

# Impact of Seasonal and Pandemic Influenza on Thai Children:

## The Case for Expanded Pediatric Influenza Vaccination

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**Mark Simmerman, PhD.RN.**

International Emerging Infections Program

Thailand MOPH-US CDC Collaboration

[msimmerman@cdc.gov](mailto:msimmerman@cdc.gov)

# Disclaimer

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**The findings and conclusions in this presentation are those of the author and do not necessarily represent the views of the Centers for Disease Control and Prevention.**

# Outline

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1. Background
2. Seasonal influenza
  - Incidence, seasonality & mortality from influenza pneumonia
3. 2009 H1N1 Pandemic Influenza
  - Pediatric outpatient illness and hospitalizations
4. Expanded pediatric influenza vaccination
  - Arguments and obstacles
5. Conclusions

# Background

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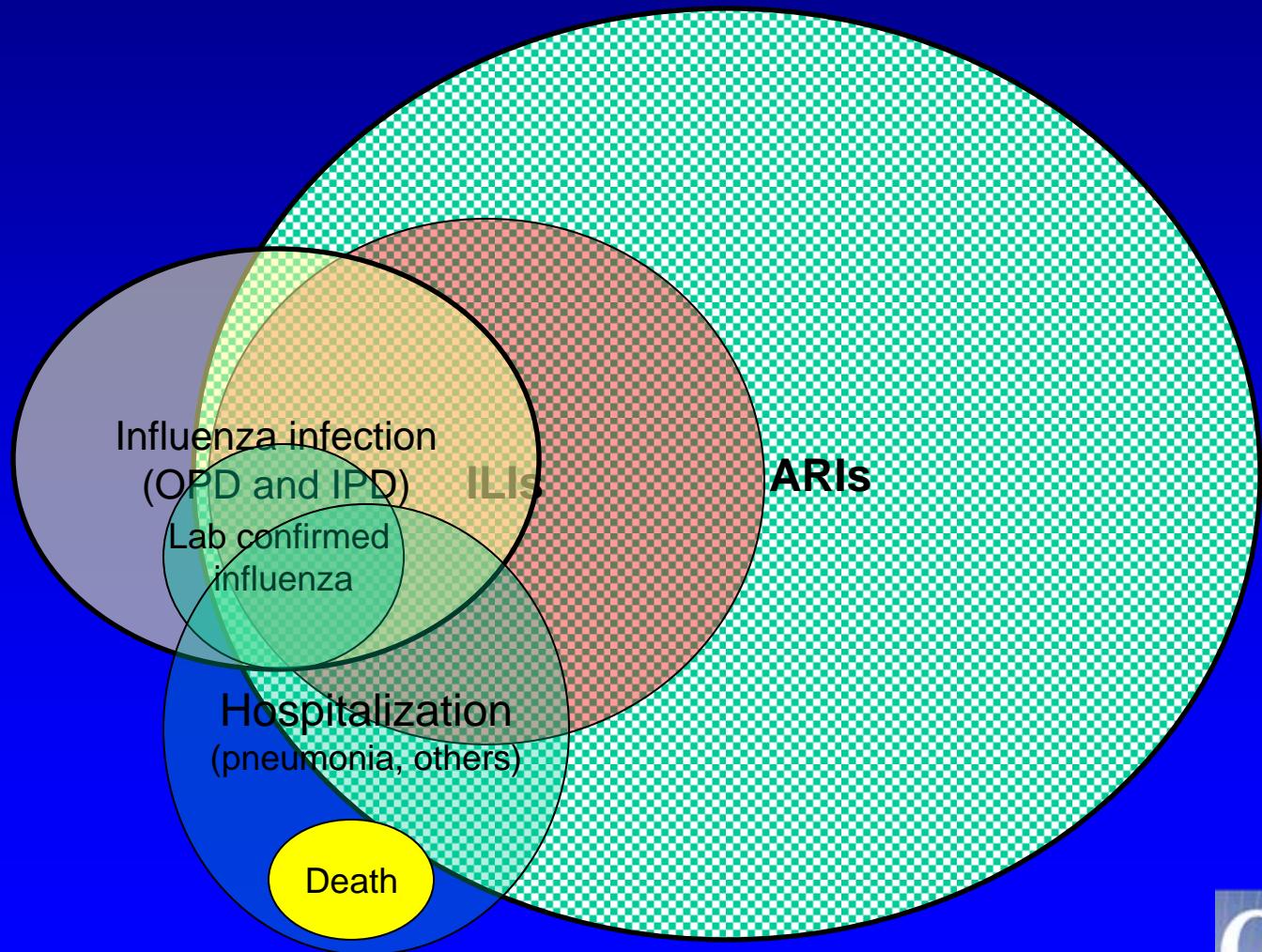
- **Influenza disease burden research has largely been limited to wealthy countries in temperate climates**
- **Pneumonia remains the primary cause of pediatric mortality causing 2 million deaths each year in children <5 years**
- **The contribution of influenza virus infection to pediatric pneumonia has not been adequately described**
- **Influenza vaccination is not routinely available to Thai children**

# Background (2)

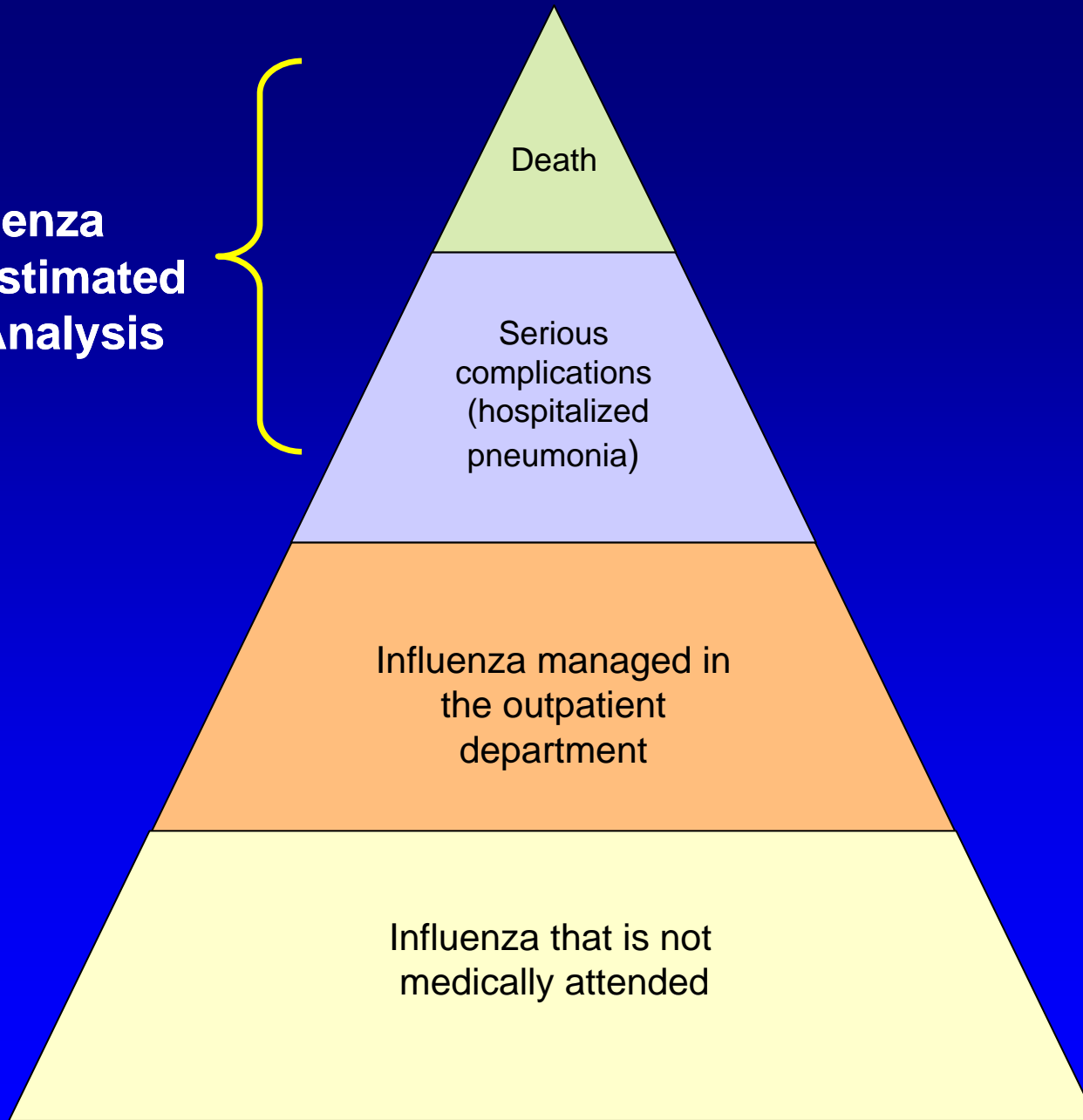
	Cambodia	Thailand	USA
Population (million):	14	65	304
Provinces/States:	20	76	50
Age Structure 0-14:	33.2%	21.2%	20.2%
15-64:	63.2%	70.3%	67.1%
>65:	3.6%	8.5%	12.7%
Pop. Growth Rate:	1.75%	0.64%	0.88%
Life Expectancy at Birth	62.1	73.1	78.11
Median Per Capita Income:	\$2,100	\$8,700	\$48,000
Literacy:	74%	93%	99%



# Respiratory Illness, Influenza Infection & Case Definitions



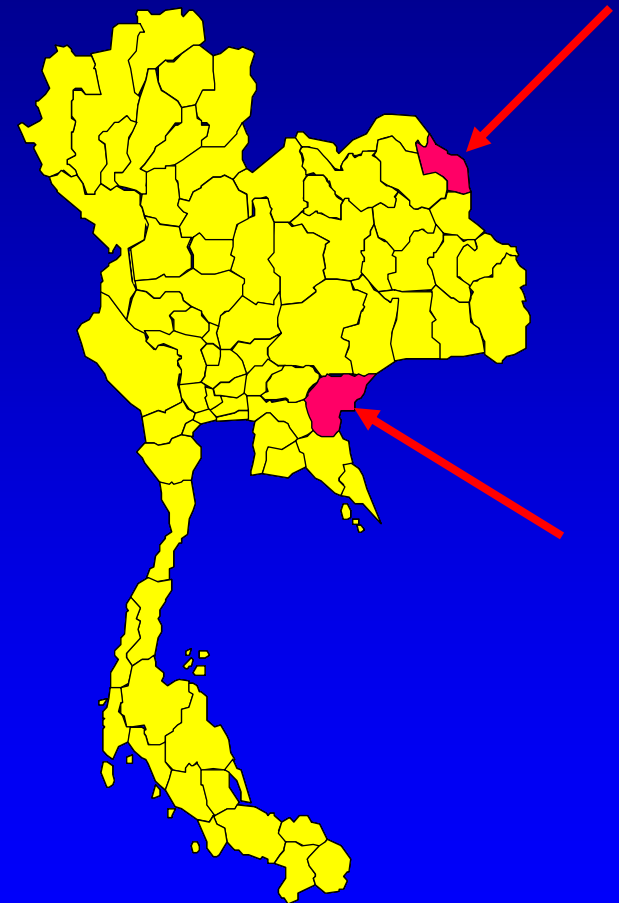
**Influenza  
Burden Estimated  
In This Analysis**



# Study Sites: Sa Kaeo and Nakhon Phanom Provinces

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- Rural
- Population approx 1.2 million
- 20 hospitals (all public, no private)
- Hospital-based pneumonia surveillance since 2002
- Presently in 7<sup>th</sup> year of enrollment

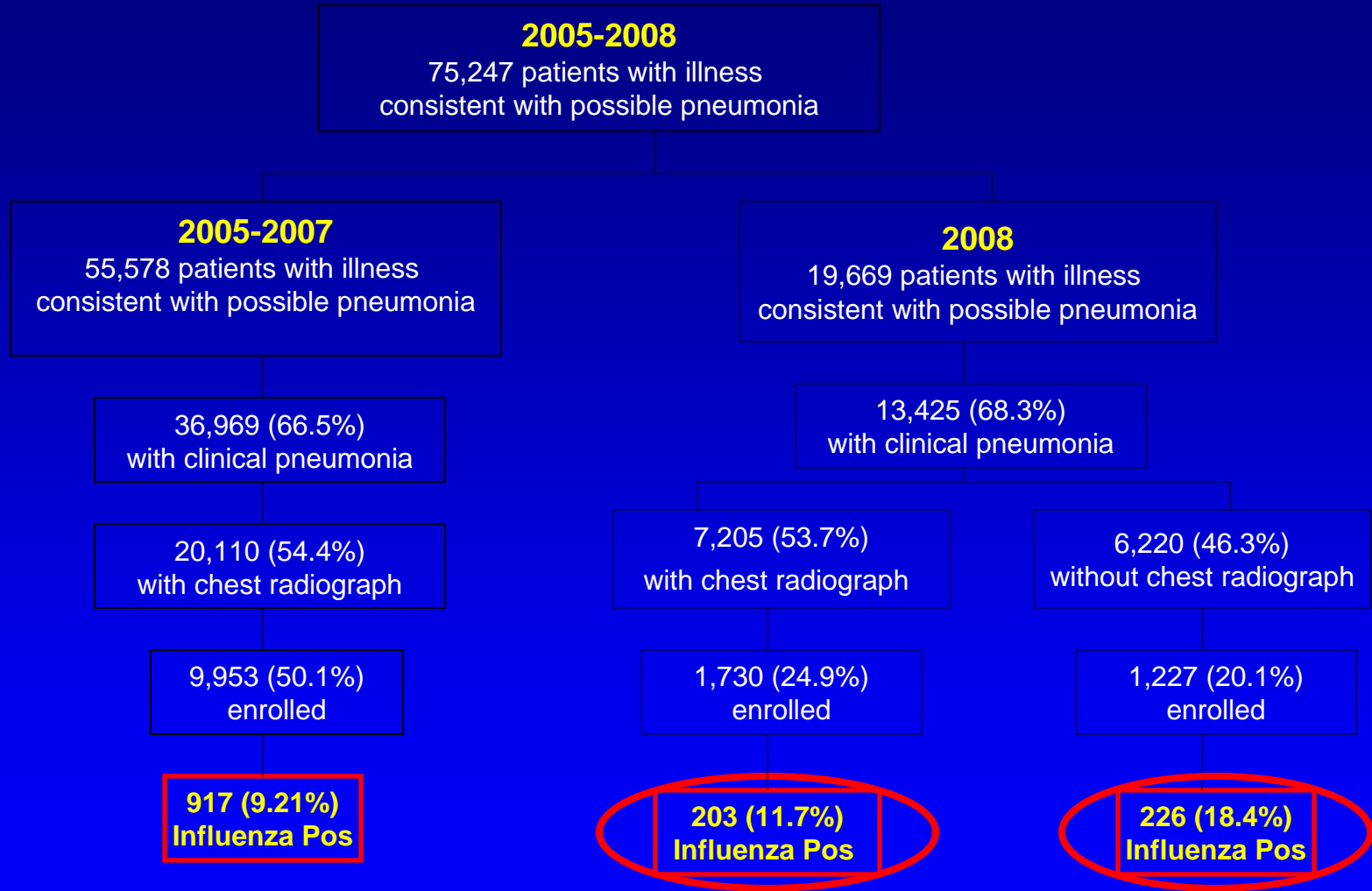


# Methods

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- Inclusion criteria: **Hospitalized patients** of all ages with clinical pneumonia:
  - Acute onset of respiratory tract infection
  - 2005-07: Chest X-Ray within 48 hours of admission
  - 2008: Chest X-Ray requirement dropped
- Specimens: Nasopharyngeal swabs
- Laboratory testing: RT PCR for viral panel at Thai NIH

# Enrollment Process



**P <.0001**

# Viral Etiologies of Pneumonia\*

## 2005 – 2008

Pathogen	All ages, N=13,119*	Age <5 years, N=5,112
	n (%)	n (%)
<b>Influenza (A or B)</b>	<b>1346 (10.4)</b>	<b>429 (8.5)</b>
Influenza A	912 (7.1)	311 (6.2)
Influenza B	444 (3.4)	123 (2.4)
Respiratory syncytial virus	1236 (9.4)	986 (19.3)
Adenovirus	247 (1.9)	166 (3.3)
Human metapneumovirus- NA in 2008	171 (1.3)	125 (2.5)
Parainfluenza virus 1,2,3 - NA in 2008	461 (4.6)	319 (8.1)
<b>Any of above viruses</b>	<b>3320 (25.3)</b>	<b>1928 (37.7)</b>

\*Excludes 9 patients for whom no results were available

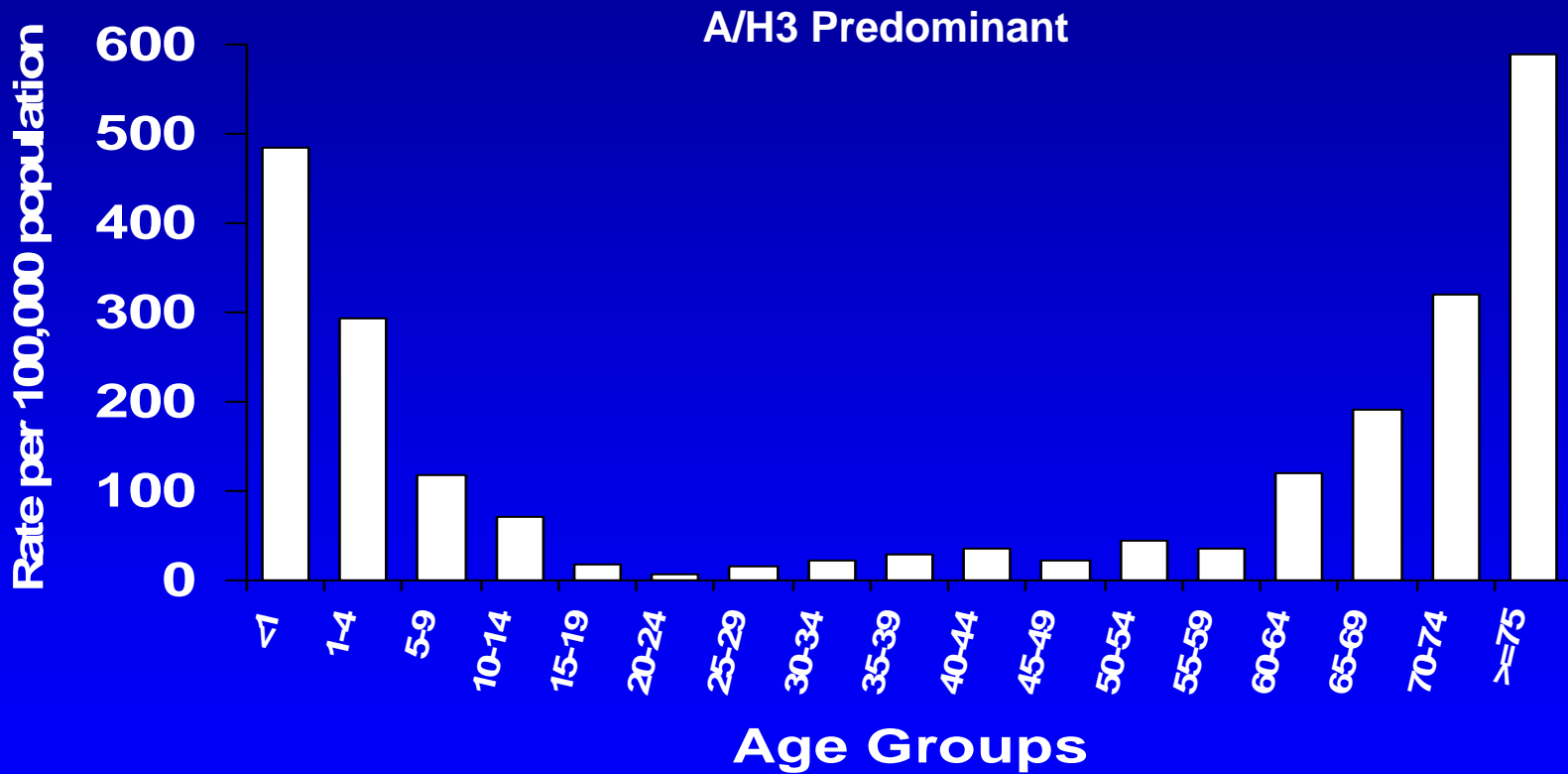
# Proportion of Hospitalized Pneumonia Patients That Were Influenza Positive

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<b>AGE</b>	<b>Tested</b>	<b>Positive</b>	<b>Percent</b>
<b>&lt;1</b>	<b>1569</b>	<b>99</b>	<b>6.3%</b>
<b>1-4</b>	<b>3486</b>	<b>330</b>	<b>9.5%</b>
<b>5-9</b>	<b>746</b>	<b>164</b>	<b>22.0%</b>
<b>10-14</b>	<b>426</b>	<b>109</b>	<b>25.6%</b>
<b>15-19</b>	<b>196</b>	<b>35</b>	<b>18.0%</b>
<b>&gt;60</b>	<b>3484</b>	<b>345</b>	<b>9.9%</b>

# 2005 Influenza Pneumonia Incidence

(n=535)



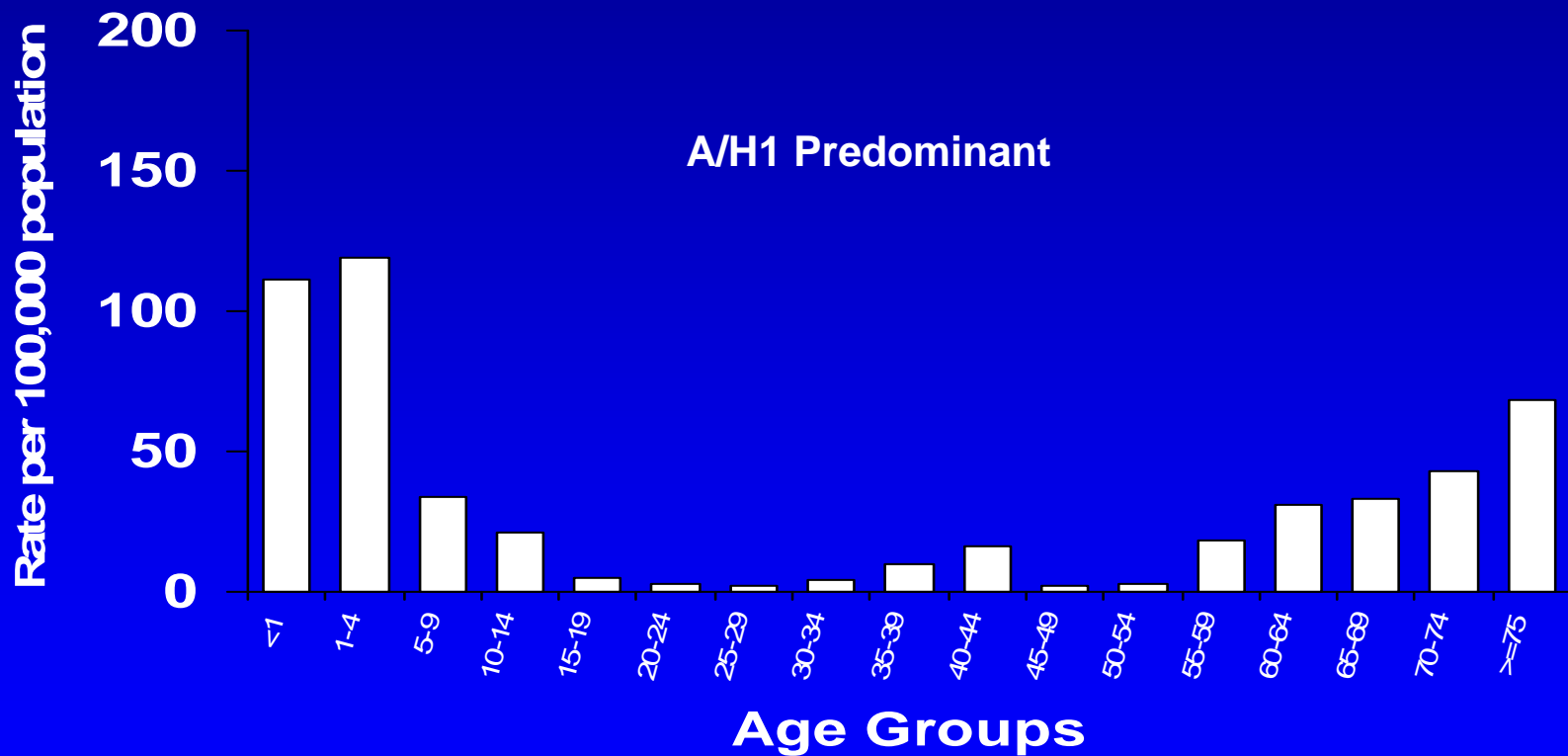
\*Adjusted for those eligible but not enrolled



# 2006 Influenza Pneumonia Incidence

(n=152)

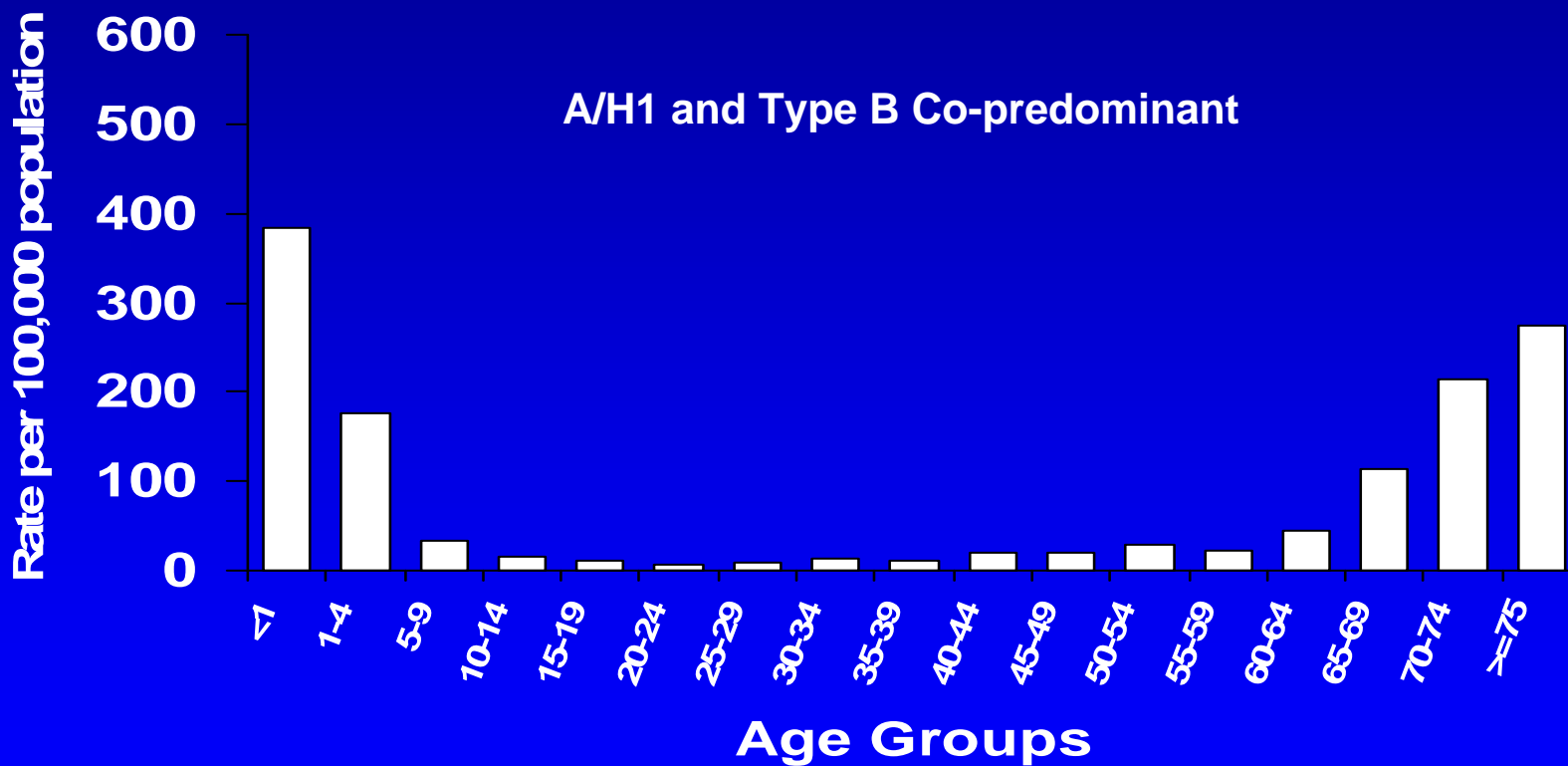
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\*Adjusted for those eligible but not enrolled

# 2007 Influenza Pneumonia Incidence

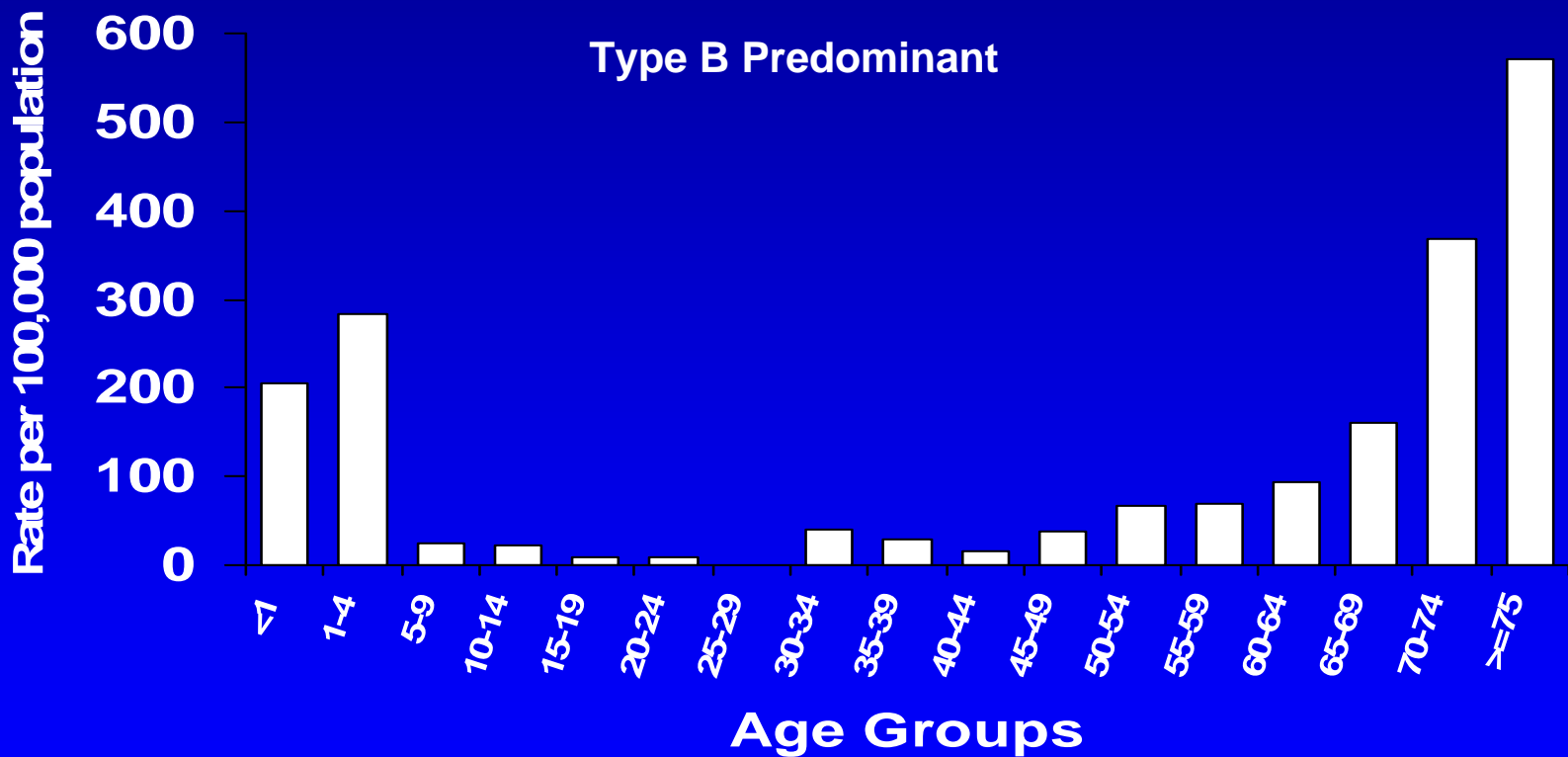
(n=249)



\*Adjusted for those eligible but not enrolled

# 2008 Influenza Pneumonia Incidence

(n=203)



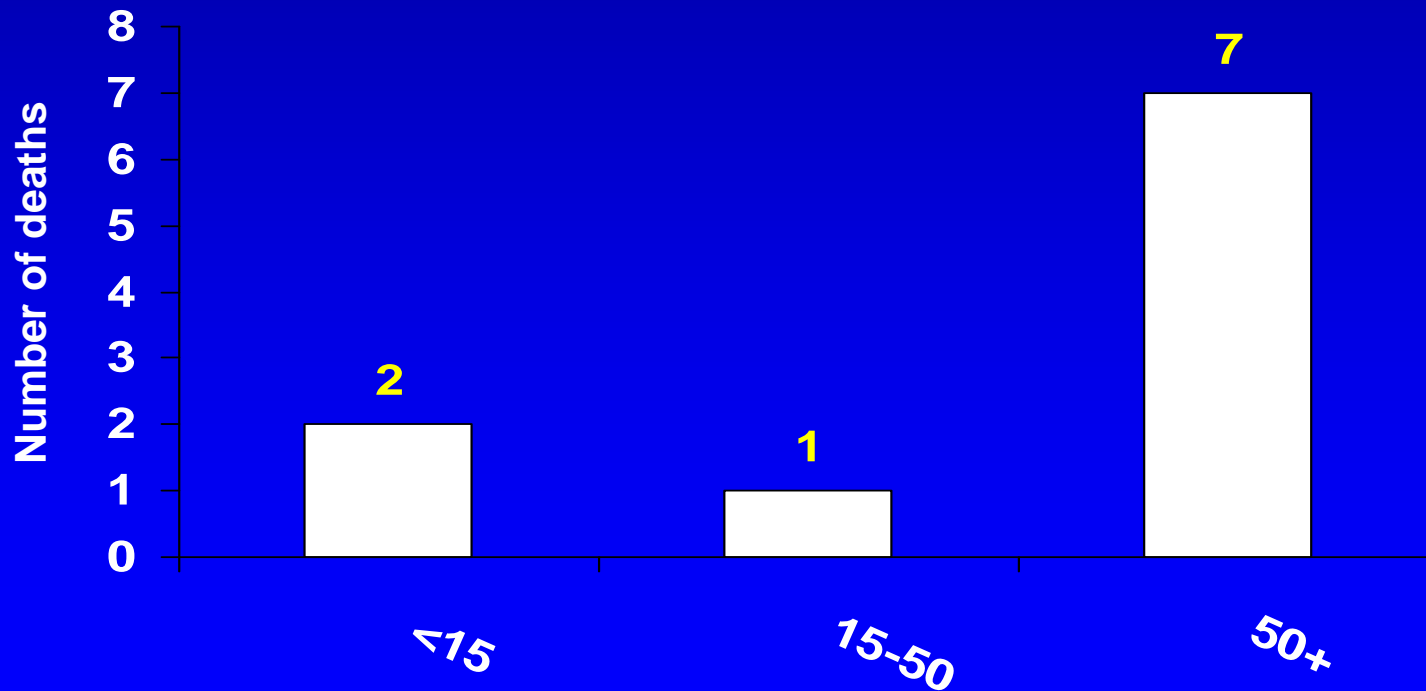
\*Adjusted for those eligible but not enrolled

# Incidence of Influenza-Associated Hospitalization in Healthy Children

First Author	Country	Years	Age	Incidence / 100,000
Simmerman	Thailand	2005-08	<2	150-300
Neuzil	USA	1974-95	<2	300-400
Poehling	USA	2000-04	<2	60-90
Izurieta	USA	1993-97	<2	230
Grijalva	USA	2003-04	<2	240
Ampofo	USA	2002-04	<2	100-200
Heikkinen	Finland	2001-02	<3	135
O'Brien	USA	1994-00	<2	100

# Age Distribution of Influenza Pneumonia In-Hospital Deaths 2005-2008 (n=10/1340)

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# Estimated Annual Influenza Pneumonia Hospital Admissions and In-Hospital Deaths in Thailand, 2005-2008<sup>1,2</sup>

YEAR	<15 years		15-50 years		50+ years		Total	
	Admissions	Deaths	Admissions	Deaths	Admissions	Deaths	Admissions	Deaths
<b>2008<sup>2</sup></b>	14,569	42	7,643	37	24,984	403	47,196	481
<b>2007</b>	12,528	36	4,783	23	12,298	198	29,609	257
<b>2006</b>	8,321	24	2,339	11	3,550	57	14,210	92
<b>2005</b>	25,116	72	8,098	39	21,422	346	54,636	456
<b>Total</b>	60,534	173	22,863	110	62,254	1004	145,651	1,287
<b>Average</b>	15,134	43	5,716	27	15,564	251	36,413	322

1. Adjusted for patients who were eligible but who were not enrolled

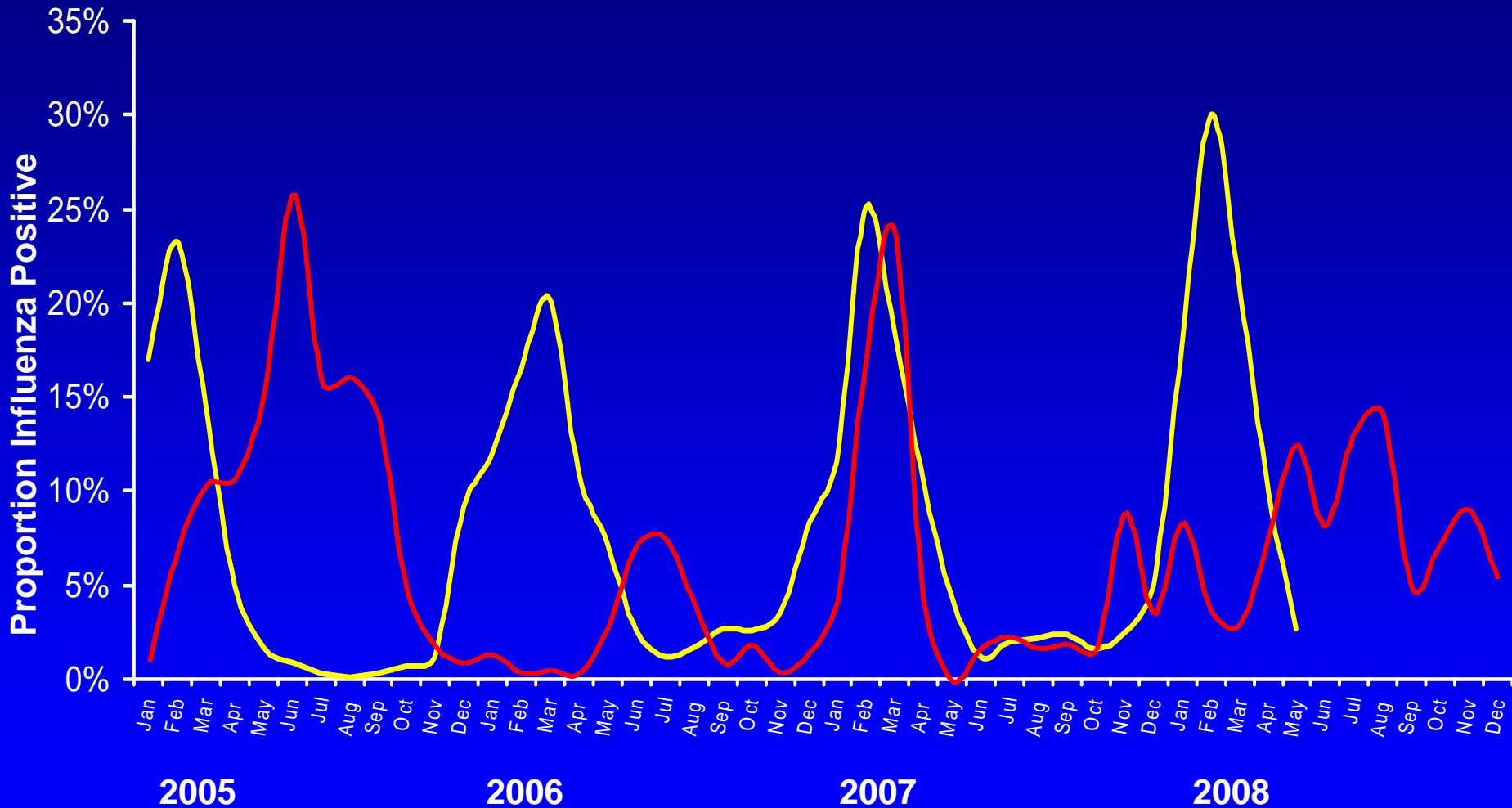
2. As with 2005-2007, these estimates include only pneumonia patients with a chest radiograph

# Factors Contributing to Under-ascertainment

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- Specimen quality, time from illness onset to collection, transportation & storage affect diagnostic sensitivity
- No adjustment for residents who sought care outside study provinces
- During 2005-2007, no adjustment for pneumonia patients who did not receive a chest X-ray and were therefore excluded
- In 2008, patients without a chest X-ray were more likely to be influenza positive. If also true during 2005-2007, we substantially underestimated the incidence

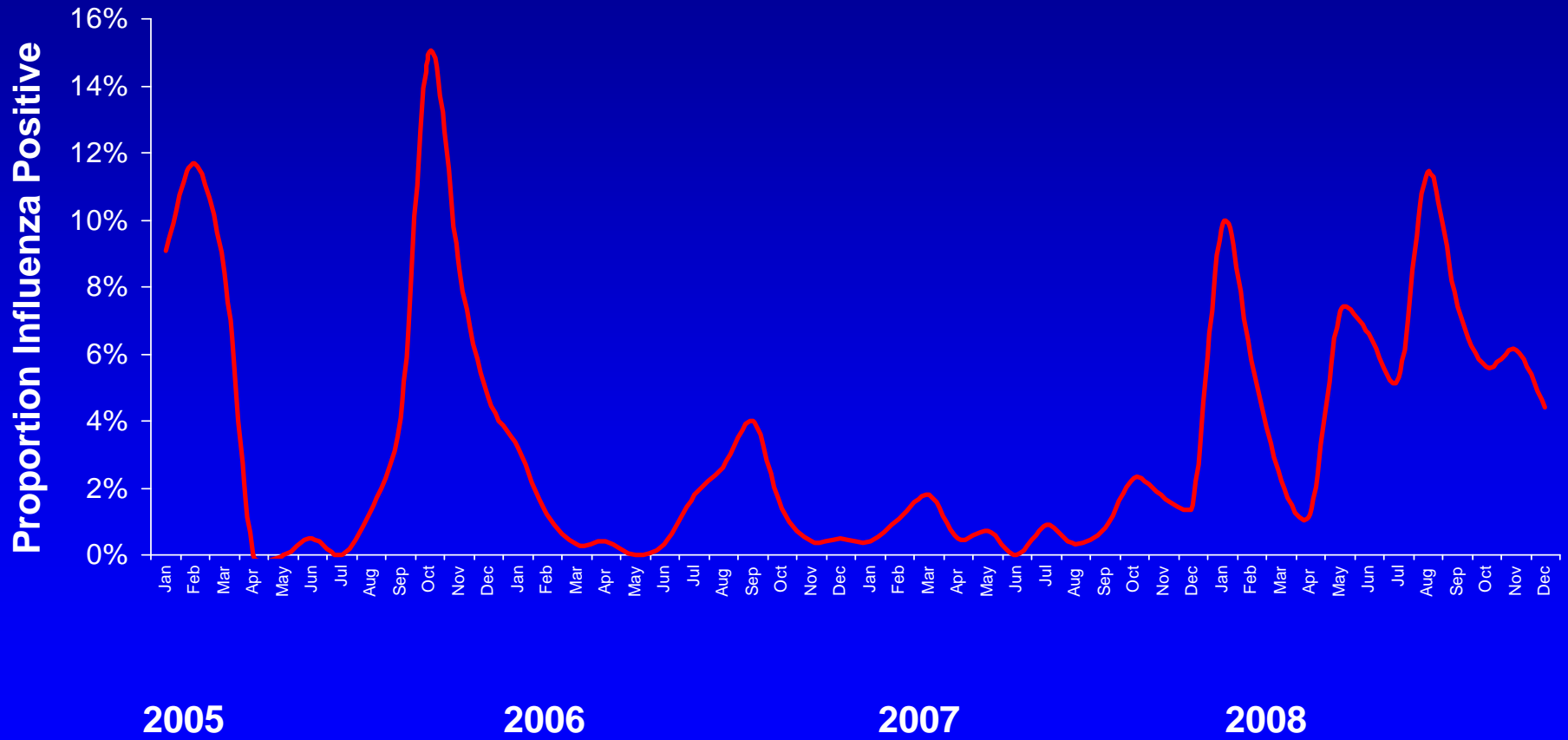
# Seasonality of Hospitalized Influenza A Pneumonia 2005-2008



Thailand= Red

Yellow= USA

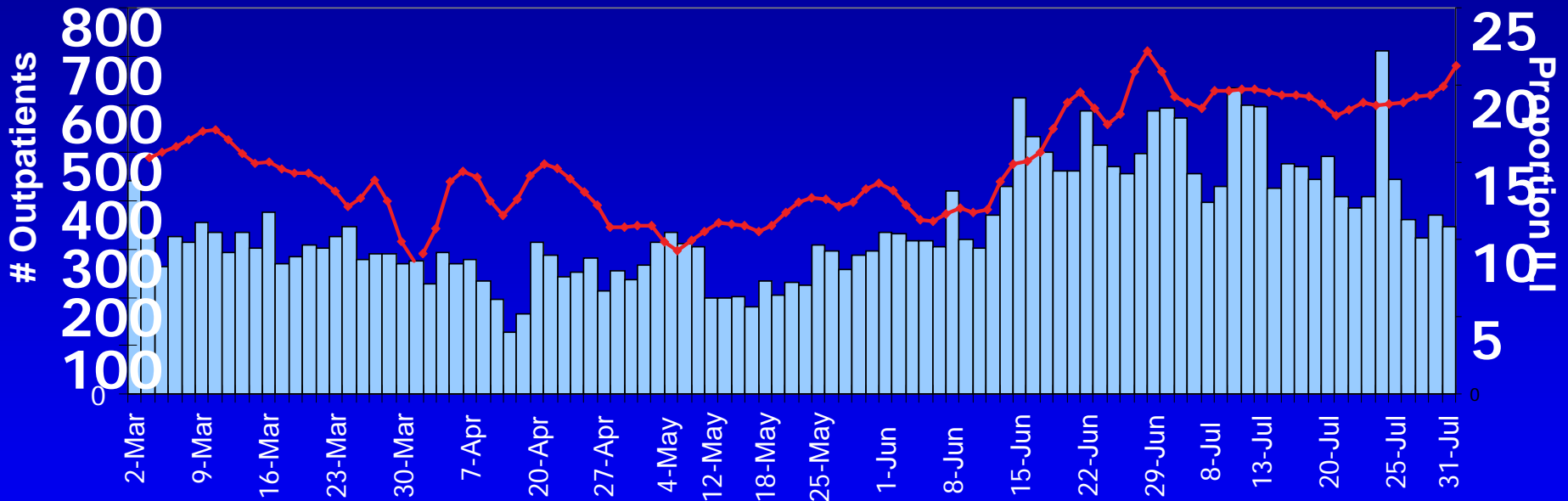
# Seasonality of Hospitalized Influenza B Pneumonia 2005-2008



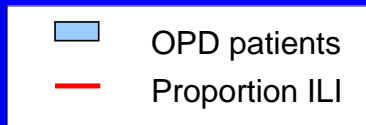
# 2009 Influenza A/H1N1 Pandemic- Impact on Children



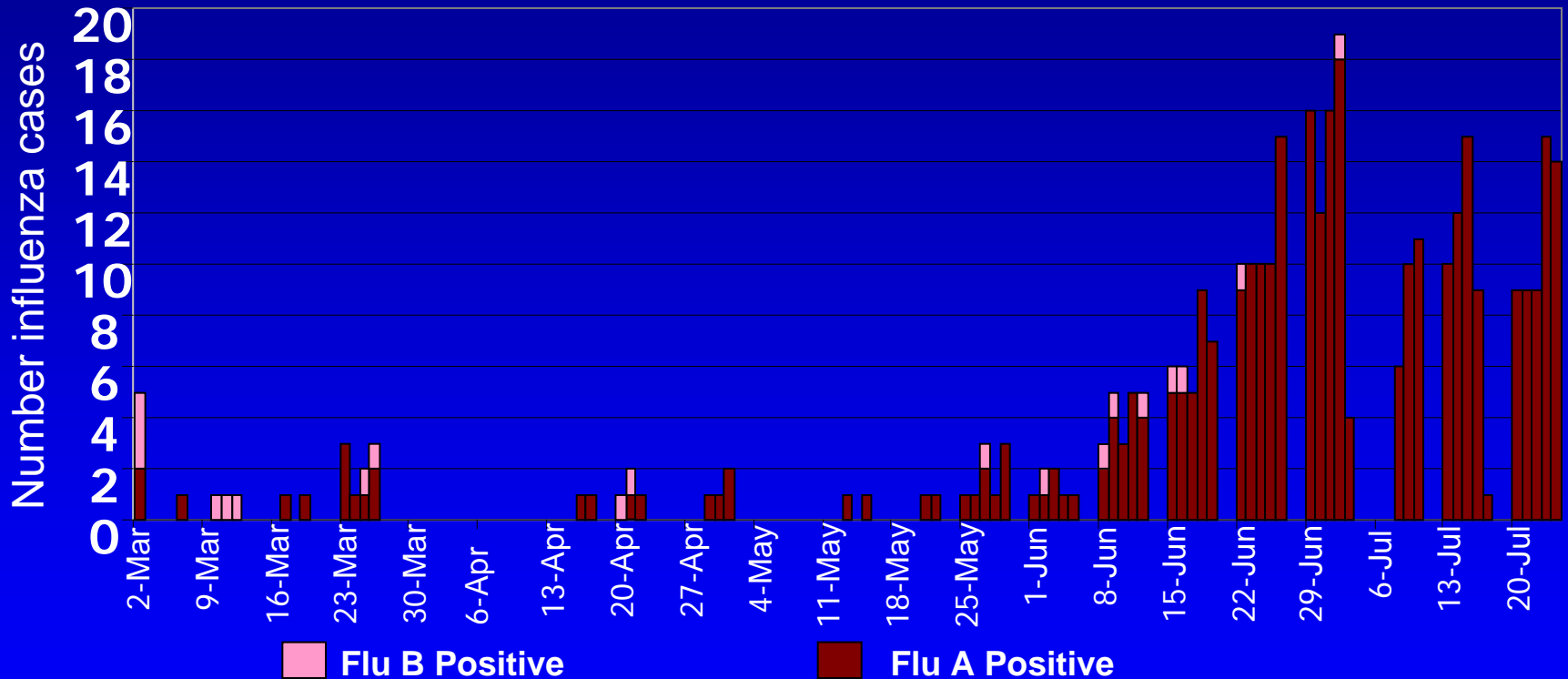
# Pediatric Outpatient and ILI visits in Children at Queen Sirikit National Institute of Child Health



Proportion pH1N1 by week ————— 0%, 10%, 24%, 67%, 76%, 67%, 85%, 84% 80%



# Pediatric Outpatients Influenza Positive by Rapid Test



Proportion pH1N1 by week

0%, 10%, 24%, 67%, 76%, 67%, 85%, 84% 80%

\*Data from the Household Influenza Transmission Study, Bangkok Thailand



# Age Distribution of pH1N1 Cases in Thailand

Age Group	0-5	6-10	11-20	21-30	31-60	>60	Total
Outpatient	197 (5.5%)	578 (16.2%)	1,803 (50.4%)	480 (13.4%)	497 (13.9%)	23 (0.6%)	3,578 (100.0%)
Inpatient	609 (11.4%)	939 (17.5%)	2,075 (38.7%)	788 (14.7%)	831 (15.5%)	113 (2.1%)	5,355 (100%)
Total	806	1,517	3,878	1,268	612	136	8,933

**Persons 20 years and younger represent 75% of outpatient H1N1 visits and 68% of H1N1 hospitalizations**

# The Case for Expanded Pediatric Influenza Vaccination

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## Flu jabs urged for developing countries

Move should spur demand for vaccines and keep production facilities running.

“Influenza experts are recommending an extensive vaccination programme against seasonal flu in developing countries, in part to boost demand for vaccines so that firms can ramp up production to cope with pandemics. The message came from scientists and policy-makers who met on 2–3 July in Siena, Italy, to assess the gaps in their knowledge about the current H1N1 pandemic virus.”



# Arguments for Expanded Pediatric Influenza Vaccination in Developing Countries

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1. Children are at increased risk for pneumonia and other serious complications, and play an important role in propagating epidemics
2. Disease burden in Thailand is similar to the USA, Europe
3. Potential reductions in pneumonia, otitis, fever admissions, etc
4. Potential for herd immunity if vaccine coverage is sufficient
5. May decrease healthcare costs and indirect costs (lost work, missed school)
6. **Increased, constant vaccine demand could lower per-dose costs and stabilize global vaccine supply**

# **Obstacles to Expanded Pediatric Influenza Vaccination in Developing Countries**

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- 1. Global supply limited, mainly driven by wealthy country demand**
- 2. Technical limits to vaccine production (egg-based vaccines)**
- 3. Current high cost relative to EPI vaccines**
- 4. Requirement for two vaccinations in first year for young children**
- 5. Need for annual vaccination**

**"Of all the forms of inequality, injustice  
in health care is the most shocking  
and inhumane."**

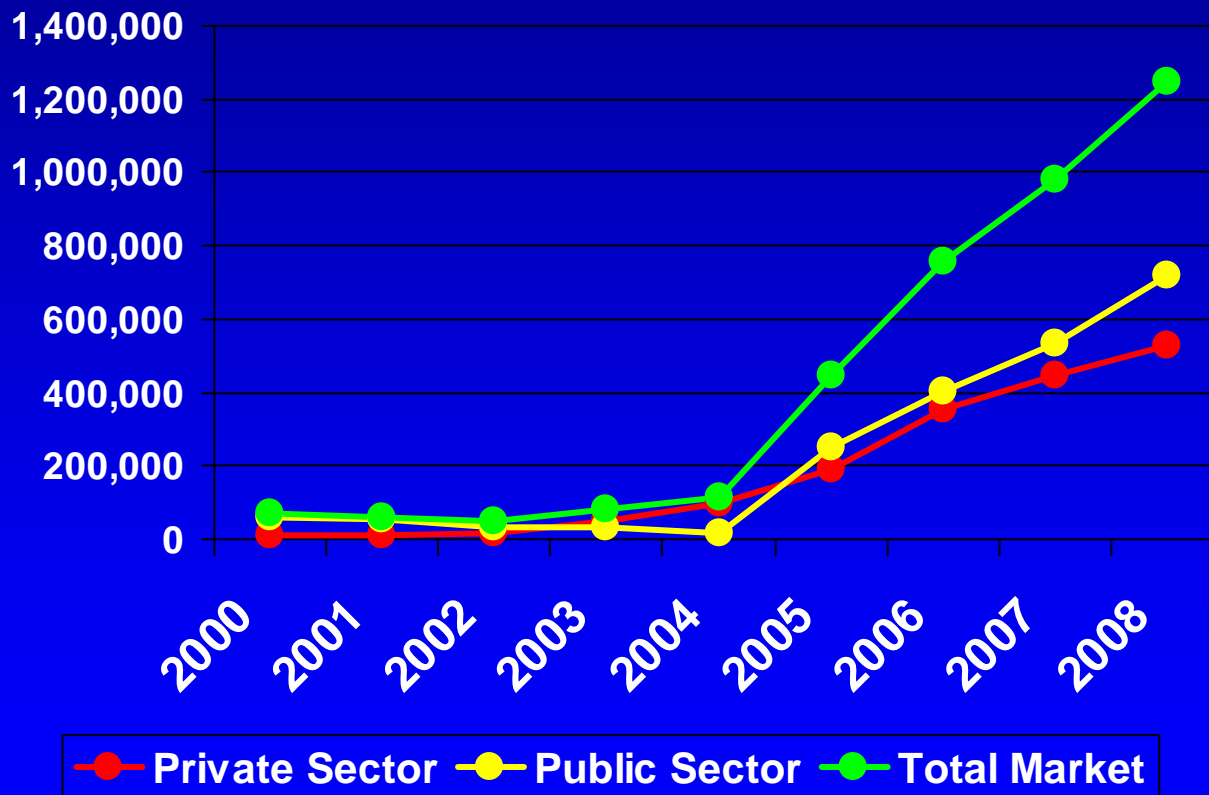
**Martin Luther King, Jr.**

# US ACIP Pediatric Influenza Vaccination Recommendations

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- Annual vaccination recommended for all children aged 6 months-18 years
- Children and adolescents at high risk for influenza complications should continue to be a focus of vaccination efforts as providers and programs transition to routinely vaccinating all children

# Thailand Influenza Vaccine Distribution 2000-08



# Conclusions

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- **Influenza is an important cause of childhood pneumonia requiring hospitalization in Thailand**
- **Seasonal and pandemic influenza both cause substantial morbidity in children**
- **Thai children should be considered for annual influenza vaccination**
- **Additional studies from other developing countries are needed to determine the contribution of influenza to childhood pneumonia**

# Acknowledgments

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- Jens Levy
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- Somrak Chantra
- Abdullah Brooks
- Sununta Henchaichon

**“When the facts change, I change  
my mind. What do you do, sir?”**

**John Maynard Keynes**