

# Pertussis in the Americas Region



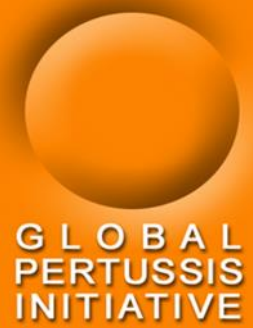
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BOGOTA**

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# Development

- ✓ **Epidemiology - ¿ Is there reemergence of the disease?**
- ✓ **Vaccination policy and programs**
- ✓ **Current vaccination guidelines and recommendations**
- ✓ **Immunization in children, pregnant women and other recommendations**
- ✓ **Challenges, barriers and obstacles for effective implementation**
- ✓ **Prioritization of vaccination strategies to regional resources**



# 2017 Global Pertussis Initiative

## Pertussis in The Americas and Global Challenges

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<b>Colombia</b>	<b>Cristina Marino</b>
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<b>El Salvador</b>	<b>Maria Lourdes Dueñas</b>
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<b>Uruguay</b>	<b>Monica Pujadas</b>
<b>Venezuela</b>	<b>Maria Graciela Lopez</b>



**In 2010, Argentina, Mexico, and Panama worked together to form the Latin American Pertussis Project (LAPP)—a collaboration between**

- **the CDC**
- **the Sabin Vaccine Institute,**
- **the Pan American Health Organization (PAHO), and**
- **the Ministries of Health in select Latin American countries.**

**Brazil, Chile, and Colombia were incorporated into a 2nd phase between 2012 and 2015.**

**The goal of LAPP is to expand understanding of current pertussis **epidemiology** in Latin America in order to **guide national and regional pertussis prevention and control strategies.****

# Global Situation

A resurgence in pertussis has been observed in many countries across the globe—including countries that use wP and aP vaccines

Pertussis generally results in most severe disease in the very young; however, it continues to be a problem in all age groups.

## Recent Epidemics

Australia	Epidemic since 2008 >38.000 cases in 2011 (a)
Latin America (Argentina, Brazil, Colombia, Chile and Uruguay)	Epidemics reported 2011 y 2012 (b)
Nueva Zelandia	Currently in an epidemic > 8800 cases since 2011 (c)
United Kingdom	>8000 cases in 2012 (d)
USA	>40.000 cases in 2012 (e)

- a. Australian Government. National Notifiable Disease Surveillance System. [www.health.gov.au](http://www.health.gov.au)
- b. Pan American Health Organization. Epidemiological Alert, Pertussis, 2012. [www.paho.org](http://www.paho.org)
- c. New Zealand Ministry of Health. [www.health.govt.nz/your-health/conditions-and-treatments/diseases-and-illnesses/whooping-cough](http://www.health.govt.nz/your-health/conditions-and-treatments/diseases-and-illnesses/whooping-cough)
- d. Health Protection Report. [www.hpa.org.uk/hpr/archives/2012/news5112.htm#prtsss1211](http://www.hpa.org.uk/hpr/archives/2012/news5112.htm#prtsss1211)
- e. CDC. [www.cdc.gov/pertussis/outbreaks/about.htm](http://www.cdc.gov/pertussis/outbreaks/about.htm)
- f. [www.irinnews.org/report/76583/sudan-whooping-cough-outbreak-in-west-darfur](http://www.irinnews.org/report/76583/sudan-whooping-cough-outbreak-in-west-darfur)

# Pertussis Surveillance

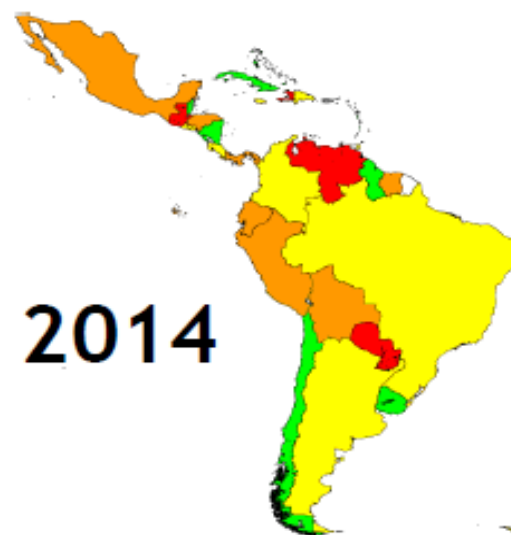
- Pertussis notification is mandatory in many countries in the Americas
- Cases should be reported to the National Ministry of Health (MoH) in each country.
- Different countries have considered adaptations **in clinical criteria, including age stratification and cough duration.**
- The **laboratory criteria for diagnosis** are based mainly on the isolation of *B. pertussis* from clinical specimens, and/or through PCR for *B. pertussis*.
- Pertussis is still underreported, particularly in adolescents and older individuals
- The number of deaths due to pertussis is also underestimated



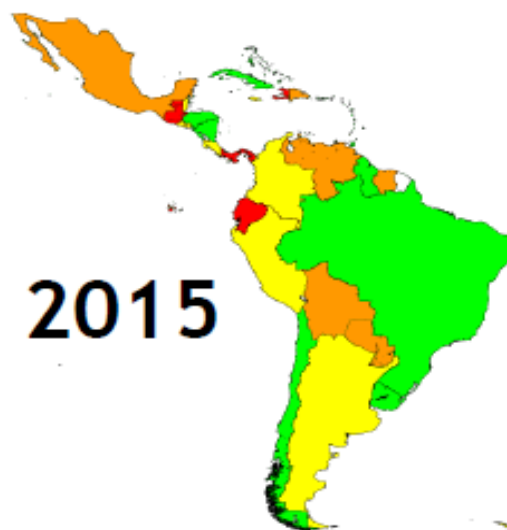
## DTP3 coverages. 2013-2015



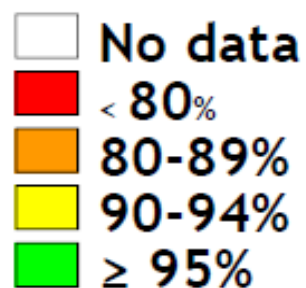
2013



2014

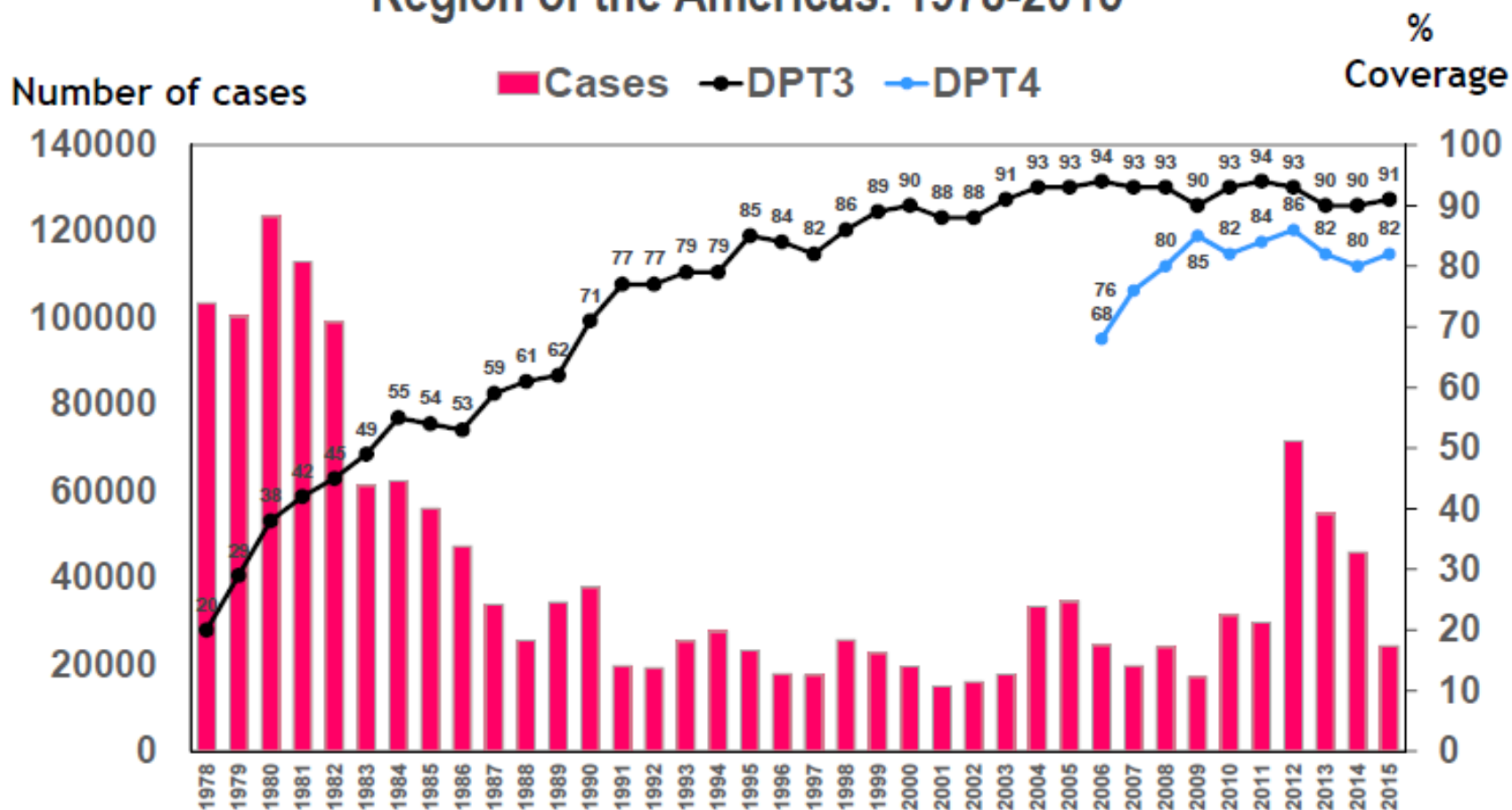


2015



DTP3 coverage per country per year between 2013 and 2015. As you can see, for most countries there was an improvement in coverage over the years. Moreover, some countries reached the recommended 95% coverage.

# Number of pertussis reported cases and vaccination coverages. Region of the Americas. 1978-2015



Fuente: Tablas del PAI, Formulario Conjunto de Informes de la OPS / OMS / UNICEF (JRF) e informes de los países.

This figure shows the distribution of the number of pertussis cases in the Americas region per year. In the upper part of the figure, the DTP3 and DTP4 vaccination coverages are shown. The DTP3 vaccination coverage was never higher than 95%. The DTP4 coverage, available since 2006, was lower than 90% in the represented period. A clear decrease in the number of cases could be detected after the introduction of mass vaccination. As reported in other regions, the decrease in incidence did not change the periodicity of the epidemic cycles. Since 2004, there has been an increase in the number of reported cases. From 2012 to 2015, on average, 41,000 cases were reported annually.



# Pertussis Diagnosis Region of the Americas 2015

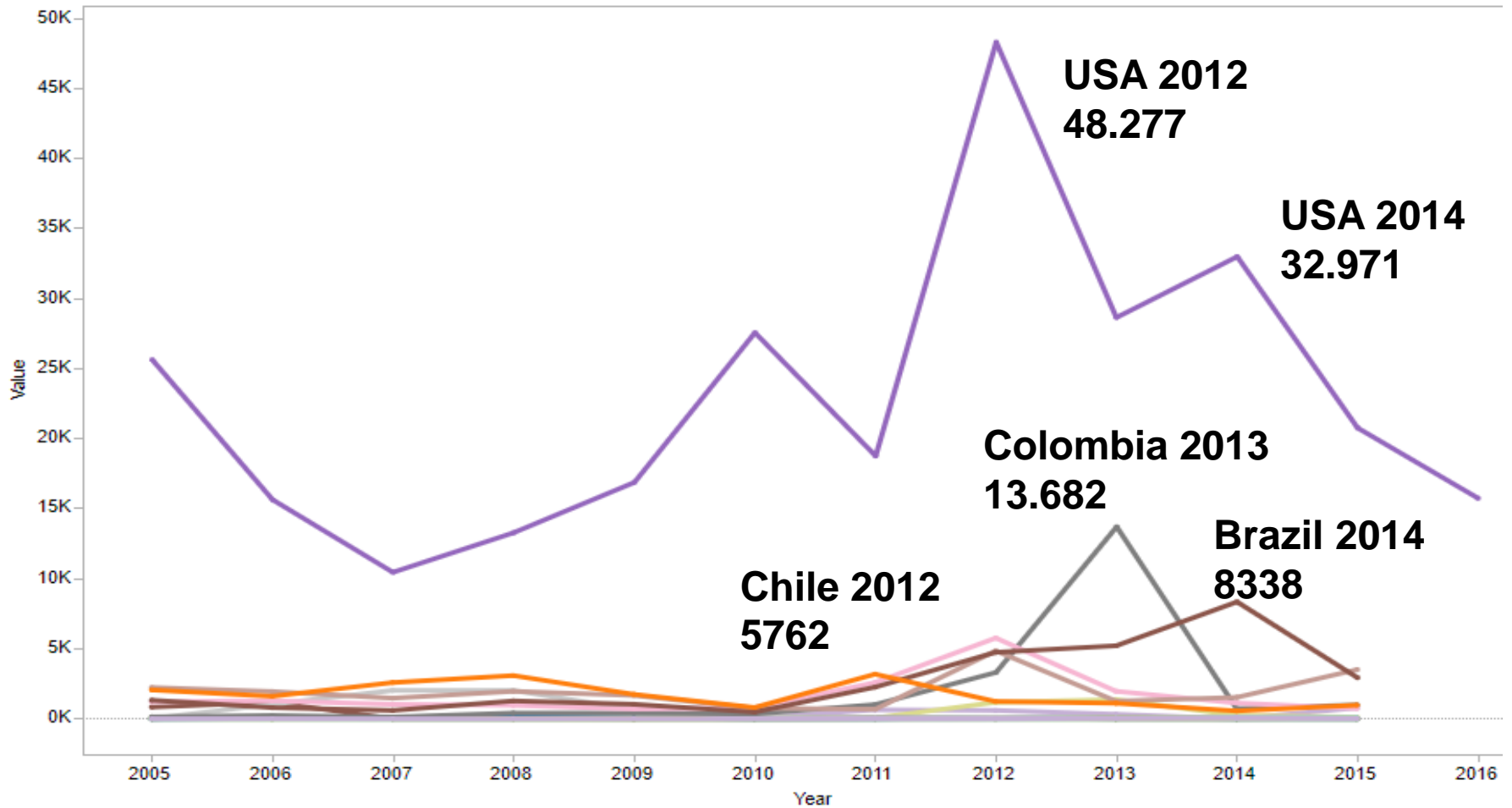
PCR	Culture + PCR	RT-PCR	Cultura + RT-PCR	Culture + PCR + Serology	Culture + PCR + Serology + IFD
1. Costa Rica 2. Saint Lucia	1. Bolivia 2. Brazil (PCR: 2 states) 3. El Salvador 4. Guatemala 5. Honduras 6. Uruguay 7. Venezuela	1. Peru 2. Suriname	1. Colombia 2. Mexico 3. Panama 4. Paraguay	Argentina US	Chile

# Epidemiological Data in Latin America

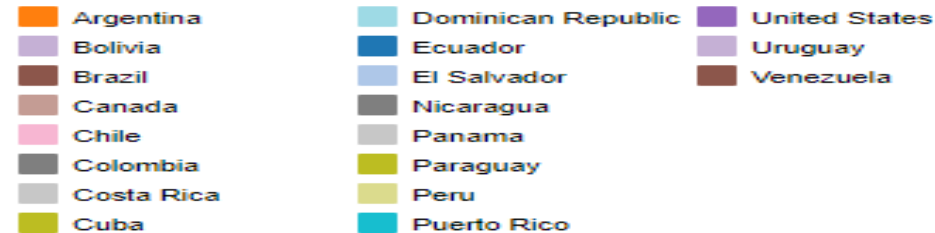
**¿Is there reemergence of the disease?**

<http://www.paho.org/data/index.php/en/mnu-topics/immunizations/300-vaccine-preventable-disease.html>

# Number of Cases per Country in the Americas

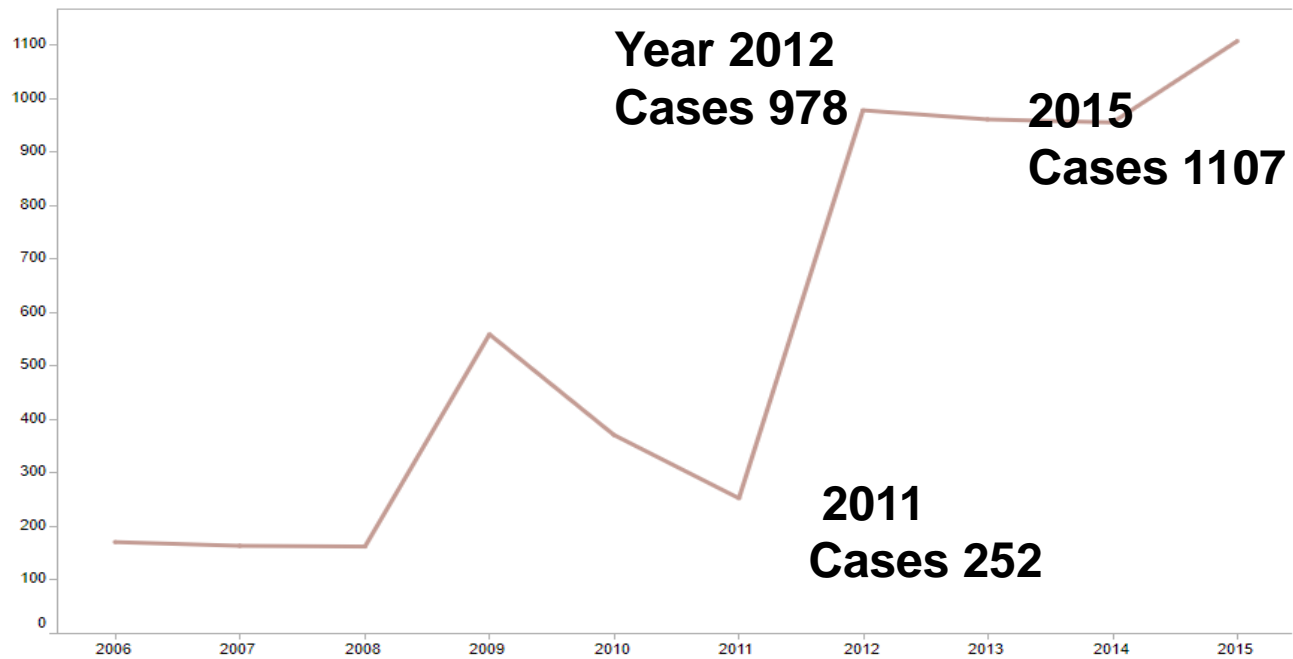


## Country

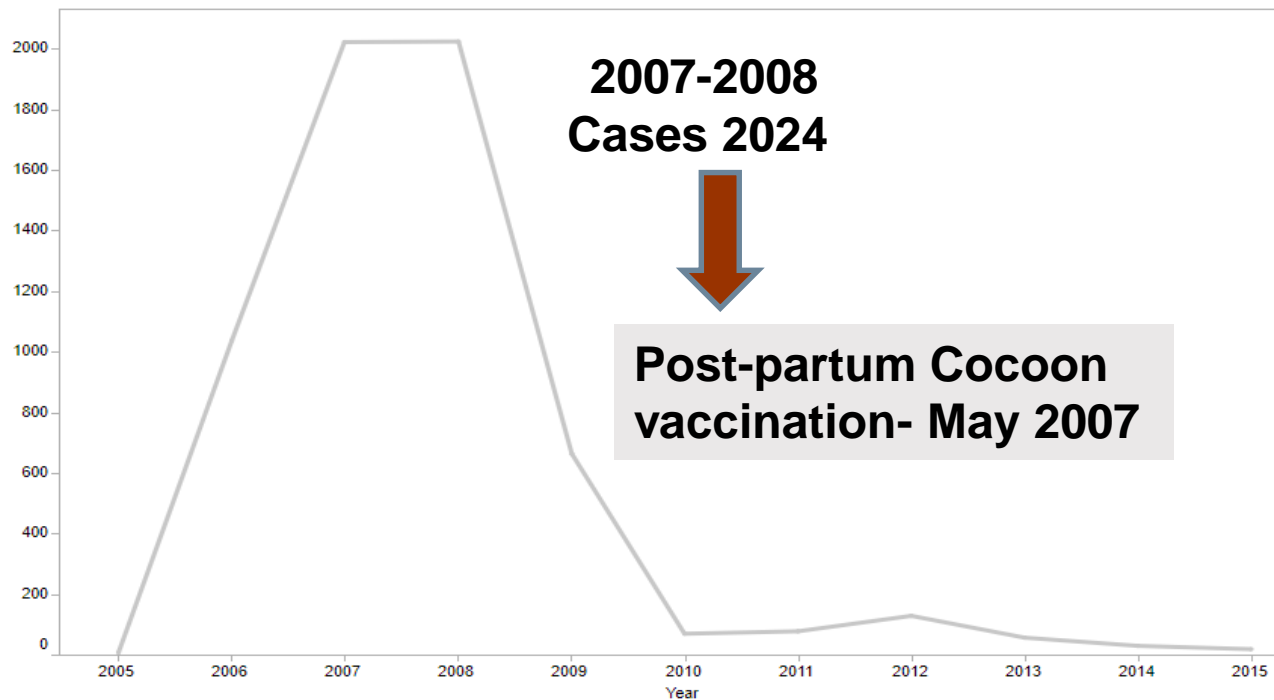
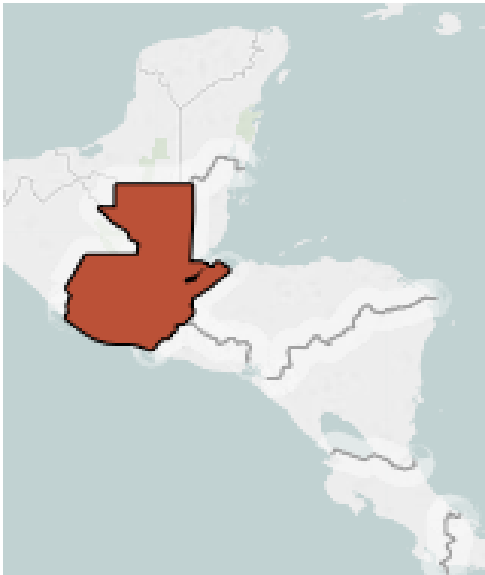


Source: Country reports and PAHO-WHO/UNICEF Joint Reporting Forms (JRF). Data updated 9 February 2015.

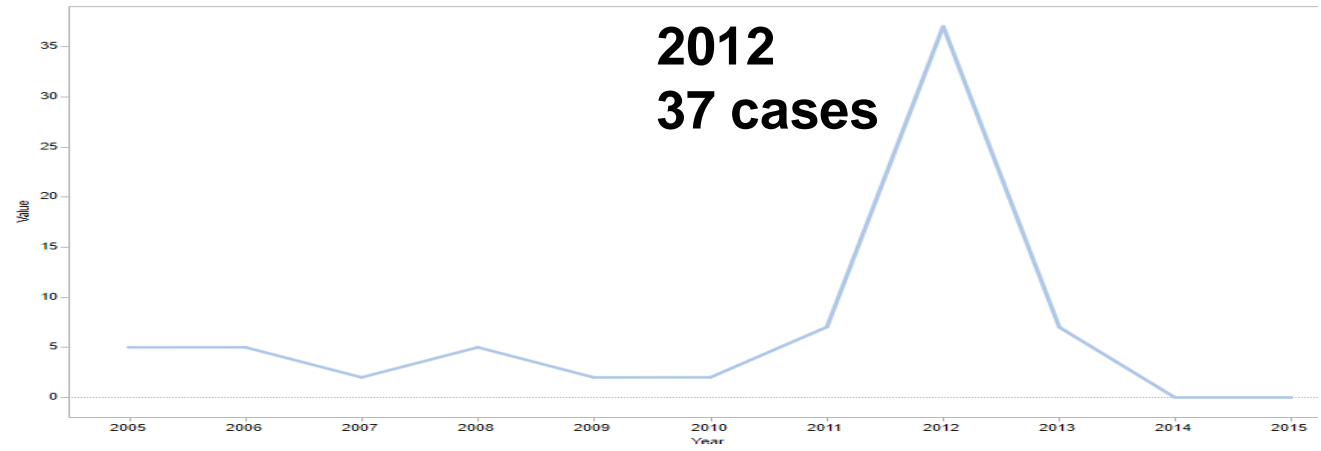
# MEXICO



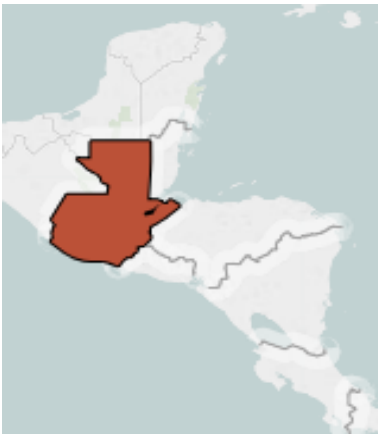
# COSTA RICA



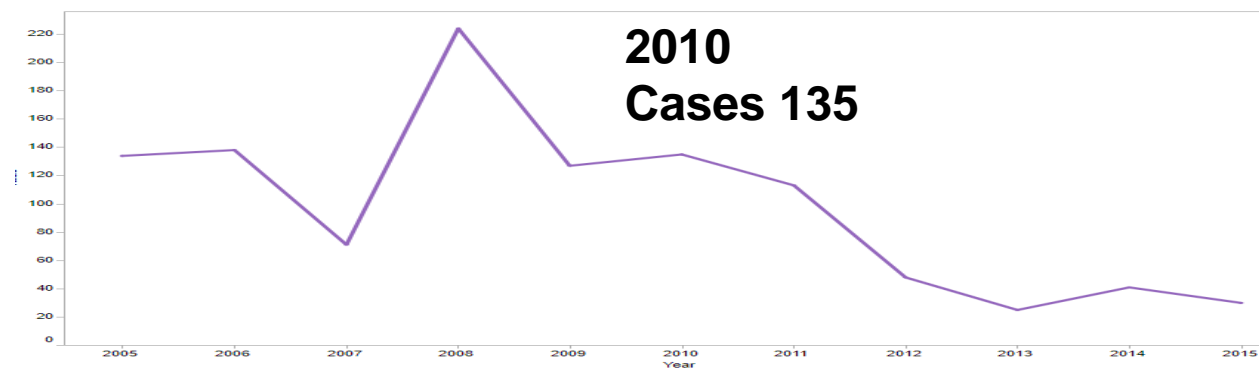
# El Salvador



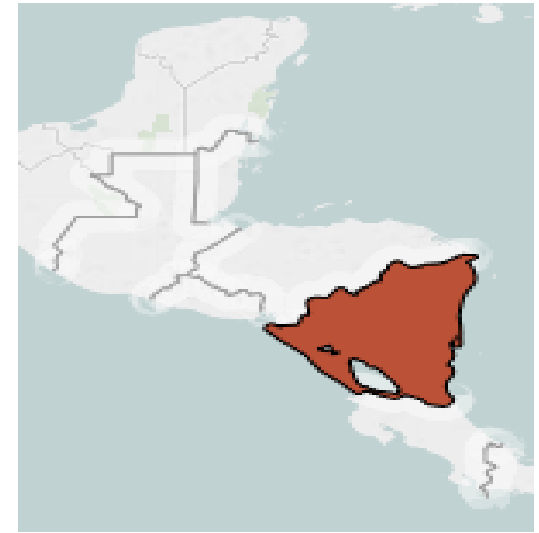
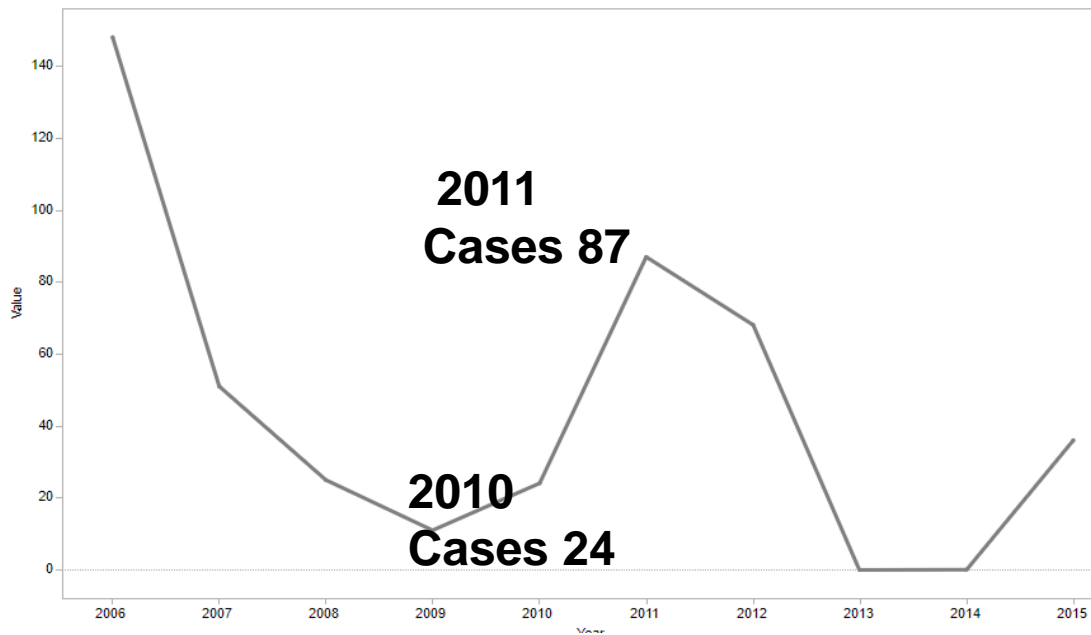
# Guatemala



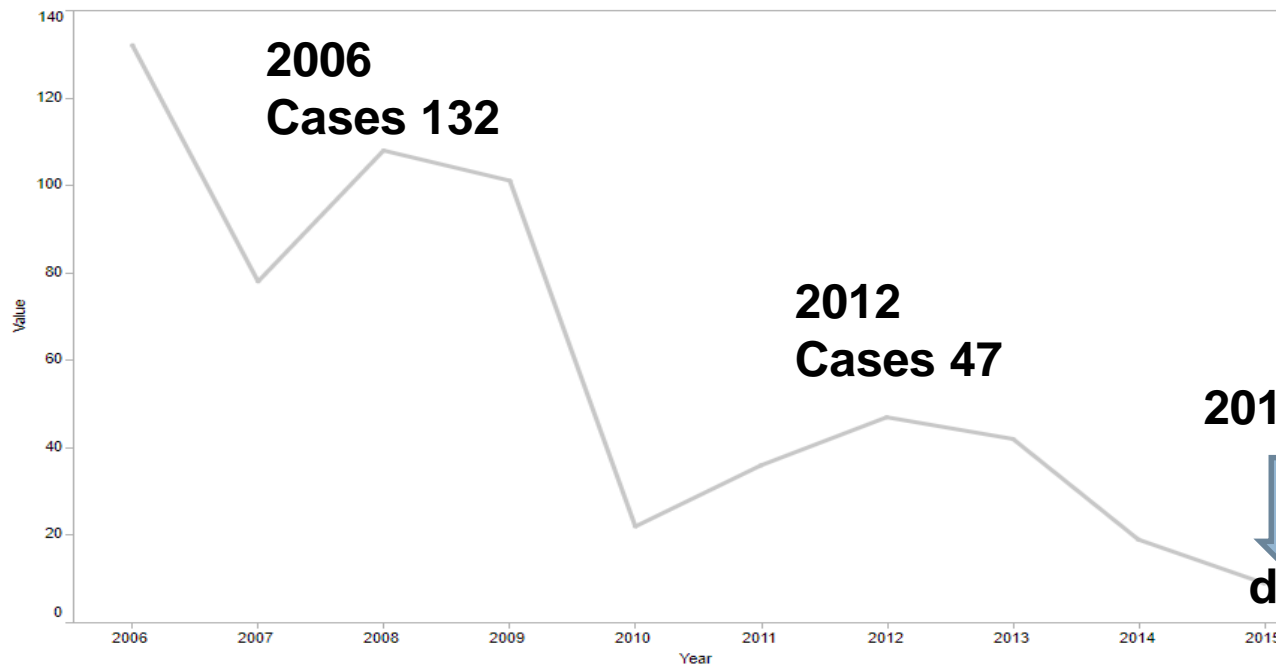
# Honduras



# Nicaragua



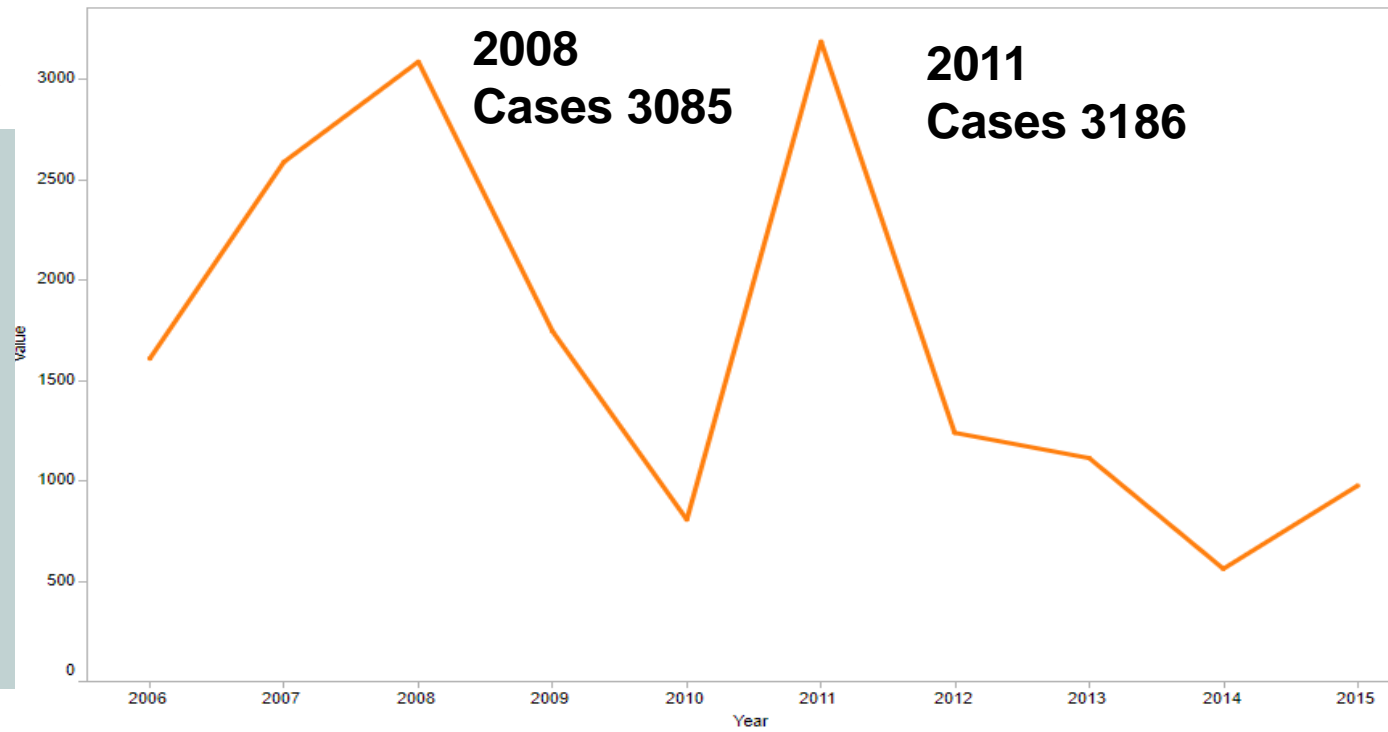
# Panama



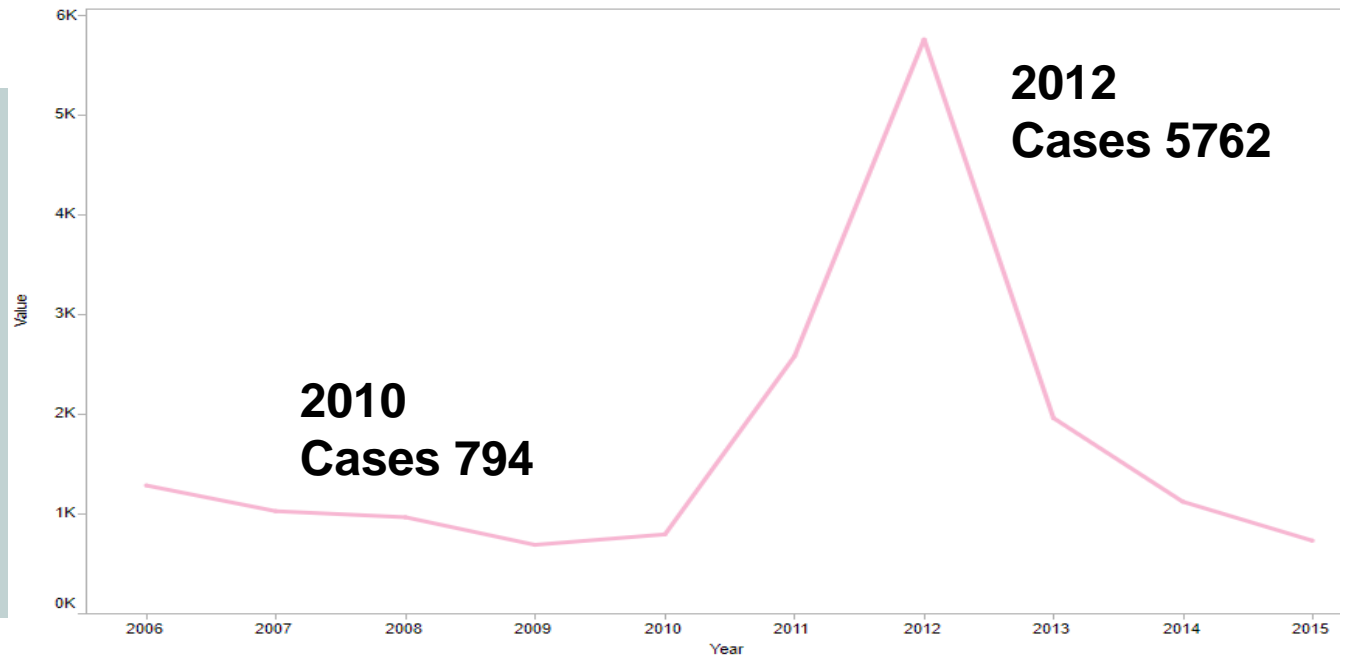
2014  
↓  
dpaT



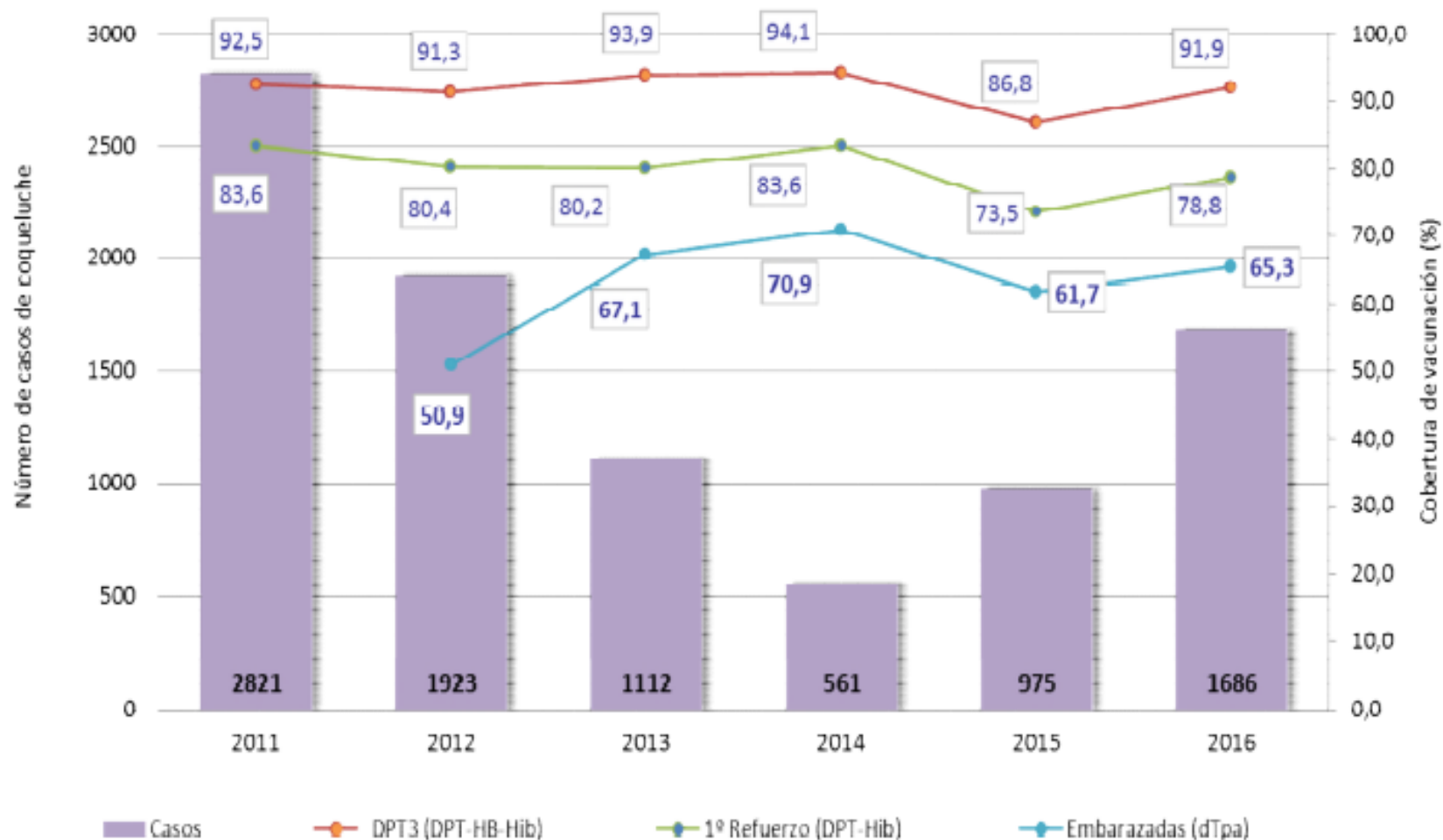
# Argentina



# Chile



## Pertussis cases and coverages. Argentina, 2011-2016



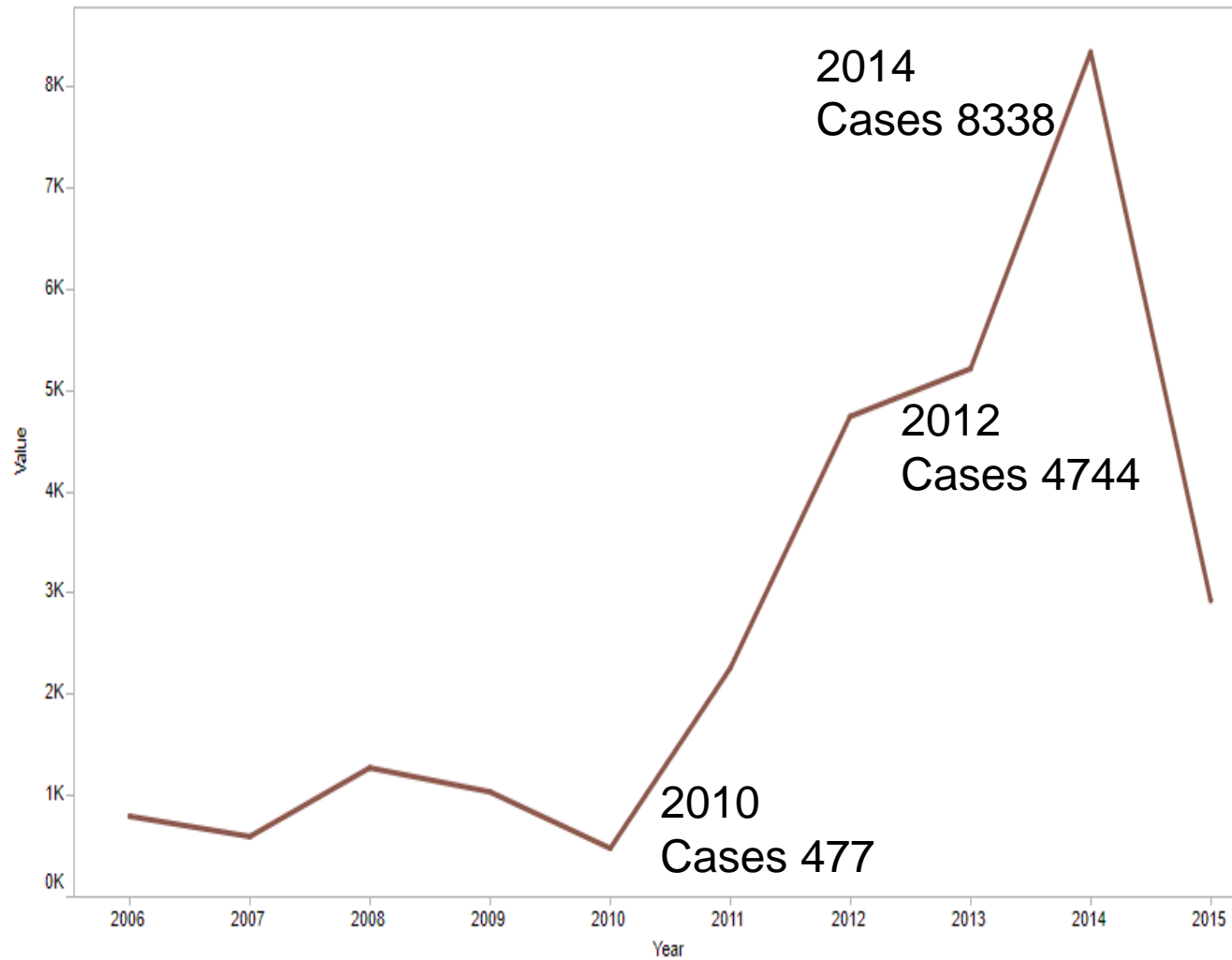
Fuente: SNVS. DiCEi. Ministerio de Salud de la Nación.

**In 2016, 72% more cases were detected than in 2015. In addition, 15% more cases were confirmed.**

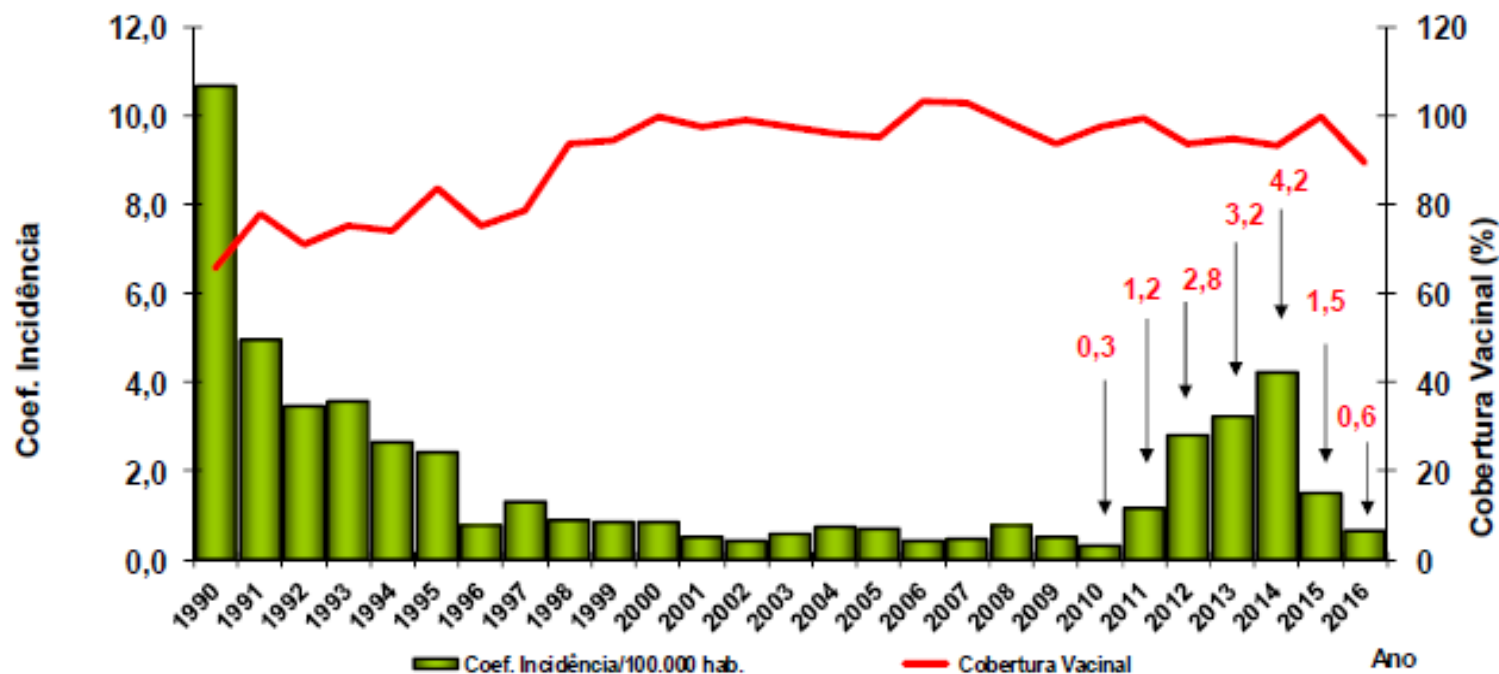


# Brazil

Country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Brazil	797	596	1275	1037	477	2257	4744	5211	8338	2920



## Pertussis Incidence and Vaccination Coverage with (DTP e DTP+Hib). Brazil, 1990–2016\*

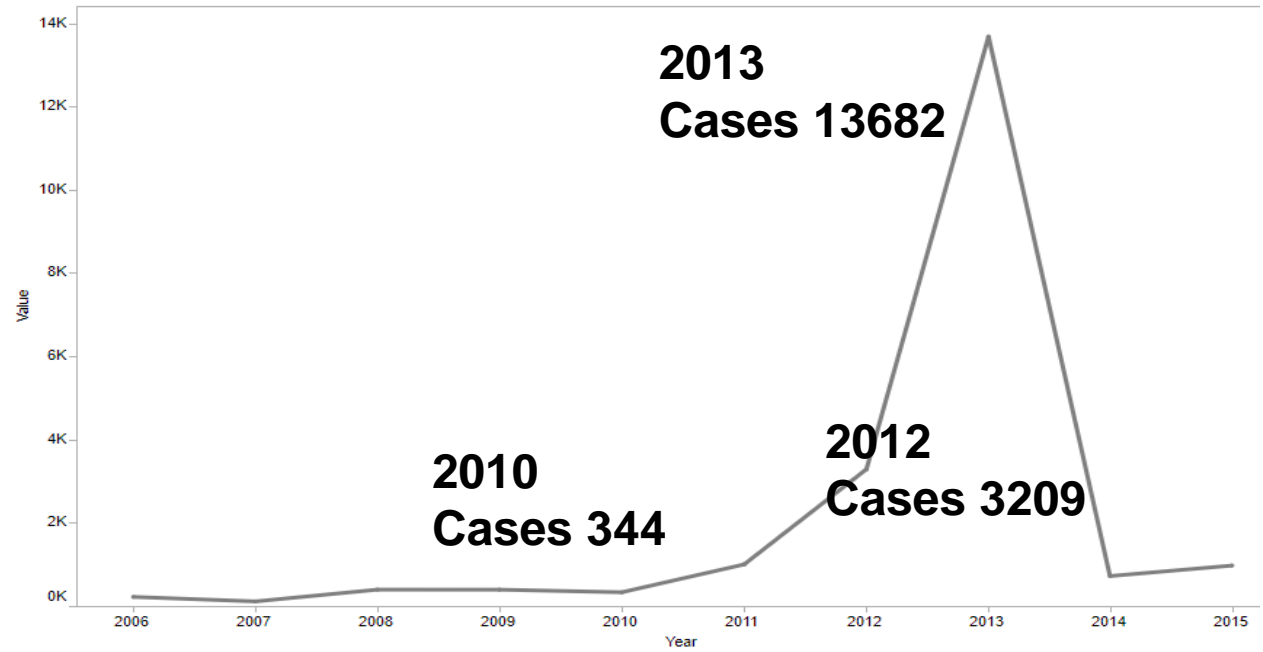


Fonte: CGDT/DEVIT/SVS/MS  
CGPNI/DEVIT/SVS/MS  
População: IBGE/DATASUS  
\*Subject to revision

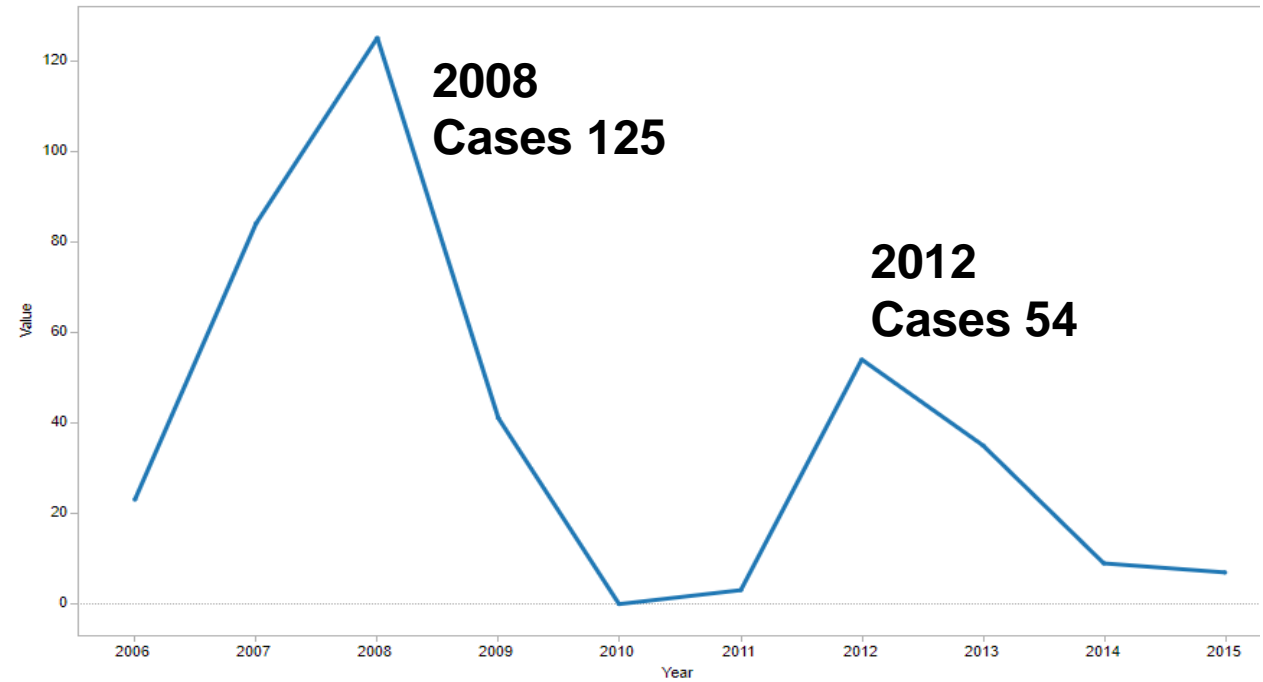
• In 2013 - 2016 - Pentavalent Vaccine.

<http://portalsaude.saude.gov.br/index.php/o-ministerio/principal/leia-mais-o-ministerio/635-secretaria-svs/vigilancia-de-a-a-z/coqueluche/11196-situacao-epidemiologica-dados> Access October 17, 2017

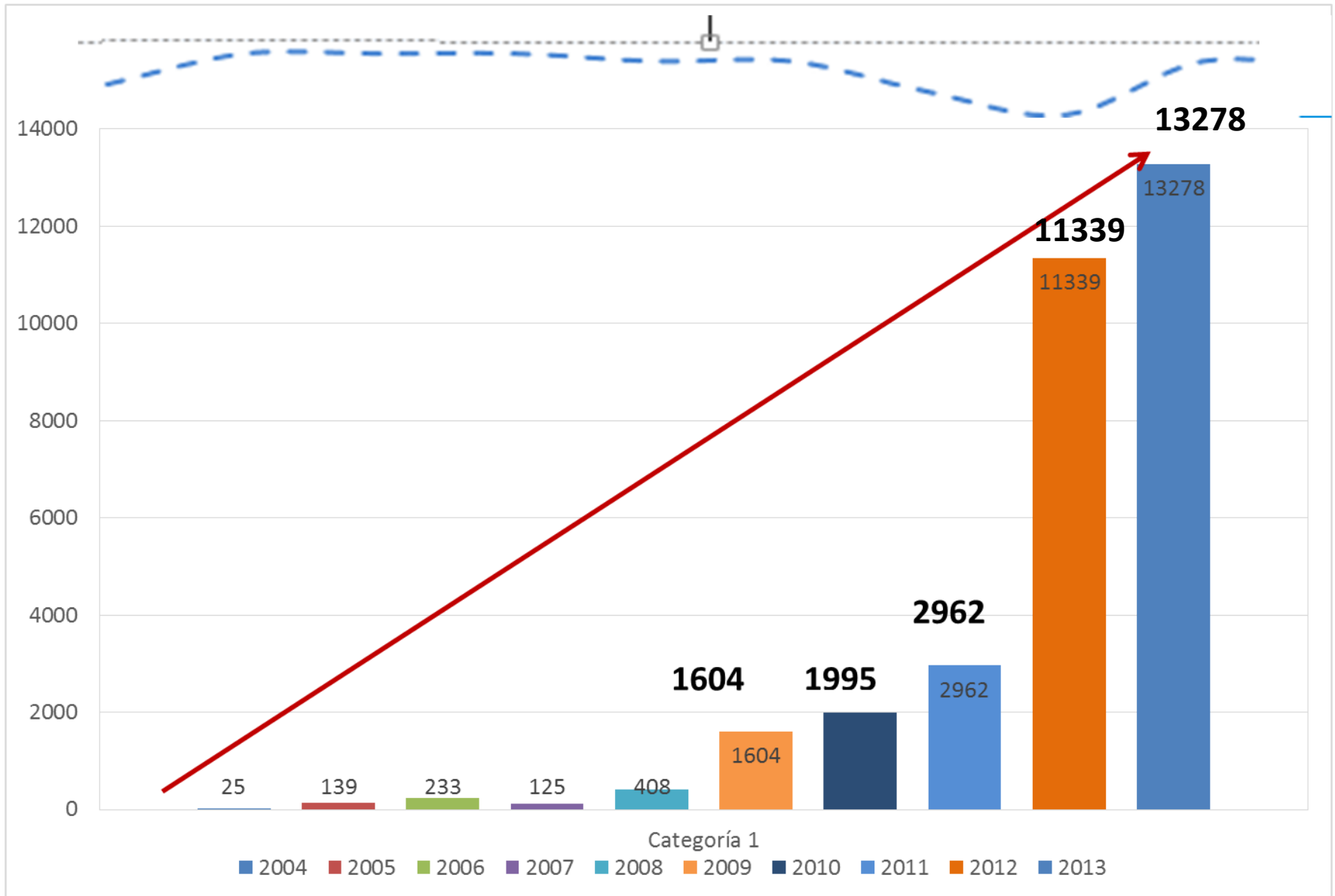
# Colombia



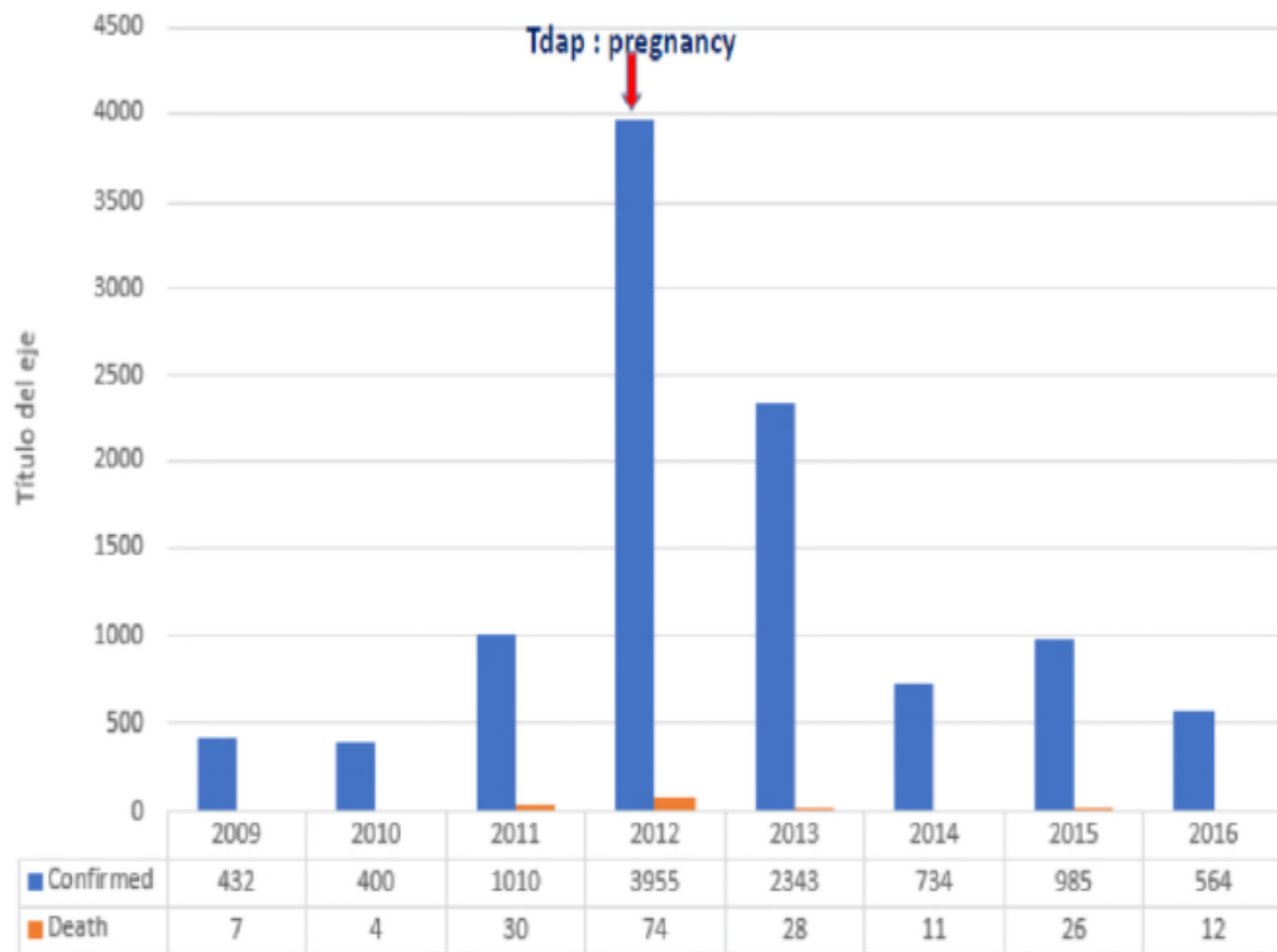
# Ecuador



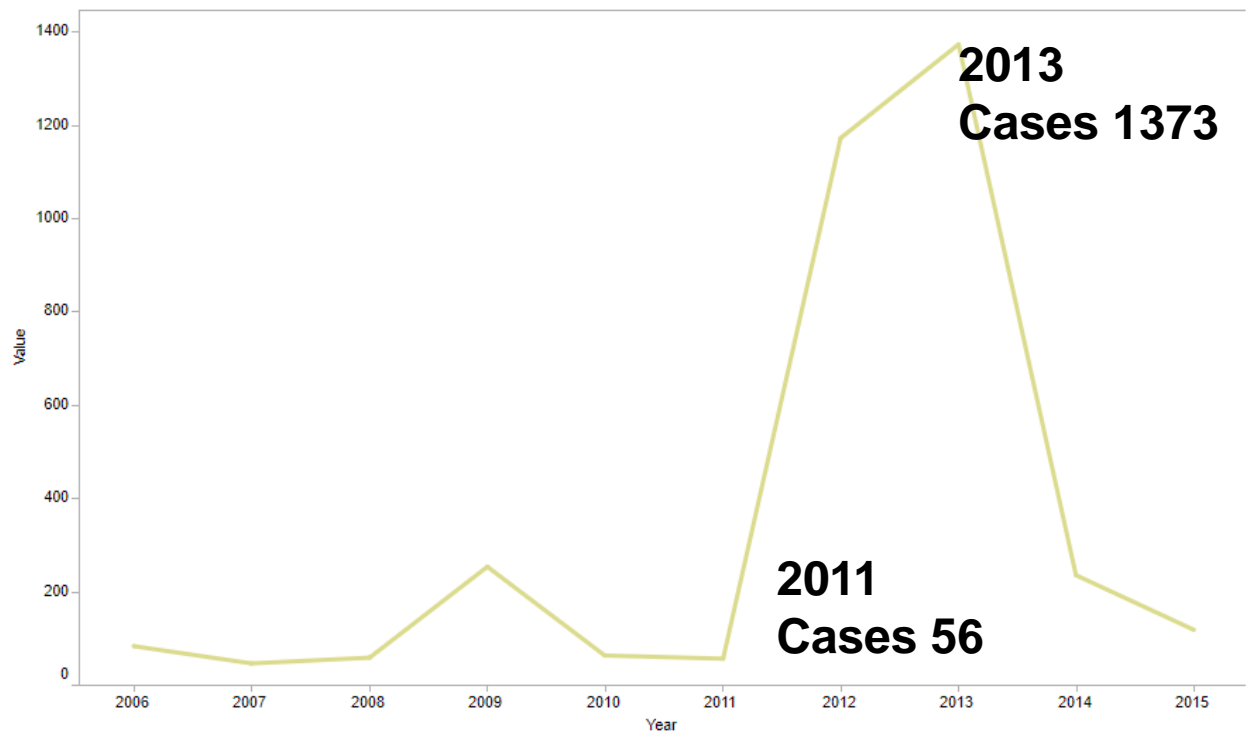
# Pertussis in Colombia 2004 -2013



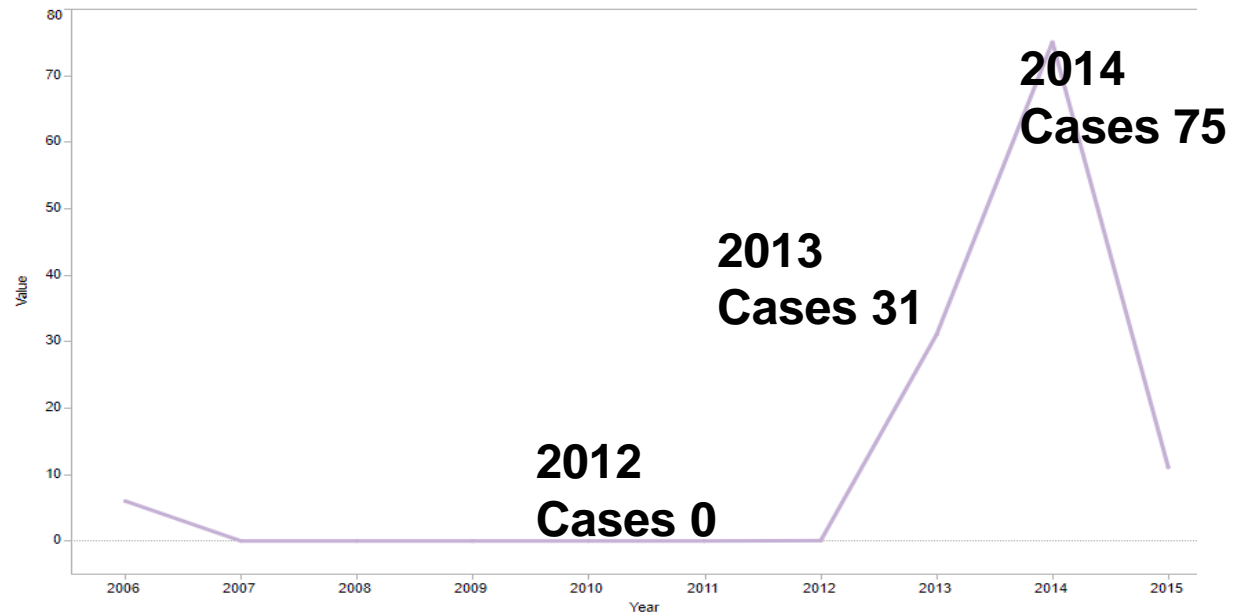
# COLOMBIA CONFIRMED AND DEATH 2009-2016



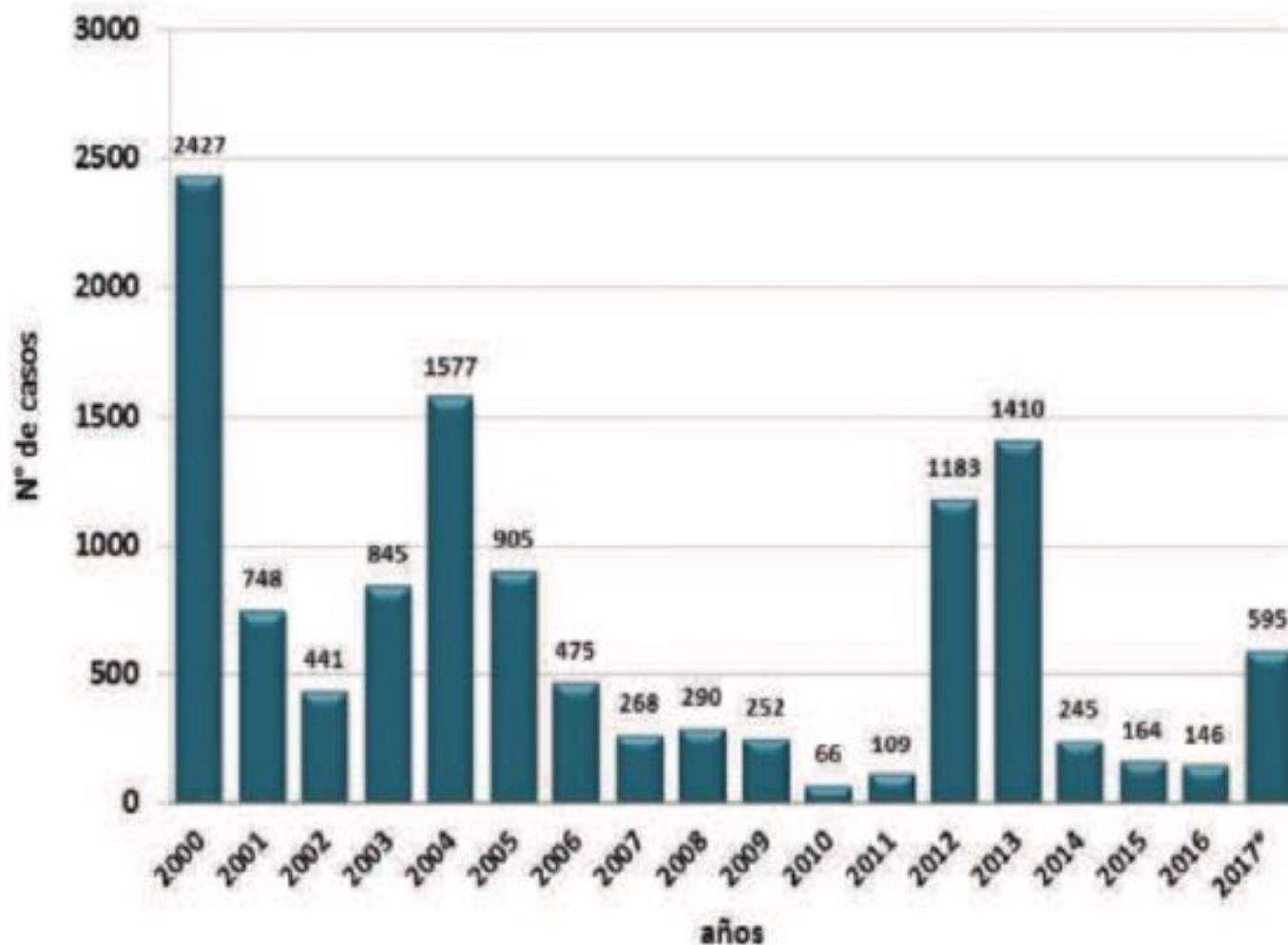
# Perú



# Bolivia

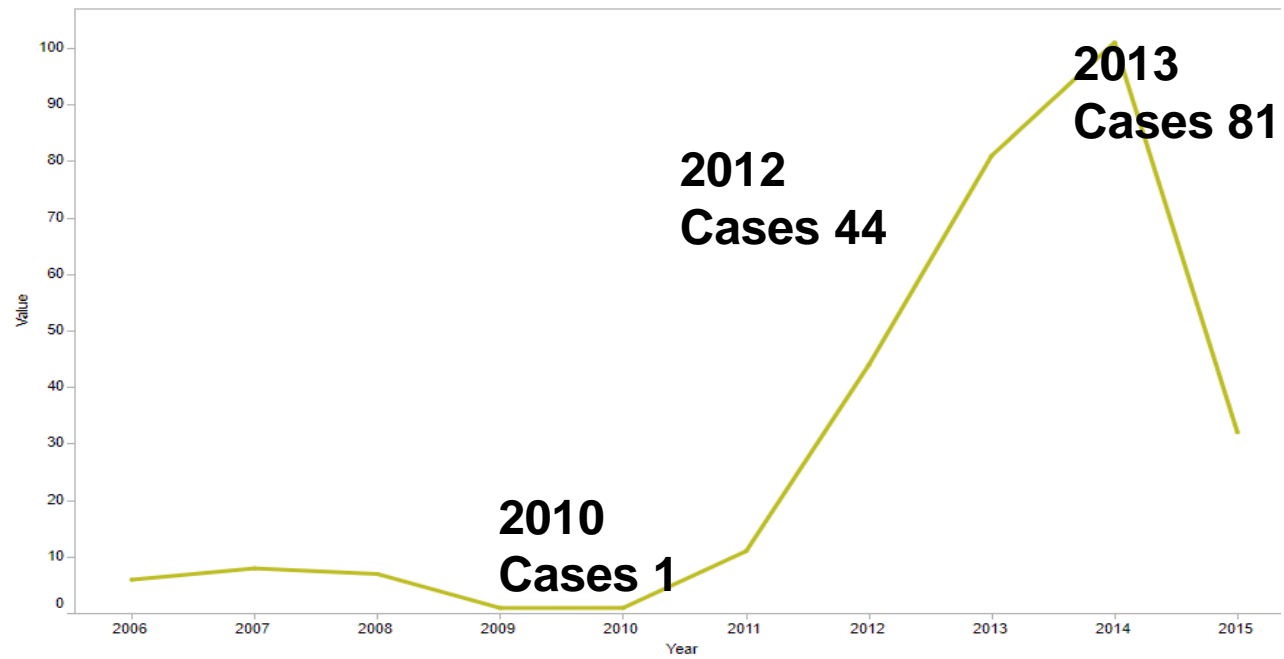


# N° de casos de Tos ferina, Perú 2000 – 2016 y 2017\*

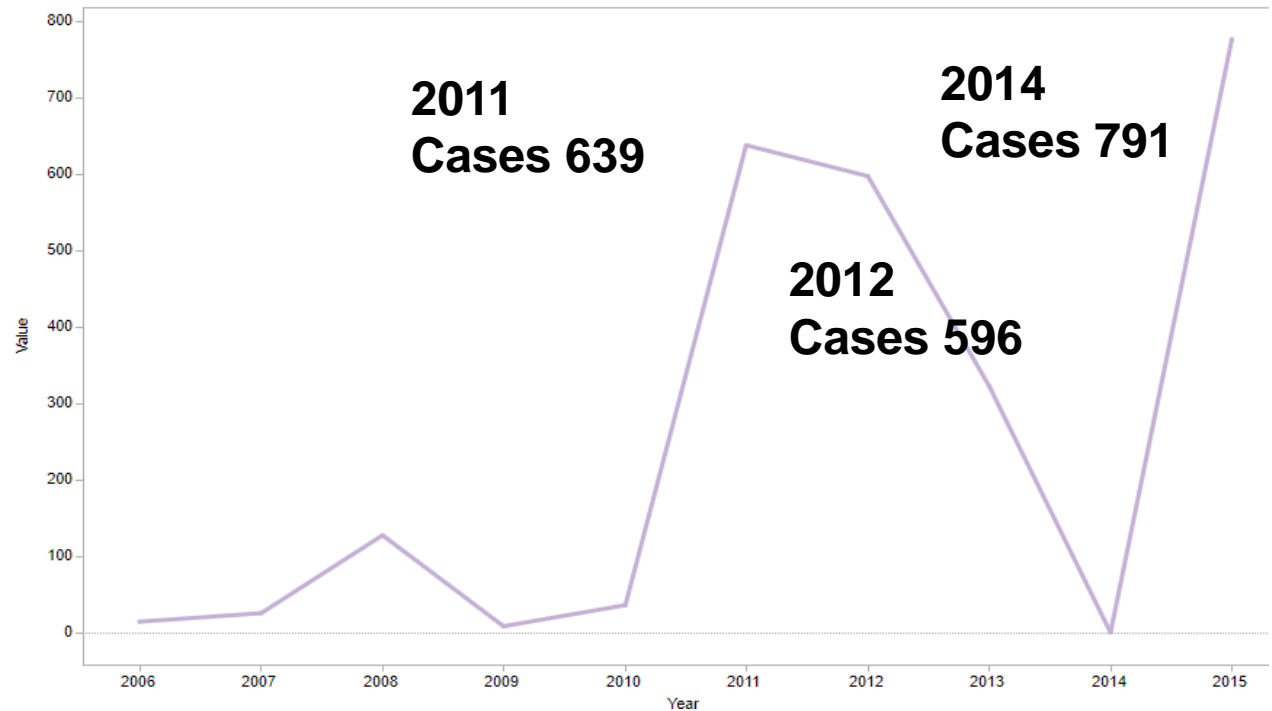


FUENTE : Centro Nacional de Epidemiología, Prevención y Control de Enfermedades - MINSA  
(\* ) Hasta la SE 41 del 2017

# Paraguay

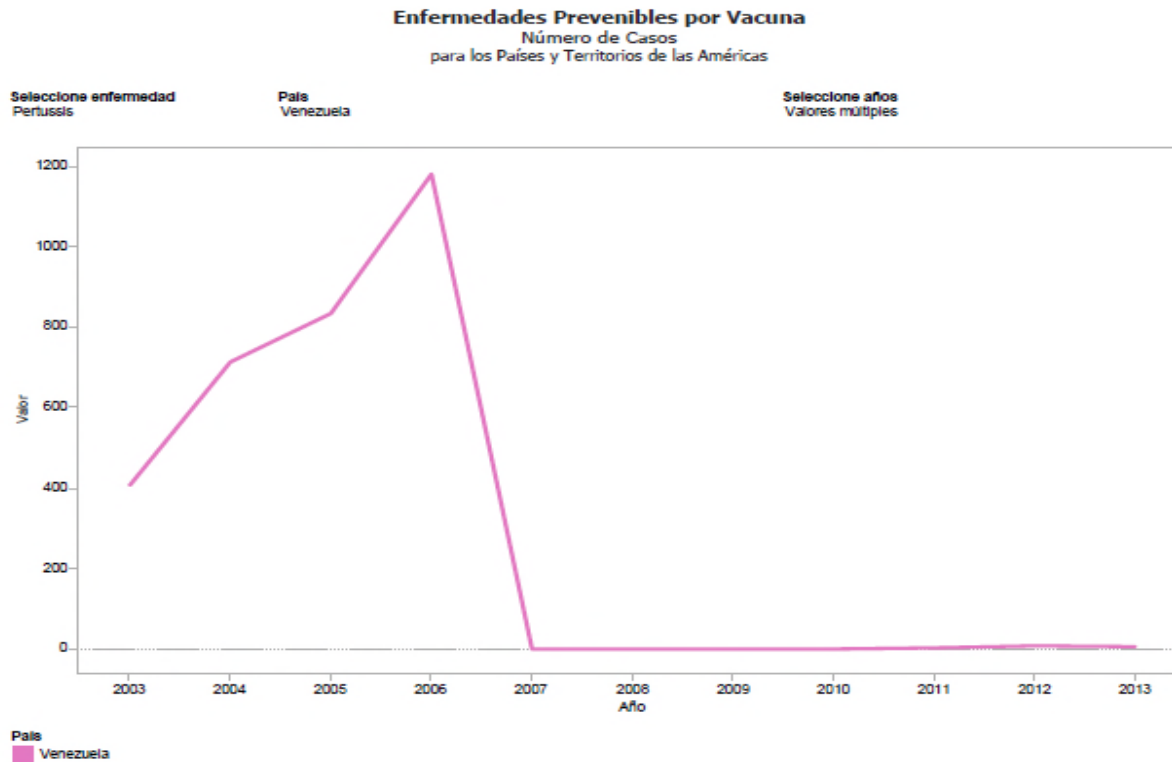


# Uruguay





# Venezuela



**Data for pertussis information on the PAHO website for Venezuela are sparse and it is unlikely that they reflect the real situation in the country.**

**The PAHO website reports either no data or zero cases of pertussis for the years 2007–2010, 3 cases for 2011, 8 in 2012, and 6 in 2013.**

# Países que reportaron brotes de tos ferina. Región de las Américas. 2012-2016

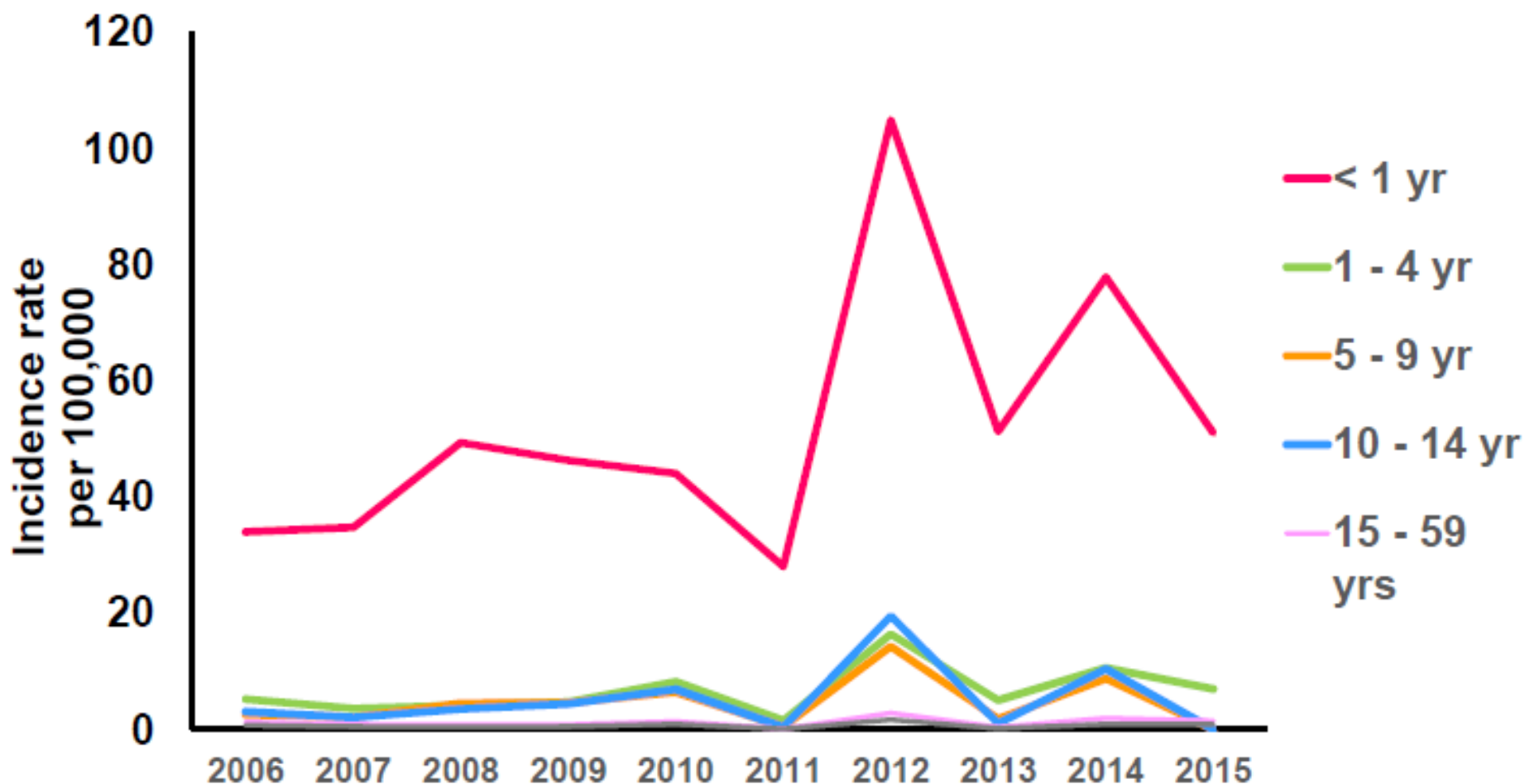
2012	2013	2014	2015	2016
1. Argentina	1. Argentina	1. Brasil	1. Canada	1. Argentina
2. Belize	2. Belize	2. Canadá	2. Chile	2. Aruba
3. Brazil	3. Bolivia	<b>3. Colombia</b>	<b>3. Colombia</b>	3. Canadá
4. Canada	4. Brazil	4. Dominican Republic	<b>4. Guatemala</b>	4. Chile
5. Chile	<b>5. Colombia</b>		5. Mexico	<b>5. Colombia</b>
<b>6. Colombia</b>	<b>6. Guatemala</b>	<b>5. Guatemala</b>	6. Panama	6. El Salvador
7. Costa Rica	7. Panama	6. Panamá	<b>7. Peru</b>	<b>7. Guatemala</b>
8. Ecuador	8. Paraguay	7. Paraguay	8. Saint Lucia	8. México
<b>9. Guatemala</b>	<b>9. Perú</b>	<b>8. Perú</b>		<b>9. Perú</b>
10. Mexico	10. Suriname	9. Surinam		
11. Paraguay		10. USA		
<b>12. Perú</b>				
13. Suriname				

Source: EPI Tables, PAHO-WHO/UNICEF Joint Reporting Form (JRF) , and country reports.

# Classification of Pertussis Cases per Age Group in Latin American Countries



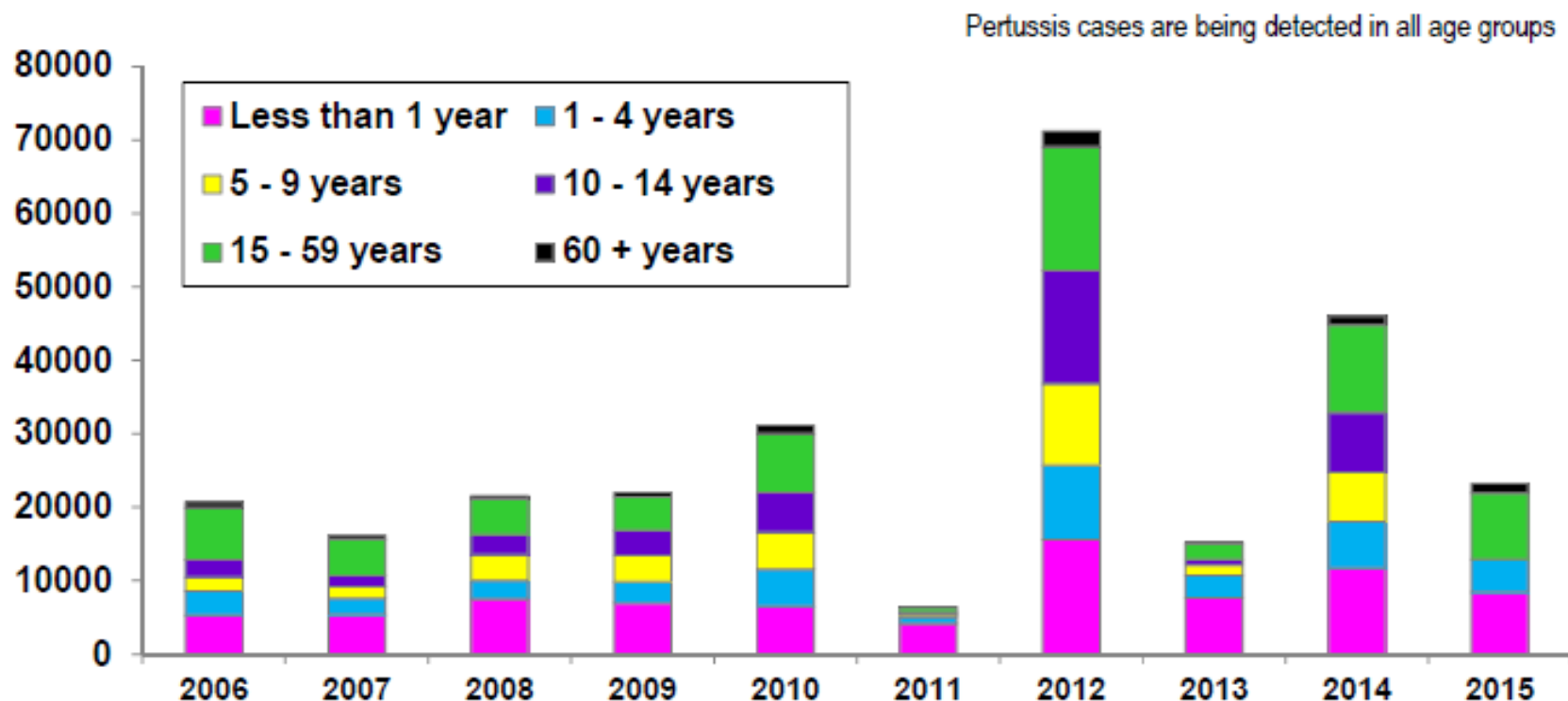
# Incidence rate by age. Region of Americas, 2006 - 2015



Fuente: Tablas del PAI, Formulario Conjunto de Informes de la OPS / OMS / UNICEF (JRF) e informes de los países.

# Distribution of pertussis reported cases by age. Region of the Americas, 2006-2015

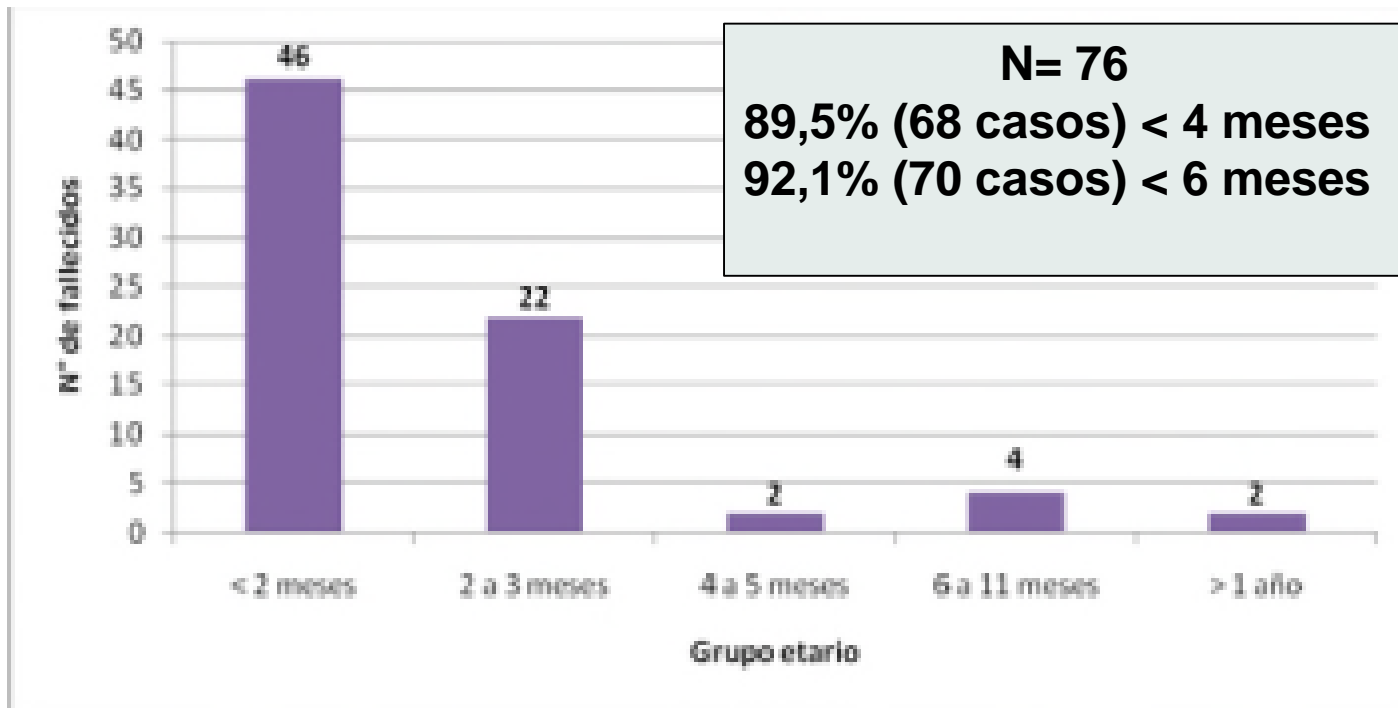
## Number of cases



Fuente: Tablas del PAI, Formulario Conjunto de Informes de la OPS / OMS / UNICEF (JRF) e informes de los países.

# Argentina

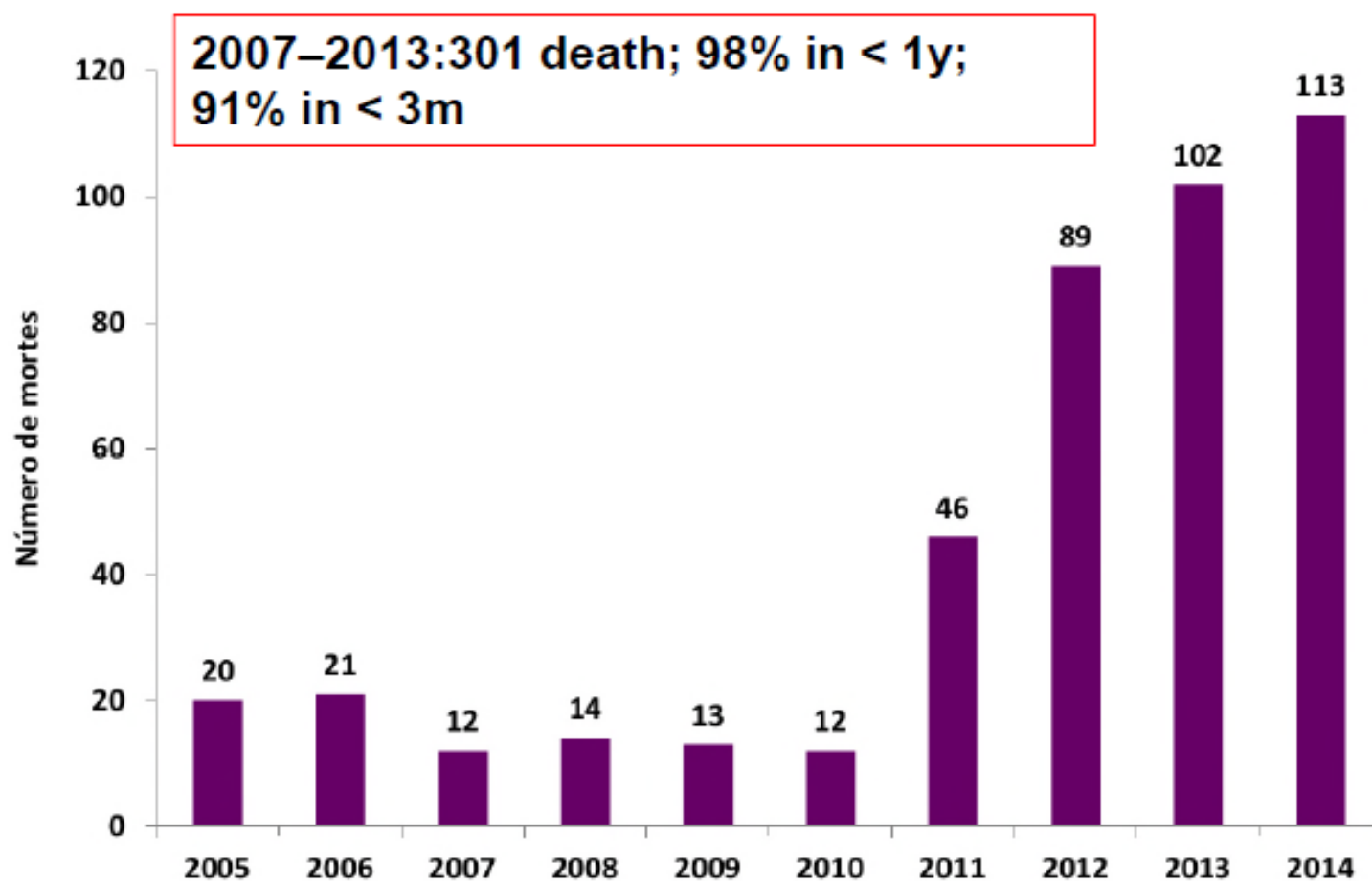
## Deaths associated with pertussis by age group. 2011



Fuente: Informes oficiales de las jurisdicciones.

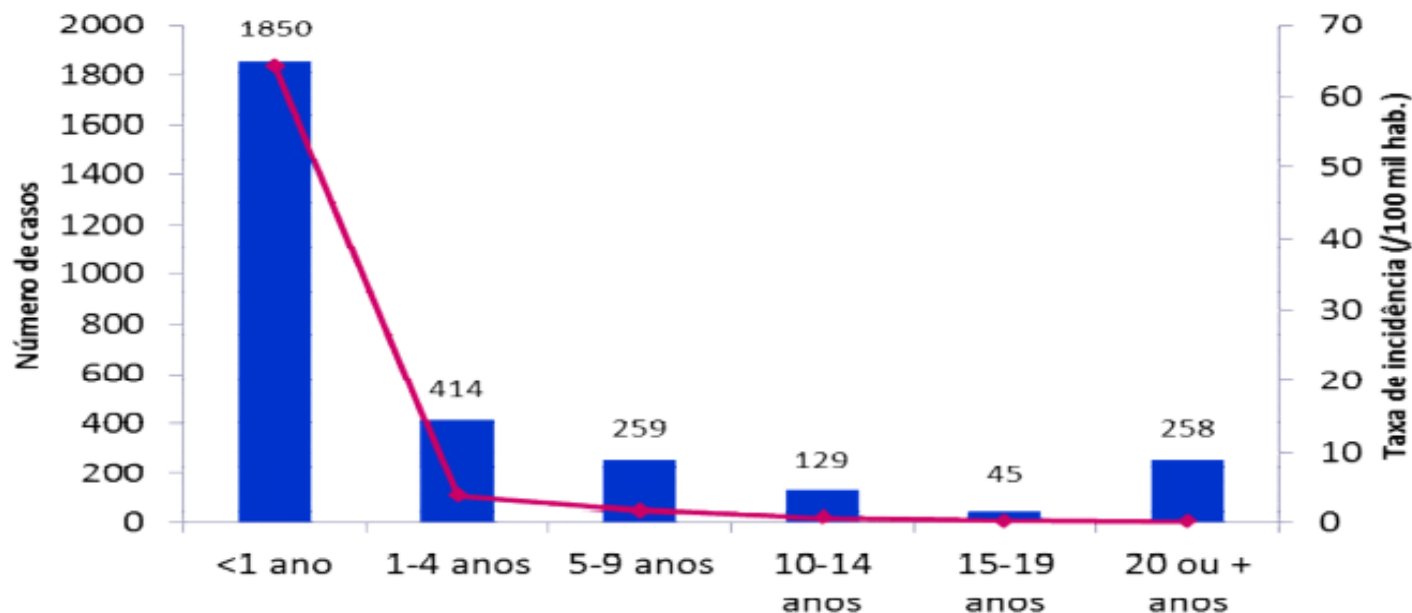
**In 92% of the deaths infants had not been vaccinated  
5% had receives only 1 dose and 3% had received  
only 3 doses**

## Pertussis mortality in those < 1 year of age Data SUS Brazil, 2005–2014



\*Dados de 2013 e 2014 atualizados em 10/02/2015, sujeitos a revisão.

## Pertussis confirmed cases & according to age Brazil, 2015, N=2,955



Fonte: Sistemas de informação de agravos de notificação (Sinan)  
Dados sujeitos a alteração

**Casos** **Incidência**

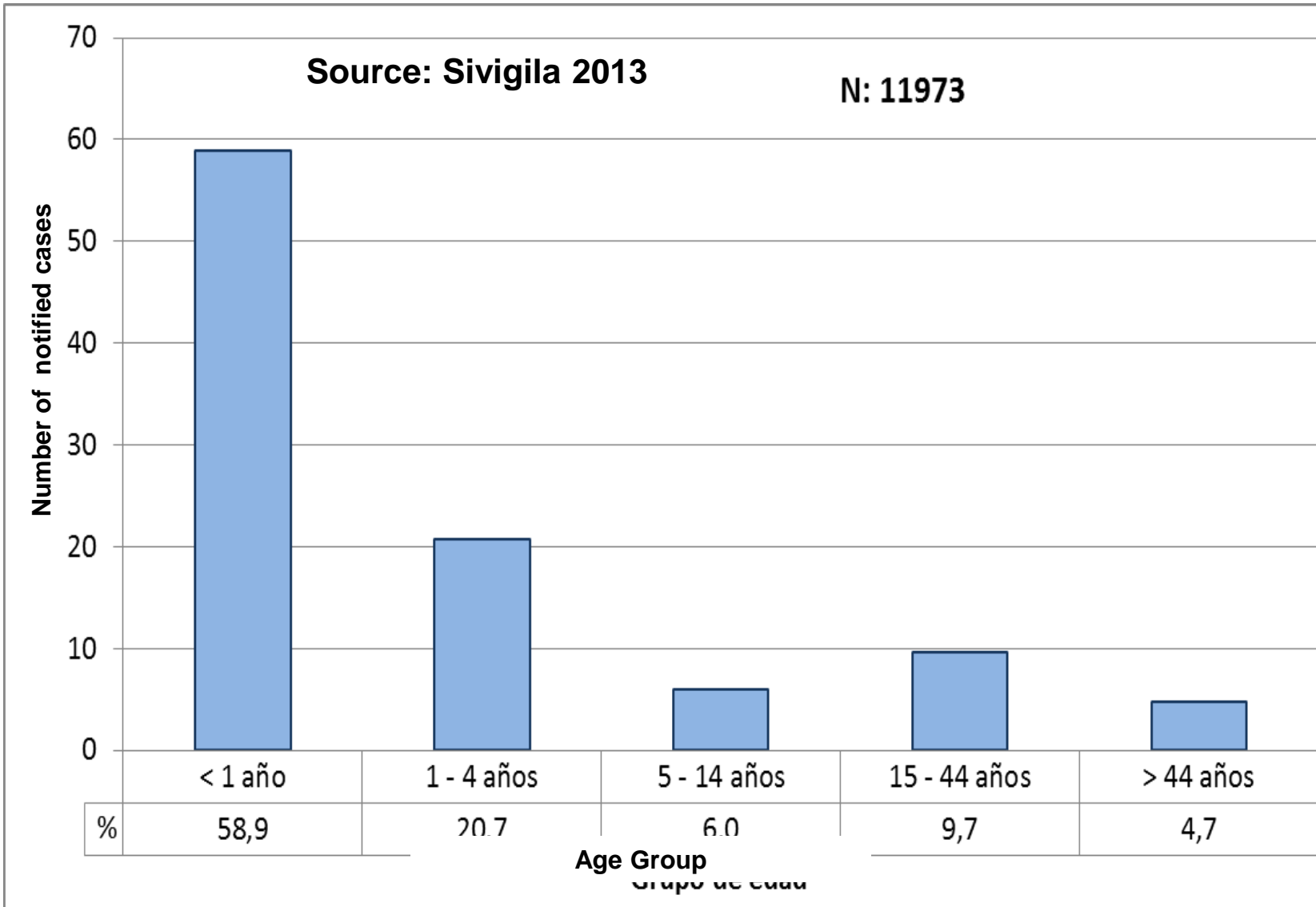
\*Dados atualizados: 29/04/2016

	<1 y	1-4 y	5-9 y	10-14 y	15-19 y	20 and + y
<b>Cases</b>	1850	414	259	129	45	258
<b>Tx Incidência</b>	64,2	3,7	1,7	0,7	0,3	0,2

Brasil. Boletim epidemiológico. Situação epidemiológica de coqueluche. Brasil, 2015 [Internet]. 2015 [atualizado 2016; citado 2017 Mar 23]. Disponível em: <http://portal.arquivos.saude.gov.br/images/pdf/2016/setembro/15/2016-025---Coqueluche-publica---o.pdf>

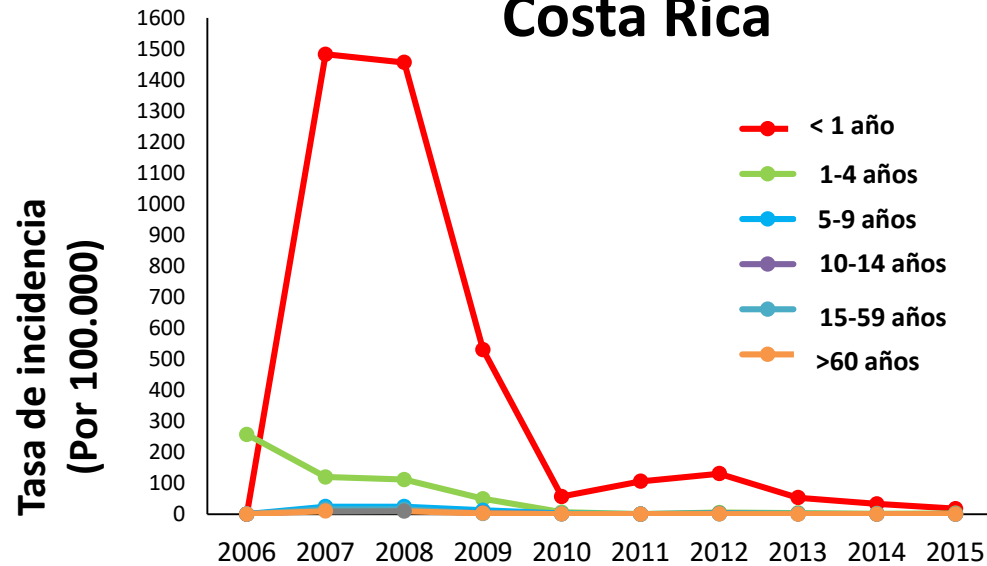


# Classification of Whooping Cough Cases per Age Group Notified in 2013 Colombia

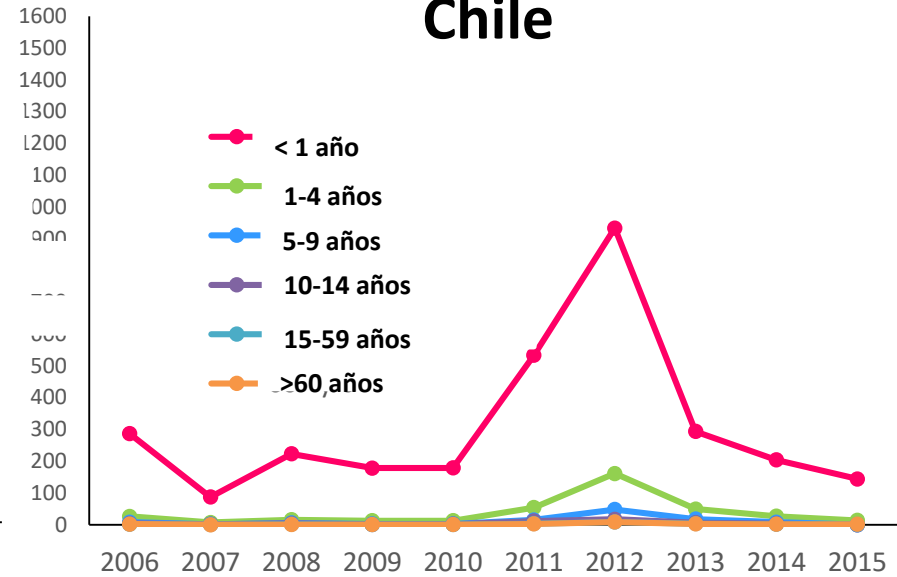


# Tasa de incidencia de tos ferina en países seleccionados. 2006-2015

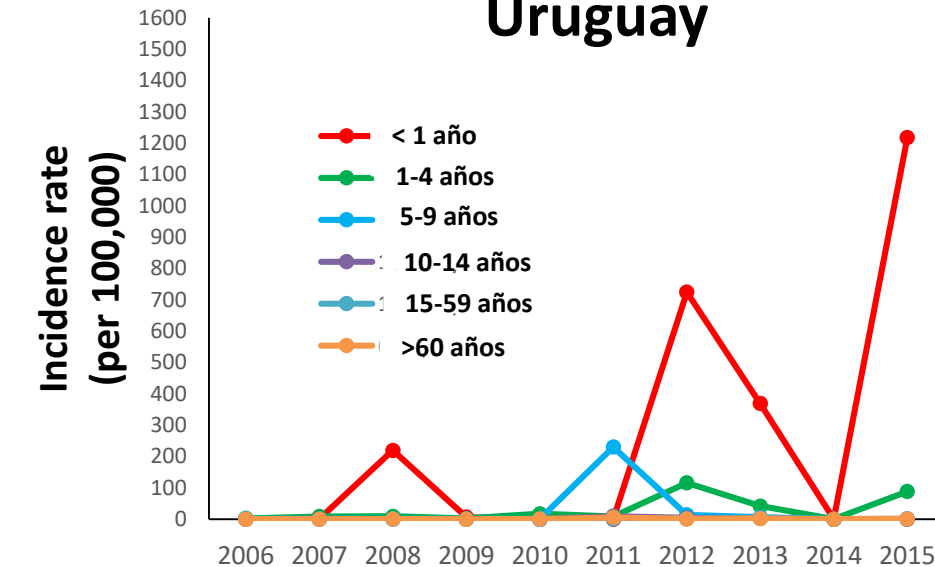
## Costa Rica



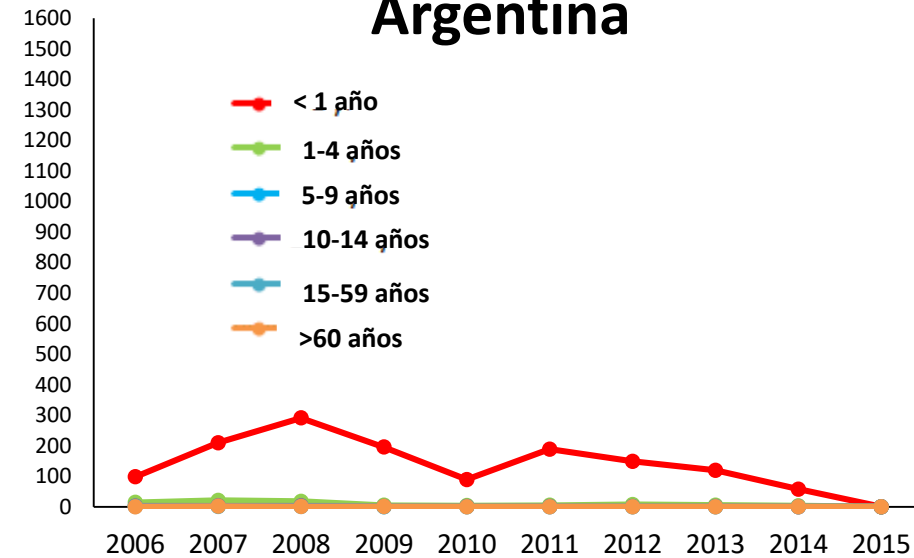
## Chile



## Uruguay



## Argentina



# Who was the Source?

## Mexico

192 confirmed cases . 434 contacts \*

111 **Mother** □ 48.2% positive PCR

71 **Father** □ 16.9% positive PCR

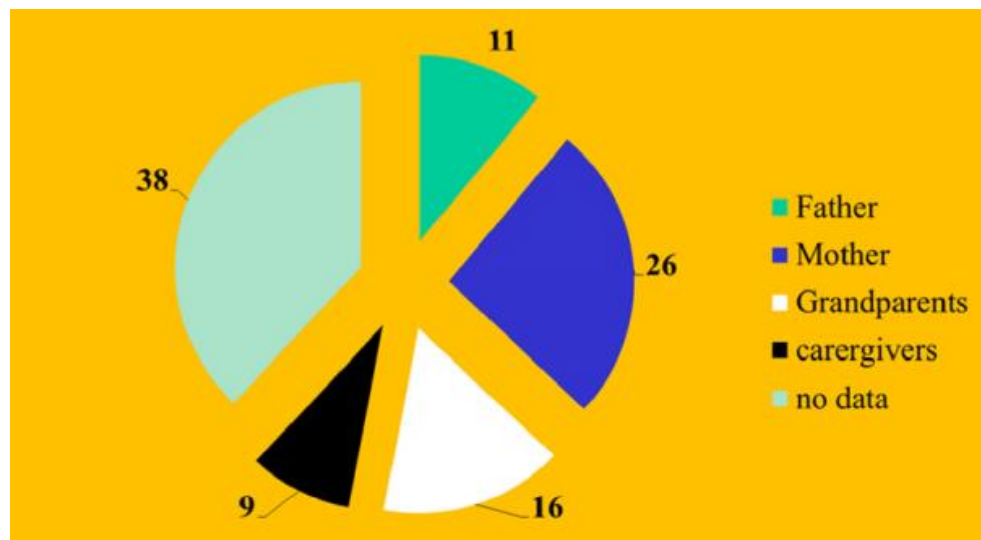
46 **Siblings** □ 14.1% positive PCR

74 **Grandparents** □ 9.4% positive PCR

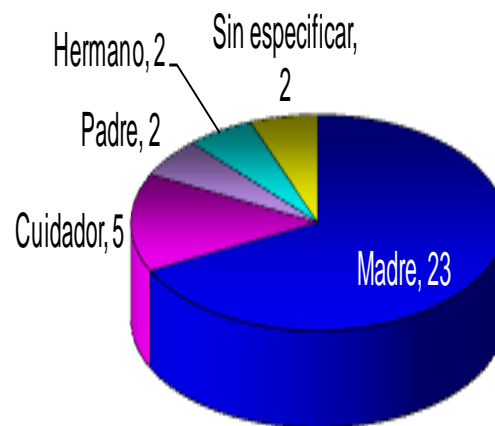
92 **Uncles/Aunts** □ 12.9% positive PCR

36 **Cousins** □ 1.2% positive PCR

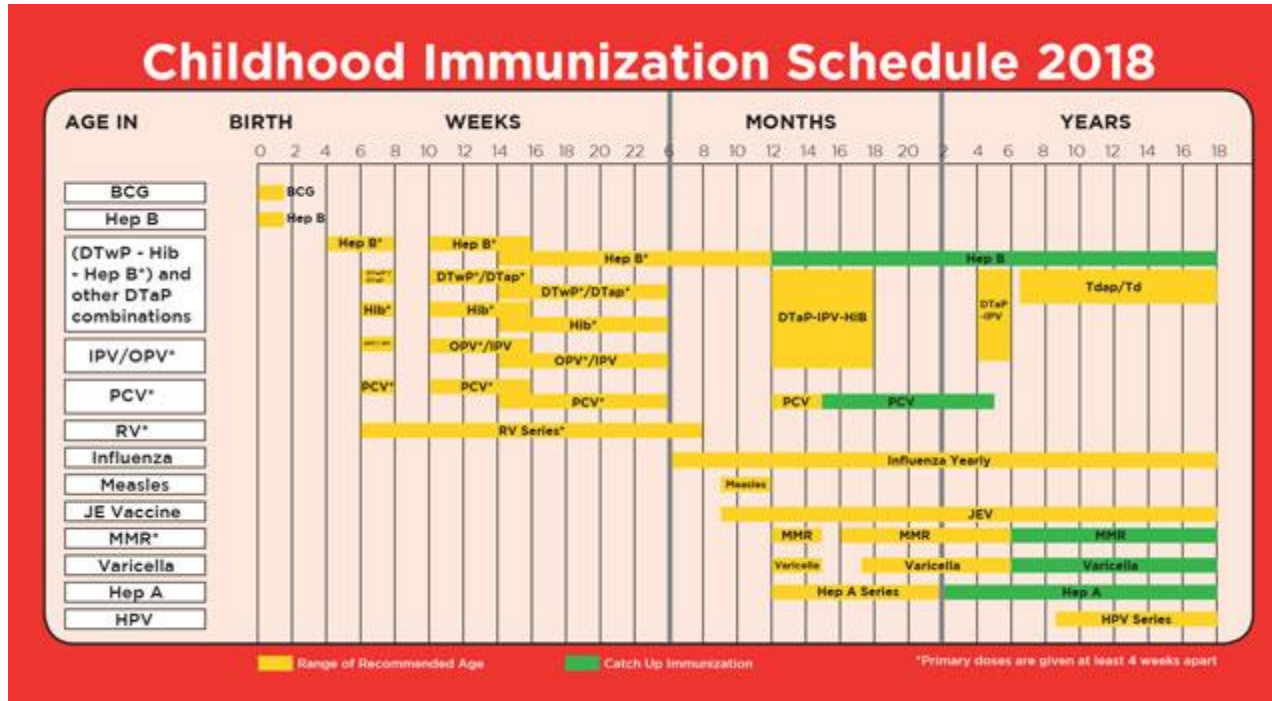
## El Salvador



## COLOMBIA



# Vaccination Schedules



**Table 1. Official vaccination schedule used in Latin American countries 2012.**

Country	Primary series 2, 4, 6 months	Booster 15–18 months	Booster 4–6 years	Adolescents	Pregnant	Postpartum	HCW
Argentina	DTwP-HB-Hib	DTwP-Hib	DTwP	<u>Tdap</u>	Tdap	Tdap	Tdap
Brazil	DTwP-HB-Hib	DTwP	DTwP	NO	NO	NO	NO
Chile	DTwP-HB-Hib	DTwP-HB-Hib	<u>Tdap</u>	<u>Tdap</u>	NO	NO	NO
Colombia	DTwP-HB-Hib	DTwP	DTwP	NO	<u>Tdap</u>	NO	NO
Costa Rica	<u>DTaP-Hib-IPV</u>	<u>DTaP-Hib-IPV</u>	<u>DTaP-IPV</u>	NO	<u>Tdap</u>	<u>Tdap</u>	NO
El Salvador	DTwP-HB-Hib	DTwP-HB-Hib	DTwP	NO	NO	NO	NO
Guatemala	DTwP-HB-Hib	DTwP	DTwP	NO	NO	NO	NO
Honduras	DTwP-HB-Hib	DTwP	DTwP	NO	NO	NO	NO
Mexico	<u>DTaP-Hib-IPV</u>	<u>DTaP-Hib-IPV</u>	DTwP	NO	<u>Tdap</u>	NO	NO
Panama	DTwP-HB-Hib	DTwP-Hib	DTwP	<u>Tdap</u>	<u>Tdap</u>	<u>Tdap</u>	<u>Tdap</u>

DTwP: Diphtheria, tetanus pertussis; HB: Hepatitis; HCW: Healthcare workers; Hib: *Haemophilus influenzae* type B; IPV: Inactivated poliovirus vaccine; NO: Not used.

Hexavalent vaccine containing DTaP (Diphtheria, Tetanus and acellular pertussis) IPV (inactivated polio), Hepatitis B and Hib (*Haemophilus Influenzae* type B) was introduced in 2014 for infant doses at 2, 4 and 6 months

# Vaccination During Pregnancy 2012



Country	Pregnant	Postpartum	HCW
Argentina	<b>Tdap</b>	<b>Tdap</b>	<b>Tdap</b>
Brazil	NO	NO	NO
Chile	NO	NO	NO
Colombia	<b>Tdap</b>	NO	NO
Costa Rica	<b>Tdap</b>	<b>Tdap</b>	NO
El Salvador	NO	NO	NO
Guatemala	NO	NO	NO
Honduras	NO	NO	NO
Mexico	<b>Tdap</b>	NO	NO
Panama	<b>Tdap</b>	<b>Tdap</b>	<b>Tdap</b>

# Vaccination during Pregnancy 2014 - 2017

Country	Pregnant	Postpartum	HCW
<b>Brasil</b>	Tdap	NO	If treat patients <1
<b>Chile</b>		Postpartum 5/15 regions	No ( outbreak if treat patients < 1)

# Vaccination Schedules - DPT

- Most countries in Latin America use wP vaccines for primary vaccination and the 4th and 5th doses.
- The use of booster doses (and coverage rates) for adolescents, pregnant/postpartum women, and HCWs varies quite widely, but countries have introduced, or are introducing, adult boosters

## Schedules - DPaT

### Costa Rica

Costa Rica switched from wP vaccine to DTaP in 2010.

Don't risk spreading whooping cough to your infant.

Create a circle of protection – get vaccinated.



postpartum cocoon vaccination was introduced in May 2007

switched to vaccination during pregnancy in 2013.

### Adults:

- Pregnancy (>20 wks) (Tdap)
- HCW's at nurseries: Mandatory ...
- Adult HCW's recommended



# Vaccination Schedules – DTaP schedule

## Mexico



**Pentavalent vaccine, which contains DTaP, IPV, and Hib, administered at 2, 4, 6 months, and a booster at 18m months. DTP vaccine (whole cell pertussis component) at 4 years of age**

**Vaccination during pregnancy since 2012.**

## Panama



**changed in 2014 from a pentavalent vaccine which contained DTP ,HB, and Hib, to a hexavalent, which contains DTaP, IPV, HB, and Hib, administered at 2, 4, and 6 months. booster doses at 18 months (DTP/Hib) and 4 years (DTP).**

**Tdap for children at 10 years. Catch up in >5 years  
HCW and adults in contact with children**

**Vaccination during pregnancy since 2012.**

# The Current Pertussis Situation Across the Americas

- Several countries in the Americas region have reported pertussis **outbreaks** over the past 6 years.
- The majority of countries have **challenges with surveillance**; pertussis is underreported and underdiagnosed.

- Reasons for this include
  - the clinical diagnosis definitions used
  - inconsistent laboratory confirmation
  - lack of uniformly accessible detection techniques, and
  - incomplete epidemiologic notification.



- The **laboratory criteria for diagnosis** are based mainly on the isolation of *B. pertussis* from clinical specimens, and/or through PCR. **Most countries in LA use conventional PCR, or real-time PCR**  
Serology is used in only 3 countries of the region.

# The Current Pertussis Situation Across The Americas

## Vaccination

- Data from 1978–2012 show that the overall DTP3 vaccination **coverage has never been higher than 95%**. The coverage for **DTP4** has always been <90%.
- Data on pertussis incidences during the same period show a **clear decrease in the number of cases following the introduction of mass vaccination**
- While the introduction of vaccines has led to a clear decrease in pertussis, since 2004, an increase in the number of cases has been reported
- There has been resurgence in many countries. In particular, **Argentina, Brazil, Canada, Colombia, El Salvador, Peru, and Uruguay all reported outbreaks in 2011 and/or 2012.**
- Country-specific data for 2013–2015 show that the coverage for DTP3 is generally improving and has reached  $\geq 95\%$  in a few countries.

# The Current Pertussis Situation Across the Americas

- **Maternal immunization** was introduced in 2012 in several Latin America countries, and Brazil and Chile introduced maternal immunization 2 years later. Coverage is generally good in this population group within the region.
- From 2006–2015, most reported pertussis cases were in infants <1 year, but increases have been seen in all age groups. **In recent years, the number of pertussis-related deaths was highest in 2009 and 2012.**
- The most frequent source of pertussis in infants are mothers and other household contacts
- Between 2006–2015, Argentina, Chile, Costa Rica, and Uruguay had the highest incidence of pertussis.

Many **South American countries using Pw experienced a pertussis outbreak in 2011–2012.** Other countries (eg, Canada and United States) were using aP vaccines during the outbreak in 2011–2012, so the occurrence of this outbreak did not seem to be dependent on which vaccine was being used.

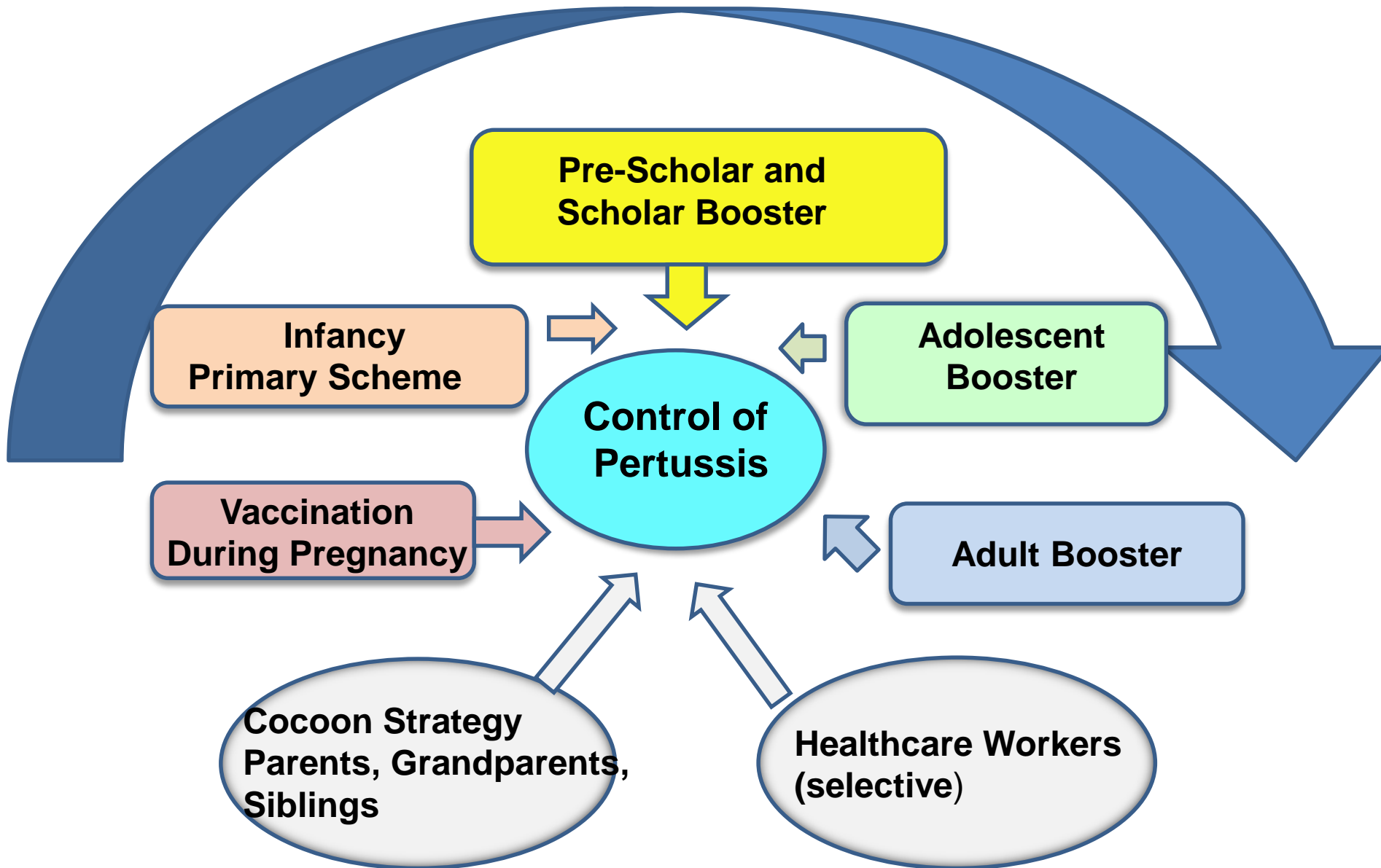
# Possible Causes of the Increase in Pertussis Cases:

- ✓ Higher sensitivity of the **surveillance systems**, and the improvements in diagnosis tests.
  - ✓ Suboptimal coverage **rates of vaccination**
  - ✓ The implementation of **new diagnostic technologies** (PCR) have largely contributed to the detection and confirmation of pertussis cases
- ✓ There is **NO lifelong immunological protection** (evanescent immunity)
    - Immunity is lost even after natural disease, it is estimated that the loss of immunity is between 4-20 years of age
    - Immunity also disappears after vaccination; its protection is estimated at least for 4-12 years off to vaccination, be it with DPwT or DPaT

¿What are the vaccination strategies considering this Epidemiological Panorama?



# Vaccination across “The Life Course”



# OBJECTIVES OF aP VACCINATION DURING PREGNANCY

- Reduce morbidity and mortality associated with pertussis in infants with less than six months of age



**After 4 years of introducing the vaccination in pregnant women, a remarkable effect begins to be registered as it is the reduction of the lethality in infants**

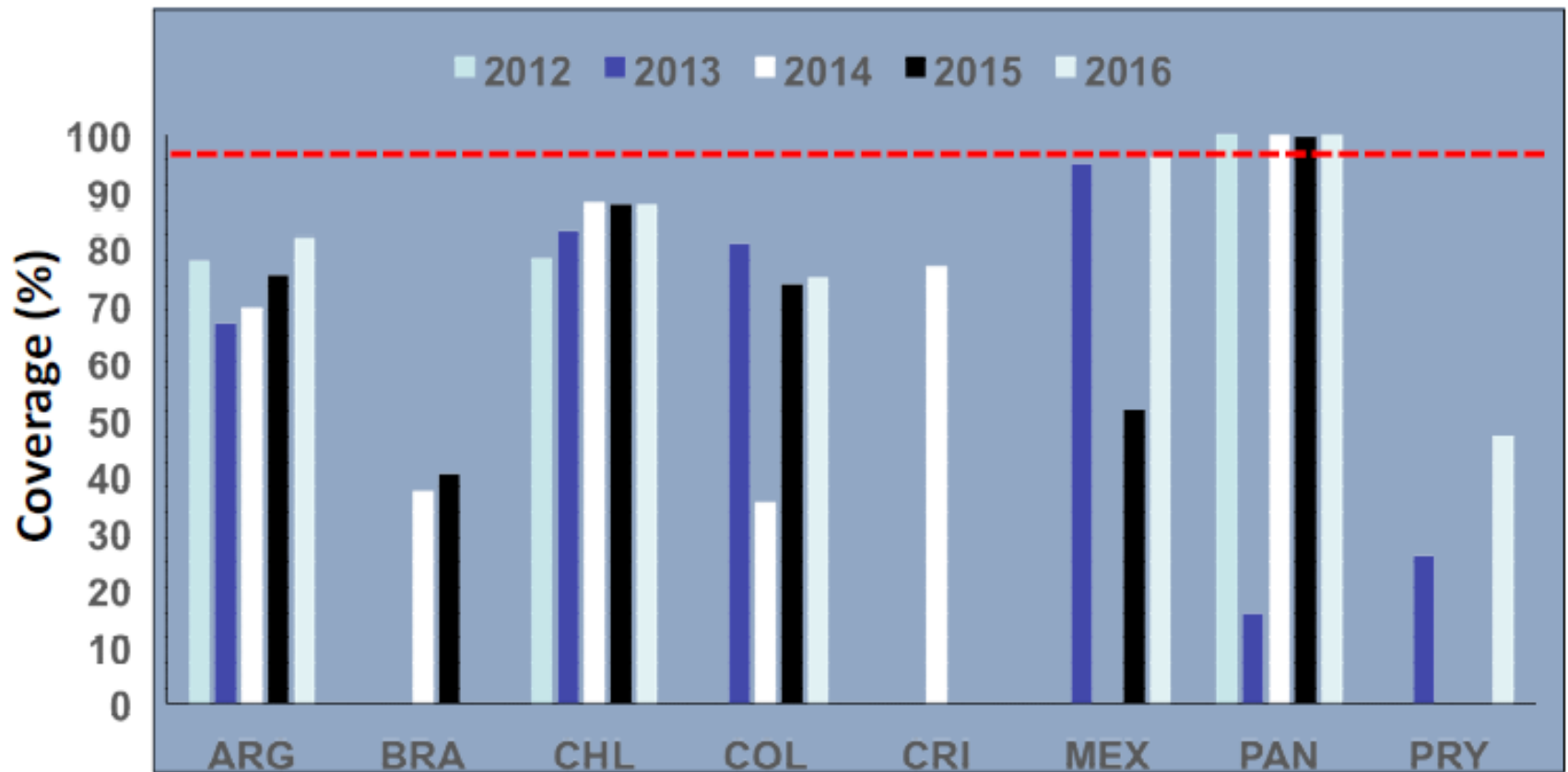


# Maternal Vaccination

- Maternal immunization should form a key part of a country's vaccination schedule.
- Many countries reported a **reduction in pertussis cases and pertussis-related mortality following the introduction of maternal immunization.**
- Recommendations are inconsistent and several countries, including Brazil, Costa Rica, El Salvador, Mexico, and Uruguay, noted that implementation of maternal immunization needs drastic improvement.
- Currently, the implementation is suboptimal, and in some countries it is not recommended yet.



# Maternal vaccination coverage in Latin America, 2012-2015.



Fuente: Tablas del PAI, Formulario Conjunto de Informes de la OPS / OMS / UNICEF (JRF) e informes de los países.

## Effectiveness of Tdap vaccination during pregnancy in preventing pertussis among infants less than 6 months of age in Argentina

Viviana Romerón<sup>1</sup>, Anna M. Accosta<sup>2</sup>, María Del Valle Juárez<sup>1</sup>, Elizabeth Bierre<sup>2</sup>, Stella Maris Sánchez<sup>2</sup>, Beatriz Lopez Córdoba<sup>4</sup>, María Eugenia Sevilla<sup>6</sup>, María Florencia Lucion<sup>6</sup>, Analí Urrutia<sup>7</sup>, Sagrada Sandra<sup>1</sup>, Tami Skoff<sup>2</sup> and Carla Vizzotti<sup>1</sup>

<sup>1</sup> Dirección de Control de Enfermedades Inmunoprevenibles (DICE), Ministry of Health of Argentina, Buenos Aires, Argentina, <sup>2</sup> Meningitis and Vaccines Programme (MVP), Centers for Disease Control and Prevention, Atlanta, GA, <sup>3</sup> Hospital del Niño Jesús, Tucumán, Argentina, <sup>4</sup> Hospital Pardo Mazzeo (HMPM), Salta, Argentina, <sup>5</sup> Hospital General Gurruchaga, Buenos Aires, Argentina, <sup>6</sup> Hospital General Gurruchaga, Buenos Aires, Argentina, <sup>7</sup> D. N. H. H. Hospital, Mendoza, Argentina

- ✓ **Argentina was the first country in Latin America to implement routine Tdap vaccination during pregnancy, rapidly reaching 60-65% coverage. To our knowledge, this is the first evaluation of maternal Tdap VE among a population that received whole-cell pertussis vaccines during childhood.**
- ✓ **Our analysis shows that vaccination during pregnancy is effective in preventing pertussis in infants <6 months of age, especially among those <2 months of age, the population most vulnerable to severe disease and death.**

# PERTUSSIS EPIDEMIOLOGY IN ARGENTINA: TRENDS AFTER THE INTRODUCTION OF MATERNAL IMMUNIZATION

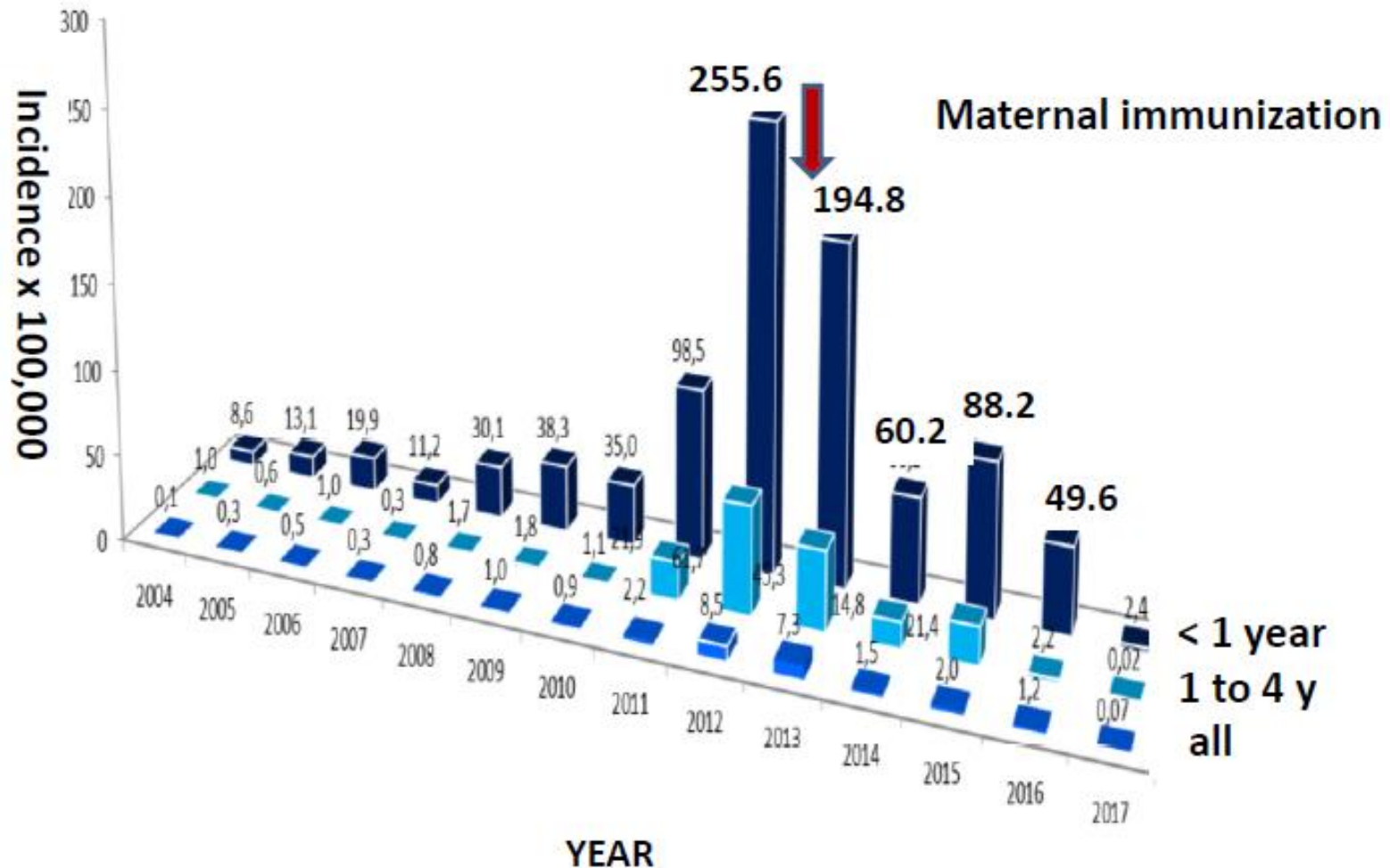
We point out that during the 2016 outbreak the increment in the incidence was fortunately not accompanied by an increase in the lethality rate. Indeed, In 2016 the lethality rate was the lowest (0.6%). Moreover, during the 2016 outbreak the incidence (3.9/100,000 inhabitants) and the case severity detected in the most vulnerable population (infants 0-2) were both lower than those in 2011.

**After the implementation of Tdap maternal immunization strategy a significant reduction in hospitalization rate was observed.**

**VACUNACIÓN**  
CONTRA EL  
COQUELUCHE  
O TOS CONVULSIVA



# PERTUSSIS INCIDENCE: COLOMBIA 2004–2017



Source: Sivigila, Individual and Collective 2004–2017  
DANE, National Department of Statistics

# Effectiveness of maternal pertussis vaccination in England: an observational study

Gayatri Amirthalingam, Nick Andrews, Helen Campbell, Sonia Ribeiro, Edna Kara, Katherine Donegan, Norman K Fry, Elizabeth Miller, Mary Ramsay

## Study in the United Kingdom

Effectiveness in **under 3 months of age was 91% CI (84%-95%)**

*www.thelancet.com Vol 384 October 25, 2014*

## Immunization During Pregnancy: Impact on the Infant

Kirsten P. Perrett<sup>1,2,3</sup> · Terry M. Nolan<sup>1</sup>

- ✓ 90% protection against confirmed Pertussis in infants
- ✓ 95% effective in reducing deaths due to Pertussis

# Effectiveness of Vaccination During Pregnancy to Prevent Infant Pertussis

Roger Baxter, MD,<sup>†</sup> Joan Bartlett, MPH, MPP, Bruce Fireman, MA, Edwin Lewis, MPH, Nicola P. Klein, MD, PhD

**METHODS:** In a retrospective cohort study of infants born at Kaiser Permanente Northern California from 2010 to 2015, we estimated the effectiveness of maternal pertussis vaccination for protecting newborns against pertussis in the first 2 months of life and in the first year of life accounting for each infant DTaP dose.

**CONCLUSIONS:** Maternal Tdap vaccination was highly protective against infant pertussis, especially in the first 2 months of life. Even after infant DTaP dosing, there was evidence of additional protection from maternal Tdap vaccination for the first year of life. This study strongly supports the United States' current recommendation to administer Tdap during each pregnancy.

# Maternal vaccination against pertussis: a systematic review of the recent literature

## RESULTS

- ✓ Prenatal vaccination induces high concentrations of antibodies in pregnant women → effective transfer to the fetus transplacentally
- ✓ The safe strategy without evidence of adverse effects during pregnancy or in the fetus

## CONCLUSIONS

Quantity of evidence that supports **safety, immunogenicity and effectiveness** of prenatal vaccination to reduce morbidity and mortality due to Pertussis in NB and lactating infants before they initiate their primary scheme

*Gkentzi D, et al. Arch Dis Child Fetal Neonatal Ed 2017;*

RESEARCH ARTICLE

Open Access

Efficacy and safety of pertussis vaccination for pregnant women – a systematic review of randomised controlled trials and observational studies



Marie Furuta<sup>1\*</sup>, Jacqueline Sin<sup>2</sup>, Edmond S. W. Ng<sup>3</sup> and Kay Wang<sup>4</sup>

*Furuta et al. BMC Pregnancy and Childbirth (2017) 17:390*



# Strategies for the Control of *Bordetella pertussis* Infection

## Immunization of Infants and Preschoolers

Strategy	Objectives
<ul style="list-style-type: none"><li>Reinforce and/or improve the immunization strategy in <b>infants and preschool children at 4–6 years old</b></li></ul>	<ul style="list-style-type: none"><li>Reduce morbidity and mortality in infants and children<ul style="list-style-type: none"><li>Reduce the circulation of pertussis in general</li></ul></li></ul>



# First Pertussis Vaccine Dose and Prevention of Infant Mortality

Tejpratap S.P. Tiwari, MD<sup>a</sup>, Andrew L. Baughman, PhD, MPH<sup>b</sup>, Thomas A. Clark, MD, MPH<sup>a</sup>

- ✓ The most severe cases of the disease occur during the first months of life
- ✓ Study in the USA de >45,000 of whooping cough in children 1999 – 2008
  - ✓ 64% of the 258 deaths were presented before 6 weeks of age
  - ✓ All occurred before 34 weeks
  - ✓ **Recieve  $\geq 1$  dose of the vaccine at  $\geq 6$  weeks of age**



**Protection against death, hospitalization and pneumonia**

# Other Strategies



**Immunization of  
Adolescents and  
Adults**



**Immunization of  
Healthcare Workers**



# Strategies for the Control of *B. pertussis* Infection

Strategy	Objectives
<ul style="list-style-type: none"><li>✓ Universal immunization of the adolescent</li></ul>	<ul style="list-style-type: none"><li>✓ Reduce morbidity in adolescents and Young adults</li><li>✓ Development of herd immunity</li><li>✓ Reduce transmission to young children</li></ul>
<ul style="list-style-type: none"><li>✓ Selective immunization (new mothers and family contacts)</li><li>✓ Cocoonin</li></ul>	<ul style="list-style-type: none"><li>✓ Decrease mortality and morbidity in newborns and small infants</li><li>✓ Reduce transmission to younger infants</li></ul>
<ul style="list-style-type: none"><li>✓ Selective immunization of health care workers</li></ul>	<ul style="list-style-type: none"><li>✓ Reduce patient transmission and bidity in health workers</li></ul>

# Obstacles to Vaccination in Latin America

- **Surveillance systems** are deficient and irregular in some countries
- The **medical staff needs** continuous and better training in pertussis
- There is also **poor awareness of pertussis among HCWs** and the general population
- **Lack of knowledge** about vaccination in medical training programs
- The **diagnostic methods** such as PRC-RTC are not available in all of the countries and in those in which they are available are only done in a few centers where there is uniformity in the same country

# Obstacles to Vaccination in Latin America

- Under-reporting of vaccine coverage
- There could be **low vaccine coverage** within the same country (difficult access, internal conflicts, immigrants etc.)
- HCWs should be vaccinated against pertussis (this is only achieved in a few countries)
- Complicated access to special populations (indigenous, and to areas of conflict)
- **Inequity** between rural and urban areas
- Several Latin American countries have **high numbers of immigrant children** with an unknown immunization status; there is no consistent system to manage this issue.



# Challenges in LA

- ✓ **Case definition must be the same everywhere;**
- ✓ **Offer the best quality medical attention to reduce mortality**
- ✓ **Improve the infrastructure for laboratory diagnosis; introduction of PCR – RTC in all of the countries of the region and increase reference laboratories in the countries**
- ✓ **Some countries need to improve their vaccine coverage records**
- ✓ **Continue to monitoring the pertussis burden and assessing vaccine effectiveness**
- ✓ **Impact of pregnancy-Tdap implementation should be measured**

**In general, better surveillance is needed, coverage has increased, but is prone to operational and acceptance problems; infant mortality should be more closely monitored.**

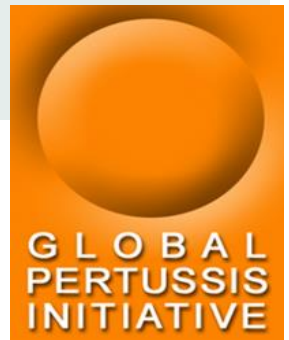
# Challenges to Vaccine Uptake

- Maintaining **vaccine coverage** in children in the face of vaccine hesitancy and nonmedical exemptions
- There is, in general, a lack of **booster dose recommendations** in many countries; in those countries that do have booster recommendations, there is a relatively low uptake rate.
- **Optimizing coverage with 4 and 5 doses**
- Enhancing uptake in **adolescent populations**
- Circumventing the **financial and demographic factors** contributing to decreased vaccine rates in certain populations
- Maintaining **regional supply of the Tdap vaccine**
- Evaluating **new approaches to boost waning immunity**
- **Increase vaccination coverage in pregnant woman**



# GPI Vaccination Recommendations

- ✓ Reinforce and/or improve current infant and toddler immunization strategies
- ✓ 4th or 5th dose for all preschool children (4–6 years old)
- ✓ Immunization of pregnant women and cocoon strategies—ie, immunization of, new mothers, family and close contacts of newborns
- ✓ Universal immunization of adolescents
- ✓ Immunization of healthcare workers
- ✓ Immunization of childcare workers



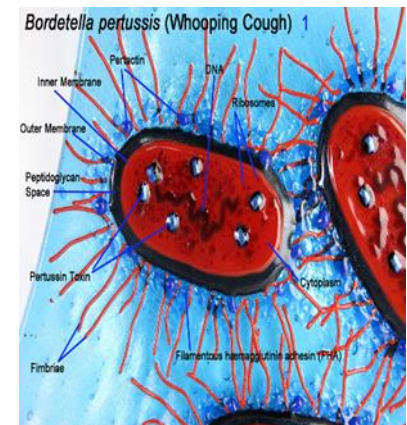
# RECOMMENDATIONS

- **Maternal immunization should form a key part of a country's vaccination schedule**, as a reduction in pertussis cases and pertussis-related mortality following its introduction was widely reported.
- The administration of **adolescent boosters** needs to be introduced in some countries; in countries where it is already available the implementation needs to be optimized.
- However, the GPI only recommends adolescent boosters when
  - it is known that there is optimal use in maternal vaccination and in younger ages
  - there is a problem with adolescent disease,
  - the country has aP in widespread use.



# Future Challenges at a Global Level

- *B. pertussis* clinical isolates circulating different from those used for the current vaccines - Changes have been observed in *B. pertussis* populations post vaccination introduction
- Basic research on the **genetics and evolution** of circulating *B. pertussis* strains is needed
- Clear need for **more data on the impact of vaccination on the innate and adaptive immune responses following both acellular and wP vaccination**
- Focus should remain on using what is **currently available to the best of its ability**
- **Strategies employing the vaccines we have must be reconsidered** (boosting, cocooning, and maternal immunization etc)



# Controlling pertussis: how can we do it? A focus on immunization

Federico Martín-Torres<sup>a,b</sup>, Ulrich Heininger<sup>c</sup>, Angus Thomson<sup>d</sup> and Carl Heinz Wirsing von König<sup>e</sup>

To provide maximum vaccine coverage we propose a schedule that incorporates

- immunization of infants, preschoolers, adolescents, adults, and pregnant women.
- Uptake of vaccines may also vary between populations due to a variety of causes, including hesitancy to vaccinate, so any national strategy to control pertussis should also include
  - sustaining public and healthcare provider **confidence in vaccination**.
  - Addressing and **improving regional variations in surveillance** will also help better monitor annual incidence and outbreaks.
  - Looking towards the future, the **development of new pertussis vaccines** with longer duration of protection would be advantageous.

EXPERT REVIEW OF VACCINES, 2018

VOL. 17, NO. 4, 289–297

<https://doi.org/10.1080/14760584.2018.1445530>



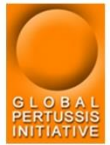
ESP 18-0935

# PERTUSSIS IN THE AMERICAS REGION

RECENT EPIDEMIOLOGICAL DATA PRESENTED AT THE 2017 GLOBAL PERTUSSIS INITIATIVE (GPI) ROUNDTABLE MEETING; CANCUN, MEXICO, NOVEMBER 2017

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## BACKGROUND & AIMS

Whooping cough or pertussis is a respiratory disease mainly caused by *Bordetella pertussis*. Though preventable by vaccination the disease remains an important problem for health in particular in infants but also in adolescents and adults. For several decades, the immunization programs with anti-pertussis vaccines have been very successful in preventing severe disease. However, in recent years pertussis has resurged with a number of cases surprisingly higher in different developed and developing countries, including those from the Americas region (1-3).

The GPI is an expert scientific forum, which publishes consensus recommendations for pertussis monitoring, prevention, and treatment across many regions of the world. Here, we report the proceedings of regional GPI meeting, held in Mexico in November 2017.

## METHODS

Information on current pertussis epidemiology, surveillance, vaccine strategies, diagnostic capabilities, disease awareness, and major local obstacles was presented by researchers from 12 countries: Argentina, Brazil, Canada, Colombia, Costa Rica, El Salvador, Mexico, Peru, Puerto Rico, United States, Uruguay and Venezuela.

## RESULTS

In the region of the Americas, it is mandatory to notify pertussis nationally. Cases should be reported to the National Health Ministry in each country. Epidemiological surveillance in most of the countries is based on the recommendations of international organizations such as WHO and the CDC.

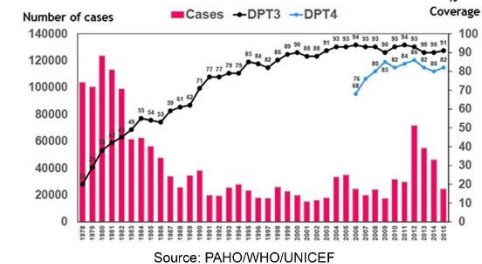
The different countries of the Americas have considered adaptations in clinical criteria including age stratification and cough duration. Currently, for the primary vaccination schedule series: 7 countries use wP vaccine and the other 5 aP vaccine (Table 1).

Table 1 Vaccination Schedule for pertussis

COUNTRY	PRIMARY SERIES 2-5 yrs	BOOSTER 15-18m	BOOSTER 4-6 years	ADOLESCENT 5	PREGNANT	POST PARTUM	HCW
ARGENTINA	DTPa-Hb-hb	DTPa-hb	DTPa	Yes	Yes	Yes	Yes
BRAZIL	DTPa-Hb-hb	DTPa	DTPa	NO	Yes	NO	NO
CANADA	DTPa-IPV/hb or DTPa-IPV/hb-hb	DTPa-IPV/hb or DTPa-IPV/hb-hb	DTPa-IPV or Tdap-IPV	Yes	Indicates if have not received such dose	NO	NO
COLOMBIA	DTPa-Hb-hb	DTPa	DTPa	NO	Yes	NO	NO
COSTA RICA	DTPa-Hb-IPV	DTPa-Hb-IPV	DTPa-IPV	NO	Yes	Yes	NO
EL SALVADOR	DTPa-Hb-hb	DTPa-Hb-hb	DTPa	NO	Yes	NO	NO
MEXICO	DTPa-Hb-IPV	DTPa-Hb-IPV	DTPa	NO	Yes	NO	NO
PANAMA	DTPa-Hb-hb	DTPa-hb	DTPa	Yes	Yes	Yes	Yes
PERU	DTPa	DTPa	NO	NO	NO	NO	NO
PUERTO RICO	DTPa	DTPa	DTPa	Yes	Yes	Yes	Yes
UNITED STATES OF AMERICA	DTPa	DTPa	DTPa	Yes	Yes	Yes	Yes
URUGUAY	DTPa-Hb-hb	DTPa-Hb-hb	DTPa	Yes	Yes	Yes	Yes
VENEZUELA	DTPa-Hb-hb	DTPa-Hb-hb	DTPa-Hb-hb	NO	NO	NO	NO

Pertussis outbreaks have been detected during the last decade in the majority of participant countries. In particular, in 2011-2012 an important outbreak was detected in the majority of the countries (Figure 1). Improvements in pertussis surveillance have been accomplished after these outbreaks. Molecular-based diagnosis based on polymerase chain reaction is available in most of the countries. Due to improvements in surveillance, pertussis prevalence in the most vulnerable population (infants <1 year) is much better defined

Figure 1: Number of pertussis reported cases and vaccination coverages. Region of the Americas. 1978-2015



Source: PAHO/WHO/UNICEF

This figure shows the distribution of the number of pertussis cases in the Americas region per year. In the upper part of the figure, the DTP3 and DTP4 vaccination coverages are shown. The DTP3 vaccination coverage was never higher than 95%. The DTP4 coverage, available since 2006, was lower than 90% in the represented period. A clear decrease in the number of cases could be detected after the introduction of mass vaccination. As reported in other regions, the decrease in incidence did not change the periodicity of the epidemic cycles. Since 2004, there has been an increase in the number of reported cases. From 2012 to 2015, on average, 41,000 cases were reported annually.

Based on these data and recommendations from organizations such as the GPI, 7/12 countries introduced maternal immunization during pregnancy (4,5). Interestingly, countries in which this strategy has been introduced >two years ago have begun to detect a reduction in the infant case-fatality rate (6-8).

## CONCLUSIONS

Surveillance and vaccination strategies are not homogeneous among different regions of the Americas. However, all countries need to maintain and improve pertussis surveillance and to reach primary dose coverage of above 90%. Moreover, countries without maternal immunization programs should strongly consider them

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