



# Analysis of Fatal Train-Pedestrian Collisions in Metropolitan Chicago 2004-2012

Ian Savage

## Data Set . . .

- 338 fatalities in collisions between moving trains and non-motorized persons (97% pedestrian, 3% bicycle)
- No on-train fatalities in these incidents
- Nine-year period 2004-2012
- 6-county Chicago Metropolitan region
- “Railroads” only, does not include Chicago Transit Authority rail rapid transit service

# Illinois Commerce Commission data

- More expansive and inclusive than the Federal Railroad Administration data
- Includes data on apparent suicides (FRA only starting collecting these data in June 2011, but details not for public dissemination)
- Includes fatalities that do not appear in the federal database (4% at stations and crossings, 26% of trespassers)

# Three Categories . . .

338 non-motorized deaths in 334 separate incidents

- Apparent suicides (161 deaths, 47%)
- Non-suicides at stations and crossings (20 at stations, 50 at crossings, 70 total, 21%)
- Non-suicides not at stations or crossings – “trespassers” (107 deaths, 32%)

## Annual Risks per Million . . .

|                           | United States<br>(2012-13) | Metropolitan<br>Chicago<br>(2004-12) |
|---------------------------|----------------------------|--------------------------------------|
| Stations and<br>Crossings | 0.26                       | 0.94                                 |
| Trespassers               | 1.46                       | 1.43                                 |
| Apparent<br>Suicides      | 0.74                       | 2.15                                 |

# 84% of all Chicago Railroad Fatalities ...

## Pedestrians

|                    |            |
|--------------------|------------|
| Crossings/Stations | 70         |
| Trespassers        | 107        |
| Apparent Suicides  | <u>161</u> |
|                    | 338        |

## Other Fatalities

|                      |          |
|----------------------|----------|
| Vehicle Occupants    | 39       |
| Vehicle Suicides     | 2        |
| Employees            | 6        |
| Contractors          | 8        |
| Passengers on Trains | 4        |
| Misc. other          | <u>5</u> |
|                      | 64       |

Ratio of 8 pedestrians to  
each vehicle death

A pedestrian death every  
10 days

# Demographic Analysis

# Fatalities by Gender . . .

- Gender known in 90% of cases

|                        |          |
|------------------------|----------|
| Stations and crossings | 57% male |
| Trespassers            | 80% male |
| Apparent suicides      | 73% male |

- Comparable with national studies
- Suicide by train more prevalent for women relative to suicides by all methods



# Annual Risk per Million by Age . . .

|       | Stations & Crossings | Trespassers | Apparent Suicides |
|-------|----------------------|-------------|-------------------|
| 0-9   | 0.1                  | 0.1         |                   |
| 10-19 | 0.8                  | 1.1         | 3.9 (13-19)       |
| 20-29 | 1.5                  | 1.5         | 2.7               |
| 30-39 | 1.1                  | 2.4         | 2.2               |
| 40-49 | 1.2                  | 2.7         | 3.2               |
| 50-59 | 0.9                  | 1.5         | 2.6               |
| 60-69 | 0.7                  | 0.8         | 2.5               |
| 70-79 | 1.2                  | 1.1         | 1.4               |
| 80+   | 1.3                  | 0           | 0                 |

# Temporal Analysis

# Fatalities by Time of Year . . .

- Fatalities are higher in the warmer months
- Trespassing deaths peak in April to July, and in November
- 27% of station/crossing deaths occurred in the month of June
- The peak months for apparent suicides are March to October, with November through February having lower counts

# Fatalities by Day of Week . . .

- Surprising consistency across the week
- Trespassing fatalities do not increase on the weekend (of course, there are less trains)
- Perhaps some increase in apparent suicides on a Friday

# Fatalities by Time of Day . . .

- 56% of station/crossing fatalities occurred in the commute hours of 7am-9am and 3pm-7pm
- Trespassing fatalities are equally spread across all hours of day and night
- Apparent suicides are distributed across the day with hotspots in the 1am, 7am, noon, 5pm and 6pm hours

# Clustering of Apparent Suicides?

# Highly-Publicized Suicide May 7, 2010

| 18 weeks | Jan 1 – May 6 | May 8 – Sept 10 |
|----------|---------------|-----------------|
| 2004     | 4             | 8               |
| 2005     | 6             | 5               |
| 2006     | 8             | 5               |
| 2007     | 4             | 6               |
| 2008     | 6             | 8               |
| 2009     | 11            | 2               |
| 2010     | 5             |                 |
| 2011     | 5             | 4               |
| 2012     | 8             | 9               |

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| 2009     | 11            | 2               |
| 2010     | 5             | <b>13</b>       |
| 2011     | 5             | 4               |
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# Highly-Publicized Suicide May 7, 2010

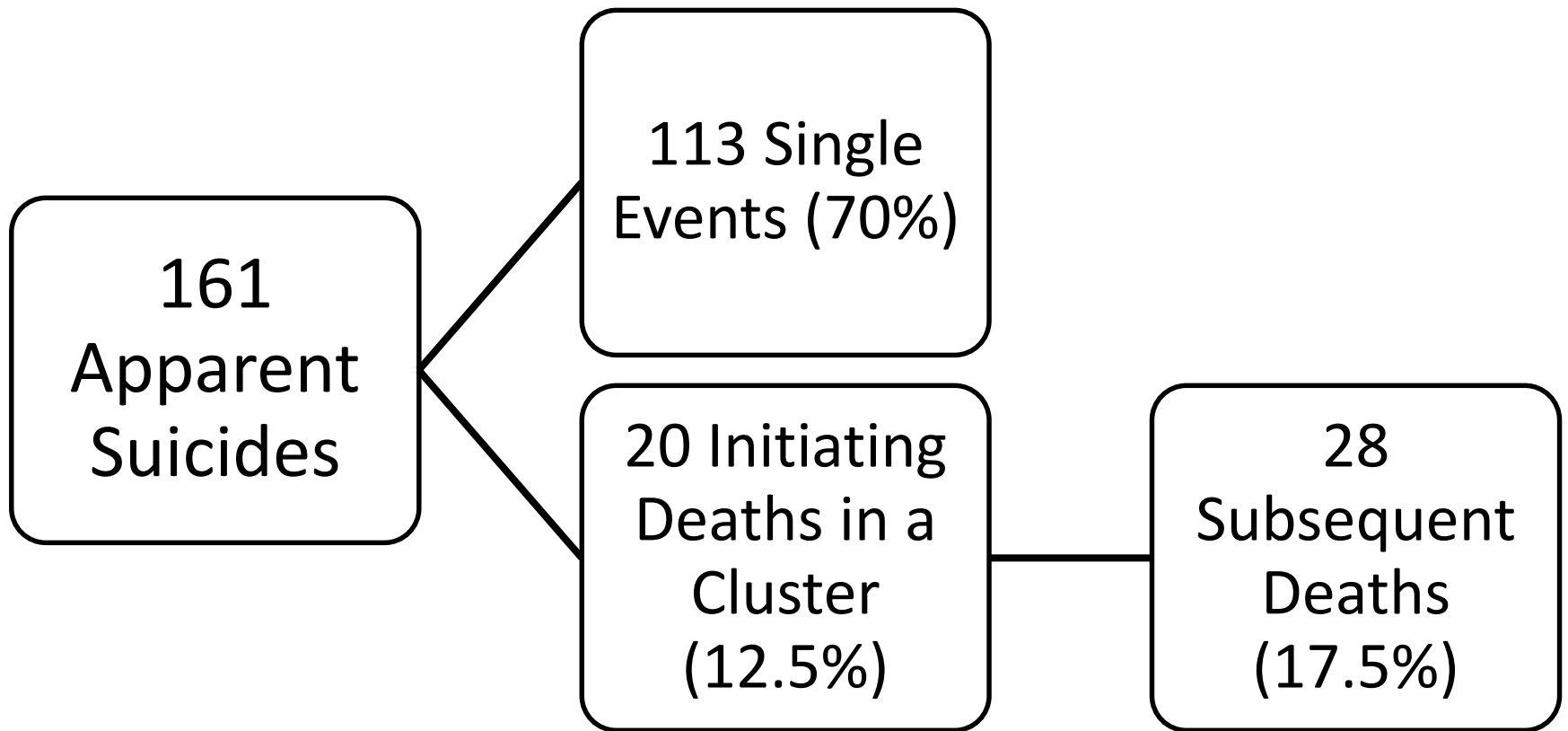
| 18 weeks | Jan 1 – May 6 | May 8 – Sept 10 |
|----------|---------------|-----------------|
|          |               | 8               |
|          |               | 5               |
|          |               | 5               |
|          |               | 6               |
| 2007     | 7             | 8               |
| 2008     | 6             | 8               |
| 2009     | 11            | 2               |
| 2010     | 5             | <b>13</b>       |
| 2011     | 5             | 4               |
| 2012     | 8             | 9               |

95% above average.  
Poisson probability  
of 13 or more = 1 in 50

# Clustering of Apparent Suicides . . .

- Suicides by rail in a municipality are rare:
  - annual rate in suburban areas is 0.03 per 10,000 popn
  - average municipality population is 22,000
  - so even one fatality in a given year for most communities is unusual
- Look for “clusters”
  - within 4 months (120ish days) of each other
  - in the same municipality, or in
  - immediately adjacent municipality on the same rail line

# Clustering of Apparent Suicides . . .



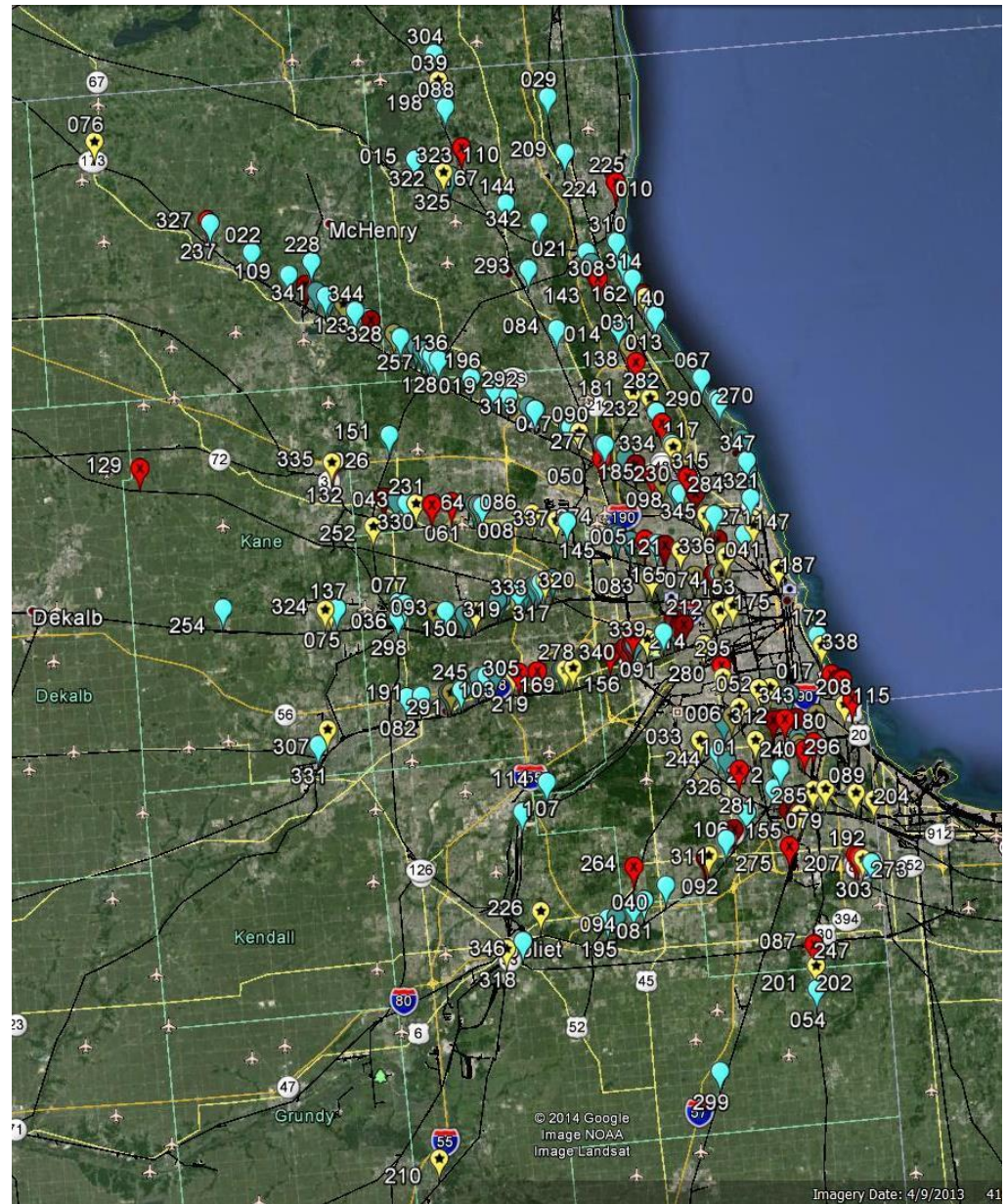
# Spatial Analysis

# Google Earth

Red = Stations  
and Crossings

Yellow =  
Trespassers

Blue = Apparent  
Suicides



# Fatalities by Route Type and Train . . .

|                          | Stations & Crossings | Trespassers | Apparent Suicides |
|--------------------------|----------------------|-------------|-------------------|
| Commuter Rail Routes     |                      |             |                   |
| Commuter                 | 60%                  |             |                   |
| Inter-City               | 11%                  |             |                   |
| Freight                  | 13%                  |             |                   |
| <b><i>Sub-Total</i></b>  | <b><i>84%</i></b>    |             |                   |
| Non-Commuter Rail Routes |                      |             |                   |
| Inter-City               | 3%                   |             |                   |
| Freight Train            | 13%                  |             |                   |
| <b><i>Sub-Total</i></b>  | <b><i>16%</i></b>    |             |                   |

# Fatalities by Route Type and Train . . .

|                          | Stations & Crossings | Trespassers       | Apparent Suicides |
|--------------------------|----------------------|-------------------|-------------------|
| Commuter Rail Routes     |                      |                   |                   |
| Commuter                 | 60%                  | 48%               |                   |
| Inter-City               | 11%                  | 8%                |                   |
| Freight                  | 13%                  | 17%               |                   |
| <b><i>Sub-Total</i></b>  | <b><i>84%</i></b>    | <b><i>73%</i></b> |                   |
| Non-Commuter Rail Routes |                      |                   |                   |
| Inter-City               | 3%                   | 5%                |                   |
| Freight Train            | 13%                  | 22%               |                   |
| <b><i>Sub-Total</i></b>  | <b><i>16%</i></b>    | <b><i>27%</i></b> |                   |

# Fatalities by Route Type and Train . . .

|                          | Stations & Crossings | Trespassers       | Apparent Suicides |
|--------------------------|----------------------|-------------------|-------------------|
| Commuter Rail Routes     |                      |                   |                   |
| Commuter                 | 60%                  | 48%               | 67%               |
| Inter-City               | 11%                  | 8%                | 4%                |
| Freight                  | 13%                  | 17%               | 17%               |
| <b><i>Sub-Total</i></b>  | <b><i>84%</i></b>    | <b><i>73%</i></b> | <b><i>88%</i></b> |
| Non-Commuter Rail Routes |                      |                   |                   |
| Inter-City               | 3%                   | 5%                | 1%                |
| Freight Train            | 13%                  | 22%               | 12%               |
| <b><i>Sub-Total</i></b>  | <b><i>16%</i></b>    | <b><i>27%</i></b> | <b><i>12%</i></b> |



# Regression Analysis . . .

- 216 rail-served suburban municipalities
- 269 fatalities
- Separate regressions for:
  - Stations and Crossings
  - Trespassers
  - Apparent Suicides
- Negative binomial technique
- Dependent variable is count of fatalities

# Explanatory Variables. . .

- Population (exposure variable)

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- Population (exposure variable)
- Public crossings and stations per square mile
- Daily trains
- Proportion of freight trains to total trains
- Maximum number of tracks
- Maximum line speed
- Population per square mile
- Median household income

# Findings . . .

- Lots of randomness (269 fatalities in 3 categories in 216 possible suburban municipalities)

But . . .

- Some strong explanatory relationships
- Some notable outliers (“hot spots”)

# Density of Public Access . . .

| Effect on Risk of Density per mile <sup>2</sup> |      | Stations & Crossings | Trespassers | Apparent Suicides |
|---|------|----------------------|-------------|-------------------|
| Minimum   | 0.00 |                      |             |                   |
| Lower Quartile                                  | 0.41 |                      |             |                   |
| Median  | 0.78 |                      |             |                   |
| Upper Quartile                                  | 1.44 |                      |             |                   |
| 90 <sup>th</sup> percentile                     | 2.56 |                      |             |                   |
| 95 <sup>th</sup> percentile                     | 4.87 |                      |             |                   |

# Density of Public Access . . .

| Effect on Risk of Density per mile <sup>2</sup> |      | Stations & Crossings | Trespassers | Apparent Suicides |
|---|------|----------------------|-------------|-------------------|
| Minimum   | 0.00 | 1.0 times            |             |                   |
| Lower Quartile                                  | 0.41 | + 20%                |             |                   |
| Median  | 0.78 | + 39%                |             |                   |
| Upper Quartile                                  | 1.44 | + 81%                |             |                   |
| 90 <sup>th</sup> percentile                     | 2.56 | + 187%               |             |                   |
| 95 <sup>th</sup> percentile                     | 4.87 | + 640%               |             |                   |



# Density of Public Access . . .

| Effect on Risk of Density per mile <sup>2</sup> |      | Stations & Crossings | Trespassers | Apparent Suicides |
|---|------|----------------------|-------------|-------------------|
| Minimum   | 0.00 | 1.0 times            |             | 1.0 times         |
| Lower Quartile                                  | 0.41 | + 20%                |             | + 7%              |
| Median  | 0.78 | + 39%                |             | + 13%             |
| Upper Quartile                                  | 1.44 | + 81%                |             | + 26%             |
| 90 <sup>th</sup> percentile                     | 2.56 | + 187%               |             | + 50%             |
| 95 <sup>th</sup> percentile                     | 4.87 | + 640%               |             | + 117%            |

# Other Explanatory Variables . . .

|                          |  |  |  |
|--------------------------|--|--|--|
| Significant elasticities |  |  |  |
| Daily trains             |  |  |  |
| % Freight trains         |  |  |  |
| Number of Tracks         |  |  |  |
| Maximum Speed            |  |  |  |
| Popn Density             |  |  |  |
| Income                   |  |  |  |

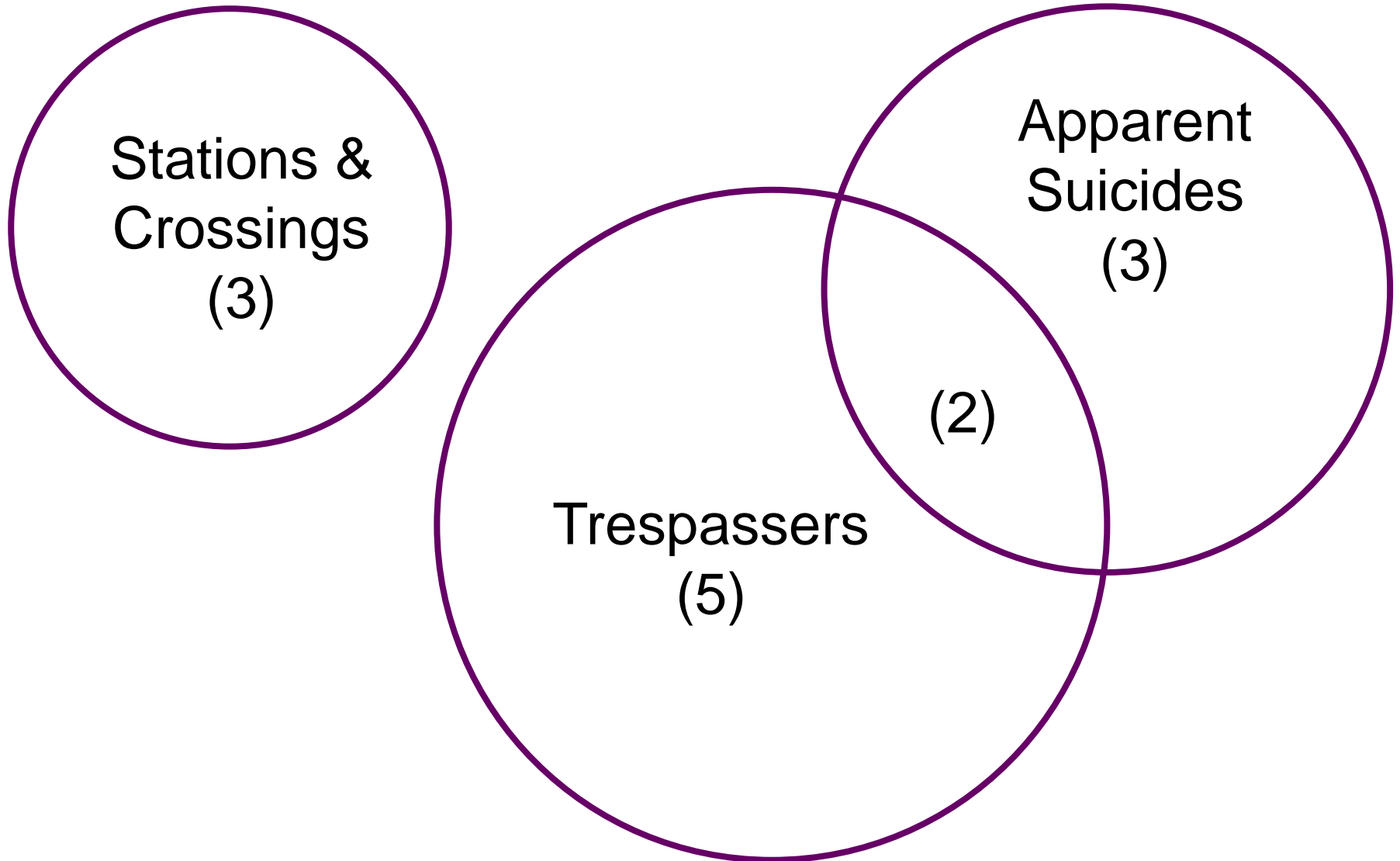
# Other Explanatory Variables . . .

| Significant elasticities | Stations & Crossings | Trespassers |  |
|--------------------------|----------------------|-------------|--|
| Daily trains             |                      |             |  |
| % Freight trains         |                      |             |  |
| Number of Tracks         |                      |             |  |
| Maximum Speed            |                      | ↑ 1.93      |  |
| Popn Density             |                      |             |  |
| Income                   |                      |             |  |

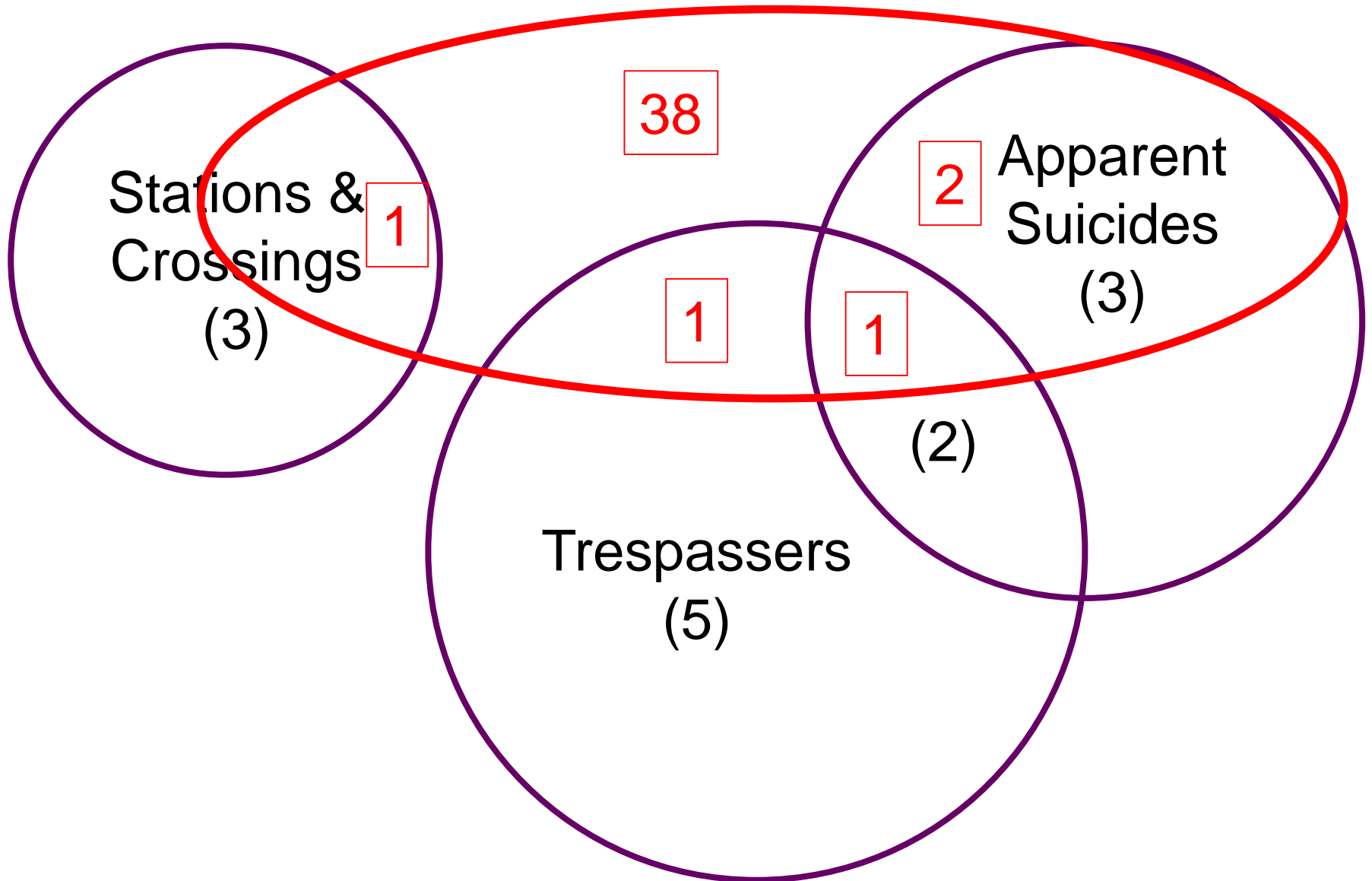
# Other Explanatory Variables . . .

| Significant elasticities | Stations & Crossings | Trespassers | Apparent Suicides |
|--------------------------|----------------------|-------------|-------------------|
| Daily trains             |                      |             | ↑ 0.60            |
| % Freight trains         |                      |             | ↓ 0.26            |
| Number of Tracks         |                      |             |                   |
| Maximum Speed            |                      | ↑ 1.93      |                   |
| Popn Density             |                      |             | ↓ 0.43            |
| Income                   |                      |             | ↑ 0.85            |

# Extreme Outliers (Prob < 0.05) . . .



# In Top Quintile of OL Audience . . .



## In Conclusion . . .

- Dwarf motor vehicle fatalities (338 to 41)
- Typically middle-aged, not minors or seniors
- Fewer access points deter trespassing, but not so much for apparent suicides
- Apparent suicides
  - are 47% of the total
  - attracted to busy lines with published schedules
  - generally in higher-income areas
  - 17.5% are subsequent deaths in a cluster

## Contact Information . . .

- ipsavage@northwestern.edu
- (847) 491-8241
- Read my rail safety papers at:  
<http://faculty.wcas.northwestern.edu/~ipsavage/rail.html>



