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Peer Review

Spanish influenza of 1918–19: the extent and spread in South Australia

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Abstract

The 1918–19 Spanish influenza was the first pandemic for which official records were compiled in South Australia. This followed the recognition of the disease as notifiable under the Public Health Act and the establishment of a surveillance system by the then South Australia Central Health Board (a precursor to the current South Australian Health Department). This is the first paper to describe the Spanish influenza epidemic for South Australia from an epidemiological and geographical perspective. Notification numbers were retrieved from the South Australian Central Health Board meeting records. Data were entered into an Excel spreadsheet and Epi™info 7 software to enable a geographical analysis. There were 8,839 influenza notifications: of these, 4,854 (55.0%) originated from metropolitan areas (Attack Rate 9.9 per 1,000 population) and 3,985 notifications (45.0%) originated from regional areas (Attack Rate 8.0 per 1,000 population). There was a lack of comprehensive epidemiological data due to the still developing surveillance system. This restrained more in-depth analysis of risk factors and geological spread.

* The pandemic is reportedly called the 'Spanish' flu because the king of Spain at the time was amongst its earlier victims (McQueen 1976). Another explanation is that it was thus named because the uncensored Spanish press was amongst the first to report on it Harvard University Library (2014).

Introduction

The Spanish influenza pandemic of 1918–19 was the first of three influenza pandemics to occur in the 20th century. This particular H1N1 strain was highly virulent, contributing to its rapid spread and high mortality rate: >2.5% compared with <0.1% for other influenza pandemics.[1] It is estimated that the pandemic resulted in about 500 million infections and 50 million deaths globally.[1–4] The pandemic was unique as it was particularly virulent among young adults, e.g. those aged 18–30 years, in addition to those individuals who are traditionally considered at risk of seasonal influenza, i.e. young children and the elderly.[1, 5, 6] It is believed Spanish influenza originated in the United States in early 1918, and that it was largely spread by American soldiers deploying to Europe during World War I (WWI).[7]

Australia was an isolated continent at the time of the pandemic and remained free from the disease until October 1918, when the disease was introduced by boat arrivals, mostly returning WWI soldiers. The exact date of the introduction of Spanish influenza into Australia is widely debated.[7] *The Daily Observer* reported, on the 28th of January 1919, that the first suspected case of Spanish flu had occurred in New South Wales[7, 8], while the first case on the Western Australian Coast was reported in October 1918.[9]

Figure 1: Death rates due to influenza by jurisdiction and region, Australia, 1919 (21)

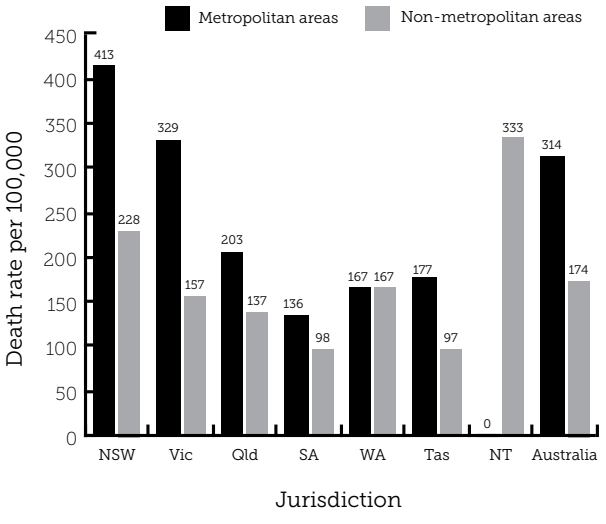
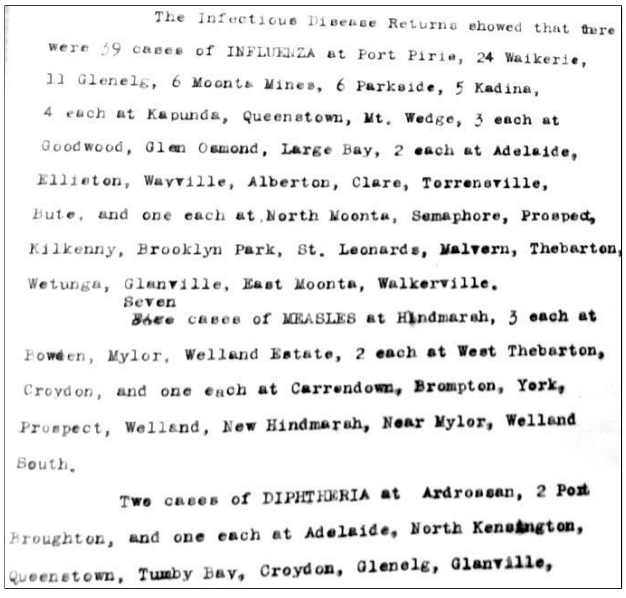


Figure 2: Example of notifications recorded in the South Australian Central Health Board



The Infectious Disease Returns showed that there were 39 cases of INFLUENZA at Port Pirie, 24 Waikerie, 11 Glenelg, 6 Moonta Mines, 6 Parkside, 5 Kadina, 4 each at Kapunda, Queenstown, Mt. Wedge, 3 each at Goodwood, Glen Osmond, Large Bay, 2 each at Adelaide, Elliston, Wayville, Alberton, Clare, Torrensville, Bute, and one each at North Moonta, Semaphore, Prospect, Kilkenny, Brooklyn Park, St. Leonards, Malvern, Thebarton, Wetunga, Glanville, East Moonta, Walkerville.

Seven ~~More~~ cases of MEASLES at Hindmarsh, 3 each at Bowden, Mylor, Welland Estate, 2 each at West Thebarton, Croydon, and one each at Carrendown, Brompton, York, Prospect, Welland, New Hindmarsh, Near Mylor, Welland South.

Two cases of DIPHTHERIA at Ardrossan, 2 Port Broughton, and one each at Adelaide, North Kensington, Queenstown, Tumby Bay, Croydon, Glenelg, Glanville,

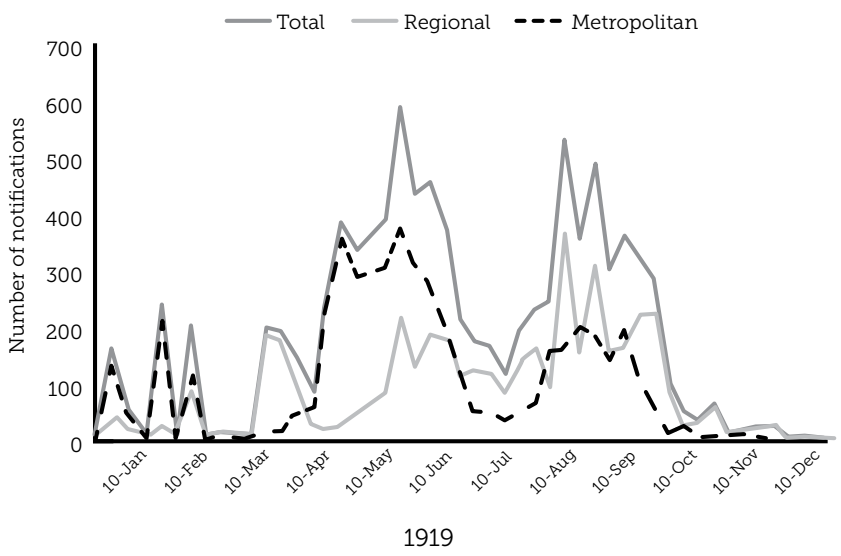


Figure 3: South Australia influenza notifications, January–December 1919

Coastal entry points, including Port Adelaide in South Australia, became the gateposts for quarantining individuals suspected of being infected. Dr John HL Cumpston, Director of Quarantine at the time (and later the first Director-General of the Commonwealth Health Department newly formed in 1921), was responsible for creating an interstate and international quarantine system in 1921.[11-16] As part of the quarantine procedure regulated by the Quarantine Act, all ships arriving from New Zealand and South Africa were quarantined for a seven-day period upon arrival. Since the travel time of about 20 days from South Africa to Australia was longer than the incubation period of the illness[17], exceptions were in place for South African vessels, if the ship's master could supply a Statutory Declaration that there had been no shore contact since departure and that there were no infected patients on board at the time of arrival.

An estimated 11,552 Australians died during the 1918–19 pandemic[18] out of the total Australian population of 5,435,734, resulting in an overall mortality rate of 212 per 100,000 population.[19] Rates for other countries ranged from 390 per 100,000 in the United States, 580 per 100,000 in New Zealand (except Māori) and 630 per 100,000 in Canada.[20]

New South Wales, the most populous state, had the highest number of influenza deaths (n=5,980); resulting in an overall mortality rate (MR) of 304 per 100,000 population. This was followed by Victoria with 3,561 deaths (MR=243 per 100,000) and Queensland with 1,111 deaths (MR=156 per 100,000). A total of 540 deaths were reported in both Western Australia (MR=167 per 100,000) and South Australia (MR=118 per 100,000). Tasmania recorded 240 deaths (MR=114 per 100,000). There were only 16 deaths recorded in the Northern Territory, but this yielded a MR of 333 per 100,000 population.[21] In all jurisdictions, except for Western Australia and the Northern Territory, rates were higher in metropolitan areas (*Figure 1*).

Although historical studies of the 1918–19 epidemic have been carried out within Australia, for example, Ballarat Hospital in Victoria[22], Western Australia[9] and Sydney; no South Australian studies of the influenza pandemic have been reported to date. This paper is therefore the first to describe the epidemic for South Australia and presents a brief overview of the extent and spread of the disease throughout the State using archival data.

Methods

Data were obtained from historical South Australian records. This was possible since, following the first recognised case of Spanish flu in the State in January 1919, all influenza cases had been reported during the weekly meetings of the then Central Health Board. This regular reporting continued until the end of the epidemic in December 1919. The weekly South Australia influenza notification reports for 1919 were retrieved from the archived Central Health Board meeting records, located in South Australia State Records.[23] The total number of influenza notifications was extracted by each suburb or district. The notification records included the notifying suburb/district, notification date and notification number, but did not include information on age, sex, or a detailed residential address for affected individuals (*Figure 2*). These records also did not include information on case outcomes, for example, fatality or otherwise. Data on deaths due to influenza were obtained from different sources, i.e. the South Australia Parliament Paper on Births, Deaths and Marriages (1919–20)[24] and the Official Year Book of the Commonwealth of Australia, Bureau of Census Statistics (what is now the Australian Bureau of Statistics).[25] Population figures for South Australia by age also came from the 1921 Australian population census (i.e. the closest census year).[26]

The influenza notifications were entered into an Excel spreadsheet and imported into Epi™info 7 software. Due to the lack of residential address information, the address of the suburb/district's Town Hall was used instead of the actual residential location for each case. These addresses were recognised as a geographical location in Epi™info 7 and could therefore be mapped.

Data analysis

Attack rates, defined as the cumulative incidence of Spanish influenza in various regions of South Australia over the epidemic period, were computed by dividing the number of

new cases of Spanish influenza in the population by the population at risk at the beginning of the time period in question.

Results

In 1921, South Australia was the fourth most populous State with a population of 495,160.[27] At the time of the pandemic, there were 184 suburbs and districts in South Australia[26, 28] and 265,583 (54.0%) people resided in the metropolitan Adelaide area, while 208,559 people (42.0%) were living in regional areas[29], with the remaining 4.0% living in areas outside of 'governed boundaries'.[25]

Deaths

The South Australian Births, Deaths and Marriages records for 1919–20 reported that there were 532 influenza deaths in the State during 1919, of which 303 (57.0%) were among males and the majority of which (n=494, 91.0%) occurred in the six-month period from April to September 1919. Another source, the Yearbook of the Commonwealth Bureau of Census and Statistics, reported a total of 540 influenza deaths occurred in South Australia during 1919. Of these, 334 (61.9%) occurred in metropolitan areas, resulting in an influenza death rate of 136 per 100,000 population, compared to the death rate of 98 per 100,000 population for the remainder of the State. The overall influenza death rate for South Australia was 118 per 100,000 in 1919.

Notifications

The first influenza notifications in South Australia appeared in the Central Health Board records on 18 January 1919. Figure 3 shows the number of influenza notifications for each month in 1919, with a total of 8,839 influenza notifications recorded during the year. Three main waves of the influenza epidemic in South Australia are evident with the wave trends being emulated across the metropolitan and regional areas. The first wave demonstrates that small three peaks presenting the notification number between 154 and 230. The second wave shows that the largest outbreak occurred in the metropolitan areas, with the third wave peaking higher in the regional areas.

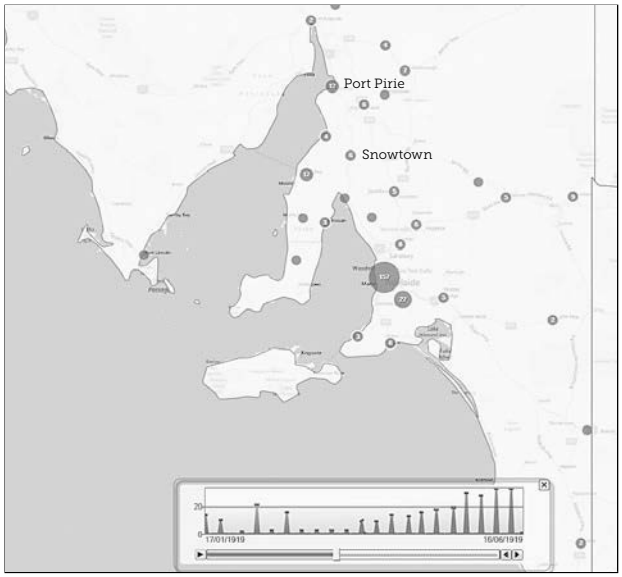
The South Australian influenza attack rate (AR) was 1,784.4 per 100,000 population for 1919 overall. Of the notifications, 4,854 (54.9%) originated from the metropolitan areas (yielding an AR of 2,281.2 per 100,000 population) and 3,985 notifications (45.1%) were from regional areas in South Australia (resulting in an AR of 1,514.6 per 100,000 population).

Figures 4a to 4c show the geographical spread of influenza cases across South Australia during 1919 at three different points in time. These three points are the closest days of three waves' peaks. The figures suggest that the locations where influenza notifications were reported were initially in relatively close proximity to the ocean and spread inland over time. The infection appeared to spread from the major hubs and towns situated on the coast of the State following the main transport routes to locations within the South Australia interior, as indicated by the clusters on the maps.

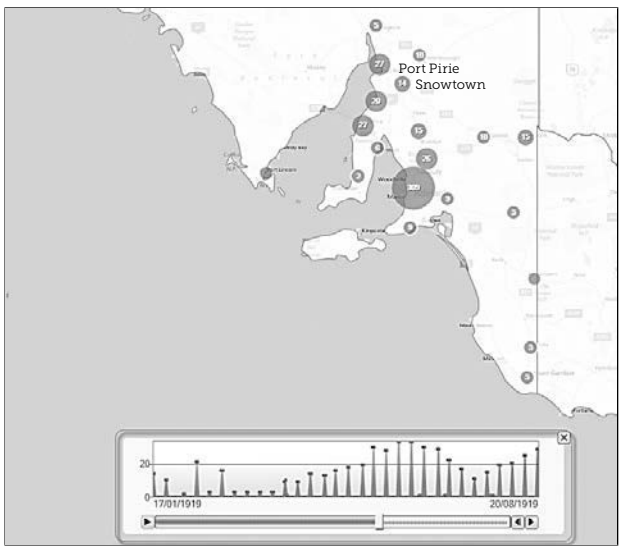
Figure 4a-c: Cumulative notification numbers and spread through SA at three time periods in 1919

(4a) 19 February 1919

(4b) 16 June 1919



(4c) 20 August 1919



Metropolitan

The greatest number of influenza notifications were recorded in Port Adelaide (n=1,330), Adelaide (n=1,041) and East Torrens (n=383) in the metropolitan area (*Table 1*). However, East Torrens had the highest attack rate of 17,060.1 per 100,000, followed by Port Adelaide (4,418.5 per 100,000) and Glenelg (4,028.0 per 100,000).

Table 1: Population figures, influenza notifications and attack rate for metropolitan suburbs and regional towns, South Australia, 1919

Area	Number of		Attack rate per 100,000 population
	Population	Notifications	
South Australia, state	**495,160**	**8,839**	**1,785.1**
Metropolitan suburbs	**212,779**	**4,854**	**2,281.2**
Port Adelaide	30,101	1,330	4,418.5
Adelaide	39,552	1,041	2,632.0
East Torrens	2,245	383	17,060.1
Thebarton	14,031	374	2,665.5
Woodville	12,719	339	2,665.3
Glenelg	7,994	322	4,028.0
Unley	34,093	278	815.4
Hindmarsh	12,454	200	1,605.9
Mitcham	9,188	148	1,610.8
St Peters	11,098	143	1,288.5
West Torrens	8,585	95	1,106.6
Prospect	12,857	62	482.2
Noarlunga	1,502	53	3,528.6
Walkerville	4,223	29	686.7
Edinburgh	792	26	3,282.8
Tea Tree Gully	968	18	1,859.5
Highercombe	871	8	918.5
Other metropolitan areas with <5 cases each	3,572	5	..
Regional areas	**263,107**	**3,985**	**1,514.6**
Port Pirie	9,801	883	9,009.3
Mt Gambier	5,067	277	5,466.7
Snowtown	994	184	18,511.1
Kadina	9,737	164	1,684.3
Lameroo	1,526	145	9,502.0
Peterborough	2,189	137	6,258.6
Mt Baker	2,197	135	6,144.7
Onpakaringa	3,405	127	3,729.8
Neals	1,700	123	7,235.3
Port Broughton	1,188	121	10,185.2
Wallaroo	3,455	114	3,299.6
Robe	494	112	22,672.1
Renmark	3,455	99	2,865.4
Minlaton	1,905	99	5,196.9
Millcent	2,458	91	3,702.2
Tanunda	1,707	81	4,745.2
Echunga	1,389	79	5,687.5

Continued

Table 1 *Continued*

Area	Number of		Attack rate per 100,000 population
	Population	Notifications	
Waikerie	1,867	75	4,017.1
Tatiala	1,362	55	4,038.2
Port Germein	1,334	54	4,048.0
Mobilong	2,124	53	2,495.3
Mannum	1,037	49	4,725.2
Saddleworth	965	45	4,663.2
Kapunda Town	2,663	40	1,502.1
Georgetown	1,099	37	3,366.7
Franklin Harbour	4,367	36	824.4
Redhill	1,037	34	3,278.7
Moonta	965	32	3,316.1
Nairne	993	29	2,920.4
Truno	792	21	2,651.5
Hall	690	20	2,898.6
Stirling	3,123	19	608.4
Upper Wakefield	1,224	16	1,307.2
Port Wakefield	1,134	14	1,234.6
Elliston	902	14	1,552.1
Penola	1,692	13	768.3
Gilbert	1,253	12	957.7
Macclesfield	600	12	2,000.0
York Penninsula	3,185	12	376.8
Gawler	3,392	12	353.8
Parra Wirra	817	11	1,346.4
Strathalbyn	1,582	10	632.1
Gladstone district	1,315	10	760.5
Rhynie	269	9	3,345.7
Orroroo	1,962	9	458.7
Port Augusta	1,032	8	775.2
Hawker	902	7	776.1
Hanson	640	6	937.5
Hutt & Hill Rivers	863	5	579.4
Other regional areas with <5 cases	27,463	44	..
Notifications from unincorporated areas	Unknown	191	..

Regional

The greatest number of influenza notifications were recorded in Port Pirie (n=9,801), Mt Gambier (n=7,234) and Snowtown (n=2,067) in the regional area (Table 1). However, Robe had the highest attack rate of 22,672.1 per 100,000 population, followed by Snowtown (18,511.1 per 100,000) and Port Broughton (10,185.2 per 100,000).

Discussion

The death rate due to Spanish flu was much lower in Australia than in other countries. It is thought that this was largely because of its geographical isolation.[20] Within Australia, South Australia had the second lowest death rate due to Spanish flu in 1919, after Tasmania. This is possibly due to South Australia's relative geographical isolation, as well as the comparatively low number of World War I soldiers being repatriated through the State relative to other Australian jurisdictions, such as Western Australia.[30]

Figures 4(a)-(c) illustrate the chronological development of Spanish influenza in South Australia. The figures suggest that the locations where influenza notifications were reported were initially in relatively close proximity to the ocean and spread inland over time. This is because the ports were the major entry points for Spanish influenza cases who had been in contact with pandemic cases overseas. The

infection appeared to spread from the major hubs and towns situated on the coast of the State following the main transport routes to locations within the South Australia interior, as indicated by the clusters on the maps.

In the Adelaide metropolitan area, Port Adelaide, which had the highest number of notifications, is located northwest of the central business district of Adelaide. In 1919 it was a major seaport for interstate and international travel. Therefore, one of the contributors to the higher attack rate could be the number of potential carriers of the influenza virus who arrived at the port and facilitated its spread in the community.

In the 1910s, Adelaide was the capital of South Australia and the centre of business and State government, as it still is today. Although the number of notifications in Adelaide was the second highest in the metropolitan area, the AR was similar to the suburbs of Thebarton and Woodville. Other areas such as Glenelg, Noarlunga and Edinburgh had higher ARs, which may be in part explained by their location close to the port. Since the quarantine procedure was only enforced within the major ports, smaller ports that were used only by locals may thus have contributed to the spread of infection within the state.

The third highest number of notifications was recorded in East Torrens, which was located along the eastern side of the River Torrens. The area included the present municipalities of Burnside, Campbelltown, Payneham and St. Peters, and the now obsolete District Council of Crafers.[31] While the number of infections is similar to that of Thebarton, the AR was significantly higher among the metropolitan area. Due to the unavailability of demographic data, it is difficult to speculate about the causes of the high AR in this area.

Based on the 1921 population data, the demographic profiles of regional towns were relatively similar to each other. The distinctive differences between the towns were the proportions of the population engaged within particular industries.

The highest number of notifications was recorded in Port Pirie, which had the largest smelters in the state and was also located close to a seaport. Although employment, age and sex data for the influenza notifications were unavailable, it has been suggested that many workers frequently travelled between towns (for example, travelling between Port Pirie to Broken Hill, where the other smelters existed).[32] This frequent travel could have contributed to an increase in transmission between and within these population hubs. The rapid spread of Spanish influenza in Port Pirie was accompanied by widespread media exposure. For example, the local paper, *The Chronicle*, featured the Health Board director's argument of the responsibility of epidemic management with a local government of the affected area over quarantine and emergency personnel issues.[33] Consequently, the Health Board issued a public notice to Port Pirie residents to restrict public meetings and gatherings.[34]

Although the second and third highest notification numbers were quite similar in Mt Gambier and Snowtown, the ARs were significantly different. Snowtown was a land transport hub connection between Adelaide and Perth[35], which resulted in heavy and frequent land traffic in the town.

Another noteworthy record is the State's highest AR which occurred in Robe. The town is located along the southeast coast of the state and at the turn of the century was a fishing port. As mentioned previously, due to data unavailability, it is difficult to speculate about the reasons for the high observed AR. Nevertheless, involvement in the local fishing and transport industries may have contributed to the spread of influenza in this town.

The major limitation of this study was the unavailability of key data, as age, gender, occupation and residential address details were not collected for influenza notifications. This meant that any discussion about the potential explanations for the observed trends were purely speculative and based on general information regarding each town's location, primary industry and transportation connections to other locations.

It is not clear what the impact of Spanish influenza was on Aboriginal and Torres Strait Islander people, as Indigenous status was not recorded for notifications. Also, the Central Health Board did not record Indigenous status and 'full-blooded' Indigenous individuals were excluded from official documents. Similarly, the official figures from the Census of 1921 were 'exclusive of full-blood Aboriginals' (as quoted directly from the publications at that time).[25]

Conclusion

This paper presents the first geographical and epidemiological analysis of the extent and spread of Spanish Flu in South Australia using available archival data. After the South Australian Public Health Act regulated influenza to be recognised as a notifiable disease, this system provided the first opportunity to conduct surveillance of the epidemic. However, the study was limited by a lack of sufficiently detailed archival data. Thus, the descriptions of the spread of influenza within the state are accompanied by speculative explanations based on available information about the key characteristics of the affected areas. The study provides an insight into early reporting mechanisms that were instigated due to the influenza pandemic, early attempts at quarantining and the patterns of disease spread throughout communities.

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