

# Bronchiolitis Pathways and the Evidence

Tom Malinowski, RRT, FAARC  
Director Respiratory Services,  
Mary Washington Hospital  
Fredericksburg, VA

# Objectives

- Describe our best understanding of the role of the following therapeutic regimens in Bronchiolitis:
  - Aerosol Therapy
  - Bronchial Hygiene
  - Corticosteroids
  - Oxygen Therapy

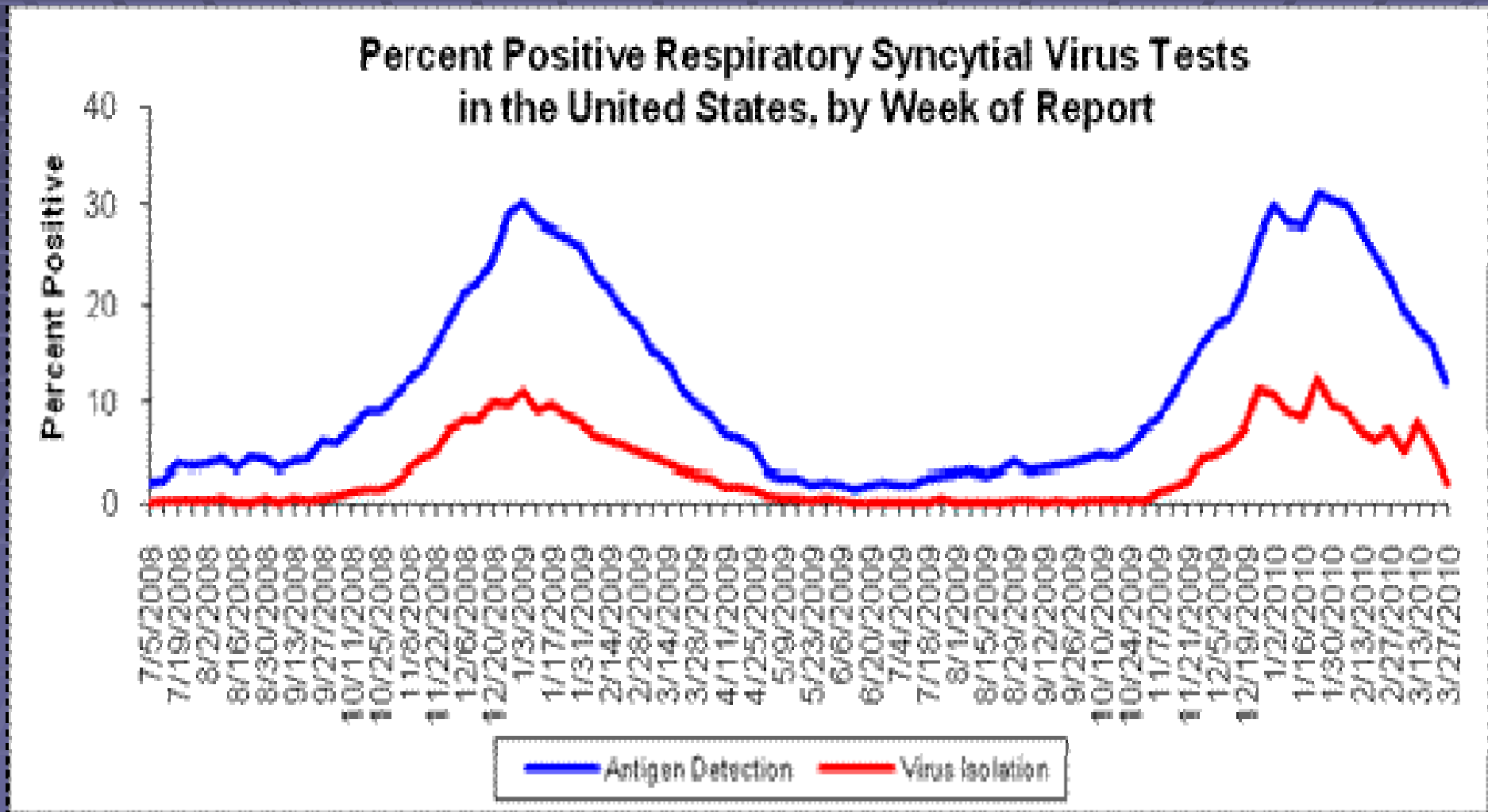
# Epidemiology of Bronchiolitis

- One of the most common seasonal admitting diagnosis for children
  - <2 years of age
  - 90% hospitalizations < 12 months
  - Peak incidence 3-6 months
- A disorder characterized by the acute inflammation, edema, and necrosis of epithelial cells in the smaller airways.
- Primary viral origin
  - RSV most common, parainfluenza, adenovirus, influenza, metapneumovirus

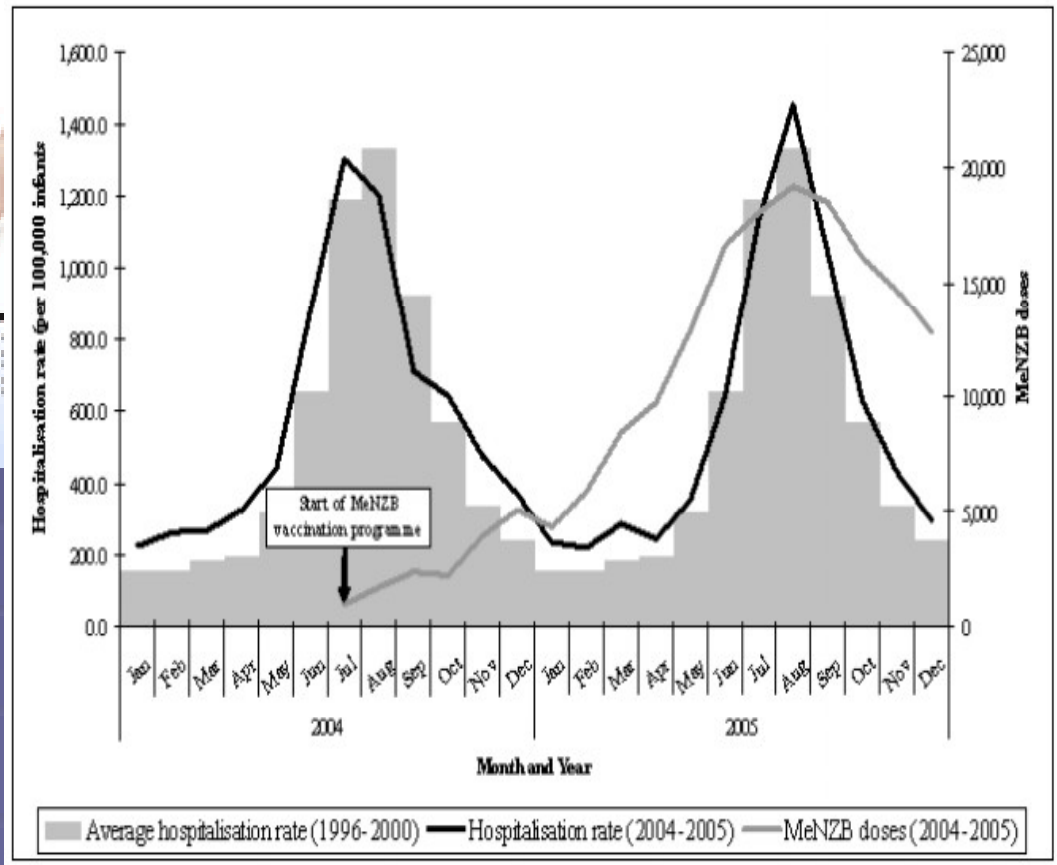
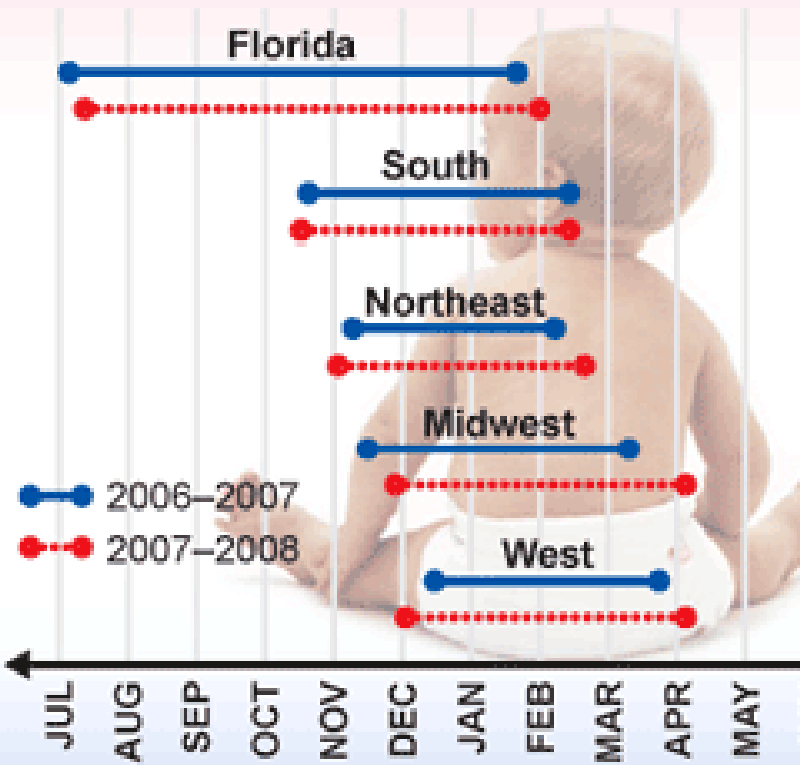
# Epidemiology cont.

- Seasonal (November – March)
- Self limiting
  - median <12 days
  - Approx. 20% > 21 days
  - Hospitalizations range 2-7 days
- Recurrent wheezing may occur in up to 40% of pts.
- High Risk Groups – prematurity, cardiopulmonary dz, immuno-suppressed

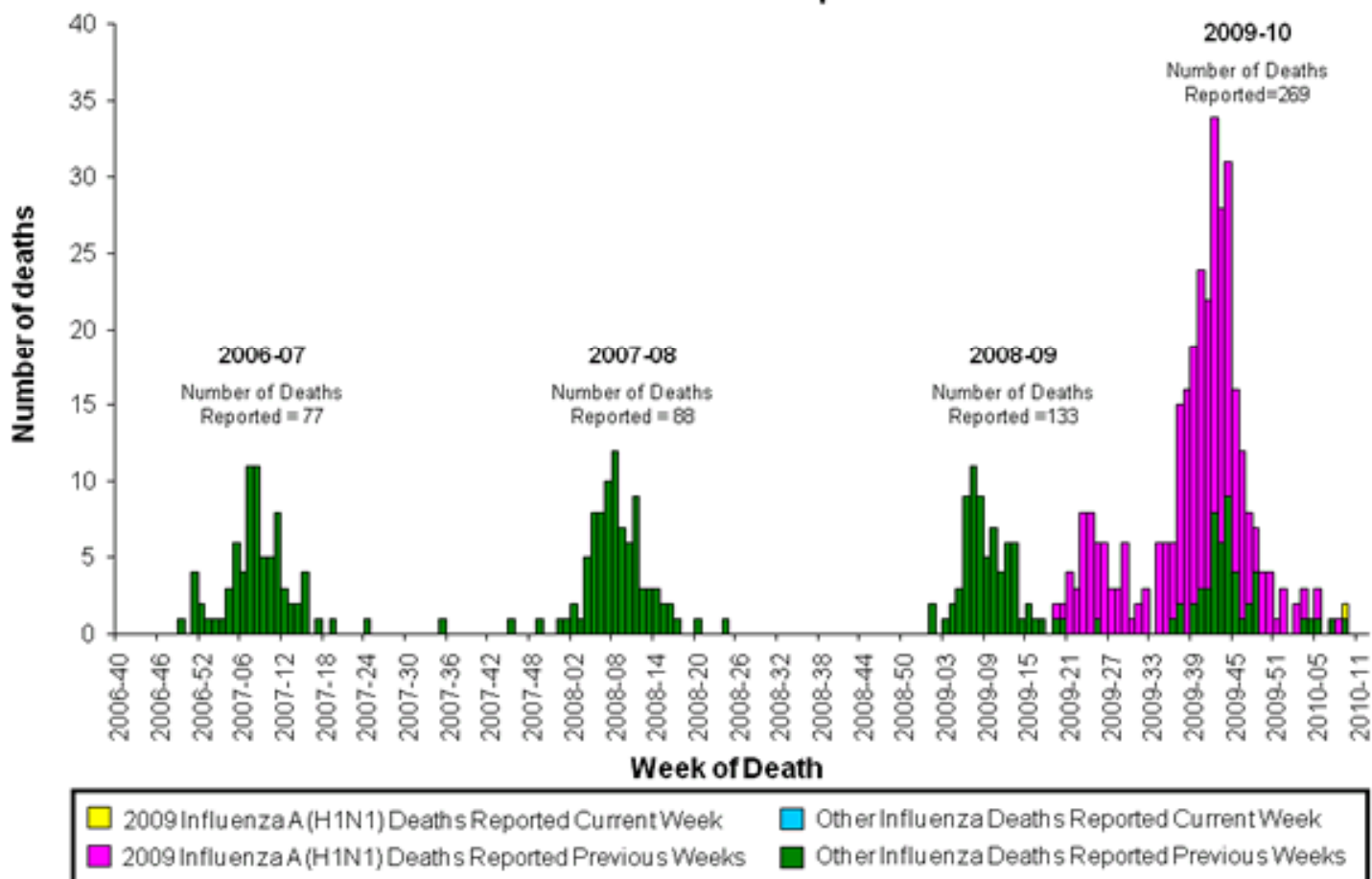
# The National Respiratory and Enteric Virus Surveillance System (NREVSS)



## Respiratory Syncytial Virus (RSV) Season United States, by Region and Florida



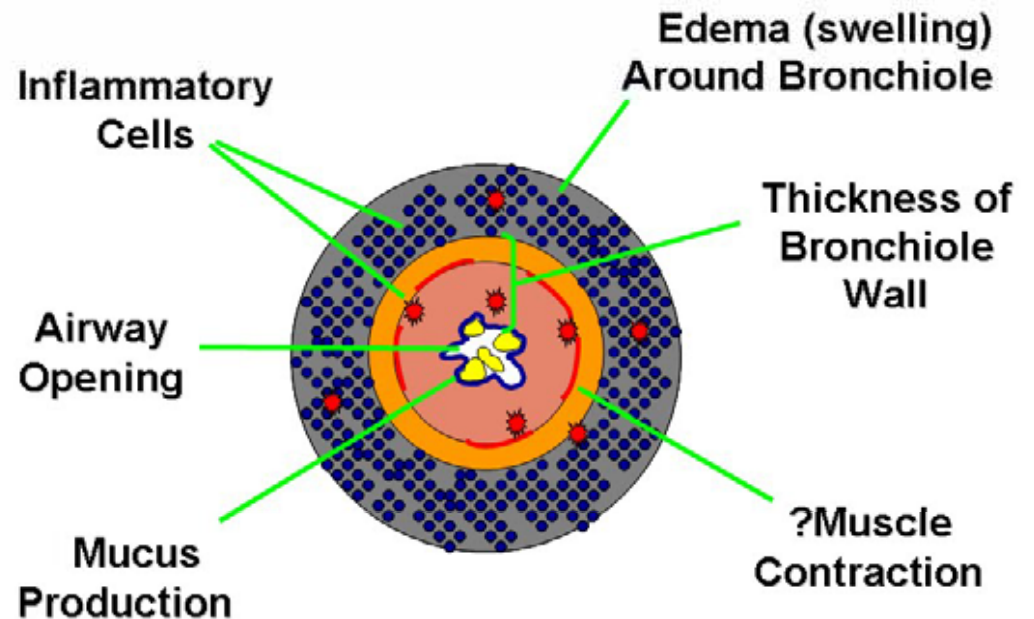
## Number of Influenza-Associated Pediatric Deaths by Week of Death: 2006-07 season to present



# Pathophysiology

- Terminal airway inflammation
- Airway epithelial shedding

## Cross-Section of Bronchiole in Bronchiolitis





What Works ?

What Doesn't?

# Assessment and Diagnosis

- **Clinical history and physical exam** is basis for diagnosis, not labs or diagnostic tests.
- RSV swab, CXR, cultures, Blood gases have not been shown to be of value in either diagnosis or guiding therapy <sup>1-3</sup>.
- Preceding URI, rhinorrhea
- **Clinical Signs**
  - Wheezing
  - Retractions
  - SOB
  - Tachypnea
  - Nasal flaring
  - Color
  - Dehydration

*The* NEW ENGLAND  
JOURNAL *of* MEDICINE

ESTABLISHED IN 1812

JULY 26, 2007

VOL. 357 NO. 4

A Multicenter, Randomized, Controlled Trial  
of Dexamethasone for Bronchiolitis

Howard M. Corneli, M.D., Joseph J. Zorc, M.D., Prashant Mahajan, M.D., M.P.H., Kathy N. Shaw, M.D., M.S.C.E.,  
Richard Holubkov, Ph.D., Scott D. Reeves, M.D., Richard M. Ruddy, M.D., Baqir Malik, M.D.,  
Kyle A. Nelson, M.D., M.P.H., Joan S. Bregstein, M.D., Kathleen M. Brown, M.D., Matthew N. Denenberg, M.D.,  
Kathleen A. Lillis, M.D., Lynn Babcock Cimpello, M.D., James W. Tsung, M.D., Dominic A. Borgialli, D.O., M.P.H.,  
Marc N. Baskin, M.D., Getachew Teshome, M.D., M.P.H., Mitchell A. Goldstein, M.D., David Monroe, M.D.,  
J. Michael Dean, M.D., and Nathan Kuppermann, M.D., M.P.H., for the Bronchiolitis Study Group  
of the Pediatric Emergency Care Applied Research Network (PECARN)\*

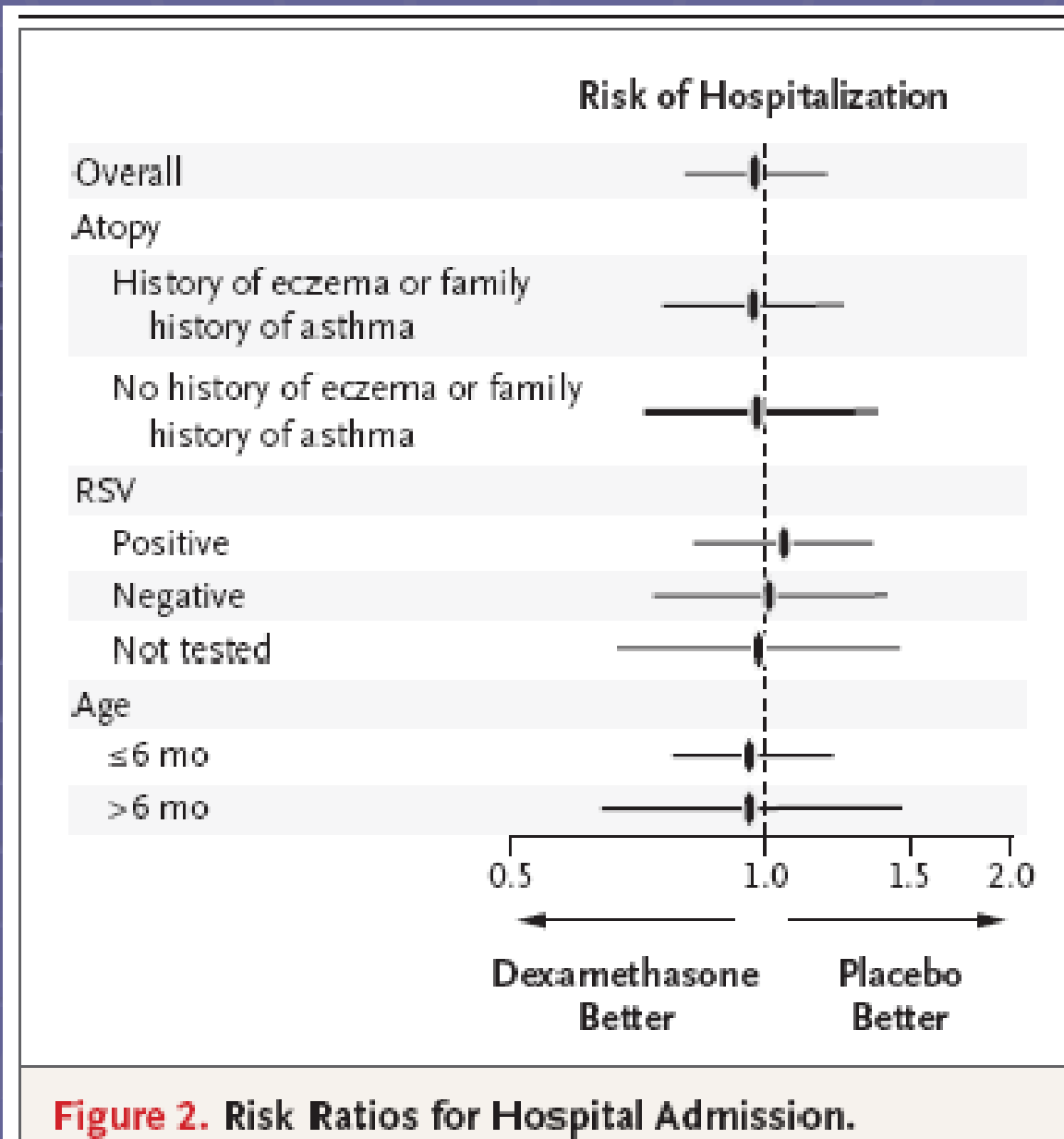
- Double blind, RCT
- 20 ED's, 600 infants
- Single dose of 1mg/Kg Dexamethasone
- Respiratory severity score

**Table 1.** Wheezing and Retraction Scales for the Respiratory Distress Assessment Instrument (RDAI).\*

Symptom	Points					Maximum
	0	1	2	3	4	
<b>Wheezing</b>						
During expiration	None	End	First half	First three quarters	Throughout	4
During inspiration	None	Part	Throughout	—	—	2
No. of involved lung fields	0	1 or 2	3 or 4	—	—	2
<b>Retractions</b>						
Supraclavicular	None	Mild	Moderate	Marked	—	3
Intercostal	None	Mild	Moderate	Marked	—	3
Subcostal	None	Mild	Moderate	Marked	—	3
<b>Total</b>						<b>17</b>

\* Both wheezing and retractions were scored. The total score on the RDAI is the sum of the scores for each row, with a range of 0 to 17; higher scores indicate more severe disease.

N Engl J Med 2007; 357:331-9



N Engl J Med 2007; 357:331-9

N Engl J Med 2009;360:2079-89.

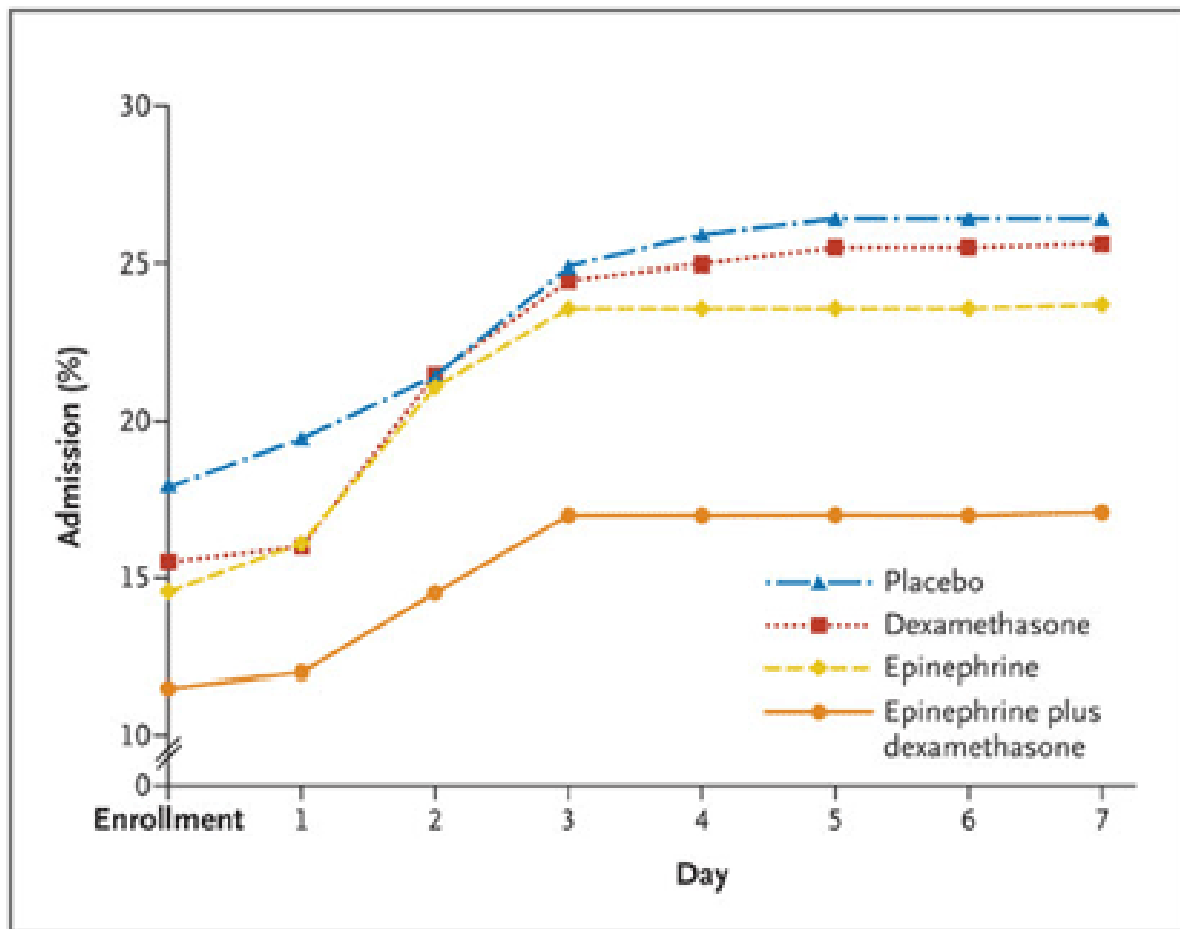
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

## Epinephrine and Dexamethasone in Children with Bronchiolitis

Amy C. Plint, M.D., M.Sc., David W. Johnson, M.D., Hema Patel, M.D., M.Sc.,  
Natasha Wiebe, M.Math., Rhonda Correll, H.B.Sc.N., Rollin Brant, Ph.D.,  
Craig Mitton, Ph.D., Serge Gouin, M.D., Maala Bhatt, M.D., M.Sc.,  
Gary Joubert, M.D., Karen J.L. Black, M.D., M.Sc., Troy Turner, M.D.,  
Sandra Whitehouse, M.D., and Terry P. Klassen, M.D., M.Sc.,  
for Pediatric Emergency Research Canada (PERC)

- Double blind, RCT
- 8 ED's, 800 infants
- 4 arms (2 neb tx. of epi/placebo, 6 oral doses dex/placebo)
- Primary outcome – hosp in 7 days of enrollment



N Engl J Med 2009;360:2079-89.

# Grades of Recommendation

**A** = High quality meta-analysis, multiple RCT, low bias risk

**B** = High quality systematic review, RCT, case cohort, low bias, high causal probability

**C** = Well conducted case control/cohort studies, moderate causal probability

**D** = Non analytic, case report, expert opinion

\* relate to the strength of the evidence on recommendation



# Evidenced- Based Practice Guidelines -Review Sources

- American Academy of Pediatrics (AAP)<sup>1</sup>
- Scottish Intercollegiate Guidelines Network (SIGN)<sup>2</sup>
- Cincinnati Children's Hospital Medical Center EBR-CPG <sup>3</sup>
- Cochrane Database of Systematic Reviews <sup>4-6,9</sup>

*Aerosolized Bronchodilators should  
not be routinely used*<sup>1-5</sup>  
*(Grade A/B evidence)*

- A single trial of racemic epinephrine or albuterol is an option if familial history for allergy, asthma or atopy<sup>1,3</sup> (**Grade D, expert opinion**).
- Treatments are **not** continued **unless** clinical improvement ( ↓ resp rate, wheezing, accessory muscle use, WOB) within 15 minutes after aerosol<sup>3</sup> (**Grade D, expert opinion**).

## *Aerosolized Bronchodilators should not be routinely used...*

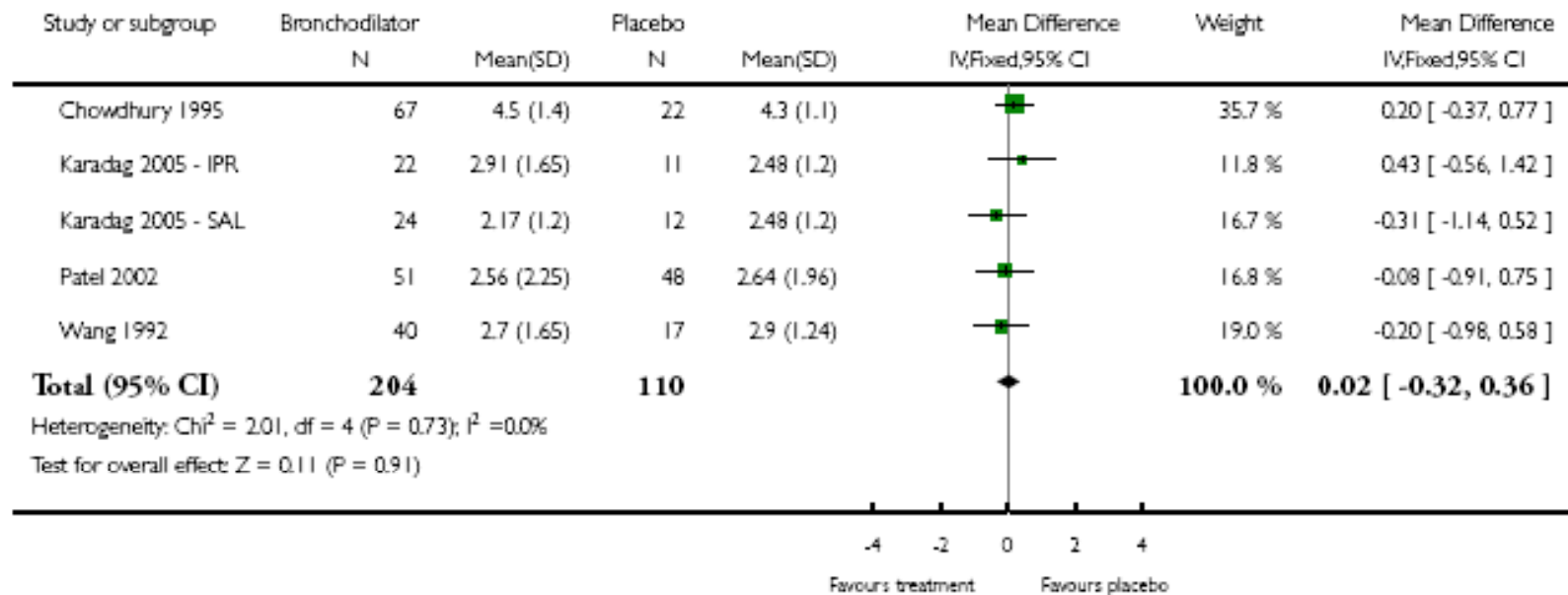
- The use of albuterol does not shorten length of illness or hospital stay (LOS) <sup>1,2,3</sup> (**Grade A** ).
- If started, treatments **should be DC'd** when the child fails to continue to demonstrate pre/post clinical improvement <sup>3</sup> (**Grade D, expert opinion**).
- If treatments improve the clinical score, treatment frequency should be no more often than Q 4-6 hrs, Q1-3 hr. regimens are not warranted (Grade D, expert opinion).

### Analysis 1.5. Comparison 1 Bronchodilator versus placebo, Outcome 5 Duration of hospitalization (inpatients).

Review: Bronchodilators for bronchiolitis

Comparison: 1 Bronchodilator versus placebo

Outcome: 5 Duration of hospitalization (inpatients)



# Aerosolized Corticosteroids should not be used<sup>1,2,3</sup> (Grade A/B evidence)

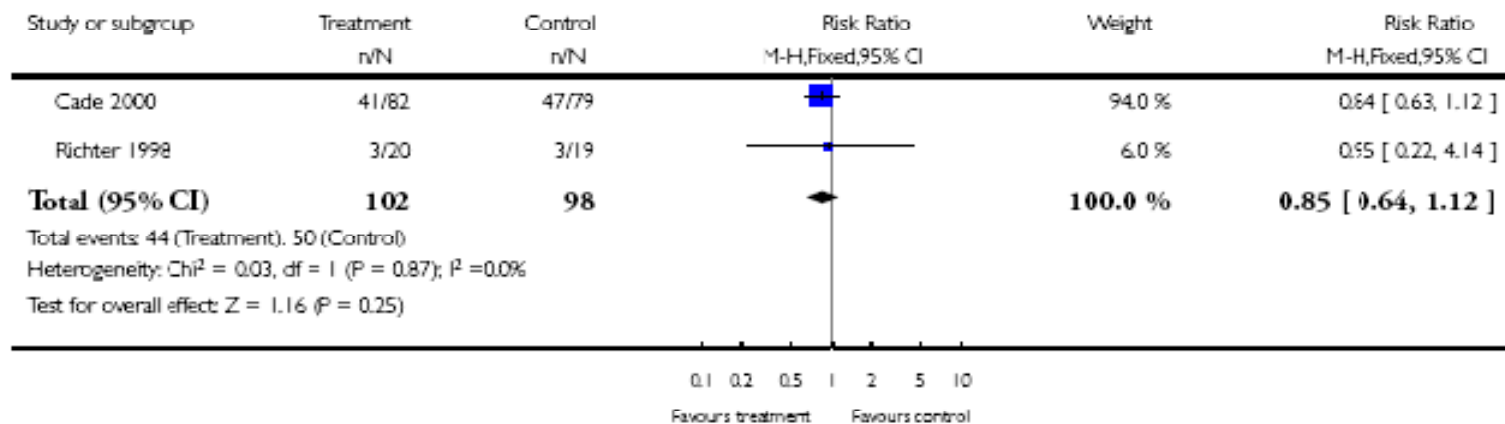
- Inhaled corticosteroids showed no benefit in the acute stage of the disease.

## Analysis 1.1. Comparison 1 Any inhaled corticosteroid versus placebo, Outcome 1 Number of infants given or prescribed steroids.

Review: Inhaled corticosteroids during acute bronchiolitis in the prevention of post-bronchiolitic wheezing

Comparison: 1 Any inhaled corticosteroid versus placebo

Outcome: 1 Number of infants given or prescribed steroids



*Aerosolized Hypertonic saline (3%)*  
*may improve symptoms and ↓ LOS<sup>6-8</sup>*  
*(Grade B/C evidence)*

- Minimal (4) clinical studies
- Meta-analysis, RCT and quasi-RCT methodology.
- 3% Saline concentration via nebulization three/four times-day (Q6-8 hrs).

**Routine Use of chest physiotherapy**  
**(CPT) should not be used** <sup>1-3, 9</sup>  
**(Grade A/B evidence)**

- No clinical benefit was found with either vibration and percussion techniques.

**Nasopharyngeal suctioning should be used to clear secretions in infants hospitalized with acute bronchiolitis who exhibit respiratory distress due to nasal obstruction <sup>1-3</sup>  
(Grade D evidence – expert opinion).**

- No clinical trials assessing the benefit of nasal suctioning.
- No evidence to support routine “deep” suctioning to the lower pharynx or larynx.



Oxygen is indicated if SpO<sub>2</sub> levels persistently fall < 90% in previously healthy infants <sup>1, 3, 10</sup>

(Grade D evidence – expert opinion).

- Continuous measurement of SpO<sub>2</sub> is not routinely needed and may prolong LOS.
- Intermittent SpO<sub>2</sub> may be sufficient to assess oxygenation status.
- Before delivering O<sub>2</sub> therapy, the infant's nose and mouth should be suctioned.

# The Sandman and Lung Volume

- REM induces airway muscle relaxation
  - Upper airway muscles (genioglossus, geniohyoid, pharyngeal and laryngeal abductors) depressed
  - Reduction in chest wall recoil
  - Diaphragmatic placement, movement
- Reduction in lung volumes
  - $V_t$
  - FRC
- Transient drops in SpO<sub>2</sub>% by up to 4%
- Transient elevations in PaCO<sub>2</sub>

# References

1. American Academy of Pediatrics: Clinical Practice Guidelines for the Diagnosis and Management of Bronchiolitis. *Pediatrics* 2006; 118(4): 1774 - 1793.
2. Scottish Intercollegiate Guidelines Network. Bronchiolitis in Children; A National Clinical Guideline. <http://www.sign.ac.uk/guidelines/fulltext/91/index.html> Guideline 91, pages 1-42, November 2006.
3. Bronchiolitis Guideline Team, Cincinnati Children's Hospital Medical Center: Evidenced based clinical practice guideline for medical management of bronchiolitis in infants 1 year of age or less presenting with a first time episode, <http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/ev-based/bronchiolitis.htm> ,Guideline1, pages 1-13, Aug 15, 2005
4. Gadomski AM, Bhasale AL. Bronchodilators for bronchiolitis. Cochrane Database of Systematic Reviews 2006, Issue 3 Art. No.: CD001266. DOI: 10.1002/14651858. CDO01266.pub.2.
5. Hartling L, Wiebe N, Russell K, Patel H, Klassen TP. Epinephrine for bronchiolitis. Cochrane Database of Systematic Reviews 2004, Issue 1. Art. No.: CDO003123. DOI: 10.1002/14651858.CD003123.pub.2

# References cont.

6. Zhang L, Mendoza-Sassi RA, Wainwright C, Klassen TP. Nebulized hypertonic saline solution for acute bronchiolitis in infants. *Cochrane Database of Systematic Reviews* 2008, Issue 4, Art. No.: CD0064548. DOI: 10.1002/14651858.CD006458.pub2.
7. Kuzik BA, Al Qadhi, SA, Kent S, Flavin MP, Hopman W, Hotte S, Gander S. Nebulized hypertonic saline in the treatment of viral bronchiolitis in infants. *J Pediatr* 2007;151:266 -70.
8. Tal G, Cesar K, Oron A, Houry S, Ballin A, Mandelberg A. Hypertonic saline/epinephrine treatment in hospitalized infants with viral bronchiolitis reduces hospitalization stay: 2 years experience. *IMAJ* 2006; 8:169-173.
9. Perrotta C, Ortiz Z, Roque M. Chest physiotherapy for acute bronchiolitis in paediatric patients between 0 and 24 months old. *Cochrane Database of Systematic Reviews* 2007, Issue 1. Art. No.: CD004873. DOI: 10.1002/14651858.CD004873.pub3.
10. Schroeder AR, Marmor AK, Pantell RH, Newman TB. Impact of Pulse Oximetry and Oxygen Therapy on Length of Stay in Bronchiolitis Hospitalizations. *Arch Pediatr Adolesc Med* 2004;158:527-530.