

# Mortality and morbidity estimates for influenza infection in Asia-Pacific countries

Ben Cowling

School of Public Health,  
The University of Hong Kong, Hong Kong

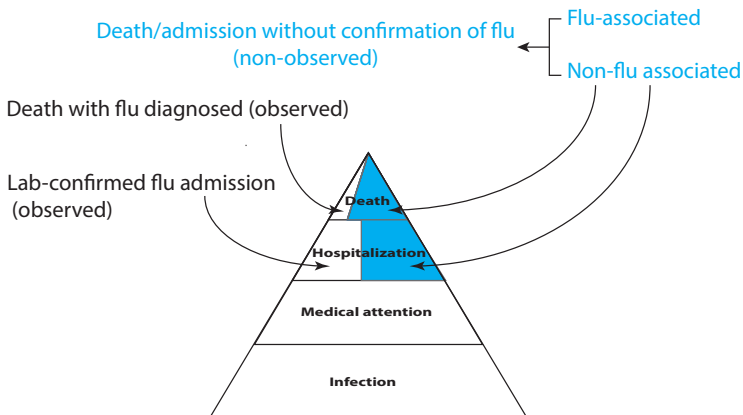
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# Introduction

- Influenza viruses cause infections and diseases in all age groups during epidemics.
- Severe disease particularly in the extremes of age.
- Incidence of influenza virus infection varies as high as 20-30% in children and 10-20% in adults in epidemics. Most infections associated with mild disease, some fraction of infections are asymptomatic.

## Iceberg/pyramid of influenza severity



Two general approaches to assess burden at the top of the pyramid in specific populations: (1) laboratory confirmation of influenza in severe cases from a population; (2) infer burden from statistical analysis of administrative data.

# Burden of influenza-associated pneumonia in Bangladesh

- Brooks et al. 2010 PIDJ
- Studied a defined population of children <5y in the catchment area of the study site, for 3.75 years
- Found an overall rate of 511 pneumonia episodes/1000 child-years
- Sampled 12,000 children with respiratory and febrile illness syndromes, estimating that the incidence of influenza-specific pneumonia was 28.6 episodes per 1,000 child-years

## Confirmed Influenza hospitalizations in Hong Kong

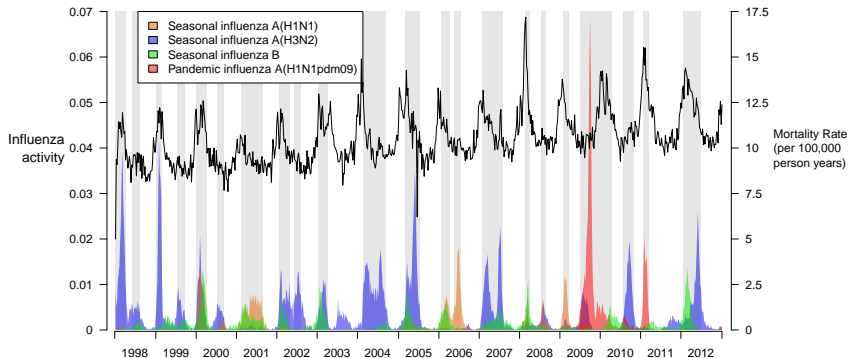
**Table:** Average annual hospitalization rates (per 10,000 population per year) associated with influenza A and B by age in Hong Kong, 2004-2013.

Age	Average hospitalization rate (per 10,000 population per year)							
	sH1N1	(95% CI)	sH3N2	(95% CI)	pH1N1	(95% CI)	B	(95% CI)
0-6m	16.9	(4.3, 40.8)	31.7	(15.8, 56.7)	63.6	(29.1, 120.8)	5.8	(0.7, 20.8)
7-12m	19.9	(6.5, 46.5)	37.4	(19.9, 64.0)	56.5	(24.4, 111.4)	11.5	(3.1, 29.5)
2-4y	21.0	(10.1, 38.6)	35.2	(22.3, 52.8)	61.5	(35.2, 99.9)	13.8	(6.3, 26.2)
5-9y	19.5	(13.1, 27.8)	36.0	(28.3, 45.1)	33.5	(22.1, 48.7)	25.9	(19.5, 33.8)
10-14y	7.4	(4.7, 11.0)	8.1	(5.6, 11.3)	19.0	(12.3, 28.1)	13.9	(10.6, 18.0)
15-17y	1.2	(0.4, 2.9)	1.8	(0.8, 3.3)	7.0	(3.6, 12.2)	3.3	(1.9, 5.3)

Based on sampling once per week from two hospitals with a defined catchment population.

*Influenza A: Chiu et al 2014 PLoS One; Influenza B: unpublished data*

# Influenza activity and excess mortality in HK



Estimation of excess influenza-associated mortality using regression models of the form: average weekly death rate =  $\beta$  \* weekly influenza activity + ...

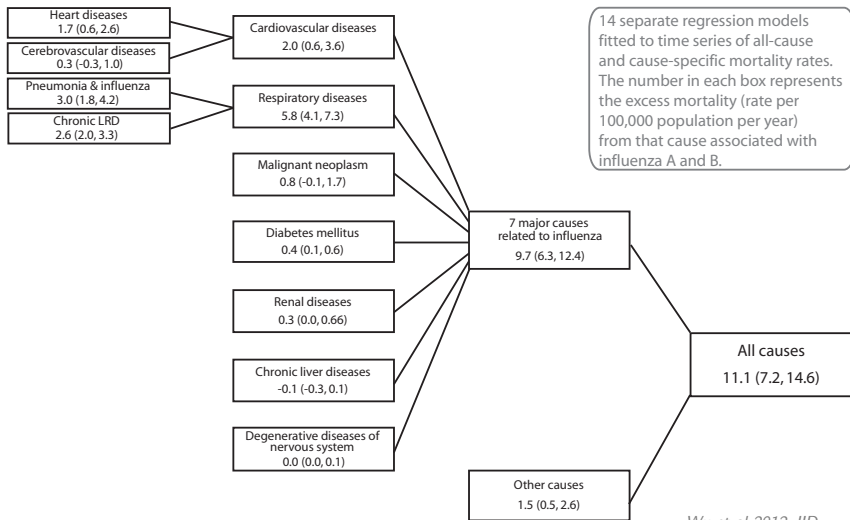
# Annual excess influenza-associated mortality rates in HK

**Table:** Average type/subtype-specific annual excess all-cause mortality rates by age in Hong Kong, 1998-2009.

Age	Average excess mortality rate (per 100,000 population per year)									
	sH1N1	(95% CI)	sH3N2	(95% CI)	pH1N1	(95% CI)	B	(95% CI)	All	(95% CI)
0-4y	0.9	(-0.3, 2.4)	0.2	(-1.7, 2.2)	-3.0	(-7.6, 2.5)	-1.5	(-4.0, 0.8)	-0.7	(-3.7, 2.4)
5-14y	0.1	(-0.2, 0.5)	-0.1	(-0.5, 0.4)	-0.7	(-1.9, 0.7)	-0.3	(-0.8, 0.3)	-0.2	(-1.0, 0.5)
15-44y	0.8	(0.1, 1.3)	0.6	(0.0, 1.4)	-0.8	(-2.6, 1.0)	0.0	(-0.8, 0.9)	1.3	(0.3, 2.4)
45-64y	0.2	(-1.5, 1.8)	1.9	(-0.1, 3.9)	-0.8	(-6.4, 5.3)	1.3	(-1.3, 3.6)	3.3	(0.1, 6.1)
≥65y	8.4	(-6.0, 21.7)	58.8	(40.5, 76.0)	23.4	(-23.7, 75.7)	20.3	(0.1, 41.5)	89.7	(61.8, 113.7)
All	1.6	(-0.3, 3.3)	6.9	(4.3, 9.4)	2.2	(-4.8, 8.8)	2.5	(-0.5, 5.3)	11.1	(7.2, 14.6)

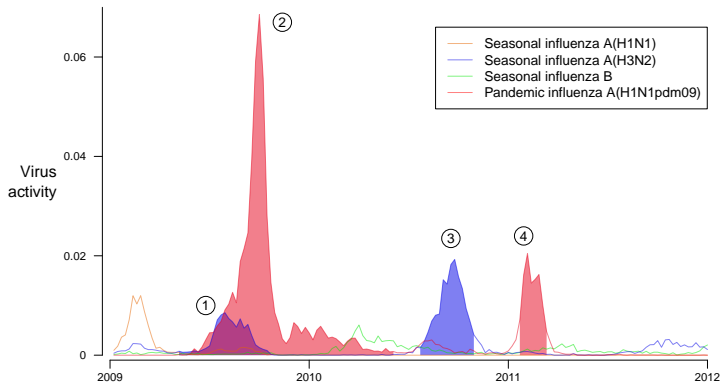
Wu et al 2012 JID

## Excess mortality by cause





## Second wave of pandemic influenza in Hong Kong



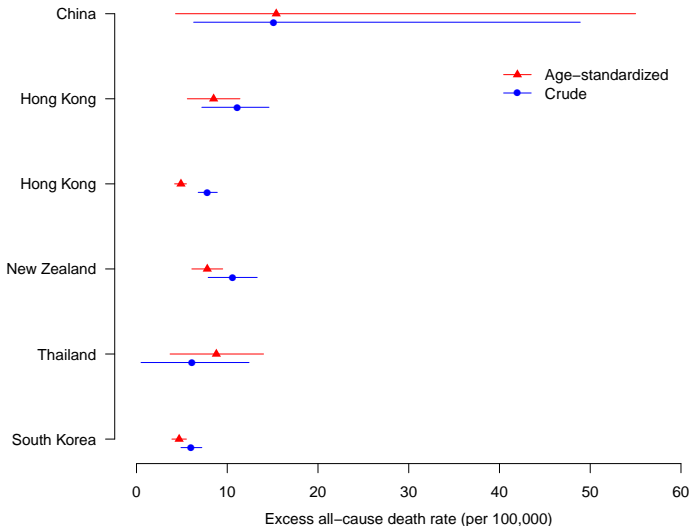
	① A(sH3N2)	② A(H1N1pdm09)	③ A(sH3N2)	④ A(H1N1pdm09)
Excess	Apr-Nov 2009	Apr 2009-May 2010	Jul-Oct 2010	Jan-Mar 2011
Deaths	Risk (95% CI)	Risk (95% CI)	Risk (95% CI)	Risk (95% CI)
All-cause	3.5 (0.3, 6.8)	2.1 (-8.1, 11.8)	6.2 (3.3, 9.0)	4.7 (-0.7, 10.5)
Respiratory	1.7 (0.2, 3.0)	1.2 (-3.2, 5.5)	2.9 (1.5, 4.0)	3.9 (1.7, 6.4)

## Influenza-associated mortality, selected locations

**Table:** Average annual excess all-cause mortality rates in all ages in selected Asia-Pacific locations.

Location	Period	Rate	(95% CI)	Reference
China	2004-2009	15.1	(6.3, 48.9)	Yu 2013 IORV
Hong Kong	1998-2009	11.1	(7.2, 14.6)	Wu 2012 JID
Hong Kong	1998-2009	7.8	(6.8, 8.9)	Yang 2012 Epidemiol Infect
New Zealand	1990-2008	10.6	(7.9, 13.3)	Kessaram 2014 IORV
South Korea	2003-2013	6.0	(4.9, 7.2)	Cowling unpublished data
Thailand	2005-2009	6.1	(0.5, 12.4)	Cooper 2015 AJE

# Accounting for different demographics in different locations



# Burden of medically-attended ILI, Mongolia

Table 3. Number of ILI cases and incidence per 1000 population in Selenge during the two influenza epidemic periods

Age group	2008–2009 influenza period Week 6, 2009–week 10, 2009 (5 weeks)		2009–2010 influenza period Week 43, 2009–week 6, 2010 (17 weeks)	
	Number of ILI cases	Incidence per 1000 population	Number of ILI cases	Incidence per 1000 population
0–11 months	13	3.7	78	21.9
1–4 years	39	2.8	157	11.3
5–9 years	26	1.4	108	5.6
10–14 years	20	1.0	82	4.2
15–24 years	14	0.3	112	2.4
25–44 years	9	0.1	92	1.3
45–64 years	4	0.1	22	0.6
≥ 65 years	0	0.0	6	0.7
<b>Total</b>	<b>125</b>	<b>0.6</b>	<b>657</b>	<b>3.1</b>

*Nukiwa et al 2011 WPSAR*

## Why should influenza be a public health priority?

- The burden of influenza is substantial in Asia-Pacific countries, pneumonia is a leading cause of hospitalization and death in the extremes of age and influenza is an important viral cause of pneumonia which is preventable by vaccination.
- Limitations — most data on disease burden come from a small number of locations, more studies would be valuable, not only on the health impact but also the broader socio-economic impact of influenza epidemics.
- Not included in this talk – burden and impact of avian influenza

## Acknowledgments

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