The Spanish Influenza in Madrid
1918-1920

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LONGPOP

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Background

1918 Spanish Influenza in Madrid, Spain, and around the World

Analysis

Data
Baseline
Excess Mortality
Strength and Timing

Final Remarks

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- Many died from secondary respiratory infections (pneumonia or bronchitis)

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  - Russian flu pandemic at the end of the 19th century (H3)
  - Strains of the H1 virus likely began circulating in some parts of the world around the turn of the century.
  - Some evidence suggests the presence of a first wave tempered the strong effects of subsequent waves.

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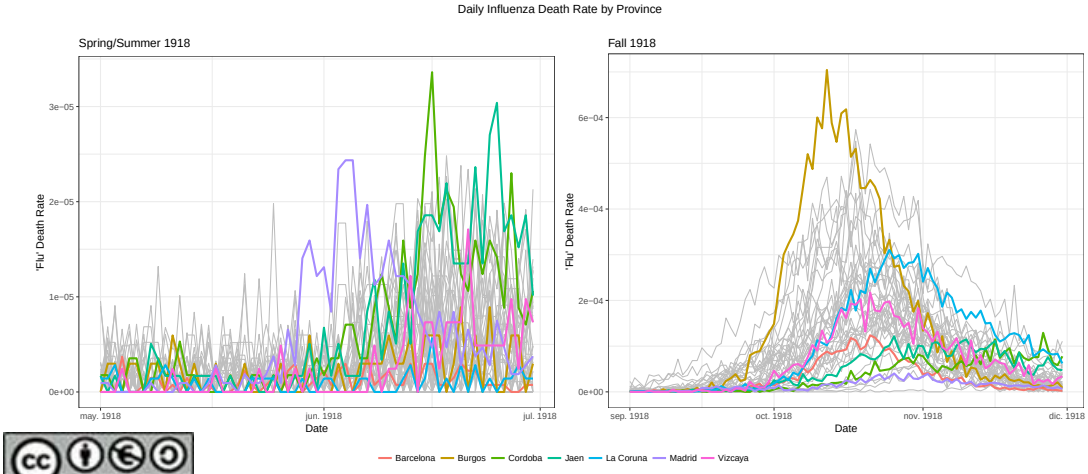
- Most places experienced a strong fall wave in October of 1918.

Spanish Influenza in Spain



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Spanish Influenza in the city of Madrid

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- Possibly brought by Spanish and Portuguese Migrant Workers from Southern France

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- Contribute information on the excess mortality by wave and according to age structure in an large urban population

- **Madrid Civil Register Records on Deaths (1917-1922)**
  - Sex, Age, Civil Status, Cause of Death, Foreign Born, Death and Inscription Dates, District of Death, Address, Occupation
  - We distinguish influenza and respiratory related deaths by extracting records with pneumonia, bronchopneumonia, and bronchitis listed as a cause of death, then disregarded those records in the subset which also contained tuberculosis.

Table: **Madrid Civil Register Death Records, 1917-1922**

Year	1917	1918	1919	1920	1921	1922	total
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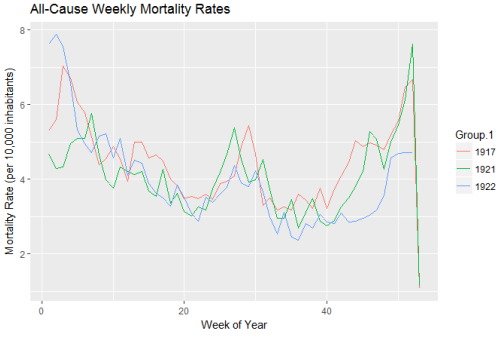
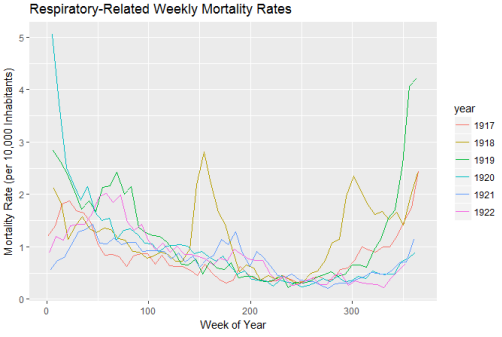
- **Yearly Statistical Books for the city of Madrid (1917-1922)**
  - ly Population by Age-group in the city

Yearly Mortality Rates, 1917-1922





Left: all cause weekly mortality rates using yearly population data and deaths from the civil register.

spiratory related (*without* tuberculosis deaths) mortality rates by year.

Simple Serfling Regression Model using 1917 mortality records

$$\frac{Deaths_{x_t}}{Population_{x_t}} = u + \alpha * (t) + \beta * sin(\frac{2\pi}{52.17} * t) + \beta * cos(\frac{2\pi}{52.17} * t)$$

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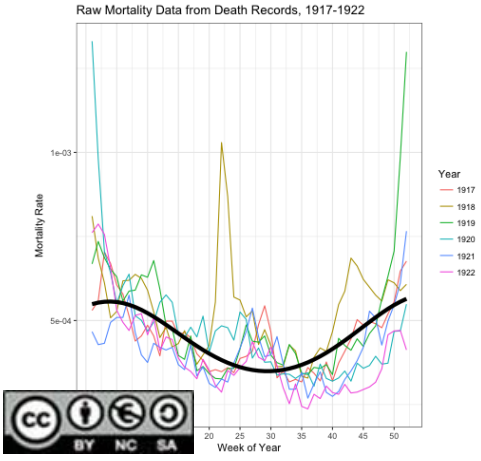

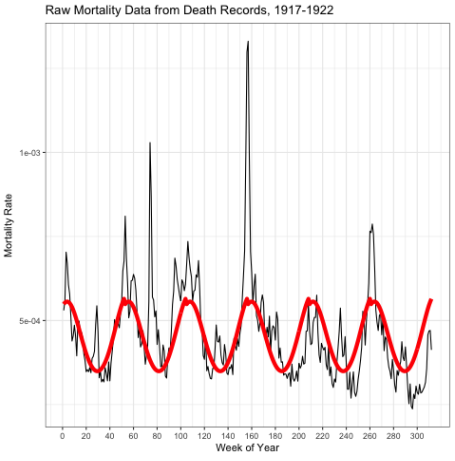

Ultimately, we first added new parameters to account for the summer peak:

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But..... because we only have one year of pre-epidemic mortality data (1917), we wanted to account for year-to-year fluctuation in deaths by week

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Parametric Bootstrapping of Baseline Estimation

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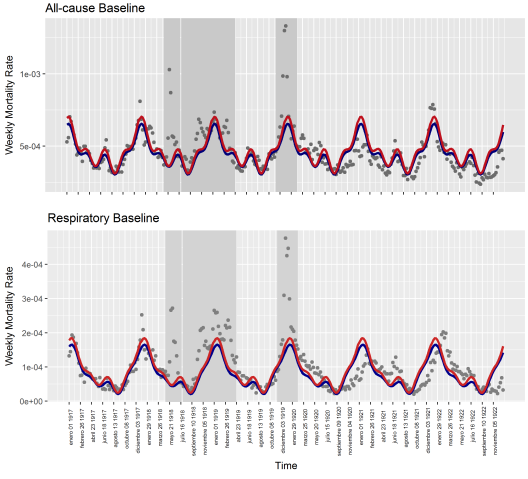
- Construct our final mortality baselines from the mean and upper 95% values of the 500 sets of coefficients generated above.



actual weekly mortality rates from 1917-1922, and lines show mean and upper 95% from simulated 1917 deaths data. Vertical lines indicate breakpoints from which excess mortality is generated.

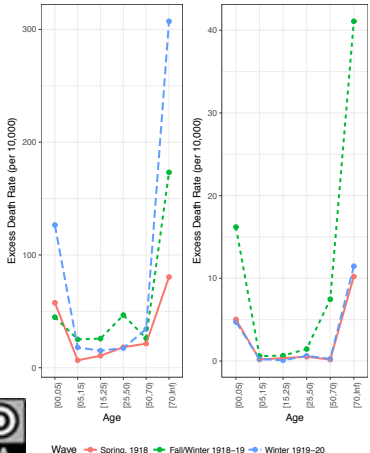
Table: **Age-Specific Excess Mortality By Wave**

Age Group	Total Excess Deaths	Weekly Excess Mortality Rate (Per 10,000)	Standardized Mortality Risk
Herald Wave, 1918			
Overall	1456	19.42	1.57
[00, 04)	375	57.57	1.40
[05, 14)	95	6.58	2.03
[15, 24)	165	10.59	2.28
[25, 49)	486	18.13	1.95
[50, 69)	213	21.32	1.55
[70, *Inf*)	127	80.39	1.68
Fall and Winter, 1918-1919			
Overall	2511	33.50	1.27
[00, 04)	293	44.90	1.22
[05, 14)	364	25.11	1.40
[15, 24)	401	25.73	1.40
[25, 49)	1250	0.1019	1.43
[50, 69)	262	26.22	1.24
[70, *Inf*)	275	173.58	1.24
Echo Wave 1919 -1920			
Overall	2538	33.86	1.52
[00, 04)	823	126.34	1.59
[05, 14)	261	17.98	2.18
[15, 24)	235	15.08	2.14
[25, 49)	467	17.41	1.63
[50, 69)	344	34.45	1.41
[70, *Inf*)	485	306.51	1.63

Table: **Age-Specific Excess Respiratory Mortality By Wave**

Age Group	Total Excess Deaths	Weekly Excess Mortality Rate (Per 10,000)	Standardized Mortality Risk
Herald Wave, 1918			
Overall	613	8.17	2.59
[00, 04)	253	38.81	2.62
[05, 14)	19	1.31	3.11
[15, 24)	49	3.13	4.43
[25, 49)	114	4.25	2.89
[50, 69)	100	9.98	2.27
[70, *Inf*)	77	48.72	3.15
Fall and Winter, 1918-1919			
Overall	1670	22.28	1.82
[00, 04)	308	47.25	1.69
[05, 14)	82	5.65	2.27
[15, 24)	185	11.87	4.20
[25, 49)	524	19.56	2.77
[50, 69)	346	34.66	1.65
[70, *Inf*)	250	157.79	1.88
Echo Wave 1919 -1920			
Overall	1061	14.15	1.86
[00, 04)	397	61.04	2.04
[05, 14)	58	3.97	2.35
[15, 24)	83	5.33	3.56
[25, 49)	180	6.71	2.18
[50, 69)	168	16.85	1.67
[70, *Inf*)	193	121.84	1.89

Age-specific mortality patterns reveal majority of absolute excess mortality in young and old ages, and high relative rates among young and middle aged adults



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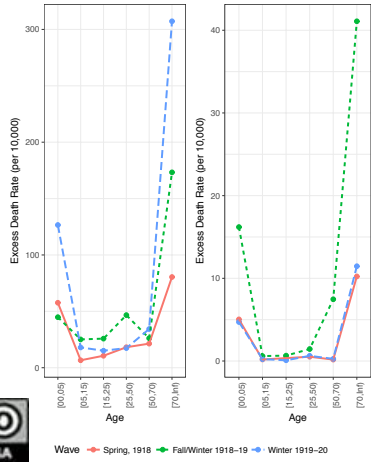

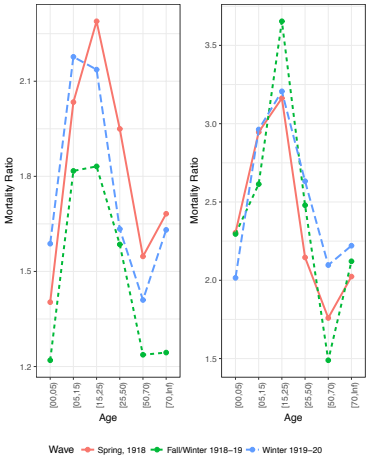

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  - Spring and fourth waves more closely resemble mortality curve of seasonal epidemics, however the standardized mortality risk is much higher for young adult and adult age groups.

Timing and Strength of Each Wave: Segmented Regression

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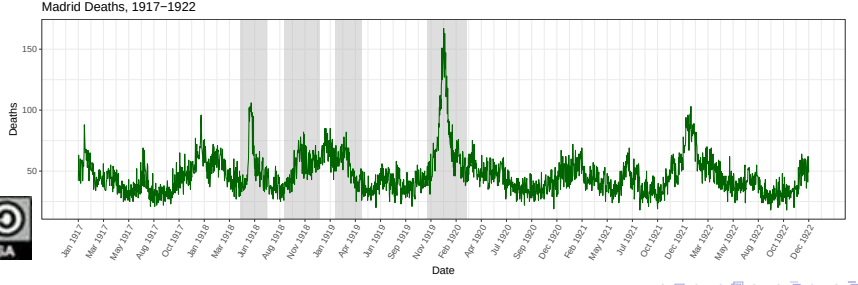
- We examine four distinct wave periods:



Fitted Segmented Regression, Madrid

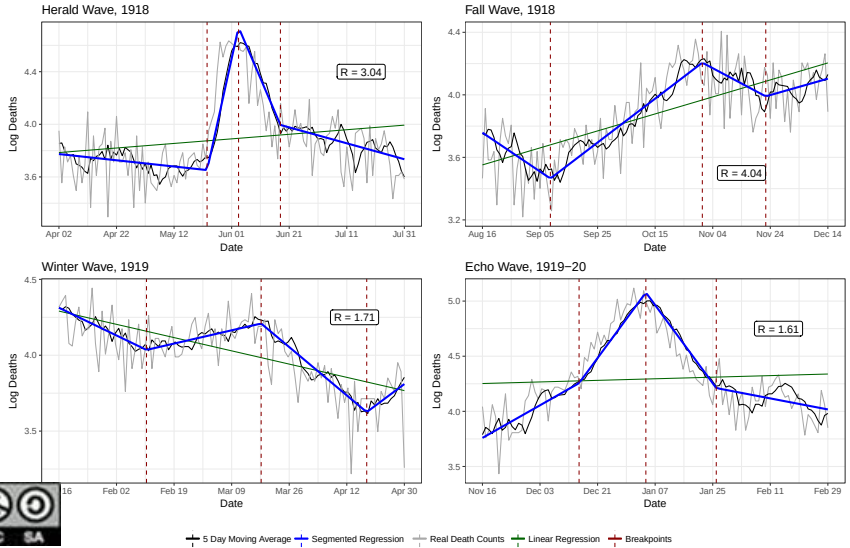


Table: Strength and Timing of each wave, Madrid

Wave	**Start Date**	**Peak Date**	**End Date**	**Length (days)**	R_0
Herald 1918	26 May	06 June	21 June	25	3.04
Fall 1918	09 Sept	29 Oct	23 Nov	75	4.04
Winter 1919	11 Feb	18 Mar	19 Apr	66	1.71
Winter 1919-20	15 Dec	05 Jan	26 Jan	42	1.61

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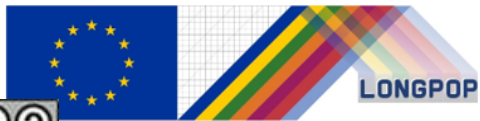
Future Aims

- We have been working on the role of neighborhood environment (social, economic, and structural) in excess mortality; we will continue to explore how the city-wide excess mortality presented today varies from neighborhood to neighborhood.
- Expand the context of our study to include other provinces in Spain to examine differences in the strength and timing in each wave

Thank you for your attention.

We welcome all comments and feedback
(en español tambien)!



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