



Espace populations sociétés

2023/3-2024/1 | 2024

La mortalité selon les causes de décès : approches spatio-temporelles

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Electronic version

URL: <https://journals.openedition.org/eps/14368>

DOI: 10.4000/12tpp

ISSN: 2104-3752

Translation(s):

Le choléra en milieu rural : la pandémie de 1866 dans les provinces de Namur et Luxembourg - URL : <https://journals.openedition.org/eps/14403> [fr]

Publisher

Université de Lille

Provided by Université catholique de Louvain



Electronic reference

Mélanie Bourguignon, Yoann Doignon, Thierry Eggerickx and Jean-Paul Sanderson, "Cholera in rural areas: the 1866 pandemic in the provinces of Namur and Luxembourg", *Espace populations sociétés* [Online], 2023/3-2024/1 | 2024, Online since 13 November 2024, connection on 05 December 2024.
URL: <http://journals.openedition.org/eps/14368> ; DOI: <https://doi.org/10.4000/12tpp>

This text was automatically generated on December 4, 2024.



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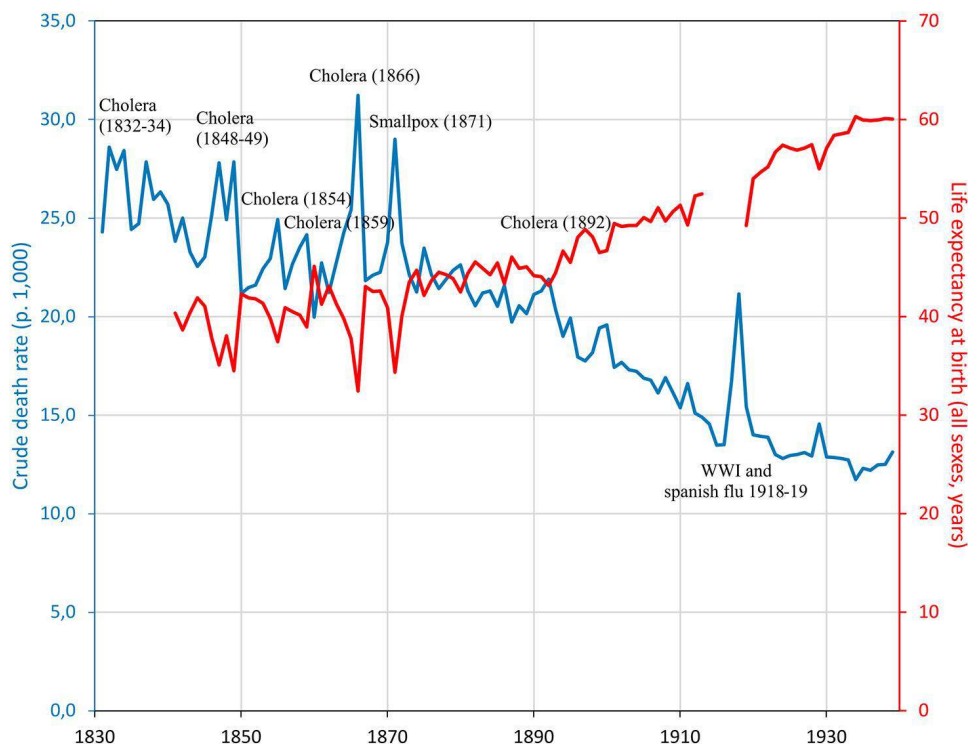
Le choléra en milieu rural : la pandémie de 1866 dans les provinces de Namur et Luxembourg

Mélanie Bourguignon, Yoann Doignon, Thierry Eggerickx and Jean-Paul Sanderson

Introduction

- 1 Cholera was the pandemic par excellence of the 19th century, as the plague had been in previous centuries [Bourdelaïs, Raulot, 1987; Evans, 1988]. The disease played an essential role in the genesis and development of public and private hygiene measures in many countries¹ [Mackenbach, 2020; Oris, 1988], as well as in strengthening medical power [Bourdelaïs, Raulot, 1987]. Europe experienced six cholera pandemics in the 19th century: in 1829-1837, 1848-1849, 1853-1854, 1865-1866, 1883-1884 and 1892-1894. There are no continent-wide figures for the number of victims of these pandemics, but data is available for certain countries. These show that the pandemics' virulence varied between countries. In France, the pandemic of 1854 was the most deadly [Bourdelaïs, Raulot, 1987]. In Belgium, it was the pandemic of 1866 [Eggerickx, Poulain, 1991], with 43,400 deaths officially due to cholera, almost 30% of the total number recorded in 1866. This was Belgium's worst mortality crisis of the 19th century: between 1865 and 1866, the crude death rate rose from 25.6 to 31.3%, and life expectancy at birth fell by 5.3 years (Figure 1).

Figure 1. Trends in crude mortality rate and life expectancy at birth in Belgium, 1830-1939.



Source: Human Mortality Database.

- 2 In Belgium, the cholera pandemic of 1866 was the subject of a series of reports, most of which focused on large- and medium-sized towns, to which were added the production of aggregate data by commune on the number of deaths attributed to cholera and nominative data specifying the socio-demographic characteristics of cholera sufferers and decedents. Our research, largely based on these unpublished individual data, concerns two essentially rural provinces—Namur and Luxembourg—located in the south of the country.² Cholera, often presented as an urban disease, also affected the countryside. The south of the province of Luxembourg was one of the gateways to the 1866 Belgian pandemic [Oris, 1988; Eggerickx, Poulain, 1991].
- 3 This article has two primary objectives. Firstly, it looks at the spatial spread of the pandemic in these two provinces. Why were some areas heavily affected while others emerged virtually unscathed from the pandemic? Secondly, the socio-demographic profile of cholera patients is analysed: do those who recovered and those who died have similar characteristics?

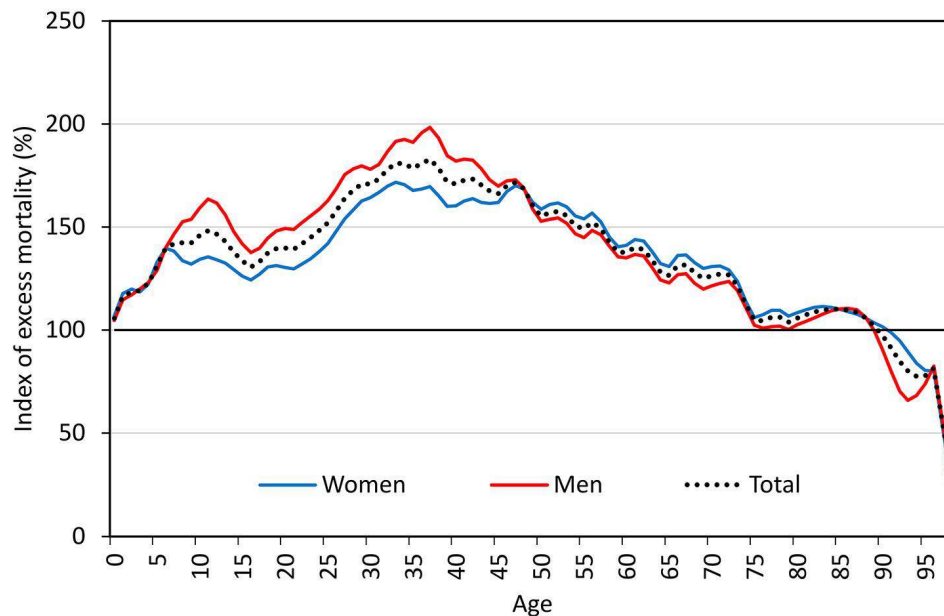
State of the art

- 4 Because cholera is both an ancient (in Europe, it disappeared at the beginning of the 20th century) and a contemporary disease (a resurgence of the pandemic has been reported in some countries in the 21st century [Natchaba et al., 2023; Yacouba et al., 2023]), publications on the subject are particularly abundant. This review of the literature focuses on two aspects related to the objectives of the article: firstly, identification of the main socio-demographic determinants of the disease and cholera mortality, and secondly, analysis of the pandemic's spatial spread. We also add figures

relating to the overall situation in Belgium, based on data published by Eggerickx and Poulain [1991].

- 5 Which socio-demographic groups are most exposed to the disease and to cholera mortality? Cholera spared no one and, according to Davenport et al [2019], its high lethality among adults was one of the main causes of the panic associated with the disease. Indices of excess mortality by age, comparing the Belgian mortality rates in 1866 and 1865, confirm this observation (*Figure 2*). If the higher mortality observed in 1866 compared with 1865 was solely due to cholera, this distribution indicates that the pandemic largely affected adults aged between 25 and 50. Mortality in this group was 50 to 75% higher in 1866 than in 1865. The same observation, based on indices of excess mortality by age, was made for the 1832 cholera pandemic in France [Bourdelaïs, Raulot, 1987]. This excess adult mortality could be explained by their greater mobility and interpersonal contacts related to their professional activity without forgetting, of course, that these age groups are characterised by classically low mortality rates, which can rise sharply when a few extra deaths are added.

Figure 2. Excess mortality indices (expressed in %) by age and sex in Belgium: ratio of 1866 mortality rates to 1865 mortality rates.



Source: Human Mortality Database; authors' calculations.

- 6 Whereas adults saw their risk of dying increase more than others in relative terms during the pandemic (*Figure 2*), the cholera mortality quotients, which relate to the number of deaths attributed to cholera in each age group, show a U-shaped age distribution (*Figure 3*). This means that mortality mostly affects the oldest age groups, i.e., very young children, under the age of five, and the elderly. The pandemic thus reinforced the classic mortality pattern of the time, and its prime targets were those – children and the elderly – who were biologically the most fragile. This U-shaped pattern of cholera mortality was also observed in the 1854 pandemic in France [Bourdelaïs, Raulot, 1988] and the 1833-1835 pandemic in Spain [Vincent, 1988].
- 7 In Belgium, during the 1866 pandemic, the cholera mortality quotient was on average higher for men than for women [*Figure 3*]. However, depending on age, this trend was

reversed, with higher male mortality between the ages of 0 and 65, and higher mortality among older females. The same pattern can be observed in Brussels, Ghent and Namur [Eggerickx, Poulain, 1991]. Nevertheless, during the 1849 cholera pandemic in Leuven, relatively more women than men died [Van der Haegen, De Vos, 1980]. In 1832, cholera in France affected more women over the age of 50 and girls aged between 5 and 14, while men were more affected between the ages of 15 and 35 [Bourdelaïs, Raulot, 1988]. In the province of Poznań, Poland, cholera pandemics in the 19th century killed far more women than men, in contrast to the classic non-pandemic mortality situation. This situation could be explained by the greater involvement of women in helping the sick at home, in hospitals and other dispensaries [Liczbińska, G., 2021]. The pattern of mortality by age and sex is not stable and can vary greatly locally or from one pandemic to another. According to these two demographic variables, the risk of dying from cholera is linked to lifestyles and working patterns, which differ from regionally and from one town to another [Bourdelaïs, Raulot, 1988].

Figure 3. Cholera mortality rate (expressed per 10.000), by age and sex in Belgium in 1866.



Source: Statistics on population movements and civil status, special Cholera section, 1866; authors' calculations.

- 8 Several authors have highlighted the pandemic's social dimension. In 1958, Louis Chevalier pointed out that contemporary texts on cholera epidemics offered a dual social interpretation: the wealthier classes perceived the disease as generated and spread by the poorer classes because of their lack of hygiene; conversely, the idea circulated among the poorer classes that the disease was "sown" by the wealthier classes to exterminate them [Lequin, 1987, p.416]. This led to social riots, particularly in Italy and Russia [Cliff et al., 2004; Cohn, 2017].
- 9 Various studies confirm that cholera mainly affected poorer social classes, while wealthier populations were spared to a greater extent [Fernander et al., 2011; Ali et al., 2002; Oris, 1995; Skillnäs, 1999; Cawood, Upton, 2013; Bourdelaïs, Raulot, 1987]. Alfani [2022] explains that cholera contamination and mortality were linked to living

conditions, and more specifically to overcrowded neighbourhoods, poor nutrition and inadequate access to drinking water. The work of John Snow [cited by Cliff et al., 2004] on the 1848-49 pandemic in London highlighted the role of water quality and supply in the spread of the pandemic and led to a fundamental advance in the fight against the disease.

- 10 In the case of Belgium, Eggerickx and Poulain [1988] show that there is a difference according to social class – blue-collar workers being more affected than other occupational categories – but also according to work environment. These observations were also made for Lille during the pandemic of 1832 [Engrand and Engrand, 1972]. In short, everything depended on social and professional position, but also on the ability to avoid interpersonal contact, in particular by fleeing, which was most often the prerogative of the wealthiest. Other groups, such as craftsmen, manual workers and small shopkeepers, *"have little alternative but to continue working in order to support themselves and their families. From then on, promiscuity and the multiplication of contacts, as well as the harsh working conditions, played a decisive role in their contamination"* [Bourdelaïs, Raulot, 1987, pp.121-122]. However, most of these observations are based on an analysis of the situation in cities and industrial environments. Do these conclusions also apply to rural areas?
- 11 To what extent was cholera a specifically urban pandemic, given the often reported high population densities and urban promiscuity? About the 1832 pandemic in France, Bourdelaïs [1991] points out that literary accounts and iconographic representations generally highlight the disastrous situation in Paris. Much of the current international scientific literature, such as the period reports on the 1866 pandemic in Belgium, for example, focuses on large or medium-sized towns [Lafosse, 1977; Patout-Libion, 1982; Poncelet, 1986; Verbaeys, 2008; Devos et al., 2022]. Figures for the 1866 cholera pandemic in Belgium confirm that the disease primarily affected urban and industrial areas, with the highest population densities and migratory exchanges [Eggerickx, Poulain, 1991]. However, not all rural regions were spared. In France, the 1832 pandemic claimed many victims in the Ardennes, Normandy and western Brittany [Lequin, 1987]. In Belgium, during the 1866 pandemic, the countryside in the southeast of the country on the Belgian-Luxembourg border was particularly hard hit.
- 12 The geography of a pandemic can tell us how it spreads (hierarchically and/or by contiguity), as well as certain factors that explain its virulence. We need to distinguish between "transmission chains", which are patterned according to human movements (railways, troop movements, refugee movements, etc.), and "transmission reservoirs", which determine "hot spots" in terms of mortality. The latter are based on several factors: population density, promiscuity, poverty, poor hygiene conditions, poor medical supervision, previous pathological conditions, etc. [Vinet, 2018]. Lequin [1987] notes, cholera routes within a country like France, and within cities, are not clear-cut; heavily affected areas, neighbourhoods and streets rub shoulders with others that are virtually unaffected.
- 13 Spatial analyses generally focus on two different levels. Some use very precise data to analyse the spread of disease and the distribution of deaths within a city, on the scale of streets and neighbourhoods. During the 1866 pandemic in Linköping, Sweden, the victims were mainly located around infected water sources, as John Snow had shown in the case of London [Skillnäs, 1999]. This was also the case in Leuven, Belgium, during the 1849 epidemic. There, the high cholera mortality observed in working-class

neighbourhoods is thought to be due to water pumps contaminated by seepage from nearby toilets [Van Der Haegen, De Vos, 1980]. In Brussels, during the same epidemic, the poor quality of the water, combined with unsanitary housing and lack of hygiene, would also explain the excess mortality observed in poor neighbourhoods [Vermeire, 1993]. In the 19th century, the health situation in cities was regularly singled out for criticism [Dupâquier, 1990], and the beginnings of industrialisation did nothing to improve the situation. Relatively poor urban environments encouraged the spread of cholera, from which residents had no means of escape. Poor neighbourhoods would be epidemiological traps of sorts [Alfani, 2022], and cholera would be "*... a further sanction of misery, to such an extent that its urban distribution more or less exactly mirrors the social geography of cities*" [Lequin, 1988, p.415]. In cities, there would therefore be two patterns of spread: one from water-supply points and the other, from person to person, encouraged by overcrowding, poverty, malnutrition and poor hygiene [Lachenal, Thomas, 2023].

- 14 Other studies focus on a smaller scale, examining how a pandemic spreads within a region or country. Analysing the spread of the 1832, 1849 and 1866 pandemics in the United States, Pyle [1969] highlights the impact of the development of rail transport. While in 1832 there was a short distance spread around the points of entry, from 1849 onwards, and especially from 1866 onwards, a more hierarchical spread pattern emerged. Regarding the 1902-1904 cholera pandemic in the Philippines, Smallman-Raynor [1998] hypothesises a mixed approach combining urban hierarchy and close-to-home spread. The pandemic would have spread from urban centres to less urbanised neighbouring areas. The cities were the entry points and amplifiers of the disease. This hypothesis is also put forward by Bourdelais and Raulot [1987], who point to the existence of 'buffer' zones in France where the disease was virtually absent. These zones essentially covered villages where travellers rarely stopped, even if they did cross them on their way from one town to another. These areas would have been preserved thanks to the low intensity of contact. All this gave rise to a hierarchical distribution pattern involving the cities, combined with a pattern of distribution by proximity (spreading out around the cities and entry points). This model would be favoured by mobility: the greater the exchanges with the infected area, the greater the probability of contamination. Added to this would be the spread of the disease via waterways.
- 15 This article analyses the cholera pandemic of 1866 in a rural region of southern Belgium made up of the provinces of Namur and Luxembourg; it is structured around two questions. The first concerns the process by which the disease spread spatially. How did the pandemic spread? Which areas were most affected? We hypothesise that (1) proximity to major communication routes (roads, railways) and rivers explains the spread of the pandemic, as does proximity to major towns (Namur) or areas that were already contaminated. In other words, cholera cases and deaths were not evenly distributed across these rural areas, and heavily affected areas coexisted with disease-free zones.
- 16 The second question specifically concerns the socio-demographic profile of those who died of cholera. Does it correspond to that observed elsewhere, particularly in other regions of the country and in other areas of residence, especially urban areas? Knowing that cholera deaths predominantly affected demographically and socially most vulnerable populations, we hypothesise (2) that in these rural provinces, the youngest

and oldest, as well as the poorest, were, as elsewhere in Belgium, among the preferred victims of cholera. Furthermore, the data makes it possible to identify not only those who died of cholera, but those who were ill with the disease and those who recovered from it. Are there any differences between the profiles of those who recovered and those who died? Based on the same findings, we hypothesise (3) that people who recovered from cholera had different socio-demographic characteristics to those who died, with more adults and people from privileged social classes.

Data and methods

- 17 This article focuses on the cholera pandemic of 1866 in the southern Belgian provinces of Namur and Luxembourg (Figure 4 and Figure 5).

Figure 4. Location map of Belgium.

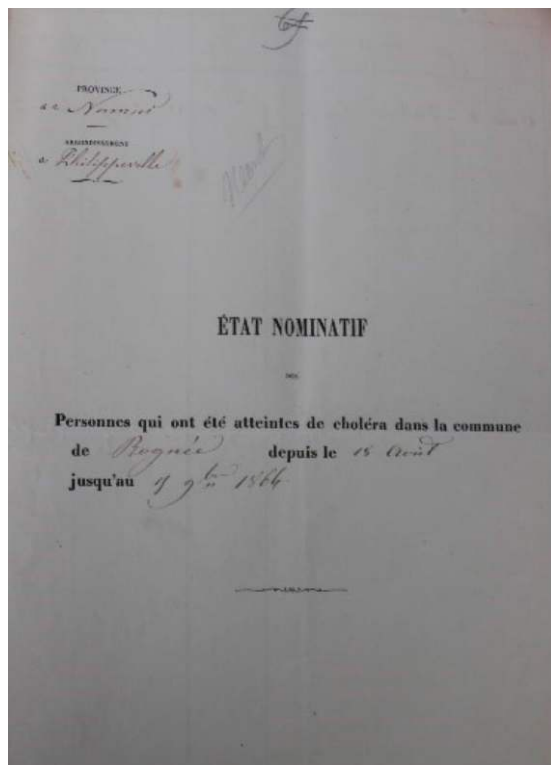


Figure 5. Map showing the location of the study area (provinces of Namur and Luxembourg).



- 18 With 43,400 deaths, this was the deadliest pandemic Belgium had ever seen, but it was also the best documented, thanks in particular to the lists kept by local authorities of people suffering from cholera, whether they died or recovered (Figure 6). This data source,³ whose exact title is "*Etat nominatif. Persons who contracted cholera in the commune of ... from ... 1866 to ... 1866*", is available from the Provincial Archives in Namur for communes in the Province of Namur and from the Provincial Archives in Arlon for communes in the Province of Luxembourg.
- 19 This is a very rich source that includes the person's first and last names, age, profession and social status, the dates the illness began and ended, as well as its outcome (recovery or death), in addition to the address or neighbourhood and any comments on the pandemic, or, depending on the municipality, the number of cases in the dwelling. All municipalities affected by the pandemic were to complete the form and send a copy to the province.

Figure 6. Example of a register of people infected with cholera used in 1866.



NOM ET PRÉNOM	ÂGE	SEX	ÉTAT CIVIL	PROFESSION	DATE DE DÉCÈS	CAUSE DE DÉCÈS	LIÈGE	PROVINCE	ARRONDISSEMENT	COMMUNE	PAROISSE	ÉGLISE	CEMENTIERE	REMARQUES
1. J. J. J. J.	1	M	Jeune	Châtelain	15/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
2. J. J. J. J.	2	F	Jeune	Châtelain	16/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
3. J. J. J. J.	3	M	Jeune	Châtelain	17/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
4. J. J. J. J.	4	F	Jeune	Châtelain	18/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
5. J. J. J. J.	5	M	Jeune	Châtelain	19/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
6. J. J. J. J.	6	F	Jeune	Châtelain	20/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
7. J. J. J. J.	7	M	Jeune	Châtelain	21/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
8. J. J. J. J.	8	F	Jeune	Châtelain	22/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
9. J. J. J. J.	9	M	Jeune	Châtelain	23/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
10. J. J. J. J.	10	F	Jeune	Châtelain	24/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
11. J. J. J. J.	11	M	Jeune	Châtelain	25/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
12. J. J. J. J.	12	F	Jeune	Châtelain	26/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
13. J. J. J. J.	13	M	Jeune	Châtelain	27/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
14. J. J. J. J.	14	F	Jeune	Châtelain	28/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
15. J. J. J. J.	15	M	Jeune	Châtelain	29/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
16. J. J. J. J.	16	F	Jeune	Châtelain	30/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
17. J. J. J. J.	17	M	Jeune	Châtelain	31/08	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
18. J. J. J. J.	18	F	Jeune	Châtelain	01/09	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
19. J. J. J. J.	19	M	Jeune	Châtelain	02/09	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
20. J. J. J. J.	20	F	Jeune	Châtelain	03/09	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
21. J. J. J. J.	21	M	Jeune	Châtelain	04/09	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
22. J. J. J. J.	22	F	Jeune	Châtelain	05/09	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
23. J. J. J. J.	23	M	Jeune	Châtelain	06/09	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
24. J. J. J. J.	24	F	Jeune	Châtelain	07/09	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
25. J. J. J. J.	25	M	Jeune	Châtelain	08/09	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	
26. J. J. J. J.	26	F	Jeune	Châtelain	09/09	Choléra	1	Namur	Philippeville	Rogée	St. Pierre	St. Pierre	St. Pierre	

- 20 There are, however, specific limitations to this data, and, above all, it is important to test its completeness. The first certainty is that these nominative data were used to compile the official statistics on mortality due to cholera in 1866, aggregated by municipalities and published in the series, "Statistics on population movements and civil status in 1866". According to this series, the provinces of Luxembourg and Namur suffered 2,557 deaths from cholera, whereas *the nominal census* records only 2,366, an underestimate of 191 cases. How can this discrepancy be explained, given that in the vast majority of communes, the number of deaths provided by *the nominal register*

corresponds to the nearest unit to that produced by the official statistics? The only notable exception to this rule is the town of Namur, where *the nominal register records* 462 deaths and the official statistics 501. In addition, the difference between the two databases can be explained mainly by the absence of around ten communes from the provincial nominal census.⁴ Either these communes did not send their data to the province, or it has been lost. It is therefore very likely that the socio-demographic profile of those "absent" corresponds to that of those "present" in the nominal database.

- 21 A second question arises: in both datasets, around 60% of municipalities did not report any cholera deaths. Does this mean that there were no cases, or that they were not detected because they had been rare in the commune? It is difficult to give a definitive answer to this question. Nevertheless, the crude cholera mortality rates derived from these data series can be compared with the excess mortality index, which compares the total number of deaths observed in 1866 with the average number of deaths in the years 1863-1864, according to population movement and civil status statistics. Logically, zero gross cholera mortality rates (no deaths due to cholera) should correspond to excess mortality indices of less than or slightly greater than 1. This turns out to be the case for 68% of the communes, which is a satisfactory result given the excess mortality index's sensitivity to small numbers.⁵ It is therefore legitimate to assume that a non-declaration corresponds to an absence of cholera deaths in each commune.
- 22 Another potential problem concerns the date of registration of the event. The form was supposed to record the date of recovery or death, the date of onset of the illness and the date of registration. Very often, the patient's registration date coincides with the date of death. Given that an individual's illness can progress very rapidly [Lequin, 1987; Lachenal, Thomas, 2023], the coincidence may reflect reality.
- 23 Another problematic point concerns the 'social position' variable, which places individuals on a continuum from 'indigent' to 'well-to-do', with variations in the modalities according to the different communes. This variable is potentially very important as it allows us to identify the social position of women and children for whom no occupation is mentioned. It also provides some nuance for those who do declare an occupation. Within the same commune, one farmer may be declared "well-off" and another "poor,"⁶ which no doubt reflects the reality on the ground. Nevertheless, the description of social position is left to local authorities' free interpretation, and we do not know the criteria on which it is based. Thus, alongside the word 'indigent', we find the following nuances: 'absolute destitution', 'in misery', 'unfortunate', 'bad', 'mediocre', 'not well off', etc. Furthermore, in some municipalities, the variable 'indigent' appears systematically for people with no declared occupation. To compensate for these uncertainties, we have simplified the information. The various terms have been grouped into three categories: Poor – Average – Well-to-do, to which was added an Indeterminate category containing individuals not classified in the three previous categories. This variable cannot be used for the municipality of Namur (the only 'large' city in the two provinces), as all patients were classified as indigent. Analyses taking this variable into account therefore do not include data from Namur.
- 24 Occupation is another important variable. This is mentioned predominantly for adult men and, where applicable, for single women or those who worked as seamstresses. In most cases, the women were described as 'housewives', while no occupation was

specified for children. There are several limitations to this information, including two main ones. Pluri-activity was common in 19th-century rural contexts, as it enabled multiple sources of income [Bourguignon, 2023]. The data do not allow this dimension to be considered. Since our aim was to work on socio-professional groups, we used the *Hiclass* (*Historical International Social Class Scheme*) classification [Van Leeuwen and Maas, 2011]. This classification groups the different professions in such a way as to create categories that can be used to structure the social space. Given the size of our workforce, a typology of five classes was adopted: an upper-class comprising elites and employees; a second class comprising skilled workers; a third-class comprising owners, farmers and other land workers (excluding day labourers); a fourth class comprising workers with few or no skills (including day labourers); and a final category comprising 'no occupations'. Given the information available, this classification was only applied to men aged 15 or over.⁷ The models including the *Hiclass* typology will therefore cover only this population. On the other hand, information on social position (a social continuum ranging from poor to well-to-do) covers the entire population, including women and children.

- 25 Despite these limitations, it is an exceptional source that makes it possible to follow the pandemic's path through the communes of the provinces of Namur and Luxembourg, and to characterise the socio-demographic characteristics of those who recovered and those who died of cholera. In total, no fewer than 5,168 people were recorded, of whom 2,365 died of cholera, 2,693 recovered from the effects of the disease and 118 were left undocumented. The latter had no particular characteristics, apart from the fact that 65 of these undocumented cases occurred in Gembloux. The others were spread across all the communes, with no age or sex profile. They could be patients identified during the doctor's visit, but for whom there was no follow-up.
- 26 For purposes of this contribution, these data are analysed twice, at different levels. First: spatio-temporal analyses at the municipality level. Mapping deaths attributed to cholera on a national scale is carried out, to place the study area in a wider context. This reading considers the territories' rural or urban dimensions. With cholera cases also available on a day-by-day basis, maps of the spatio-temporal evolution of the disease were produced at a local level, that of the communes, based on increasing cumulative frequencies of cholera cases per week. Spatial smoothing was applied to highlight the geographical dynamics of the disease, and to limit the statistical variability, arising from small numbers, inherent in local-level analyses. The potential smoothing method, *i.e.*, Stewart's method, was chosen [Stewart, Warntz 1958; Grasland, Mathian, Vincent 2000] and carried out using the online Magrit interface (<http://magrit.cnrs.fr>), based on the following parameters: exponential function, span = 10 km, beta = 2.
- 27 The data was then analysed individually. These included descriptive and multivariate analyses. Logistic regressions were performed to model the individual probability of dying from cholera (compared with the probability of recovering from the disease, which is our reference event). The marginal means were also interpreted in addition to the standard regression parameters. They indicate the probability of dying for a specific modality of a variable (all other things being equal in terms of the other variables introduced into the model), and not in relation to a reference modality. This makes it possible to compare the effect of the size of the different modalities on the probability of dying.

The results

Nationally, two-thirds of deaths attributed to cholera are recorded in cities

- 28 Mapping the number of cholera deaths in 1866 reveals a very uneven spatial distribution of the disease across the country (*Figure 7*). Firstly, the majority of communes (60%) would not, *a priori*, have been affected by cholera. The areas with the highest number of deaths due to the disease are the large cities (Brussels, Antwerp, Ghent), the industrial basins of Mons, Charleroi, Liège and Verviers, and the densely populated areas (such as the Brussels-Ghent-Antwerp triangle). To a lesser extent, intermediate towns such as Ostend, Kortrijk, Tournai, Leuven and Dendermonde were also affected.
- 29 As noted in the literature, cholera in Belgium in 1866 was a predominantly urban disease. In fact, around two-thirds of cholera deaths were concentrated in urban areas with 5,000 or more inhabitants, and 40% in towns with more than 20,000 inhabitants (*Table 1*). These statistics partly illustrate why cholera has been mainly studied in cities. Rural areas, on the other hand, were proportionally less affected, even though more than 14,000 cholera deaths were recorded there.

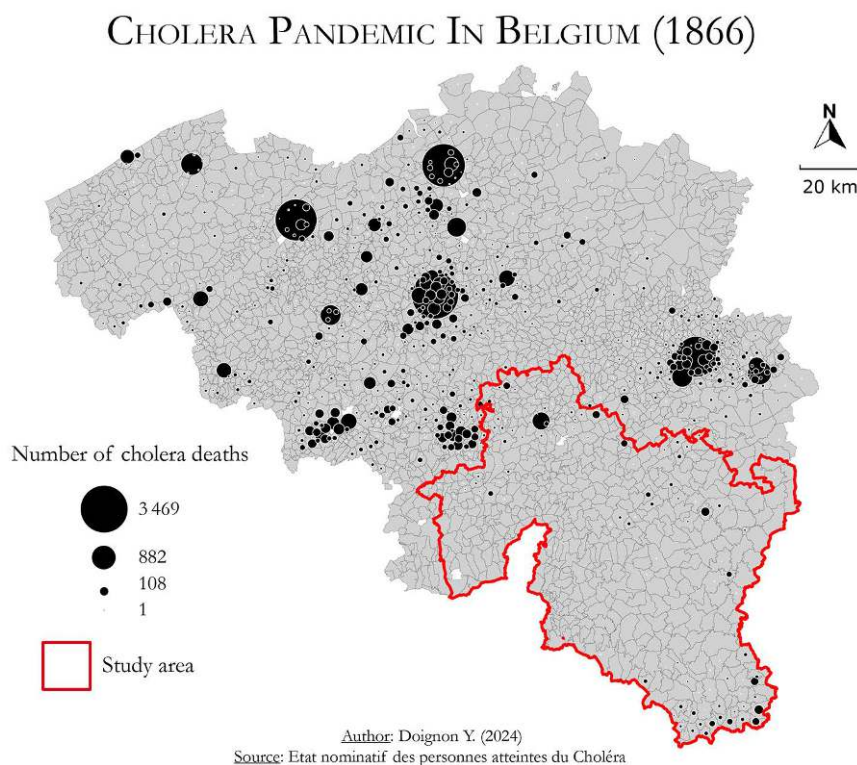
Table 1. Distribution of cholera deaths and crude death rate according to urban and rural areas.

Urban-rural typology		Number of cholera deaths	Share of all cholera deaths in Belgium (%)	Cholera crude mortality rate (%)	Communes with no deaths	Number of communes
Urban	> 100,000 inhab.	11 827	27,25	2,42	0%	3
	20,000 - 100,000 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

Source: Statistics on population movements and civil status, special Cholera framework, 1866 (figures supplied by the Quetelet Center⁸). Authors' calculations.

30 In addition to this urban- and population-density effect, the impact of international borders can be seen very clearly in *Figure 7*. Cholera appeared in 1865 in the Mediterranean region and in central Germany [Vacher, 1868]. After a pause during the winter of 1865, it reappeared in the spring of 1866, particularly in the Grand Duchy of Luxembourg and northern France [Vacher, 1868]. Proximity to these regions, which had been affected by cholera earlier, seems to have played an important role in Belgium. This was particularly the case in the south of the province of Luxembourg, a region located near the Luxembourg border and French Lorraine. The Grand Duchy of Luxembourg recorded more than 3,500 deaths in 1865–1866, and the map confirms that the Belgian communes located nearby were one of the gateways through which cholera entered Belgium [Eggerickx, Poulain, 1991]. Similarly, several municipalities in the area bordering Greater Lille (such as Menin, Comines, Warneton and Wervik) had more cholera deaths than others in West Flanders. One explanation for this is that Roubaix was particularly hard hit (around 2,500 deaths in 1866). On the other hand, no 'border' effect was observed near the Netherlands, probably because the Dutch border area was spared cholera in 1866.⁹

Figure 7. Cholera deaths in Belgium (1866).

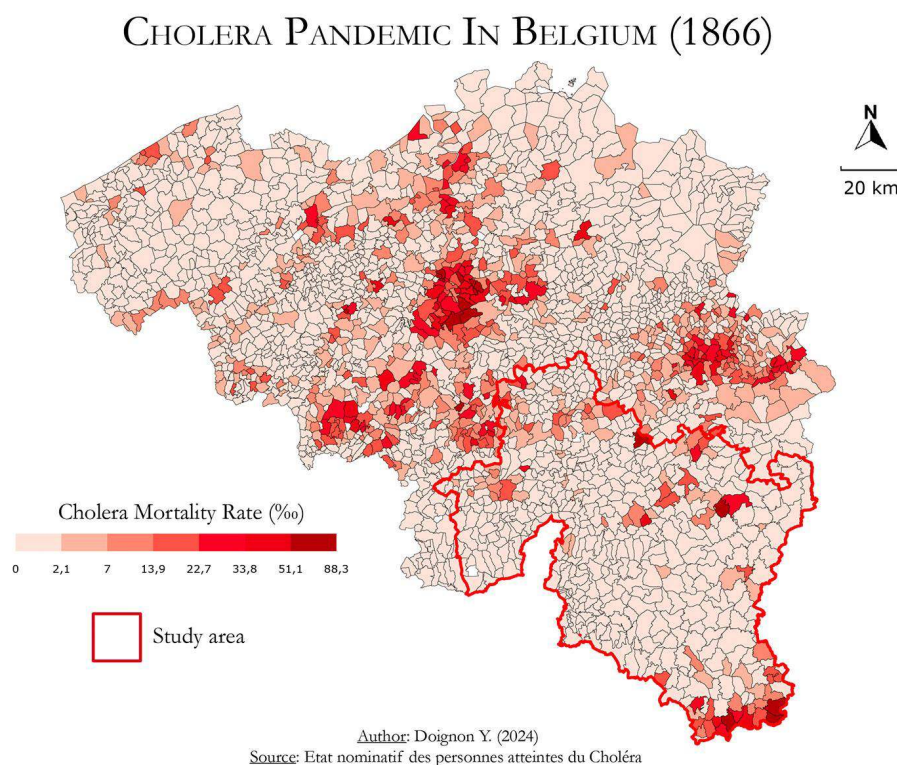


Source: Statistics on population movements and civil status, special Cholera framework, 1866 (figures and background map provided by the Quetelet Center). Cartography by the authors.

31 Another indicator is the crude death rate from cholera. At the national level, this is 0.9% (*Table 1*), which means that 0.9% of the Belgian population died of cholera in 1866.¹⁰ There is a clear urban gradient: the larger the city, the higher the mortality rate. This reached 2.42% in the country's four largest cities, and half that (1.18%) in towns with between 5,000 and 10,000 inhabitants. The lowest crude death rate was in rural areas (0.47%).

- 32 Beyond these broad territorial categories, some nuances can be mapped (*Figure 8*). The situation in the urban world remains largely like that observed previously. The major urban and industrial conurbations (particularly Brussels, Mons, Charleroi, Liège and Verviers) have high rates. However, cholera is not just an urban disease. Although the rural environment has the lowest crude cholera mortality rate of all the different territorial categories, it is also the one with the greatest contrasts. Indeed, 63% of communes had no deaths attributed to cholera (*Table 1*). On the other hand, the highest crude rates are found mainly in rural areas: of the 154 communes with a mortality rate of over 2%, 80% are rural. Proximity to Luxembourg also seems to play a role, as particularly high crude rates are observed in this region, notably in La Roche-en-Ardenne (8.8%), Aubange (7.8%) and Messancy (5.8%). The border effect can also be seen in the Lille region, although to a lesser extent.

Figure 8. Crude death rate (‰) from cholera in Belgium (1866).



Source: Statistics on population movement and civil status, special Cholera framework, 1866 (figures and map backgrounds provided by the Quetelet Center). Authors' calculations.

Cholera in the countryside: the case of the Walloon provinces of Namur and Luxembourg

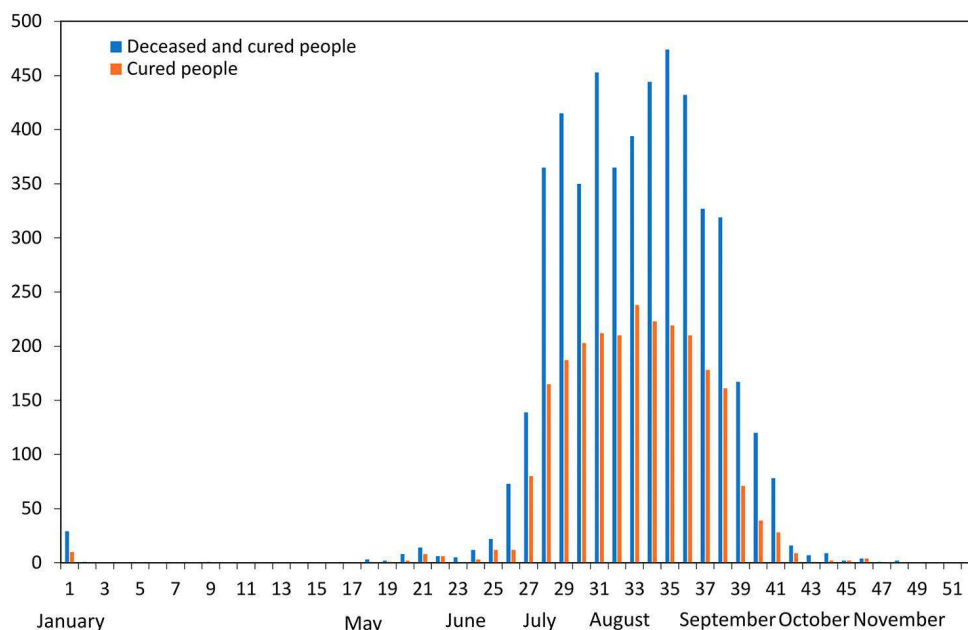
- 33 We now change the scale to focus on the provinces of Luxembourg and Namur (the area outlined in red on the previous maps). This predominantly rural region had proportionately fewer cholera deaths than the rest of Belgium, even though very high cholera mortality rates were observed locally.

Aggregate analyses

Temporal evolution of the pandemic

- 34 Unlike the figures presented so far at the national level, those drawn from the nominative lists of the provinces of Namur and Luxembourg have the advantage of covering the sick, in other words, the cases of cholera, and not just who died of it.
- 35 At the very beginning of 1866, there were only a few isolated cases of cholera, all in Bastogne on the Luxembourg border (Figure 7). These could be traces of cholera that had been endemic for several decades. It was not until May that the number of cases began to rise, with a marked increase from the beginning of July (week 27). The summer of 1866 was thus marked by many cases, and it was also the time when the number of deaths was highest, with a peak that could exceed 450 deaths per week. It was not until the second half of September (week 38) that the number of cases began to decline, reaching very low levels from mid-October onwards. No further cases were recorded from the end of November. As for deaths, 97% were concentrated over three months (July, August, September), underlining the speed with which cholera spreads and kills.

Figure 9. Trends in the weekly number of cholera patients and deaths in the provinces of Namur and Luxembourg in 1866.



Source: Individual list of cholera patients. Authors' calculations.

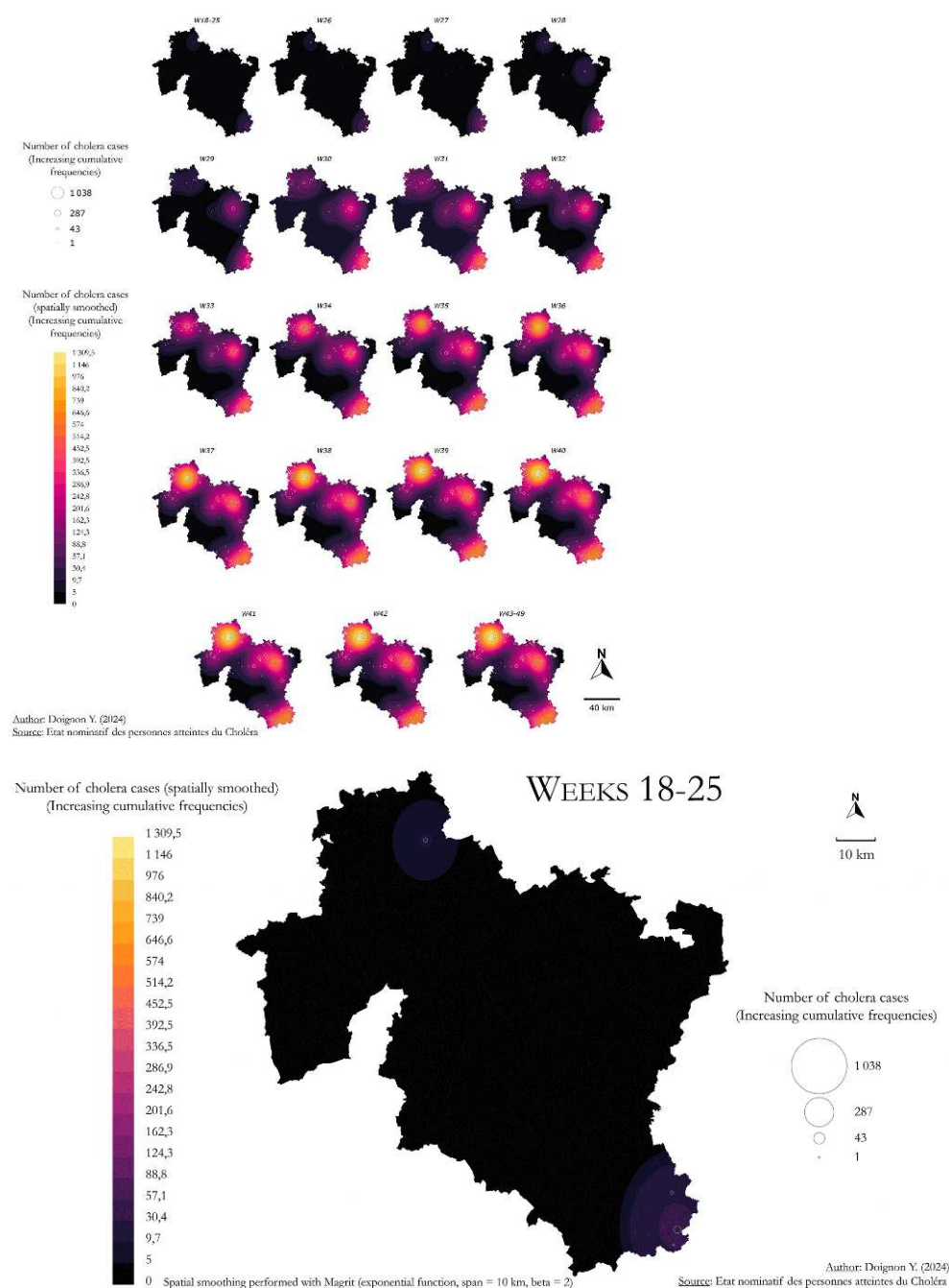
Space and time

- 36 In addition to the fact that the data relate to patients, not just deaths, the individual data offer the opportunity to map the cholera pandemic's spatial spread within the two provinces. The exercise begins in week 18, when the pandemic began in earnest in 1866 (Figure 10 a. & b.). Cholera first appeared in May (week 18) in communes close to the Luxembourg border (Aubange, Messancy, Arlon), and occasionally in the Namur countryside (Marche-les-Dames). The disease then spread from these places of

emergence, particularly intensively near the Luxembourg border. From week 28 onwards, the first cases were observed in La Roche-en-Ardenne, the third focus of the pandemic's emergence.

- 37 The spatial spread of the pandemic was structured from these three early-affected locations via the two classic channels of spatial dissemination: geographical proximity and the urban network [Saint-Julien, 2007]. In the north of the study area, cholera spread rapidly to Namur, then within its urban area, and finally to the surrounding small towns (Gembloux, Florennes, Andenne). From La Roche-en-Ardenne, the disease spread southwards to Bastogne, and westwards to Jemelle, Marche-en-Famenne and Hotton. In the south, the spatial spread remained confined to municipalities located less than 40 kilometres from the tri-border area (Belgium, Luxembourg, France). From week 34 onwards, the spatial structure of the areas affected by cholera remained unchanged. Cholera cases continued to increase, but the majority of cases remained in areas that had already been affected. At the end of the pandemic, the number of cases was highest in the Namur region and near the tri-border area. On the other hand, some areas were entirely spared, notably the communes along the Franco-Belgian border.
- 38 There are several possible explanations for this pattern of spatial spread. The early emergence of cholera in the south of the country can be explained by its proximity to the Grand Duchy of Luxembourg, which was affected earlier by the pandemic. The region is also located on an axis of intense trade linking the industrial basin of Lorraine with that of the Sambre-et-Meuse corridor, and these industrial basins with the ports of Antwerp, Zeebrugge and Rotterdam. The Namur region and towns such as Gembloux and Andenne are located at the centre of the Sambre-et-Meuse industrial belt, at the heart of the rail, river and road links.
- 39 The case of La Roche-en-Ardenne remains the most difficult to explain because, although almost 9% of the population died of cholera, it is not directly connected to the main communication routes. According to Mr Weverbergh's 1867 report on the pandemic in this commune, cholera spread when a woman arrived on 10 July from Liège, where the pandemic was already underway. She died the same day and, on 12 July, a new case was detected in the house where she had been staying. As a result of these two isolated cases, cholera spread rapidly through the municipality, causing between 200 and 300 people to flee [Weverbergh, 1867], which may have increased the risk of contamination in the surrounding municipalities. On the other hand, the negative effect of communication routes can be seen in Jemelle, Marche-en-Famenne and Hotton, which are located on the railway line linking Arlon to Liège; its Angleur (Liège) – Marche-en-Famenne section has just been inaugurated [Laffut, 1985-1995]. Similarly, Bastogne is on the main road linking Arlon to Liège.

Figure 10 (a. details; b. animated). Spatial distribution of cholera in the provinces of Namur and Luxembourg (1866). Cumulative number of cases by week (w).



Source: Individual list of cholera patients. Authors' calculations.

Individual analyses

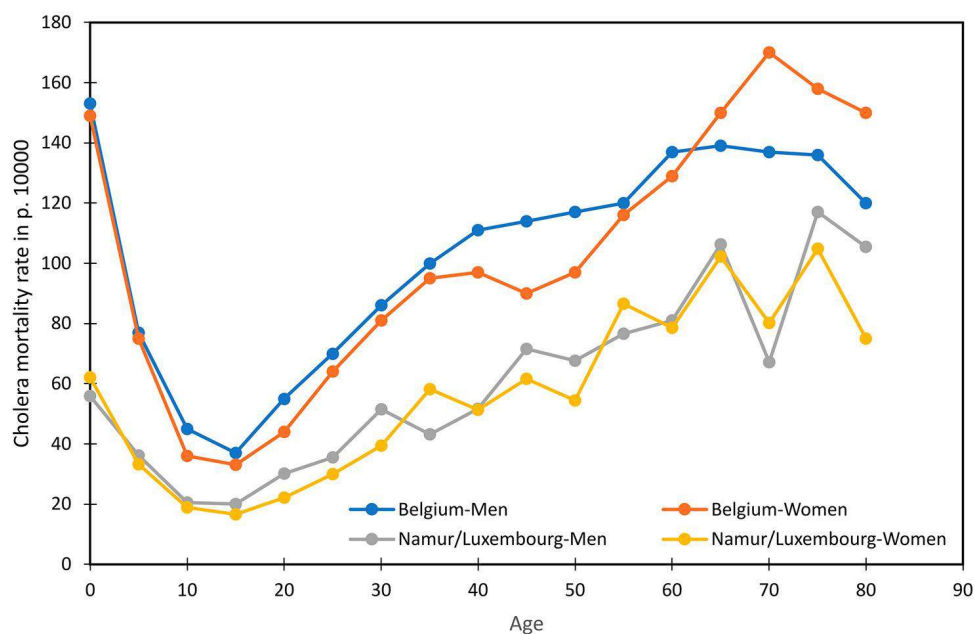
Socio-demographic profiles

- 40 This pandemic's specific development in rural areas raises the question of profiles. The literature and statistics (Figure 3) indicate that the socio-demographic profile of cholera deaths did not deviate fundamentally from the classic pattern with a U-shaped mortality curve by age [Eggerickx, Poulain, 1991], reflecting a significant impact of

cholera at young and old ages, and an excess mortality rate among the least privileged social groups. Does the socio-demographic "profile" of cholera deaths in rural areas deviate from the national pattern or not? And does this profile differ between those who died and those who recovered?

- 41 The number of cholera-related deaths is particularly high between the ages of 0 and 15. Cholera mortality rates (i.e., the probability of dying from the disease) by age group confirm the profile of a U-shaped curve. However, while the literature mentions excess male mortality, this is not the case in the provinces of Namur and Luxembourg, where the curves show fairly similar values (*Figure 11*). It is only between the ages of 15 and 39, when mortality reaches very low levels, that a slight male disadvantage emerges. Finally, the lower quotient levels for the two rural provinces confirm the findings of the literature: cholera is primarily, on average, an urban pandemic, although, as shown above, there are also areas in the countryside where the disease is very deadly.

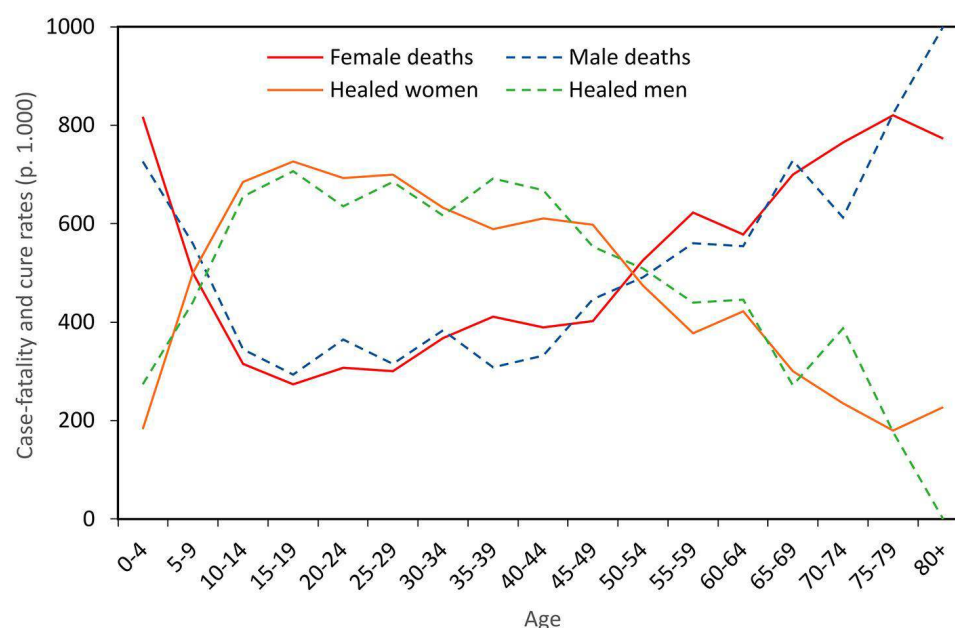
Figure 11. Cholera mortality rate (expressed in p. 10,000) by age and sex, in Belgium and the provinces of Namur and Luxembourg, for the year 1866.



Source: Individual list of cholera patients. Authors' calculations.

- 42 Further analysis will focus on the use of data extracted from the nominative lists. We do not have individual data on people who did not contract the disease. In other words, we can analyse the probability of dying/surviving once affected by the disease, but not the probability of contracting it. A comparison of deaths and recoveries by age reveals that recovery rates are particularly high over the age of 15 (*Figure 12*). The curve for deaths is U-shaped, while the curve for recoveries is the opposite, with adults recording the highest scores, as opposed to children or the elderly. In these two rural provinces, cholera mortality therefore follows a similar pattern to that observed elsewhere, particularly in towns.

Figure 12. Case-fatality and cure rates (%) by age and sex among cholera patients in the two provinces (1866).



Source: Individual list of cholera patients. Authors' calculations.

- 43 Compared with age, the other variables are less discriminating (Table 2). The proportions of men and women are equivalent, whether among the sick, the deceased or the cured, and they have roughly the same probability of dying. In terms of social position, around 60% of the sick, the deceased and the healed are 'poor', and 27% are 'well-off'. This social profile may have depended above all on the social structure of the municipalities. The 'poor', 'undetermined' and 'well-off' all have a 48% probability of dying once they have contracted cholera. Individuals with an 'average' social position are less likely to be affected by cholera (and have a lower probability of dying), but it is difficult to determine whether this reflects a social reality or whether it is mainly due to how individuals' social situation was defined by commune staff. In terms of occupation, two-thirds of cholera patients were manual workers (skilled or unskilled) and 13% were farmers. Lethality, on the other hand, reveals a social gradient: 44% of low-skilled workers affected by cholera died, compared with 37% of the elite. The discrepancy between these two variables, which is probably linked to problems with the declaration of social position and/or the classification of professions, means that it is not possible at this stage to conclude whether cholera has a social effect.

Table 2. Socio-demographic profiles of cholera patients, deaths and recoveries in the two provinces (1866)].

Variables/methods	Sick	Deceased	Healed	Sick (% column)	Deceased (% column)	Healed (% column)	Deceased (% line)
Age group							
0-14	1.097	633	464	21,8	26,9	17,3	57,7

15-29	1.037	321	716	20,6	13,6	26,7	31,0
30-44	1.229	448	781	24,4	19,0	29,1	36,5
45-59	954	475	479	18,9	20,2	17,8	49,8
60-74	582	375	207	11,5	15,9	7,7	64,4
75+	113	95	18	2,2	4,0	0,7	84,1
Unknown	30	10	20	0,6	0,4	0,7	33,3
Gender							
Woman	2.391	1.141	1.250	47,4	48,4	46,6	47,7
Men	2.651	1.216	1.435	52,6	51,6	53,5	45,9
Social position (without Namur)							
Easy	1.090	513	577	27,2	27,1	27,4	47,1
Medium	244	88	156	6,1	4,6	7,4	36,1
Poor	2.448	1.187	1.261	61,1	62,6	59,8	48,5
Undetermined	222	107	115	5,5	5,7	5,5	48,2
HISCLASS Recoded (Men 15+)							
Elites, managers, lower professions, sales	172	64	108	8,3	7,2	9,1	37,2
Foremen and skilled workers	686	289	397	32,9	32,4	33,4	42,1
Farmers and farm workers	262	110	152	12,6	12,3	12,8	42,0
Low-skilled or unskilled workers	660	289	371	31,7	32,4	31,2	43,8
Undetermined	302	141	161	14,5	15,8	13,5	46,7
Grand total	5.042	2.357	2.685	100,0	100,0	100,0	46,7

Source: Individual list of cholera patients. Authors' calculations.

Modelling the probability of dying (vs. the probability of recovery)

- 44 The initial results are confined to descriptive trends but do not make it possible to determine the individual probability of dying (versus recovering) from cholera, all other things being equal. This section proposes a model of the probability that an

individual suffering from cholera will die from the disease. Model 1 includes all individuals recorded as being ill with cholera in the provinces of Namur and Luxembourg in 1866, except those residing in the commune of Namur.¹¹ The results are partly consistent with the observations made earlier (*Table 3*). Age has a structuring effect; it leads to significant variability in the probability of dying but this is not the case for the other variables. This is more apparent with the marginal means (*Table 4*). All other things being equal for the variables introduced into the model, the probability of dying for individuals aged 0-14 is almost equal to that for individuals aged 60-74. Between the ages of 15 and 60, the risk is lower, but increases with advancing age. An individual aged over 75 has an 80% probability of dying from cholera, compared with 62% for those aged 60-74. In regard to the social position of individuals, "average" people, and to a lesser extent the "well-off", have a lower probability of succumbing than the "poor". The marginal averages show that the probability of death for the 'well-off' (54%) remains close to that of the 'poor' (56%), while that of the 'average' on the social continuum needs to be qualified given the small number of individuals in this category. Finally, there is no difference between men and women.

Table 3. Logistic model 1 for the probability of dying from cholera in the two provinces (excluding Namur).

Variable	Estimate	Standard error	Z	p	Odds ratio
Ordinate at origin	0,37779	0,0817	4,6252	<0,001	1,459
Gender					
<i>Men</i>	<i>Ref.</i>				
Woman	0,03335	0,0659	0,5061	0,613	1,034
Age group					
<i>0-14</i>	<i>Ref.</i>				
15-29	-1,08635	0,1038	-10,4631	<0,001	0,337
30-44	-0,8720	0,0978	-8,9196	<0,001	0,418
45-59	-0,36788	0,1008	-3,6484	<0,001	0,692
60-74	0,24856	0,1186	2,0959	0,0360	1,282
75+	0,17975	0,2857	4,1296	<0,001	3,254
Social position					
<i>Poor</i>	<i>Ref.</i>				
Medium	-0,47982	0,1450	-3,3095	<0,001	0,619
Easy	-0,08709	0,0761	-1,1451	0,252	0,917

Undetermined	0,00814	0,1461	0,0557	0,956	1,008
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Source: Individual list of cholera patients. Authors' calculations.

Table 4. Marginal means of logistic model 1.

Variable/ methods	Probability (marginal average)	Standard error	95% confidence interval	
			Lower terminal	Upper terminal
Gender				
M	0,522	0,0185	0,486	0,558
F	0,530	0,0189	0,493	0,567
Age group				
0-14	0,563	0,0204	0,523	0,603
15-29	0,303	0,0182	0,269	0,340
30-44	0,350	0,0177	0,317	0,386
45-59	0,472	0,0207	0,432	0,512
60-74	0,623	0,0239	0,575	0,669
75+	0,808	0,0433	0,708	0,879
Social position				
Poor	0,561	0,0150	0,531	0,590
Medium	0,442	0,0357	0,373	0,512
Easy	0,539	0,0187	0,503	0,576
Undetermined	0,563	0,0360	0,492	0,632

Source: Individual list of cholera patients. Authors' calculations.

- 45 Model 2 concerns men aged 15 or over, and uses the social affiliation variable *Hisclass*, instead of the 'social position' variable in model 1. The results show an age effect like that of the previous model (Tables 5 and 6). On the other hand, the *Hisclass* variable makes it possible to refine the effect of individuals' social backgrounds. Workers (skilled or unskilled) have the highest probability of dying from cholera (57%) compared with managers/elites and farmers (who have a similar probability of 50%). Cholera thus appears to be an extremely deadly disease, with at least half of all sufferers succumbing. The differences between the well-off and the working classes

potentially reflects working-class living conditions, often with small, overcrowded and unsanitary dwellings that do not allow for proper sanitary conditions, but also the tendency to use communal water sources due to a lack of housing facilities [Chevalier, 1958; Engrand & Engrand, 1972]. What is more, people from privileged backgrounds certainly have more opportunity to isolate themselves elsewhere during the pandemic, unlike low-skilled workers whose occupations may involve more frequent contact, and therefore a greater likelihood of contracting the disease.

Table 5. Logistic model 2 of the probability of dying from cholera (men aged over 15).

Variable	Estimate	Standard error	Z	p	Odds ratio
Ordinate at origin	-1,0076	0,187	-5,387	<0,001	0,365
Age group					
15-29	<i>Ref.</i>				
30-44	0,1094	0,124	0,884	0,377	1,116
45-59	0,7388	0,129	5,736	<0,001	2,093
60-74	1,3124	0,152	8,637	<0,001	3,715
75+	2,7971	0,445	6,287	<0,001	16,398
HISCLASS					
<i>Elites and employees</i>	<i>Ref.</i>				
Skilled workers	0,304	0,181	1,677	0,094	1,355
Farmers and farm workers	0,0440	0,209	0,210	0,834	1,045
Low-skilled or unskilled workers	0,3122	0,182	1,717	0,086	1,366
No HISCLASS (no profession)	0,2952	0,207	1,428	0,153	1,343

Source: Individual list of cholera patients. Authors' calculations.

Table 6. Marginal means of logistic model 2.

Variable/methods	Probability (marginal average)	Standard error	95% confidence interval	
			Lower terminal	Upper terminal
Age group				
15-29	0,306	0,0206	0,268	0,348

30-44	0,330	0,0194	0,293	0,369
45-59	0,481	0,0232	0,435	0,526
60-74	0,621	0,0286	0,564	0,676
75+	0,879	0,0465	0,755	0,945
Social position				
Elites, managers, lower professions, sales	0,496	0,0462	0,407	0,586
Foremen and skilled workers	0,571	0,0290	0,514	0,627
Farmers and farm workers	0,507	0,0384	0,432	0,582
Low-skilled or unskilled workers	0,574	0,0288	0,516	0,629
No HISCLASS	0,569	0,0354	0,499	0,637

Source: Individual list of cholera patients. Authors' calculations.

Conclusions

- 46 This article considers the mortality linked to the cholera pandemic in Belgium in 1866. The approach has two key original features. Firstly, it focuses on the provinces of Namur and Luxembourg, which are mainly rural areas, whereas most of the historical sources and scientific studies focus on large and medium-sized towns. Secondly, it draws upon a previously unpublished individual database listing: for all the communes in the provinces concerned, the people affected by cholera, i.e., those who were ill, whether the outcome was recovery or death. This provides an individual series of more than 5,000 cases, broken down by date of infection and outcome of the disease. These data are also accompanied by a range of socio-demographic information, making it possible to study the profile of individuals affected by cholera, a relatively new approach on an individual scale.
- 47 In Belgium, the cholera pandemic of 1866 was the worst in the country during the 19th century. This was primarily an urban plague, as it was in other countries. No town with more than 10,000 inhabitants escaped the disease, while many rural areas recorded no cholera deaths. Nevertheless, rural areas – some located close to large towns, others much more isolated – did not emerge unscathed. Indeed, it was in rural communes that the highest cholera mortality rates were observed. In this respect, the provinces of Namur and Luxembourg, the most rural in the country, were marked by a highly heterogeneous local situation in terms of the consequences of cholera mortality and incidence: three 'hot spot' zones rubbed shoulders with areas devoid of any cholera deaths. The first was on the border with the Grand Duchy of Luxembourg, one of the gateways for cholera into Belgium. After a few weeks, cholera spread to the Marche

region and above all to La Roche-en-Ardenne, both in the heart of the province of Luxembourg, mainly because of the movement of initially isolated cases. The third 'hot spot' appeared a little later, in the town of Namur. As several previous studies have also shown, the spatial progression of cholera was erratic, both nationally and within towns and rural communities.

- 48 The intensity of the pandemic was determined first and foremost by the location of the site, in particular its proximity to areas that had already been contaminated – as was the case with the communes bordering the Grand Duchy of Luxembourg, where cholera had already been raging for several weeks – and the major road, rail and river routes that dominated the trade flows of the time. Secondly, local spread depended on the extent of local mobility and population density, but probably also on hygiene and sanitation conditions, as well as the immune resistance of the inhabitants of the areas concerned [Bourdelaïs, 1991; Neven, 1997]. Overall, these results support our first hypothesis.
- 49 From the point of view of individual socio-demographic characteristics, the analysis highlights the structuring effects of age in cholera-related mortality. The situation in the two rural provinces conforms to the classic pattern of cholera mortality observed at the national level and in the main towns. There is a U-shaped curve, highlighting a very high mortality risk for the most vulnerable people, i.e., the youngest (under 15) and the oldest (over 60). Age also structures the profile of those who are cured and those who die, with particularly high cure rates among adults aged 15 to 59, while the lethality rate is very high among young children and the elderly. These results confirm our second and third hypotheses and underline the vulnerability of very young and very old population segments to cholera. On the other hand, contrary to the literature and to the results reported for both Belgium, as a whole, and individual cities, no significant difference was observed between men and women in the two rural provinces in the south of the country, either in terms of the comparison between those who had recovered and those who had died, or in terms of the probability of dying from cholera among those affected (model 1). Furthermore, while the 'social position' variable did not reveal any obvious differences, contrary to our hypothesis and to the literature (this may be explained by the imprecision and subjectivity of the information or may reflect the specific nature of the rural world in the face of the disease), the *Hisclass* variable showed a relative under-mortality among 'higher' professions and farmers, and an over-mortality among unskilled and skilled workers. These trends suggest that factors such as poverty, close contacts between individuals and the existence of contact occupations explain this differential.

BIBLIOGRAPHY

ALFANI G., 2022, Epidemics, Inequality, and Poverty in Preindustrial and Early Industrial Times, *Journal of Economic Literature*, 60 (1), pp. 3-40.

- ALI M. et al, 2002, The spatial epidemiology of cholera in an endemic area of Bangladesh, *Social science & medicine*, 55, pp. 1015-1024.
- BOURDELAIS P. and RAULOT J.-Y., 1987, *Une peur bleue. Histoire du choléra en France. 1832-1854*, Paris, 310 p.
- BOURDELAIS P., 1991, Choléra des villes et choléra des champs. Faits et représentations. *Historiens et Populations, Liber Amicorum Etienne Hélin*, Société Belge de Démographie, Académia, Louvain-La-Neuve, pp.219-230.
- BOURGUIGNON M., 2023, *Fécondité et régimes démographiques au 19^e siècle dans les campagnes du sud de la Wallonie*, Louvain-la-Neuve, PhD thesis.
- CAWOOD I. & UPTON C., 2013, 'Divine Providence': Birmingham and the Cholera Pandemic of 1832. *Journal of Urban History*, 39(6), 1106-1124.
- CHEVALIER L., 1958, Le Choléra, la première épidémie du XIX^e siècle, In: *Bibliothèque de la Révolution de 1848*, Paris, Tome 20.
- CLIFF A.D., HAGGETT P. & SMALLMAN-RAYNOR M.R., 2004, *World Atlas of Epidemic Diseases*, London: Arnold, 212 pp.
- CULEMBORGS HISTORISCH GENOOTSCHAP AWK VOET VAN OUDHEUSDEN, KORTWEG VOET, undated, Cholera, de blauwe dood, website: <https://www.voetvanoudheusden.nl/2020/06/voet-voor-thuis-6-cholera-de-blauwe-dood/>
- DAVENPORT R.J., SATCHELL M., MATTHEW L., SHAW-TAYLOR W., 2019, Cholera as a 'sanitary test' of British cities, 1831-1866, *The History of the Family*, 24:2, pp. 404-438.
- DEVOS I., VRIELINCK S., WIEDEMANN T., RONSIJN W. & VANWAMBEKE S., 2022, *Spatial Analysis of Cholera in 19th century Brussels*, presentation at the AIPRIL Workshop Spatial analysis of mortality and inequality, Antwerp, 16 September 2022.
- DUPÂQUIER J., 1990, La surmortalité urbaine, *Annales de démographie historique*, Démographie des villes et des campagnes. pp. 7-11.
- EGGERICKX T., POULAIN M., 1988, L'épidémie de choléra de 1866. Le cas de la Belgique. In: Bardet J.-P., Bourdelais P., Guillaume P., Lebrun F., Quélet C. (eds), *Peurs et terreurs face à la contagion. Cholera, tuberculosis, syphilis, XIXe-XXe siècles*, Fayard: Paris 1988, pp. 56-82.
- EGGERICKX T., POULAIN M., 1991, Le choléra, cet autre fléau social du XIX^e siècle. L'épidémie de 1866 en Belgique et l'exacerbation des inégalités face à la mort, *Historiens et Populations, Liber Amicorum Etienne Hélin*, Société Belge de Démographie, Academia, Louvain-La-Neuve, pp. 203-218.
- ENGRAND M., ENGRAND C., 1972, Épidémie et paupérisme : le choléra à Lille en 1832. In Gillet, M. (Ed.), *L'homme, la vie et la mort dans le Nord au 19^e siècle*. Villeneuve d'Ascq: Presses universitaires du Septentrion.
- EVANS R., 1988, Epidemics and revolutions. Cholera in nineteenth century Europe. In: Bardet J.-P., Bourdelais P., Guillaume P., Lebrun F., Quélet C. (eds), *Peurs et terreurs face à la contagion. Cholera, tuberculosis, syphilis, XIXe-XXe siècles*, Fayard: Paris, pp. 107-135.
- FALISE C., 1979, Le choléra à Bruxelles en 1866, *Annales de la Société Belge d'Histoire des Hôpitaux*, t. XVII, pp. 26-30.
- FERNANDER L. M., MASON P.R., GRAY H., BAUERNFEIND A., FESSELET J.F. & MAES P., 2011, Descriptive spatial analysis of the cholera epidemic 2008-2009 in Harare, Zimbabwe: a secondary data analysis, *Trans R Soc Trop Med Hyg*. 105(1), pp. 38-45.

- LAFOSSE A., 1977, Epidemics of cholera in Verviers (133-1834, 1849, 1866), Dissertation in History, Liège.
- LICZBIŃSKA G., 2021, Spatial and Social Inequalities in the Face of Death: Pilot Research on Cholera Epidemics in Poznań of the Second Half of the 19th Century, *Historical Social Research*, Supplement, 33, pp. 37-55.
- MACKENBACH J.P., 2020, A history of population health. Rise and fall of disease in Europe, *Clio Medica*, vol. 101, Brill Rodopi, Leiden, Boston, 430 p.
- MAHAMADOU Y.M., IBRAHIM A., YANOGO P., KABORÉ J. & MEDA N., 2023, Facteurs Associés à La Récurrence Des Épidémies De Choléra Au Niger Entre 2011 Et 2020, *Health Sciences and Disease*, 24 (5). <http://www.hsd-fmsb.org/index.php/hsd/article/view/4409>.
- NATCHABA R., DEGUE G.K., ATTAH M.K., DOMPE K., LAMBONKALE A., AMENYIDO N., ADANLEKPONSI K.E., KINDE D.R. & ASSANE S.P.H., 2023, Investigation de l'épidémie de choléra dans le district des Lacs, Togo, novembre 2021, *Revue d'Épidémiologie et de Santé Publique*, Volume 71, Supplément 3.
- NEVEN M., 1997, Epidemiology of Town and Countryside Mortality and Causes of Death in East Belgium, 1850-1910, *Revue Belge d'Histoire Contemporaine*, XXVII, 1-2, pp. 39-82.
- ORIS M., 1988, Cholera and public health in Belgium. Les réactions d'un système social face à une maladie sociale. In: Bardet J.-P., Bourdelais P., Guillaume P., Lebrun F., Quétel C. (eds), *Peurs et terreurs face à la contagion. Cholera, tuberculosis, syphilis, XIXe-XXe siècles*, Fayard, Paris, pp. 83-106.
- ORIS M., 1995, Hygiène publique et médicalisation dans une cité industrielle. Seraing au XIXe et au début du XXe siècle, *Revue belge de philologie et d'histoire*, tome 73 (4), Histoire médiévale, moderne et contemporaine - Middeleeuwse, moderne en hedendaagse geschiedenis. pp. 983-1009.
- PATOUT-LIBION H., 1982, Le choléra à Namur en 1893-1894, *Pays de Namur*, pp. 117-152.
- PONCELET P., 1986, *Le choléra à Liège en 1866*, Liège, unpublished dissertation.
- PYLE G.F., 1969, The diffusion of cholera in the United States in the nineteenth century, *Geographical Analysis*, 3, pp. 59-75.
- SAINT-JULIEN T., 2007, The process of spatial diffusion and modeling change. In Sanders L. (ed.), *Models in spatial analysis*, London: ISTE Ltd, pp. 127-157.
- SAMUEL KLINE COHN JR, 2017, Cholera revolts: a class struggle we may not like, *Social History*, 42:2, pp. 162-180.
- SKILLNÄS N., 1999, *Modified innovation diffusion - A way to explain the diffusion of cholera in Linköping in 1866? A study of methods*, GéoProdig, geographic information portal, accessed on 31 January 2024, <http://geoprodig.cnrs.fr/items/show/68145>.
- SMALL-RAYNOR M., 2015, Geographical perspectives on epidemic transmission of cholera in Haiti, October 2010 through March 2013, *Annals of the association of American geographers*, 105/4, pp. 665-683.
- STEWART J., WARNTZ W., 1958, Physics of population distribution, *Journal of Regional Science*, 1/1, pp. 99-121.
- VACHER, 1868, Statistique du choléra de 1865 à 1867 en Europe, *Journal de la société statistique de Paris*, 9, pp. 165-176

- VAN DER HAEGEN H., DE VOS R., 1980, L'épidémie de choléra à Louvain en 1849, *Bulletin trimestriel du Crédit Communal*, no. 133, July, pp. 197-210.
- VAN LEEUWEN M. H. D., MAAS I., 2011, *Hisclass: A Historical International Social Class Scheme*, Universitaire Pers Leuven, 181 p.
- VERBAEYS NELE N., 2008, *In de ban van de cholera: Brugge en Gent in 1866*, Ghent, Dissertation.
- VERMEIRE M., 1993, Le choléra à Bruxelles en 1849. Confrontation de l'environnement et de l'épidémie, *Bulletin trimestriel du Crédit Communal*, n° 184, 2, pp. 21-36.
- VINCENT B., 1988, Le choléra en Espagne au XIXe siècle. In: Bardet J.-P., Bourdelais P., Guillaume P., Lebrun F., Quétel C. (eds), *Peurs et terreurs face à la contagion. Cholera, tuberculosis, syphilis, XIXe-XXe siècles*, Fayard, Paris, pp. 43-55.
- VINET F., 2018, *La grande grippe. 1918. La pire épidémie du siècle*, Vendémiaire, Paris, 261 p.
- WEVERBERGH M., 1867, *Compte rendu de l'épidémie cholérique de Laroche*, Brussels, pp. 3-27.

NOTES

1. The cholera pandemic of 1866 was a driving force for the reorganisation of working-class districts in Brussels, with the vaulting of the River Senne and the destruction of the cul-de-sacs where people were living in squalor [Falise 1979; Gaiardo L., n.d.].
2. In Belgium, in 1866, a town was defined as a municipality with more than 5,000 inhabitants. That same year, the urbanisation rate (proportion of people living in urban areas) was 3% for the province of Luxembourg and 12% for the province of Namur, compared with a Belgian average of 37%. These were the two most rural provinces in the Kingdom at that time.
3. As early as 1854, during the second pandemic, local authorities were required to keep lists of the names of people affected by the disease.
4. These included the communes of Barvaux (30 deaths from cholera), Dampicourt (12 deaths), Mettet (5 deaths), Rochefort (15 deaths) and Sclayn (10 deaths).
5. In the case of small towns, 2 or 3 extra deaths in the course of a year can double the excess mortality index.
6. The term "indigent" also appeared. In 19th century Belgium, an "indigent" was an "official pauper", i.e., someone who received assistance (sometimes financial, often in kind) from the local Charity Office. These people were counted in the population censuses. However, there is nothing in these nominal lists to indicate whether those described as "indigent" were "official paupers" or it was simply an appellation used for convenience.
7. The forms include a 'civil status' section, which is often not completed. Around 30% of the information is missing, regardless of age. This variable was therefore not included in the rest of the analyses.
8. The Quetelet Center is a research centre at Ghent University whose aim is to promote quantitative historical research by offering advice and expertise.
9. See the Culemborg Historical Society website (<https://www.voetvanoudheusden.nl/2020/06/voet-voor-thuis-6-cholera-de-blauwe-dood/>)
10. By way of comparison, this is three times more than for COVID-19 in Belgium.
11. See Data and methods for more details.

ABSTRACTS

A major cholera pandemic struck Belgium in 1866, resulting in 43,400 deaths (around 30% of all deaths in 1866) and a drop in life expectancy of more than 5 years. Although cholera is often presented as an urban disease, the Belgian countryside was not spared, and the south of the province of Luxembourg was one of the gateways to the pandemic in 1866.

This article answers two questions. Firstly, why were some areas heavily affected by the pandemic while others were spared? Secondly, what were the characteristics of individuals who recovered and those who died, and to what extent did they differ?

In Belgium, the 1866 cholera pandemic was the subject of specific data production, giving rise to detailed nominal lists of people affected (cured or deceased) by the disease. This article is based on these individual data for municipalities located in the provinces of Namur and Luxembourg.

In Belgium, the pandemic is affecting all the major towns, but cholera mortality rates are highest in certain rural municipalities. In addition, the situation is highly heterogeneous in the provinces of Namur and Luxembourg, with highly variable levels of incidence and mortality. The intensity of the pandemic is mainly determined by proximity to contagion hot spots (e.g. close to the Luxembourg border) and the presence of road, rail or sea links. Local spread depends on local mobility and population density.

Concerning the determinants of cholera mortality, the analyses confirm the structuring effect of age, with a high risk of death among the most vulnerable, i.e. the youngest and the oldest. Differences were also observed according to the individuals' socio-professional background and can be explained essentially by poverty, frequency of interpersonal contacts and proximity linked to working conditions.

Une pandémie majeure de choléra a frappé la Belgique en 1866, entraînant 43.400 décès (environ 30% des décès de 1866), et le recul de plus de 5 ans d'espérance de vie. Bien que le choléra soit souvent présenté comme une maladie urbaine, les campagnes belges n'ont pas été épargnées, et le sud de la province du Luxembourg fut l'une des portes d'entrée de la pandémie en 1866.

Cet article répond à deux questions. Premièrement, pourquoi certains espaces sont-ils lourdement affectés par la pandémie alors que d'autres en sont épargnés ? Deuxièmement, quelles sont les caractéristiques des guéris et des décédés et dans quelle mesure diffèrent-elles ?

En Belgique, la pandémie de choléra de 1866 a fait l'objet d'une production de données spécifiques, donnant lieu à des listes nominatives et détaillées des personnes atteintes (guéries ou décédées) de la maladie. Cet article est basé sur l'exploitation de ces données individuelles pour les communes des provinces de Namur et de Luxembourg (situées dans le sud du pays).

En Belgique, la pandémie touche toutes les grandes villes, mais les taux de mortalité par choléra sont les plus élevés dans des communes rurales. En outre, la situation est très hétérogène dans les provinces de Namur et du Luxembourg, avec des niveaux très variables en termes d'incidence et de mortalité. L'intensité de la pandémie est essentiellement déterminée par la proximité avec des hot spots en termes de contagion (p. ex. à proximité de la frontière luxembourgeoise) et la présence d'axes de communication routiers, ferroviaires ou maritimes. La diffusion locale dépend quant à elle notamment de la mobilité locale et des densités de population.

Concernant les déterminants de la mortalité par choléra, les analyses confirment l'effet structurant de l'âge avec un risque de décès élevé chez les plus précaires, c'est-à-dire les plus jeunes et les plus âgés. Des différences sont aussi observées selon l'appartenance

socioprofessionnelle des individus et s'expliquent essentiellement par des critères de pauvreté, de fréquence de contacts interpersonnels ou encore de proximité liée aux conditions de travail.

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Mots-clés: choléra, mortalité, diffusion spatiale, pandémie, Belgique, 1866, rural, 19e siècle

Keywords: cholera, mortality, spatial diffusion, pandemic, 19th century, 1866, rural

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