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Abstract: *»Die Spanische Grippe in Belgien 1918–1919. Ein Stand der Technik«*
This article provides the first comprehensive overview of the severity and impact of the Spanish flu in Belgium (1918–1919) and thereby makes a long overdue connection with the extensive international literature on pandemics in general and Spanish flu in particular. Leveraging ego documents (diaries), municipal-level excess mortality, and individual-level cause-of-death registers, we present new evidence on the chronology and spatial distribution of Spanish flu mortality in Belgium in 1918 and 1919 as well as social and demographic characteristics of the Spanish flu deaths in the city of Antwerp and discuss the government measures taken in the difficult context of the German occupation. In Belgium, our analysis shows that the chronology and geography of the Spanish flu cannot be seen in isolation from the vagaries of the First World War, in terms of soldiers and evacuees both acting as likely vectors of influenza transmission as well as inflating crude death rates at the municipal level.

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1. Introduction

A century before COVID-19, the world was struck by an even more deadly pandemic caused by the H1N1 influenza virus, commonly known as the "Spanish" influenza or flu. Between 1918 and 1920, this unusually severe strain of flu ravaged the globe and infected at least a third and killed up to 5 per cent of the world population (Johnson and Mueller 2002; Taubenberger and Morens 2006). In the context of the long and devastating First World War, Belgium – an occupied country and a major battle site on the western front – represents an interesting case study for the Spanish flu, as the war played a crucial role in the spread and the severity of the pandemic (Erkoreka 2009).

The neutral state Belgium was occupied by the German empire from 1914 to 1918, under various military regimes (the so-called *Operations-, Etappen-, Marinegebiet and Generalgouvernement* – the closer to the front line, the more repressive the regime, see Figure 1). Only a small area in the western corner of the country remained under Belgian control. The occupation resulted in severe restrictions on freedom, widespread unemployment, and food scarcities that brought broad sections of the Belgian population on the edge of starvation. Hundreds of thousands of people fled to the Netherlands, France, or Britain at the beginning of the war and for the whole duration of it (De Schaepdrijver 2004; Nath 2013; Vrints 2015).

Whilst research on the First World War in Belgium is well established (De Schaepdrijver 1997, 2004; Wouters 2015), the impact of the Spanish flu in the country has hardly been studied. The disease is often mentioned in works dealing with the end of the war and the immediate post-war period, but only as a contextual element, and its nature and effects are typically described in broad general terms (Serrien 2018). Indicative in this respect is that, at the international conference *The 1918 Influenza Pandemic: Historical and Biomedical Reflections*, held on 7 and 8 February 2019 in the Belgian town of Ypres and mainly organized by Belgian scholars, there were no contributions on Belgium. Still, recent years have seen exciting students' work clearing the ground, mostly in the framework of master theses in history (Brulard 2018; De Smet 2005; Hendrickx 2017; Jans 2019; Stevens 2021). Also worth mentioning are local studies, which have shed light on the epidemic in the city of Ostend (François and Mahieu 2020) and the Bruges countryside (de Meester and Huys 2019).[1]

[1] See Figure 1 or a spatial overview of the localities mentioned in the text.

The lack of attention for the Belgian case stands in sharp contrast with the research dynamic on the international scene. While since 1918 epidemiologists, virologists, and biologists have been examining the medical conundrum of the pandemic, historians did not join until the 1990s. In Europe, historical studies at the national level have been carried out for countries as diverse as Germany (Salfellner 2018; Vasold 2009; Witte 2008), Sweden (Åman 1990), and Ireland (Colvin and McLaughlin 2021; Foley 2011). Research on the 1918–1919 pandemic is very active in the Anglo-Saxon world, where it has led to work on the United Kingdom (Johnson 2006), the United States (Bristow 2012; Crosby 2003), and, more locally, on the Canadian city of Winnipeg (Jones 2007). It has also resulted in syntheses of global ambition, such as that of Barry (2004) and more recently of Spinney (2017) and Breitnauer (2019) as well as international multidisciplinary volumes (Killingray and Phillips 2003). Taking advantage of rich military archives, some studies have focused on the spread of the virus in the American and Swiss armies for example (Byerly 2005; Rusterholz 2010). Others, drawing on colonial history and the history of medicine, have shed light on the ravages of influenza in African and Asian countries (Chandra, Kuljanin, and Wray 2012; Mills 1986; Phillips 1990).

Whereas the Anglo-Saxon world is clearly in the forefront, as well as certain European countries, Belgium constitutes a blind spot with regard to historical scholarship on the Spanish flu. Research has been hampered by incomplete, missing, or non-existent sources due to wartime conditions, and by practical issues such as a 100-year embargo on public access to many personal and demographic documents until 2018–2020. Nevertheless, Belgian sources do offer a diverse range of both aggregated-level data and original individual-level records (such as cause-of-death registers and war diaries) enabling us to study the particularities of the Spanish flu during and after the war. In this article, the first overview of the Spanish flu in Belgium, we tap into this wealth of information to sketch the contours, demonstrating the strengths and weaknesses of the Belgian source material in relation to the international state of the art.

This article is structured as follows: first, by combining aggregate-level data, government sources and a series of diaries, we piece together the general chronology and (perceived) severity of the Spanish flu in Belgium (section 2). Then we delve deeper and analyse the geographical history of the pandemic, comparing the spatial distributions of excess mortality by sex and wave (section 3) and some of the measures taken by local, provincial, and national governments (section 4). The following section leverages the unique cause-of-death registers of the city of Antwerp as a case in point, discussing sex, age, and occupational determinants of the Spanish flu (section 5). The conclusion highlights opportunities for future research (section 6).

2. General Chronology of the Spanish Flu in Belgium

2.1 How Many Died?

Estimates as to how many people died worldwide vary greatly: from 17 million to 100 million people, with an acknowledged range of 30 to 50 million deaths. No doubt the Spanish flu was one of the most devastating epidemic outbreaks in history, killing more people than the First World War (Johnson and Mueller 2002; Patterson and Pyle 1991; Spreeuwenberg, Kroneman, and Paget 2018). As one of the few truly global pandemics, the Spanish flu struck all countries.

Besides the analysis by Murray et al. (2006), Belgium is barely mentioned in international studies on the pandemic. Because aggregate cause-of-death statistics for the war years have not been preserved, it is difficult to distinguish between deaths caused by war, flu, or other diseases. As the national data for 1918 are incomplete, researchers have focused mainly on the municipal level, showing that excess mortality varied from place to place, but that overall mortality in 1918–1919 was much higher than before the war almost everywhere (Brulard 2018; De Smet 2005). This is confirmed by *Le Mouvement de la Population et de l'Etat Civil (1841–1976)*, an annual government publication providing yearly deaths for each municipality. In comparison with the prewar figures (about 110,000 deaths annually), we find that mortality in 1918–1919 was on average a third higher.

Many European countries have more complete sources to measure the impact of the pandemic. In recent decades, scholars using different statistical methodologies have determined estimates for the Netherlands ranging between 23,000 and 50,000 victims, for France between 240,000 and 360,000, and for Germany between 225,000 and 580,000 (Ansart et al. 2009; Fichou 2020; Johnson and Mueller 2002; Patterson and Pyle 1991). Depending on the scale of the epidemic, the Spanish flu accounted for 10 to 25 per cent of the total annual deaths in the different countries. Based on these cases and taking into account a correction for under registration, we estimate the outbreak in Belgium to have claimed about 30,000 victims in the best-case scenario and almost 80,000 in the worst case, corresponding to 0.4 and 1 per cent of the population. Murray et al. (2006), employing regression models, assess the Belgian death toll at 0.83 excess deaths per 100 people, or approximately 62,000 deaths. Contemporaries estimated the mortality figure from the Spanish flu in Belgium to be 20,000 (Baudhuin 1946).

Figure 1 Wartime Belgium (February 1918) and the Municipalities and Provinces Mentioned in the Text

Source: Cartography by UGent Quetelet Center based on (Debruyne 2018).

2.2 When Did They Die? Perceived and Actual Severity of the Spanish Flu in Belgium

Since the airborne virus spread across the globe and did not strike everywhere at the same time, the chronology and the geography of the pandemic have been the subject of discussion. The first infections are said to have been observed in 1917, while others believe that the virus had already appeared in 1915–1916 (Breitnauer 2019). Whereas the United States (Kansas), France (Etaples), UK (Aldershot), and China have all been identified as potential geographical origins of the Spanish flu (Crosby 2003; Humphries 2014; Oxford and Gill 2018, 2019), there is little doubt about the military context of the pandemic. In April 1918, soldiers in France began to fall prey to the flu, complaining of sore throats, headaches, and loss of appetite (Fichou 2020). Contemporary sources indicate that the first cases in the small unoccupied part of Belgium were reported on 27 April in the Military Hospital of Cabour in Adinkerke, near the French border (Nolf et al. 1919, 2-3). Three French air force officers coming from the Reims area arrived there by train with flu symptoms. The first Belgian victims, three employees from the aerostation, entered the hospital on 9 May (Nolf et al. 1919). Infected soldiers were systematically sent to the hospital in an effort to avoid contagion. The accounts describe a mysterious illness that strikes the patients suddenly, leaving them without strength and resulting in a very high “three-day-fever” (the name initially given to the disease). Most patients recovered and although mortality was relatively mild, military operations were seriously disrupted, with many soldiers sick.

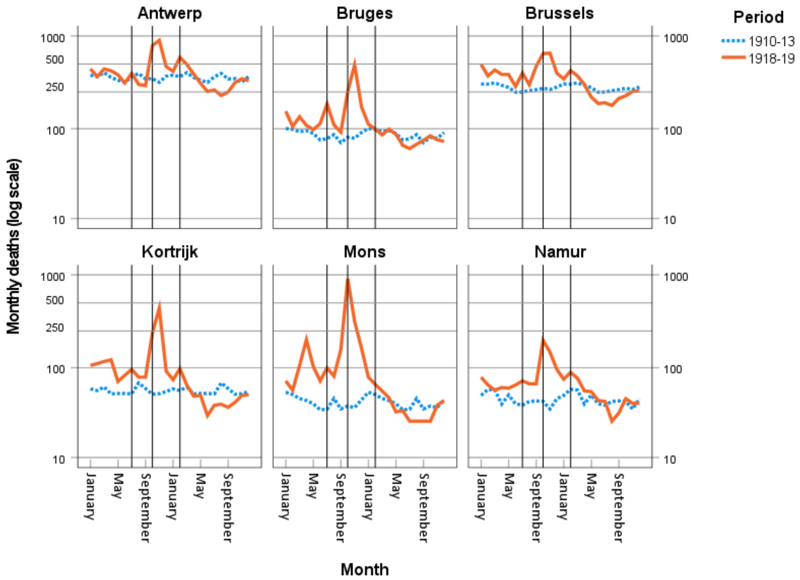
For the rest of Belgium, under German occupation, it appears that the war front prevented the flu from spreading across the country in the following weeks. It is difficult to record when exactly it arrived in the territory, as the German authorities limited information flows. For instance, there were no monthly reports of the *Académie Royale de Médecine de Belgique*, the official medium of Belgian doctors. Belgian military sources discussing the epidemic were rare and observed essentially the unoccupied territory (exceptions are Colard 1920; Nolf et al. 1919). However, for occupied Belgium, diaries kept by many people during the war are an interesting alternative source and indicator regarding the knowledge and concern of the disease, since public opinion no longer had any means of expressing itself. Of the 66 war diaries analysed by Benjamin Brulard (2018), three-quarters (i.e., 51) evoked at some point the disease. Still, the flu was not mentioned until the end of June 1918, when it began to spread quickly across the country. As such, it arrived in occupied Belgium two months later than in unoccupied territory, probably in the wake of the German spring offensives of 1918, which broke the allied front in several places. Tens of thousands of allied war prisoners were brought back in German-controlled territories – quite possibly (although at present impossible to prove) including some infected with flu who contaminated German soldiers and in turn spread the virus in Belgium. The first mention dates back to 28 June when female diarist Irma van de Male from Wakken in West Flanders mentioned that an unnamed infectious disease was spreading among the German soldiers in her village. This observation preceded by two days the first mention of the epidemic by the censored press: on 30 June, *La Belgique,* the main German-censored newspaper in occupied Belgium, echoed the idea that, coming from Spain, this disease was spreading in France. It was not until the following 7 July that the same newspaper revealed it had now reached Belgian soil. From then on, the disease was mentioned also more regularly in the diaries (27 diarists mentioned the first wave), although references with regard to the east of the country did not appear until August.

We know today that the origins of this flu were not Spanish. Whereas public officials and the press in Spain, a neutral country in the war, reported freely about the outbreak, elsewhere information was censored to maintain morale of the population and the troops. As such, it was falsely assumed that Spain was bearing the brunt of the disease. Nevertheless, the epithet “Spanish” flourished universally to designate this extraordinary flu. Although occupied, Belgium was no exception: the press, even censored, quickly popularised the expressions “*grippe espagnole*” and “*spaansche griep*,” commonly used as early as July 1918 by French- and Dutch-speaking diarists, with some variations such as “*fièvre espagnole*” or “*spaansche ziekte*.” A few people in occupied Belgium, eager to assign to the German occupiers all the misfortunes of the war, wondered if the flu would not be rather of German origin. For instance, Pierre Nicolay, the parish priest of Pussemange in the south of Belgium, wondered, when the disease reached his little village in August 1918 and infected more than two thirds of the inhabitants, “this epidemic that wreaks so much havoc, would it not be the product of their infernal inventions?” (Brulard 2018, 39, 45).

Initially there was no great concern, as shown in the diaries studied by Brulard (2018). The censored press hawked the belief in a relatively benign disease, yet the reactions were quite diverse: the flu was sometimes the subject of jokes about its “Spanish” character, and some diarists downplayed its severity. Others, on the contrary, wrote about it in much more serious terms, evoking for instance the “terror” that it spread in the small town of Nivelles from the beginning of July 1918. The most attentive observers noticed that it was especially dangerous for the most fragile and reported in different localities that the medical profession was overwhelmed by the epidemic. They mentioned that doctors could only prescribe rest and hygiene, or sometimes quinine, and that local authorities closed schools to slow down the spread of the virus, while the Germans, who had already banned most gatherings except religious ceremonies, now forbade processions. Eventually, the flu disappeared towards the end of August (Brulard 2018).

Besides diaries, and since cause-of-death registers are rare in Belgium (see section 5), we can rely on all-cause mortality to determine the course of the pandemic. Figure 2 shows the monthly deaths (plotted on a logarithmic scale to facilitate comparisons of relative severity) for 6 locations across the country between January 1918 and December 1919: the two largest Belgian cities, Antwerp and Brussels, and four middle-size towns, Bruges and Kortrijk in Flanders and Mons and Namur in Wallonia. Even though it concerns absolute numbers, comparison with the pre-war figures (monthly averages for 1910–1913) enables us to identify different waves and the severity of the pandemic in Belgium. We can distinguish three waves: Summer 1918, Fall 1918, and Winter 1918–1919 (visualised by the vertical lines added to Figure 2 to indicate the months of July 1918, October 1918, and February 1919). The first wave of Spanish flu is hard to discern, given the rather erratic evolution of death counts during the first months of 1918 in most cities analysed. The most explicit example is the large spike in Mons in April 1918, which was unrelated to flu.[2] Taking these numbers at face value, the first wave presumably hit Bruges, Kortrijk, and Mons (near the front line) harder than the other cities where the death toll in July does not really stand out compared to the previous months.

Figure 2 Monthly Deaths in 6 Belgian Cities, January 1918–December 1919 (Compared to Average 1910–1913)



Source: State Archives Belgium, Death certificates, 1910–1913, 1918–1919.

The second wave arrived in Belgium in early October and packed a much harder punch: this time two-thirds of the diarists (44 diarists out of 66) evoked the flu in their notebooks, and their allusions to it were more frequent despite the rush of the military operations (Brulard 2018). The flu continued to be called “Spanish,” but with increasing doubt as to its Iberian origin. The censored press, echoed by some diarists, even suggested that it could come from China like previous epidemics. But above all, the Spanish flu now caused widespread fear because of its scale and lethality. The press had observed the development of the second wave abroad since September, echoed from 4 October its arrival in Belgium, and broadcasted basic prophylactic measures: avoiding crowds, paying attention to hygiene, etc. (Brulard 2018).

[2] The spike in mortality in Mons in April 1918 was the result of a large number of war-related casualties of British and German soldiers lodged and hospitalised in the city after the German spring offensives of 1918.

As Figure 2 shows, deaths spiked to record levels in October and November 1918. Towns in West Flanders such as Bruges and Kortrijk noted a fivefold increase in deaths from September to November. In Antwerp and Brussels, the largest Belgian cities at the time, the relative excess mortality was markedly lower than in the other cities under study. Deaths in the Walloon city of Mons, however, grew exponentially with nearly 1,200 per cent: from 81 deaths in August to 157 deaths in September and 914 deaths in October, mainly a result of an epidemic among French evacuees (Brulard 2018). As the Germans imposed displacements on those who remained near the zones of military operations, the Mons area saw a massive influx of people (especially from Douai) because of the war front shifting northwards. From September 1918 onwards, the French arrived by train, but there was no room for them, not even in the surrounding areas. Forced to stay, they were housed in schools and churches, where the virus ran rampant. The flu claimed hundreds of victims in only a few weeks who were buried in mass graves: "There were not enough hearses to carry the bodies; there were no coffins due to a lack of wood," a diarist from Mons observed (Niebes 2014). Similar observations were made in other cities such as Nivelles, Namur, Antwerp, and Brussels. Interestingly, Figure 2 suggests that the second wave first hit Mons and Namur, with a clear peak mortality in October 1918, while in the other cities the peak occurred one month later. Mourning was all the more difficult as the sharp increase in mortality and the sanitary measures prevented the usual funeral rites. Faced with the avalanche of corpses, doctors, priests, municipal employees, funeral directors, and gravediggers had to rush their work, to the great dismay of the victims' relatives (Brulard 2018).

After the Armistice on 11 November 1918, the virus continued to spread across Europe, triggered by population movements after the liberation: demobilization and repatriation of soldiers, release of war prisoners, return of the evacuees, etc. The second wave eventually ran out by the end of November and vanished in December. By the time the third wave occurred, towards the end of January 1919, most of the war diarists had stopped writing, making it difficult to understand how the population perceived and experienced this return of the Spanish flu. Only three diarists still mentioned this winter wave (Brulard 2018), but they all testify that the general population was still struck by the significant flu-related mortality. As Figure 2 shows, mortality in Belgium had fallen sharply in December, but it increased substantially again in February and March 1919. As in many other countries, the third wave was less severe than the second, but more deadly than the first wave. Interestingly, the severity of the third wave appears to have been inversely related to that of the first wave, at least in our sample of six cities. Whereas Antwerp, Namur, and Brussels recorded a 40 to 50 per cent increase in deaths in early 1919 (versus almost no excess mortality in July 1918), Mons and Bruges cities showed no peak or a small rise (versus a rather severe first wave spike).

Geographical differences in the country for the third wave have been explained by the immunity acquired in the previous waves (Brulard 2018). It is difficult to pinpoint when and why the epidemic disappeared in Belgium, but mortality figures suggest that the virus lingered until April 1919. According to some authors, the virus mutated and became less virulent (Taubenberger, Kash, and Morens 2019). As far as we can see, the fourth wave observed in the spring of 1920 in countries such as Germany, Denmark, Switzerland, Spain, and the USA did not hit Belgium.

The diary references suggest that the pandemic, for the first and second waves, swept from (south)west to (north)east through Belgium. By mapping the excess mortality per municipality, we can better understand the geographical vagaries of the Spanish flu.

3. Where Did They Die? The Spatial History of the Spanish Flu

As Vinet (2018, 38) notes, "a pandemic is a geographical issue par excellence" because it affects virtually every country in the world, but with varying intensity and timing. The same is true within each country or even region (Cliff, Haggett, and Smallman-Raynor 2004). The geography of an epidemic can tell us something about how it spreads (hierarchically and/or by contiguity) as well as some of the factors that explain its virulence (proximity to communication routes, population density, poverty, etc.). Were some areas more severely affected than others by the Spanish flu mortality? Were there spatial differences between men and women? Was the spatial pattern of the different waves similar?

As noted above, the scientific literature on the geography of the epidemic in Belgium and its different waves is poor and the data currently available do not allow us to answer these questions conclusively. Indeed, at the level of the municipalities, only the causes of death for the year 1919 are available. Nor do we have the daily and monthly distribution of deaths at the level of the municipalities for the years 1918 and 1919, which would allow us to better circumscribe the excess mortality linked to influenza over time. We have therefore gathered the total number of deaths per municipality observed in 1918 and 1919 and calculated indices of excess mortality per municipality comparing the mortality observed in these two years (separately) with an "expected" or usual mortality, i.e., the average for the years 1910 to 1913. Given the deficiencies in the recording of causes of death at the time, the excess mortality approach is generally considered more reliable for measuring the impact of health crises on mortality (Vinet 2018). Moreover, it seems that conflict-related military deaths are not included in annual death statistics[3] (Eggerickx 2014). In this case, it can be assumed that the excess mortality observed in 1918 is largely due to the Spanish flu.

Did the excess mortality observed in 1918 and 1919 affect certain areas more than others in Belgium? Several studies have shown that the Spanish flu did not strike everywhere with the same intensity. This was the case, for example, in England and Wales (Johnson 2003), Spain (Chowell et al. 2014), France (Darmon 2000), and the Netherlands (Mourits et al. 2021). The determinants of contagion and mortality related to Spanish flu are numerous. A distinction should be made between the transmission chains, which are organised according to human movements (railways, troop movements, refugees, etc.) and the transmission reservoirs, which determine the hot spots of mortality. These are based on multiple factors: population density, crowding, poverty, sanitary conditions, family size, access to medical facilities, individual pathological history, etc. (Vinet 2018).

In Belgium, the spatial variations of the excess mortality due to Spanish flu are important. For the country as a whole and for both sexes, mortality in 1918 was 46 per cent higher than that observed between 1910 and 1913, whereas in 1919 it had almost returned to its normal level, with an index of 1.04 (4 per cent higher mortality than in 1910–1913). Let us first focus on the situation in 1918. For a number of municipalities along the war front, we have no data (see Figure 3). Moreover, many villages on both sides of the front line were evacuated, as such, few people died there. The highest excess mortality (1.80) is observed in the mostly rural district of Hasselt, followed closely by Mons (heavy industry, 1.76) and the districts of Kortrijk (textile industry, 1.72), Huy (rural, 1.68), and Neufchâteau (rural, 1.68). At the other end of the scale are the Flemish districts of Antwerp (1.20), Dendermonde (1.22), and Aalst (1.27). There are thus very large differences in mortality, a wide variety of socioeconomic contexts, and the fact that the most affected districts are not in close proximity to each other.

Figure 3,[4] constructed from municipal data, offers a more detailed reading of the spatial variations in excess mortality, which makes it possible to clearly

3 The war years 1914 to 1917 are not characterised by a higher crude death rate (14.6 per thousand) than the average of the years 1910 to 1913 (15.5 per thousand). In these data, there is no a priori trace of the 38,000 to 43,000 Belgian soldiers killed during the First World War according to the estimates of Winter (1988).

4 We decided not to comment on the raw maps of the excess mortality index by municipality because they have the major disadvantage of being subject to statistical noise due to the sometimes very small number of deaths in sparsely populated municipalities. This situation accentuates spatial heterogeneity and thus disturbs the underlying spatial structures. In order to better highlight the latter on the basis of communal data, we have produced smoothed maps, i.e., a continuous surface representation of values. The aim is to associate each place with a measure of excess mortality, taking into account the values of neighbouring territories. For this purpose, we chose the method of smoothing by potential, i.e., Stewart's method (Grasland,

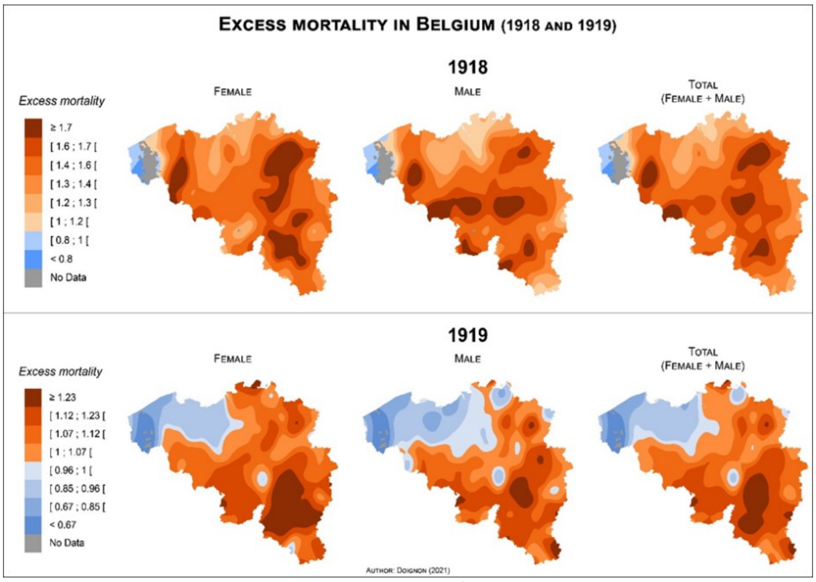
identify clusters. It is important to distinguish between excess mortality for women and men in 1918, as their spatial patterns are very different, even though excess mortality for men and women is equivalent for the country as a whole (1.47 and 1.46 respectively). On the female side, an excess mortality well above the national average (index > 1.60) affects a large area located in the east of the country and stretching from north to south through the essentially rural territories of Limburg, Liège, Namur, and Luxembourg. Another zone of high female mortality appears in the north-west of the country, centred on the Tournai and Kortrijk regions near the French border. This same area of excess mortality is found on the male side. Nevertheless, the main zone of excess male mortality stretches from west to east, from Mons to Liège, encompassing the whole of the Walloon industrial belt. Other smaller clusters are located in the rural regions of Maaseik (Campine), Chimay, and Bouillon-Neufchâteau, close to France.

How can we explain this diversity and the differences between male and female spatial patterns? At this stage, we can only make observations and formulate hypotheses. A number of studies suggest that urban areas, coastal areas, and those well served by mass communications and transport links have suffered higher mortality than rural, inland, and isolated areas (Johnson 2003). However, in Belgium, with the exception of the Walloon industrial basins in Hainaut and Liège and the city of Namur, densely populated urban areas are characterised by excess mortality indices for both women and men that are much lower than the national average (1.46). Thus, the cities of Antwerp, Brussels, and Ghent, with more than 100,000 inhabitants, had an excess mortality index of 1.16, 1.28, and 1.27 respectively in 1918. In contrast, rural municipalities with less than 5,000 inhabitants have an excess mortality index of 1.43 and small towns with 10 to 20,000 inhabitants an index of 1.52. This result is in line with those observed in other countries. In France, the rural departments of the centre-east and the southern Alps, where medical care was poor, have the highest mortality rates (Darmon 2000). In the United States, population density was not a factor in the increase in mortality, whereas in the Netherlands, at the height of the epidemic (October-December 1918), high excess mortality mainly affected the north-east of the country. This was a predominantly rural and more isolated region with high levels of tuberculosis, largely caused by malnutrition and poverty (Mourits et al. 2021). Tuberculosis, which was one of the main causes of death in the 19th and early 20th centuries, particularly among young adults, increased significantly during the First World War, partly as a result of food shortages (Mackenbach 2020). According to Noymer and Garenne (2000) and Mamelund and Dimka

Mathian, and Vincent 2000; Stewart and Warntz 1958), which we perform with the online interface Magrit (http://magrit.cnrs.fr/). The parameters used are: exponential function, span = 10 km, beta = 2.

(2019), tuberculosis infections were an important factor in deaths caused by the Spanish flu.

Figure 3 Excess Mortality by Sex in 1918 and 1919 Compared to the Average Death Rate in 1910–1913. Identification of Clusters from Municipal Data



Source: Cartography by UCL Centre de Recherche en Démographie based on *Mouvement de la Population et de l'Etat Civil, 1910-13, 1918-19* (UGent Queteletcenter, LOKSTAT and HISSTER datasets).

Can these factors explain the high excess mortality, especially among women, observed in 1918 in eastern Belgium? In the early 20th century, these were rural, sparsely populated, and rather isolated regions with poor communication links (road, rail, and waterways; Van Hecke et al. s.d.) and limited access to medical care (Havelange 1990; Velle 1985). These rural regions were also characterised by an excess mortality of young women due to tuberculosis, linked in particular to insalubrious workplaces, poor housing, poor health care, and nutritional deficiencies, all amplified by the requisitions of the German army, the naval blockade imposed by England, and food shortages (Brulard 2018; Devos 1996). This excess female mortality observed in 1918 could therefore be linked to the general issue of women's conditions, leading to nutritional and medical discrimination in favour of men. This gender segregation was more marked in the countryside, which was more traditional and where the economic contribution of girls and women was less valued than in cities and industrial areas (Devos 1996; Eggerickx and Tabutin 1994). Another factor could be crowding (Vinet 2018). These areas, and in particular the Campine in the provinces of Antwerp and Limburg, were characterised in the early 20th century by very high fertility and large household sizes (Costa, Eggerickx, and Sanderson 2011; Vanhaute 1992).

Environmental factors and individual pathological vulnerabilities may also explain, at least in part, the particular situation of the Walloon industrial basins of Hainaut and Liège marked by a very high excess male mortality and an average excess female mortality. Atmospheric pollution due to coal mining activity may lead to deterioration of lung tissue and explain this excess mortality, as was the case in certain regions of the United States (Clay, Lewis, and Severnini 2018). The pathological history associated with mining occupations (silicosis, anthracosis, pneumoconiosis, etc.), which weakens the respiratory system, is also an aggravating factor, particularly for men (Mackenbach 2020).

The geography of the war and the occupation are important factors. In the regions close to the war front (*Operations- und Etappengebiet,* see Figure 1), living conditions were harsher than elsewhere in the country, possibly contributing to the higher mortality in areas such as Kortrijk. Finally, the second wave of the pandemic took place in a context of the end of the war marked by the forced evacuation of civilians by the German occupier, driving more than 250,000 French and about 150,000 Belgians into the interior of Belgium (Brulard 2018). As Figure 3 shows, cities such as Nivelles and Mons located on the evacuation routes and housing a large number of evacuees, appear particularly affected by the pandemic.

Were the spatial patterns observed in 1918 and 1919 similar or not (Figure 3)? Studies for the Netherlands (Mourits et al. 2021) and England and Wales (Johnson 2003; Smallman-Raynor, Johnson, and Cliff 2002) have shown that the spatial pattern of Spanish influenza mortality varied from wave to wave. These results inevitably raise the still unresolved question of immunity between waves: were the most affected regions in 1918 relatively spared in 1919, and vice versa? As was the case in most Western and Northern European countries, the virulence of the epidemic in Belgium was much less important in 1919 (third wave) than in 1918 (Vinet 2018). The excess mortality index was 1.04 in 1919 and 1.46 in 1918. This decrease in excess mortality can be observed everywhere in the country, and it even disappeared on average in Flanders (0.97), whereas it remained in almost all of Wallonia (1.13). It is in the south-east of the country that the main cluster of excess mortality is detected, covering almost the entire rural Ardennes (province of Luxembourg), as was already observed in 1918. And as in 1918, this cluster is more marked for women than for men. On the other hand, the clusters observed in 1918 in the Campine (north-east), in the Walloon industrial basins, and in the Kortrijk-Tournai region (north-west) have almost disappeared. The regions of Antwerp and East Flanders are characterised by the absence of excess mortality in 1919, in addition to being already among the areas least affected by excess mortality in 1918. Finally, as in 1918, the urban character and population density do not appear to be factors that aggravated excess mortality; on the contrary, apart from Liège (1.28), the country's large cities have excess mortality indices close to or below 1 (Antwerp, 1.01; Brussels, 0.86; Ghent, 0.83). To sum up, despite some similarities here and there, the spatial pattern of excess mortality in 1919 does not follow that of 1918 and suggests interwave immunity. However, at this stage we cannot fully confirm the hypothesis.

4. A First Look at Government Measures in Belgium

Besides immunity, national, regional, and/or local governments can mitigate the impact of an epidemic. By studying local measures versus pandemic deaths in 43 American cities, Markel et al. demonstrated "a strong association between early, sustained, and layered application of nonpharmaceutical interventions and mitigating the consequences of the 1918–1919 influenza pandemic in the United States" (Markel et al. 2007, 644). In the previous sections, we showed quite substantial differences in the timing and severity of excess mortality in a number of Belgian cities and regions. Ideally, we would compare these numbers with the various nonpharmaceutical interventions (NPI) at the local, provincial, and national level. However, for a number of reasons, first and foremost the political and military distress of the German occupation, it has proven difficult to reconstruct measures taken in detail. We therefore are limited to presenting a more anectodical review of NPIs taken in Belgium in 1918–1919.

When the first wave struck, as shown in Figure 1, all but the entire Belgian territory was occupied. Provincial and local authorities could perform their administrative duties but were closely supervised by the German authorities. Due to German censorship as well as gaps in the sources, we only have bits and pieces to work with, as information about measures is scarce. Sometimes sanitary advice was given to the population by the mayor, such as in the city of Namur at the end of August, who recommended the isolation of patients at home or in hospitals, disinfection, and particular foods.[5] A few weeks later, measures were already more intrusive, such as the closure of public establishments, theatres, and the popular music-halls.[6] War diaries show that in some places schools were closed, for instance in Brussels and Loppem near the war front (Brulard 2018, 53-4). In Borgerhout, near Antwerp, doctor Janssens had observed almost empty classes by mid-July, as people kept their children away from school by fear of the Spanish flu. However, school

[5] "Ville de Namur. Avis à la population," in *L'Ami de l'ordre*, 25 August 1918.
[6] *Le Peuple Wallon*, 4 September 1918.

closures were not necessary, according to him, as no actual increase in the number of sick people was seen.[7] Army doctors, furthermore, tried to prevent a flu outbreak among soldiers by advising a range of measures such as cleaning kitchens and toilets, drinking boiled water, opening doors and windows for ventilation, letting laundry dry in the sun, and isolating the sick in a separate room. Disinfection of dormitories was also recommended for instance in the benevolence colony of Merksplas already in April 1918, which was ravaged by a flu outbreak in July 1918 and again in October 1918. During the last outbreak, the director received support of the minister of Justice to temporarily ban transport between detention houses in order to prevent the disease from spreading (De Smet 2005, 150-2).

The second wave left more traces. According to the newspaper *Vooruit*, the German health council announced that after a decline in late summer, the Spanish flu had flared up again by October. In their view, there was no need to panic nor to take strong measures, besides ensuring hygiene and closing schools when teachers and students were hit in large numbers by the disease.[8] Even though the flu had spread across the country and clearly hit some areas more severely than others, no *cordons sanitaires* were installed (Brulard 2018, 79-80). Still, measures during the second wave, which was particularly lethal, were more numerous and more widespread than during the first one. In localities where German soldiers were billeted, local *Kommandanturen* isolated or quarantined contaminated patients. On their side, Belgian local authorities prescribed different measures, such as in Namur on 30 October 1918. Medical commissions there stipulated that sick people had to stay in bed in a well-heated and clean room and had to be isolated as much as possible to prevent contamination. All "forms of excess" were to be avoided, hands and mouth kept clean, and detailed instructions for disinfection were given.[9]

In the months of October and November, local councils increasingly advised to avoid crowded public places, and in some places, such as Joost-ten-Node near Brussels, specific examples referred to cafes, theatres, and tramways.[10] Other councils went one step further and temporarily forbade public gatherings and closed concert halls and cinemas, such as in Leuven in October 1918 and in Charleroi in November 1918 (Brulard 2018, 81). Children were considered particularly vulnerable and contagious. Consequently, several schools temporarily closed their doors, for example in Antwerp, Mechelen, Bruges, and Leuven, but also in smaller communities such as Meerle, Borgerhout near Antwerp, and specific institutions such as the university of Leuven

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7 City Archives Antwerp, Archieven van het OCMW, Borgerhout, Verslagboeken Burgerlijke Godshuizen, 1918, Letter of L. Janssens 17 July 1918.

8 "De Spaansche Griep. Maatregelen tegen de ziekte," *Vooruit,* 27 October 1918.

9 "Communiqué de la commission médicale. Mesures à prendre," *L'Ami de l'ordre*, 30 October 1918.

10 *La Belgique*, 14 November 1918.

and the abbey school of Maredsous (Brulard 2018; François and Mahieu 2020).[11] In the Borgerhout case, there was clear pressure to reopen the schools as early as possible, which happened on 25 November 1918. The high infection rates among soldiers urged a range of new measures in the army. Special wards for soldiers with flu were set up in non-occupied Belgium such as in the previously mentioned Cabour hospital in Adinkerke, while in Sint-Michiels near Bruges, a new hospital was opened on 28 October, nine days after the city's liberation, mainly treating soldiers with flu infections (De Smet 2005). In order to deal with flu outbreaks among refugees, a temporary residence in Borgerhout was set up.[12]

Provincial administrations furthermore issued circulars to the municipalities about measures to stop the spread of the disease. For instance, the letter sent to the mayors in West Flanders on 4 November 1918 – at the time recently liberated territory – not only included advice for the treatment of the sick, but also insisted on ensuring sufficient rooms for patient care. The costs of beds and medication would be provided by the Ministry (De Smet 2005, 164-5). On the same day, a poster by the Bruges city council ordered to isolate contaminated people, avoid public gatherings, cleanliness of body and clothes, disinfecting the throat by gargling, etc. (François and Mahieu 2020), followed a few weeks later by similar advice by the Antwerp city council to its population, again just after the liberation of the city.[13] Unlike many U.S. cities where face masks were ubiquitous (Markel et al. 2007), mask wearing was not enforced nor recommended in Belgium.

The country's medical capacities were largely saturated at the time. There was an important shortage of medical staff because doctors were either employed by the army, had fled abroad, or had become ill themselves. In some places, for example in Nivelles, nurses and doctors from abroad were hired, and for instance in Charleroi, German military physicians provided care to the population (Brulard 2018, 86-7). All sources, whether in the press or diaries, point out how exhausted the caregivers were, much more than during the first wave. The lack of disinfectants and medical drugs also worried local authorities, such as in Leffinge in West Flanders where disinfection rooms were destroyed by warfare (De Smet 2005, 136). Based on the many references in the war diaries, disinfection was common practice. Some doctors prescribed methods to fight the infection that may seem fanciful today, such as ingesting milk or alcohol, including champagne (very difficult to find at the time!) or inhaling cigarette smoke (Brulard 2018, 85-6). Newspaper

[11] For Leuven: Belgisch Dagblad (Den Haag), 4 November 1918; Borgerhout: City Archives Antwerp, Archieven van het OCMW, Borgerhout, Verslagboeken Burgerlijke Godshuizen, 1918, letters of 31 October 1918 and 20 November 1918.

[12] City Archives Antwerp, Archieven van het OCMW, Borgerhout, Verslagen zittingen bestuur Burgerlijke Godshuizen Borgerhout, 13 October 1918 and 27 October 1918.

[13] "Un fait entre mille," *Le Matin*, 19 November 1918.

advertisements recommended “Malva pills” and “Standaert pills” that would bring relief from cough, sore throat, and the Spanish flu.[14] Obviously, these remedies were powerless.

As the territory was liberated, the Belgian central administration regained progressive control of the sanitary management. However, at this point in our analysis, it is unclear if or how the authorities dealt with the third wave. Overall, despite the evidence for the first and second wave showing that several measures were taken to mitigate the impact of the flu epidemic, most local councils appear to have by and large ignored the disease. In Ostend, as in most places, the Spanish flu was not mentioned in the yearly reports of the city council (François and Mahieu 2020), or it was only referred to in general terms. In Antwerp, for instance, the yearly cause-of-death reports registered flu victims in the broader category of respiratory diseases.[15] Wartime hardship and censorship during the German occupation had hindered communication about the flu, while military operations and the food crisis caught most of the attention. Unlike 19th-century cholera and smallpox epidemics for which sources are plentiful and well-studied, an in-depth study of health care at the time of the Spanish flu still needs to be undertaken.

5. Who Died? Exploring the Antwerp Cause of Death Registers

As the previous sections demonstrated, the study of excess mortality provides a powerful tool to unearth many of the Spanish flu’s secrets. Yet recent academic research has also emphasized the need to delve deeper into the nitty-gritty of the Spanish flu – who died when and where? – to really understand its transmission, spread, and impact (Chowell et al. 2007; Killingray and Phillips 2003; Mamelund 2006; Mamelund, Shelley-Egan, and Rogeberg 2020; Viboud and Lessler 2018). In this section we briefly discuss the main conclusions of the international literature on the social profile(s) of Spanish flu deaths, and we highlight where the Belgian case study can provide important novel contributions.

To illustrate its potential, we leverage the unique cause-of-death registers of the city of Antwerp. From 1851 onwards, all Belgian municipalities were obliged to record in detail the cause of death of all deaths in their territory, including age, occupation, and marital status of the deceased. The registers of the city of Antwerp started even earlier, in 1820, and are unique in their quality and scope: whereas most other Belgian (or indeed, international)

[14] “Standaert Pillen,” *Gazet van Antwerpen*, 25 December 1918; “Malva pastillen,” *De Volksgazet*, 28 december 1918.

[15] Gemeenteblad stad Antwerpen, jaargang 1918 tweede halfjaar, 14.

19th- and 20th-century records were destroyed for medical privacy reasons, all Antwerp registers were preserved for the entire period 1820–1946. We use this source to delve into the (social) profile of the Antwerp "*grippe espagnole*" victims as a case in point and present a first preliminary study, as the methodical data collection of the registers is still in full swing thanks to a large-scale citizen science project.[16]

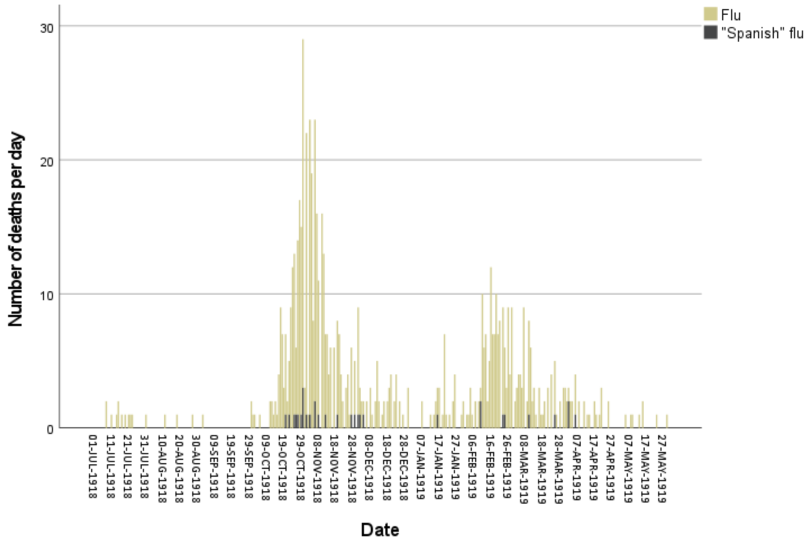
The Antwerp cause-of-death registers recorded a total of 9,600 deaths in the years 1918 and 1919. Earlier we estimated the excess mortality in Antwerp at 16 per cent in 1918 and 1 per cent in 1919. In this section, we take a minimalistic approach to delineate the target population under study: we only consider those deaths labelled by the contemporary scribes as directly or primarily caused by an infliction "*grippale*" from January 1918 to December 1919. Thus, we included direct references to "*grippe espagnole*" or "*spaansche griep*" (n= 31) as well as variations of "*bronchopneum grippe,*" "*grippe infectieuse,*" "*grippe pneunomie,*" and "*influenza,*" for a total of 758 deaths from flu or with symptoms of flu (8 per cent of all deaths). References solely to "*(broncho)pneumonie*" were not included but will be part of future more in-depth inquiries into patterns of comorbidity and interactions with other diseases such as tuberculosis (Mamelund and Dimka 2019; Noymer and Garenne 2000; on the issue of underreporting of flu, also see Johnson and Mueller 2002).[17]

Figure 4 summarizes the day-to-day deaths based on the date of registration, for clarity making abstraction of the eight flu-related deceased between 1 January and 1 July 1918 and the 13 similar deaths after 1 June 1919. In line with the general Belgian experience discussed above, Antwerp by and large dodged the first wave of Spanish flu during the 1918 summer months but was hit front and centre by the second wave from mid-October to late December 1918. A third and final, in Antwerp more modest, wave lasted from early February to mid-May 1919. The cases of specifically labelled "Spanish" flu were chronologically bracketed by Jean Deman, a 36-year-old married merchant, the first reported case on 21 October 1918, and Zelie Escolle, a married 41-year-old woman further unknown to us, whose death was reported on 7 April 1919.

[16] The S.O.S. Antwerpen project, see https://sosantwerpen.be/project/ (Accessed 5 November 2021).

[17] The yearly reports of the city council of Antwerp registered a noticeable increase in deaths by respiratory diseases: from 411 deaths (1915) and 483 (1916) to 769 (1917) and even 1077 (1918). In 1919, the number declined to 576. "Longtering" (tuberculosis) also rose from 574 deaths (1917) to 683 (1918). Gemeenteblad Antwerpen (Antwerp 1919, 1920), Annexe 1: Verslag over het bestuur en den zakentoestand Antwerpen dienstjaar 1918, Vierjarige staat der oorzaak van overlijden.

Figure 4 Deaths per Day of "Flu" and "Spanish Flu" in Antwerp, 1 July 1918–1 June 1919



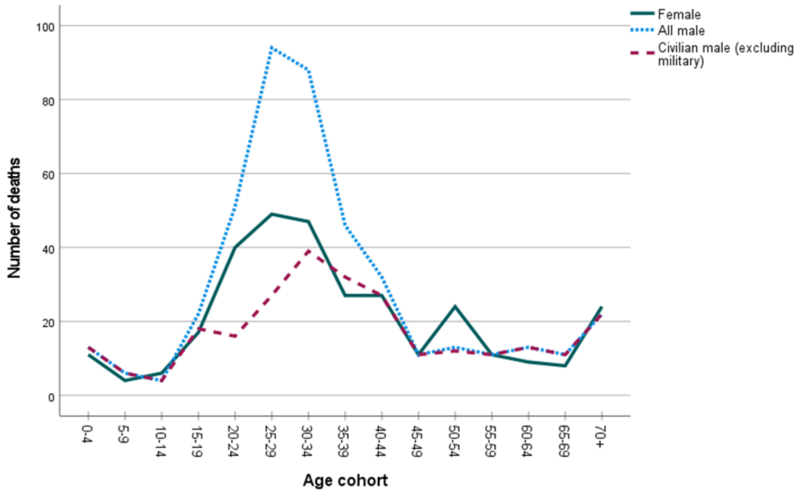
Source: City Archives Antwerp, Cause-of-death registers, Antwerp, 1918–1919.

The cause-of-death registers allow us to further dissect the flu deaths where possible in relation to the wider Antwerp populace. One salient finding is the large presence of military personnel, nursed at the army hospital in Antwerp, among the victims. For a number of authors, soldiers are the main sources of the introduction and spread of the Spanish flu in Europe, rippling out from the U.S. and allied navy to the regular troops and finally the civilian population via the French harbour towns and massive demobilisation (Ansart et al. 2009; Barry 2004; Chertow et al. 2015; Erkoreka 2009; Humphries 2014; Taubenberger, Kash, and Morens 2019; Taubenberger and Morens 2006). The Antwerp case lends further credence to this hypothesis: English prisoners of war and German soldiers made up no less than 13 of the first 17 flu-deaths of the second wave (recorded between 1 and 17 October 1918), but only 22 out of 327 deaths registered the next 30 days. Conversely, whereas by late December 1918 the daily number of civilian deaths had finally declined to zero, it was Belgian soldiers who kept paying the Reaper's toll in January and early February 1919, accounting for 43 out of 61 flu deaths between 21 January and 16 February. The following month, deaths were largely split evenly between military and civilian victims, before the number of soldiers' demises receded while civilian flu-deaths kept occurring until mid-May 1919.

Another important finding confirmed by many case studies (Colvin and McLaughlin 2021; Erkoreka 2010; Gagnon et al. 2013; Gavrilova and Gavrilov 2020; van Wijhe et al. 2018) has been the age-specific mortality pattern: unlike the typical U-shaped profile characteristic of regular influenza outbreaks, high excess mortality for both the very young and very old, the Spanish flu exhibited a W-shaped mortality curve with high to very high excess mortality among the 20- to 39-year-olds. Explanations put forward include reference to the so-called Russian flu of 1889–1892 (leading scholars to argue both for a lack of immunity for those younger than 30 who “missed” this pandemic, or conversely for those older than 30 suffering increased risk as a consequence of being exposed; van Wijhe et al. 2018), an overreaction of the immune system typical for young adults (mostly male), more risk-prone behaviour (not being able or wanting to take rest when feeling sick), and severe co-morbidity from tuberculosis (Erkoreka 2010; Mamelund, Haneberg, and Mjaaland 2016; Noymer and Garenne 2000; Sheng et al. 2011; Taubenberger, Kash, and Morens 2019; Woo 2019). Interestingly, even though on aggregate men were overrepresented among the deaths, for a number of case studies higher death rates for (young) women were attested – in Paris, for example, between July 1918 and April 1919 among the aged 20 to 39, female death rates more than doubled male death rates. This has been explained largely on socioeconomic grounds: many young women not only lived in overcrowded neighbourhoods, their work, involving substantial person-to-person contact, also made them more vulnerable to the epidemic (as maids, cooks, dressmakers, laundresses, etc.; Zylberman 2003) and quite possibly to tuberculosis. Still, we should also take into account that there was a substantial gender imbalance in the local population because of the army mobilization of young men.

Our preliminary Antwerp figures by and large confirm these findings. Looking at the absolute number of deaths by age and gender shown in Figure 5, the 20- to 39-aged males clearly stand out. Note, however, that if we exclude all soldiers (and the handful of military officers) from the equation, maybe not unlike in Paris, actually more young women than young (civilian) men perished. Combining the Antwerp cause-of-death registers with other sources will allow us to better understand the social, economic, and spatial determinants of these findings.

Figure 5 Deaths by Age and Sex, Antwerp, 1918–1919



Source: see Figure 4.

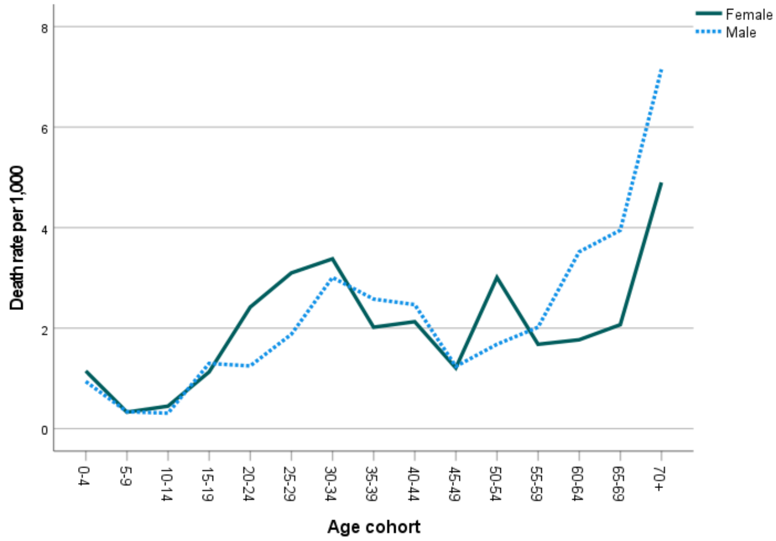
Total numbers of deaths only tell part of the story, for a proper understanding we need to relate the deaths to the population at risk. A confounding factor is the "seasonality" of the military presence in Antwerp. As noted above, the large majority of foreign soldiers appears to have left Antwerp by the end of 1918, as evidenced by the cause-of-death registers – but we have no clear indication of the total numbers of Belgian or foreign soldiers living in Antwerp in 1918 and 1919, nor of the impact of the war-related temporary migrations (refugees to the Netherlands, the United Kingdom, etc.) on the "population at risk."[18] Given that our population estimates for Antwerp derive from an interpolation from the census records of 1910 and 1920, it thus makes sense to exclude the military altogether from our next analysis.

The total death rate of the civilian population amounts to 1.9 per thousand inhabitants: 569 deaths, mostly concentrated between 1 July 1918 and 1 June 1919, for an estimated population of ca. 300,000. Figure 6 shows how, relative to the population, the elderly suffered the highest age-specific mortality. Alternatively, the low mortality rates for infant and children stand out. This has been attested for some specific cases (for example in Copenhagen; van Wijhe et al. 2018), but in general the Spanish flu was associated with heavy mortality of the youngest (Langford 2002; Mamelund, Haneberg, and Mjaaland 2016). For Belgium, it has been asserted that care for infants ameliorated markedly

[18] In the yearly reports of the city council of Antwerp, the number of sailors, skippers, soldiers, and travellers is estimated at 2,154 persons in 1918 and 2,478 in 1919. Gemeenteblad Antwerpen (1919, 1920), Annex 1: Verslag over het bestuur en den zakentoestand Antwerpen dienstjaar 1918, Beweging der Bevolking.

during the First World War, which could explain the low infant mortality recorded in 1918–1919 Antwerp. With strong support by the U.S. Commission for Relief in Belgium, the number of infant health care centres and school canteens quadrupled across the country (Eggerickx 2014; Masuy-Stroobant 2005).

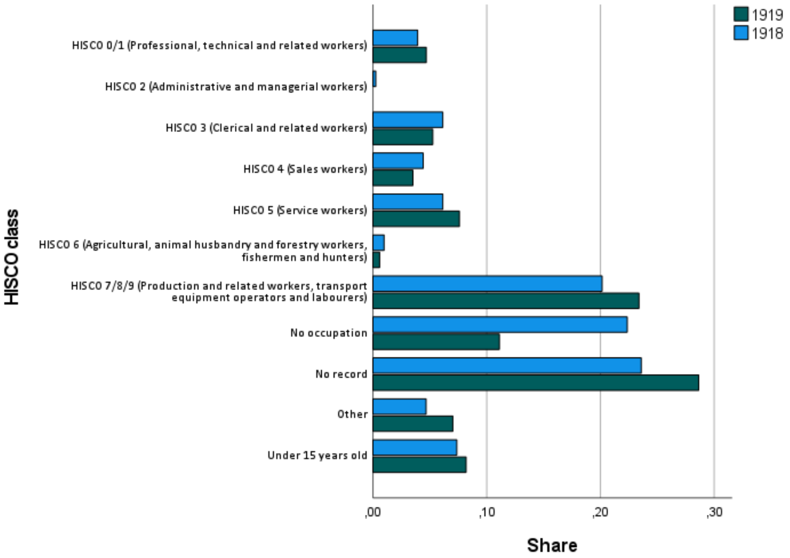
Figure 6 Age-Specific Death Rate per 1,000 Inhabitants, (Spanish) Flu, Civilian Population Antwerp, 1918–1919



Source: City Archives Antwerp, Cause-of-death registers, 1918–1919; UGent Queteletcentrum, Lokstat database (Recensement de la population, Antwerp, 1910, 1920).

To conclude we consider one of the big questions: was the Spanish flu a socially neutral epidemic (Mamelund 2006; Mamelund and Dimka 2021; Mamelund, Shelley-Egan, and Rogeberg 2020)? Early studies assumed rather than proved that this was the case (Crosby 1976; Rice and Bryder 2005; Tomkins 1992), but recent research has confirmed the early findings of Sydenstricker (1931) by showing how social inequalities exacerbated death rates for specific social groups, typically un- and low-skilled workers (Bengtsson, Dribe, and Eriksson 2020; Chowell and Viboud 2016; Grantz et al. 2016; Herring and Korol 2012; Mccracken and Curson 2003). Interestingly, in Bergen, Norway, the study of a unique contemporary survey revealed that “the first wave hits the poor, the second wave hits the rich” (Mamelund 2018; Mathews et al. 2010). Explanations offered focus mainly on the immunization effects of the first wave on the poorer groups due to crowding, occupational exposure, summer holiday separation (the rich spending the summer in the countryside), and (assumed lack of) hand hygiene (Mamelund 2018, 311-3).

Figure 7 Deaths per Occupational Group (HISCO scheme), as Percentage of Total Deaths per Year (Excluding Military Deaths), Spanish Flu in Antwerp, 1918-1919



Source: See Figure 4.

Of the 758 flu-related deaths in the Antwerp cause-of-death registers, 458 cases included an occupational title, 111 cases (mostly women) listed "no occupation," and 189 cases were left blank (including 43 minors younger than 15 years of age). Gender-wise, we have occupational data for 387 men (out of 442, or 88 per cent) and 76 women (out of 315, or 24 per cent). Most-listed occupational groups were the military (as noted above, 180 out of 758 victims or 24 per cent – but a massive 41 per cent of all deaths during the third wave), dock workers (n = 14), maids, and clerics (for both n = 11). To bring order to the myriad occupational titles, for Figure 7 we utilized the Historical International Standard Classification of Occupations (HISCO)[19] scheme that groups occupational titles into nine major groups (van Leeuwen, Maas, and Miles 2002). In terms of HISCO major groups, the group of production and transport workers and labourers (HISCO 7/8/9) was the most numerous (n = 122), while the other groupings recorded below 40 cases. Making abstraction of the

[19] See https://historyofwork.iisg.nl/major.php (Accessed 5 November 2021). In summary, HISCO 0/1 = Professional, technical and related workers; HISCO 2 = Administrative and managerial workers; HISCO 3 = Clerical and related workers; HISCO 4 = Sales workers; HISCO 5 = Service workers; HISCO 6 = Agricultural, animal husbandry and forestry workers, fishermen and hunters; HISCO 7/8/9 = Production and related workers, transport equipment operators and labourers.

deaths with unknown or no occupation (of which respectively 90 per cent and 80 per cent were women) and the military victims (all men), there is little difference in occupational composition of the deaths in both years or in both major waves hitting the town. Further analysis is needed to relate these numbers to "normal" occupation-specific mortality as well as to the wider population distribution.

6. Conclusions

Although historical sources are scarce compared to other countries, our overview of the Spanish flu in Belgium has revealed some important findings regarding its chronology, severity, inequalities, and the measures implemented. We have identified, furthermore, a number of issues that need to be addressed in order to get a better grasp of the differential impact of the pandemic in the country. Epidemics and Inequalities in Belgium from the Plague to COVID-19 (EPIBEL), a new research project in which the authors of this article collaborate, will take these issues up.[20] EPIBEL aims to map and explain inequalities in the impact of epidemic outbreaks. It compares COVID-19 with five previous epidemic outbreaks including the Spanish flu. A very recent study for Belgium by Poulain, Chambre, and Pes (2021) for instance indicates that centenarians exposed to the Spanish flu in their early life survived better to COVID-19, suggesting a link between exposure to 1918 H1N1 influenza and resistance towards 2020 SARS-Cov-2.

In this analysis we examined (Spanish) flu/influenza deaths only. Studies have pointed to significant interactions with bacterial infections, in particular pneumonia and tuberculosis. People suffering from respiratory diseases appear more susceptible to developing influenza once exposed. In our follow-up studies, it is therefore important to calculate (excess) mortality for influenza as well as accompanying respiratory causes such as pneumonia, bronchitis, phthisis, and tuberculosis. We believe that this might give a more accurate account of the mortality due to the pandemic. As the aetiology of the flu (and many other diseases) was not known at the time, physicians might have had difficulties in assigning the cause of death. The rich Antwerp cause-of-death registers, which mention the name of the doctor who certified the cause of death, will enable us to examine registration practices by doctor: Who noted "Spanish" flu? Who registered co-morbidities? And in what cases?

Nonetheless, it is extremely difficult, if not impossible, to know the exact number of victims of the Spanish flu. Estimates for Belgium and other countries vary greatly. Considering its strong involvement in the war, the Belgian case, even more than elsewhere, suffers from wartime conditions that

[20] See www.epibel.be (Accessed 5 November 2021).

resulted in incomplete registration of deaths and population numbers. Another major complicating factor is the difficulty in distinguishing war effects from those of the flu pandemic. In an effort to separate these two forces, Barro, Ursúa, and Weng recently revealed that India, Kenya, Mexico, Indonesia, and South Africa were presumably among the countries most affected by the pandemic, and not the United States, Canada, and most European countries (Barro, Ursúa, and Weng 2020). When examining the geography of the flu in Belgium, in the absence of cause-of-death data by municipality, it is therefore more useful to focus on excess mortality during the time of the epidemic (July 1918–April 1919) in comparison with the same months in war time (e.g., July 1917–April 1918), rather than comparing with pre-war figures (1910–1913). This way we can isolate the (excess) deaths related to war and winter deprivation from the actual Spanish flu victims. Indeed, we are in dire need of further research to relate "war" to 1918–1919 flu mortality, or in other words examine excess mortality due to the Spanish flu, much like the present-day COVID-19 analyses are being done. Likewise, examining weekly and daily deaths, besides monthly ones, should allow us to establish a more precise chronology of epidemic mortality in the different localities and provide better insight into geographic pathways of the three flu waves across the country, together with an in-depth study of health care measures and their impact on the population. Our knowledge of health policies and actions by central, provincial, and local authorities and institutions at the time of the Spanish flu is sporadic and incomplete at this point. The core aims of EPIBEL are precisely to better understand how policies mitigate epidemic effects on populations as well as how epidemics shape health policies and (care) institutions in the long run.

Although the high virulence of the second wave (peaking in October and November 1918) has not been conclusively explained yet, our exploration here suggests that exposure provided some protection against the next wave. On the other hand, some regions, notably in the provinces of Limburg, Namur, and Luxembourg seem to be hit twice, and yet others, in the north of Flanders and near Antwerp, seem to have escaped the worst impact of the pandemic. Again, the Antwerp cause-of-death registers bear the potential to drill deeper and allow us to distinguish possible temporary migration movements skewing our excess mortality estimates – if the Antwerp population was markedly smaller during the Spanish flu episode (due to Antwerp citizens fleeing to the Netherlands, for example), this should show up in the detailed mortality numbers as well.

In order to examine the differential impact of the Spanish flu, we need to observe, besides the general population, specific population groups. We have pointed to certain vulnerabilities with regard to (French) evacuees and soldiers in Belgium. Our analysis has indicated the need for future research to distinguish flu-related deaths of civilians from military deaths. In addition, the excess female mortality observed in some areas and cities, in relation to the absence of a large number of people and specifically young men involved in combat elsewhere or refugees fled abroad, needs further scrutiny. Furthermore, we still ignore the extent to which specific occupations – medical occupations, household staff, etc. – or poverty and malnutrition exacerbated by four years of warfare, increased the risk of dying from the Spanish flu. Combining individual-level cause-of-death registers (including disease, sex, occupation of the deceased) with death certificates (place of birth and address), as EPIBEL proposes to do in the near future, will offer unique opportunities for tracking occupation-, origin-, place-, and household-specific excess influenza mortality from one wave to another.

This way, EPIBEL hopes to provide Belgium with a better pandemic memory of the Spanish flu, raising both the preparedness for future pandemics and the awareness that taking into account inequalities is crucial to mitigate impacts and prevent catastrophic outcomes.

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