Complications of Influenza in Children

Viruses in May, Katoomba, 2010

Elizabeth Elliott

University of Sydney
Children's Hospital at Westmead
Australian Paediatric Surveillance Unit
Paediatric Active Enhanced Disease Surveillance

Protect your child from swine flu

A swine flu vaccine is now available for children over 6 months

Learn more

Or call 180 2007

June 11th WHO declared influenza pandemic

To September 30th 2009 in Australia
36,605 laboratory-confirmed cases
180 deaths

Children important:

- Attack rates pre-schoolers ~ 50%
- Reservoir and transmitter of flu
- Perception that flu is a mild illness in previously healthy children

- What is the **inpatient** burden of pandemic influenza in children?

Aim

Identify and document children (<15 years) hospitalised with laboratory-proven influenza at 6 major paediatric hospitals in 4 states from June 1st – Sept 30th 2009 using the **PAEDS** system

PAEDS

- **P**aediatric
- **A**ctive
- **E**nhanced
- **D**isease
- **S**urveillance

Novel surveillance system developed and managed by

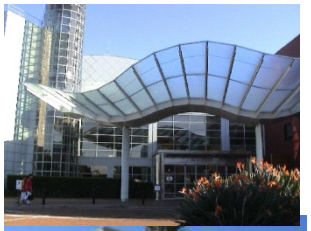
Australian Paediatric Surveillance Unit,

National Centre Immunisation Research and Surveillance
and involving a group of infectious diseases experts

PAEDS

- Hospital based surveillance with active, daily case-finding by specialist nurses
- Based in the successful Canadian system IMPAct (Immunisation Monitoring Program Active)
- PAEDS funded by DoHA since June 2007 in 4 hospitals
- Influenza surveillance enabled by:
  - NHMRC Emergency Influenza Grant;
  - NSWHealth

PAEDS hospitals



➢Children's Hospital at Westmead, Sydney, NSW

APSU Elizabeth Elliott, Yvonne Zurynski
NCIRS Peter McIntyre, Robert Booy, Nick Wood

➢Royal Children's Hospital Melbourne, Vic

Jim Buttery
Jenny Royle

➢Women's and Children's Hospital Adelaide, SA

Helen Marshall
Mike Gold

➢Princess Margaret Hospital, Perth, WA

Peter Richmond

➢John Hunter Children's Hospital, Newcastle, NSW

Bruce Whitehead

➢Sydney Children's Hospital, Randwick, NSW

Tony Walls

Surveillance Coverage

- Collectively:
  - 260,741 ED presentations
  - 91,340 admissions per year
  - 35.3% paediatric admissions in Australia (N=258,451)

PAEDS: strengths

- Standardised data collection, timely, detailed
  - Demographics
  - Diagnosis
  - Complications
  - Management
  - Risk factors
  - Immunization
  - Short term outcomes
- Biological specimens
- Centralized database in APSU – weekly uploads
- Follow-up

Cases identified (n=601)

June 1st – September 30th 2009

CHW (NSW)	226 (38%)
SCH (NSW)	65 (11%)
JHH (NSW)	33 (5%)
RCH (Vic)	83 (14%)
WCH (SA)	86 (14%)
PMH (WA)	108 (18%)
Total	601 (100%)

Ethics

- 601 cases identified
- Detailed clinical data available for 529

- Data for NSW complete: ***Health records and Information privacy Act 2002*** allowed data collection without ethics to assist in States response to this serious epidemic.
- Consent not obtained for 72 in Vic, SA and WA due to delayed ethics approval

Influenza type (n=601)

Influenza A	596 (99.2%)
H1N1 (2009)	506 (84.3%)
H3	42
H3/H1N1	1
H1	3
Not H1N1 but not further sub-typed	10
Not sub-typed	34
Influenza B	5

Demographics (n=601)

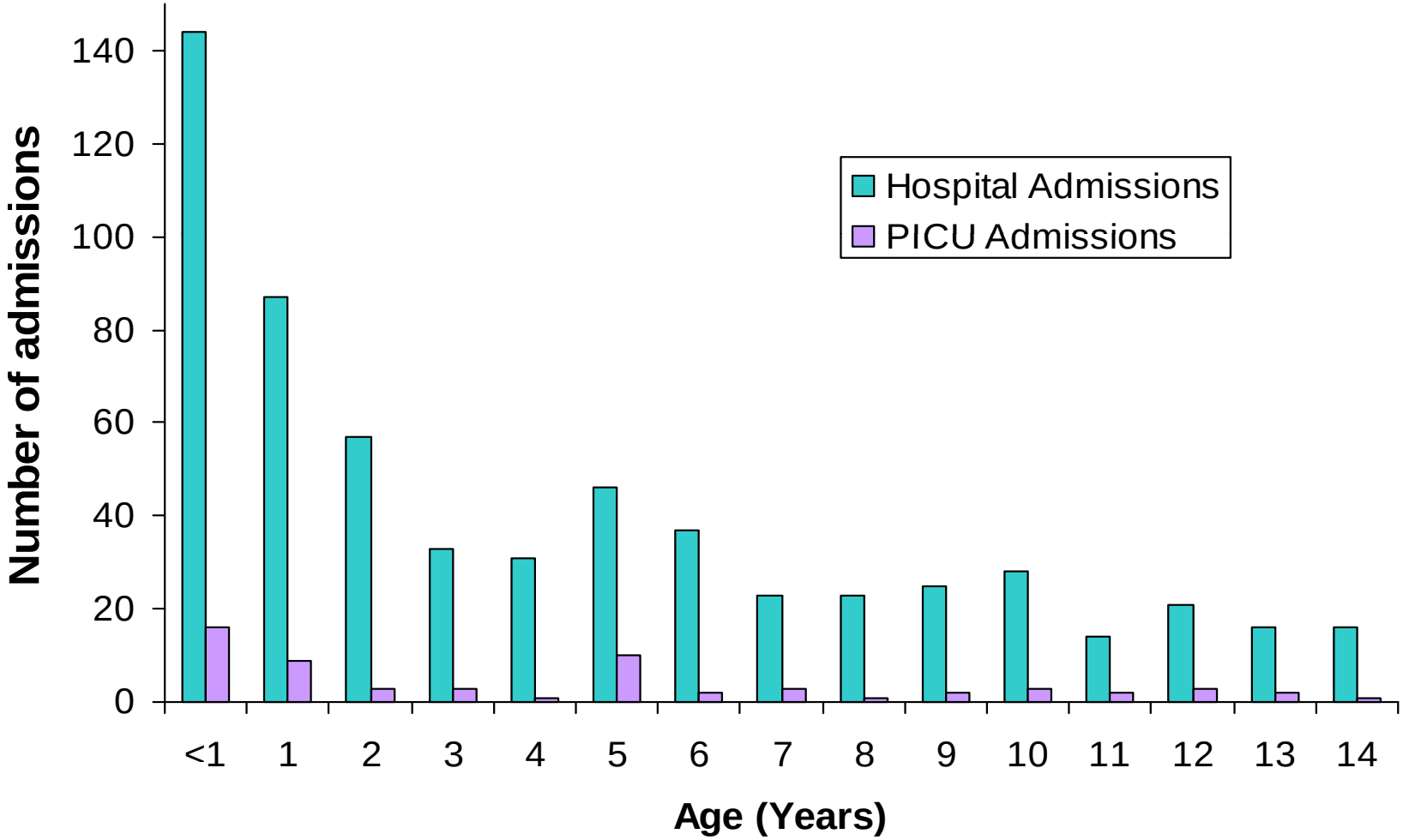
- Gender (Male): 358 (59.6%)
- Age (median, range, yrs): 3.4 (0-14.9)
- Median hospital stay, days) 2(1-107)

- Country of birth
  - Australia: 517 (86.0%)
  - Other: 36 (6.0%)
  - Unknown: 48 (8.0%)

- Ethnicity
  - ATSI: 29 (4.9%)*
  - Pacific I: 20 (3.3%)

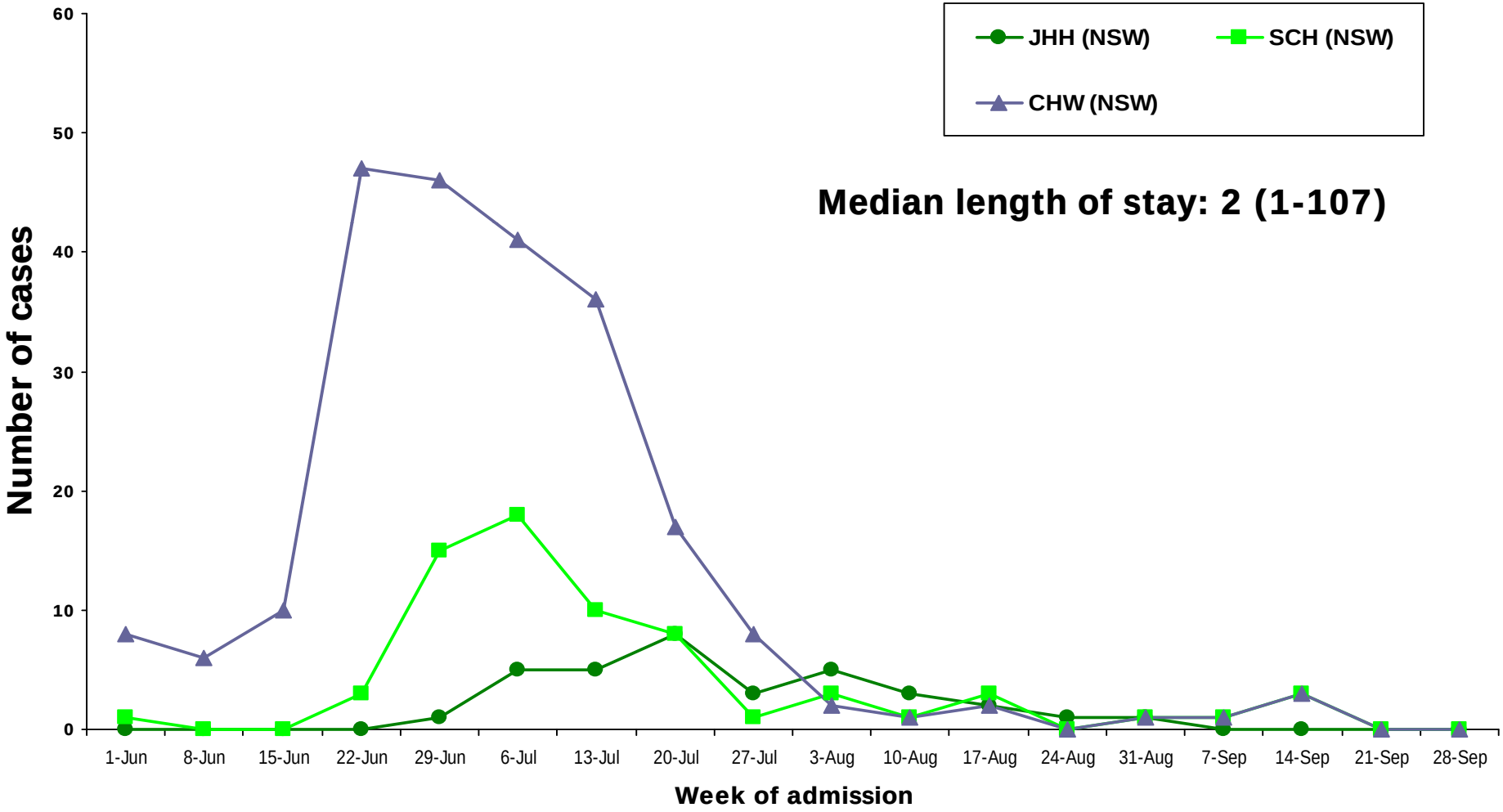
Admissions for influenza by age

June-Sept 2009 N=601

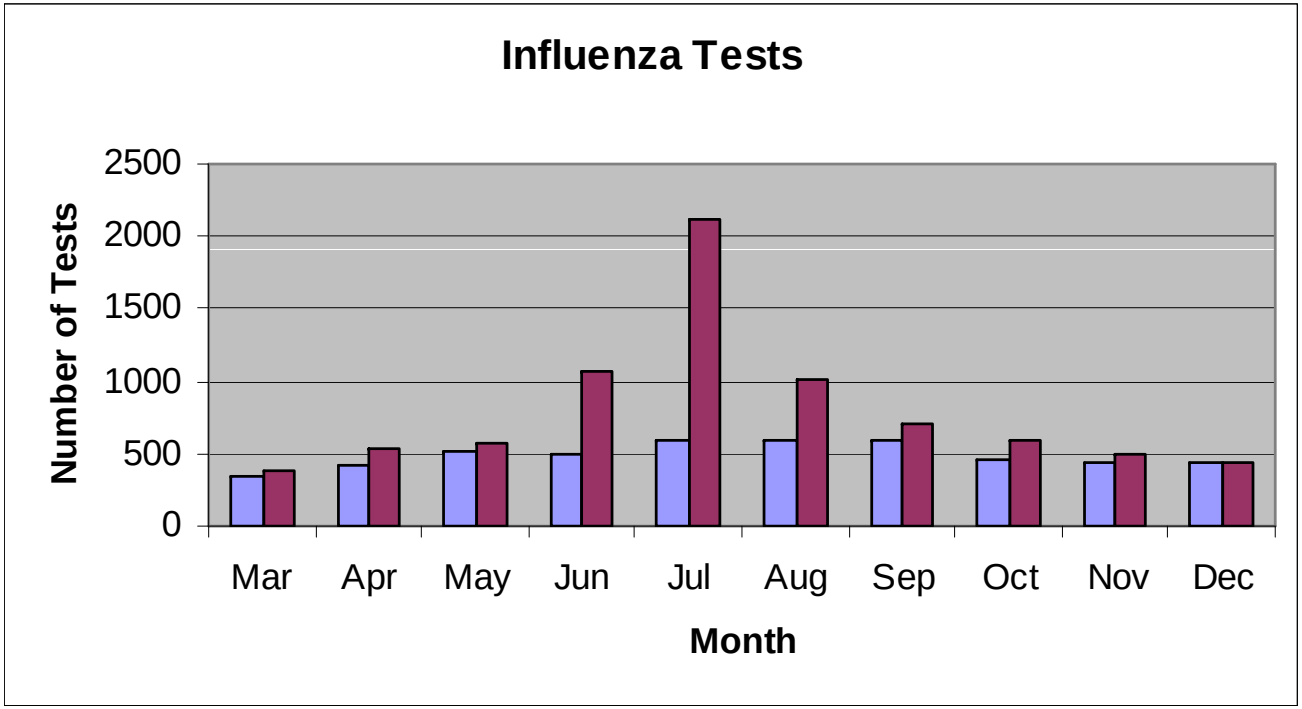


< 6 months: 83 (14%); <12 months: 144 (24%)

Influenza in NSW (CHW, SCH, JHH)
2009 (N=324)



CHW Influenza Testing

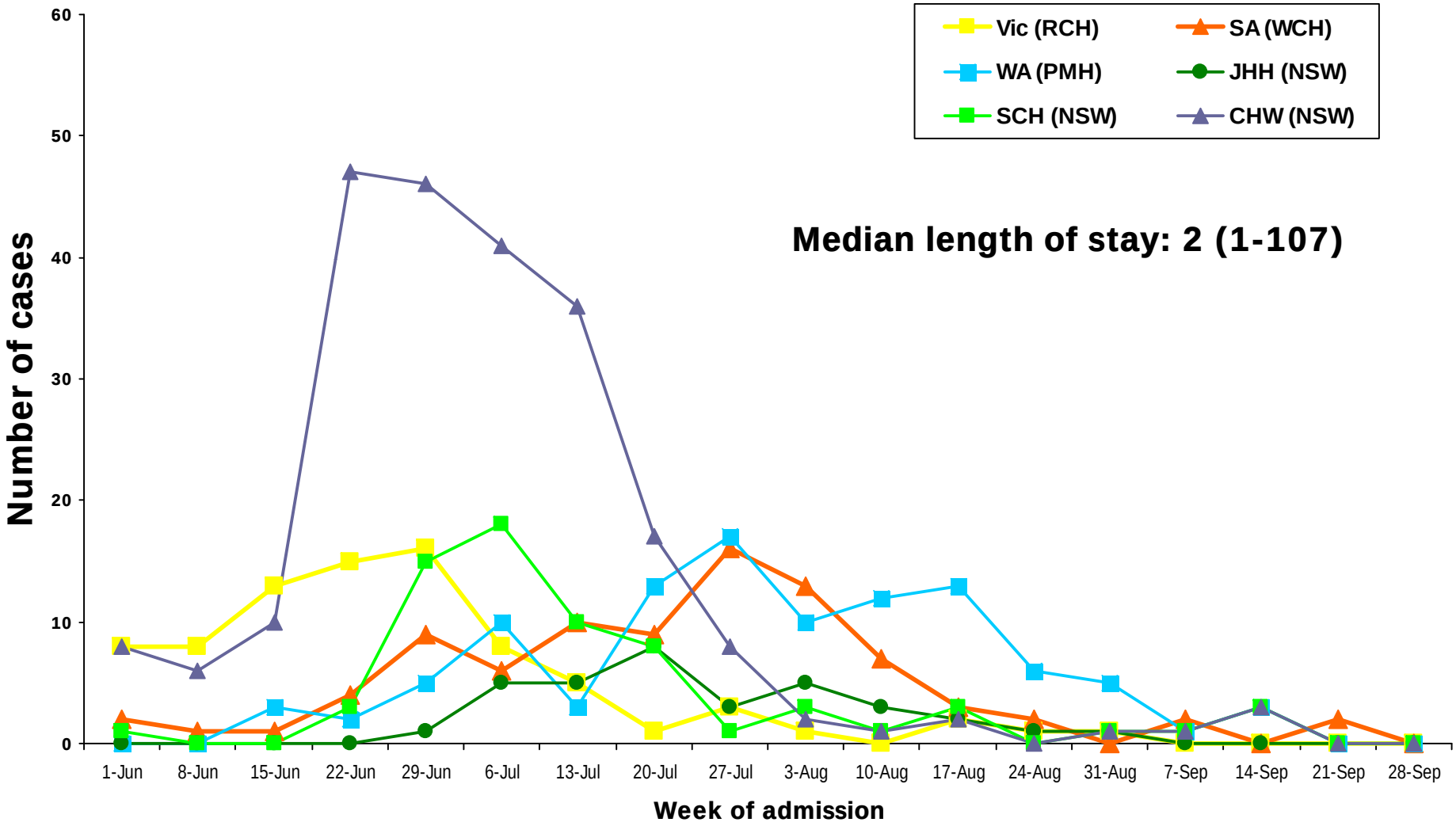


- Total tests
  2008 = 4860
  2009 = 7915

In the **contain** phase everyone suspected of influenza;

In the **protect** phase we tested children who required admission or were at risk of severe disease who would qualify for anti-virals.

Influenza (NSW, Vic, SA, WA)
2009 (N=601)



Cohorting in hospital (not testing); earlier cases?; Monash

Presenting features (n=529)

Cough	412 (78%)
Fever	330 (62%)
Coryza	313 (59%)
Vomiting	205 (39%)*
Dyspnoea	150 (28%)
Diarrhoea	84 (16%)
Headache	65 (12%)
Myalgia/joint pain	61 (11%)
Rash	47 (9%)
Difficulty walking	41 (8%)
Seizure	36 (7%)**
Other Neurological	31 (6%)***

* Not due to Tamiflu (Oseltamivir)

** 29 fever, documented (15) and/or self-reported (21)

*** Loss consciousness (5), weakness (1), confusion/disorientation (25)

Risk factors

Pre-existing chronic conditions

Any pre-existing disease	**279 (52.7%)**
Neurological disease	88 (16.6%)
Immune compromised	57 (10.8%)
Asthma	55 (10.2%)
Respiratory disease	32 (6.0%)
Heart disease	28 (5.3%)
Gastrointestinal	23 (4.3%)
Haematological	18 (3.4%)
Chronic metabolic disease	16 (3.0%)
Prematurity/ex-prem	15 (2.8%)
Diabetes	13 (2.5%)
Chronic liver disease	10 (1.9%)
Metabolic/endocrine disorder	7 (1.3%)
Chronic renal disease	8 (1.5%)
Cystic fibrosis	5 (0.9%)
Previous GBS	1 (0.2%)
Other condition	7 (13.2%)**

* Cerebral palsy, epilepsy, hydrocephalus, hypoxic brain injury, neurodegenerative disorders

** Severe allergy, undiagnosed disorder

Other risk factors

- Smoking: nil
- Smoking in household: 143 (24%)
  - 19% adults; 40% in households with children <14y
- Morbid obesity (adjusted BMI>40): nil
  - ~4% severe obesity, Victorian children 5-10y
- Pregnancy: nil
- Contact with person with proven Flu: 75 (14.2%)
  - Mostly family members
- Travel overseas: 7 (1.1%)
  - Indonesia, Singapore, Noumea, Pakistan, Sri Lanka

Vaccination

Eligible

- Age > 6 months 518 (86%)
- Vaccinated for seasonal influenza : 59 (11.4%)

Strongly recommended:

- Age > 6 months with chronic conditions 256 (43%)
- Vaccinated for seasonal influenza 43 (17%)

Complications

Complications

One or more complications	**182/529 (35%)***
CXR proven pneumonia	**110 (20.8)****
Laboratory proven bacterial co-infection	**36 (6.8%)**
Seizure	**44 (8.3%)**
Lab proven viral co-infection	**18 (3.4%)**
ARDS	**11 (2.1%)**
Pleural effusion	**11 (2.1%)**
Encephalitis/encephalopathy	**6 (1.9%)**
Pneumothorax	**4 (0.8%)**
Cardiomyopathy	**3 (0.6%)**
Guillaine-Barre Syndrome	**3 (0.4%)**
Shock	**2 (0.4%)**
Acute renal failure	**2 (0.4%)**
Other***	**10 (2.0)**

* 51% no underlying condition

** 83% radiological, 14% clinical, 3% neither

** Stroke, myocarditis, pericarditis, transverse myelitis, shock

Risk of complications

- One or more complications 182 (34.4%)

- Children with a complication
  - With pre-existing condition 89 (48.9%)
  - Previously healthy 93 (51.1%)

(Chi-sq=1.64; P=0.20)

Co-infection

- **Viral co-infection: 3.4%**
  - RSV, Adenovirus, Influenza H3 & H1N1, Parainfluenza 3, Rhinovirus

- **Bacterial co-infection: 7%**
  - Blood, urine, pleural fluid, CNS
  - *Staph Aureus, Bordetella pertussis, Streptococcus pneumoniae, Pseudomonas aeruginosa, H Influenza*, E. coli, Proteus

Complications

- **Deaths: 5 (0.8%)**
- **ICU: 61 (10.1%).**
  - **Median stay 2.5 (1 - 41) days**
- **Ventilated: 36 (7.9%)**
- **ECMO: 1**

Deaths

- SA, F, 12y

  Down syndrome, immunodeficiency, bronchiectasis, GORD + aspiration, severe DD.
- SA, M, 12y

  Severe cerebral palsy
- WA, M, 4y

  Cerebral palsy, epilepsy, seizures
- SCH, M, 9y

  Cerebral palsy (spastic quadriplegia), epilepsy, DD, ARDS
- RCH, M, 4y

  Await release of details

All cases had Influenza H1N1 09; 4 PICU, all antiviral and antibiotic

ECMO

- Male, 3.6 y
- Burkitts Lymphoma (immune suppressed)
- Malaise, diarrhoea, abdominal pain
- Nosocomial infection (H1N1 – 09)
- PICU 3 days
- Tamiflu and antibiotics
- Discharged alive

Treatment

Antiviral	266 (50.3 %)
Tamiflu	262 (49.5%) includes 55 aged <12 m
Relenza	4 (0.2%)
Antibiotics	331 (62.6%)
Paracetamol	456 (86.2%)
NSAID	171 (32.3%)
Aspirin	18 (3.4%); 15 were < 12 yrs

Risk factors and complications

PAEDS vs ANZIC

BMI >35	Nil	28.6%
Diabetes	2.5%	16%
Asthma or CLD	16%	33%
Underlying condition	53%	28%
Viral pneumonitis or ARDS	22%	49%

Comparison CHW admissions 2007 v 2009

CHW audit 2007

2007 Jan – Dec

- Total admissions:122
- PICU admissions:12 (10%)
- Deaths: NIL

Lester-Smith, et al *CDI* 2009

CHW PAEDS 2009

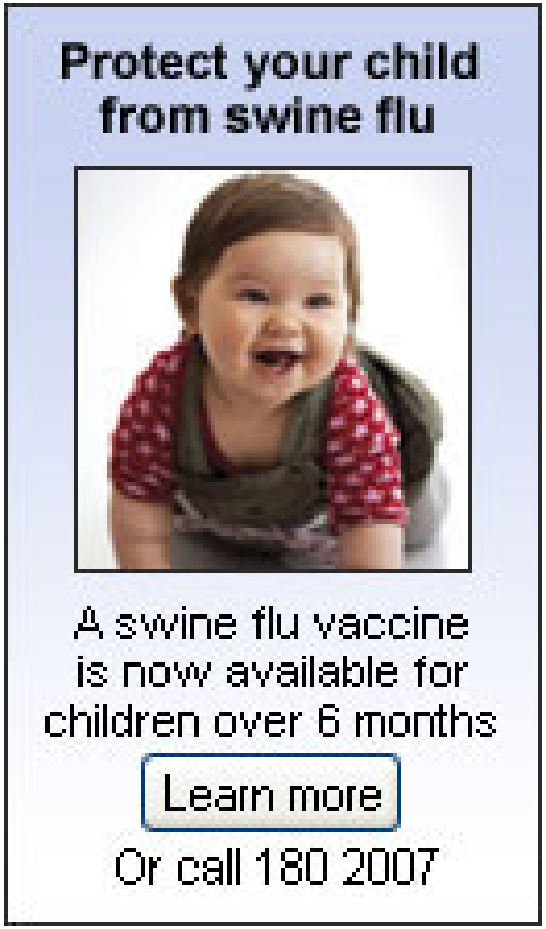
Jun-Sept 2009

- Total admissions: 226
- PICU admissions: 22 (10%)
- Deaths: NIL

Conclusions

- **Influenza H1N1 significant impact in children**
- Significant health costs
- Young particularly vulnerable
- Many have underlying chronic disease
- Low levels of vaccination
- High complication rate
  - risk not increased by underlying condition
- Likely overuse of antibiotics
- Under use of antivirals

- **PAEDS data impacted vaccination policy**
- PAEDS surveillance invaluable but under-resourced
- Provides mechanism to link Public Health and Clinical data



The PAEDS Team

- **Elizabeth Elliott, Robert Booy, Yvonne Zurynski, Peter McIntyre, Nick Wood, Leanne Vidler, Jenny Murphy, (CHW NSW)**
- **Tony Walls, Meg Bruce (SCH NSW)**
- **Bruce Whitehead, Elizabeth Notaras, (JHH, NSW)**
- **Jim Buttery, Jenny Royle, Sonja Elia, Jessica Elia (RCH Vic)**
- **Helen Marshall, Mike Gold, Chris Heath (WCH SA)**
- **Peter Richmond, Meg Bruce (PMH WA)**

Kerry Chant, Jeremy McAnulty, Robin Gilmore (NSW Health)