

Linking Emergency Medical Services and Emergency Department Data for Heat-Related Illness Surveillance, Virginia, 2024-2025



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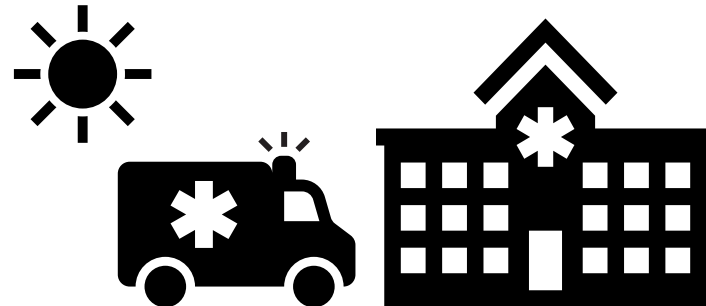
Background: What story do heat data tell?

- Heat-related illness (HRI)
 - Ranges from mild heat stress to severe heat stroke
 - A leading cause of weather-related morbidity and death

- Timely HRI data:

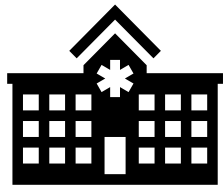
Emergency
medical services
(EMS) encounters

Emergency
department
(ED) visits



Virginia Dashboard:

HRI Emergency Department and Urgent Care Visits



<https://www.vdh.virginia.gov/surveillance-and-investigation/syndromic-surveillance/hri-surveillance/>

Heat-Related Illness Surveillance

This dashboard is updated on weekdays (Monday - Friday) in July and August, and weekly on Mondays in May, June, and September.

Heat-Related Illness (HRI) in Virginia

Heat-related illness (HRI) ranging from mild (heat cramps) to severe (heat stroke, death) occurs when the body is unable to properly cool itself. This dashboard includes emergency department and urgent care visits for heat-related illness from May - September for years 2015 - 2025.

Use the filters below to view data for a specific year or health region and to switch between counts or rates. By default, the second graph displays daily HRI visit counts. Select "Rates per 10,000 visits" to view monthly HRI rates compared to the combined rate for all available years.

Use the [VDH Geography Reference Guide](#) for a list of cities and counties in each health region.

Filters

Select Year
(Affects All Graphs and Map)

2025

Select Patient Geography
(Affects All Graphs and Map)

All Visits

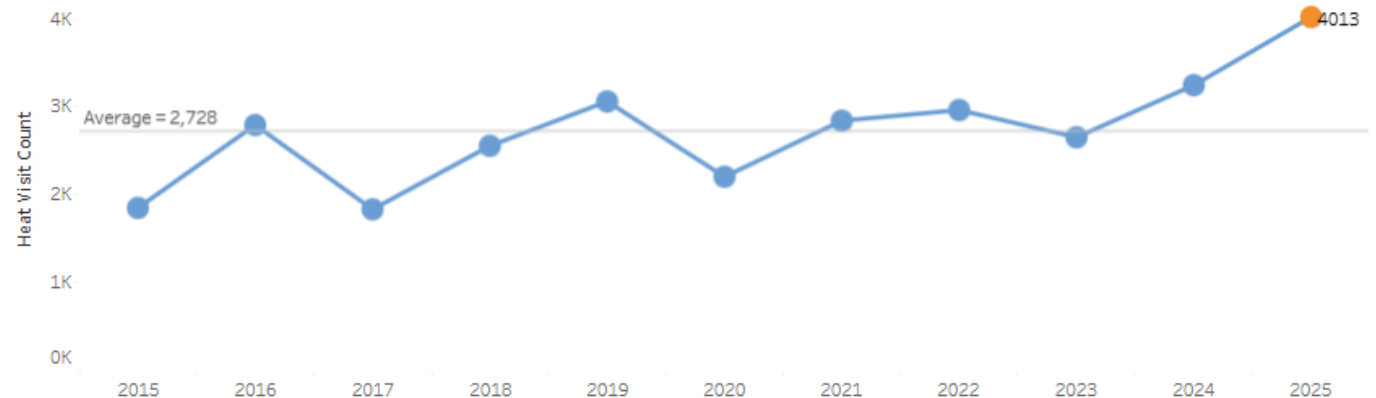
Select Counts or Rates
(Affects All Graphs and Map)

☒ Counts

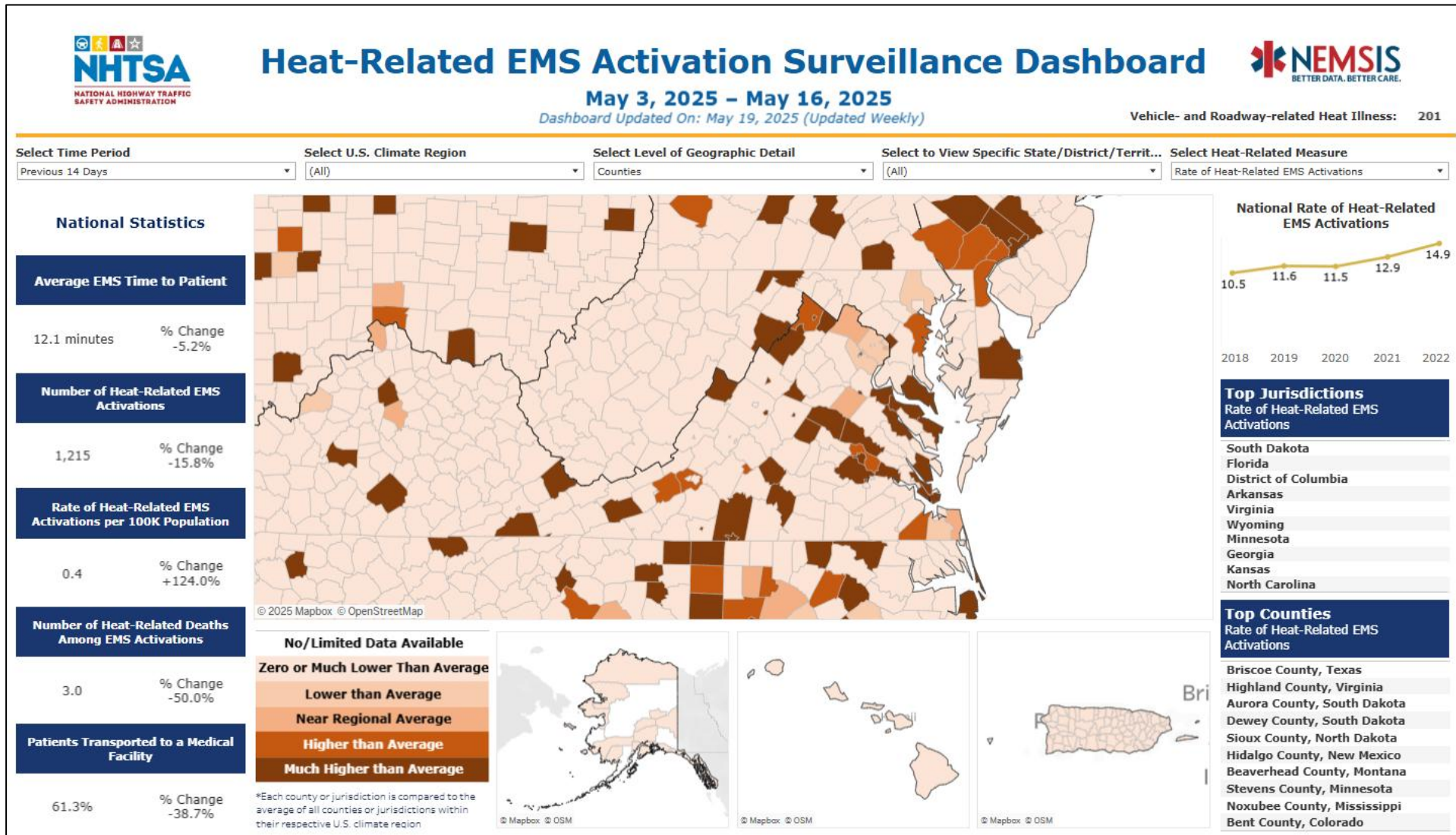
☐ Rates per 10,000 visits

Annual Heat-Related Illness

Visit Counts in Virginia, May - September



National Dashboard: EMS HRI Calls



Virginia Open Data Portal:

EMS HRI datasets by

1. Race
2. Age
3. Gender
4. Locality



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OEMS 4

VDH 4

EMS 3

HRI 3

Locality 2

FIPS 1

Gender 1

Heat Related Illness 1

heat related illnes... 1

Show More Tags

Formats

CSV 4

PDF 4

EMS HRI

4 datasets found for "EMS HRI"

Order by: Relevance

EMS Heat-related Illness Incidents by Race and Year

This dataset contains Emergency Medical Services (EMS) information for reported emergency response incidents in Virginia that involve heat-related illness (HRI), as defined...

674 total views

CSV PDF

EMS Heat-related Illness Incidents by Locality and Month/Year

This dataset contains Emergency Medical Services (EMS) information for reported emergency response incidents in Virginia that involve heat-related illness (HRI), as defined...

553 total views

CSV PDF

EMS Heat-related Illness Incidents by Age and Year

This dataset contains Emergency Medical Services (EMS) information for reported emergency response incidents in Virginia that involve heat-related illness (HRI), as defined...

692 total views

CSV PDF

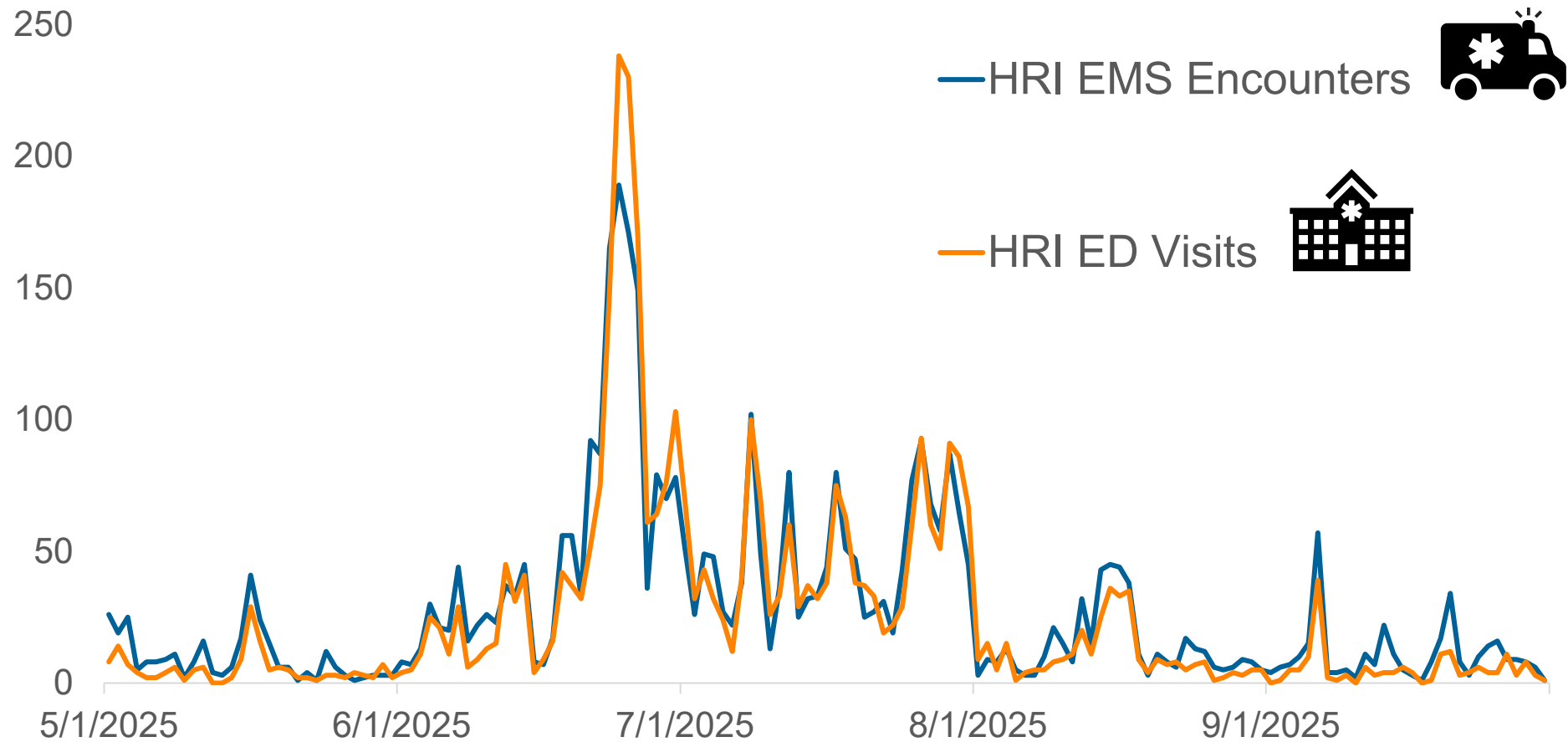
EMS Heat-related Illness Incidents by Gender and Year

This dataset contains Emergency Medical Services (EMS) information for reported emergency response incidents in Virginia that involve heat-related illness (HRI), as defined...

763 total views

CSV PDF

How do Virginia EMS and ED HRI data overlap?



Objective: Link EMS and ED HRI data to better understand HRI burden in Virginia

Research Aims

- 1. Develop and evaluate an EMS–ED record linkage protocol**
 - Assess linkage accuracy
 - Compare deterministic (exact) matching with probabilistic (fuzzy)
 - Examine linkage rates across case definition criteria
- 2. Use linked data to identify overlapping and unique HRI events**
- 3. Assess insights gained from linking EMS and ED data**

Methodology

- **Study Design:** retrospective observational linkage study
- **Study Period:** May–September, 2024–2025
- **Data Sources and Case Definitions:**

Virginia Prehospital Information Bridge EMS encounters

VDH-OEMS HRI definition:

- Key terms in Patient Complaint or Patient Care Narrative; OR
- Provider Impression codes T67 or X30 (exposure to excessive natural heat); OR
- Heat-related protocols



Virginia ESSENCE ED visits

National ESSENCE HRI v2 definition:

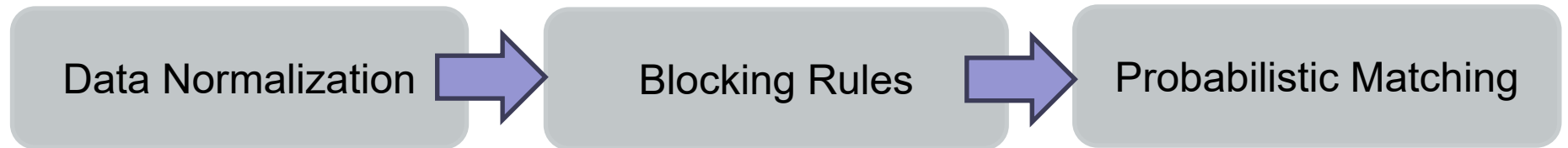
- Key terms in Chief Complaint or Discharge Diagnosis Description; OR
- Diagnosis code T67 (effects of heat and light)



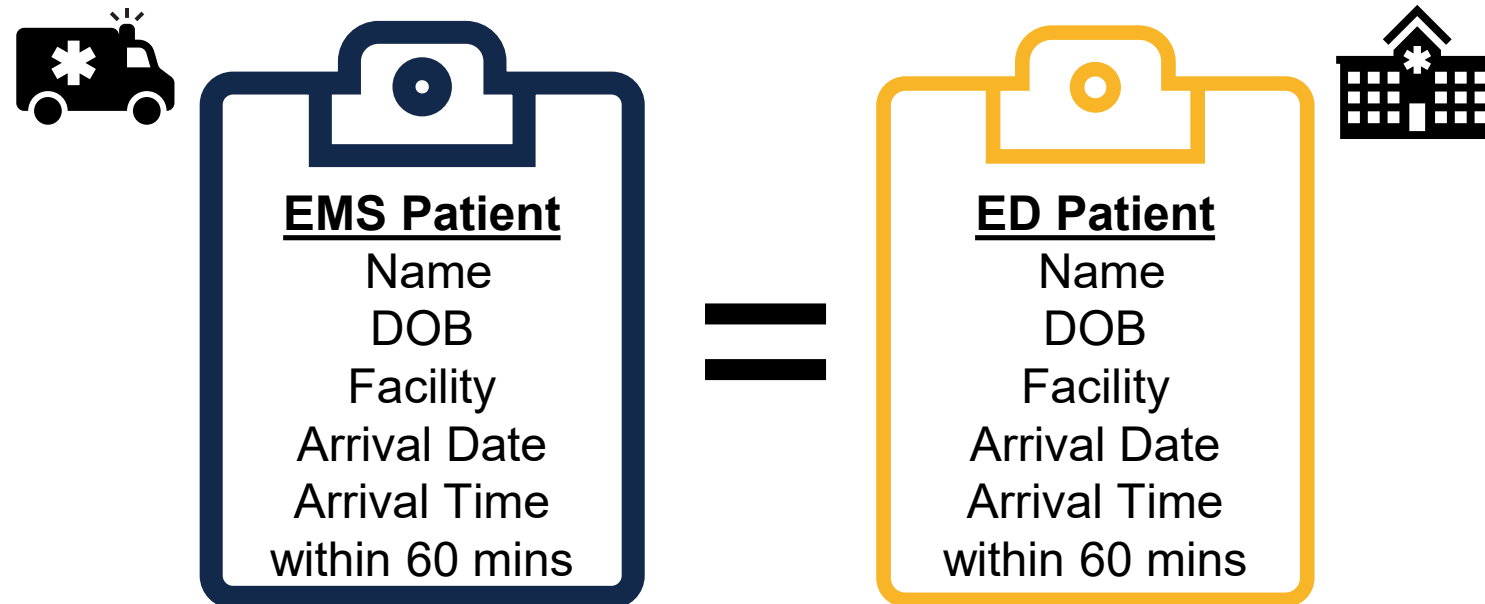
Linkage Protocol

- Created probabilistic record linkage protocol using *Splink* Python package

- Key steps:

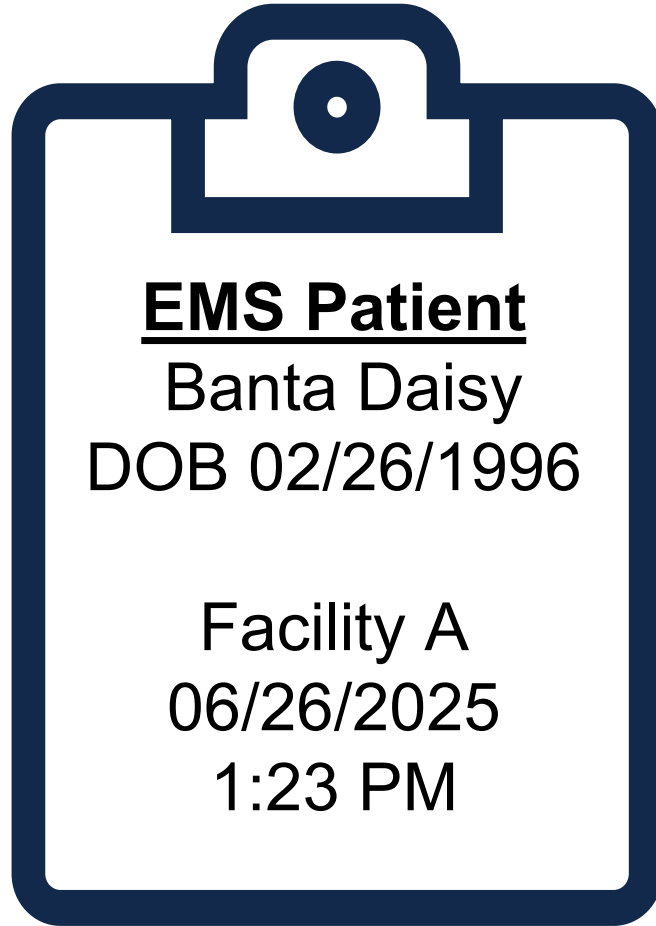


- Linkage results classified as deterministic (exact) or probabilistic (fuzzy) match:

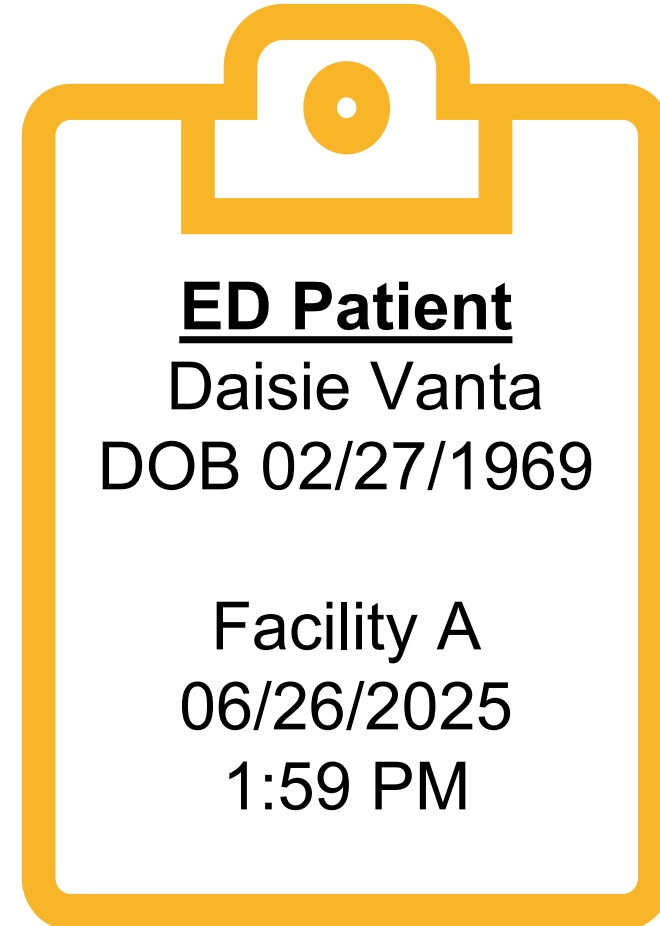


Exact Match

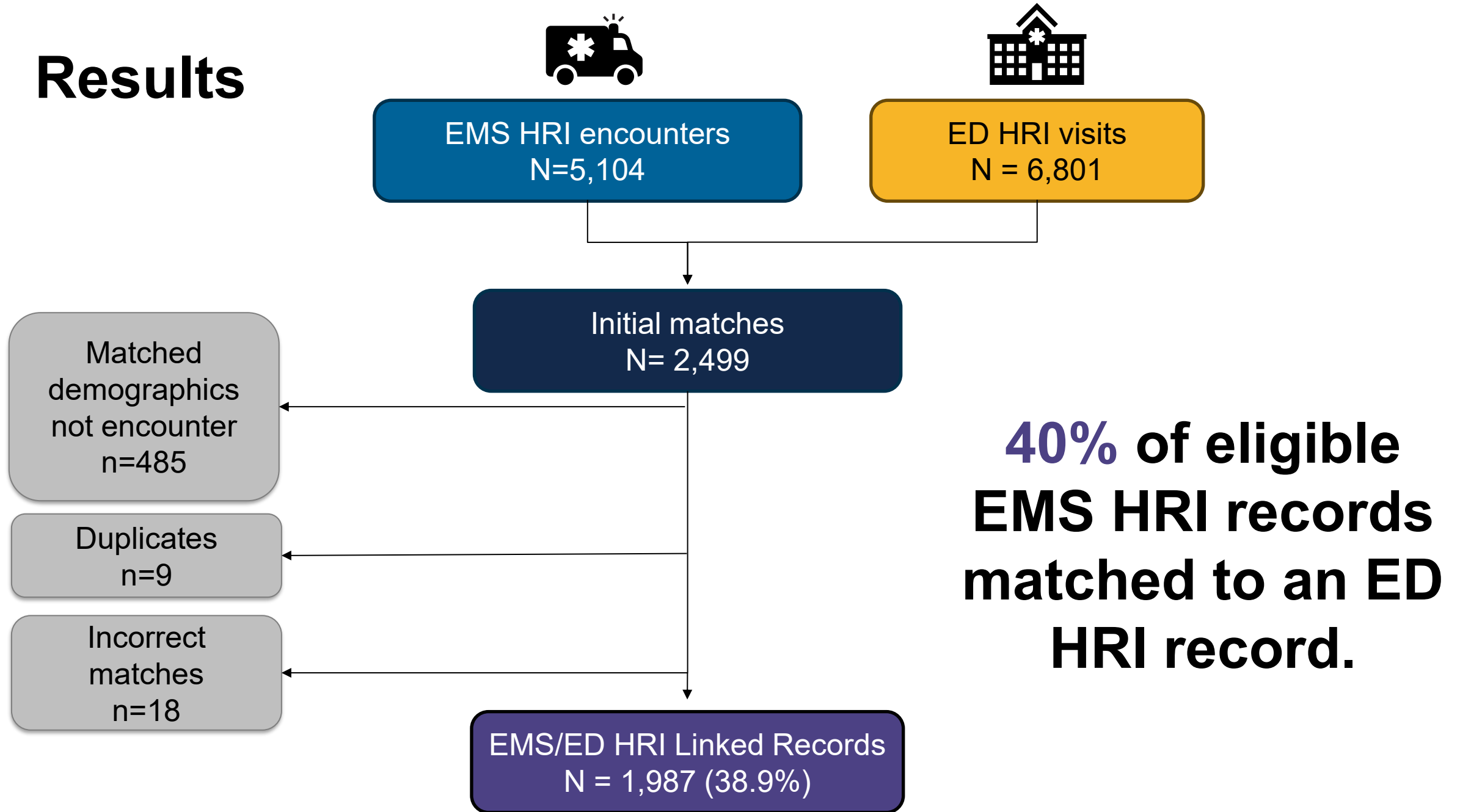
Fuzzy Match



=

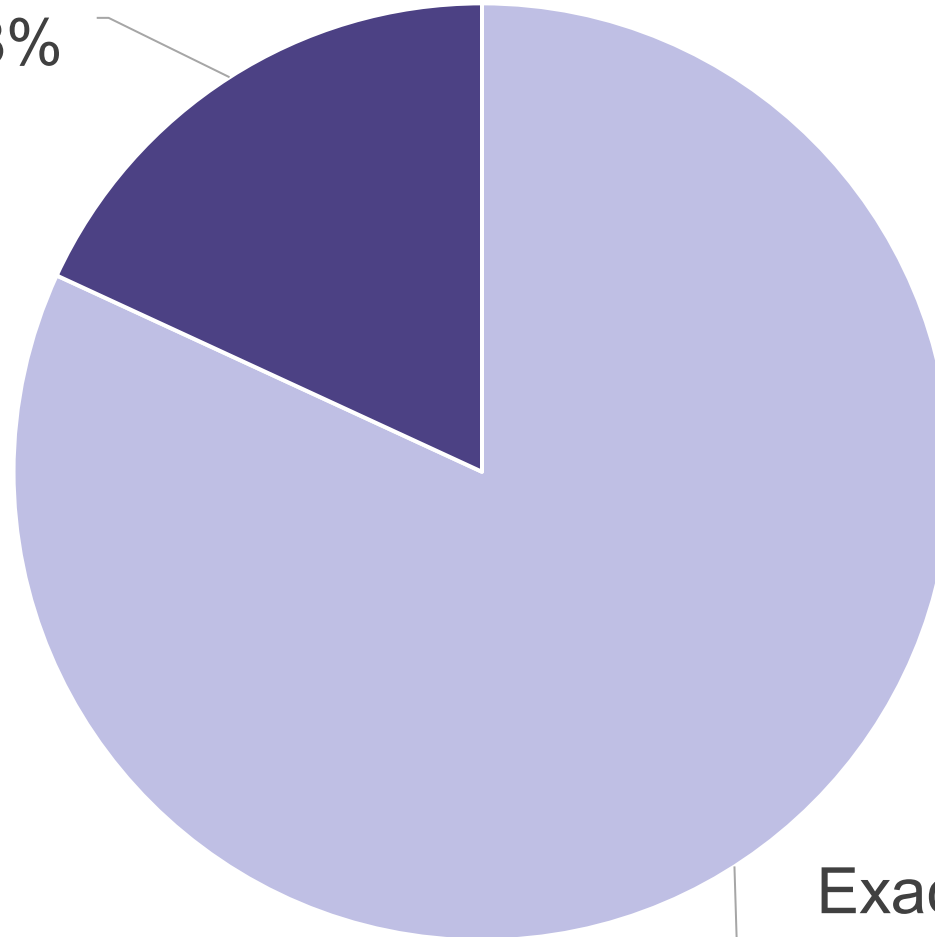


Results



Of 1,987 linked records, **18.1%** were fuzzy matches.

Fuzzy Matches,
360, 18%

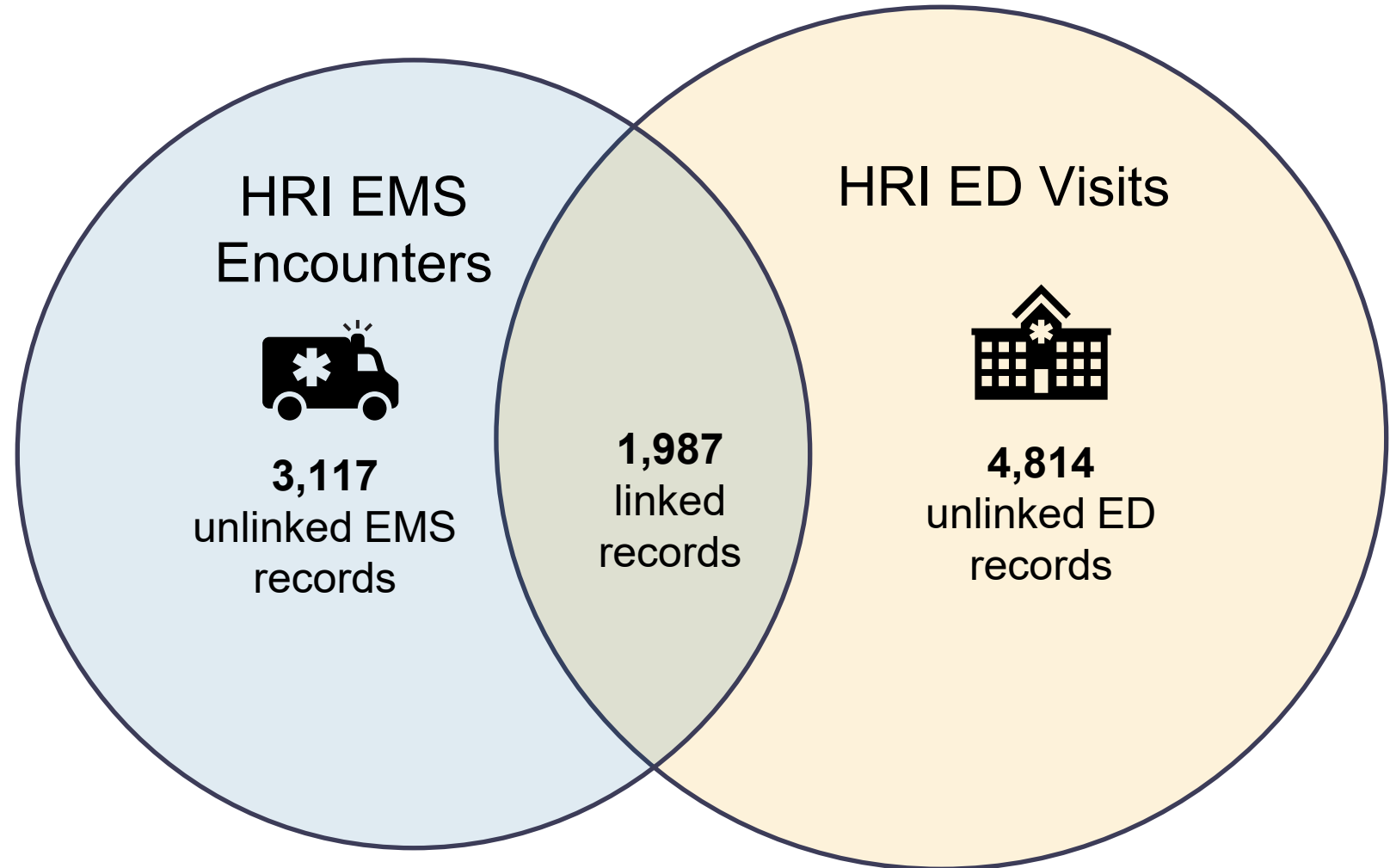


Exact Matches,
1627, 82%

Fuzzy Example:
Banta Daisy
DOB 02/26/1996
=
Daisie Vanta
DOB 02/27/1969

HRI burden is likely higher than shown by either dataset alone.

Up to a **45% higher burden** by incorporating
unlinked EMS
records.



Linkage rates varied by EMS case definition inclusion criteria.

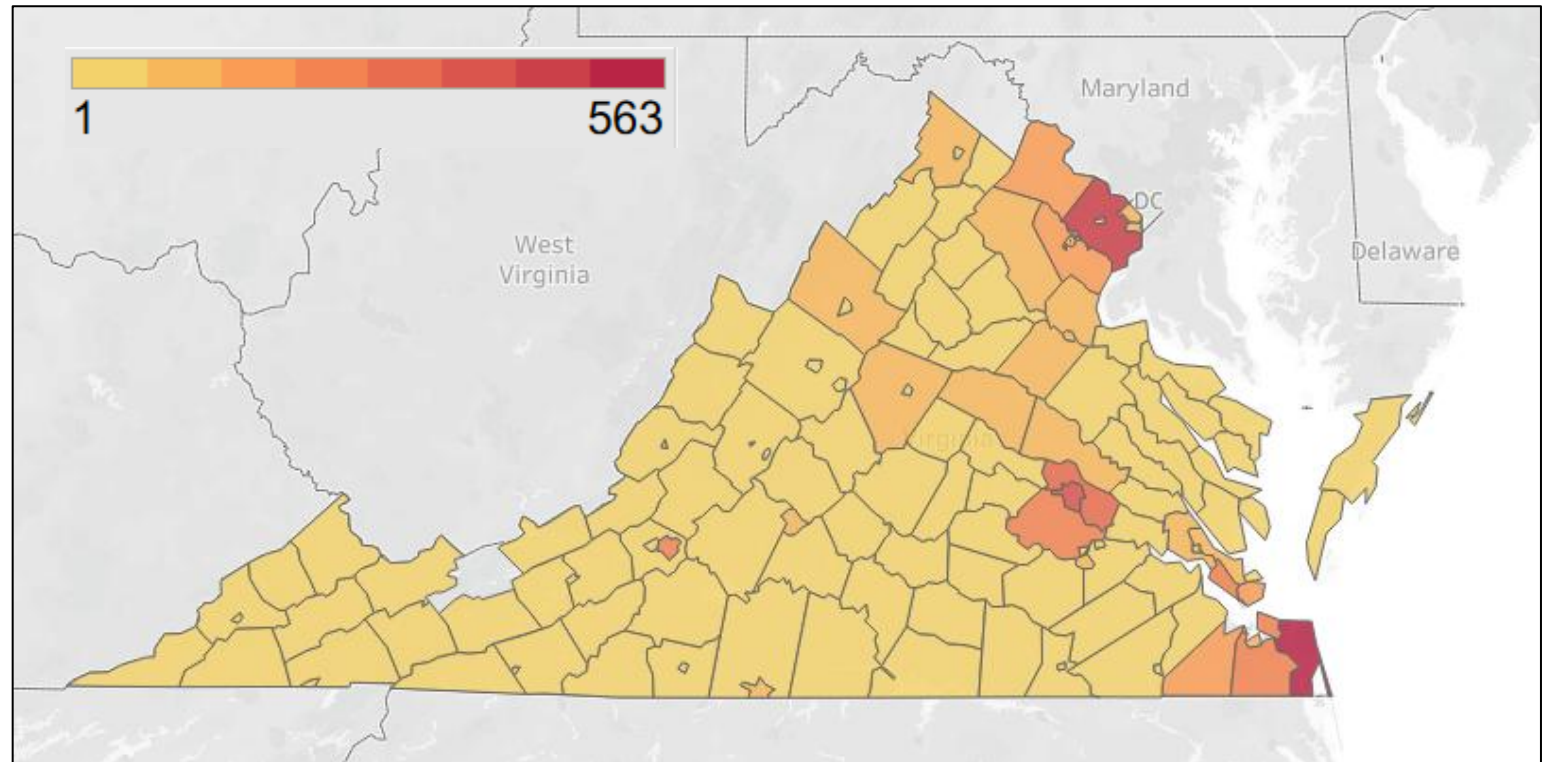
EMS Inclusion Criteria	Linkage Rate of Eligible EMS Records
Patient Complaint key terms	67.7% linked
Provider Primary Impression	58.7%
Heat Protocols	52.1%
Provider Secondary Impression	33.4%
Patient Care Narrative key terms	36.9%

Two-thirds of linked HRI incidents (1,275; **64%**) occurred outside the patient's residential ZIP code.



Median (IQR) Distance:
12.4 km (5.0–35.3 km)

Virginia EMS HRI Encounters by City/County, May–September 2024–2025



N=7,862

Next Steps

1. Explore whether unmatched records did not meet HRI case definitions
 - Link unmatched EMS HRI encounters with **all** ED visits (not just HRI)
 - Link unmatched ED HRI visits with **all** EMS encounters (not just HRI)
2. Identify super-utilizers of emergency services for HRI
3. Explore free-text fields in linked records to identify risk factors for HRI
4. Apply probabilistic matching protocol to other topic areas (e.g., overdose)

Conclusions

Developed
probabilistic
EMS–ED
linkage
applicable to
other public
health topics

Heat illness
burden likely
higher than
shown by
EMS or ED
data alone

Linking
datasets
reveals new
insights into
where and
how heat
illness occurs

Thank you! Questions?

