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Descriptive Finding

The Spanish flu and the health system: Considerations from the city of Parma, 1918

Matteo Manfredini

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Abstract

BACKGROUND
The gravity of the Spanish flu has been often associated with inadequate health systems. However, few studies have used health data effectively in their analysis of epidemics.

OBJECTIVE
To analyze the role of hospitals in an Italian town during the Spanish flu and its effect on the risk of dying at home.

METHODS
Individual-level information from the Permission of Burials was used to evaluate the impact of the epidemic on city hospitals. A logistic model was used to estimate the odds of a home death in order to elucidate possible sociodemographic mechanisms linked to hospital saturation issues.

RESULTS
During the epidemic the odds of dying at home increased by 29% overall, driven especially by an increase in home deaths among the poorest social groups. However, the well-off maintained the highest odds of dying at home throughout 1918.

CONCLUSIONS
Hospitals facilitated the spread of the epidemic in the city and contributed to its high mortality level. The increase in the odds of dying at home for the poorest was likely associated with hospital saturation, which conversely does not appear to have affected the well-off. In fact, this social group already had very high levels of home deaths in the pre-epidemic period.

CONTRIBUTION
Evaluating the role of hospitals during the Spanish flu allows better comprehension of the spread and evolution of the epidemic, especially regarding possible saturation issues and differential access to health resources.

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1. Introduction

It has often been claimed that the lethality and virulence of the Spanish flu was associated with a weak and unprepared health system. In Italy many towns suffered from poor hygienic conditions in houses and public areas, poor home sanitation, inadequate water supply, and malnutrition. The situation deteriorated during WWI due to a shortage of doctors who were enrolled in the army or had died during the war, emphasizing the vulnerability of the Italian public health system and worsening its capacity to cope with the epidemic (Tognotti 2002). As a consequence, Italy had one of the highest mortality rates in Europe in 1918, at around 35‰ (Mortara 1925; MEN 1924), with about 410,000 victims in that year (Fornasin, Breschi, and Manfredini 2018).

Despite many scholars emphasizing the health system, few studies have effectively integrated that issue into their analysis of the epidemic. Some use hospital registers just to estimate the impact of the epidemic, some exploit autoptic material to investigate causes of death, whilst others simply provide a qualitative description of healthcare structures (Nuzum et al. 1918; Rizzo et al. 2011; Rosi et al. 2021; Gaeta, Fornaciari, and Giuffra 2020; McCrossan 2021; Tognotti 2002).

Making use of a rediscovered source of individual data, the Permissions for Burial, this paper sheds light on the impact that health facilities had on the evolution of the epidemic in an Italian town, Parma, in 1918. The research hypothesis is that the spread of the Spanish flu led to an increase in the risk of a home death, especially for some subgroups of the population, likely on account of hospital saturation. The first part of the paper provides a descriptive outline of the outbreak of the flu in Parma, while the second analyzes in more depth the place of death in order to investigate the level and characteristics of home deaths and the reasons for them.

2. Data and methods

The Permissions for Burial of 1918 contains individual-level data of all the deceased buried in the cemetery of Parma, both civilians and soldiers (Manfredini 2021). Various analyses confirmed the quality and reliability of the source. Once separated from 83 cases of stillbirth, the number of recorded burials proved to be consistent with the official aggregate death statistics for the municipality of Parma (2,692 against 2,691). Age at death was accurately recorded, as assessed through the Whipple index (102.8), and the classification by cause of death was characterized by very little missing information (0.3%) and a small share of imprecise and/or undefined causes of death, such as fever, convulsions, or elderly marasmus (1.1%).

Of all the information recorded in the register, the place of death is the focus of this study. Reporting whether the person died in a hospital (with a clear indication of its military or civil nature) or in a private house is used to evaluate aspects of the health system of that time and how it was affected by the epidemic, using both descriptive analyses and regression models. Logistic regression was run to assess the odds of dying at home versus dying in a hospital, given a set of potential explanatory variables. This analysis based on individual data is used to elucidate possible social and demographic mechanisms associated with hospital saturation. As the focus is on the risk of a home death, the model does not include military casualties because they died exclusively in military hospitals.

As explanatory variables the model includes demographic elements such as age at death, gender, and cause of death, profession as a proxy for socioeconomic status, and a time period variable. Age at death is included to control for specific health authority policies regarding fragile groups, the incidence of age-associated diseases, or family decisions regarding terminal illness. Gender is included because women might present a lower risk of dying at home due to hospitalization in the case of a difficult pregnancy. The risk of a home death could also be associated with the cause of death: Those with diseases deemed to be of public interest, such as infectious diseases or the flu, might have preferential access to hospitals, while others, such as those with degenerative diseases, might be directed toward home treatment, especially in their terminal phase. Finally, profession is addressed to capture possible socioeconomic differentials in the odds of dying at home, including possible differential access to health structures.

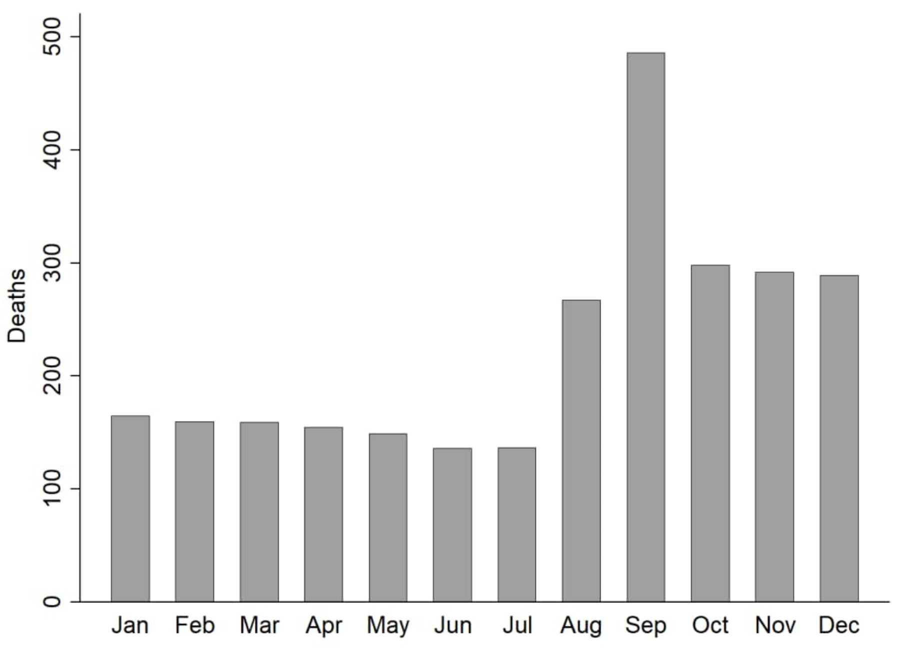
Besides a basic model, different interaction models relative to age, cause of death, and socioeconomic group were estimated to capture possible differential risks of home death between the pre-epidemic (January–mid-August) and the epidemic period (mid-August–December). Application of a likelihood-ratio test showed that the first two models did not increase model fit significantly ($\chi^2 = 5.08$, p-val = 0.166 and $\chi^2 = 8.90$, p-val = 0.113, respectively), whilst the latter one did ($\chi^2 = 10.49$, p-val = 0.062).

Robust standard errors were adopted to correct model misspecifications, in particular heteroskedasticity.

3. Results

The Spanish flu hit Parma in three distinct waves, with only one severely affecting mortality levels. It started in mid-August when, in an Italian army camp close to Parma, 500 out of 1,600 soldiers were infected and later transferred to the city hospitals (Boggio Tomasaz 2015). From that moment on the number of deaths began to increase rapidly, reaching 486 cases in September (Figure 1). From mid-August to the end of September the register recorded over 15 deaths per day on average, as opposed to 5 before that date. Then between October and December the number of deaths started to decrease (9.8 per day on average). Overall, 2,692 people died in 1918, with a roughly 72% increase over the average of the previous 5 years and a CDR of 47.4‰, higher than the 35‰ at the national level.

Figure 1: Monthly number of deaths. Parma, 1918



Soldiers and military personnel constituted a large part of the huge death toll inflicted by the Spanish flu, with 586 deaths (21.8% of total deaths in 1918), and was one of the reasons for the high share of residents outside Parma (59%) among the deaths recorded in the burial register.

Regarding the place of death (Table 1), the largest number of deaths occurred in hospitals (67.6%). However, during the epidemic the share of deaths in public hospitals decreased from 56.1% to 42%, with a corresponding increase in the proportion of both home deaths (32.1% to 32.6%) and casualties in military hospitals (11.8% to 25.4%). Limiting the analysis to the civilian component, home deaths increased by 44.2%

between mid-August and December, against a more modest 6.3% increase in deaths in public hospitals. In September, when deaths from the epidemic peaked, the number of people who died at home also peaked at 172, about half of the total civilian deaths in that month.

Table 1: Deaths by place and period of death. Parma, 1918

Place of death	Pre-epidemic		Epidemic		Total	
	N	%	N	%	N	%
At home or in a private house	357	32.1	515	32.6	872	32.4
Public Hospitals	624	56.1	663	42.0	1,287	47.8
Military Hospitals	131	11.8	402	25.4	533	19.8
N	1,112	100.0	1,580	100.0	2,692	100.0

The results of the logistic regression show that dying at home was 29% more likely to occur during the epidemic and it was strongly associated with both age and cause of death. Compared with adults aged 15–39, the odds of dying at home for the elderly was 44% greater, while that for children aged 0–14 was 2.4 times higher. On the other hand, those dying from tumors (–39%), tuberculosis (–40%), and infectious diseases (–88%) were less likely to die at home than people dying from respiratory illnesses or influenza, while deaths from cardiocirculatory pathologies were 48% more likely to take place at home.

Regarding professions, deaths in the upper and non-manual social class (high and low professionals, teachers, etc.) had the highest odds of occurring at home, a situation that did not change during the epidemic. Conversely, all the other occupational groups show an increase in the odds of dying at home during the flu, with poor semi-skilled and unskilled individuals 2.6 times more likely to experience a home death.

Table 2: Logistic regression of the odds of dying at home. Parma, 1918*

		No interaction		With interaction	
	%	OR	p-value	OR	p-value
Age at death (ref. 15–39 years)	23.3	1.000		1.000	
0–14 years	30.3	2.422	<0.001	2.383	<0.001
40–64 years	22.5	1.143	0.386	1.148	0.371
65+	23.9	1.441	0.020	1.461	0.017
Female (ref. M)	50.9	1.036	0.739	1.014	0.896
Cause of death (ref. Respiratory diseases/Flu)	39.5	1.000		1.000	
Cardiocirculatory	10.6	1.483	0.022	1.502	0.019
Tumors	5.1	0.611	0.029	0.623	0.039
Tuberculosis	9.6	0.602	0.005	0.613	0.008
Infectious diseases	5.5	0.120	<0.001	0.121	<0.001
Other diseases	29.7	0.562	<0.001	0.562	<0.001
Profession (ref. High and Low Professionals)	11.8	1.000		1.000	
Artisans and Skilled workers	7.0	0.268	<0.001	0.259	<0.001
Semi-skilled and Unskilled workers	13.4	0.311	<0.001	0.175	<0.001
Farmers	12.0	0.100	<0.001	0.090	<0.001
No occupation	41.6	0.406	<0.001	0.341	<0.001
Missing	14.2	0.349	<0.001	0.373	0.001
Period (ref. Pre-epidemic)	45.3	1.000		1.000	
Epidemic	54.7	1.286	0.014	0.972	0.920
Epidemic - Artisans and Skilled workers				1.091	0.852
Epidemic - Semi-skilled and Unskilled workers				2.596	0.014
Epidemic – Farmers				1.216	0.676
Epidemic - No occupation				1.428	0.251
Epidemic – Missing				0.894	0.758
Log-likelihood		–1281.1		–1275.8	
Wald test (p-value)		205.8; p < 0.001		214.8; p < 0.001	
LR test		LR chi = 10.49; p = 0.062			
N		2,102			

* The model does not include 586 soldiers and 4 civilian deaths whose age at death was unknown.

4. Discussion and conclusions

This study investigates the role of hospitals during the Spanish flu in the city of Parma and its effect on the risk of dying at home.

In 1918, Parma had a complex of public healthcare facilities called Ospedale Civile, along with some military hospitals, often housed in public buildings confiscated by the army. Because of its position in the first evacuation area during WWI, about 160,000 soldiers were accommodated in the city's military healthcare structures. Thus, it is no surprise that in Parma the onset of the Spanish flu started with the displacement of many infected soldiers to the city hospitals, which then triggered the spread of the epidemic in the urban population. Later, the public hospitals accommodated a high share of people from outside the city, so the presence of important healthcare structures in the urban context acted as a transmission channel for the infection and resulted in high mortality levels.

The study also found clear evidence of a rise in the odds of home deaths during the epidemic. Home death was not uncommon in Parma before the flu. Given the almost universal practice of home birth, most infant deaths occurred at home, probably as a consequence of complications during childbirth and a lack of adequate care for the mother and her newborn child (Reid 2005). On the other hand, the elderly were more likely to die at home than young adults, probably due to chronic diseases that could be treated at home.

Furthermore, at that time hospitals mostly housed people with infectious diseases, which were listed as pathologies of public health concern and had to be reported to the Ministry of Health. Thus, the norm of infected people isolated in hospital for public health purposes meant that they were less likely to die at home than people affected by respiratory diseases, pathologies that were not included in the list of infectious diseases (Rossi 2020). Although respiratory diseases were declared of public interest in September 1918 they remained strongly associated with higher odds of home death during the epidemic, which casts doubts over the capacity of the health system to trace, diagnose, and eventually admit to the hospital those infected with the Spanish flu.

However, the 29% increase in the odds of a home death during the epidemic could be associated not only with a failed tracing system but also with saturated health structures. The number of beds in public hospitals had already been deemed insufficient at the turn of the 20th century, when the main city hospital could accommodate around 450 patients (Banzola 1980). The huge rise in deaths during the epidemic put the health system under extreme pressure: In the month of September alone, 160 people died in the main public hospital, 104 from influenza and respiratory diseases. By applying a fatality rate of 10%–15% to deaths from causes associated with the flu (for a discussion on the Spanish Flu fatality rate see Spinney 2017), it is possible to roughly estimate that between 693 and 1,040 individuals were admitted to the main public hospital for respiratory diseases, to which should be added the patients admitted for other pathologies. Although the above is only a rough numeric estimate, in many cities the local health authorities tried to increase the bed capacity of hospitals, even by converting public buildings into makeshift healthcare facilities (Contini and Vicentini 2021; Sabbatani and Fiorino 2007). Unfortunately, the high increase in home deaths recorded during the epidemic demonstrates that those measures were insufficient to cope with an unprecedented surge of patients (Tognotti 2002). It is thus reasonable to presume that hospitals faced an overcrowding crisis and were affected by saturation issues that prevented the local health system from ensuring universal access to healthcare facilities. Saturation and overcrowding also had the effect of deteriorating health and hygienic conditions in healthcare facilities (Tognotti 2002).

The consequences of this collapse of the urban health system also had differential social effects. Previous studies have found evidence of socioeconomic differentials in mortality during the epidemic (Bengtsson, Dribe, and Eriksson 2018; Mamelund, Shelley-Egan, and Rogeberg 2021) and differential access to care has been proposed as a possible reason. This study provides support for that hypothesis by providing evidence that the poorest workers experienced higher odds of dying at home during the epidemic. This could be a sign of increasing difficulty in accessing healthcare institutions, despite hospitals' first and foremost mission being to guarantee medical assistance to the neediest, and there being little chance of receiving a doctor's home visit. However, the odds of a home death were far higher among the well-off. About 62% of deaths in this social group occurred at home, without no differential between the pre-epidemic and the epidemic periods. This finding points to two possible but not alternative reasons: hospitals continued to allow privileged access to the poorest even amidst the pandemic, while the well-off decided to be treated at home because of poor quality services and poor hygiene in the hospitals.

This study presents data that shed light on the role played by Parma's hospitals in the spread of the Spanish flu by focusing on home deaths as a possible consequence of saturation issues in healthcare facilities. Although the data presented in this study allow drawing solid and reasonable hypotheses, more studies are needed to strengthen the conclusions presented here and to deepen the knowledge of a topic of great relevance to the analysis of epidemics, as the recent COVID-19 pandemic has shown.

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