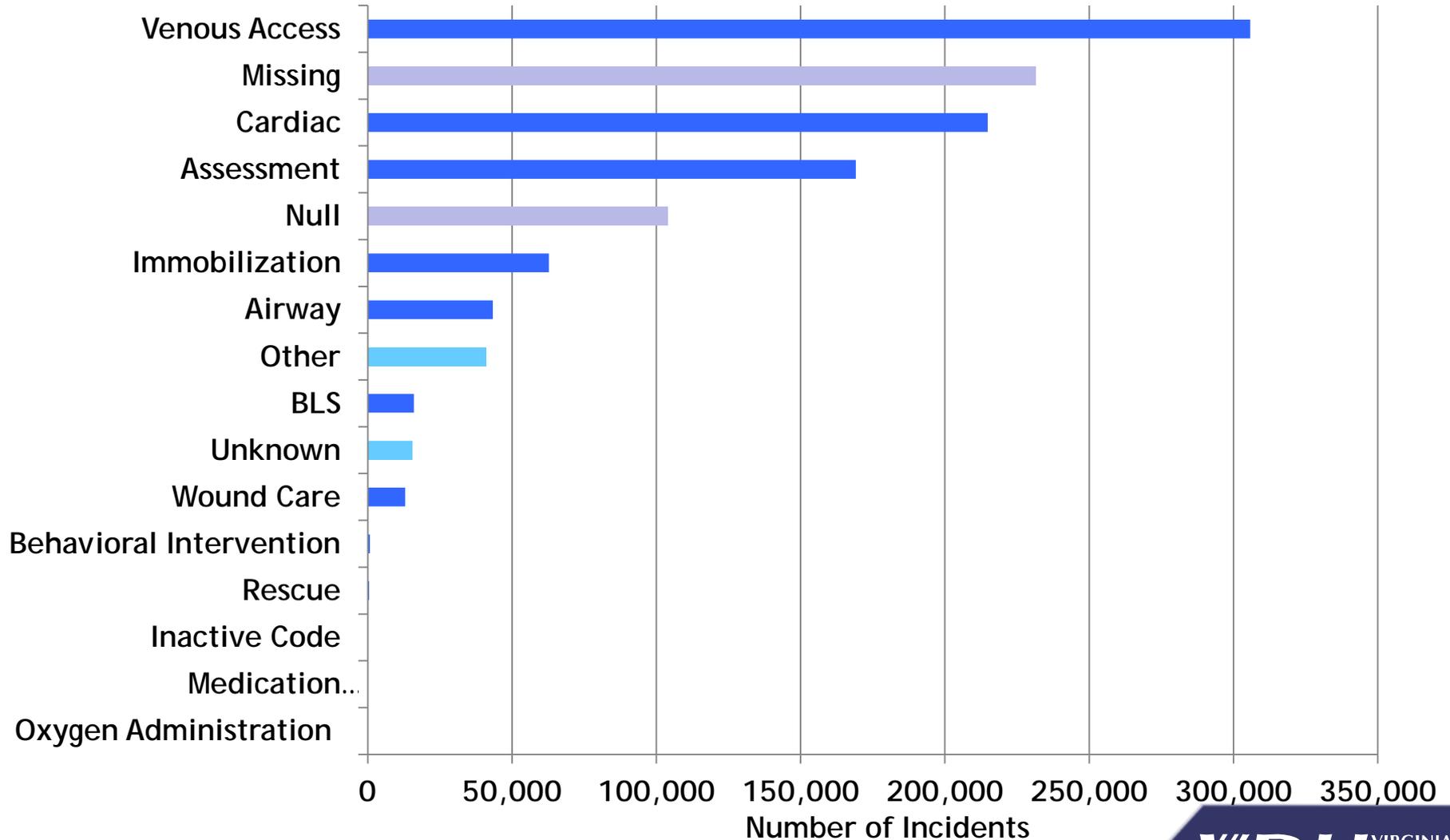
# Figure 12b. Primary Symptoms - 2013



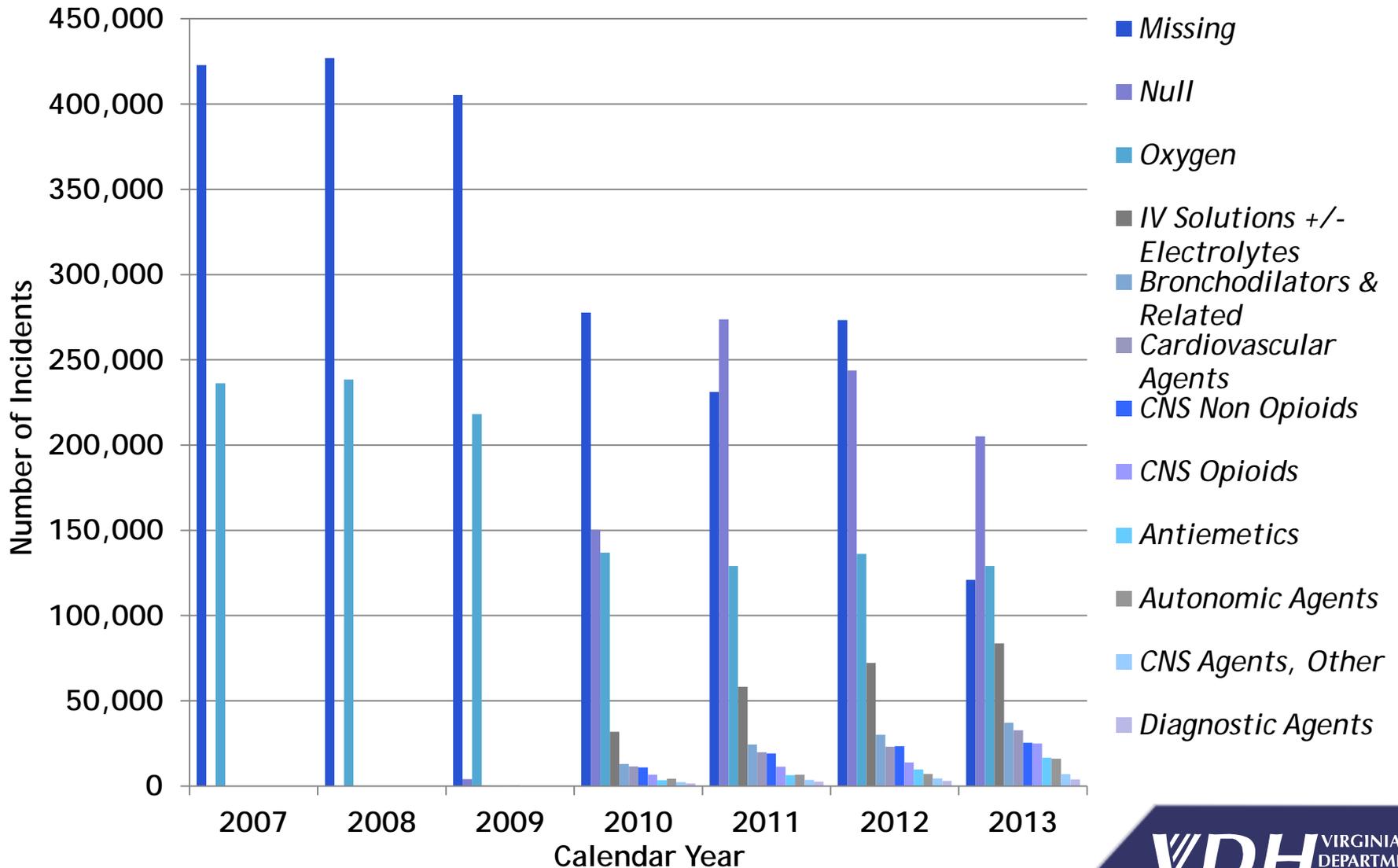
# Figure 13a. Procedures Performed - Trend



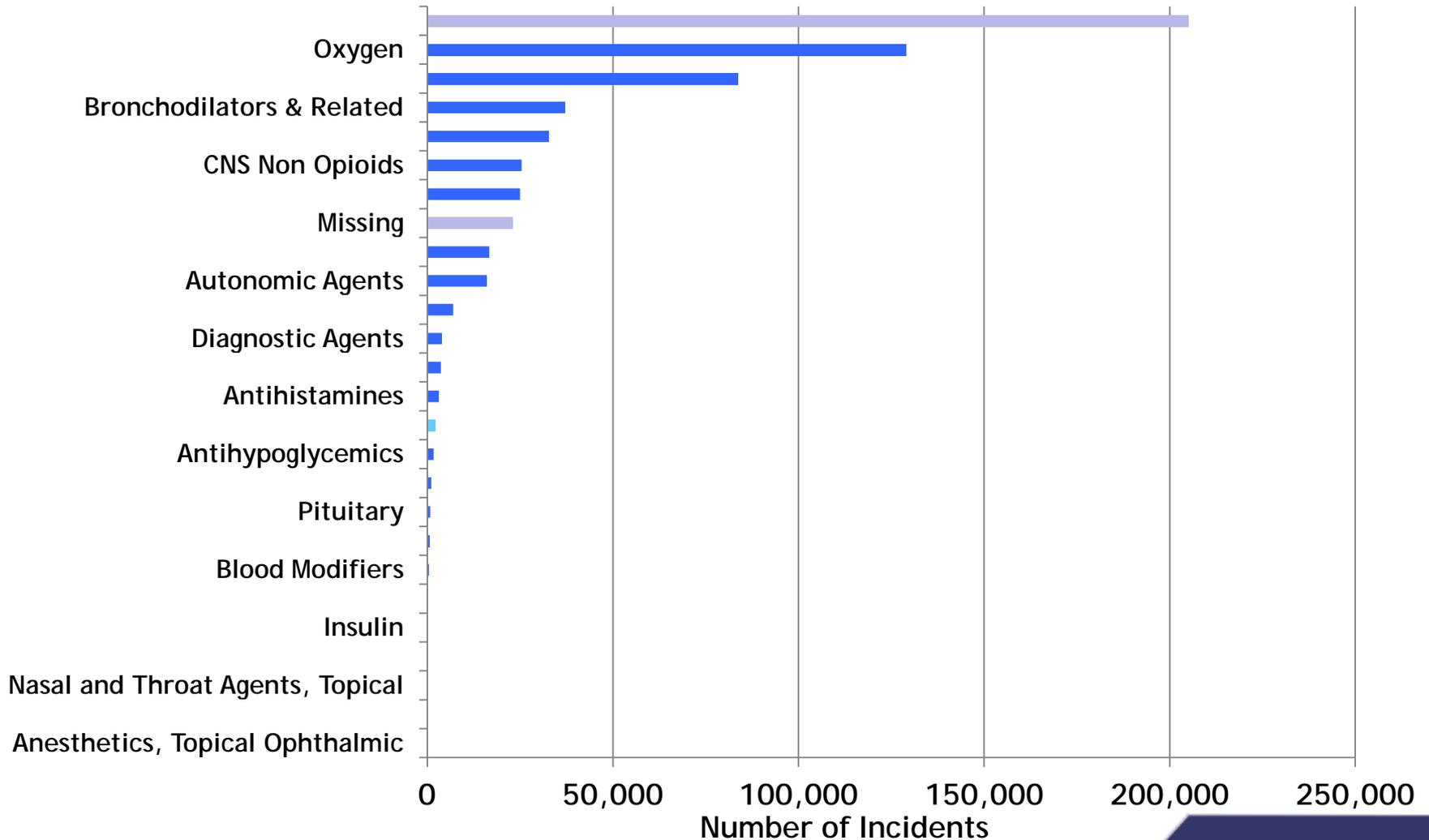
# Figure 13b. Procedures Performed - 2013



# Figure 14a. Medications Given - Trend



# Figure 14b. Medications Given - 2013



Translate the following expression:

$\sqrt{-1}$

$2^3$

$\Sigma$

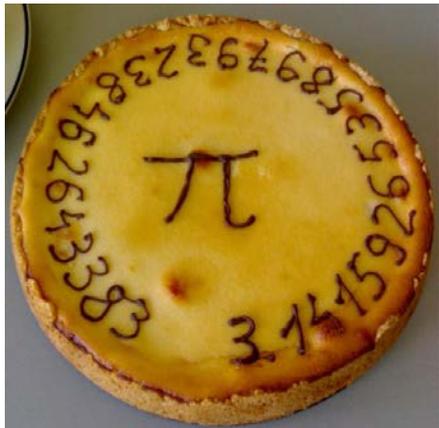
$\pi$

i

8

Sum

pi



$$41.8 = 3.14$$

# Questions?



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