# ANOMOLOUS PRESCRIBING DETECTION

W205 SPRING 2016 PROJECT

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# RESEARCH PROBLEM



**Prescription drugs** accounted for about **9 percent** of national health expenditure in the U.S. in 2013.

A major concern is that some prescribing patterns in health care lead to **unnecessary cost** and **health outcomes burdens**.

# SOLUTION



CMS has recently **changed its position** for release of physician-level prescribing data for public use.

Using this **physician-level prescription information** in concert with the **NPPES Physician Registry,** we are finding unexpected prescribing patterns among physicians, based on prescriptions and costs per person.

# DATA SETS



- **CMS Part D Prescriber PUF, 2013**
  - Prescriptions, units, days supply, and costs by physician and drug
  - 2.7GB; 23M lines
- **CMS Part D Prescriber National Summary**
  - Prescriptions, units, and costs by drug aggregated to a national level
  - 3K lines
- **National Plan and Provider Enumeration System (NPPES)**
  - Office location and specialty (credential) by physician
  - 5.7GB; 4.8M lines

# ETL / CLEANUP



- **CMS Part D Prescriber PUF, 2013**
  - Missing values: requires imputation
  - Non-numeric values in numeric fields
- **CMS Part D Prescriber National Summary**
  - Excel: requires conversion to CSV
- **National Plan and Provider Enumeration System (NPPES)**
  - Over 200 fields: requires extraction of key attributes

# ETL / CLEANUP



**Example 1: A Florida physician is Missing Number of Beneficiaries, but has values Number of Claims and Claim Cost.**

| NPI | Drug | N Bene | N Claims | S Cost | State |
|---|---|---|---|---|---|
| **123456** | XYLOCAINE | | 15 | 120.37 | FL |

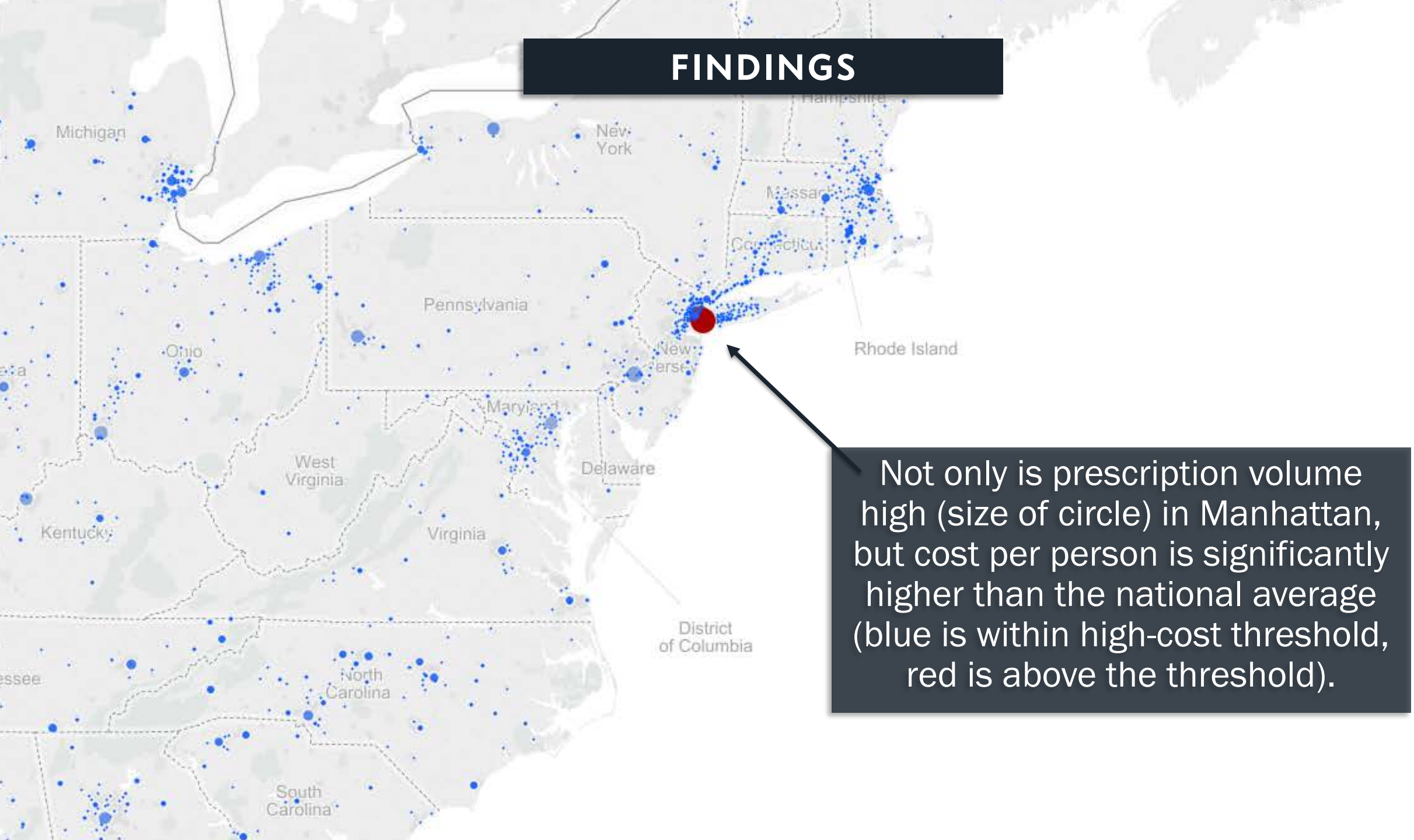
**Step 1: Retrieve avg. claims per beneficiary from physician's state summary.**

| State | Drug | Cl./Bene |
|---|---|---|
| **FL** | XYLOCAINE | 1.06897 |

**Step 2: Impute physician's prescribed beneficiaries.**

| NPI | Drug | N Bene | N Claims | S Cost | State |
|---|---|---|---|---|---|
| **123456** | XYLOCAINE | 16 | 15 | 120.37 | FL |

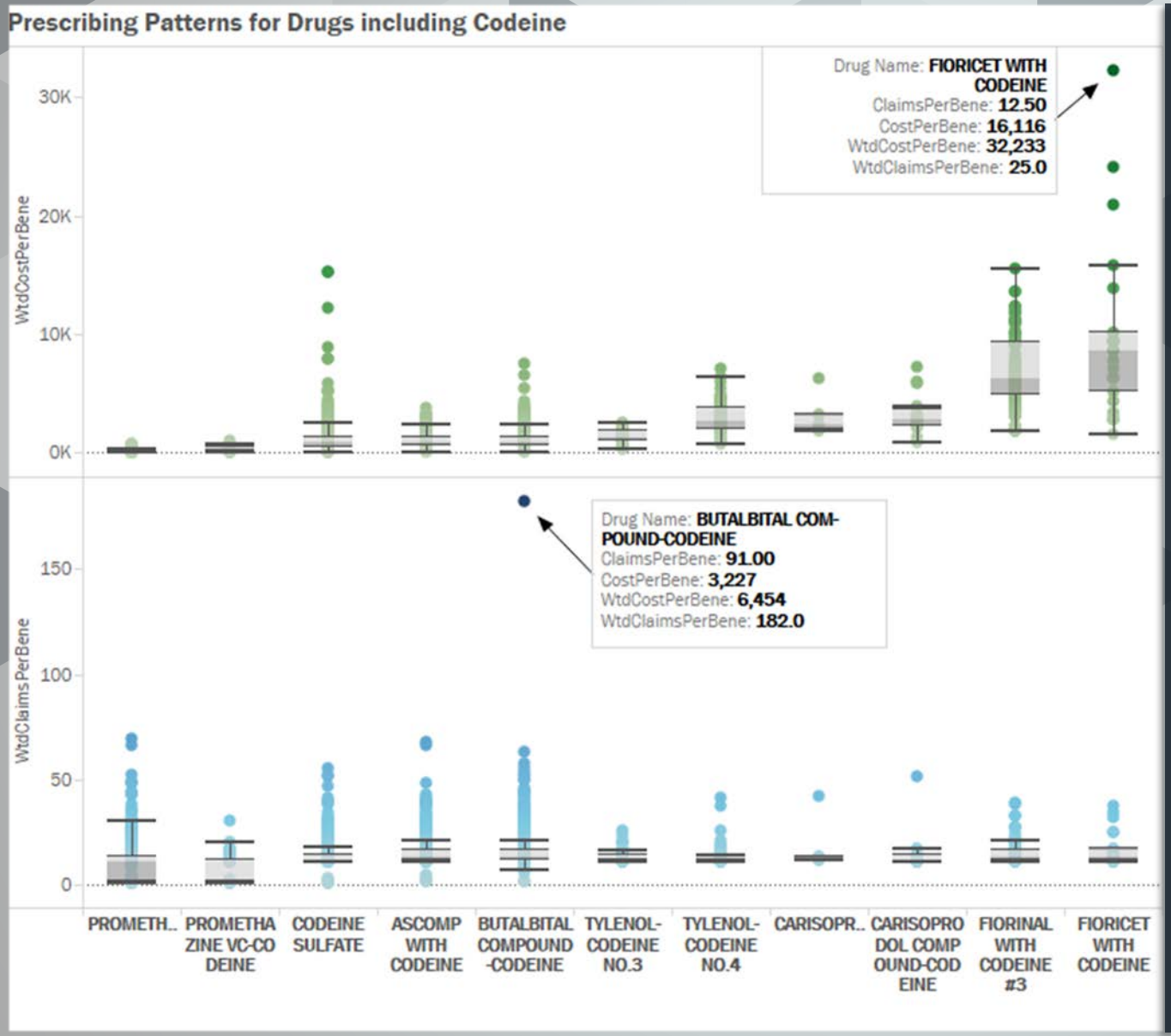
# FINDINGS




Not only is prescription volume high (size of circle) in Manhattan, but cost per person is significantly higher than the national average (blue is within high-cost threshold, red is above the threshold).

# FINDINGS






**Each dot is a physician in this data set.**

Some physicians' prescriptions have a high cost per person (but few people).

Others have a large number of prescriptions per person (but not necessarily higher cost).

# FINDINGS




This is an aggregate view of specialties for Oxycontin prescriptions.

**High and left:** many prescriptions to few people (per doc).

**Low and right:** few prescriptions to many people (per doc).

**Colored red**: very high cost per person.

A handful of medical examiners and radiologists are prescribing to relatively many people.

# ROAD MAP



- **Larger data volume and velocity**
  - Implement system as a stream reader.
  - Recompute specialty aggregations as data cubes.

- **Aggregate drugs to therapeutic classes**
  - The drugs in the data set are very specific.
  - Grouping similar drugs together could help establish patterns.

# APPENDIX



Using a graph database, we could find relationships between drugs if we connect them by the diseases/symptoms they treat.