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# Influenza outbreaks in aged care facilities in New South Wales in 2017: impact and lessons for surveillance

Tony Merritt, Craig Dalton, Sheena Kakar, Mark Ferson, Priscilla Stanley, Robin Gilmour

## Abstract

### Introduction

A record number of influenza outbreaks in aged care facilities (ACFs) in New South Wales (NSW) during 2017 provided an opportunity to measure the health impact of those outbreaks and assess the quality of routinely available surveillance data.

### Methods

Data for all ACF influenza outbreaks in NSW in 2017 were extracted from the Notifiable Conditions Information Management System. The numbers of outbreaks, residents with influenza-like illness (ILI), hospital admissions and deaths were assessed. For each outbreak the attack rate; duration; timeliness of notification; resident and staff influenza vaccination coverage; and antiviral use for treatment or prophylaxis were analysed. Data were considered for NSW in total and separately for seven of the state's local health districts. Data completeness was assessed for all available variables.

### Results

A total of 538 ACF outbreaks resulted in 7,613 residents with ILI, 793 hospitalisations and 338 deaths. NSW outbreaks had a median attack rate of 17% and median duration of eight days. Data completeness, which varied considerably between districts, limited the capacity to accurately consider some important epidemiological and policy issues.

### Discussion

Influenza outbreaks impose a major burden on the residents and staff of ACFs. Accurate assessment of the year-to-year incidence and severity of influenza outbreaks in these facilities is important for monitoring the effectiveness of outbreak prevention and management strategies. Some key data were incomplete and strategies to improve the quality of these data are needed, particularly for: the number of influenza-related deaths among residents; resident and staff vaccination coverage prior to outbreaks; and recorded use of antiviral prophylaxis.

Keywords: influenza, outbreak, aged care facility, surveillance, data quality, New South Wales



## Introduction

Aged care facilities (ACFs) in New South Wales (NSW) were heavily impacted by the 2017 influenza season, when over 500 influenza outbreaks were reported in facilities.<sup>1</sup> The predominant circulating virus was H3N2, which usually affects the elderly more severely than H1N1.<sup>1,2</sup> In contrast, the 2009 H1N1 influenza pandemic strain did not significantly impact ACF residents and generally spared people over 65 years of age as a result of prior immunity to related H1 strains.<sup>3,4</sup> Across Australia in 2017, the median age of death in notified influenza cases was 86 years (range: 3 to 107 years), with more than 91% of deaths in people aged 65 years and older.<sup>5</sup>

ACF residents are a population that is particularly vulnerable to influenza outbreaks. They have an average age at entry of over 84 years in Australia,<sup>6</sup> with significant cognitive and physical impairments and a high burden of complex chronic conditions, including cardiovascular and respiratory illness. In addition to their heightened vulnerability, ACF residents face other risk factors for acquisition and spread of infection, including communal living and shared bedrooms, which community residents do not experience.<sup>7</sup> Even with high immunisation coverage in residents, influenza continues to impose a significant burden. Influenza has been associated with increased rates of functional decline,<sup>8</sup> is among the most common reasons for transfer to hospital, and accounts for a significant proportion of mortality.<sup>9–11</sup>

There are limited published surveillance data on influenza outbreaks in ACFs. While there have been several important short-term studies of influenza and other respiratory illness and outbreaks in ACFs,<sup>12</sup> we are aware of ongoing systematic surveillance for influenza illness or outbreaks in this setting only in the Netherlands<sup>13,14</sup> and Canada.<sup>15</sup> Most notifiable disease databases collect information only at the level of the individual case; however, it is important to also collate data at the institutional cohort level to allow a better understanding of outbreaks and how to mitigate them. Some Australian states and territories do

collect data that links outbreak-related cases, but these data have not been routinely analysed and published.

In NSW, influenza in individuals is notifiable by laboratories and while influenza outbreaks are not legally notifiable, national guidelines encourage ACFs to report outbreaks to their local public health unit (PHU).<sup>7</sup> Outbreaks are defined as a minimum of three linked cases of influenza-like illness (ILI) in a 72-hour period with at least one laboratory or two point-of-care test confirmations.<sup>7</sup>

In NSW, PHU staff record ACF influenza outbreak details in the Notifiable Conditions Information Management System (NCIMS).<sup>16</sup> Over 130 fields are available for each outbreak, with some collected at the time of notification and others updated during, or at the end of, an event. Variables collected include facility and patient details, impact on residents, and facility response measures. The data recorded in NCIMS, including numbers of deaths, are those reported to PHUs by the facility; reporting criteria may vary between facilities.

PHU staff provide facilities with advice and resources to support outbreak response, including: information on preventing the spread of respiratory viruses through hygiene measures (hand hygiene, cleaning); use of personal protective equipment (masks, gloves, eye protection, gowns); isolation of ill residents; and consideration of timely antiviral treatment and/or prophylaxis.<sup>7</sup>

We considered NCIMS influenza outbreak data for all of NSW for this review. Key objectives were (i) to describe the impact of influenza outbreaks in ACFs and (ii) to review the quality of available data in order to consider opportunities for improving surveillance. Additionally, PHU staff representing seven of the fifteen local health districts (LHDs) in NSW (Hunter New England, Illawarra Shoalhaven, Nepean Blue Mountains, Northern Sydney, South Eastern Sydney, Far West and Western) collaborated to analyse differences in surveillance data between those districts (sub-group LHDs).

## Methods

Data for all ACF influenza outbreaks in NSW in 2017 were extracted from NCIMS. Data for all LHDs in NSW were included in the overall analysis (NSW total) and data for subgroup LHDs were separately considered to explore differences between districts, with a focus on data completeness. Only data available in NCIMS were included.

With the exception of staff vaccination coverage prior to the outbreak, only resident-related data were analysed.

Key impact, vaccination coverage and response variables were generated for each outbreak using standard definitions (Table 1). Influenza sub-type was often not available, was not systematically recorded and was not analysed.

Data cleaning was undertaken to address non-credible values for outbreak duration and attack rate. If the calculated value for timeliness of notification was negative (i.e. if the recorded date for PHU notification was before the onset date for the first case), the outbreak was excluded from the calculation of median timeliness of notification.

Data completeness was assessed for 132 NCIMS fields for all NSW outbreaks. A subset of 19 fields used to calculate the variables listed in Table 1, or for selected symptoms, were also assessed at district level for subgroup LHDs.

Descriptive analysis, using Microsoft Excel, was reported for variables with data missing in up to 10% of outbreaks and reported with qualification for additional variables with up to 20% missing data (indicated in italics in the results section). Variables with data missing for over 20% of outbreaks were not further reported.

The degree of variability in data completeness between LHDs was summarised with an 'Index of variation' for each variable, the ratio of the percentage of missing data in the LHD with the highest level of missing data divided by the percentage for the LHD with the lowest level of missing data.

Data presented for LHD6 are limited to fields the LHD assessed as being most reliable.

No ethics application was required for this work. The data were all routinely collected under the provisions of the NSW *Public Health Act* and the work supported appropriate data quality assurance. Data were aggregated at the level of the ACF and no patient-level data were accessed.

## Results

### Impact

Data were available for 538 ACF influenza outbreaks in NSW in 2017, substantially higher than the annual totals of between 12 and 252 outbreaks in the preceding five years (Figure 1).<sup>1,17</sup> Outbreaks occurred in each month of 2017 except April: the three months from July to September accounted for 92.2% of all outbreaks (Figure 2). Subgroup LHDs had from 23 to 90 outbreaks each, accounted for 59.3% (319/538) of all outbreaks, and experienced 6.4–9.8 outbreaks per 100,000 population compared to 6.8 per 100,000 population for NSW as a whole (Table 2).

The 538 outbreaks in NSW accounted for 7,613 ILI cases, an average of 14.2 resident cases per outbreak (average 12.4 to 16.6 in subgroup LHDs) and a median attack rate of 17% (median 12.4% to 21.6% in subgroup LHDs) (Table 3).

There were 793 hospitalisations, a median case hospitalisation rate of 9.1% (median 5.3% to 13.1% in subgroup LHDs), and 338 deaths (range 0 to 10 per outbreak) with a case fatality rate (CFR) of up to 50% per outbreak (median 0% to 5.7% in subgroup LHDs).

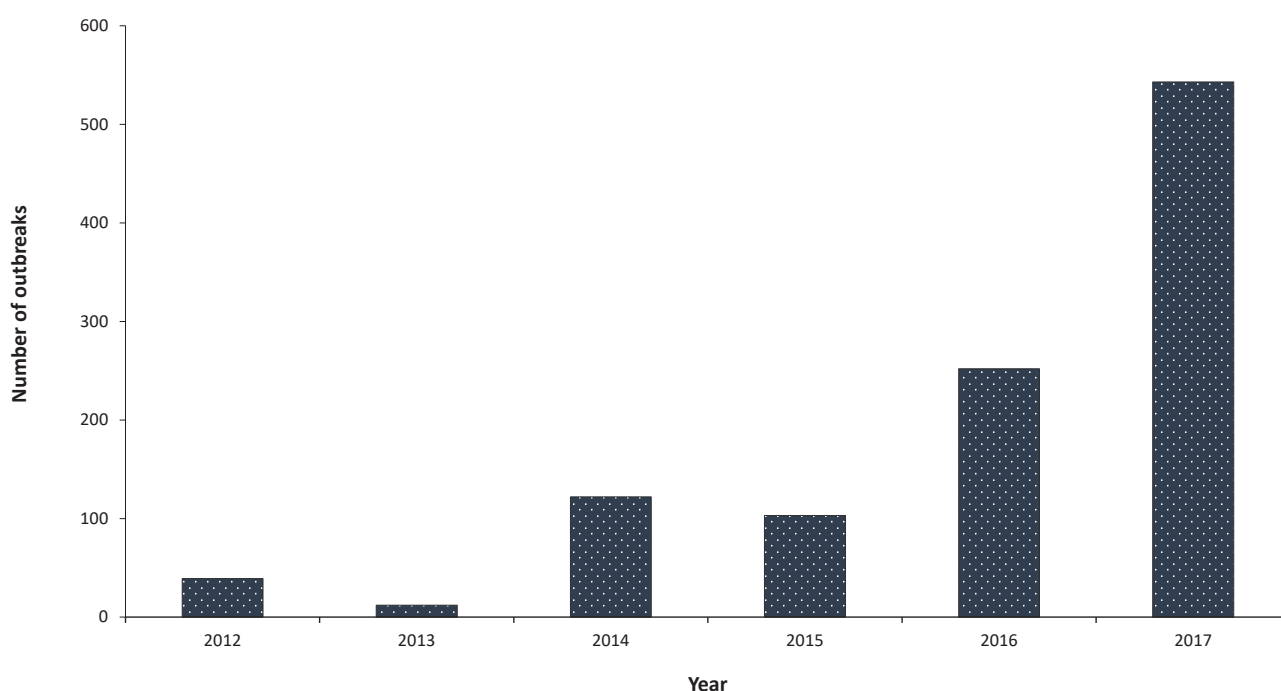
The NSW median outbreak duration was 8 days (median 8 to 10 days in subgroup LHDs) and the median resident vaccination coverage was 93.2% (median 89.3% to 94.2% in subgroup LHDs) (Table 3).

**Table 1: Definitions for calculated variables**

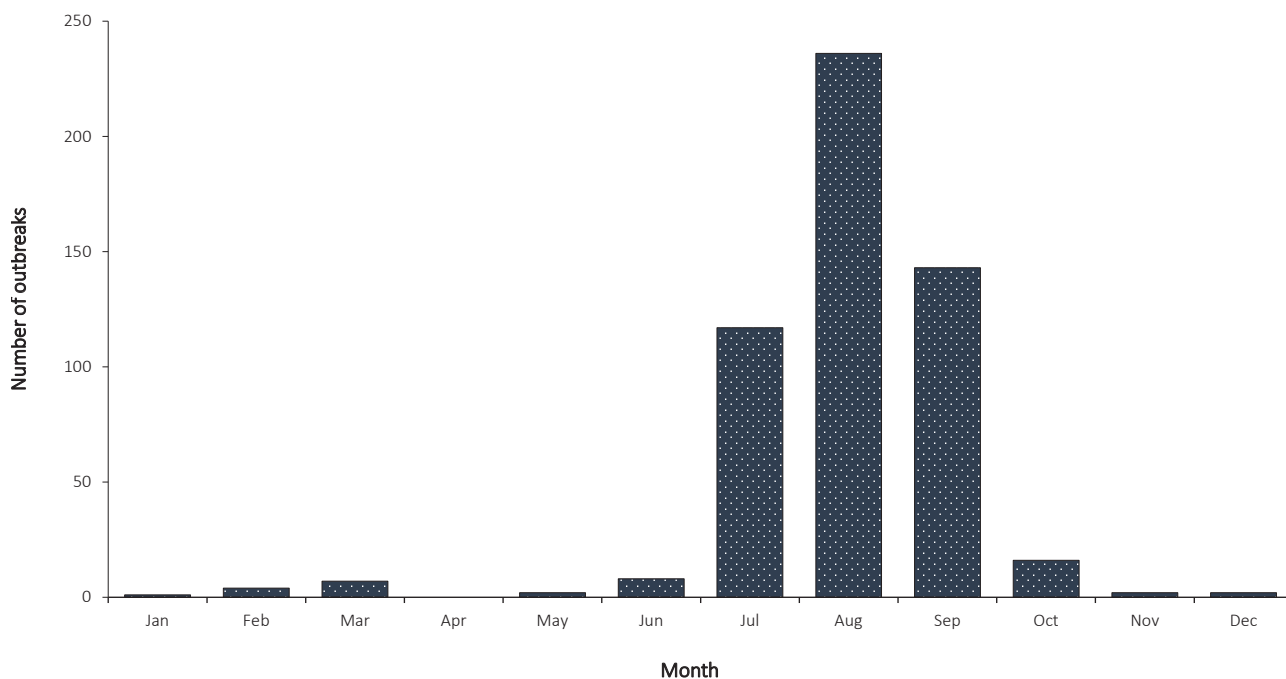
Calculated variable	Definition and NCIMS <sup>a</sup> fields used
<b>Impact measures</b>	
Outbreak duration	Date of onset for first resident to Date of onset for last resident
Attack rate	Number of residents with symptoms (ILI) / Number of residents at risk of illness
Hospitalisation rate	Number of residents hospitalised / Number of residents with symptoms (ILI)
Case fatality rate	Number of residents on outbreak linelist who died / Number of residents with symptoms (ILI)
Timeliness of notification <sup>b</sup>	Date of onset for first resident to Date PHU made aware of outbreak
<b>Vaccination coverage</b>	
Resident vaccination coverage	Number of residents vaccinated prior to outbreak / Number of residents at risk of illness
Staff vaccination coverage	Number of staff vaccinated prior to outbreak / Number of staff at risk of illness
<b>Response</b>	
AV <sup>c</sup> prophylaxis timeliness	Date PHU made aware of outbreak to AV prophylaxis commenced date (in facilities that used AV prophylaxis)
AV treatment timeliness	Date PHU made aware of outbreak to AV treatment commenced date (in facilities that used AV treatment)

- a Notifiable Conditions Information Management System.
- b This definition will over-estimate the time to notification if there is a difference between date of onset for the first resident and when the outbreak case definition is fulfilled with three cases of ILI.
- c AV: Antiviral.

**Figure 1: Number of influenza outbreaks in ACFs in NSW 2012–2017**



**Figure 2: Number of influenza outbreaks in ACFs by month, NSW 2017**



**Table 2: Total number of influenza outbreaks and outbreak ILI cases for ACFs in NSW and subgroup LHDs, <sup>a</sup> 2017**

Variable	NSW total	LHD1	LHD2	LHD3	LHD4	LHD5	LHD6
Total number of outbreaks	538	37	68	24	23	90	77
Total number ILI cases	7,613	616	843	355	286	1,308	1,123
Mean ILI cases / outbreak	14.2	16.6	12.4	14.8	12.4	14.5	14.6
Population (est. 2017)	7,861,000	409,000	925,000	374,000	311,000	922,000	925,000
Outbreaks / 100,000 population	6.8	9.1	7.4	6.4	7.4	9.8	8.3
Total ILI cases / 100,000 population	96.8	150.6	91.1	94.9	92.0	141.9	121.4

<sup>a</sup> Local Health District.

**Table 3: Calculated influenza outbreak parameters for ACFs in NSW and subgroup LHDs, 2017**

Variable	NSW total (all LHDs)	LHD1	LHD2	LHD3	LHD4	LHD5	LHD6
	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)	Median (range)
Attack rate (%)	17.0 (1.7–80.0)	13.4 (6.7–50.0)	12.4 (2.3–45.5)	16.1 (4.4–61.9)	21.6 (4.8–68.8)	19.4 (2.9–80.0)	19.7 (1.8–55.7)
Hospitalisation rate (%)	9.1 (0–100)	11.1 (0–66.7)	11.5 (0–60.0)	13.1 (0–50.0)	5.3 (0–30)	6.1 (0–66.7)	12.2 (0–60)
Case fatality rate (%)	0 (0–50.0)	0 (0–33.3)	3.3 (0–36.8)	0 (0–14.3)	5.7 (0–27.0)	0 (0–50.0)	0 (0–36.4)
Outbreak duration (days)	8 (0–48)	10 (4–27)	8 (0–37)	8 (1–15)	10 (2–20)	9 (1–45)	8 (0–48)
Resident vaccination coverage (%)	93.2 (0–393)	89.3 (0–101.1)	94.2 (37.0–137.9)	91.9 (67.9–393)	91.1 (11.5–100)	93.6 (22.9–128.3)	
Timeliness of notification (days)	4 (0–40)	4 (0–17)	3 (0–24)	4 (0–10)	5 (0–16)	4 (0–40)	3 (0–37)

**Table 4: Use of antivirals for treatment and prophylaxis in ACF influenza outbreaks in NSW and subgroup LHDs, 2017**

Variable	NSW total		LHD1		LHD2		LHD3		LHD4		LHD5	
	N	%	N	%	N	%	N	%	N	%	N	%
Antiviral prophylaxis used	310	57.6	28	75.7	45	66.2	24	100	7	30.4	26	28.9
Antiviral treatment used	402	74.7	35	94.6	53	77.9	22	91.7	9	39.1	62	68.9



**Table 5: Potentially non-credible calculated values included in the final dataset**

Variable	Criterion	NSW (Number of outbreaks)
Duration	< 0 days	0
Attack rate	> 100%	0
Hospitalisation rate	> 100%	0
Case fatality rate	> 100%	0
Timeliness of notification	< 0 days	2
Resident vaccination coverage	> 100%	15
Antiviral prophylaxis timeliness (days)	< 0 days <sup>a</sup>	9
Antiviral treatment timeliness (days)	< 0 days <sup>a</sup>	56

a Some negative values are correct, i.e. antiviral use commenced prior to notification.

## Response

Median notification timeliness was 4 days for NSW overall (median 3 to 5 days in subgroup LHDs) (Table 3); however, in 16.0% of outbreaks, notification was made more than 7 days after onset. Antiviral use for prophylaxis was reported in 57.6% of outbreaks (28.9% to 100% in subgroup LHDs) and for treatment in 74.7% of outbreaks (39.1% to 94.6% in subgroup LHDs) (Table 4).

## Data quality

Data were corrected in three outbreaks that had either a calculated outbreak duration of less than 0 days or a hospitalisation rate over 100%. No further data cleaning was conducted. Numbers of potentially non-credible calculated variables included in the final dataset are summarised in Table 5 and reflect a problem with the validity of some recorded data. Calculated resident vaccination coverage was in excess of 100% for 15 outbreaks and two outbreaks had a negative value for timeliness of notification. There was no further assessment of data validity.

Across the 132 variables exported from NCIMS, a total of 87 (66%) had data missing for more than 20% of outbreaks in NSW.

NSW data were assessed as sufficiently complete (missing in less than or equal to 10% of outbreaks) to reliably describe: the number of

outbreaks; number of residents with ILI; attack rates; hospitalisation rates; timeliness of notification; and facility use of antivirals for treatment during the outbreak.

The following key variables had data missing for over 10% and up to 20% of outbreaks in NSW: onset date for last resident (used to calculate outbreak duration); number of residents who died; number of residents with fever; number of residents with cough; number of residents vaccinated prior to the outbreak; and whether prophylactic antivirals had been used in the facility. These fields were assessed, but the results should be interpreted with care given the level of data completeness.

More than 20% of NSW outbreaks had data missing for number of staff vaccinated prior to the outbreak and commencement date for antiviral prophylaxis. Data quality was thus assessed as inadequate to further assess staff vaccination coverage and timeliness of antiviral prophylaxis.

For the 19 variables assessed by district, levels of missing data varied considerably between LHDs (Table 6). For example, onset date for last resident, critical for determining the duration of outbreaks, was missing in 13.6% of outbreaks overall in NSW and for between 3.3% and 39.1% of outbreaks in subgroup LHDs. The median “Index of variation” was 11 (range 2–44).

**Table 6: Percent of missing NCIMS data and index of variation for ACF influenza outbreak variables, NSW and subgroup LHDs,<sup>a</sup> 2017<sup>b</sup>**

Variable	NSW total (%) N = 538	LHD1 (%) N = 37	LHD2 (%) N = 68	LHD3 (%) N = 24	LHD4 (%) N = 23	LHD5 (%) N = 90	LHD6 (%) N = 77	Index of variation between subgroup LHDs <sup>c</sup>
Date of onset for first resident	2.8	0	1.5	0	8.7	1.1	0	9
Date of onset for last resident	13.6	5.4	13.2	16.7	39.1	3.3	7.8	12
Number residents at risk of illness	1.5	0	0	0	13.0	0	0	13
Number residents died	12.1	16.2	25.0	8.3	17.4	2.2	2.6	11
Number residents hospitalised	8.2	10.8	8.8	0	8.7	2.2	3.9	11
Number residents with symptoms (LI)	2.0	0	0	0	4.4	1.1	0	4
Number residents laboratory confirmed	2.8	0	5.9	0	0	0	0	6
Number residents with fever	16.7	2.7	13.2	4.2	21.7	10.0	0	8
Number residents with cough	10.8	2.7	4.4	8.3	8.7	6.7	0	3
Number residents vaccinated prior to outbreak	12.8	10.8	19.1	12.5	21.7	3.3	0	7
Number staff vaccinated prior to outbreak	28.3	8.1	47.1	20.8	56.5	12.2	0	5
Number of staff at risk of illness	8.6	0	8.8	12.5	43.5	2.2	0	44
Use of antivirals for prophylaxis	13.6	13.5	26.5	0	17.4	3.3	0	17
Use of antivirals for treatment	7.6	2.7	19.1	0	13.0	1.1	0	19
Antiviral prophylaxis commenced date	22.3	10.7	20.0	12.5	14.3	3.9	0	5
Antiviral treatment commenced date	15.2	22.9	9.4	4.6	0	1.6	0	23
Number resident cases given antiviral / antimicrobial prophylaxis	14.8	7.1	33.3	0	14.3	3.9	0	33
Outbreak duration	13.9	5.4	13.2	16.7	43.5	4.4	7.7	10
Attack rate	2.4	0	0	0	13.0	1.1	0	13
Hospitalisation rate	8.9	10.8	8.8	0	13.0	2.2	3.9	13
Case fatality rate	12.6	16.2	25.0	8.3	17.4	2.2	0	17
Timeliness of notification	2.8	0	1.5	0	8.7	1.1	0	9
Resident vaccination coverage	13.2	10.8	19.1	12.5	26.1	3.3	0	8
AV prophylaxis timeliness (days)	22.3	10.7	22.2	12.5	14.3	23.1	0	2
AV treatment timeliness (days)	15.2	22.9	9.4	4.6	0	1.6	0	23

<sup>a</sup> Local Health District.

<sup>b</sup> Fields with missing data in over 10% of outbreaks are displayed in italic font.

<sup>c</sup> Ratio of highest to lowest percentage of missing data amongst subgroup LHDs. Zero values were replaced with a value of one for index calculation.

## Discussion

Ongoing assessment of the year-to-year incidence and severity of influenza outbreaks in ACFs provides important information on the rationale and effectiveness of key health interventions, including resident and staff immunisation programs, infection control measures, clinical treatment of cases and antiviral prophylaxis. To fully understand the epidemiology, these data need to be collected and analysed by treating each institutional outbreak as a cohort.

The record number of ACF outbreaks in NSW in 2017 had a major impact on the NSW ACF resident population. In total there were 7,613 residents notified with ILI, 793 hospitalisations and 338 deaths recorded. Based on reported ACF bed numbers of 68,967 in the state, an estimated 11% of residents developed ILI as part of a notified outbreak in 2017.<sup>18</sup> This impact occurred despite reported resident vaccination coverage of over 90% in most facilities, higher than community coverage of 72.3% for NSW adults over 65 years of age in 2017.<sup>19</sup> Clearly, vaccination of residents is inadequate, in isolation, to prevent influenza outbreaks in these settings.

There was also a major impact on facilities and families, with extra demands on staff during outbreak response and potential restrictions on access for visitors. The collection and reporting of outbreak data by ACFs places additional burdens on facilities during these busy periods, and competing demands likely contribute to poor data quality at times. The 2017 outbreak season also imposed considerable demands on PHU staff responsible for supporting facilities and capturing surveillance data.

The timeliness of outbreak response measures is known to influence the course of an influenza outbreak<sup>14</sup> and these data identified opportunities for improvement. Reliable data on the timing of many specific response elements were not available; however, we found that time from illness onset in the first case to outbreak notification was more than 7 days for 16% of NSW outbreaks.

Differences between subgroup LHDs were considerable. The distribution of notified outbreaks was not uniform across the state; differences may reflect real variation in influenza activity, or other factors such as levels of testing, completeness of influenza detection and differences in reporting. Reduced access to testing is likely in more rural settings, and while outbreaks are likely to be under-reported overall, it is not clear whether testing access contributed to differences between districts.<sup>20</sup>

Amongst subgroup LHDs, there was also considerable variation in the use of antivirals for both treatment (used in 39.1% to 94.6% of outbreaks) and prophylaxis (used in 28.9% to 100% of outbreaks). The reasons for different practice were not investigated; but, as the evidence base for prophylactic use of antivirals was incomplete, and guidelines varied substantially between jurisdictions at this time,<sup>21-23</sup> we expect these were important contributing factors.

Substantial variability in data quality between subgroup LHDs was evident for a broad range of variables. As the Australian Commission on Safety and Quality in Health Care notes, variation that appropriately addresses local needs and preferences is useful, but unwanted variation likely indicates an opportunity for health system improvement.<sup>24</sup>

Levels of data completeness for key fields were problematic as demonstrated at our, perhaps arbitrary, cut-offs of 10% and 20%. Key parameters with fewer than 10% of outbreaks missing relevant data included outbreak numbers, onset date, total resident ILI cases and numbers hospitalised. However, important epidemiological and policy-determining variables such as resident and staff vaccination coverage prior to the outbreak, the use and timing of antiviral prophylaxis and the number of influenza-related deaths among residents were incomplete.

There were also indications that some recorded data were not accurate. For example, resident vaccination coverage was calculated to be in

excess of 100% for 15 outbreaks. Additionally, the criteria used by facilities when reporting deaths were not reviewed, and it is possible that some deaths reported during outbreaks were from unrelated causes. The primary focus of this analysis was on data completeness and we acknowledge that we did not systematically consider the quality of data as provided to PHUs.

Several limitations constrain this analysis. The limited data completeness restricted the set of variables which could be confidently assessed and there was limited capacity to assess the validity of data supplied by ACFs. Furthermore, there was no capacity to assess the thoroughness with which key outbreak response measures were actually implemented by facilities.

In response to the data quality issues identified in our analysis, the following options should be considered:

1. Rationalising the 132 data fields collected in NCIMS related to influenza outbreaks;
2. Introducing measures to improve data quality for a number of selected high-value fields including timeliness of outbreak notification, resident and staff vaccination coverage and details of antiviral use; and
3. Using sentinel sites or special studies to address specific surveillance questions (e.g. antiviral impacts).

We recommend that these strategies to improve the value of ACF influenza outbreak data be considered by public health agencies. Regular review of the quality of influenza outbreak data should be conducted and included with annual summaries as part of routine influenza surveillance reporting.

Finally, all jurisdictions should consider the benefits of implementing cohort-based respiratory outbreak registration. The COVID-19 pandemic has acutely demonstrated the potential impact of respiratory virus outbreaks on aged care residents and has emphasised the need for

effective surveillance and outbreak response in this setting. Robust reliable surveillance data in ACFs might have forewarned of the challenges and varying capacity in the industry and better prepared it for the COVID-19 pandemic and future threats.

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## References

1. New South Wales Government Department of Health. *Influenza monthly epidemiology report, NSW; December 2017 (including a summary for the year 2017)*. Sydney: New South Wales Government Department of Health; 2018. [Accessed during December 2019.] Available from: <https://www.health.nsw.gov.au/Infectious/Influenza/Publications/2017/december-flu-report.pdf>
2. Simonsen L, Fukuda K, Schonberger LB, Cox NJ. The impact of influenza epidemics on hospitalizations. *J Infect Dis*. 2000;181(3):831–7.
3. Kelly H, Peck HA, Laurie KL, Wu P, Nishiura H, Cowling BJ. The age-specific cumulative incidence of infection with pandemic influenza H1N1 2009 was similar in various countries prior to vaccination. *PLoS One*. 2011;6(8):e21828.
4. Van Kerkhove MD, Hirve S, Koukounari A, Mounts AW, H1N1pdm serology working group. Estimating age-specific cumulative incidence for the 2009 influenza pandemic: a meta-analysis of A(H1N1)pdm09 serological studies from 19 countries. *Influenza Other Respir Viruses*. 2013;7(5):872–86.
5. Australian Government Department of Health. *Information brief: 2017 influenza season in Australia*. Canberra: Australian Government Department of Health; 22 November 2017. [Accessed during December 2019.] Available from: [http://www.health.gov.au/internet/main/publishing.nsf/Content/097F15A91C05FBE7CA2581E20017F09E/\\$File/2017-season-summary-22112017.pdf](http://www.health.gov.au/internet/main/publishing.nsf/Content/097F15A91C05FBE7CA2581E20017F09E/$File/2017-season-summary-22112017.pdf).
6. Australian Government Productivity Commission. *Changing dynamics of residential aged care*. [Technical paper.] Canberra: Australian Government Productivity Commission; 24 May 2011. [Accessed during December 2019.] Available from: <https://www.pc.gov.au/inquiries/completed/aged-care/>



residential-care-dynamics.

7. Australian Government Department of Health. Guidelines for the prevention, control and public health management of influenza outbreaks in residential care facilities in Australia. [Internet.] Canberra: Australian Government Department of Health; 17 July 2017. [Accessed during December 2019.] Available from: <http://www.health.gov.au/internet/main/publishing.nsf/Content/cdna-flu-guidelines.htm>.
8. Gozalo PL, Pop-Vicas A, Feng Z, Gravenstein S, Mor V. Effect of influenza on functional decline. *J Am Geriatr Soc*. 2012;60(7):1260–7.
9. Gruneir A, Bell CM, Bronskill SE, Schull M, Anderson GM, Rochon PA. Frequency and pattern of emergency department visits by long-term care residents - a population-based study. *J Am Geriatr Soc*. 2010;58(3):510–7.
10. Gaillat J, Chidiac C, Fagnani F, Pecking M, Salom M, Veyssier P et al. Morbidity and mortality associated with influenza exposure in long-term care facilities for dependent elderly people. *Eur J Clin Microbiol Infect Dis*. 2009;28(9):1077–86.
11. Ellis SE, Coffey CS, Mitchel EF, Dittus RS, Griffin MR. Influenza- and respiratory syncytial virus-associated morbidity and mortality in the nursing home population. *J Am Geriatr Soc*. 2003;51(6):761–7.
12. Masse S, Capai L, Falchi A. Epidemiology of respiratory pathogens among elderly nursing home residents with acute respiratory infections in Corsica, France, 2013–2017. *Biomed Res Int*. 2017;2017. doi: <https://doi.org/10.1155/2017/1423718>.
13. Enserink R, Meijer A, Dijkstra F, van Benthem B, van der Steen JT, Haenen A et al. Absence of influenza A(H1N1) during seasonal and pandemic seasons in a sentinel nursing home surveillance network in the Netherlands. *J Am Geriatr Soc*. 2011;59(12):2301–5.
14. Vaux S, Poujol I, Bonmarin I, Lévy-Bruhl D, Desenclos JC. Surveillance of lower respiratory tract infections outbreaks in nursing homes in France. *Eur J Epidemiol*. 2009;24(3):149–55.
15. Mahmud SM, Thompson LH, Nowicki DL, Plourde PJ. Outbreaks of influenza-like illness in long-term care facilities in Winnipeg, Canada. *Influenza Other Respir Viruses*. 2013;7(6):1055–61.
16. New South Wales Government Department of Health. Influenza control guideline. [Internet.] Sydney: New South Wales Government Department of Health; July 2018. [Accessed during January 2021.] Available from: <https://www.health.nsw.gov.au/Infectious/control-guideline/Pages/influenza.aspx>.
17. New South Wales Government Department of Health. *Influenza surveillance monthly report, December 2019 (weeks 49-52)*. Sydney: New South Wales Government Department of Health; 2020. [Accessed 12 March 2020.] Available from: <https://www.health.nsw.gov.au/Infectious/Influenza/Publications/2019/december-flu-report.pdf>
18. Australian Institute of Health and Welfare (AIHW). Aged care data: explore services and places in aged care. [Internet.] Canberra: Australian Government, AIHW; 2019. [Accessed during December 2019.] Available from: <https://www.gen-agedcaredata.gov.au/Topics/Services-and-places-in-aged-care/Explore-services-and-places-in-aged-care>.
19. Centre for Epidemiology and Evidence. HealthStats NSW: Influenza and pneumococcal disease immunisation. [Internet.] Sydney: New South Wales Government Ministry of Health. [Accessed during December 2019.] Available from: [http://www.healthstats.nsw.gov.au/Indicator/com\\_flupneumoimmu\\_age/com\\_flupneumoimmu\\_age\\_sn.ap?&topic=Immunisation&topic1=topic\\_](http://www.healthstats.nsw.gov.au/Indicator/com_flupneumoimmu_age/com_flupneumoimmu_age_sn.ap?&topic=Immunisation&topic1=topic_)

immunis&code=immu.

20. Boonwaat L, Fletcher-Lartey S, Conaty S. Underreporting of influenza outbreaks in aged care facilities in South Western Sydney, Australia, 2014. *Western Pac Surveill Response J.* 2016;7(1):32–4.
21. The Academy of Medical Sciences. *Use of neuraminidase inhibitors in influenza; October 2015.* London: Academy of Medical Sciences; 2015. [Accessed during December 2019.] Available from: <https://acmedsci.ac.uk/file-download/38069-561595082cd83.pdf>.
22. Merritt T, Hope K, Butler M, Durrheim D, Gupta L, Najjar Z et al. Effect of antiviral prophylaxis on influenza outbreaks in aged care facilities in three local health districts in New South Wales, Australia, 2014. *Western Pac Surveill Response J.* 2016;7(1):14–20.
23. Centers for Disease Control and Prevention (CDC). Interim guidance for influenza outbreak management in long-term care and post-acute facilities. [Internet.] Atlanta: United States Government Department of Health and Human Services, CDC; 2016. [Accessed during December 2019.] Available from: <https://www.cdc.gov/flu/professionals/infectioncontrol/ltc-facility-guidance.htm>.
24. Australian Commission on Safety and Quality in Health Care (ACSQHC). Australian Atlas of Healthcare Variation Series. [Internet.] Canberra: Australian Government, ACSQHC. [Accessed during December 2019.] Available from: <https://www.safetyandquality.gov.au/atlas/#2>