

Supplementary

Table S1. Estimated annual influenza-attributable hospitalisation rate by principal diagnosis and year, 50-64 and 65 years and over, Australia, 2001-2017.

a. Influenza/pneumonia and respiratory

Principal diagnosis	Year	Hospitalisation rate* – attributable to influenza (95%CI)	
		Age group	
		50-64 years	≥65 years
Influenza/ pneumonia	2001 (Jul-Dec)	14.6 (10.9, 18.2)	41.9 (29.8, 53.9)
	2002	20.0 (15.7, 24.2)	110.3 (96.3, 124.2)
	2003	29.7 (26.5, 32.9)	145.7 (135.2, 156.1)
	2004	29.3 (25.0, 33.6)	134.9 (120.7, 149.0)
	2005	27.7 (23.1, 32.3)	105.7 (90.4, 120.9)
	2006	13.6 (9.2, 18.0)	54.9 (40.4, 69.4)
	2007	17.7 (14.4, 21.1)	67.1 (56.1, 78.0)
	2008	19.3 (15.5, 23.1)	86.2 (73.7, 98.8)
	2009	42.0 (38.8, 45.2)	48.7 (38.2, 59.3)
	2010	20.7 (16.7, 24.8)	31.1 (17.7, 44.5)
	2011	12.0 (7.3, 16.8)	-5.9 (-21.6, 9.8)
	2012	38.3 (34.3, 42.2)	179.6 (166.4, 192.7)
	2013	36.3 (31.5, 41.1)	67.5 (51.7, 83.2)
	2014	59.0 (55.1, 62.8)	130.1 (117.5, 142.8)
	2015	33.4 (29.6, 37.1)	142.0 (129.6, 154.5)
	2016	45.7 (41.3, 50.1)	227.0 (212.6, 241.4)
	2017	98.9 (95.2, 102.6)	459.1 (446.7, 471.4)
Respiratory	2001 (Jul-Dec)	61.3 (52.1, 70.4)	116.8 (88.8, 144.7)
	2002	64.4 (53.8, 75.0)	332.1 (299.8, 364.4)
	2003	94.2 (86.3, 102.1)	427.5 (403.3, 451.7)
	2004	60.0 (49.3, 70.8)	319.6 (286.9, 352.4)
	2005	78.8 (67.3, 90.4)	342.9 (307.6, 378.2)
	2006	66.0 (55.0, 77.1)	241.2 (207.6, 274.8)
	2007	57.4 (49.0, 65.7)	161.3 (135.8, 186.7)
	2008	87.2 (77.6, 96.7)	278.9 (249.9, 308.0)
	2009	75.3 (67.3, 83.3)	111.6 (87.1, 136.0)
	2010	24.1 (13.9, 34.3)	20.5 (-10.6, 51.6)
	2011	33.9 (22.0, 45.8)	53.5 (17.2, 89.8)
	2012	100.0 (90.0, 110.0)	468.3 (437.8, 498.8)
	2013	100.3 (88.4, 112.3)	197.2 (160.8, 233.6)
	2014	116.0 (106.4, 125.7)	300.2 (270.8, 329.6)
	2015	67.7 (58.2, 77.1)	306.0 (277.2, 334.9)
	2016	111.3 (100.4, 122.3)	396.6 (363.2, 429.9)
	2017	139.3 (129.9, 148.7)	638.0 (609.4, 666.7)

* Rate per 100,000 population.

Statistically significant years are presented in bold font.

b. Myocardial infarction and circulatory

Principal diagnosis	Year	Hospitalisation rate* – attributable to influenza (95%CI)	
		Age group	
		50-64 years	≥65 years
Myocardial infarction	2001 (Jul-Dec)	-5.9 (-10.1, -1.7)	19.1 (9.0, 29.1)
	2002	2.8 (-2.0, 7.7)	28.9 (17.2, 40.5)
	2003	3.1 (-0.5, 6.7)	27.0 (18.2, 35.7)
	2004	0.4 (-4.5, 5.3)	18.9 (7.1, 30.7)
	2005	9.2 (3.9, 14.5)	56.7 (44.0, 69.4)
	2006	6.3 (1.3, 11.4)	14.6 (2.5, 26.8)
	2007	2.2 (-1.7, 6.0)	15.0 (5.9, 24.2)
	2008	6.2 (1.9, 10.6)	14.2 (3.7, 24.6)
	2009	3.3 (-0.4, 6.9)	12.9 (4.8, 20.9)
	2010	-6.2 (-10.9, -1.6)	0.8 (-9.4, 11.0)
	2011	-1.9 (-7.3, 3.5)	-4.4 (-16.3, 7.5)
	2012	2.8 (-1.7, 7.4)	16.0 (6.0, 26.1)
	2013	-0.3 (-5.7, 5.1)	-7.4 (-19.4, 4.6)
	2014	-0.2 (-4.6, 4.2)	-3.5 (-13.2, 6.2)
	2015	-5.4 (-9.7, -1.1)	6.8 (-2.7, 16.3)
	2016	1.1 (-3.9, 6.1)	0.1 (-10.9, 11.1)
	2017	5.6 (1.3, 9.9)	19.0 (9.6, 28.5)
Circulatory	2001 (Jul-Dec)	3.1 (-18.2, 24.3)	39.0 (-16.4, 94.3)
	2002	17.3 (-7.3, 41.9)	168.2 (104.2, 232.3)
	2003	-15.9 (-34.4, 2.5)	24.1 (-23.9, 72.2)
	2004	9.2 (-15.8, 34.1)	34.1 (-30.9, 99.1)
	2005	0.2 (-26.7, 27.1)	193.0 (123.0, 263.0)
	2006	26.0 (0.3, 51.6)	78.9 (12.1, 145.7)
	2007	-15.7 (-35.1, 3.7)	14.6 (-35.9, 65.1)
	2008	20.4 (-1.7, 42.6)	64.4 (6.8, 122.1)
	2009	-5.0 (-23.6, 13.6)	48.5 (2.2, 94.8)
	2010	7.8 (-15.8, 31.4)	6.2 (-52.7, 65.0)
	2011	-6.4 (-34.1, 21.2)	10.7 (-58.1, 79.5)
	2012	1.2 (-22.0, 24.4)	48.8 (-9.1, 106.6)
	2013	-44.1 (-71.9, -16.4)	-8.7 (-77.8, 60.4)
	2014	0.6 (-21.8, 23.0)	47.7 (-8.1, 103.5)
	2015	24.8 (2.9, 46.8)	131.7 (77.0, 186.4)
	2016	-3.7 (-29.1, 21.6)	65.4 (2.2, 128.7)
	2017	-13.4 (-35.2, 8.4)	-2.9 (-57.2, 51.4)

* Rate per 100,000 population.

Statistically significant years are presented in bold font.

Table S2. Estimated annual influenza-attributable mortality rate by principal diagnosis and year, 50-64 and 65 years and over, Australia, 2001-2017.

a. Influenza/pneumonia and respiratory

Principal cause of death	Year	Death rate* – attributable to influenza (95%CI)	
		Age group	
		50-64 years	≥65 years
Influenza/ pneumonia	2001	-0.1 (-0.5, 0.3)	2.2 (0.0, 4.5)
	2002	-0.6 (-1.0, -0.2)	13.3 (10.9, 15.7)
	2003	0.3 (0.0, 0.6)	11.7 (9.9, 13.5)
	2004	0.2 (-0.2, 0.6)	2.3 (-0.2, 4.7)
	2005	0.6 (0.2, 1.1)	13.1 (10.5, 15.7)
	2006	0.2 (-0.3, 0.6)	4.6 (2.0, 7.1)
	2007	-0.2 (-0.5, 0.2)	2.7 (0.8, 4.6)
	2008	0.2 (-0.2, 0.6)	0.6 (-1.6, 2.8)
	2009	0.2 (-0.2, 0.5)	1.9 (0.0, 3.7)
	2010	1.2 (0.8, 1.6)	-0.1 (-2.5, 2.2)
	2011	1.6 (1.1, 2.1)	-1.1 (-3.9, 1.6)
	2012	0.5 (0.1, 0.9)	10.3 (8.0, 12.6)
	2013	0.4 (-0.1, 0.9)	-1.5 (-4.2, 1.3)
	2014	0.8 (0.4, 1.2)	6.4 (4.2, 8.6)
	2015	0.1 (-0.3, 0.5)	10.4 (8.3, 12.6)
	2016	0.9 (0.5, 1.3)	11.0 (8.5, 13.5)
	2017	1.9 (1.5, 2.2)	36.1 (34.0, 38.3)
Respiratory	2001	0.2 (-0.8, 1.1)	9.5 (4.7, 14.3)
	2002	0.1 (-0.9, 1.1)	34.4 (29.3, 39.5)
	2003	1.2 (0.5, 2.0)	27.0 (23.1, 30.8)
	2004	-0.3 (-1.3, 0.7)	13.2 (8.1, 18.3)
	2005	2.6 (1.5, 3.7)	23.9 (18.3, 29.5)
	2006	-0.3 (-1.4, 0.7)	14.1 (8.8, 19.5)
	2007	0.1 (-0.7, 0.9)	4.1 (0.1, 8.1)
	2008	0.2 (-0.7, 1.1)	5.8 (1.2, 10.4)
	2009	1.1 (0.4, 1.9)	11.4 (7.6, 15.3)
	2010	0.6 (-0.3, 1.6)	4.5 (-0.4, 9.3)
	2011	0.7 (-0.5, 1.8)	-1.9 (-7.7, 3.9)
	2012	2.3 (1.4, 3.3)	30.1 (25.2, 34.9)
	2013	-0.2 (-1.3, 1.0)	11.4 (5.6, 17.2)
	2014	3.0 (2.1, 3.9)	21.3 (16.6, 25.9)
	2015	-0.2 (-1.1, 0.7)	22.1 (17.5, 26.7)
	2016	2.6 (1.6, 3.6)	24.4 (19.1, 29.7)
	2017	1.9 (1.0, 2.8)	47.2 (42.7, 51.8)

* Rate per 100,000 population.

Statistically significant years are presented in bold font.

b. Myocardial infarction and circulatory

Principal cause of death	Year	Death rate* – attributable to influenza (95%CI)	
		Age group	
		50-64 years	≥65 years
Myocardial infarction	2001	1.9 (0.8, 3.0)	10.8 (4.9, 16.8)
	2002	0.5 (-0.7, 1.7)	31.1 (24.8, 37.4)
	2003	-0.2 (-1.2, 0.7)	18.1 (13.4, 22.9)
	2004	0.3 (-0.9, 1.6)	10.5 (4.1, 16.8)
	2005	-0.9 (-2.2, 0.4)	37.5 (30.6, 44.4)
	2006	0.0 (-1.2, 1.3)	14.2 (7.6, 20.8)
	2007	-0.5 (-1.4, 0.5)	6.6 (1.6, 11.6)
	2008	-0.1 (-1.2, 1.0)	15.6 (9.9, 21.3)
	2009	0.1 (-0.8, 1.0)	11.0 (6.4, 15.5)
	2010	1.0 (-0.2, 2.1)	-2.0 (-7.7, 3.8)
	2011	0.0 (-1.3, 1.4)	11.3 (4.5, 18.1)
	2012	0.9 (-0.2, 2.1)	20.5 (14.8, 26.2)
	2013	1.7 (0.3, 3.0)	0.5 (-6.3, 7.2)
	2014	0.8 (-0.4, 1.9)	9.3 (3.8, 14.9)
	2015	-0.1 (-1.2, 1.0)	6.1 (0.7, 11.5)
	2016	-0.9 (-2.1, 0.4)	6.8 (0.6, 12.9)
	2017	0.5 (-0.6, 1.6)	7.5 (2.1, 12.8)
Circulatory	2001	1.1 (-0.9, 3.1)	22.3 (9.2, 35.5)
	2002	0.7 (-1.4, 2.8)	122.8 (108.8, 136.7)
	2003	1.1 (-0.5, 2.7)	39.2 (28.6, 49.7)
	2004	-0.6 (-2.7, 1.5)	23.6 (9.5, 37.7)
	2005	1.0 (-1.3, 3.4)	105.5 (90.2, 120.8)
	2006	2.3 (0.1, 4.6)	30.1 (15.4, 44.8)
	2007	1.5 (-0.2, 3.2)	23.1 (12.1, 34.2)
	2008	-0.8 (-2.7, 1.1)	26.8 (14.2, 39.5)
	2009	0.0 (-1.6, 1.6)	29.0 (19.2, 38.8)
	2010	0.9 (-1.1, 2.9)	0.7 (-11.7, 13)
	2011	0.3 (-2.1, 2.7)	28.7 (14.1, 43.4)
	2012	3.9 (1.9, 5.9)	69.2 (56.9, 81.5)
	2013	0.1 (-2.3, 2.4)	10.8 (-3.8, 25.4)
	2014	1.0 (-0.9, 3.0)	26.9 (15.1, 38.8)
	2015	0.3 (-1.6, 2.2)	27.7 (16.1, 39.4)
	2016	-0.8 (-2.9, 1.4)	13.9 (0.6, 27.2)
	2017	2.1 (0.2, 3.9)	31.9 (20.4, 43.4)

* Rate per 100,000 population.

Statistically significant years are presented in bold font.

Table S3. Comparison of estimated influenza-attributable hospitalisation and mortality rate between two Australian studies.

a. Influenza-attributable hospitalisation rate per 100,000 population

	Age (50-64 years)			
	IP*	Respiratory	MI***	Circulatory
<i>This study</i> (Jun 2001-2017)	32.3 (31.2, 33.3)	78.9 (76.3, 81.4)	1.2 (0.1, 2.4)	0.7 (-5.2, 6.6)
Newall et al. ¹ (Jul1998-Jun2005)	33.3 (23.2, 43.4)	57.6 ** (32.5, 82.8)	-	-1.5 (-58.8, 55.8)
	Age (≥65 years)			
<i>This study</i>	123.6 (120.2, 126.9)	287.5 (279.8, 295.3)	13.9 (11.2, 16.6)	57.2 (42.1, 72.3)
Newall et al. ¹	157.4 (108.4, 206.5)	282.0 ** (183.7, 380.3)	-	39.6 (-114.9, 194.1)

IP (J09-J18); Respiratory (J00-J99); MI (I21-I22); Circulatory (I00-I99)

*IP, Influenza/pneumonia; ** Other respiratory; ***MI, Myocardial infraction

b. Influenza-attributable mortality rate per 100,000 population

	Age (50-64 years)			
	IP*	Respiratory	MI***	Circulatory
<i>This study</i> (2001-2017)	0.5 (0.4, 0.6)	0.9 (0.7, 1.2)	0.3 (0.0, 0.6)	0.9 (0.4, 1.4)
Newall et al. ¹ (Jul1998-Jun2005)	0.6 (0.3 to 1.0)	2.1 ** (1.2 to 3.0)	-	1.4 (-0.6 to 3.4)
	Age (≥65 years)			
<i>This study</i>	7.6 (7.0, 8.2)	18.2 (16.9, 19.4)	12.8 (11.3, 14.3)	37.7 (34.4, 41.0)
Newall et al. ¹	17.6 (12.9 to 22.3)	24.4 ** (18.8 to 30.0)	-	49.3 (27.0 to 71.6)

IP (J09-J18); Respiratory (J00-J99); MI (I21-I22); Circulatory (I00-I99).

*IP, Influenza/pneumonia; ** Other respiratory; ***MI, Myocardial infraction

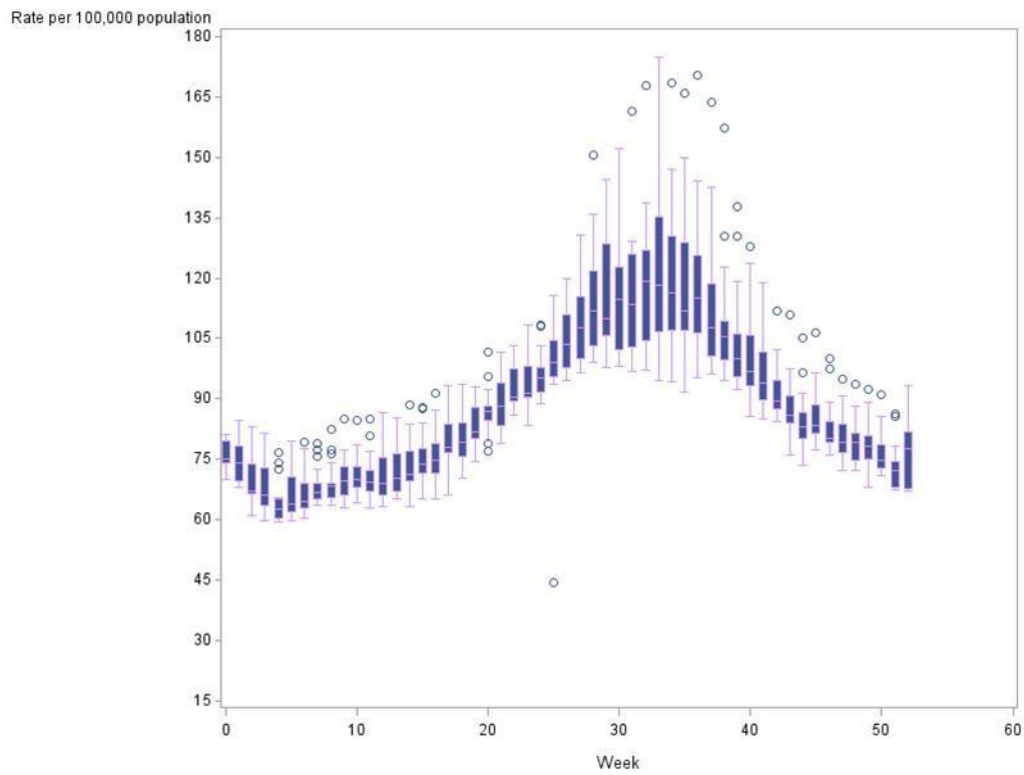
Ref:

1. Newall AT, Wood JG, MacIntyre CR. Influenza-related hospitalisation and death in Australians aged 50 years and older. *Vaccine*.2008;26(17):2135-2141.

Figures:

Figure S1: Observed rate of hospitalisation with principal diagnosis of respiratory disease.

a. ≥ 65 years



b. 50-64 years

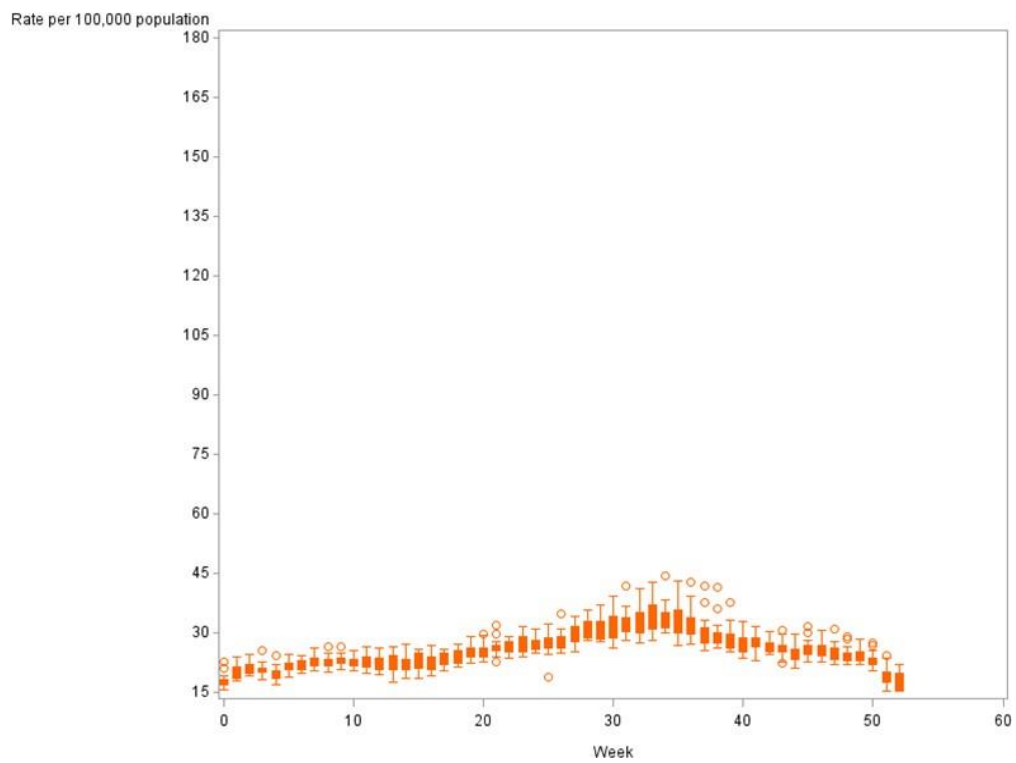
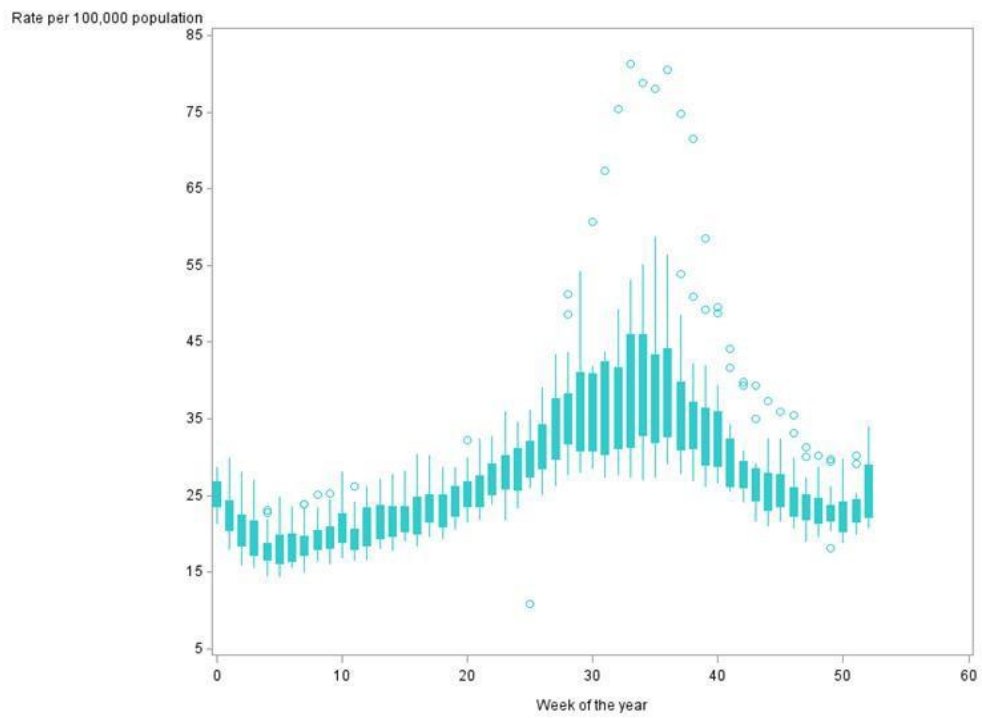


Figure S2: Observed rate of hospitalisation with principal diagnosis of influenza/pneumonia.

a. ≥ 65 years



b. 50-64 years

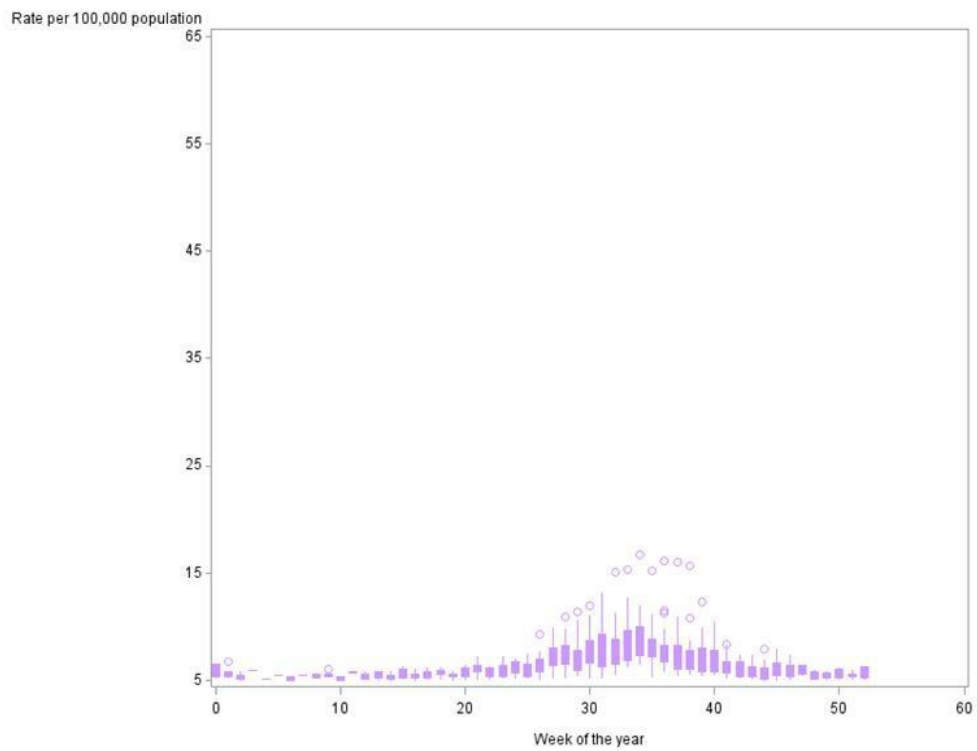
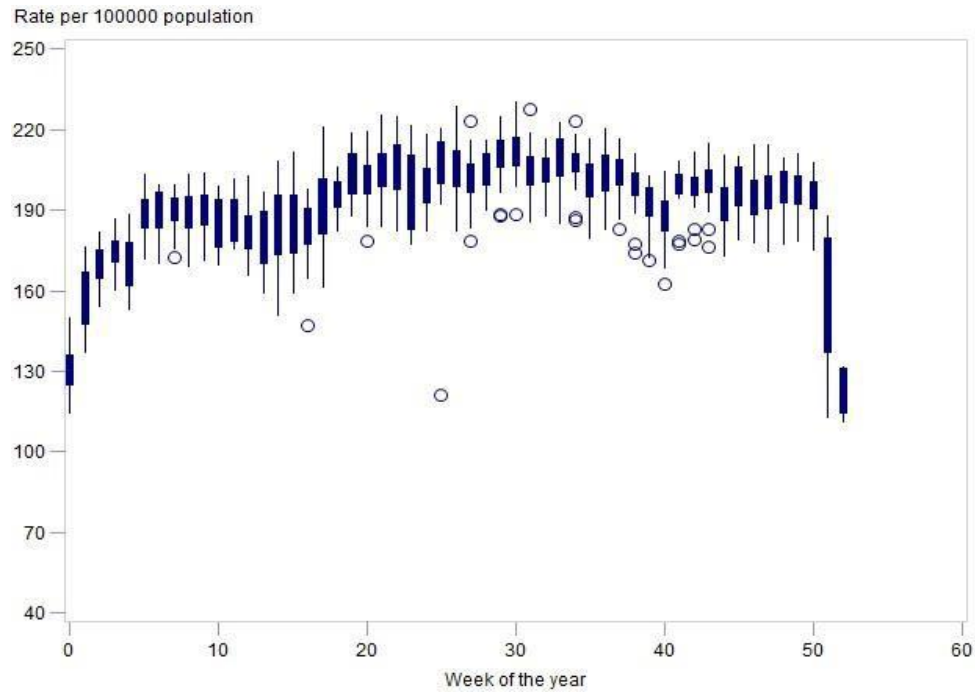


Figure S3: Observed rate of hospitalisation with principal diagnosis of circulatory disease.

a. ≥ 65 years



b. 50-64 years

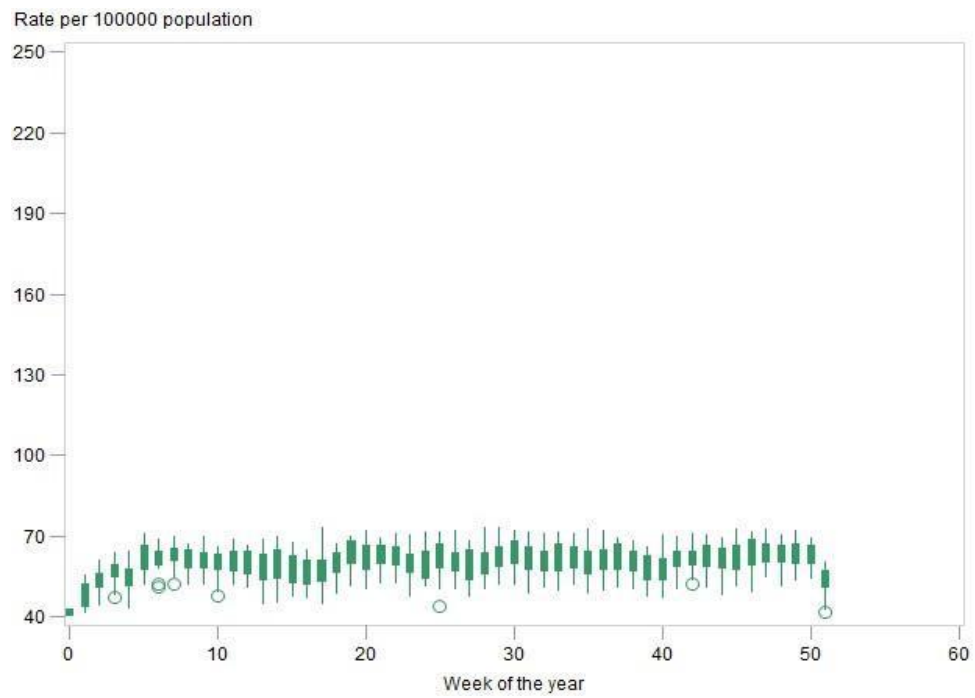
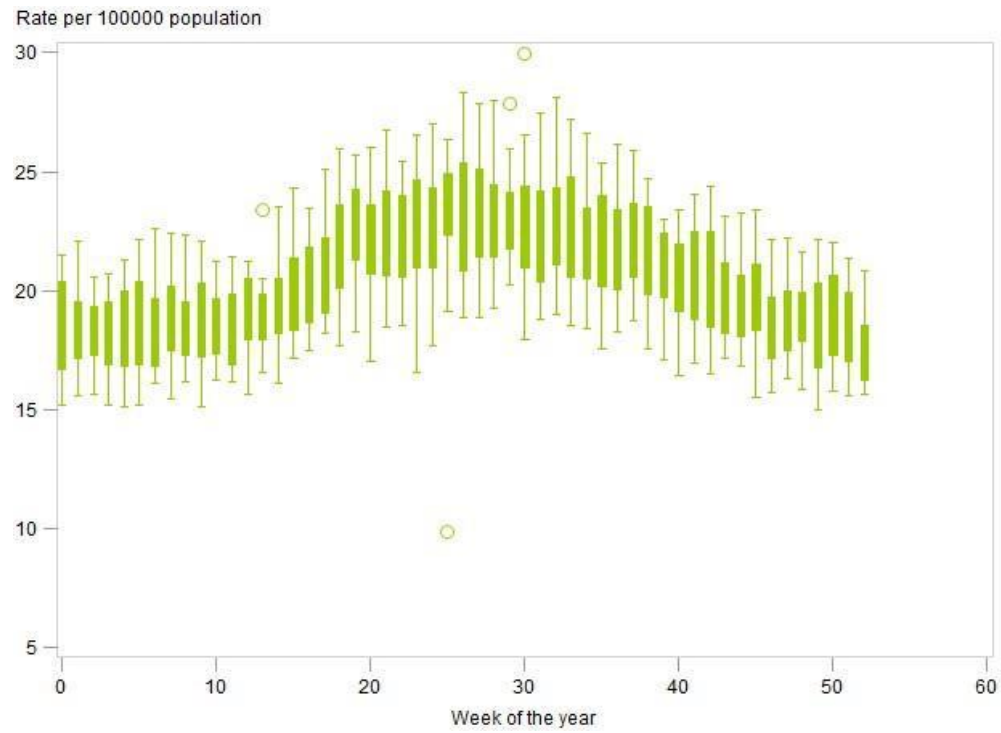


Figure S4: Observed rate of hospitalisation with principal diagnosis of myocardial infraction
a. ≥ 65 years



b. 50-64 years

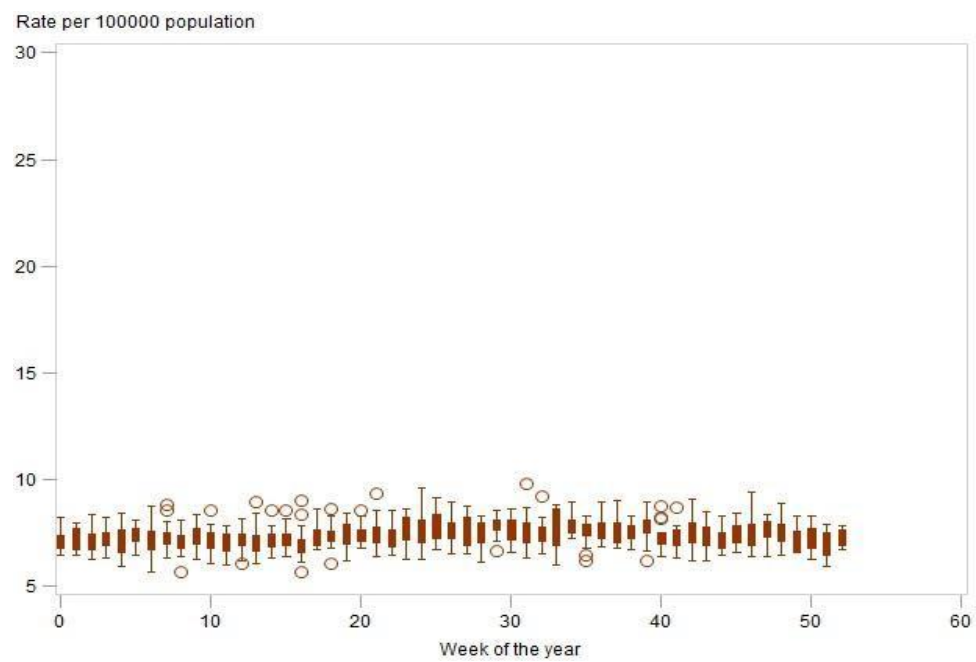
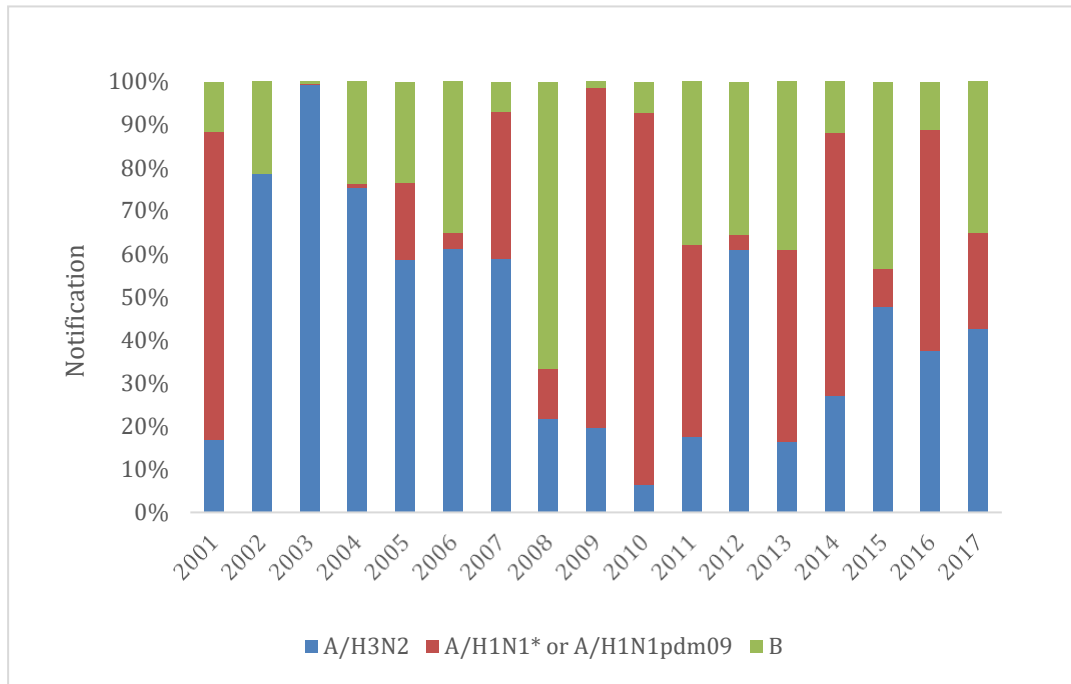


Figure S5. Laboratory-confirmed influenza notifications by type, subtype and year, Australia, 2001-2017.



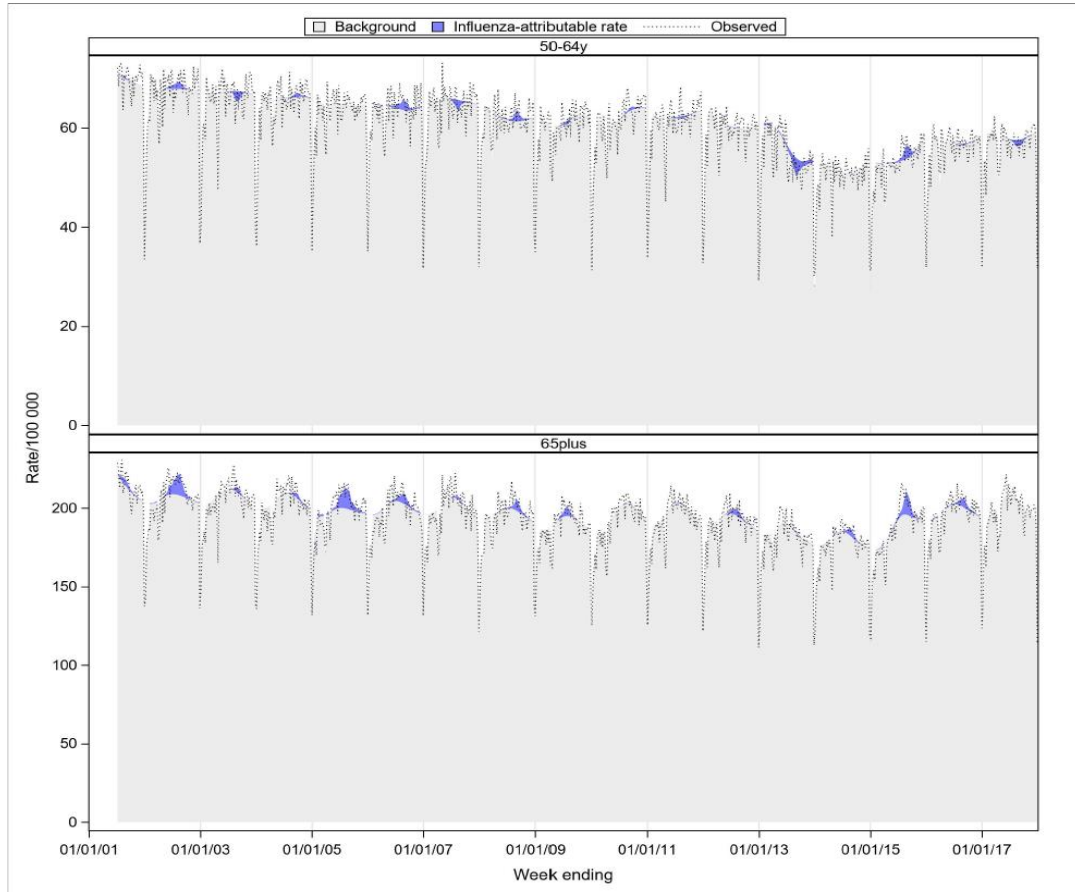
* A/H1N1 strain was replaced by A/H1N1pdm09 from 2009 onwards.

Source: NNDSS (WHOCC)

Hospitalisation

Figure S6: Estimated, observed and baseline hospitalisation rate* of influenza-attributable circulatory and myocardial infraction, by year and age group, Australia, 2001-2017.

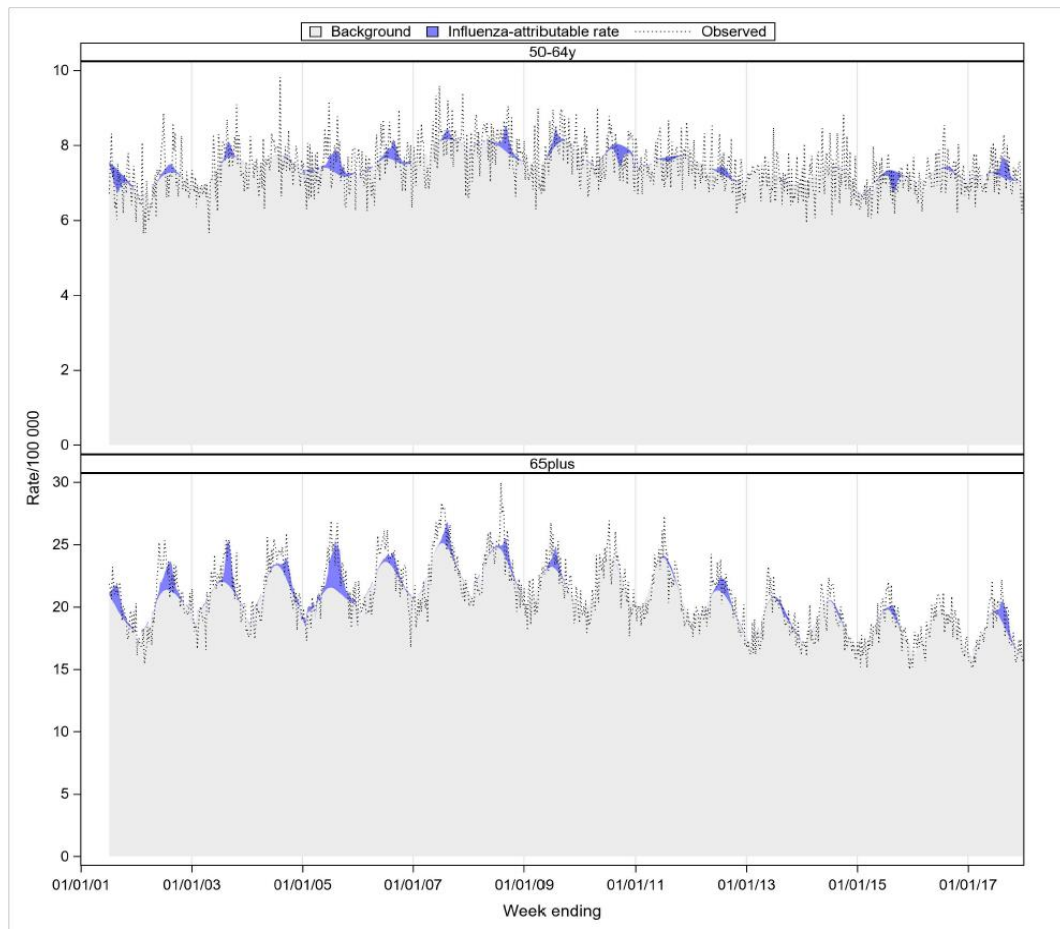
a. Circulatory



Note: Blue-coloured area indicates rate of influenza-attributable hospitalisation and light grey area denotes baseline hospitalisation rate in the graph.

* Rate per 100,000 population.

b. Myocardial infraction



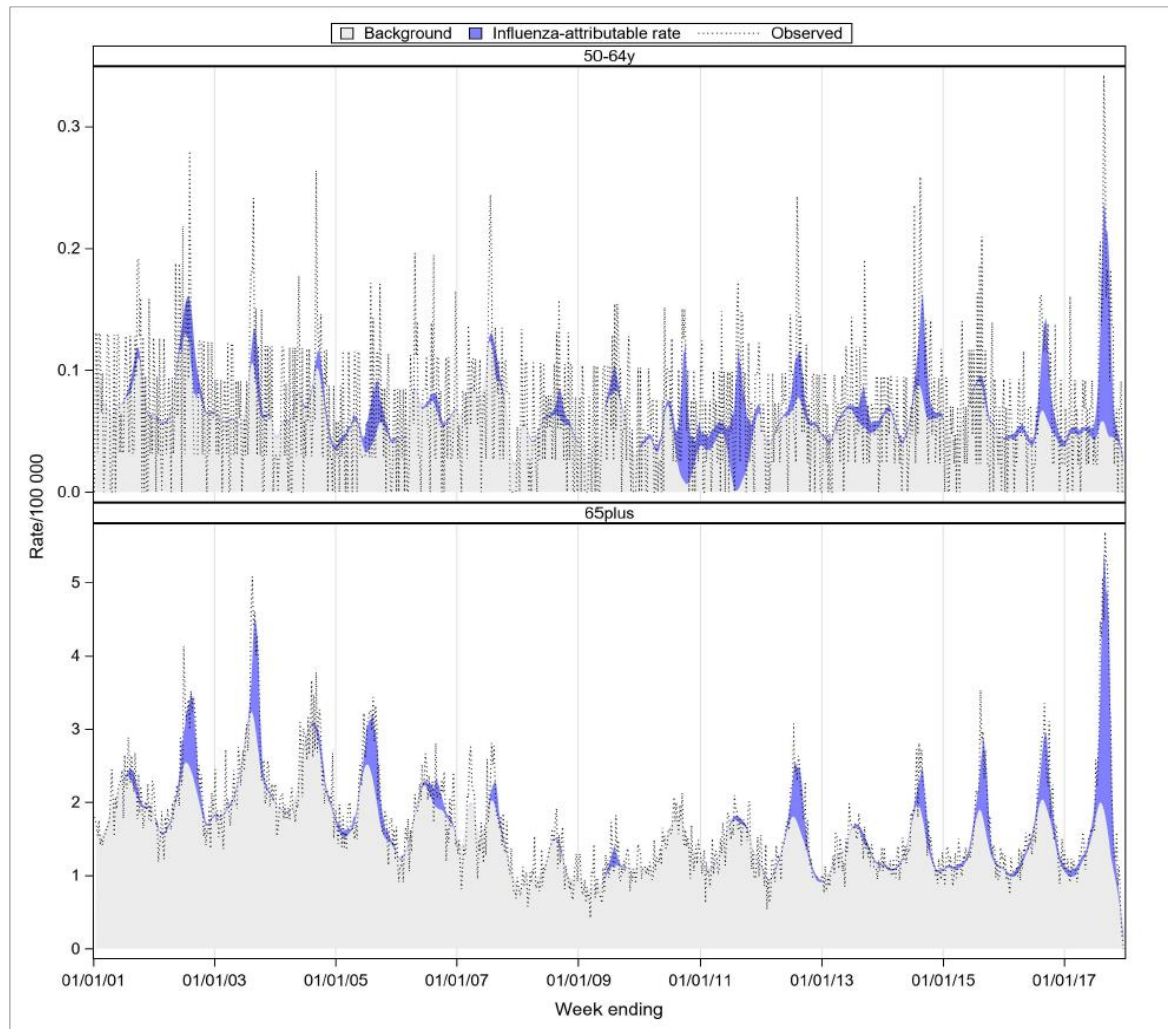
Note: Blue-coloured area indicates rate of influenza-attributable hospitalisation and light grey area denotes baseline hospitalisation rate in the graph.

* Rate per 100,000 population.

Mortality

Figure S7: Estimated, observed and baseline rate* of influenza-attributable influenza/pneumonia and respiratory death, by year and age group, Australia, 2001- 2017.

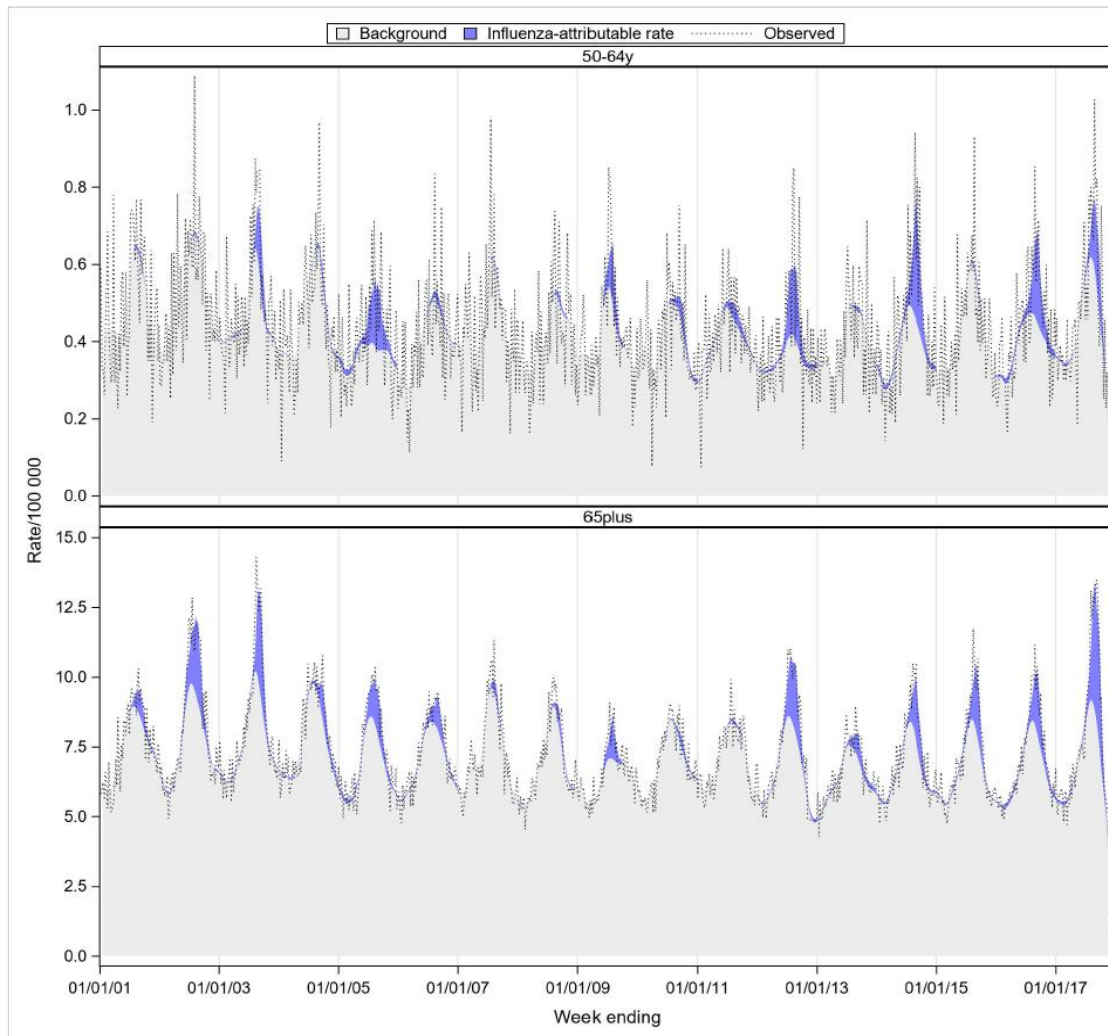
a. Influenza and pneumonia



Note: Blue-coloured area indicates rate of influenza-attributable death and light grey area denotes baseline death rate in the graph.

* Rate per 100,000 population.

b. Respiratory



Note: Blue-coloured area indicates rate of influenza-attributable death and light grey area denotes baseline death rate in the graph.

* Rate per 100,000 population.