```
Our contingency table...
                    Deaths              Non Deaths
Close to sewer      224                 482
Far from sewer      436                 1047
```

```
# Now let us get our p-value!
# ... when doing data science in Python, it is common convention to use
#     "_" characters to mark variables whose values we don't need.

from scipy.stats import chi2_contingency
chi_square, p_value, _, _ = chi2_contingency(contingency_table)
print(f"Our p-value: {p_value}")
print(f"Our Chi-squared value: {chi_square}")
```

```
Our p-value: 0.28927858447134214
Our Chi-squared value: 1.1229758183695626
```

```
Death rate per 1000
North: 1.7805598480785025
South: 12.59968677572774
East: 6.326962726552367
West: 3.2989610482397667
Central: 5.021616246078257
```

Year	Population	Deaths	Deaths per 1000
1840	1842458	46281	25.119161
1841	1877963	45284	24.113361
1842	1916860	45272	23.617792
1843	1953787	48574	24.861461
1844	2033816	50423	24.792312
1845	2073298	48332	23.311651
1846	2113535	49089	23.226017
1847	2195401	60442	27.531189
1848	2238703	57628	25.741691
1849	2282858	68432	29.976459
1850	2327884	48579	20.868308
1851	2373799	55354	23.318739
1852	2420619	54213	22.396337
1853	2468362	61202	24.794580
1854	2517048	73697	29.279140

```
Our contingency table...
                    Deaths 1849         Deaths 1854
Mostly SV           3708                3726.0
Mostly Lam          2108                895.0
```

```
Our contingency table...
                    Deaths              Non Deaths
Close to pump       492                 214
Far from pump       303                 1180
```

```
# Task 3: Determine if there is a statistically signif

from scipy.stats import chi2_contingency

# Now let us get our p-value!
# ... when doing data science in Python, it is common
#     "_" characters to mark variables whose values we
chi_square, p_value, _, _ = chi2_contingency(contingen
print(f"Our p-value: {p_value}")
print(f"Our Chi-squared value: {chi_square}")
```

```
Our p-value: 1.2325783049887838e-79
Our Chi-squared value: 357.0551926130695
```

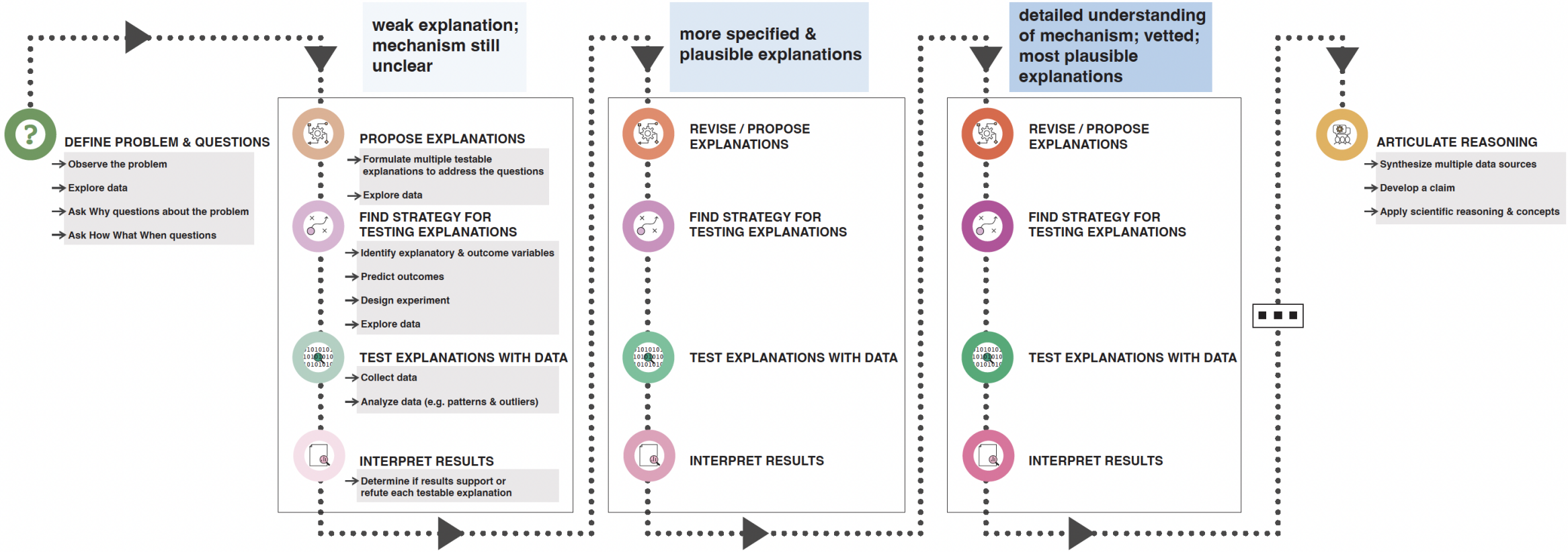
```
# Find p-value here.

# Now let us get our p-value!
# ... when doing data science in Python, it is common convention to use
#     "_" characters to mark variables whose values we don't need.

from scipy.stats import chi2_contingency
chi_square, p_value, _, _ = chi2_contingency(contingency_table)
print(f"Our p-value: {p_value}")
print(f"Our Chi-squared value: {chi_square}")
```

```
Our p-value: 1.1436488037757276e-110
Our Chi-squared value: 499.6308374196881
```

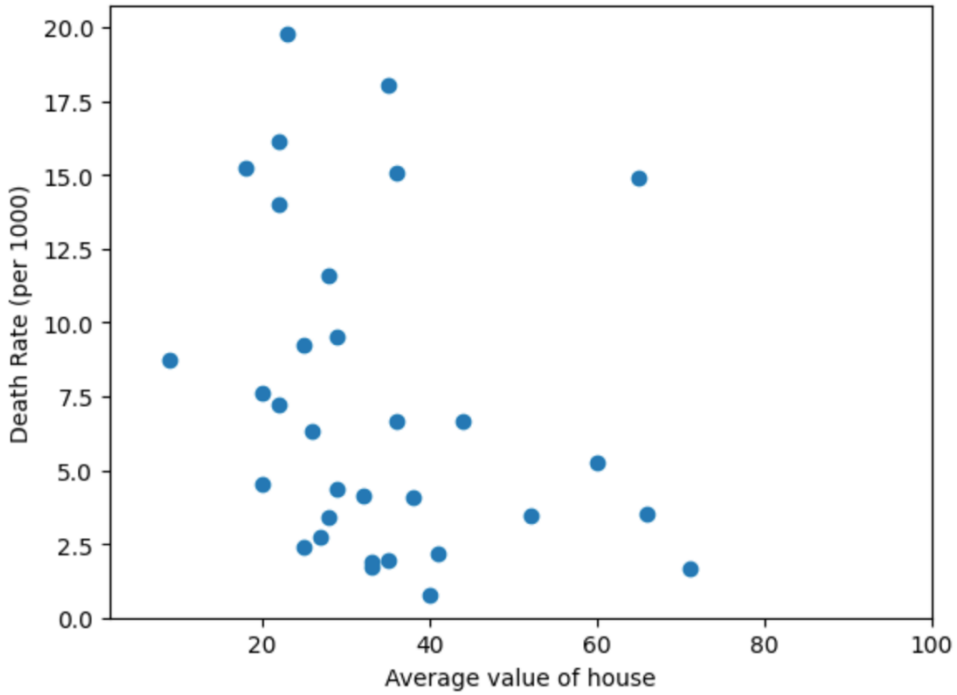
THE DATA SCIENCE REASONING FRAMEWORK

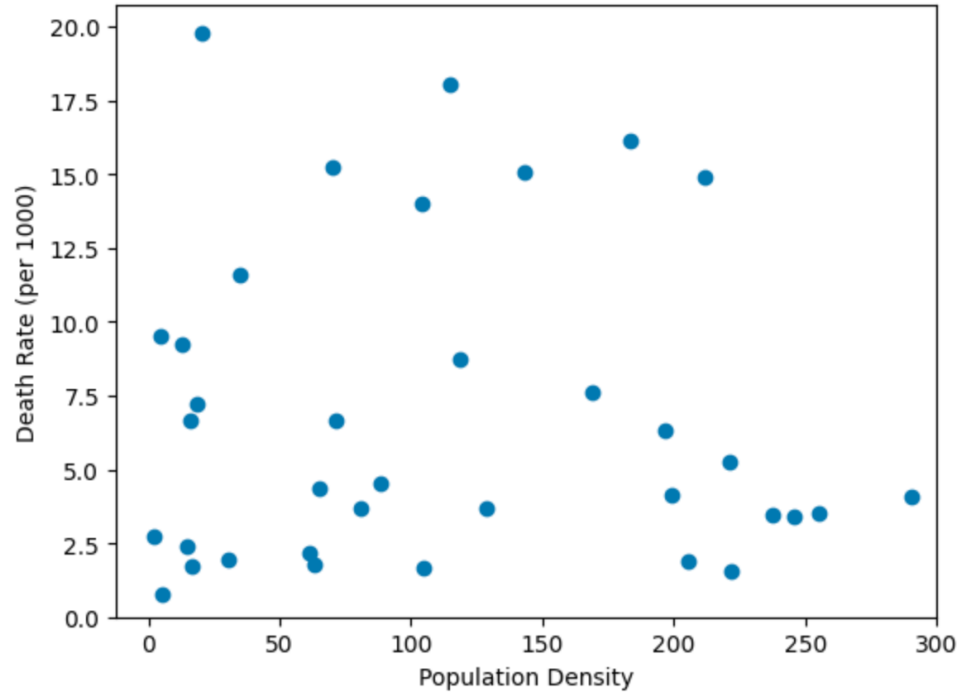


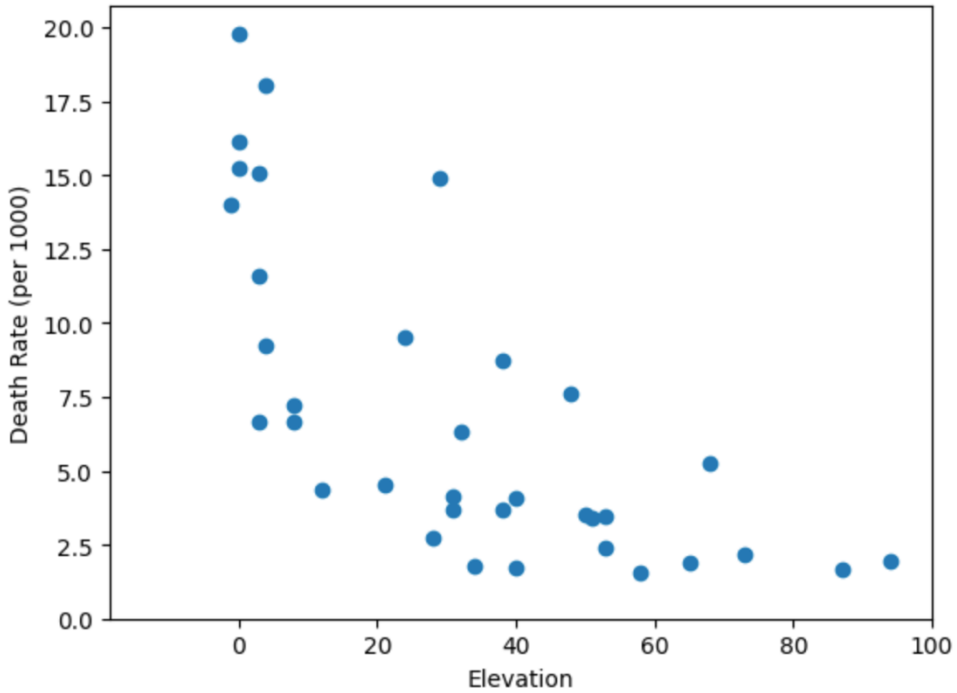
EXPLANATION IMPROVES WITH EVERY NEW ROUND OF TESTING & EVIDENCE

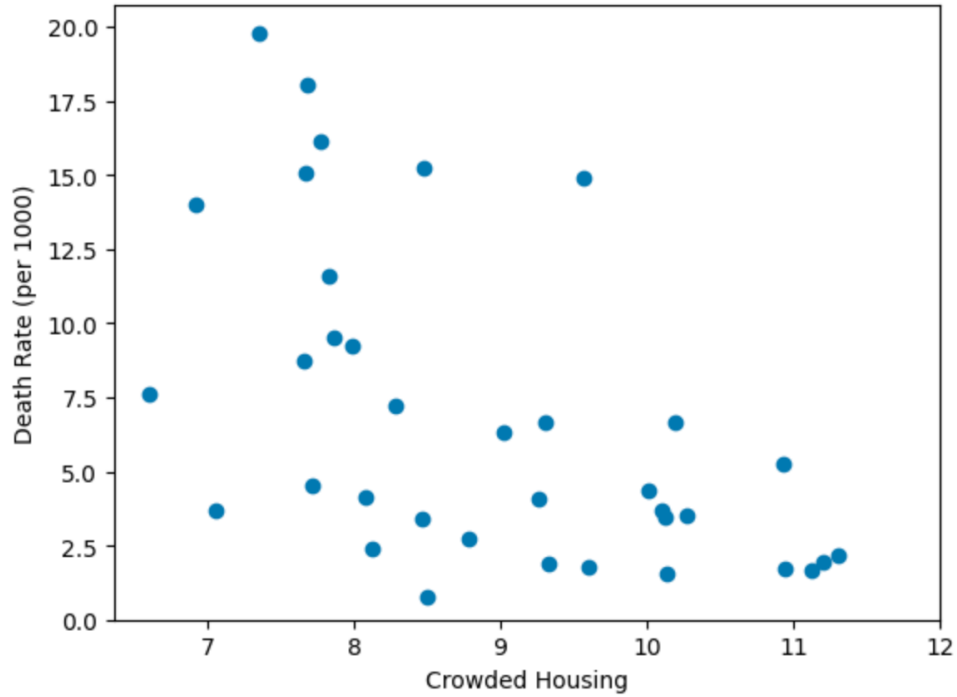
THE UNIVERSITY OF CHICAGO
DATA SCIENCE INSTITUTE

A COURT FOR KING CHOLERA.

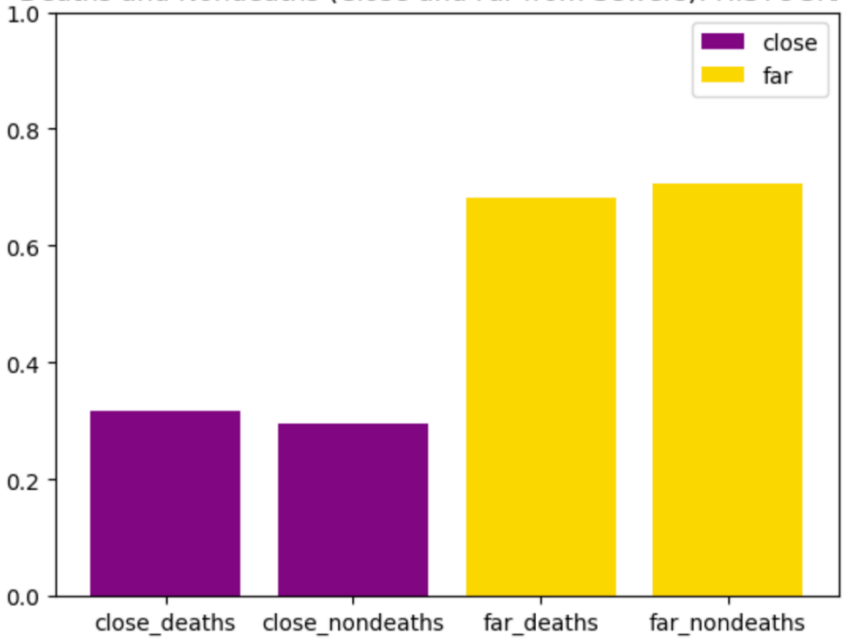

Death Rate (per 1000)
Average value of house
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
20
40
60
80
100


Death Rate (per 1000)
Population Density
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
0
50
100
150
200
250
300

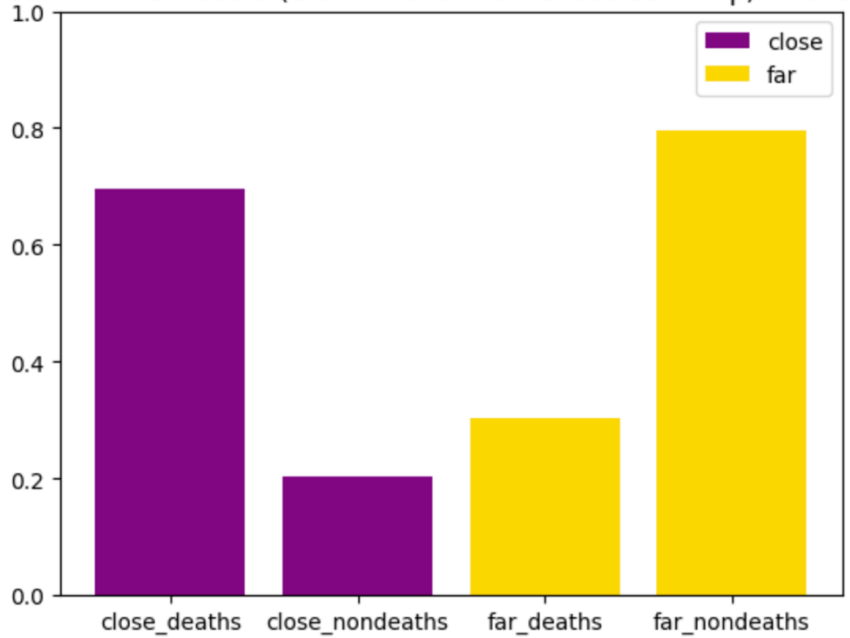

Death Rate (per 1000)
Elevation
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
0
20
40
60
80
100


Death Rate (per 1000)
Crowded Housing
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
7
8
9
10
11
12

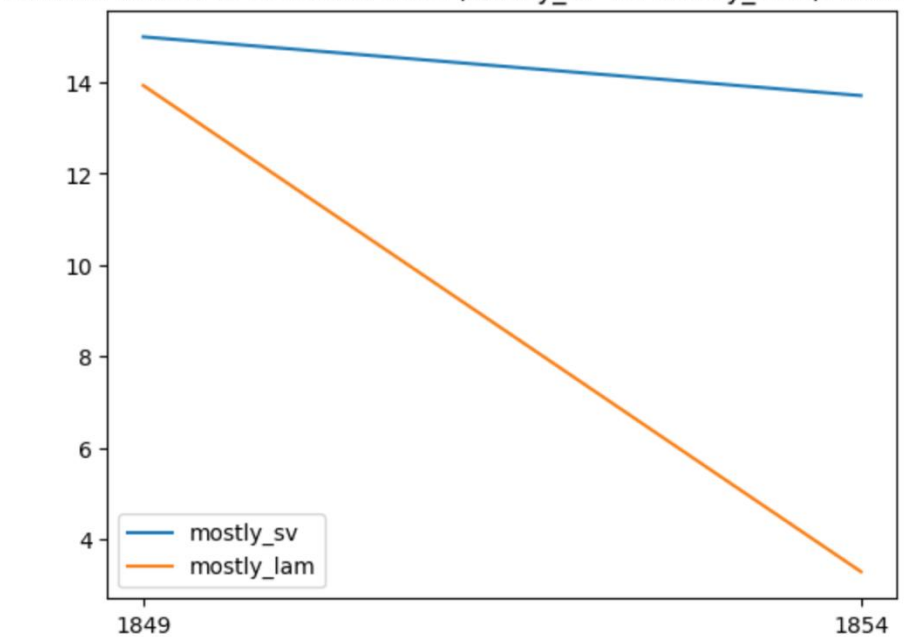
Deaths and Nondeaths (Close and Far from Sewers): HISTOGRAM

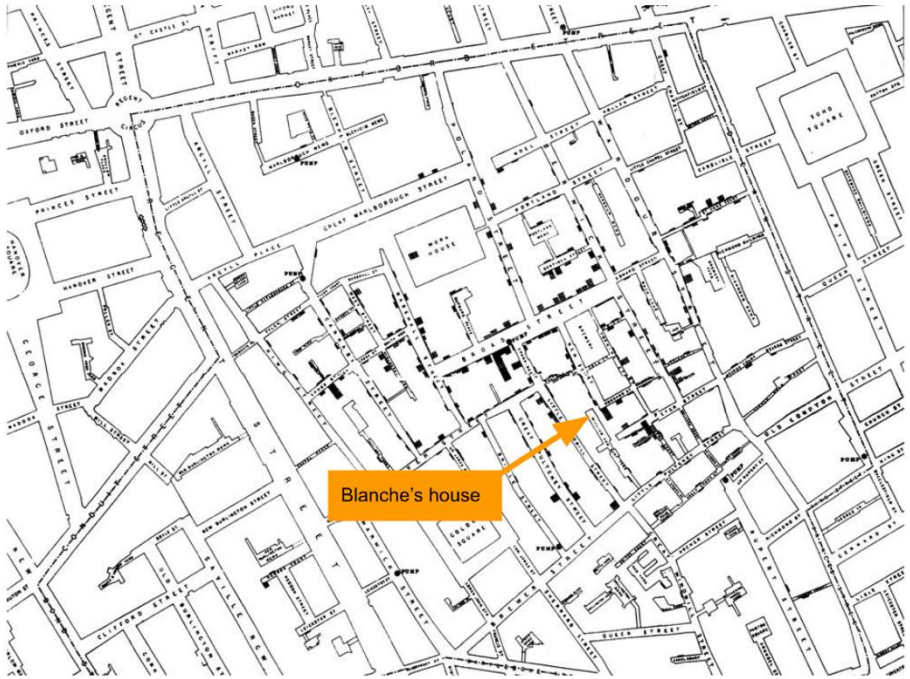


Deaths and Nondeaths (Close and Far from Broad St. Pump): HISTOGRAM



Cholera deaths of 1849 and 1854 (Mostly_SV vs. Mostly_Lam): LINE GRAPH





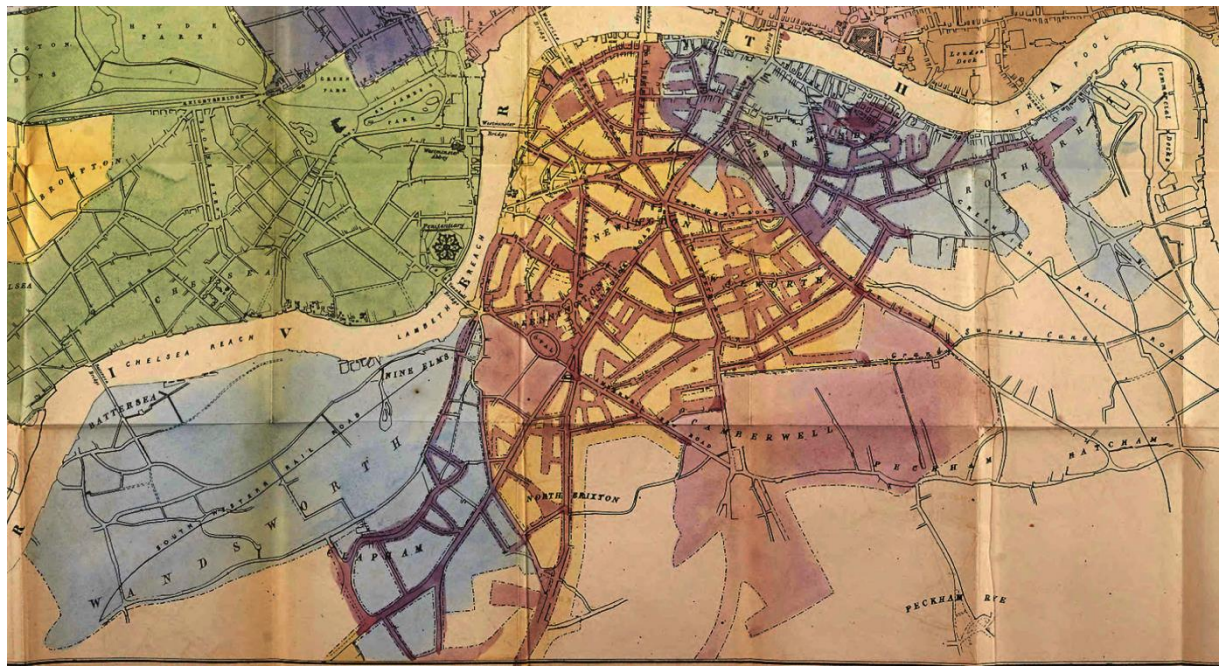
At 7, Layton's Buildings, July 29, a tailor, aged 20, "cholera 17 hours" . *Southwark and Vauxhall.*

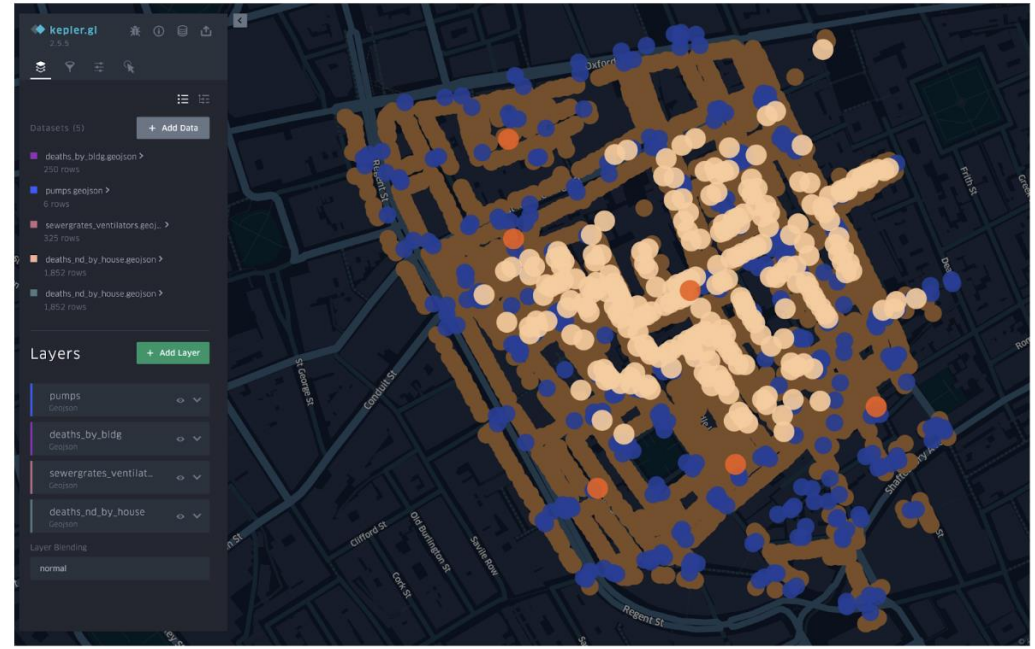
At 2, Dobb's Cross, July 30, the son of a shop-keeper, aged 10 yrs., "cholera Asiatic 24 hours". *Southwark & Vauxhall.*

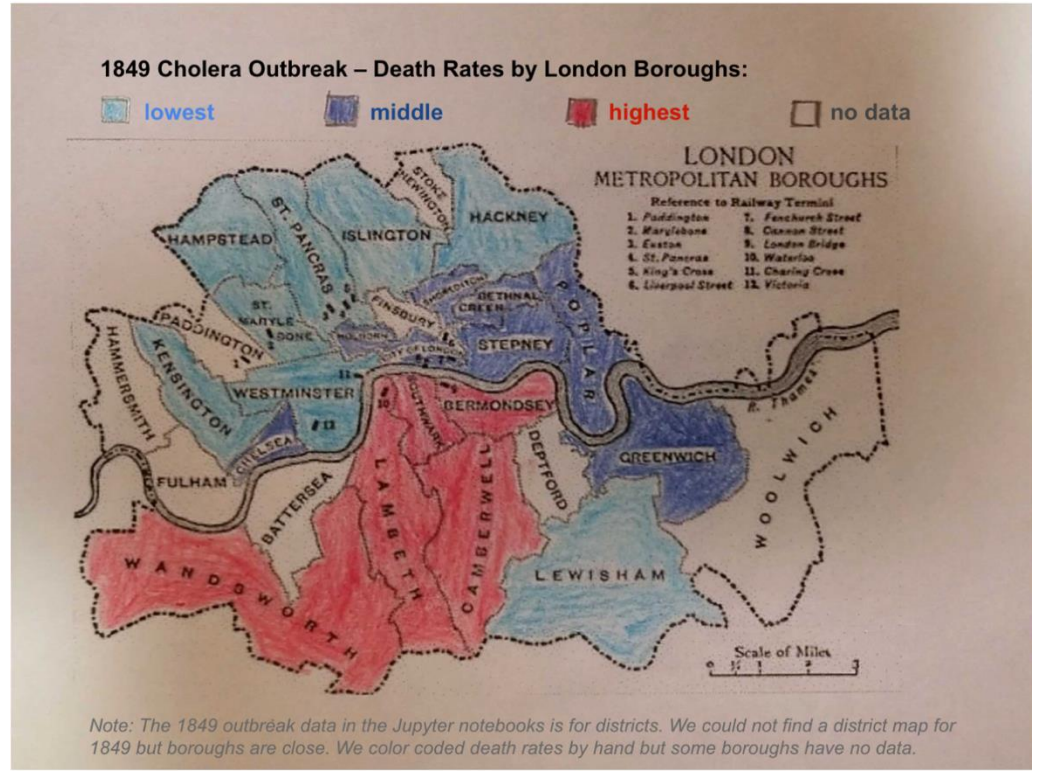
At 81, Ann Street, July 29, the son of a labourer, aged 12 years, "cholera 8 hours". *Southwark and Vauxhall.*

At 28, Wickham Pl., Aug. 2, son of a brush-mkr., aged 2½ yrs., "choleraic diarrhœa 24 hours." *Southwark & Vauxhall.*

At 2, Russell Place, Aug. 2, the widow of a labourer,







Note: The 1849 outbreak data in the Jupyter notebooks is for districts. We could not find a district map for 1849 but boroughs are close. We color coded death rates by hand but some boroughs have no data.