

Monitoring For Rotavirus Serotypes In The Americas

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



PAHO/WHO Collaborating
Center for Rotavirus and Other
Viral Agents of Gastroenteritis

Introduction

- Rationale for rotavirus strain surveillance
- Introduction to serotypes
- Surveillance in the Americas
- Conclusions and future directions

Rotavirus Strain Surveillance in Vaccine Era

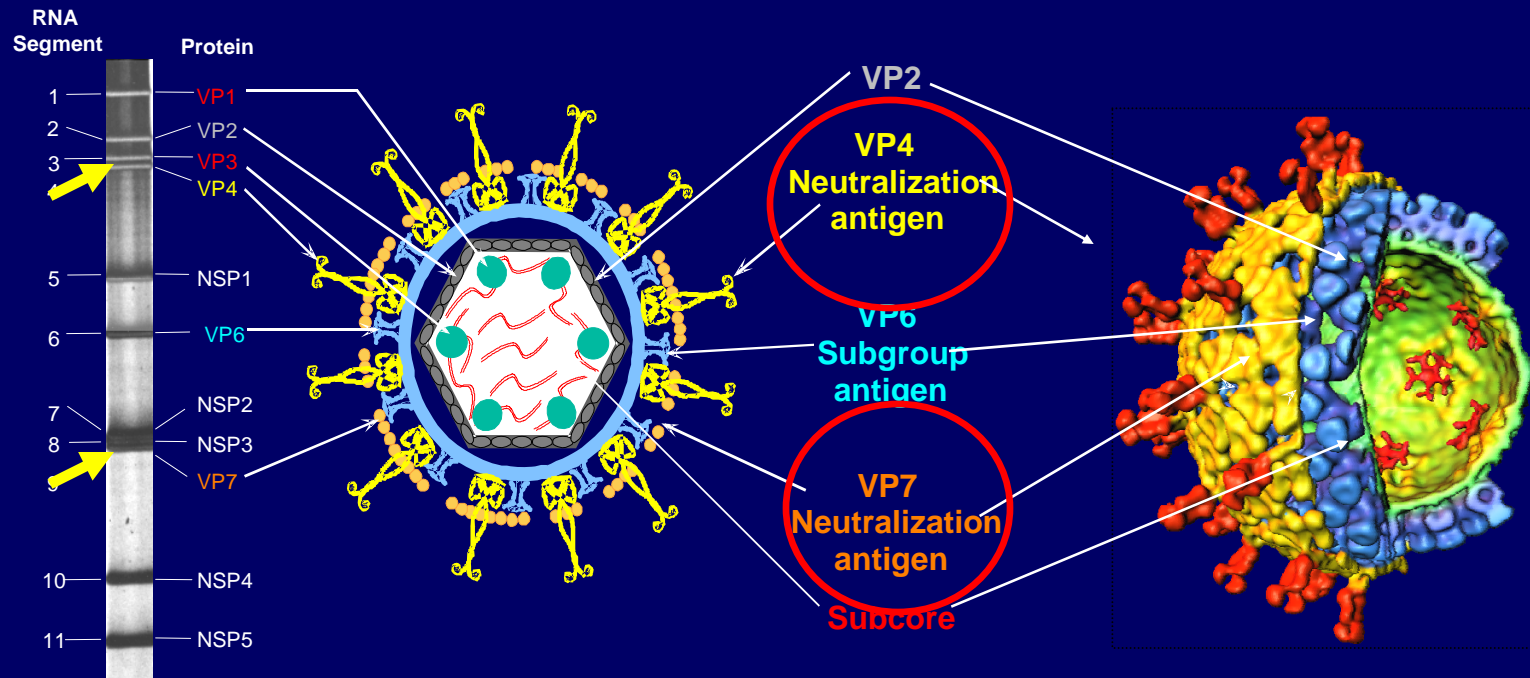
Vaccine Research

- Impact of vaccines on strain prevalence and evolution
 - Will immune selection over time result in emergence of strains that escape protection?
- Vaccine stability
 - Reversion to virulence
 - Transmission, gastroenteritis in unvaccinated
 - Reassortment with wild-type rotavirus

Virus Evolution

- origin of new strains through reassortment
 - Role of animal rotaviruses
- genetic variation in RV genes

Rotavirus Serotype Classification



Provided by MK Estes

P type
G type

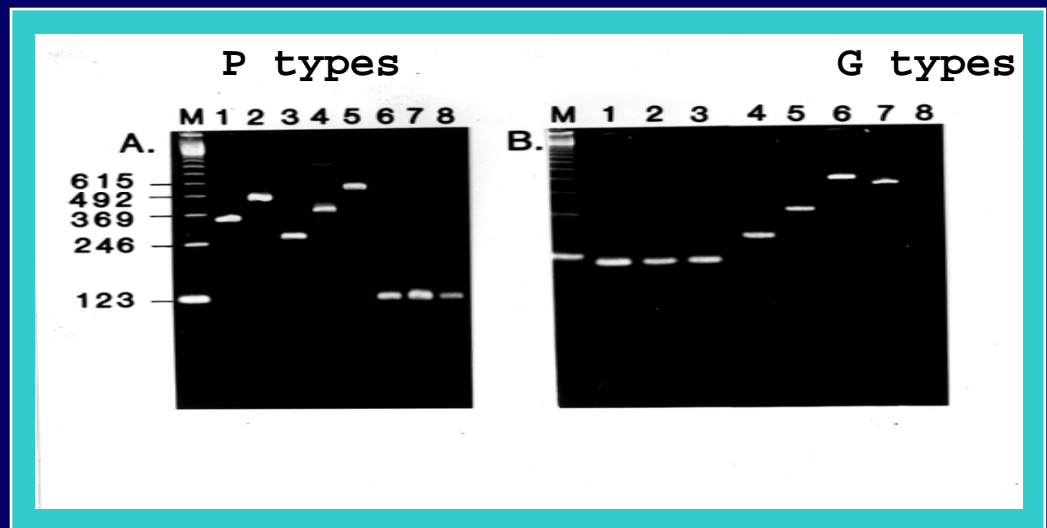
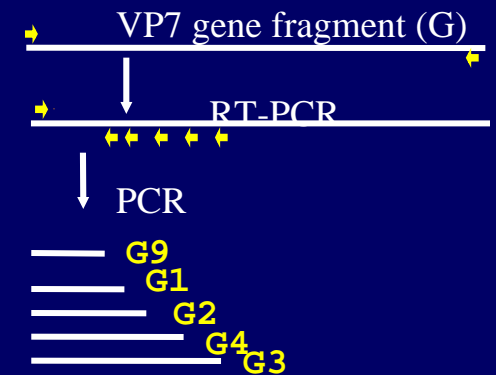
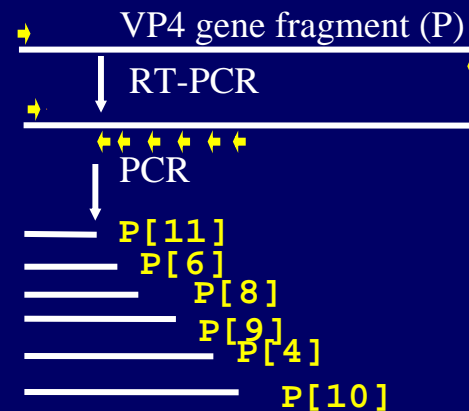


Methods: Processing Stool Samples for Strain Surveillance

Rotavirus Detection
(e.g., IDEIA (Oxoid [Ely]))

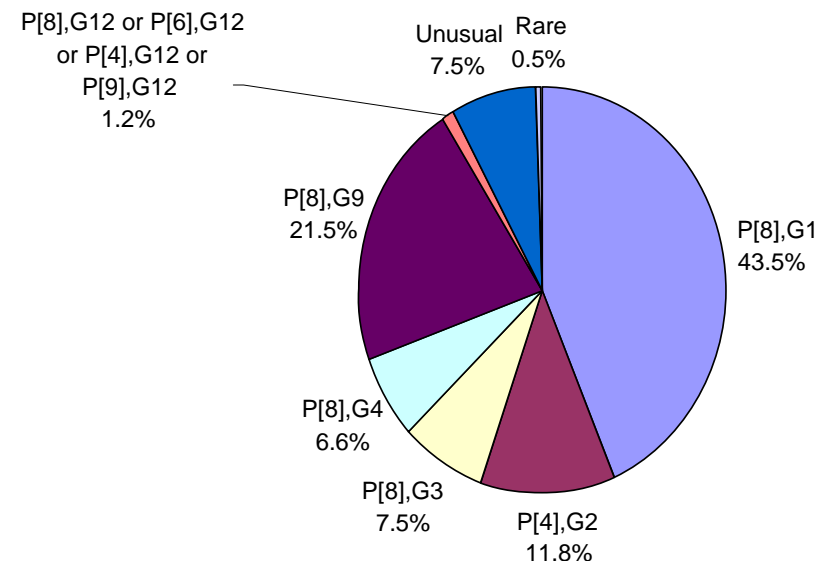
Genotype positives
using hemi-nested
RT-PCR

Identify genotypes
by electrophoresis



Human Rotavirus Serotypes and Genotypes

- Four historically common strains globally (>30 yrs)
- P[8]G9 emerged since 1995
- Emerged since 2000



Data of K Banyai, PG types 2004-2008

Uncommon rotavirus genotypes: >20 G types, >30 P types and ~80 G-P combinations in humans

Uncommon G & P types

G5-P[6], [8]

G6-P[6], [9] & [14]

G8-P[1], [14]

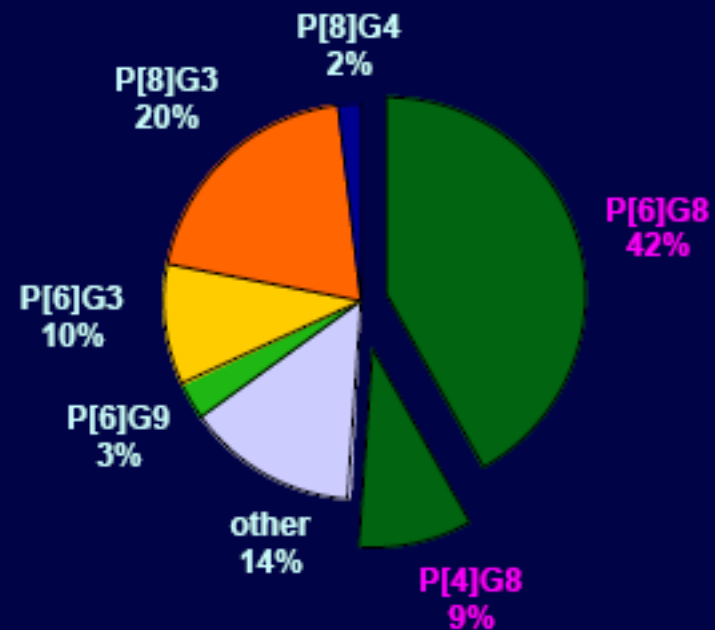
G10-P[9], [11] & [14]

G12-P[6], [8]

G3-P[11], [14]

Occasionally some are regionally important

Malawi
serotype G8 (51%)



Adapted from Kirkwood et al

Rotavirus Serotypes: Lessons learned from surveillance

- Only few globally common strains
- Periodic emerging strains
- Huge diversity
- Large temporal and geographic variation

Surveillance in the United States

- National Rotavirus Strain Surveillance System (NRSSS)
- New Vaccine Surveillance Network (NVSN)

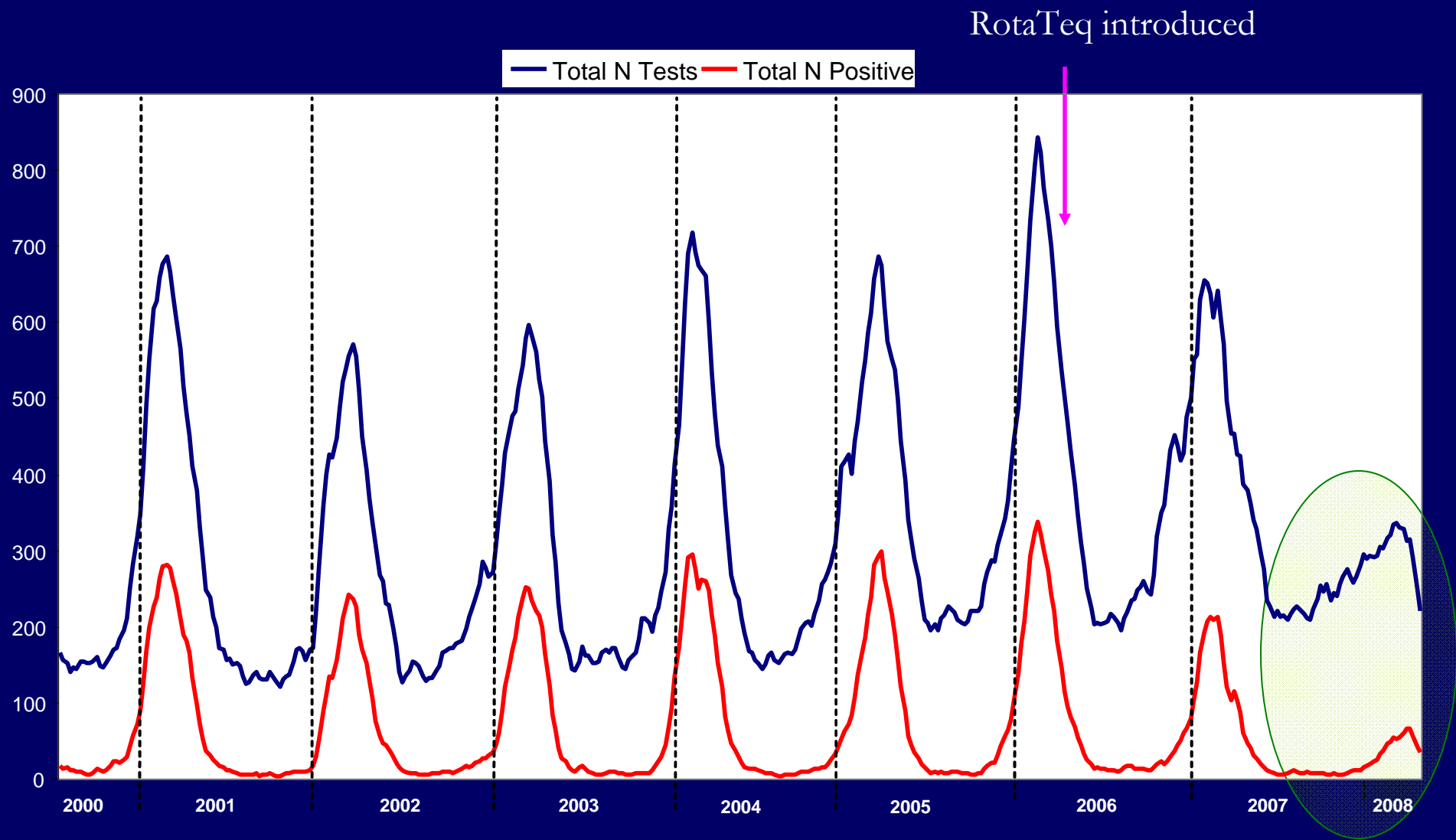


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National Rotavirus Strain Surveillance System (United States, 1996-2008)

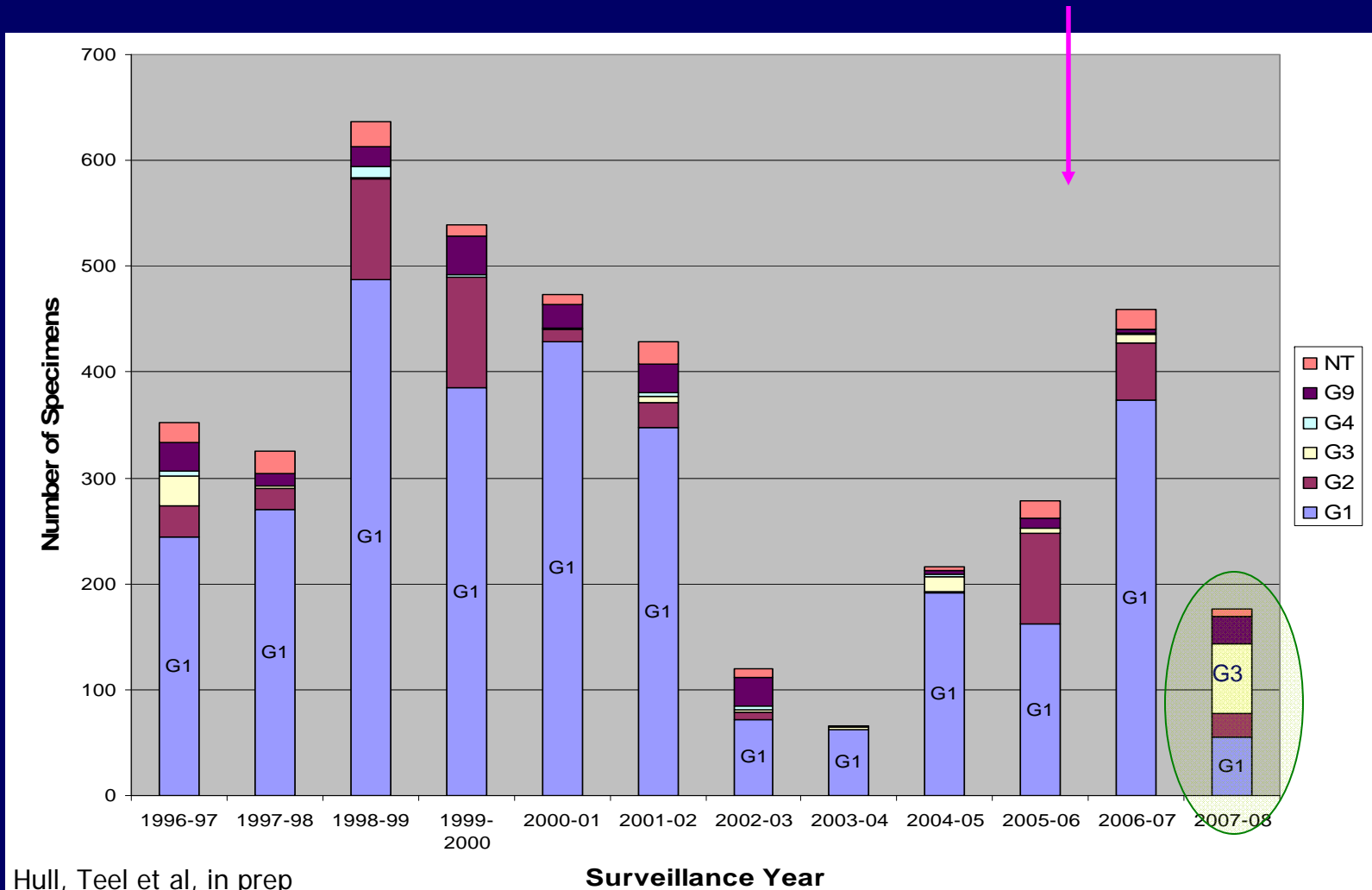


Number of Positive and Total Rotavirus Tests, United States, 2000-2008, 33 Continuously Reporting Labs

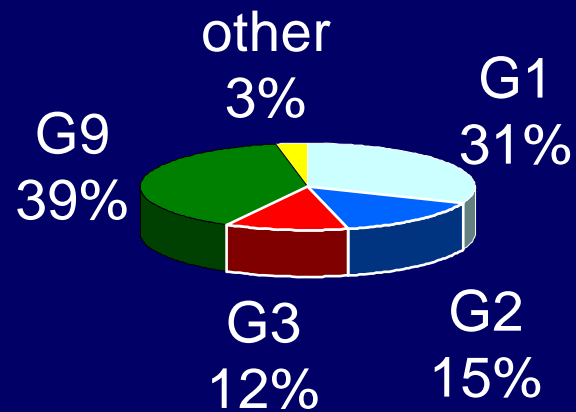


Longitudinal Variation of Rotavirus G Types in the United States (1996-2008)

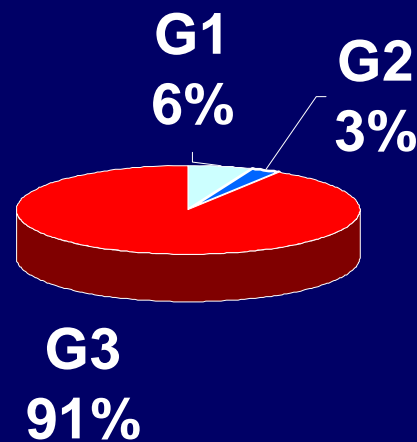
RotaTeq introduced



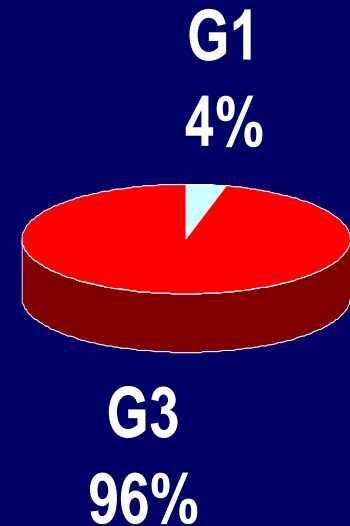
Geographical Serotype Variation USA (2007-2008)



Seattle WA, N=61



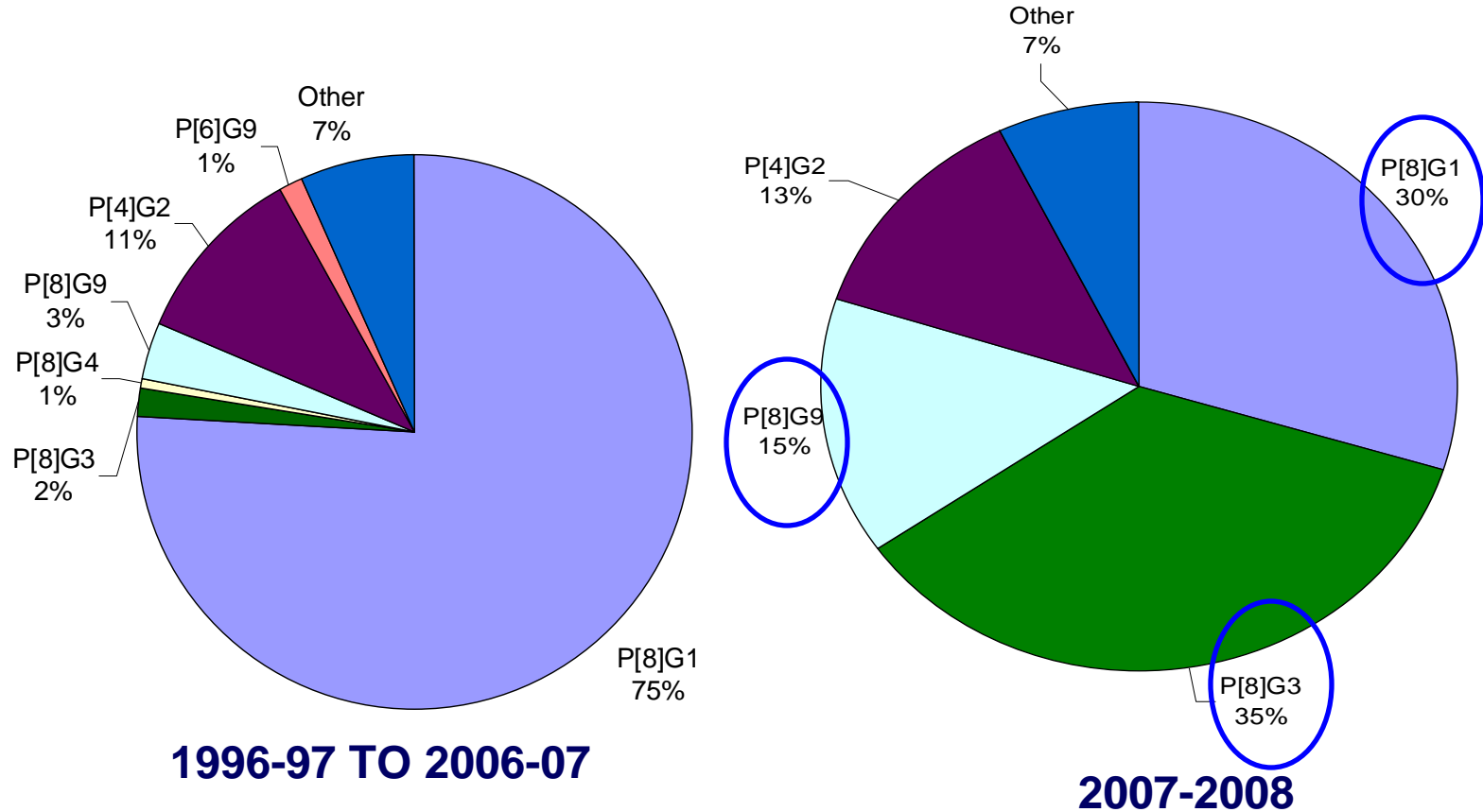
Omaha NE, N=40



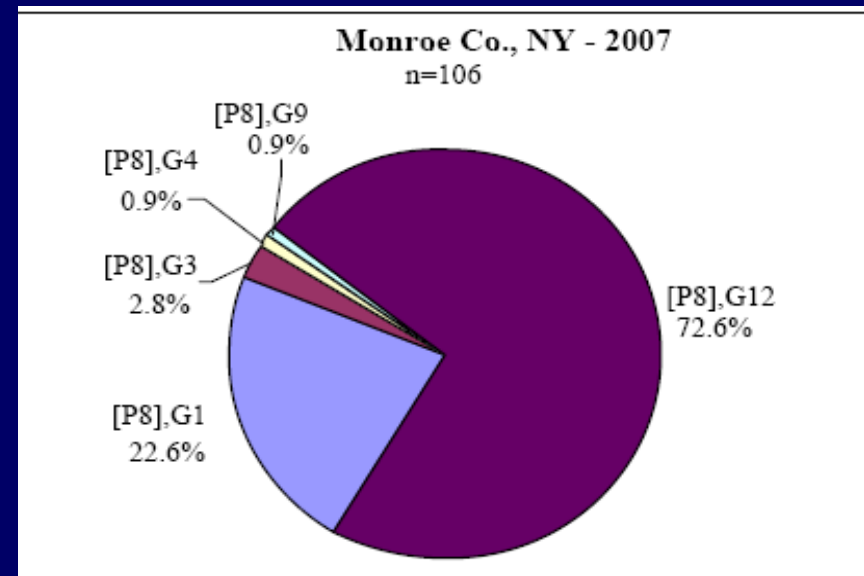
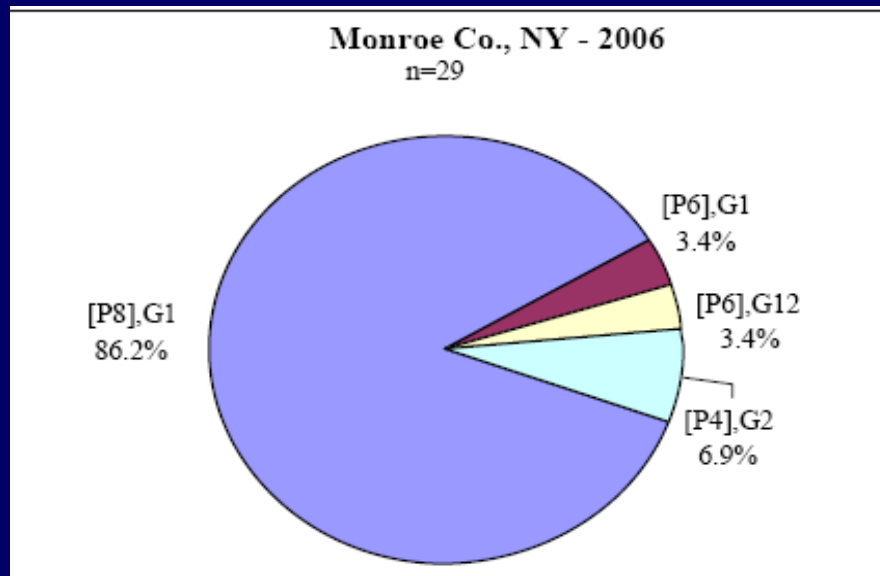
Fort Worth TX, N=23

Hull, Teel et al, in prep

P and G Genotypes of Rotavirus Strains in United States (NRSSS)



Genotyping by sequencing identified a major outbreak of genotype G12 in the United States (primers for G12 are not routinely present in multiplex RT-PCR)

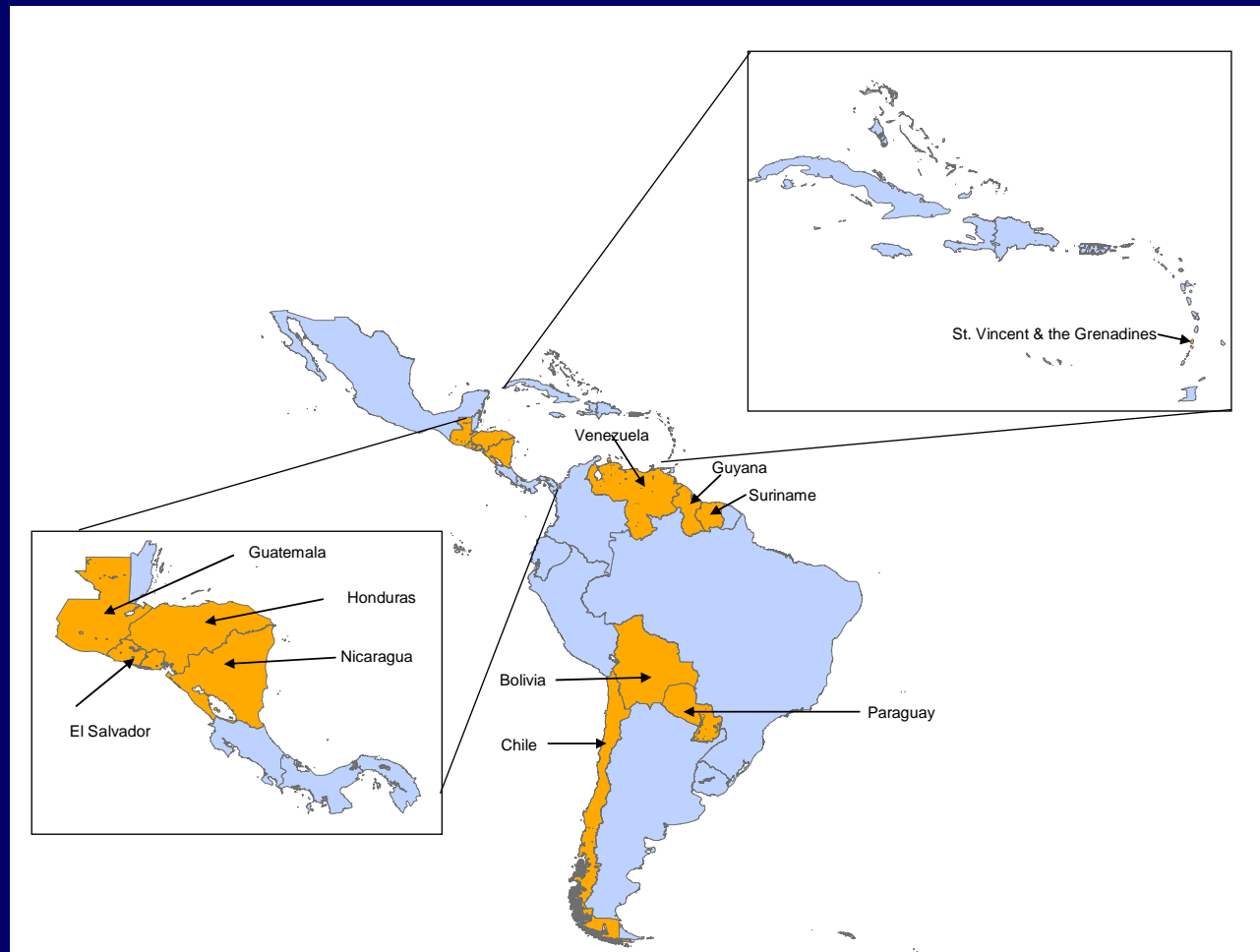


From Payne et al, PIDJ, 2009

Surveillance in Latin America and the Caribbean

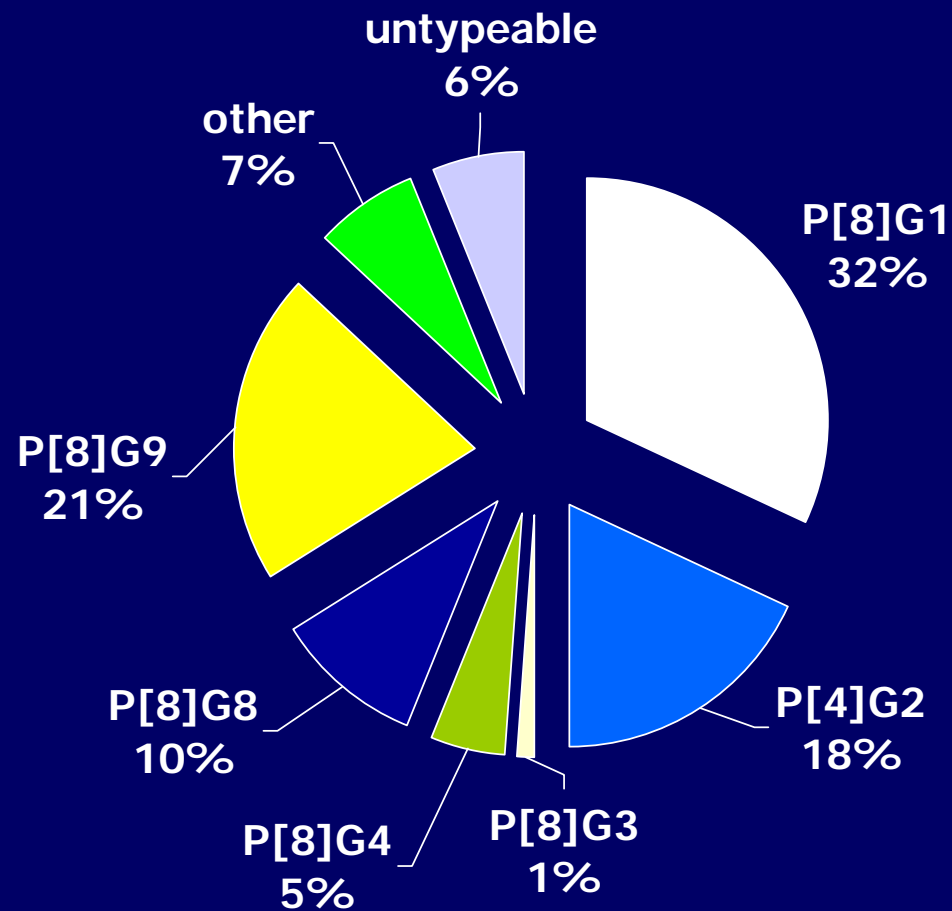
- Set up starting 2004 to assess disease burden and strains
- Strains received from rotavirus sentinel hospital surveillance network 2005-2007 analyzed at CDC
- Genotyping results from seven sites

Map of Countries Participating in the Rotavirus Surveillance Network in Latin America and the Caribbean



L Oliveira et al, JID 2009

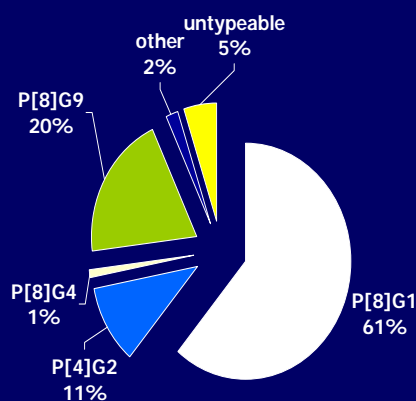
Strains Circulating in Seven Latin American Countries (2005-2007)



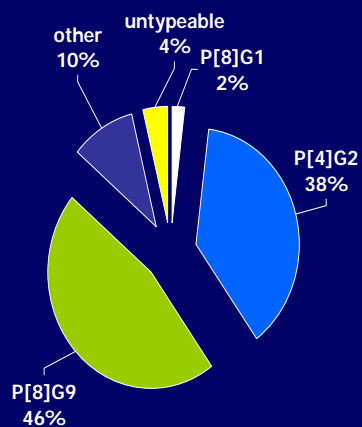
N=388
Adapted from
L Oliveira et al, JID 2009

Regional Variation of Strains Circulating in the Latin American (2005-2007)

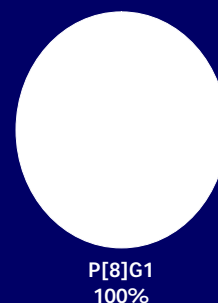
El Salvador



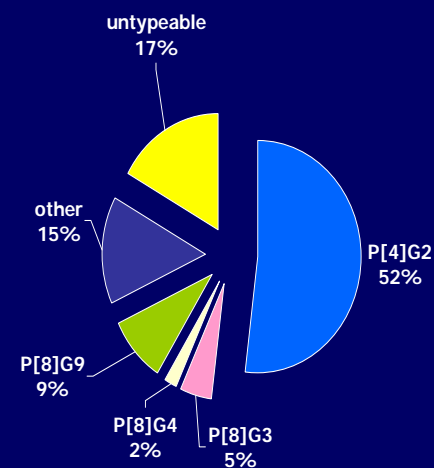
Guatemala



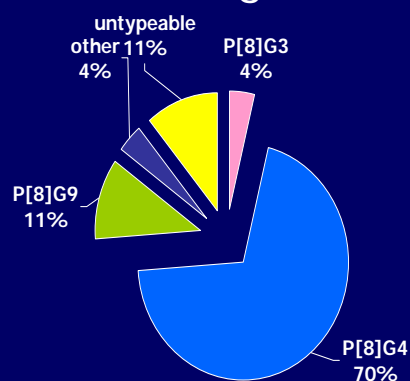
Guyana



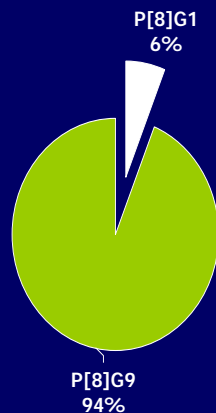
Honduras



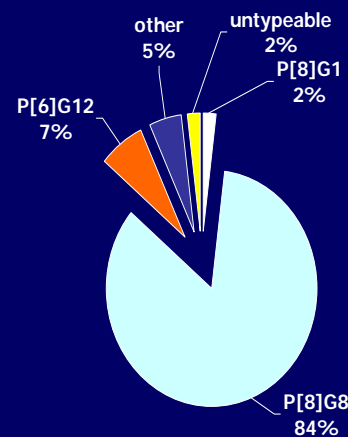
Nicaragua



St Vincent



Suriname



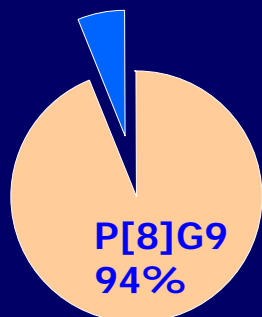
Adapted from
L Oliveira et al, JID 2009

Are Vaccination Programs Impacting Prevalence of Common Strains?

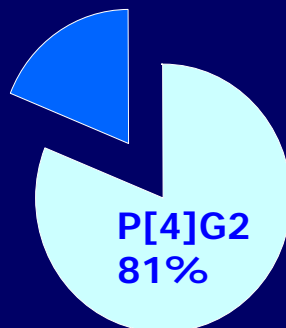
- Vaccination of populations with Rotarix
 - Increased prevalence of P[4]G2 (Brazil, Australia)
- Vaccination with RotaTeq
 - Increased prevalence of P[8]G3 (Australia, United States)

Temporal Variation in Predominant Strain, Central America

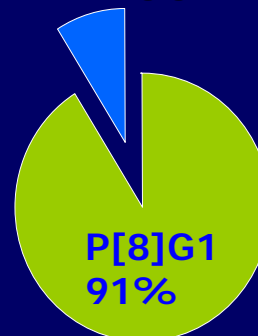
2005



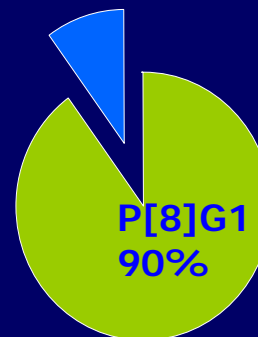
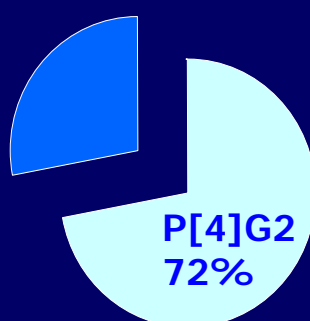
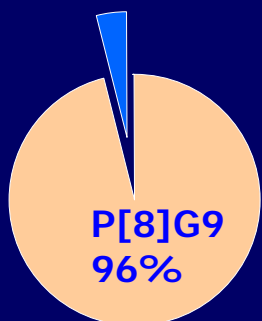
2006



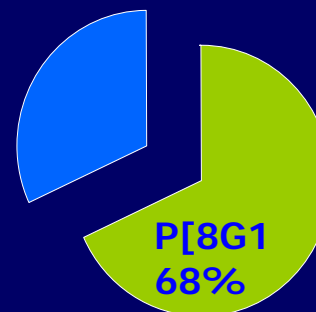
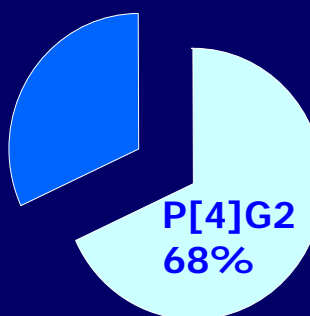
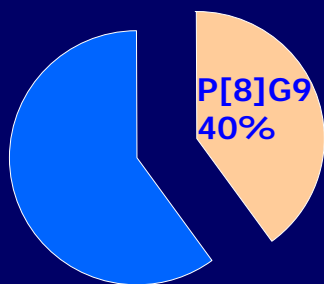
2007



Vaccine
El Salvador
(Rotarix)



Guatemala
(none)

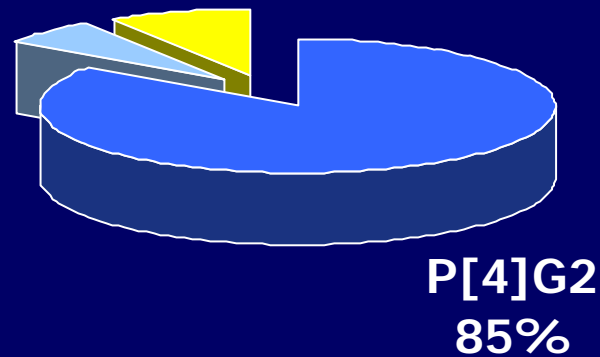


Honduras
(none)

Adapted from Patel et al.,
EID 2008; L Oliveira et
al JID 2009

RotaTeq Vaccinated Population and increased P[8]G3

Rotavirus Genotypes in Nicaragua, 2007-2008



N=262, Patel et al, JAMA 2009

Conclusions and Future Directions

- No convincing evidence for immune selection, more likely natural variation
 - Increasing prevalence P[4]G2, P[8]G3 in countries that have not adopted vaccines
- Supported by continued moderately high field efficacy of Rotarix vs P[4]G2 (e.g., Brazil, Australia [Snelling 2009, Nakagomi 2009] , RotaTeq vs P[8]G3 [e.g., Boom et al 2008])
- Long term effectiveness studies where serotype specific VE and overall disease trends can be assessed
 - Needed to discriminate observed trends from natural strain fluctuations, emergence of new strains etc

CDC

Umesh Parashar
Margaret Cortese
Manish Patel
Dan Payne
Jackie Tate
Jazmin Vojdani
Tara Kerin
Mathew Esona
Mike Bowen

PAHO

Lucia Helena de Oliveira
M. Carolina Danovaro-Holliday
Jon Kim Andrus
Ana Maria Bispo de Fillipis
Cuauhtemoc Ruiz Matus

Epidemiological Surveillance of Ministries of
Health from countries

Members of the NVSN and NRSSS networks in
the United States