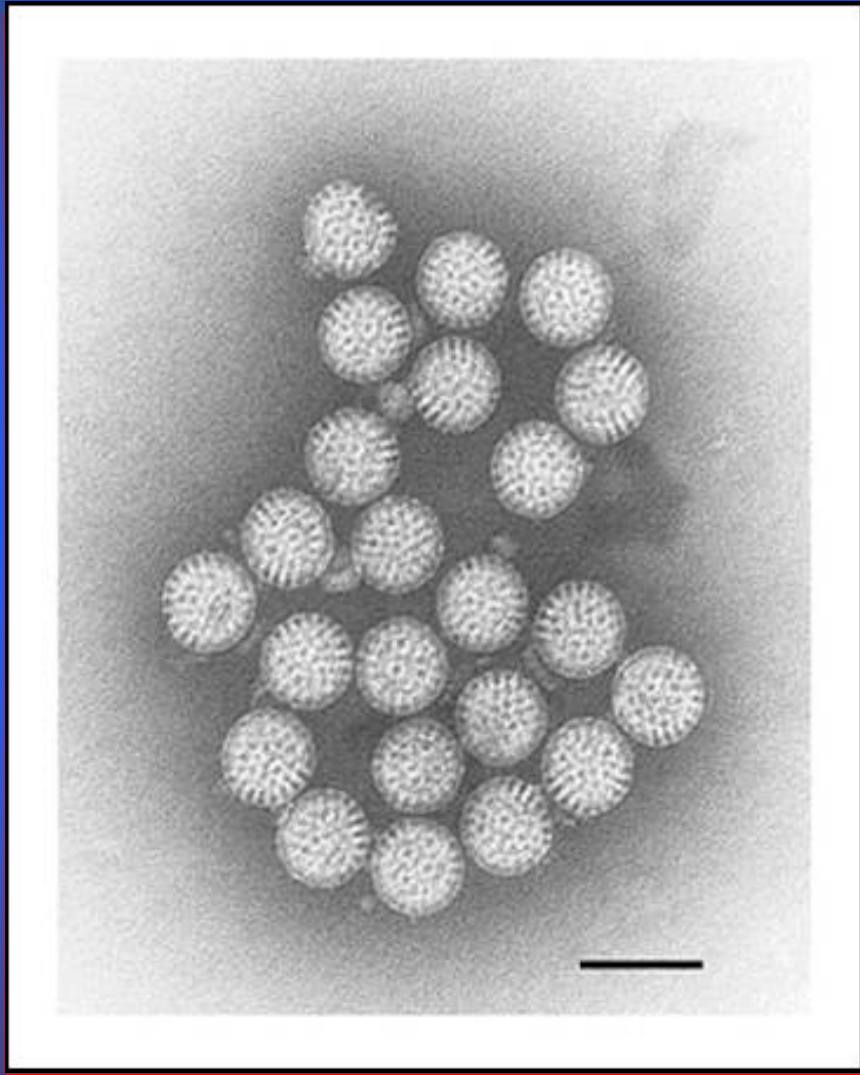


Long-term Impact of Rotavirus Vaccination in the United States



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US Centers for Disease Control and
Prevention

12th International Rotavirus Symposium
September 7, 2016

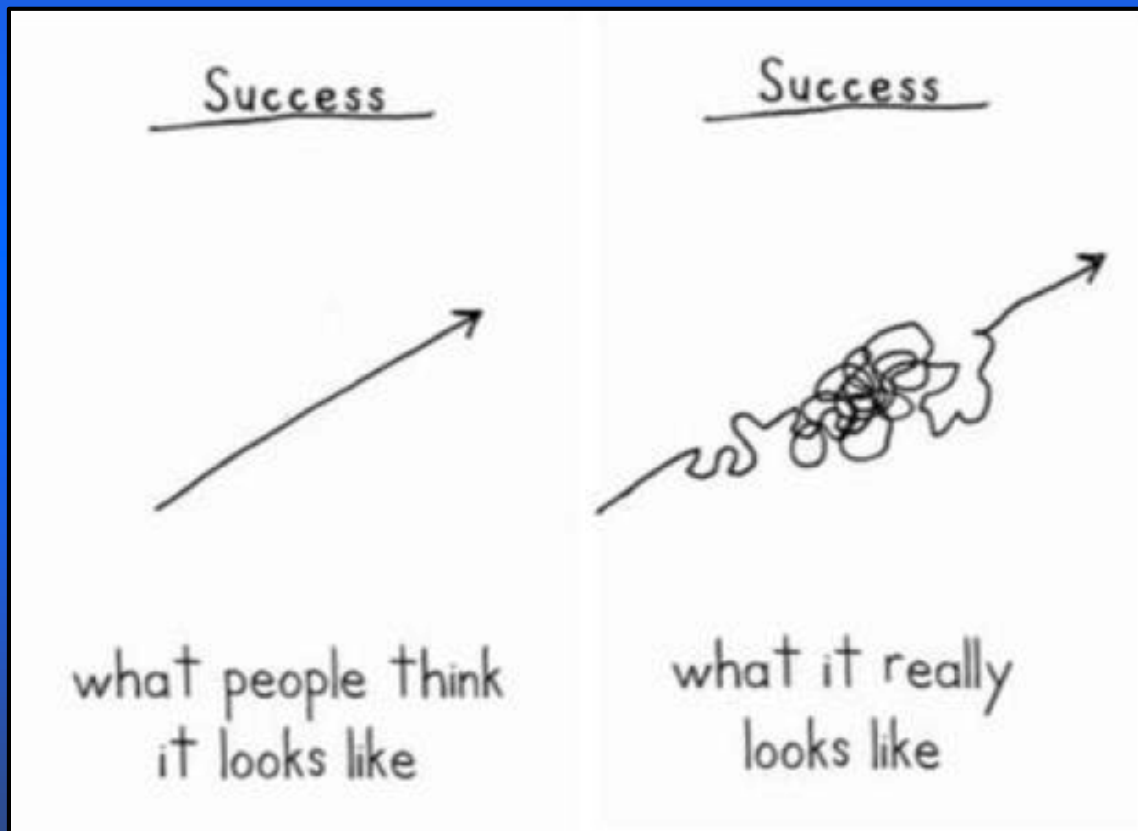


Today's presentation

- Direct rotavirus vaccine impacts among US children
 - Passive Surveillance:
 - National Respiratory and Enteric Virus Surveillance System (NREVSS)
 - Active Surveillance:
 - New Vaccine Surveillance Network (NVSN)
 - Administrative data surveillance:
 - State Inpatient Databases, State Emergency Department Databases, MarketScan
- Unexpected benefits from rotavirus vaccines
- Vaccine effectiveness (VE) results for both licensed vaccines in the United States
- Rotavirus genotype surveillance



Now with ~10 years of post-licensure observation in the US we have a very good idea of how well rotavirus vaccines perform

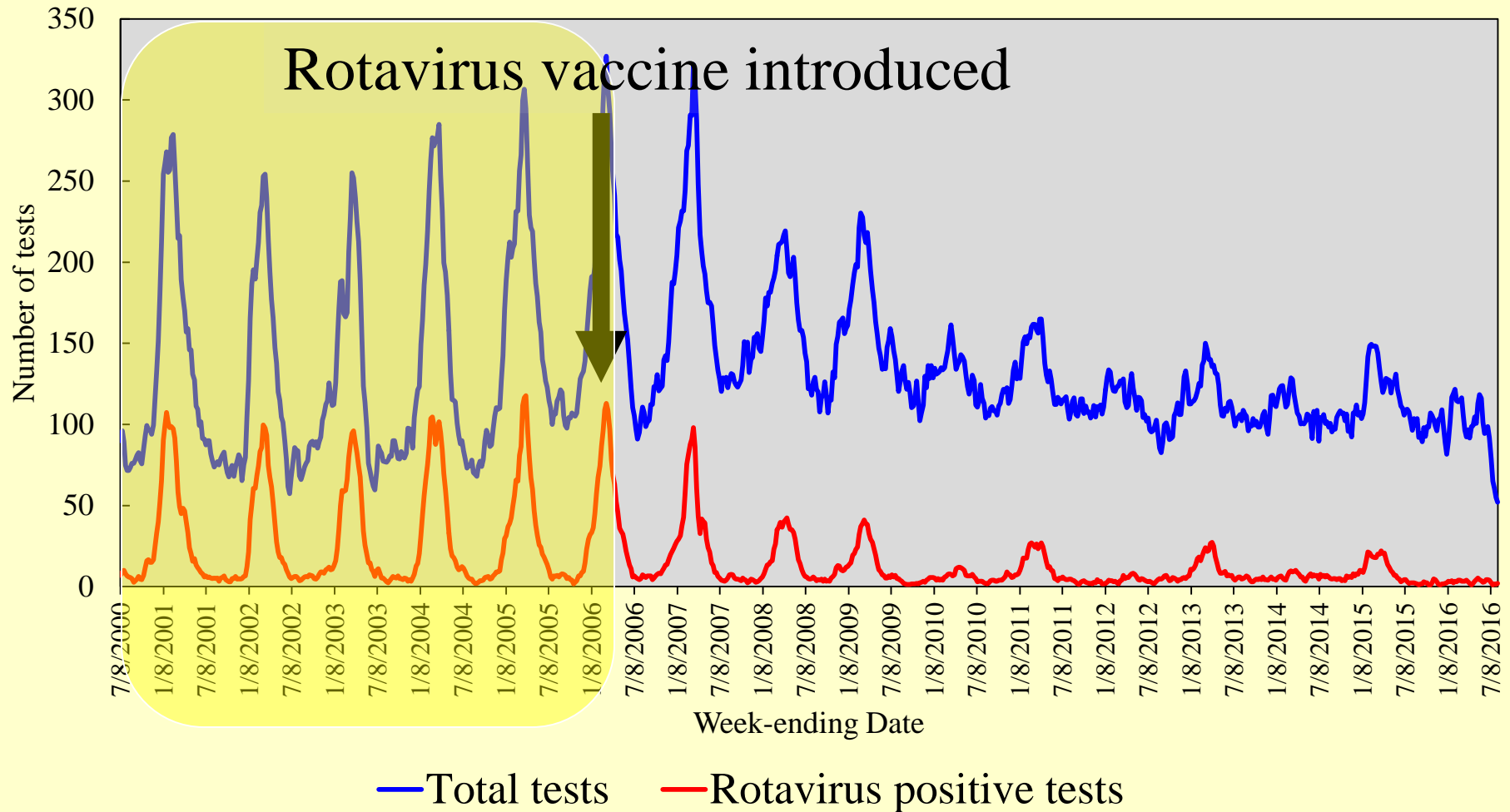


Direct rotavirus vaccine impacts among US children



Passive laboratory surveillance:

Proportion of submitted specimens testing rotavirus + NREVSS 2000-2016

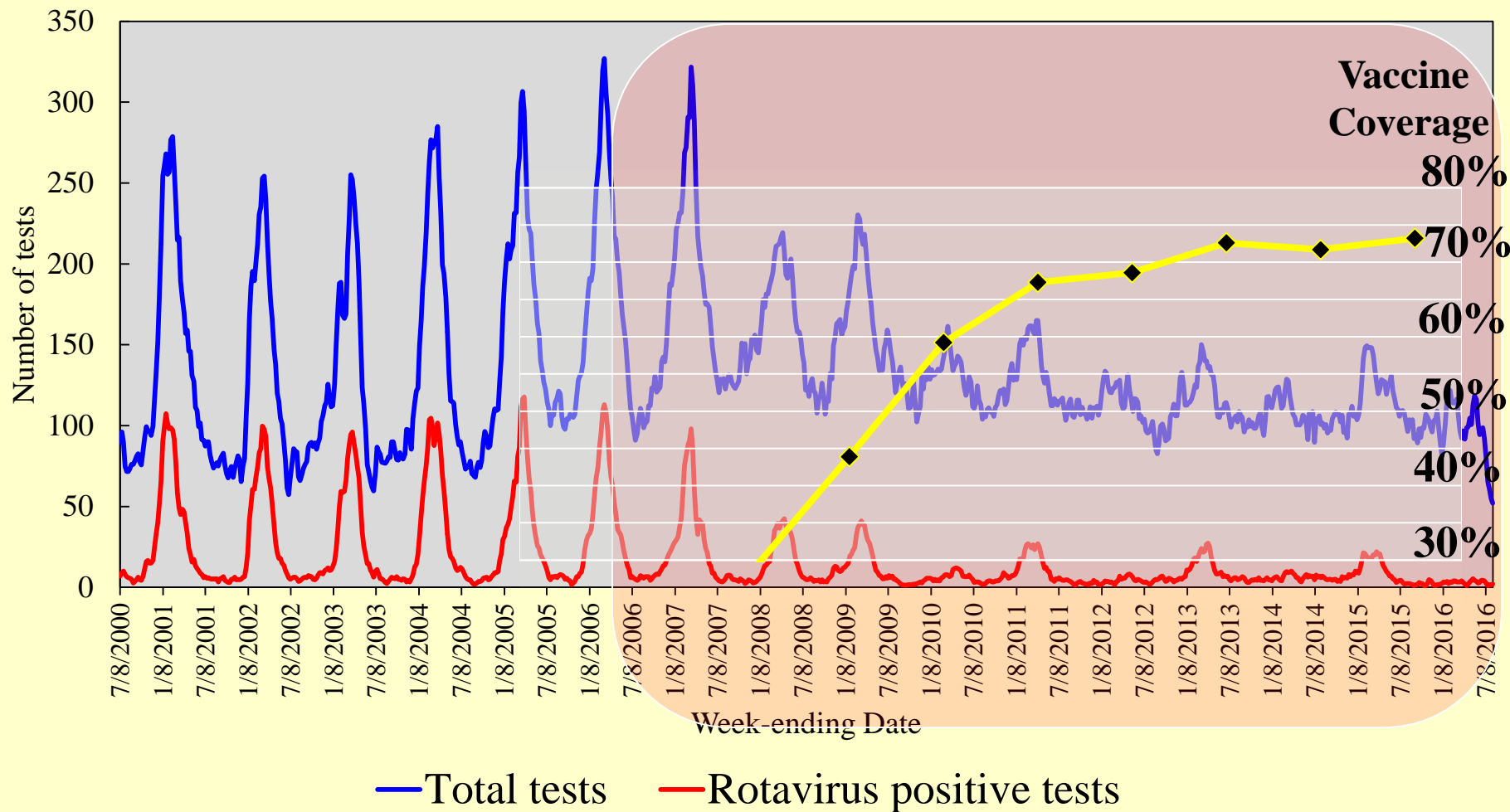


— Total tests — Rotavirus positive tests

Passive laboratory surveillance:

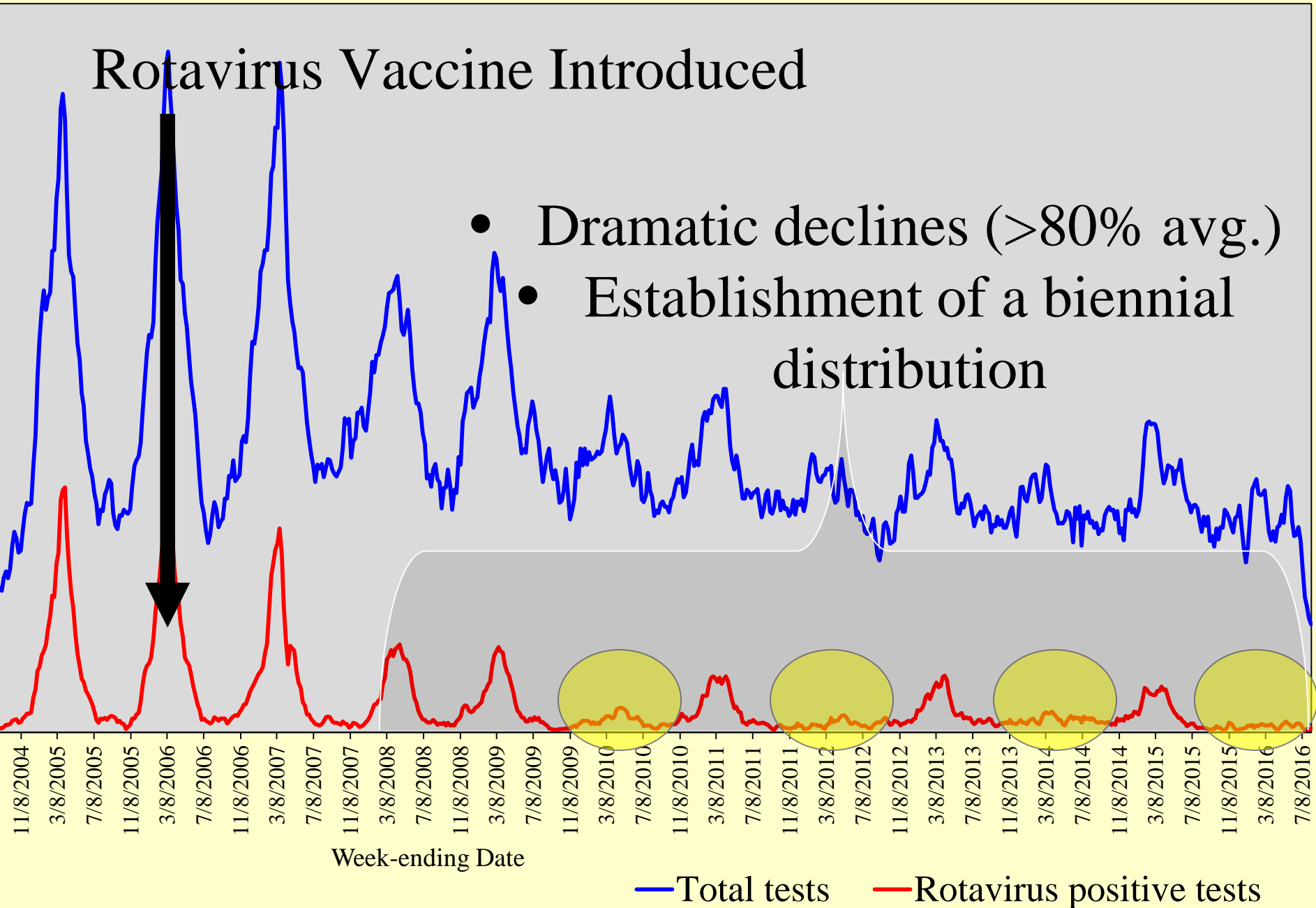
Proportion of submitted specimens testing rotavirus +

* Juxtaposed with rotavirus vaccine coverage *



Rotavirus Vaccine Introduced

- Dramatic declines ($>80\%$ avg.)
- Establishment of a biennial distribution



Week-ending Date

— Total tests — Rotavirus positive tests

unpublished



Active, population-based surveillance: New Vaccine Surveillance Network (NVSN) 2006-2016

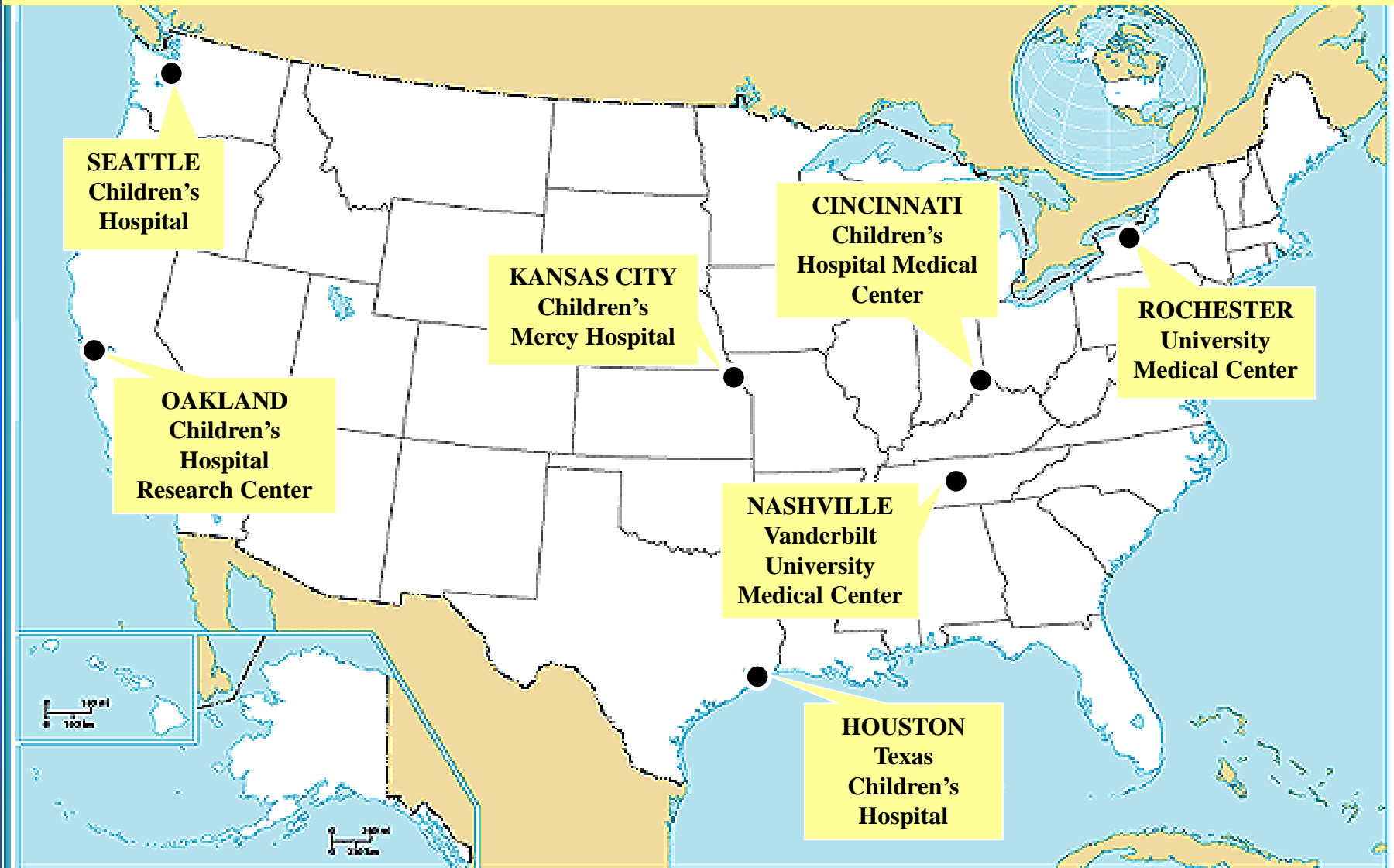
Children with diarrhea/vomiting actively enrolled at hospitals and emergency departments located throughout the US

Data collected:

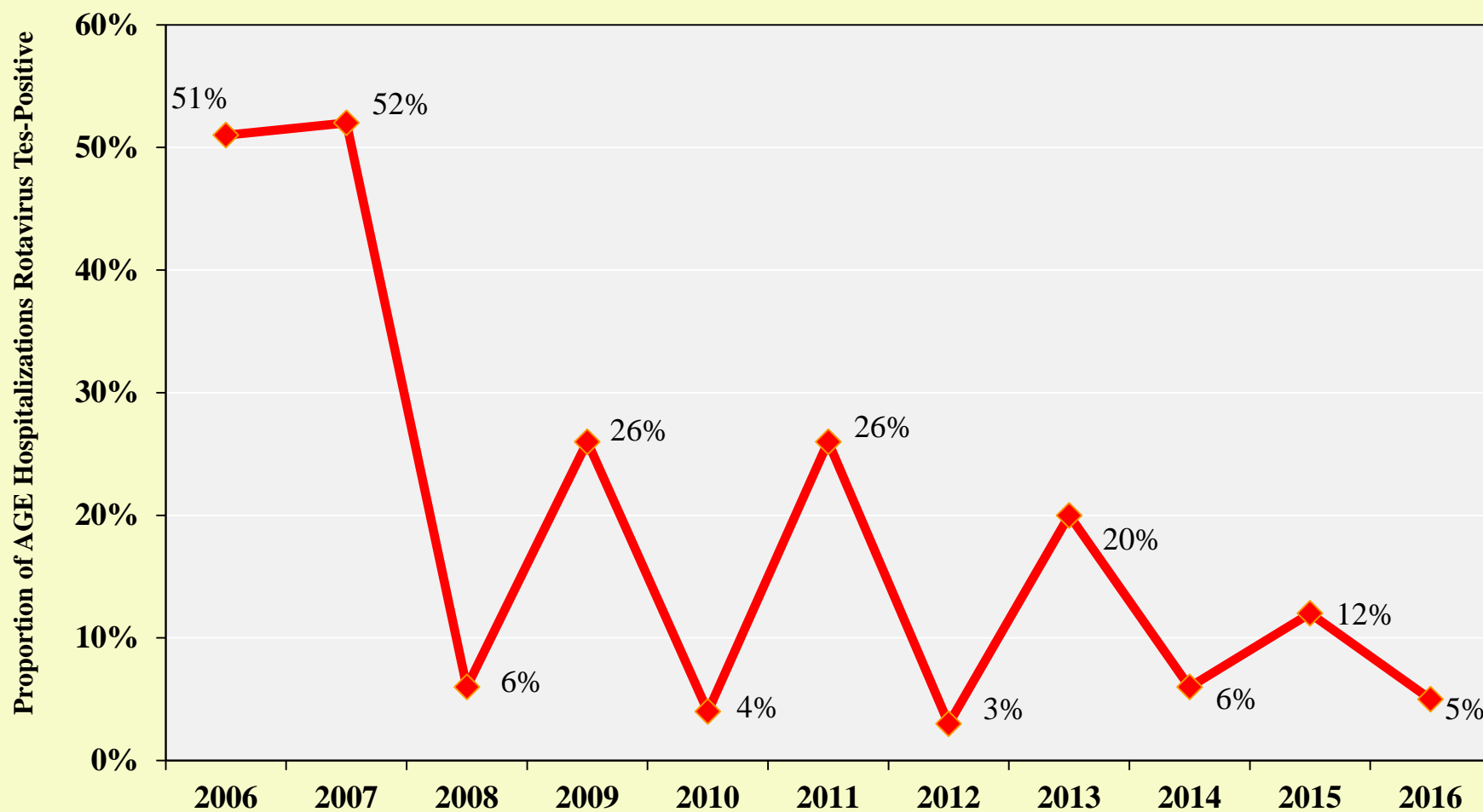
- Epidemiological (parental interviews)
- Clinical (medical charts)
- Vaccinations (verified from provider)
- Stool specimens (enzyme immunoassay, genotyping)



New Vaccine Surveillance Network (NVSN)

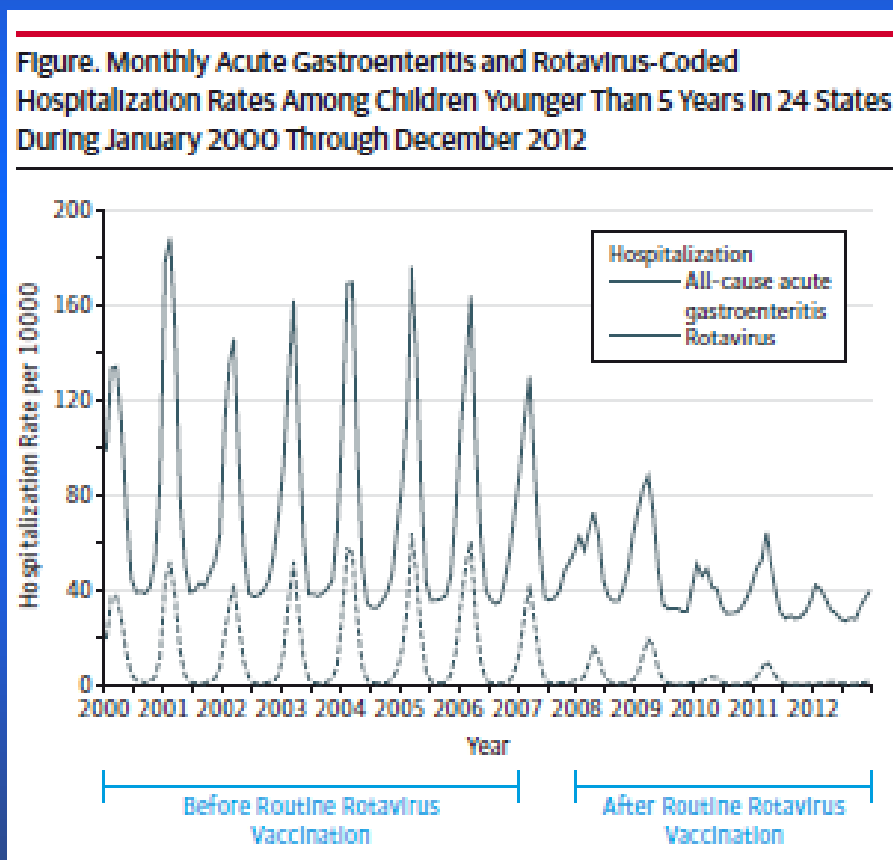


Proportion of children <3 years old admitted to hospitals with acute gastroenteritis and confirmed rotavirus positive, NVSN



Administrative Databases: Hospital rates among children <5 years old

- Represents 74% of US hospitalizations for children <5 years old, in 24 states
- 63-94% decline in rotavirus-coded hospitalizations in post-vaccine era (2008-2012) compared with pre-vaccine era (2000-2006)

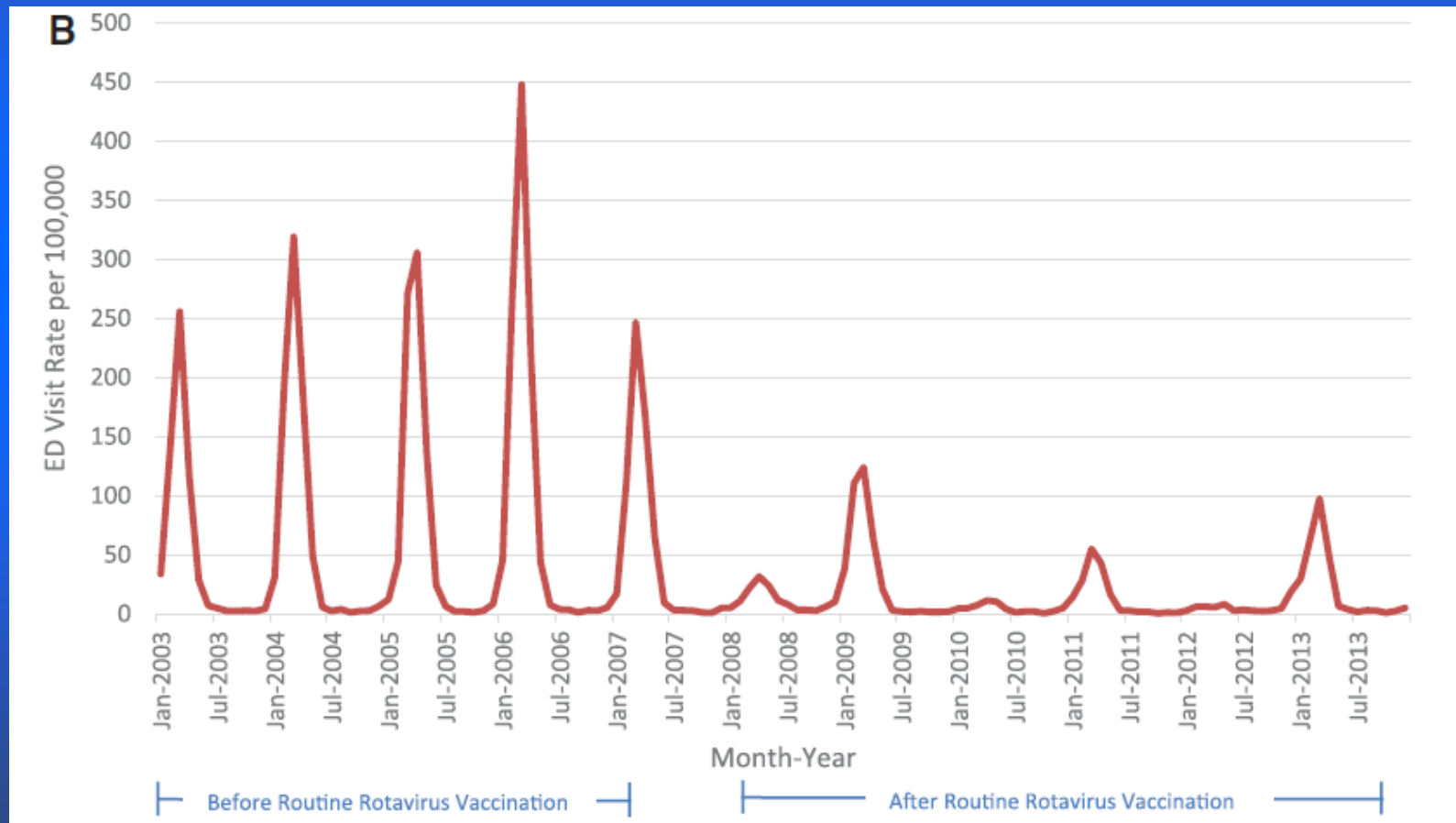


State Inpatient Databases
Leshem et al., *JAMA* 2015

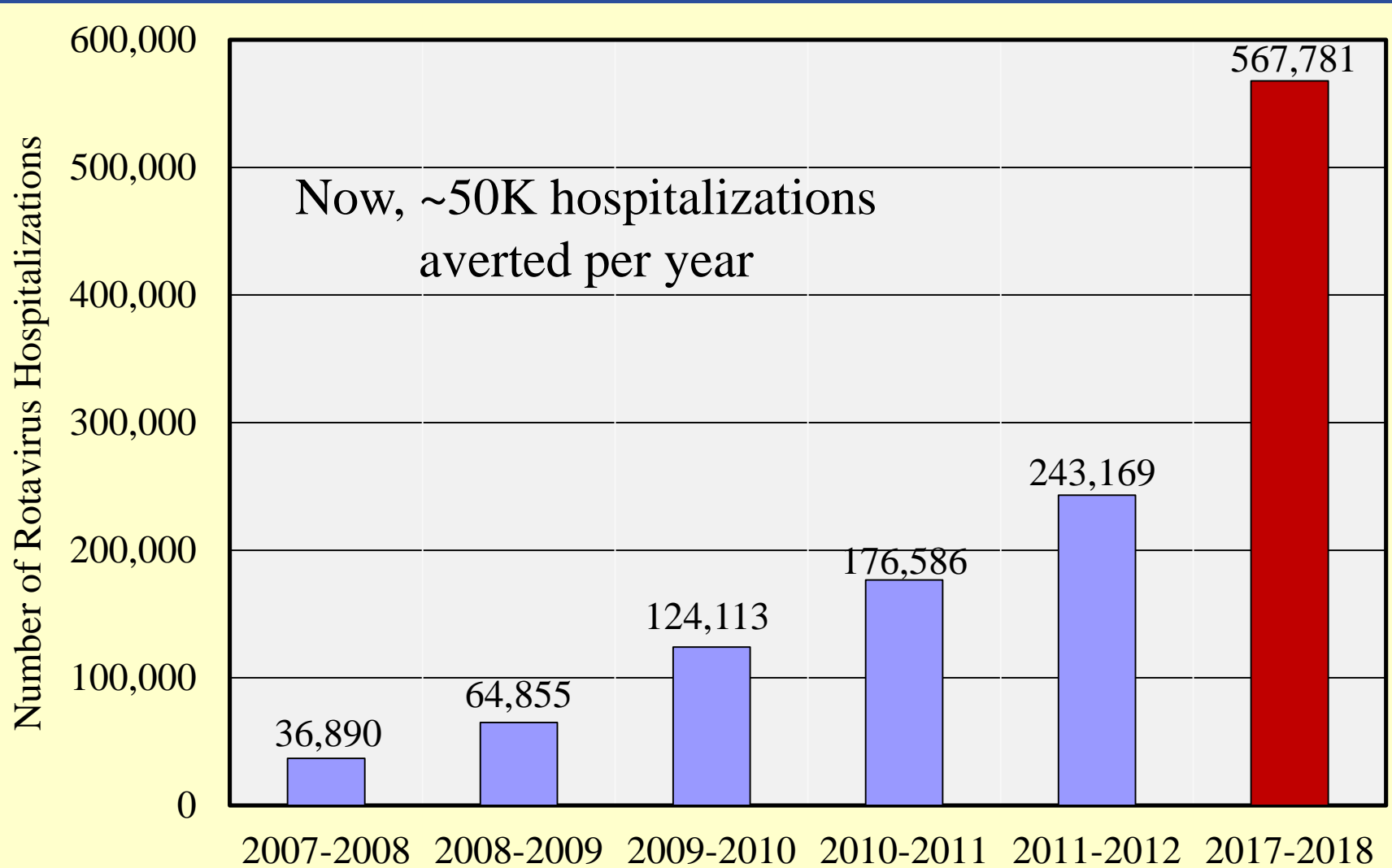


Administrative Databases: Emergency Department visit rates among children <5 years old

- Represents 13,350 US emergency department visits for children <5 years old, in 10 states
- Large declines (but slightly less dramatic) were observed in rotavirus-coded emergency department visits in post-vaccine era (2008-2013) compared with pre-vaccine era (2003-2006)



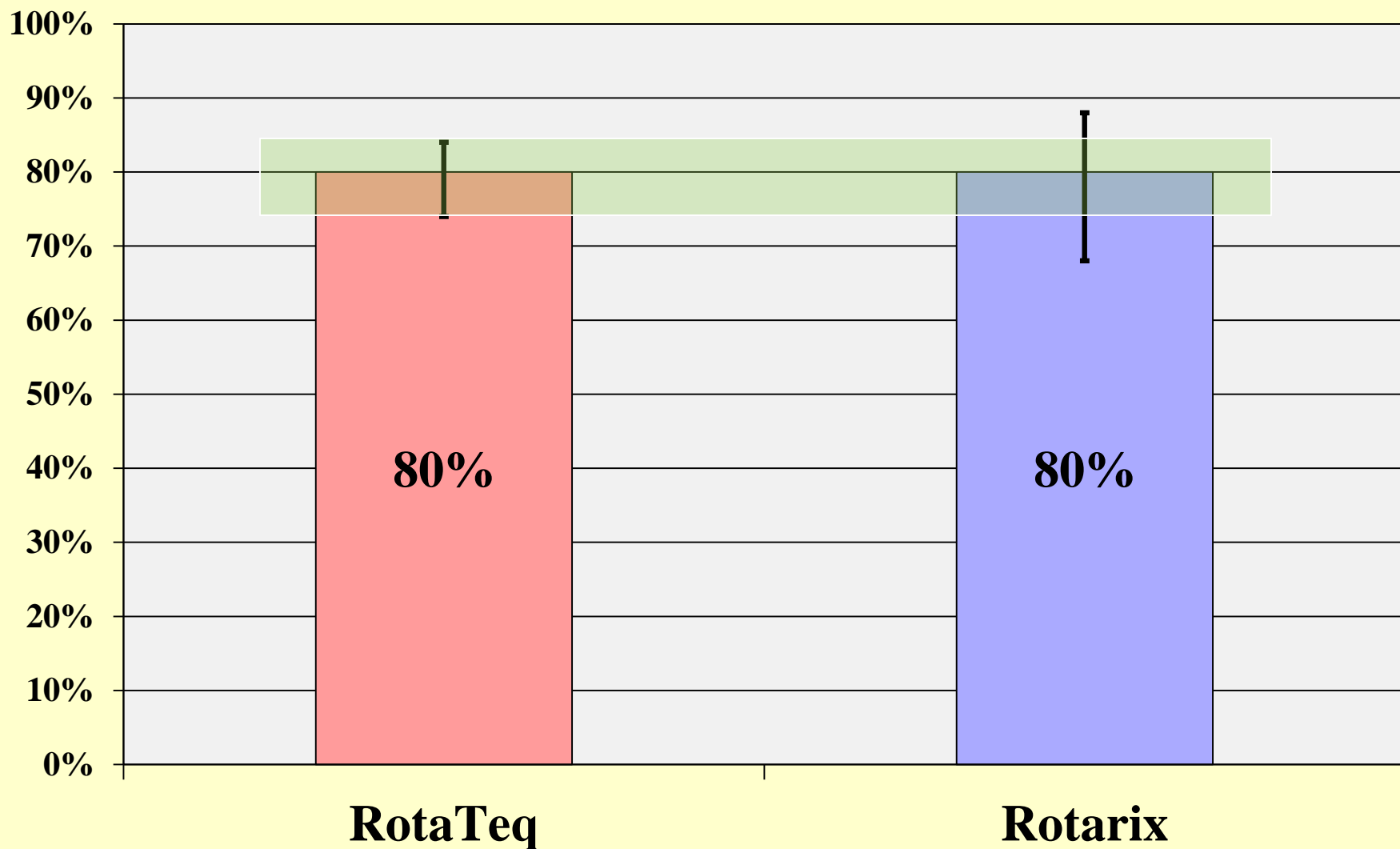
Administrative Databases: Cumulative Number of Rotavirus Hospitalizations Estimated to be Prevented in US Among Children <5 years old, MarketScan



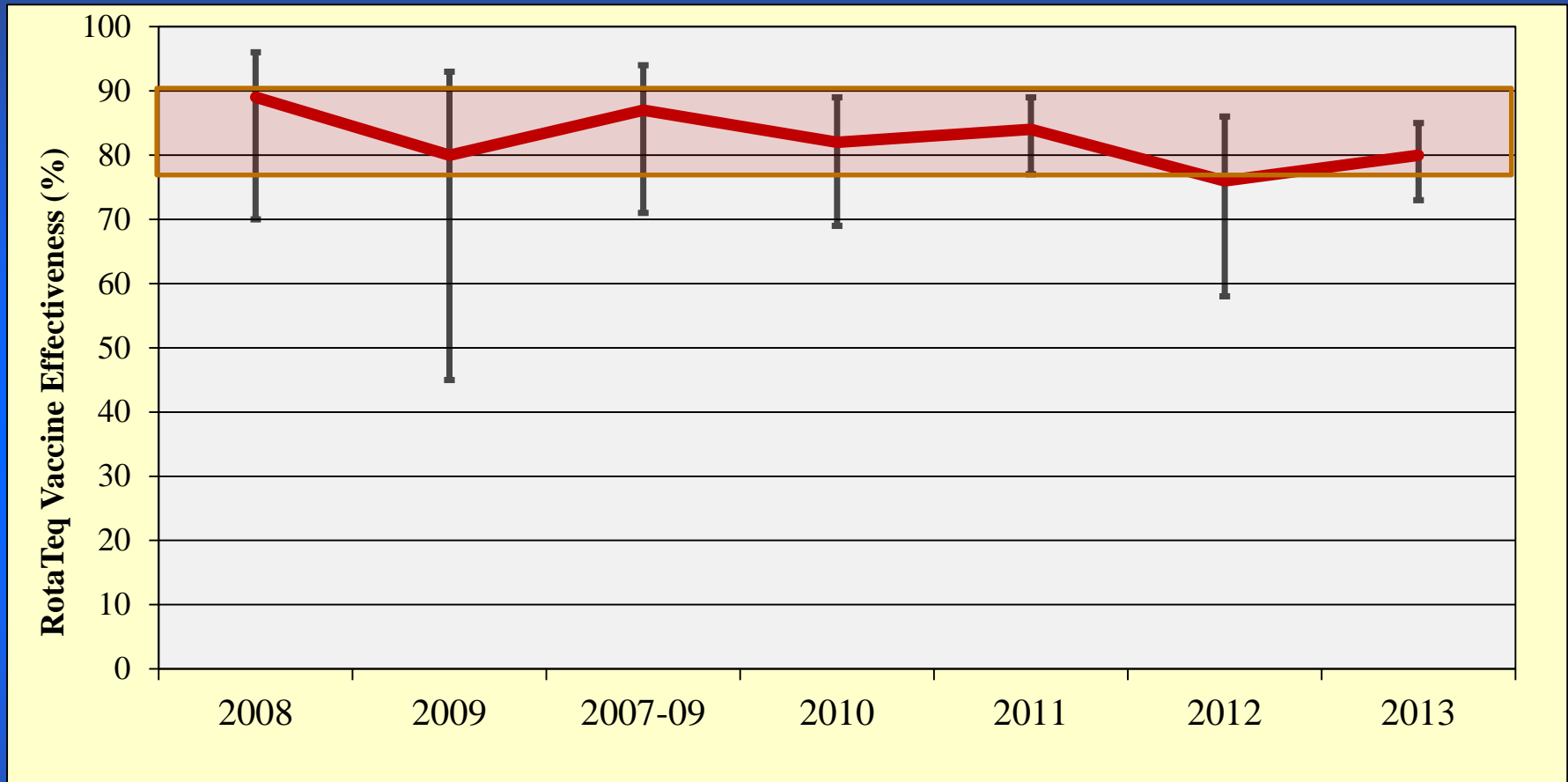
US Vaccine Effectiveness Results



Full course VE and 95% CI for RotaTeq and Rotarix NVSN



Comparison of US rotavirus vaccine effectiveness results: Data years 2007-2013 (RotaTeq only)



(2008) Boom JA, et al. *Pediatrics* 2010

(2009) Boom JA, et al. *Pediatr Infect Dis J* 2010

(2007-09) Staat MA, et al. *Pediatrics* 2011

(2010) Payne DC, et al. *Clin Infect Dis* 2013

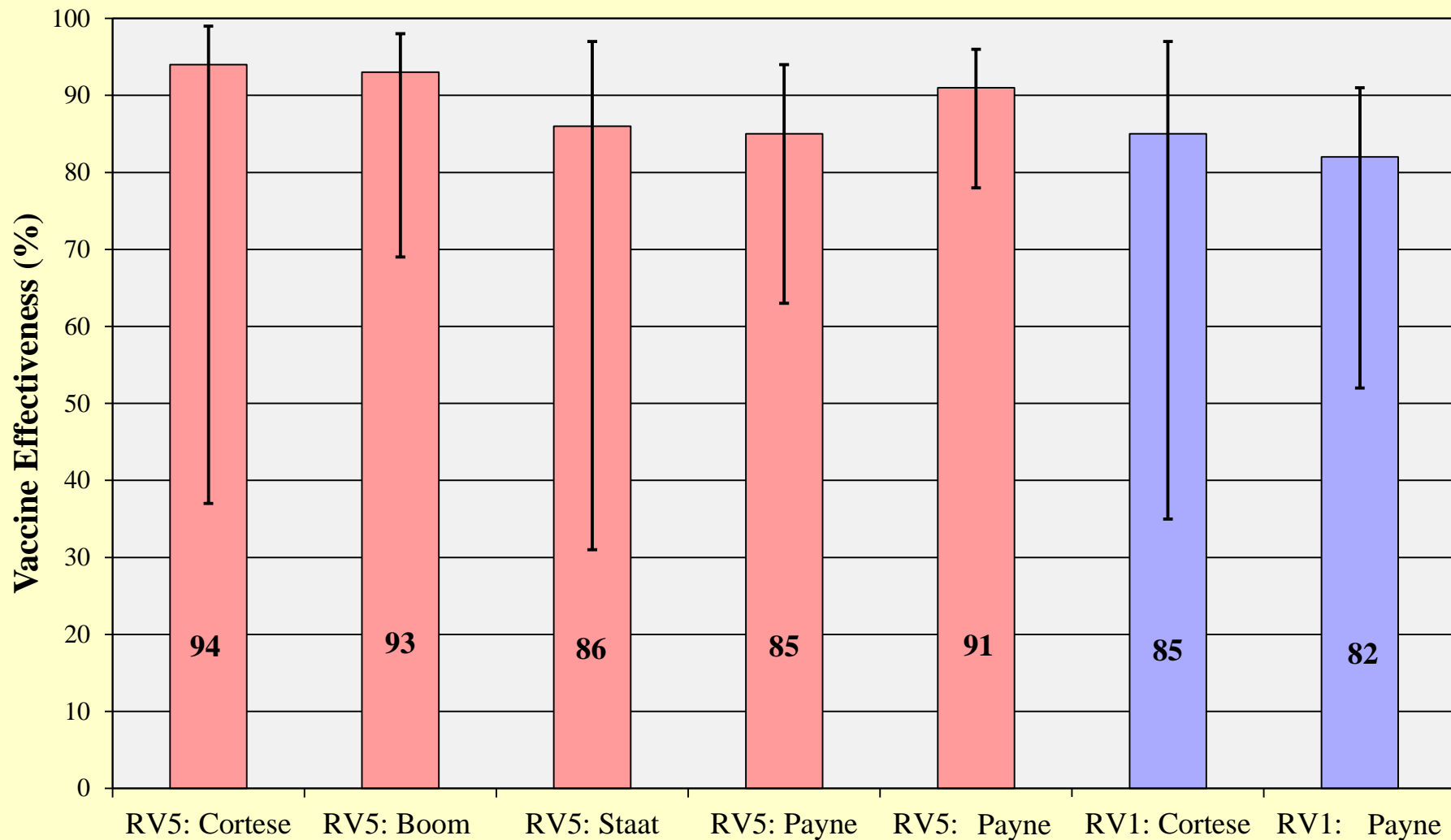
(2011) Payne DC, et al. *Clin Infect Dis* 2013

(2012) Payne DC, et al. *Clin Infect Dis* 2015

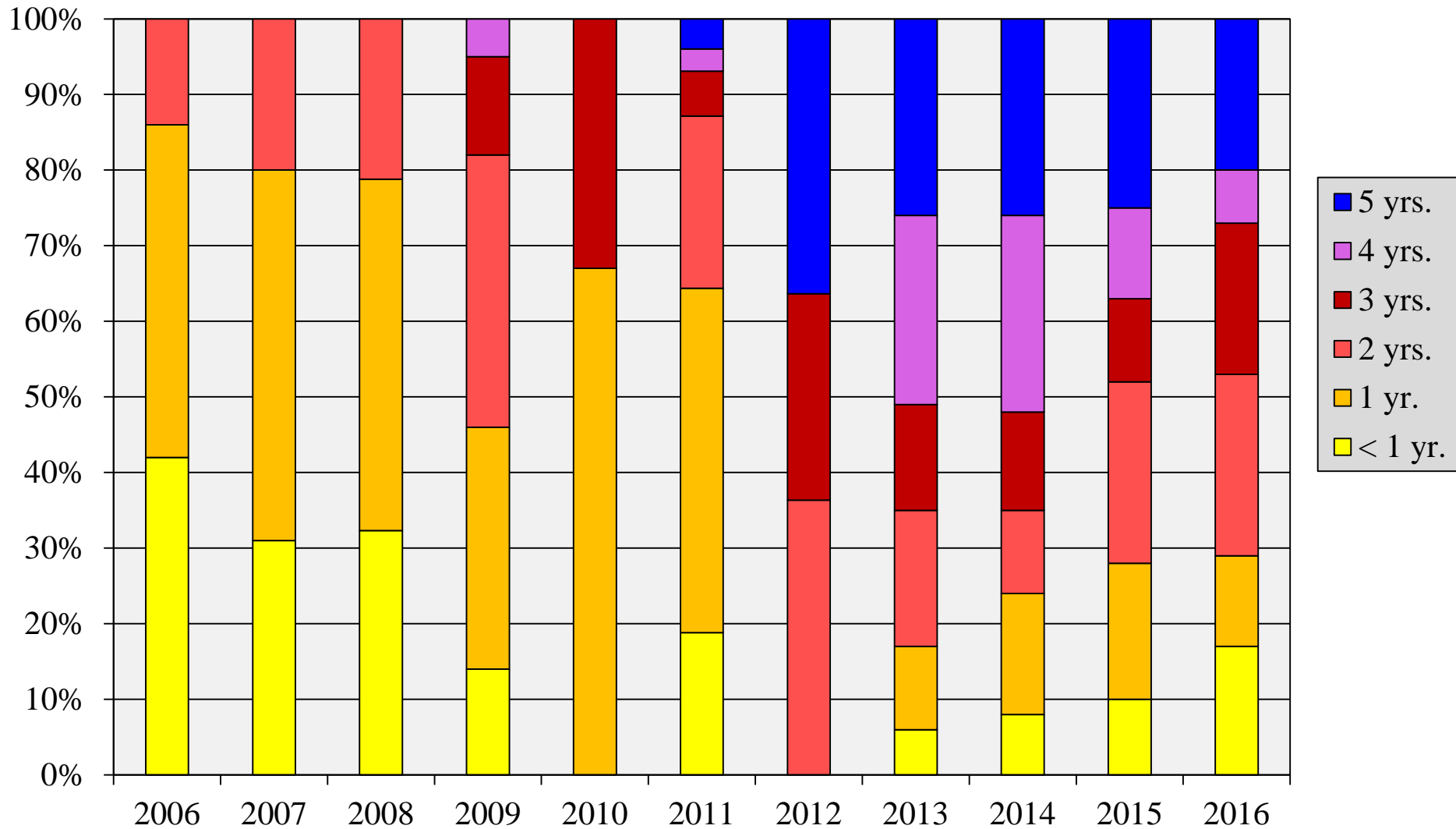
(2013) Payne DC, et al. *Clin Infect Dis* 2015



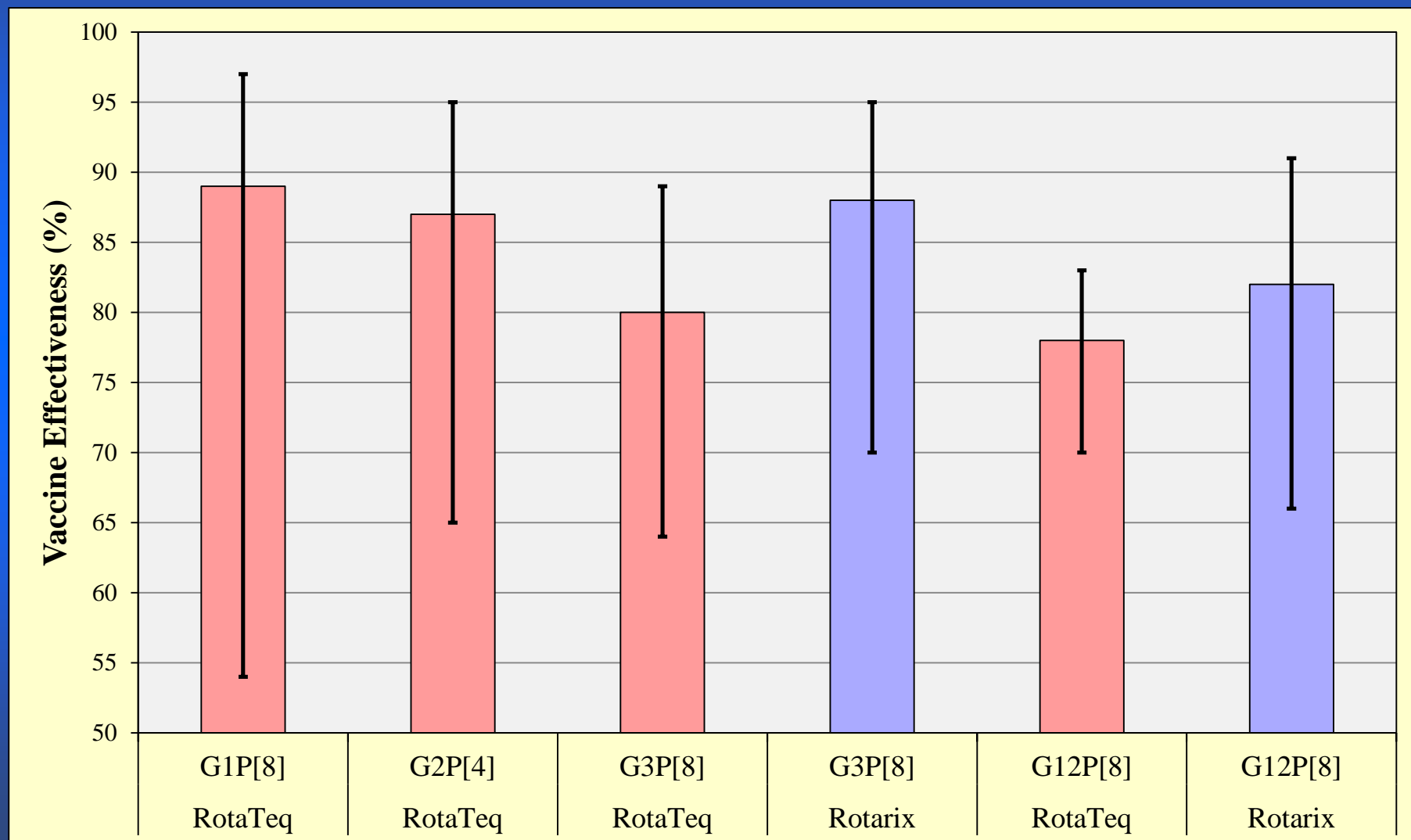
Rotavirus vaccine effectiveness (%) study comparisons: First year of life



Age distributions for hospital & emergency department visits with lab confirmed rotavirus gastroenteritis – NVSN



Full course VE and 95% CI by predominant rotavirus genotype for RotaTeq and Rotarix, NVSN, 2012-2013



Unexpected benefits from rotavirus vaccines



Indirect benefits (i.e. “herd immunity”) from rotavirus vaccine:

- Clinical vaccine trials did not evaluate herd immunity
- Large reductions in rotavirus hospitalizations seen even among children too young to have been vaccinated
- Not just among older children, but also adults (parents/caretakers)



Rotavirus vaccine avoids complications from rotavirus infections (seizures)

Protective Association Between Rotavirus Vaccination and Childhood Seizures in the Year Following Vaccination in US Children

Daniel C. Payne,¹ James Baggs,² Danielle M. Zerr,^{3,4} Nicola P. Klein,⁵ Katherine Yih,⁶ Jason Glanz,⁷ Aaron T. Curns,¹ Eric Weintraub,⁸ and Umesh D. Parashar¹

¹Epidemiology Branch, Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, and ²Prevention and Response Branch, Division of Healthcare Quality Promotion, National Center for Zoonotic and Emerging Infectious Diseases, Centers for Disease Control and Prevention, Atlanta, Georgia; ³Department of Pediatrics, University of Washington, Seattle; ⁴Seattle Children's Research Institute, Washington; ⁵Kaiser Permanente Vaccine Study Center, Kaiser Permanente, Oakland, California; ⁶Department of Population Medicine, Harvard Medical School and Harvard Pilgrim Health Care Institute, Boston, Massachusetts; ⁷Institute for Health Research, Kaiser Permanente Colorado, Denver; and ⁸Immunization Safety Office, Division of Healthcare Quality Promotion, National Center for Zoonotic and Emerging Infectious Diseases, Centers for Disease Control and Prevention, Atlanta, Georgia

Payne DC, et al. *Clin Infect Dis* 2013

Rotavirus vaccinated children had 18-21% reduction in risk of seizures requiring hospitalization or ED care compared with unvaccinated children during the year following vaccination

Australia: 36-38% reduction in ED/hosp. febrile seizures up to 2 years post-vaccination (Sheridan SL, et al. *JPIDS* 2016)

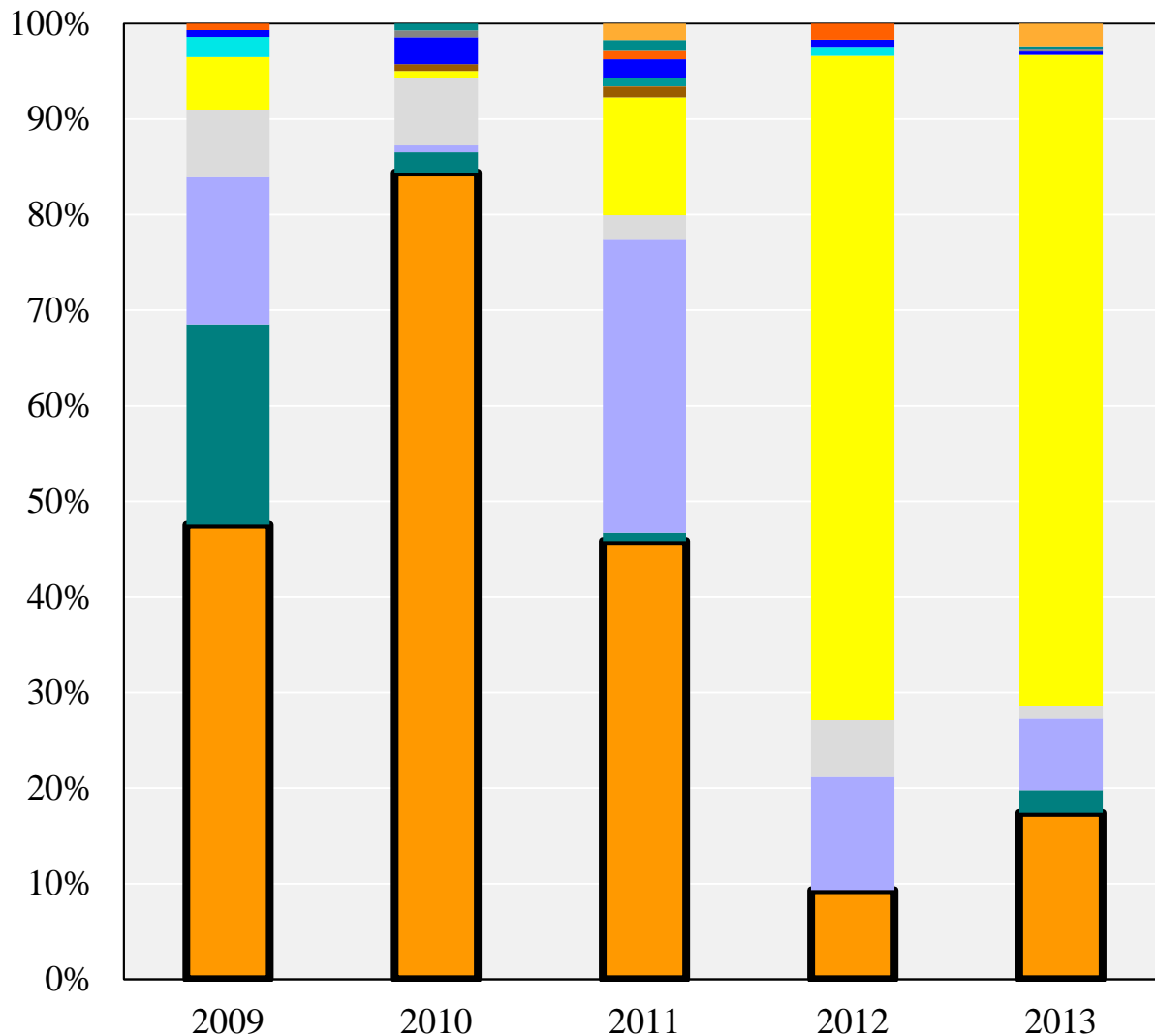
Spain: 16-34% reductions in hospitalized seizures post-vaccination (Pardo-Seco J, et al. *PIDJ* 2015)



US Rotavirus Genotype Surveillance



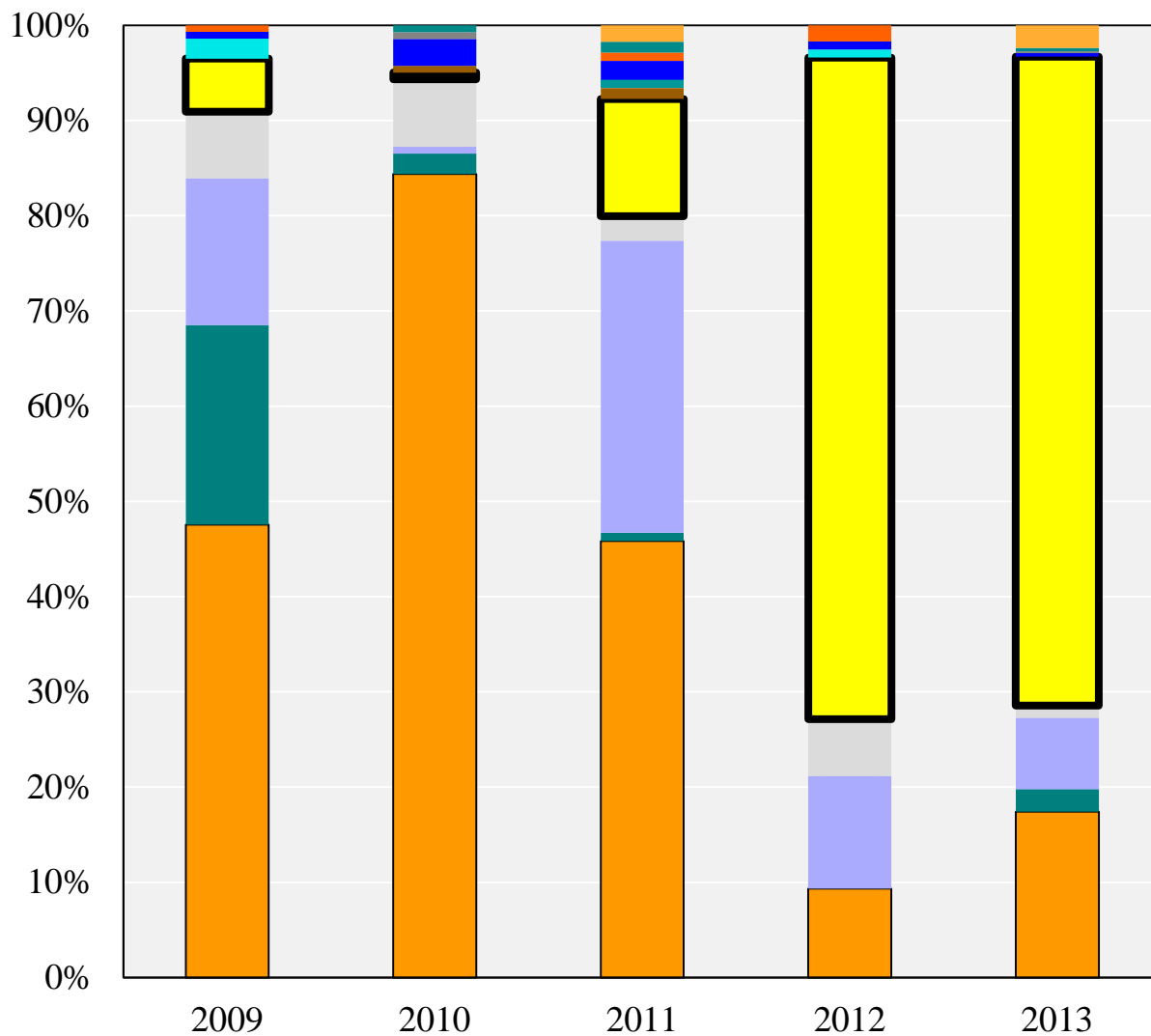
Rotavirus Genotype Distribution in the US 2009-2013



G3 P[8]

Bowen M, et al. *JID* 2016





Rotavirus Genotype Distribution in the US 2009-2013

G12 P[8]

Bowen M, et al. *JID* 2016



Conclusions

The following results are consistent across surveillance platforms and methodologies:

- ✓ Dramatic and consistent post-licensure decreases in medically-attended rotavirus infections
 - ✓ Consistently good VE for both vaccines
 - ✓ A range of expected and unexpected benefits
 - ✓ Broad protection against heterologous strains
-



Thank you

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