

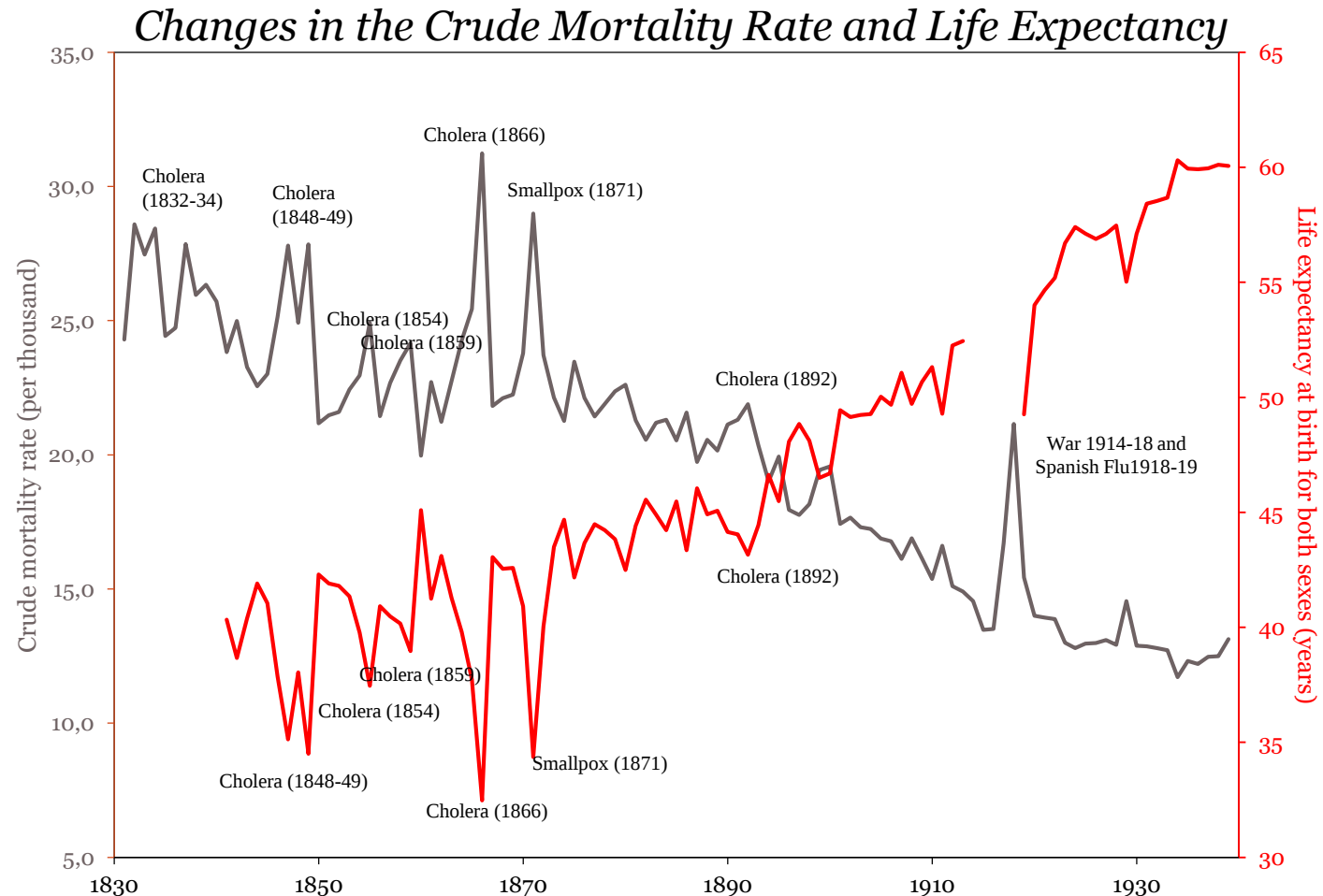
# CHOLERA IN RURAL AREAS: THE PANDEMIC OF 1866 IN THE PROVINCES OF NAMUR AND LUXEMBOURG

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# Introduction

- Diseases of the 19th century: 6 pandemics
- 1866 in Belgium: a particularly deadly epidemic (43,400 deaths).
- Gross rate at its highest: 31.3‰
- Life expectancy: -5.3 years



# Literature

- Mainly an urban disease [Lafosse, 1977 ; Poncelet, 1986 ; Verbaeys, 2008 ; Devos et al., 2022]
- Disease with a U-shaped mortality curve but rising mortality in adults [Bourdelaïs, Raulot, 1987; Eggerickx et Poulain, 1991]
- Social dimension
  - 19<sup>e</sup> [Chevalier, 1958]
    - For the affluent classes: disease of the poor (hygiene)
    - For the underprivileged: a disease sown by the rich to kill the poor

# Literature

## ➤ Social dimension

➤ Recent literature has highlighted an excess mortality rate among the poorest people linked to: [Dupâquier, 1990, Alfani, 2022]

➤ Food

➤ Access to water

➤ Overcrowding, traps

## ➤ Distribution: two models [Pyle ,1969; Smallman-Raynor, 1998]

➤ Around entry points and hotspots (short distances)

➤ From city to city (hierarchical model linked to transport)

# Questions and hypotheses

Two essentially rural provinces: Namur and Luxembourg

- How is the pandemic spreading? Which areas are most affected?
  - close to major communication routes (roads, railways, rivers)
  - close to major towns (Namur) or already contaminated areas
  - a non-uniform distribution.
- Does the socio-demographic profile of those who die of cholera correspond to that observed in urban areas?
  - the profiles are similar in urban areas : the youngest and oldest, and the poorest, are the preferred victims of cholera.
- Are there any differences between the profiles of those who have recovered and those who have died?
  - People who have recovered from cholera have different socio-demographic characteristics to those who have died (adults and people from privileged social classes).

# Data



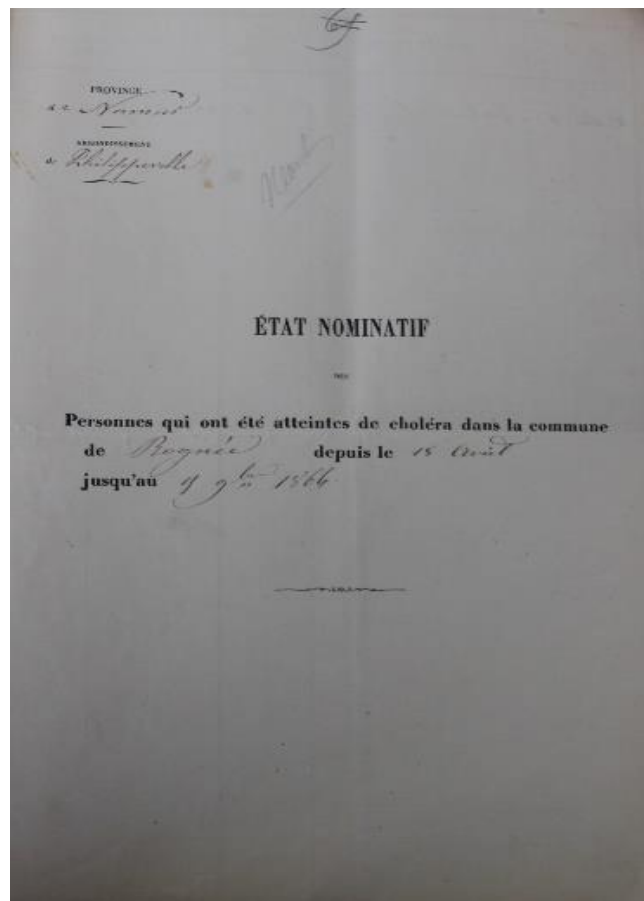
**No data for  
other provinces.**

# Data

## ➤ Data sources :

Nominal lists of people affected by cholera

Aggregate causes of death by municipality



| NOM ET PRÉNOM |               | ÂGE | ÉTAT | PROFESSION | DATE      | CAUSE DE LA MORT | REMARQUES |
|---------------|---------------|-----|------|------------|-----------|------------------|-----------|
| 1             | Jean Baptiste | 30  | Mar. | Laboureur  | 15 Août   | Choléra          |           |
| 2             | Joseph        | 35  | Mar. | Laboureur  | 16 Août   | Choléra          |           |
| 3             | Marie         | 25  | Mar. | Laboureur  | 17 Août   | Choléra          |           |
| 4             | Marie         | 25  | Mar. | Laboureur  | 18 Août   | Choléra          |           |
| 5             | Marie         | 25  | Mar. | Laboureur  | 19 Août   | Choléra          |           |
| 6             | Marie         | 25  | Mar. | Laboureur  | 20 Août   | Choléra          |           |
| 7             | Marie         | 25  | Mar. | Laboureur  | 21 Août   | Choléra          |           |
| 8             | Marie         | 25  | Mar. | Laboureur  | 22 Août   | Choléra          |           |
| 9             | Marie         | 25  | Mar. | Laboureur  | 23 Août   | Choléra          |           |
| 10            | Marie         | 25  | Mar. | Laboureur  | 24 Août   | Choléra          |           |
| 11            | Marie         | 25  | Mar. | Laboureur  | 25 Août   | Choléra          |           |
| 12            | Marie         | 25  | Mar. | Laboureur  | 26 Août   | Choléra          |           |
| 13            | Marie         | 25  | Mar. | Laboureur  | 27 Août   | Choléra          |           |
| 14            | Marie         | 25  | Mar. | Laboureur  | 28 Août   | Choléra          |           |
| 15            | Marie         | 25  | Mar. | Laboureur  | 29 Août   | Choléra          |           |
| 16            | Marie         | 25  | Mar. | Laboureur  | 30 Août   | Choléra          |           |
| 17            | Marie         | 25  | Mar. | Laboureur  | 31 Août   | Choléra          |           |
| 18            | Marie         | 25  | Mar. | Laboureur  | 1er Sept  | Choléra          |           |
| 19            | Marie         | 25  | Mar. | Laboureur  | 2er Sept  | Choléra          |           |
| 20            | Marie         | 25  | Mar. | Laboureur  | 3er Sept  | Choléra          |           |
| 21            | Marie         | 25  | Mar. | Laboureur  | 4er Sept  | Choléra          |           |
| 22            | Marie         | 25  | Mar. | Laboureur  | 5er Sept  | Choléra          |           |
| 23            | Marie         | 25  | Mar. | Laboureur  | 6er Sept  | Choléra          |           |
| 24            | Marie         | 25  | Mar. | Laboureur  | 7er Sept  | Choléra          |           |
| 25            | Marie         | 25  | Mar. | Laboureur  | 8er Sept  | Choléra          |           |
| 26            | Marie         | 25  | Mar. | Laboureur  | 9er Sept  | Choléra          |           |
| 27            | Marie         | 25  | Mar. | Laboureur  | 10er Sept | Choléra          |           |
| 28            | Marie         | 25  | Mar. | Laboureur  | 11er Sept | Choléra          |           |
| 29            | Marie         | 25  | Mar. | Laboureur  | 12er Sept | Choléra          |           |
| 30            | Marie         | 25  | Mar. | Laboureur  | 13er Sept | Choléra          |           |
| 31            | Marie         | 25  | Mar. | Laboureur  | 14er Sept | Choléra          |           |
| 32            | Marie         | 25  | Mar. | Laboureur  | 15er Sept | Choléra          |           |
| 33            | Marie         | 25  | Mar. | Laboureur  | 16er Sept | Choléra          |           |
| 34            | Marie         | 25  | Mar. | Laboureur  | 17er Sept | Choléra          |           |
| 35            | Marie         | 25  | Mar. | Laboureur  | 18er Sept | Choléra          |           |
| 36            | Marie         | 25  | Mar. | Laboureur  | 19er Sept | Choléra          |           |
| 37            | Marie         | 25  | Mar. | Laboureur  | 20er Sept | Choléra          |           |
| 38            | Marie         | 25  | Mar. | Laboureur  | 21er Sept | Choléra          |           |
| 39            | Marie         | 25  | Mar. | Laboureur  | 22er Sept | Choléra          |           |
| 40            | Marie         | 25  | Mar. | Laboureur  | 23er Sept | Choléra          |           |
| 41            | Marie         | 25  | Mar. | Laboureur  | 24er Sept | Choléra          |           |
| 42            | Marie         | 25  | Mar. | Laboureur  | 25er Sept | Choléra          |           |
| 43            | Marie         | 25  | Mar. | Laboureur  | 26er Sept | Choléra          |           |
| 44            | Marie         | 25  | Mar. | Laboureur  | 27er Sept | Choléra          |           |
| 45            | Marie         | 25  | Mar. | Laboureur  | 28er Sept | Choléra          |           |
| 46            | Marie         | 25  | Mar. | Laboureur  | 29er Sept | Choléra          |           |
| 47            | Marie         | 25  | Mar. | Laboureur  | 30er Sept | Choléra          |           |
| 48            | Marie         | 25  | Mar. | Laboureur  | 1er Oct   | Choléra          |           |
| 49            | Marie         | 25  | Mar. | Laboureur  | 2er Oct   | Choléra          |           |
| 50            | Marie         | 25  | Mar. | Laboureur  | 3er Oct   | Choléra          |           |
| 51            | Marie         | 25  | Mar. | Laboureur  | 4er Oct   | Choléra          |           |
| 52            | Marie         | 25  | Mar. | Laboureur  | 5er Oct   | Choléra          |           |
| 53            | Marie         | 25  | Mar. | Laboureur  | 6er Oct   | Choléra          |           |
| 54            | Marie         | 25  | Mar. | Laboureur  | 7er Oct   | Choléra          |           |
| 55            | Marie         | 25  | Mar. | Laboureur  | 8er Oct   | Choléra          |           |
| 56            | Marie         | 25  | Mar. | Laboureur  | 9er Oct   | Choléra          |           |
| 57            | Marie         | 25  | Mar. | Laboureur  | 10er Oct  | Choléra          |           |
| 58            | Marie         | 25  | Mar. | Laboureur  | 11er Oct  | Choléra          |           |
| 59            | Marie         | 25  | Mar. | Laboureur  | 12er Oct  | Choléra          |           |
| 60            | Marie         | 25  | Mar. | Laboureur  | 13er Oct  | Choléra          |           |
| 61            | Marie         | 25  | Mar. | Laboureur  | 14er Oct  | Choléra          |           |
| 62            | Marie         | 25  | Mar. | Laboureur  | 15er Oct  | Choléra          |           |
| 63            | Marie         | 25  | Mar. | Laboureur  | 16er Oct  | Choléra          |           |
| 64            | Marie         | 25  | Mar. | Laboureur  | 17er Oct  | Choléra          |           |
| 65            | Marie         | 25  | Mar. | Laboureur  | 18er Oct  | Choléra          |           |
| 66            | Marie         | 25  | Mar. | Laboureur  | 19er Oct  | Choléra          |           |
| 67            | Marie         | 25  | Mar. | Laboureur  | 20er Oct  | Choléra          |           |
| 68            | Marie         | 25  | Mar. | Laboureur  | 21er Oct  | Choléra          |           |
| 69            | Marie         | 25  | Mar. | Laboureur  | 22er Oct  | Choléra          |           |
| 70            | Marie         | 25  | Mar. | Laboureur  | 23er Oct  | Choléra          |           |
| 71            | Marie         | 25  | Mar. | Laboureur  | 24er Oct  | Choléra          |           |
| 72            | Marie         | 25  | Mar. | Laboureur  | 25er Oct  | Choléra          |           |
| 73            | Marie         | 25  | Mar. | Laboureur  | 26er Oct  | Choléra          |           |
| 74            | Marie         | 25  | Mar. | Laboureur  | 27er Oct  | Choléra          |           |
| 75            | Marie         | 25  | Mar. | Laboureur  | 28er Oct  | Choléra          |           |
| 76            | Marie         | 25  | Mar. | Laboureur  | 29er Oct  | Choléra          |           |
| 77            | Marie         | 25  | Mar. | Laboureur  | 30er Oct  | Choléra          |           |
| 78            | Marie         | 25  | Mar. | Laboureur  | 31er Oct  | Choléra          |           |
| 79            | Marie         | 25  | Mar. | Laboureur  | 1er Nov   | Choléra          |           |
| 80            | Marie         | 25  | Mar. | Laboureur  | 2er Nov   | Choléra          |           |
| 81            | Marie         | 25  | Mar. | Laboureur  | 3er Nov   | Choléra          |           |
| 82            | Marie         | 25  | Mar. | Laboureur  | 4er Nov   | Choléra          |           |
| 83            | Marie         | 25  | Mar. | Laboureur  | 5er Nov   | Choléra          |           |
| 84            | Marie         | 25  | Mar. | Laboureur  | 6er Nov   | Choléra          |           |
| 85            | Marie         | 25  | Mar. | Laboureur  | 7er Nov   | Choléra          |           |
| 86            | Marie         | 25  | Mar. | Laboureur  | 8er Nov   | Choléra          |           |
| 87            | Marie         | 25  | Mar. | Laboureur  | 9er Nov   | Choléra          |           |
| 88            | Marie         | 25  | Mar. | Laboureur  | 10er Nov  | Choléra          |           |
| 89            | Marie         | 25  | Mar. | Laboureur  | 11er Nov  | Choléra          |           |
| 90            | Marie         | 25  | Mar. | Laboureur  | 12er Nov  | Choléra          |           |
| 91            | Marie         | 25  | Mar. | Laboureur  | 13er Nov  | Choléra          |           |
| 92            | Marie         | 25  | Mar. | Laboureur  | 14er Nov  | Choléra          |           |
| 93            | Marie         | 25  | Mar. | Laboureur  | 15er Nov  | Choléra          |           |
| 94            | Marie         | 25  | Mar. | Laboureur  | 16er Nov  | Choléra          |           |
| 95            | Marie         | 25  | Mar. | Laboureur  | 17er Nov  | Choléra          |           |
| 96            | Marie         | 25  | Mar. | Laboureur  | 18er Nov  | Choléra          |           |
| 97            | Marie         | 25  | Mar. | Laboureur  | 19er Nov  | Choléra          |           |
| 98            | Marie         | 25  | Mar. | Laboureur  | 20er Nov  | Choléra          |           |
| 99            | Marie         | 25  | Mar. | Laboureur  | 21er Nov  | Choléra          |           |
| 100           | Marie         | 25  | Mar. | Laboureur  | 22er Nov  | Choléra          |           |

Date  
Death/Cure  
Remarks

# Data

➤ Data sources :

## Nominal lists of people affected by cholera

Interesting source:

# The epidemic day by day.

Profession (but only for working men).

## Social situation of individuals.

## Age and sex.

Cured and deceased.

Fairly accurate information because disease easily identifiable.

## Limitations

The "social position" variable places individuals on a continuum ranging from "indigent" to "well-to-do", with nuances specific to each commune (e.g. average, not very well-to-do). Namur's problem.

We don't have the population at risk.

Only one occupation is given. In the rural context of the 19th century, multiple occupations were common.

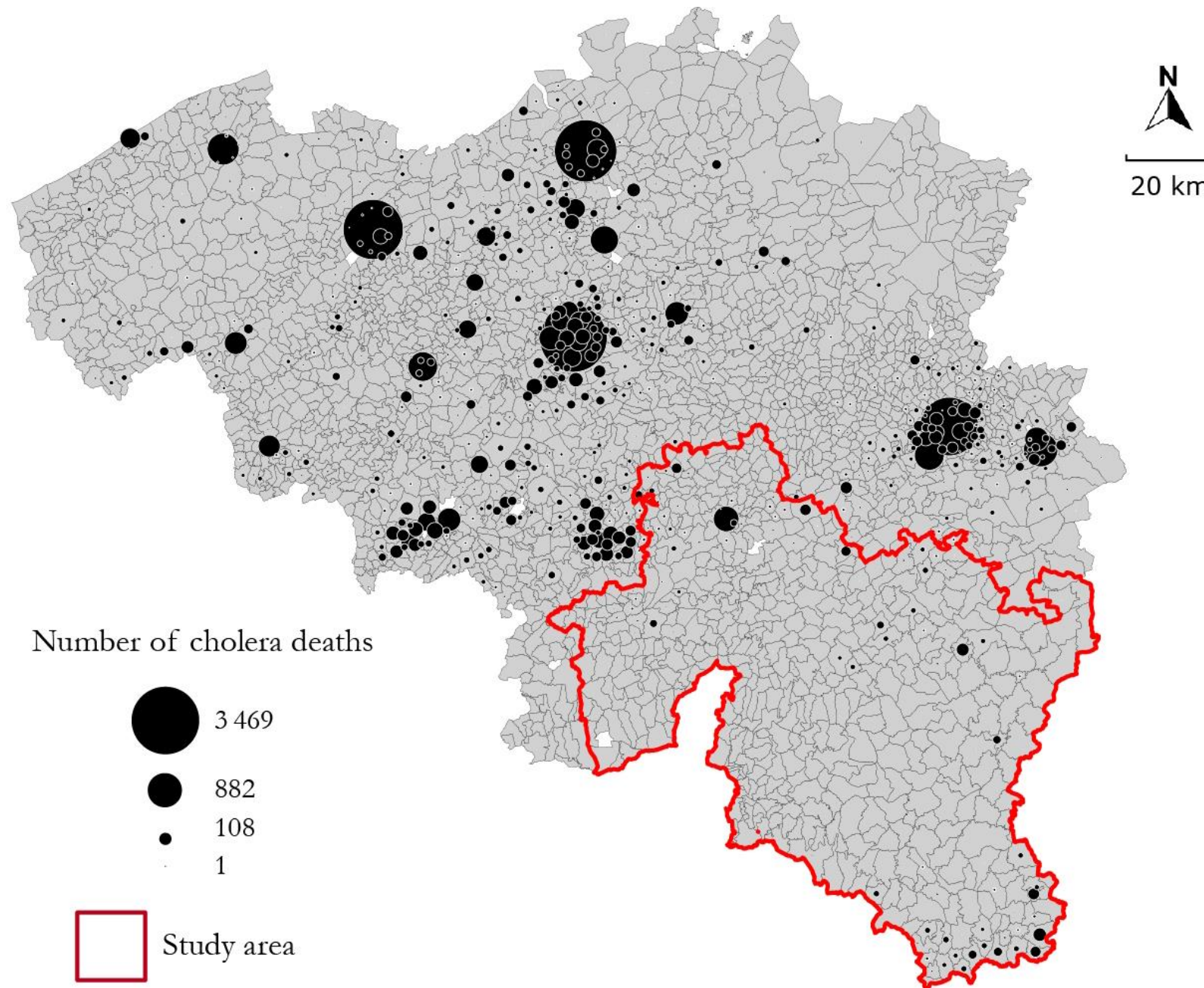
[illegible]



# RESULTS

# CHOLERA PANDEMIC IN BELGIUM (1866)

## Results

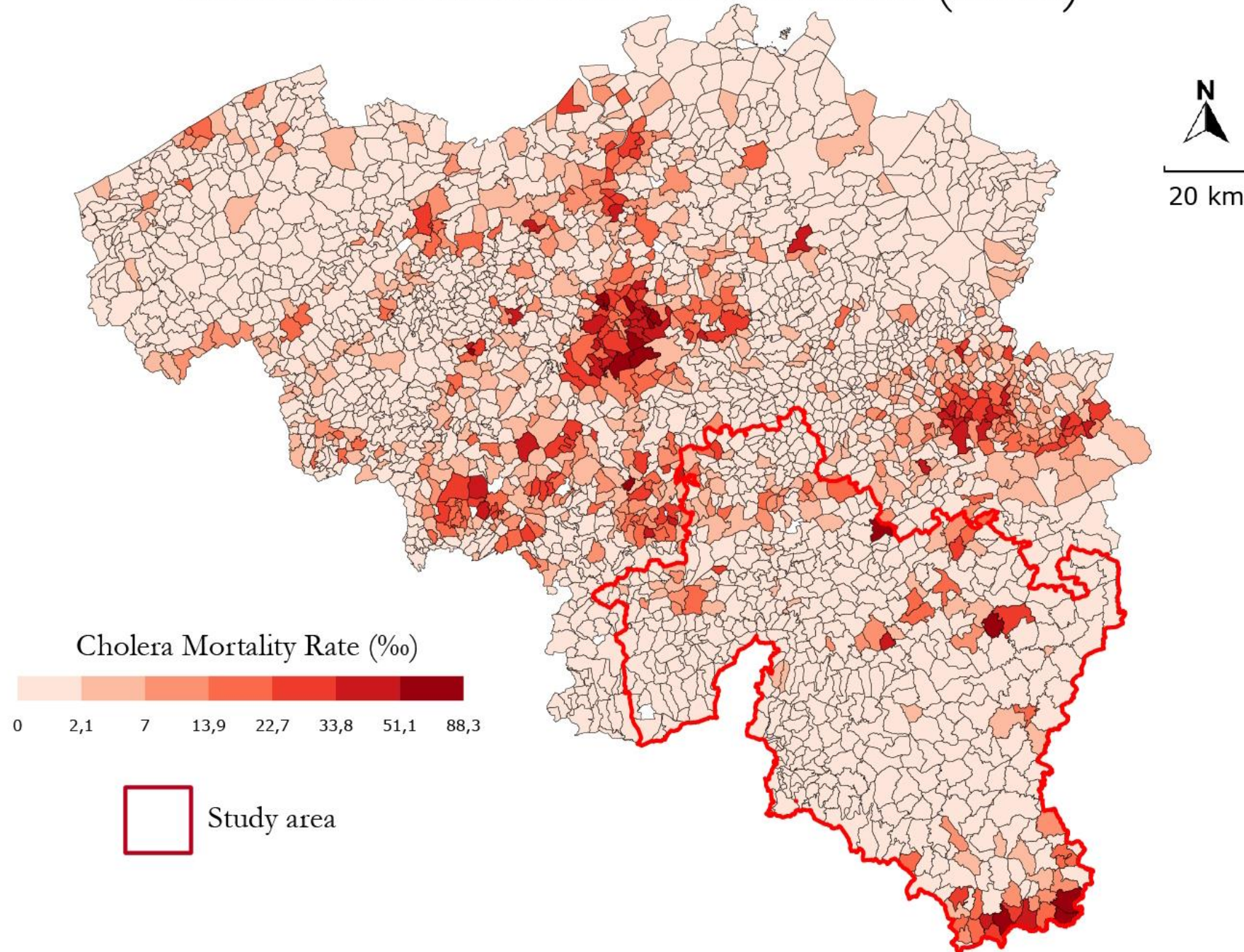


# Results

| URBAN-RURAL TYPOLOGY |                        | NUMBER OF CHOLERA DEATHS | PROPORTION OF ALL CHOLERA DEATHS IN BELGIUM (%) | CHOLERA CRUDE MORTALITY RATE (%) | MUNICIPALITY WITH NO DEATHS (%) | NUMBER OF MUNICIPALITIES |
|----------------------|------------------------|--------------------------|-------------------------------------------------|----------------------------------|---------------------------------|--------------------------|
| URBAN                | > 100 000 inhab.       | 11 827                   | 27.25                                           | 2.42                             | 0                               | 3                        |
|                      | 20 000 – 10 000 inhab. | 5 697                    | 13.13                                           | 1.70                             | 0                               | 13                       |
|                      | 10 000 - 20 000 inhab. | 4 459                    | 10.27                                           | 1.22                             | 0                               | 28                       |
|                      | 5 000 - 10 000 inhab.  | 6 996                    | 16.12                                           | 1.18                             | 17                              | 87                       |
| RURAL                | < 5 000 inhab.         | 14 421                   | 33.23                                           | 0.47                             | 63                              | 2 418                    |
| TOTAL                | Belgium                | 43 400                   | 100.00                                          | 0.90                             | 60                              | 2 549                    |

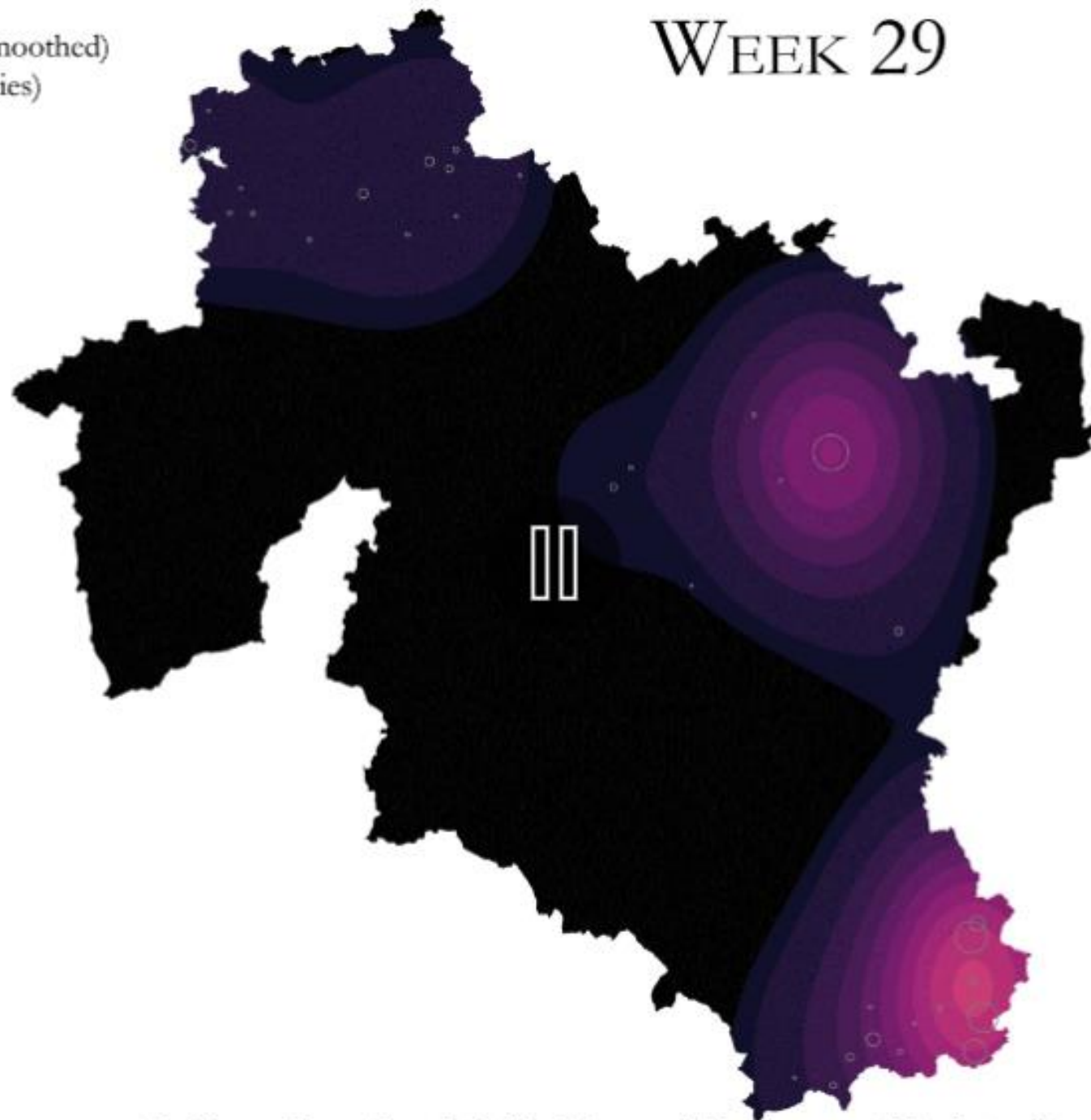
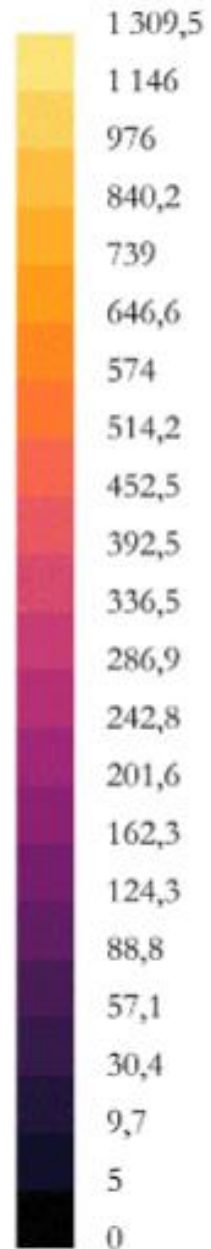
# CHOLERA PANDEMIC IN BELGIUM (1866)

## Results

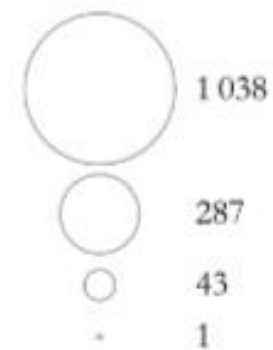


Number of cholera cases (spatially smoothed)  
(Increasing cumulative frequencies)

WEEK 29



Number of cholera cases  
(Increasing cumulative frequencies)



Spatial smoothing performed with Magrit (exponential function, span = 10 km, beta = 2)

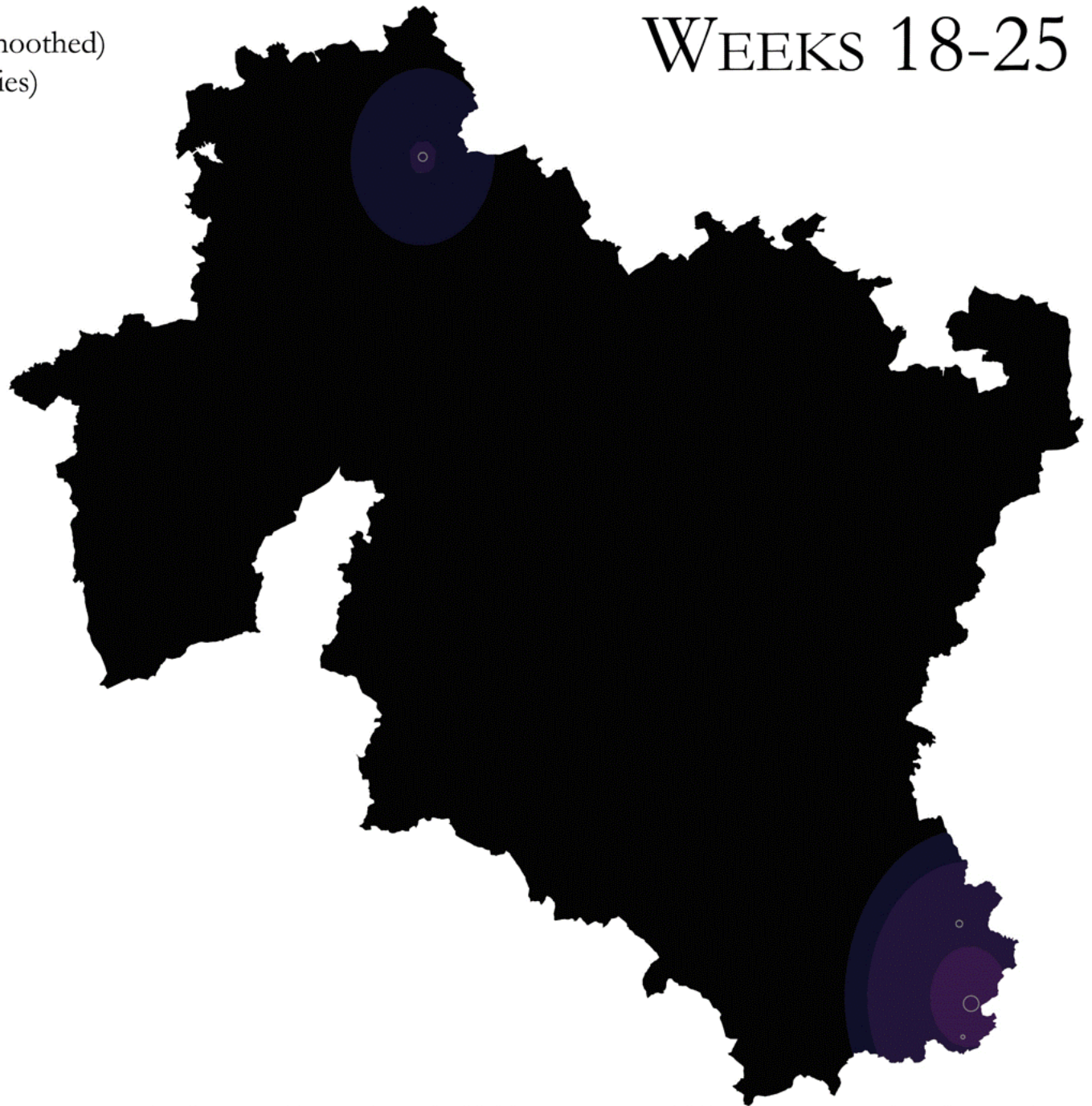
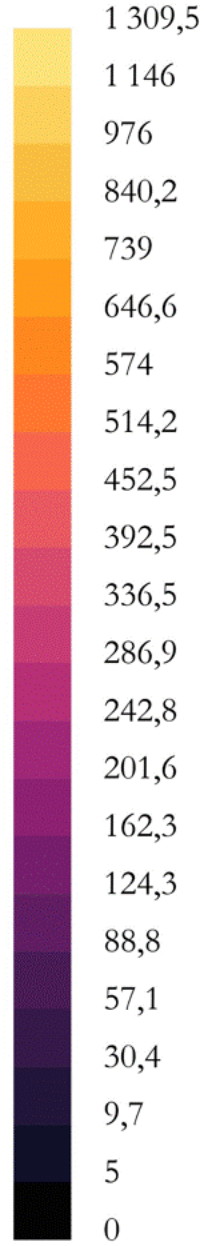
Author: Doignon Y. (2024)

# WEEKS 18-25

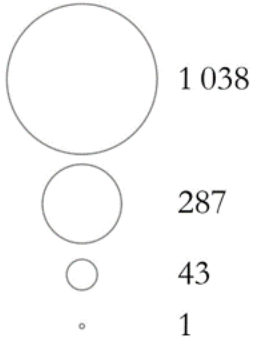


10 km

Number of cholera cases (spatially smoothed)  
(Increasing cumulative frequencies)



Number of cholera cases  
(Increasing cumulative frequencies)



Spatial smoothing performed with Magrit (exponential function, span = 10 km, beta = 2)

Author: Doignon Y. (2024)

S18-25



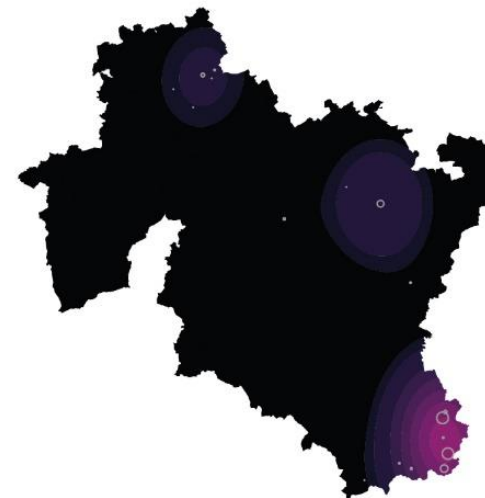
S26



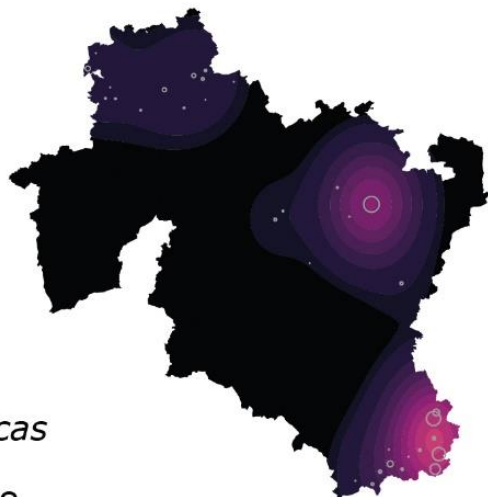
S27



S28



S29



S30



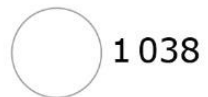
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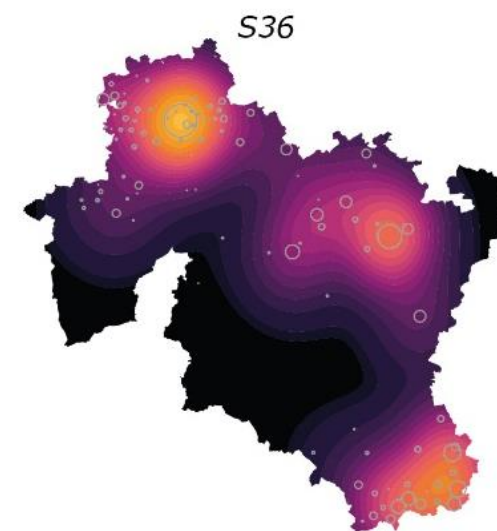
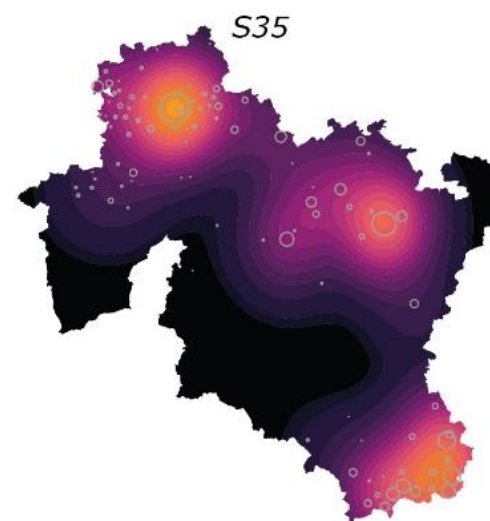
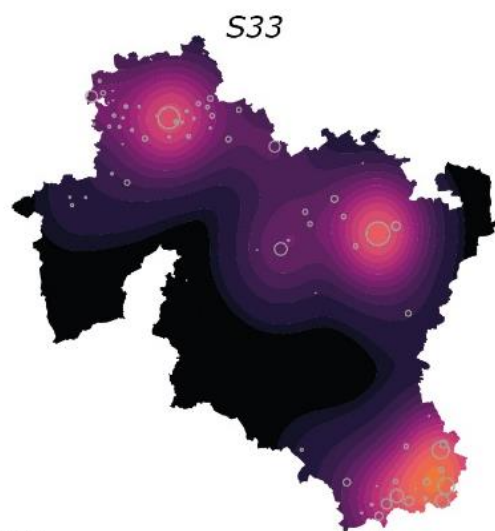
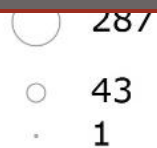


S32

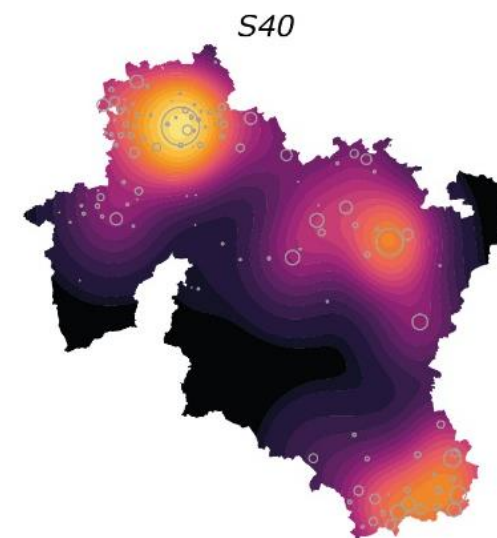
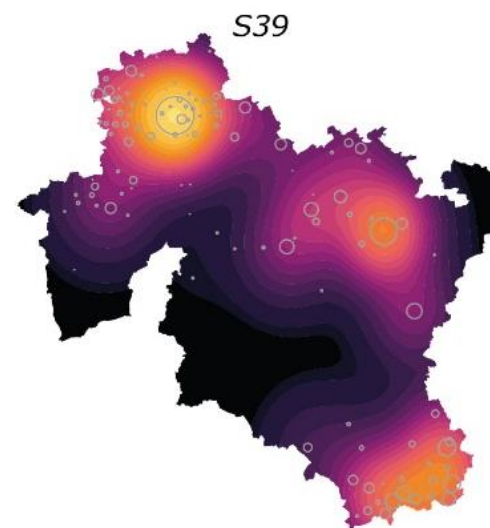
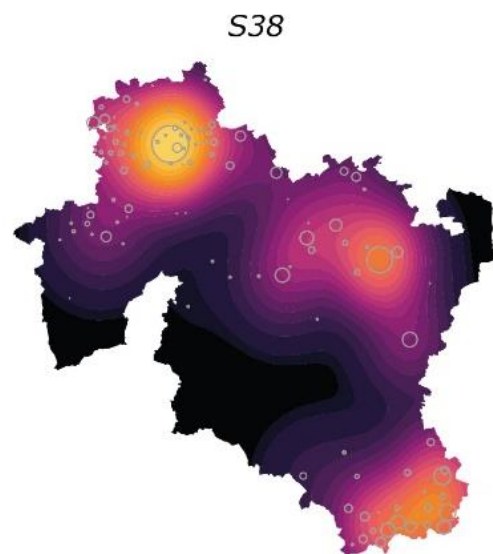
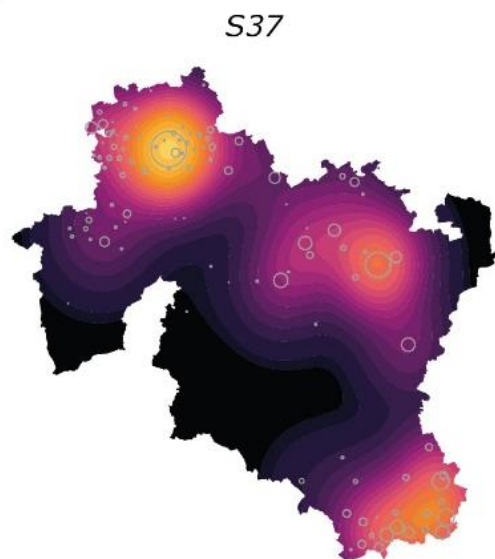
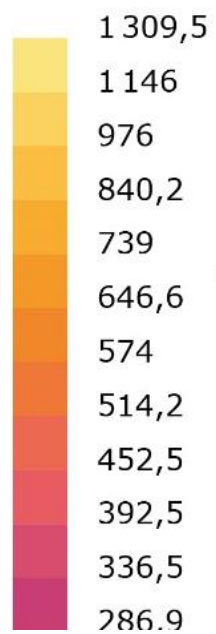


Nombre de cas

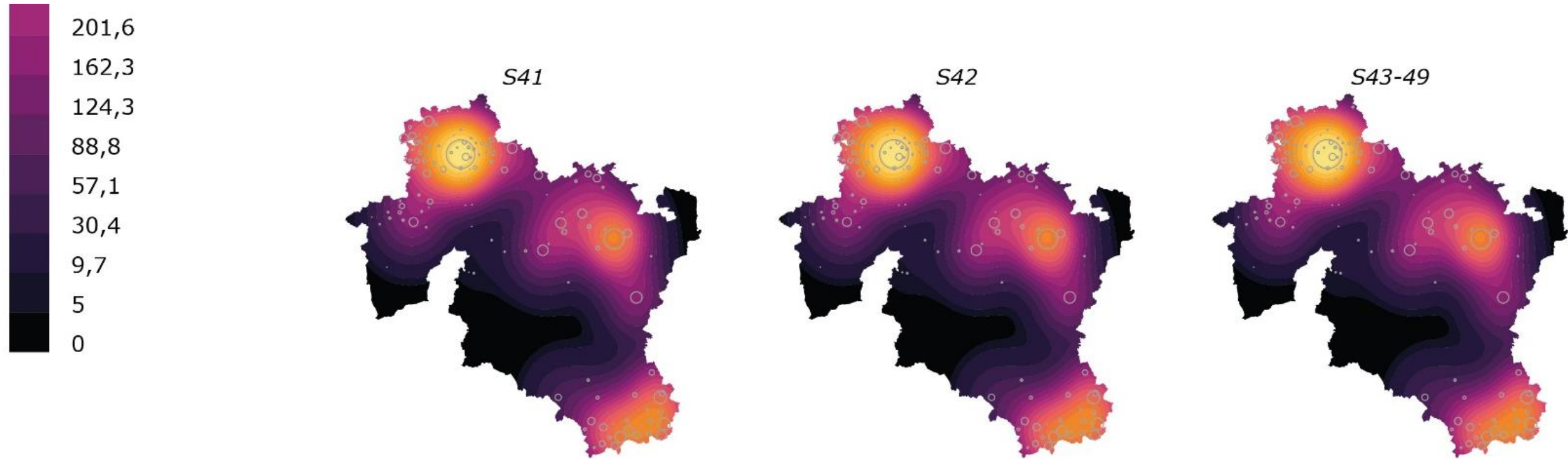




Nombre de cas  
(lissage)

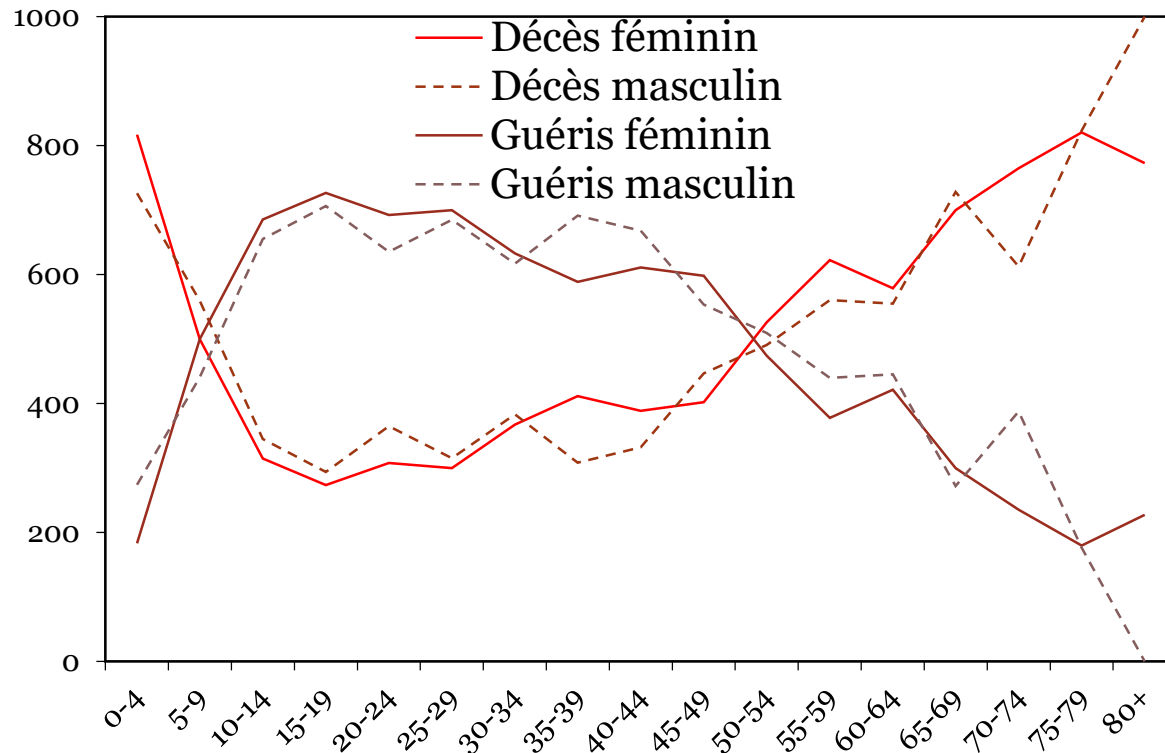


# Results: Spatial diffusion of the disease

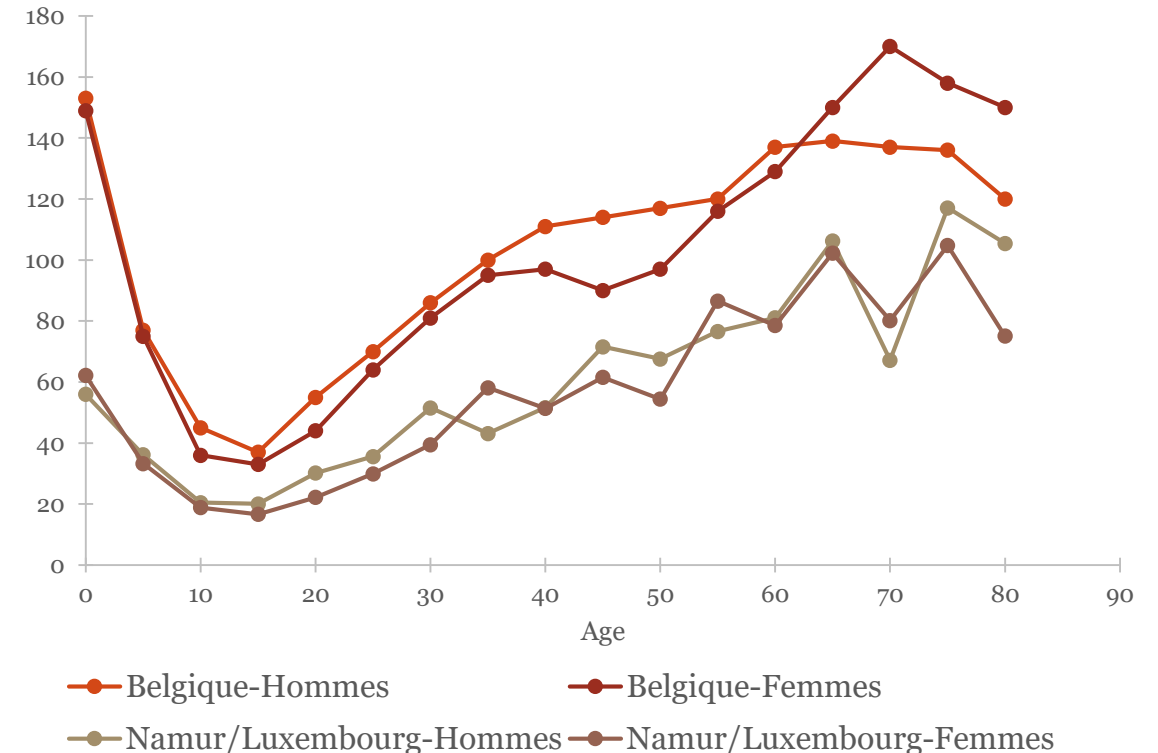


# Results: Profiles

*Lethality and cure (‰) by age and sex among cholera patients in the two provinces (1866).*



*Cholera mortality rate (expressed in p. 10,000) according to age and sex, in Belgium and the provinces of Namur and Luxembourg, for the year 1866*



# Results: Profiles

| Variables                                  | Sick | Death | Cure | Death     | Cure      |
|--------------------------------------------|------|-------|------|-----------|-----------|
|                                            |      |       |      | (% lines) | (% lines) |
| SEX                                        |      |       |      |           |           |
| Women                                      | 2391 | 1141  | 1250 | 48%       | 52%       |
| Men                                        | 2651 | 1216  | 1435 | 46%       | 54%       |
| SOCIAL POSITION (without Namur)            |      |       |      |           |           |
| Rich                                       | 1090 | 513   | 577  | 47%       | 53%       |
| Average                                    | 244  | 88    | 156  | 36%       | 64%       |
| Poor                                       | 2448 | 1187  | 1261 | 48%       | 52%       |
| Unknown                                    | 222  | 107   | 115  | 48%       | 52%       |
| HISCLASS Recoded (Men 15+)                 |      |       |      |           |           |
| Elites, managers, lower professions, sales | 172  | 64    | 108  | 37%       | 63%       |
| Skilled workers                            | 686  | 289   | 397  | 42%       | 58%       |
| Farmers and farm workers                   | 262  | 110   | 152  | 42%       | 58%       |
| Low-skilled or unskilled workers           | 660  | 289   | 371  | 44%       | 56%       |
| Unknown                                    | 302  | 141   | 161  | 47%       | 53%       |
| TOTAL                                      | 5042 | 2357  | 2685 | 47%       | 53%       |

# Results: Models

| Variable               | Estimation | Standard Error | Z       | p      | Odds ratio |
|------------------------|------------|----------------|---------|--------|------------|
| <b>Intercept</b>       | 0.378      | 0.082          | 4.625   | <0.001 | 1.459      |
| <b>Sex</b>             |            |                |         |        |            |
| Male                   | Ref.       |                |         |        |            |
| Female                 | 0.033      | 0.066          | 0.506   | 0.613  | 1.034      |
| <b>Age groups</b>      |            |                |         |        |            |
| 0-14                   | Ref.       |                |         |        |            |
| 15-30                  | -1.086     | 0.104          | -10.463 | <0.001 | 0.337      |
| 30-45                  | -0.872     | 0.098          | -8.920  | <0.001 | 0.418      |
| 45-60                  | -0.368     | 0.101          | -3.648  | <0.001 | 0.692      |
| 60-75                  | 0.249      | 0.119          | 2.096   | 0.036  | 1.282      |
| 75+                    | 0.180      | 0.286          | 4.120   | <0.001 | 3.254      |
| <b>Social position</b> |            |                |         |        |            |
| Poor                   | Ref.       |                |         |        |            |
| Middle                 | -0.480     | 0.145          | -3.310  | <0.001 | 0.619      |
| Comfortable            | -0.087     | 0.076          | -1.145  | 0.252  | 0.917      |
| Undetermined           | 0.008      | 0.146          | 0.056   | 0.956  | 1.008      |

|                        |                 |                | CI 95%      |             |
|------------------------|-----------------|----------------|-------------|-------------|
| Variable               | Marginal effect | Standard Error | Lower Bound | Upper Bound |
| <b>Sex</b>             |                 |                |             |             |
| Male                   | 0.522           | 0.0185         | 0.486       | 0.558       |
| Female                 | 0.530           | 0.0189         | 0.493       | 0.567       |
| <b>Age Groups</b>      |                 |                |             |             |
| 0-14                   | 0.563           | 0.0204         | 0.523       | 0.603       |
| 15-30                  | 0.303           | 0.0182         | 0.269       | 0.340       |
| 30-45                  | 0.350           | 0.0177         | 0.317       | 0.386       |
| 45-60                  | 0.472           | 0.0207         | 0.432       | 0.512       |
| 60-75                  | 0.623           | 0.0239         | 0.575       | 0.669       |
| 75+                    | 0.808           | 0.0433         | 0.708       | 0.879       |
| <b>Social position</b> |                 |                |             |             |
| Poor                   | 0.561           | 0.015          | 0.531       | 0.590       |
| Middle                 | 0.442           | 0.0357         | 0.373       | 0.512       |
| Comfortable            | 0.539           | 0.0187         | 0.503       | 0.576       |
| Undetermined           | 0.563           | 0.036          | 0.492       | 0.632       |

# Results: Models

Results: Models

|                                  |            |                |        |        |            | CI 95%                           |                 |                |             |             |
|----------------------------------|------------|----------------|--------|--------|------------|----------------------------------|-----------------|----------------|-------------|-------------|
| Variable                         | Estimation | Standard Error | Z      | p      | Odds ratio | Variable                         | Marginal effect | Standard Error | Lower Bound | Upper Bound |
| Intercept                        | -1.008     | 0.187          | -5.387 | <0.001 | 0.365      | Age groups                       |                 |                |             |             |
| Age groups                       |            |                |        |        |            | 15-30                            | 0.306           | 0.0206         | 0.268       | 0.348       |
| 15-30                            | Ref.       |                |        |        |            | 30-45                            | 0.330           | 0.0194         | 0.293       | 0.369       |
| 30-45                            | 0.109      | 0.124          | 0.884  | 0.377  | 1.116      | 45-60                            | 0.481           | 0.0232         | 0.435       | 0.526       |
| 45-60                            | 0.739      | 0.129          | 5.736  | <0.001 | 2.093      | 60-75                            | 0.621           | 0.0286         | 0.564       | 0.676       |
| 60-75                            | 1.312      | 0.152          | 8.637  | <0.001 | 3.715      | 75+                              | 0.879           | 0.0465         | 0.755       | 0.945       |
| 75+                              | 2.797      | 0.445          | 6.287  | <0.001 | 16.398     | HISCLASS                         |                 |                |             |             |
| HISCLASS                         |            |                |        |        |            | Elites and employees             | 0.496           | 0.0462         | 0.407       | 0.586       |
| Elites and employees             | Ref.       |                |        |        |            | Skilled workers                  | 0.571           | 0.029          | 0.514       | 0.627       |
| Skilled workers                  | 0.304      | 0.181          | 1.677  | 0.094  | 1.355      | Farmers and agricultural workers | 0.507           | 0.0384         | 0.432       | 0.582       |
| Farmers and agricultural workers | 0.044      | 0.209          | 0.21   | 0.834  | 1.045      | Low-skilled or unskilled workers | 0.574           | 0.0288         | 0.516       | 0.629       |
| Low-skilled or unskilled workers | 0.312      | 0.182          | 1.717  | 0.086  | 1.366      | No HISCLASS (no profession)      | 0.569           | 0.0354         | 0.499       | 0.637       |
| No HISCLASS (no profession)      | 0.295      | 0.207          | 1.428  | 0.153  | 1.343      |                                  |                 |                |             |             |

# Conclusion

- How is the pandemic spreading?
  - Spread at three points linked to diffusion around already contaminated areas (Messancy, La Roche, Namur)
  - A non-uniform distribution.
- Does the socio-demographic profile of cholera deaths match that observed in urban areas?
  - The age profiles are similar to those in urban areas.
  - For the social group, we had to work with the professions for working men: under-mortality of elites compared with others (for people affected by the disease).
- Were there any differences in the profiles of those who were cured and those who died?
  - A high probability of contracting the disease in adults, but a lower mortality rate.
  - Social variability (gradient).

# THANK YOU FOR YOUR ATTENTION

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