



PCV Impact and the paediatric meningitis surveillance in West Africa

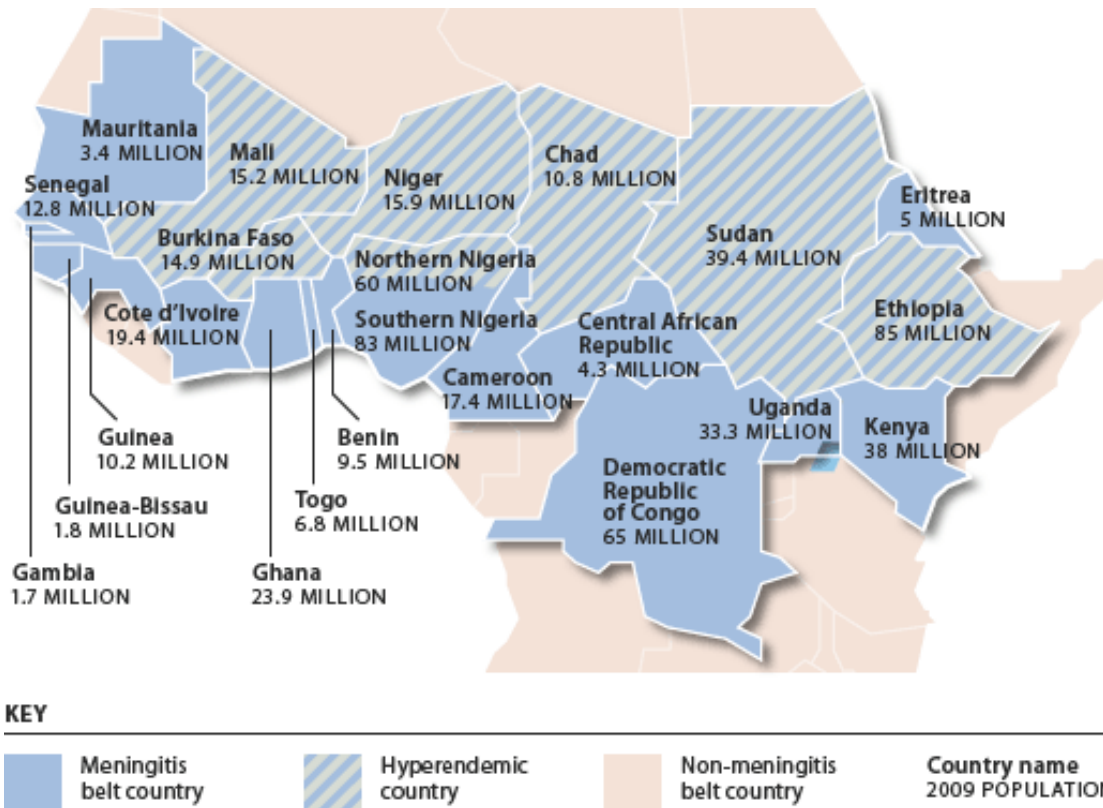
Martin Antonio

**Medical Research Council Unit The Gambia at
London School of Hygiene & Tropical Medicine**

**Meningitis Research Foundation's 12th International Conference
The British Museum, London
6th November, 2019**

Africa's meningitis belts

- Long history (>100 years) of periodic meningitis outbreaks associated with meningococcus (**Greenwood, 2006**)



Strategy for managing meningitis epidemics in Africa

The WHO strategy for the control of epidemic meningitis is based on three key pillars:

- **Surveillance**
- **Treatment and care**
- **Vaccination**

MRC Gambia @LSHTM hosts WHOCC for New Vaccines Surveillance

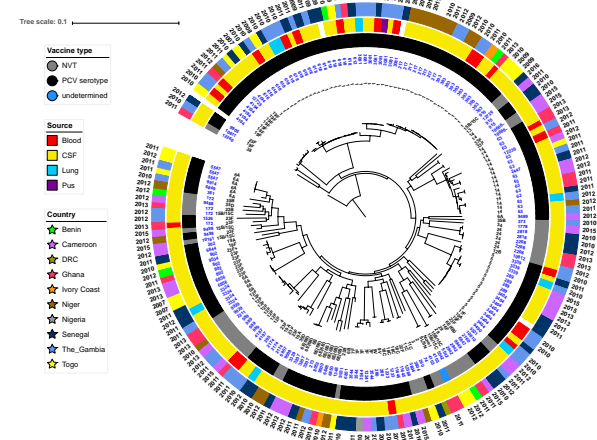
Surveillance

Outbreak

Response

Portable genome sequencing

Phylogeny of *S. pneumoniae* West Africa (2010-2016)



A maximum likelihood whole genome phylogenetic tree annotated with serotype, MLST ST (blue), whether serotype is a vaccine type and year of admission.

- MRCG designated WHO RRL (2010) and WHOCC (2017)
 - IBD surveillance in West and Central Africa (2009-2018)
 - Supports 17 sentinel sites (largest paediatric hospitals) in ten West and Central African countries
- WHO CC provides technical support during meningitis outbreaks in West Africa - **Platform for Research**

IBD surveillance

IBD surveillance is part of:

- The global VP-IBD surveillance network
- Collects data related to the detection of 3 vaccine-preventable organisms: *Haemophilus influenzae*, *Streptococcus pneumoniae* and *Neisseria meningitidis*.

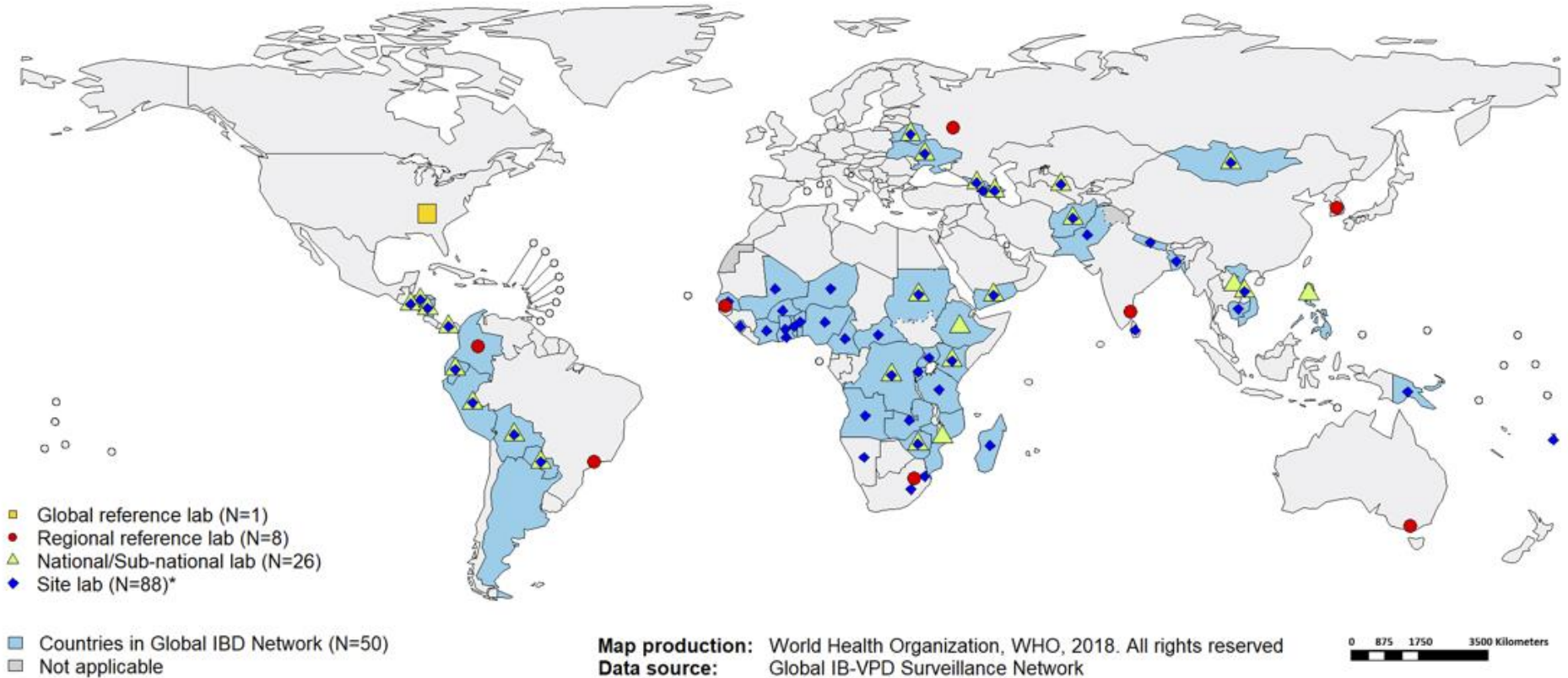
The global VP-IBD sentinel surveillance utilizes a 3-tiered approach:

- **Tier 1:** surveillance targets children under-five with suspected meningitis
- **Tier 2:** surveillance also targets children under-five with pneumonia and/or sepsis
- **Tier 3:** Population-based Surveillance (seeks to determine incidence rates of VP-IBD) **e.g. MRC Basse, The Gambia**

Goal: IBD surveillance

- Production of high quality, **local information** on the causes of two major killers of children in West Africa; Meningitis and Pneumonia.
- Enable decision makers to assess the possible value of new vaccines using the best local evidence – their own data **not estimates**
- Monitor the effect of vaccines post- introduction; sharing information widely
- All West Africa countries are using PCV-13 except Nigeria (PCV10)

WHO Member States that reported data to the Global Invasive Bacterial Vaccine-Preventable Disease Surveillance Network, 2018

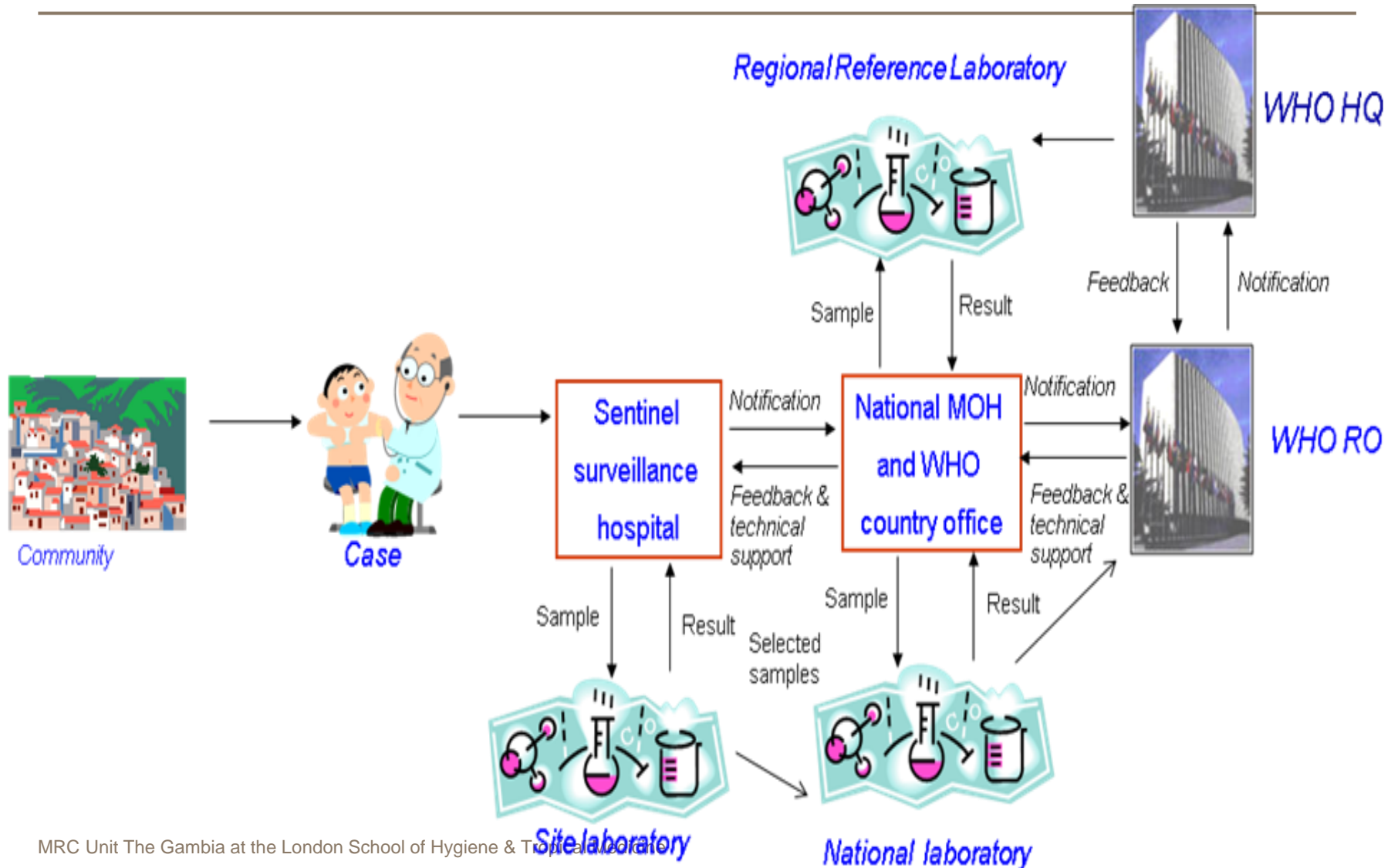


Notes:
* Only one sentinel site laboratory plotted by country. Position of labs on the map does not always reflect their exact geographical location.

Disclaimer:
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.



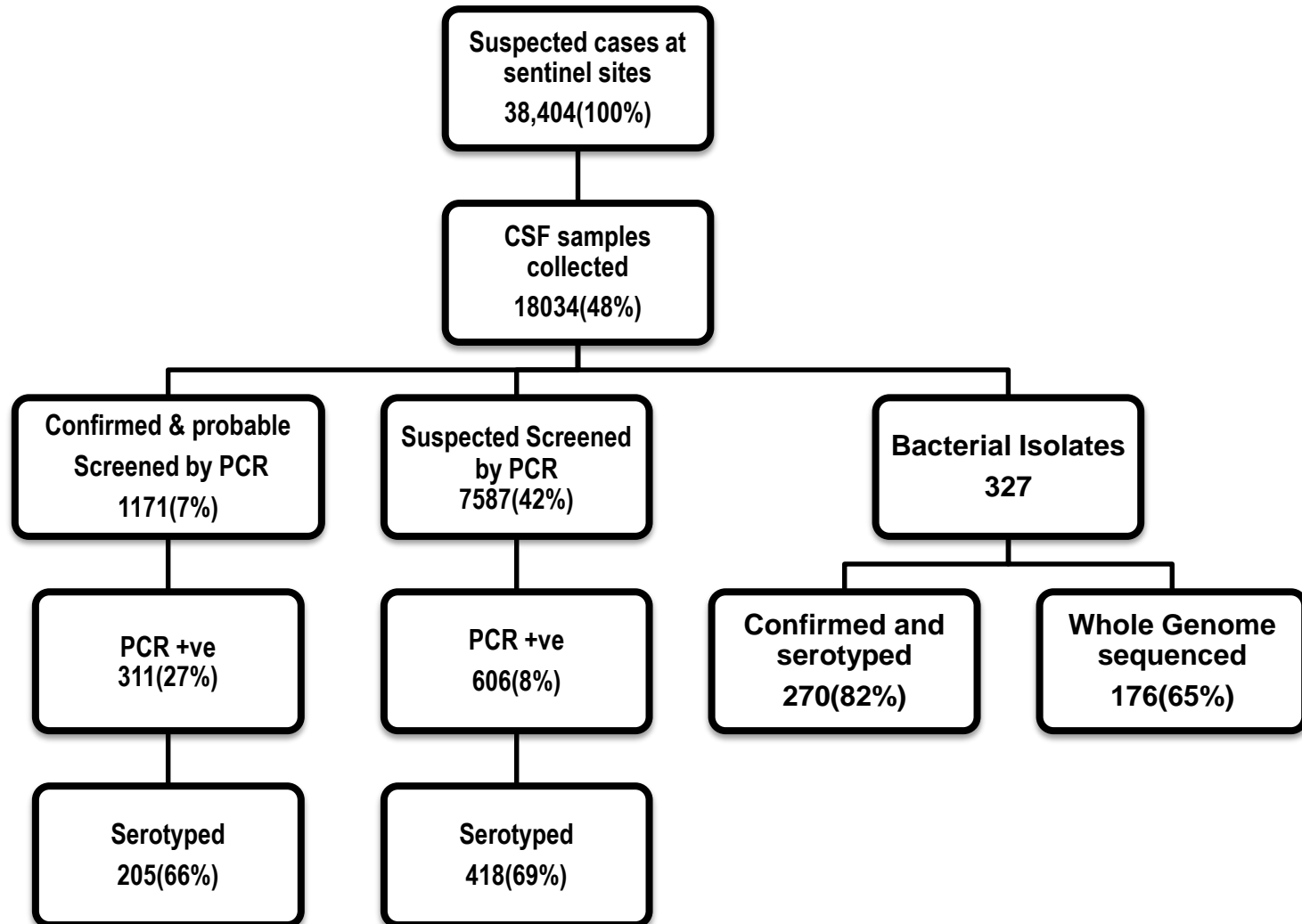
Standardized Structure



Study population

- Sentinel surveillance at the largest paediatric hospitals in West & Central Africa
- Children <5 years of age admitted to the hospital with signs & symptoms of probable bacterial meningitis &/or symptoms of invasive bacterial disease (e.g. sepsis) were recruited into the study.
- Probable meningitis is a suspected case with examination of CSF showing at least Turbid appearance *or* WBC (>100 cells/mm³) *or* WBC (10-100 cells/mm³) *AND* either an elevated protein (>100 mg/dl) or decreased glucose (<40 mg/dl)

Summary of specimens received and processed 2010 - 2016



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Clinical Infectious Diseases

Early Impact of Pneumococcal Conjugate Vaccines in African Countries

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Early Impact of Pneumococcal Conjugate Vaccines in African Countries

Guest Editors: Jason M. Mwenda, MPhil, PhD
Martin Antonio, PhD
Fernanda C. Lessa, MD, MPH
Anne Von Gottberg, MD
Brenda A. Kwambana-Adams, MSc, PhD
Adam Cohen, MD, MPH

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SUPPLEMENT ARTICLES

S49 Pediatric Bacterial Meningitis Surveillance in the World Health Organization African Region Using the Invasive Bacterial Vaccine-Preventable Disease Surveillance Network, 2011–2016

Jason M. Mwenda, Elizabeth Soda, Goitom Weldegebriel, Regis Katsande, Joseph Nsiari-Muzeyi Biey, Tretla Traore, Linda de Gouveia, Mignon du Plessis, Anne von Gottberg, Martin Antonio, Brenda Kwambana-Adams, Archibald Worwui, Ryan Glerke, Stephanie Schwartz, Chris Van Beneden, Adam Cohen, Fatima Serhan, and Fernanda C. Lessa; For the African Paediatric Bacterial Meningitis Surveillance Network

S58 Declines in Pneumonia and Meningitis Hospitalizations in Children Under 5 Years of Age After Introduction of 10-Valent Pneumococcal Conjugate Vaccine in Zambia, 2010–2016

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S66 Impact of 13-Valent Pneumococcal Conjugate Vaccine on Meningitis and Pneumonia Hospitalizations in Children aged <5 Years in Senegal, 2010–2016

Papa M. Faye, Mouhamadou A. Sonko, Amadou Diop, Aliou Thiongane, Idrissa D. Ba, Michael Spiller, Ousmane Ndiaye, Baidy Dieye, Jason M. Mwenda, Ahmed I. Sow, Boly Diop, Aliou Diallo, and Jennifer L. Farrar; For the African Paediatric Bacterial Meningitis Surveillance Network

S72 Pneumococcal Conjugate Vaccine Impact on Meningitis and Pneumonia Among Children Aged <5 Years—Zimbabwe, 2010–2016

Vongai Dondo, Hilda Mujuru, Kusum Nathoo, Vengai Jascha, Ottias Tafumane, Priscilla Chirisa, Portia Manangazira, John Mchazaraga, Linda de Gouveia, Jason M. Mwenda, Regis Katsande, Goitom Weldegebriel, Tracy Pondo, Alimea Matanock, and Fernanda C. Lessa; For the African Paediatric Bacterial Meningitis Surveillance Network

S81 Pediatric Bacterial Meningitis Surveillance in Nigeria From 2010 to 2016, Prior to and During the Phased Introduction of the 10-Valent Pneumococcal Conjugate Vaccine

Beckie N. Tagbo, Rowan E. Bancroft, Iretiola Fajolu, Mohammed B Abdulkadir, Muhammad F. Bashir, Olusola P. Okunola, Ayodeji H. Isiaka, Namadi M. Lawal, Benedict O. Edelu, Ngozi Onyejiaka, Chinonyerem J. Ihuoma, Florence Ndu, Uchenna C. Ozumba, Frances Udeinya, Folasade Ogunsoola, Aishat O. Saka, Abayomi Fadeyi, Sunday A. Aderigbigbe, Jimoh Abdulraheem, Adamu G. Yusuf, Peter Sylvanus Ndo, Philomena Ogbogu, Chinomso Kanu, Velly Emina, Olujumoke J. Makinwa, Florian Gehre, Kabir Yusuf, Fiona Braka, Jason M. Mwenda, Johnson M. Ticha, Dorothy Nwodo, Archibald Worwui, Joseph N. Biey, Brenda A. Kwambana-Adams, and Martin Antonio; for the African Paediatric Bacterial Meningitis Surveillance Network

S89 Hospital-based Surveillance for Pediatric Bacterial Meningitis in the Era of the 13-Valent Pneumococcal Conjugate Vaccine in Ghana

Lorna Awo Renner, Effua Usuf, Nuredin Ibrahim Mohammed, Daniel Ansong, Thomas Dankwah, Jonas Tetter Kusah, Sandra Kwarteng Owusu, Marah Awunyo, Bernard Arhin, Yvonne Addo, John Asamoah, Joseph Nsiari-Muzeyi Biey, Peter Sylvanus Ndo, Archibald Worwui, Madikay Senghore, Bernard Ntsama, Jason M. Mwenda, Stanley K. Diamenu, Brenda Kwambana-Adams, Martin Antonio; For the African Paediatric Bacterial Meningitis Surveillance Network

S97 Etiology of Pediatric Bacterial Meningitis Pre- and Post-PCV13 Introduction Among Children Under 5 Years Old in Lomé, Togo

Eryonam Tsolenyano, Rowan E. Bancroft, Abdul K. Sesay, Madikay Senghore, Mawouto Fiawoo, Diatougbe Akolly, Mawussi A. Godonou, Novissi Tsogbale, Segla D. Tigossou, Leopold Tientcheu, Anoumou Dagnra, Yawo Atakouma, Peter Sylvanus Ndo, Archibald Worwui, Dadjia E. Landoh, Jason M. Mwenda, Joseph N. Biey, Bernard Ntsama, Brenda A. Kwambana-Adams, and Martin Antonio; for the African Paediatric Bacterial Meningitis Surveillance Network

S105 Community-acquired Invasive Bacterial Disease in Urban Gambia, 2005–2015: A Hospital-based Surveillance

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S114 Etiology of Bacterial Meningitis Among Children <5 Years Old in Côte d'Ivoire: Findings of Hospital-based Surveillance Before and After Pneumococcal Conjugate Vaccine Introduction

Catherine Boni-Cisse, Sheikh Jarji, Rowan E. Bancroft, Nicaise A. Lepri, Hamidou Kone, N'zue Kofi, Alice Britoh-Mian, Fiore Sandrine Zaba, Effua Usuf, Peter Sylvanus Ndo, Archibald Worwui, Jason M. Mwenda, Joseph N. Biey, Bernard Ntsama, Brenda A. Kwambana-Adams, and Martin Antonio; for the African Paediatric Bacterial Meningitis Surveillance Network

S121 Impact of 10-Valent Pneumococcal Conjugate Vaccine on Bacterial Meningitis in Madagascar

Emilson Jean P. R. Andriatahirntsoa, Julia Liliane Raboba, Vonintsoa Lalaina Rahajamanana, Ando Lalaina Rakotozanany, Mengoum M. Nimpa, Yolande Vuo Masemba, Goitom Weldegebriel, Linda De Gouveia, Jason M. Mwenda, and Annick Lalaina Robinson; For the African Paediatric Bacterial Meningitis Surveillance Network

S126 Declining Trends of Pneumococcal Meningitis in Gambian Children After the Introduction of Pneumococcal Conjugate Vaccines

Bakary Sanneh, Catherine Odoi, Mary Grey-Johnson, Haddy Bah-Camara, Baba Kurta Fofana, Ignatius Baldeh, Alhagie Papa Sey, Mahamadou Labbo Bah, Mamadi Cham, Amadou Samateh, Effua Usuf, Peter Sylvanus Ndo, Madikay Senghore, Archibald Worwui, Jason M. Mwenda, Brenda Kwambana-Adams, and Martin Antonio; For the African Paediatric Bacterial Meningitis Surveillance Network

S133 Pediatric Bacterial Meningitis Surveillance in Niger: Increased Importance of *Neisseria meningitidis* Serogroup C, and a Decrease in *Streptococcus pneumoniae* Following 13-Valent Pneumococcal Conjugate Vaccine Introduction

Mamadou Kouma Hama, Dam Khan, Boubou Laouali, Catherine Odoi, Abdoulaye Yam, Moussa Haladou, Archibald Worwui, Peter Sylvanus Ndo, Ricardo Nse Obama, Jason M. Mwenda, Joseph Biey, Bernard Ntsama, Brenda A. Kwambana-Adams, and Martin Antonio; For the African Paediatric Bacterial Meningitis Surveillance Network

S140 Declines in Pediatric Bacterial Meningitis in the Republic of Benin Following Introduction of Pneumococcal Conjugate Vaccine: Epidemiological and Etiological Findings, 2011–2016

Joseph Agossou, Chinelo Ebruke, Alphonse Noudamadjo, Julien D. Adédémey, Eric Y. Danon, Honoré S. Bankolé, Mariam A. Dago, Rolande Assogba, Moussa Alassane, Abdoullah Condé, Fallatou Agbeille Mohamed, Gérard Kpanidja, Moutawakkou Gomina, François Hounsou, Basile G. Aouanou, Catherine Odoi, Claire Oluwalana, Archibald Worwui, Peter S. Ndo, Jean Nounagnon, Jason M. Mwenda, Rock A. Sossou, Brenda A. Kwambana-Adams, and Martin Antonio; for the African Paediatric Bacterial Meningitis Surveillance Network

S148 Hospital-based Surveillance Provides Insights into the Etiology of Pediatric Bacterial Meningitis in Yaoundé, Cameroon, in the Postvaccine Era

Angeline Boula, Madikay Senghore, Rose Ngoh, Flaubert Tassadio, Marie-Christine Fonkoua, Ariane Nzouankeu, Mina Kankala Njiké, Jeanne Musi, Sandrine Bebey, Madeline Ngo Baleba, Angeline Nkambe, Sidonie Médjina, Peter S. Ndo, Archibald Worwui, Marie Kobela, Marceline Nimpa, Jason M. Mwenda, Aboubacar N'diaye, Brenda A. Kwambana-Adams, and Martin Antonio; for the African Paediatric Bacterial Meningitis Surveillance Network

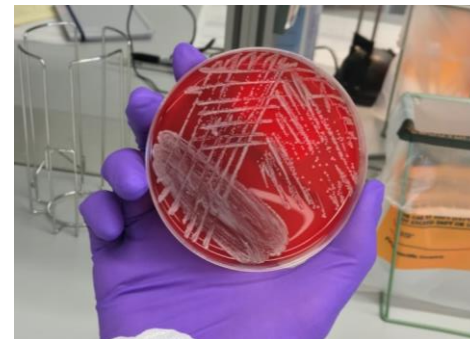
S156 Changes in the Molecular Epidemiology of Pediatric Bacterial Meningitis in Senegal After Pneumococcal Conjugate Vaccine Introduction

Mouhamadou A. Sonko, Felix S. Dubé, Catherine Bi Odoi, Amadou Diop, Aliou Thiongane, Madikay Senghore, Peter Ndo, Archibald Worwui, Papa M. Faye, Baidy Dieye, Idrissa D. Ba, Aliou Diallo, Diop Boly, Ousmane Ndiaye, Moussa F. Cissé, Jason M. Mwenda, Brenda A. Kwambana-Adams, and Martin Antonio; For the African Paediatric Bacterial Meningitis Surveillance Network

WHO Regional Workshop & Capacity Building at MRC Gambia @ LSHTM 28thOct -1st Nov 2019



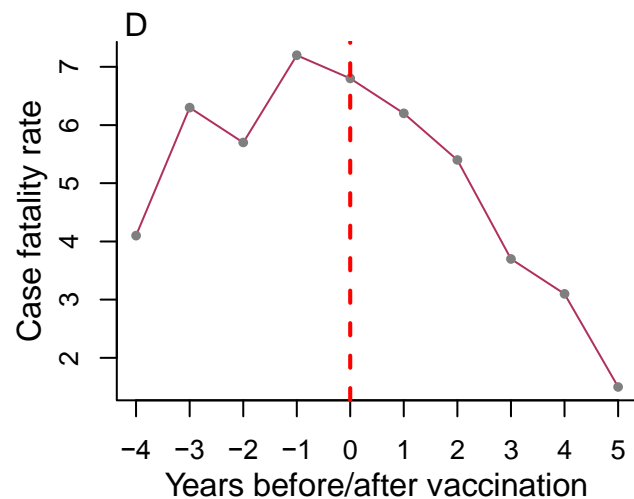
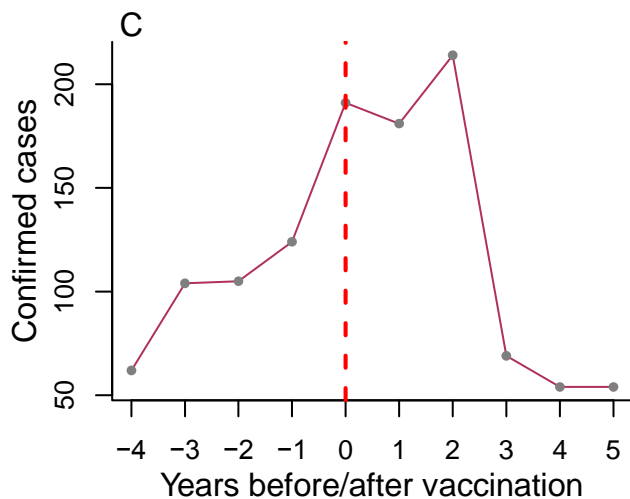
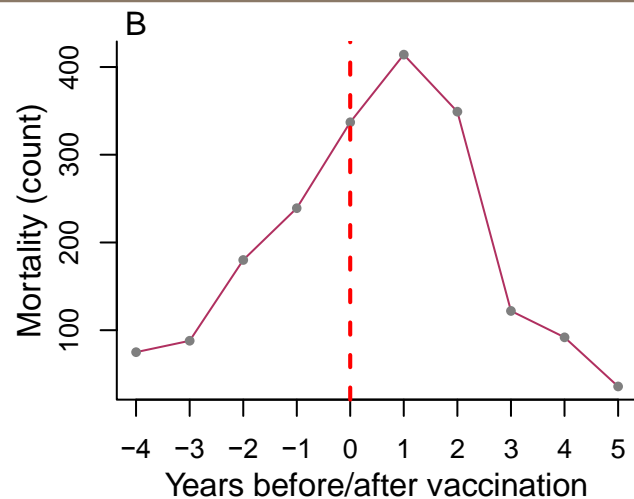
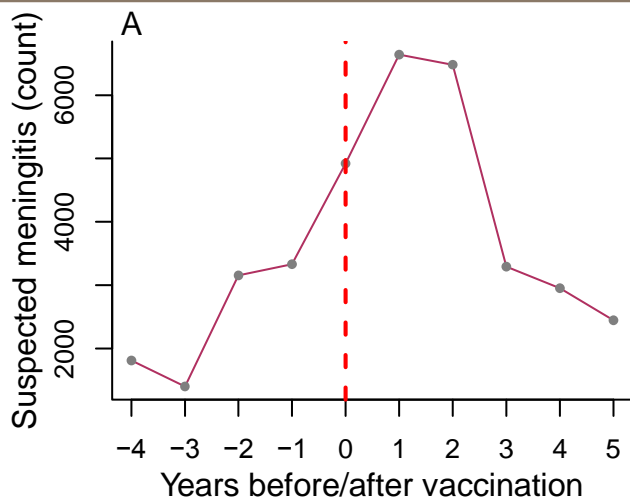
Sheep blood collection for media preparation



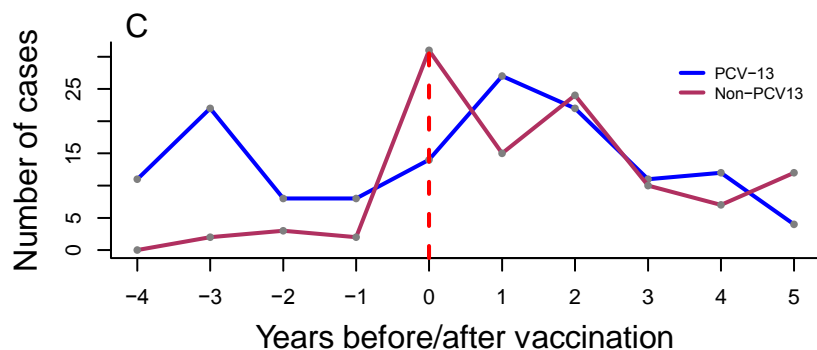
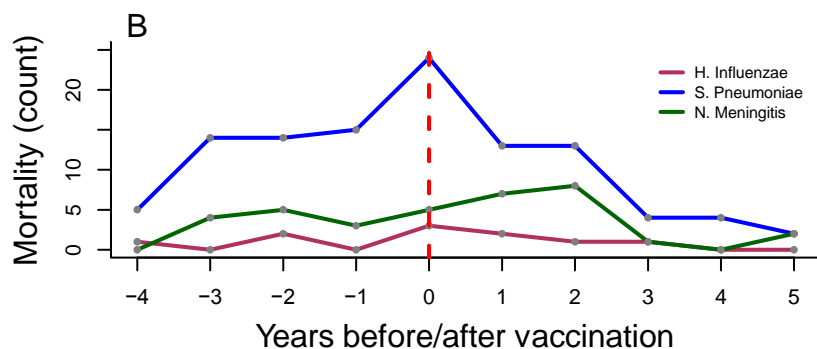
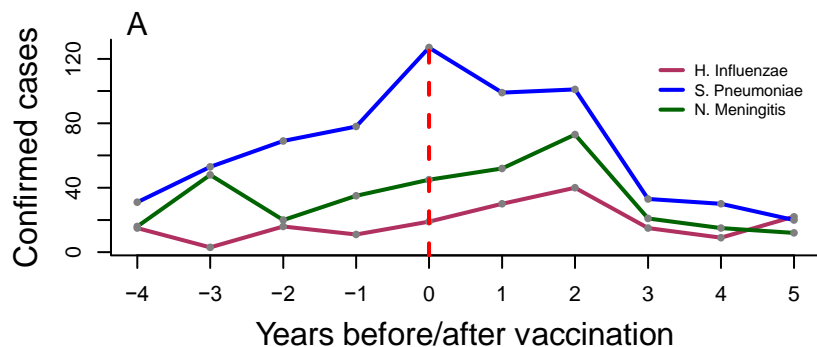
Baseline characteristics of suspected meningitis cases in West & Central Africa: 2010 - 2016

Characteristic	Category	N	%
Age	0-11m	18793	48.7%
	12-23m	6570	17.0%
	24-59m	12796	33.1%
	Unknown	442	1.2%
Sex	Female	16969	44.0%
	Male	21464	55.6%
	Unknown	168	0.4%
Antibiotic before admission	Yes	5516	14.3%
	No	17055	44.2%
	Unknown	16030	41.5%
Outcome	Discharged Alive	23829	61.7%
	Died	2181	5.7%
	Unknown	12591	32.6%
Sequelae	No	11758	30.5%
	Yes	352	0.9%
	Unknown	26491	68.6%
Case type*	Confirmed	821	2.1%
	Suspected	37780	97.9%

Trends in meningitis and mortality among suspected cases pre and post PCV in West & Central Africa (2010 – 2016)

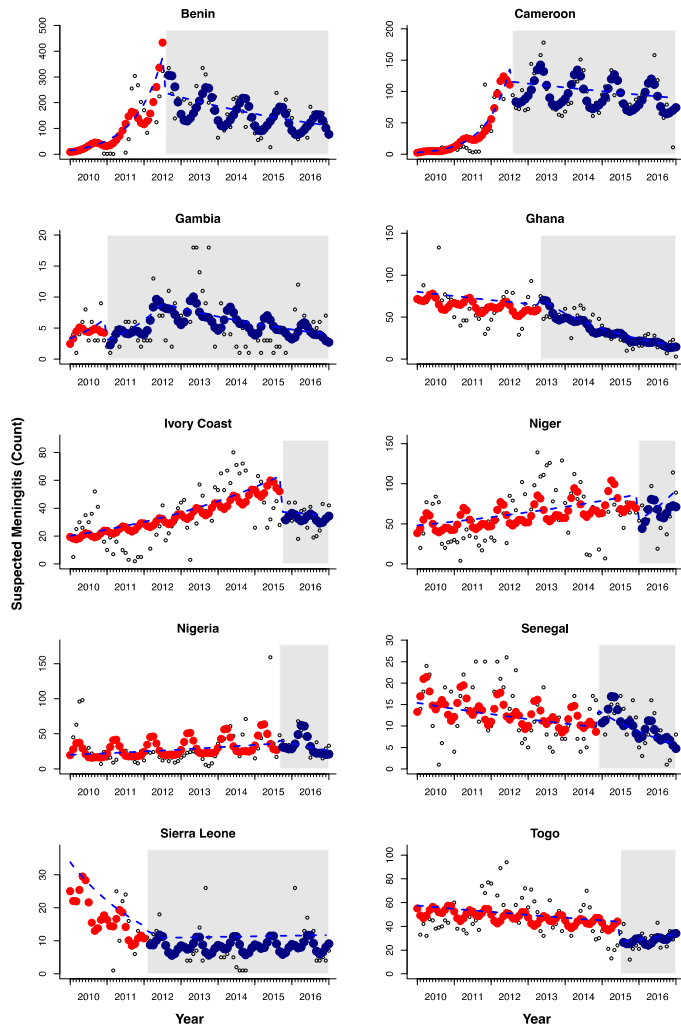


Trends in confirmed cases pre and post PCV in West & Central Africa (2010 – 2016)



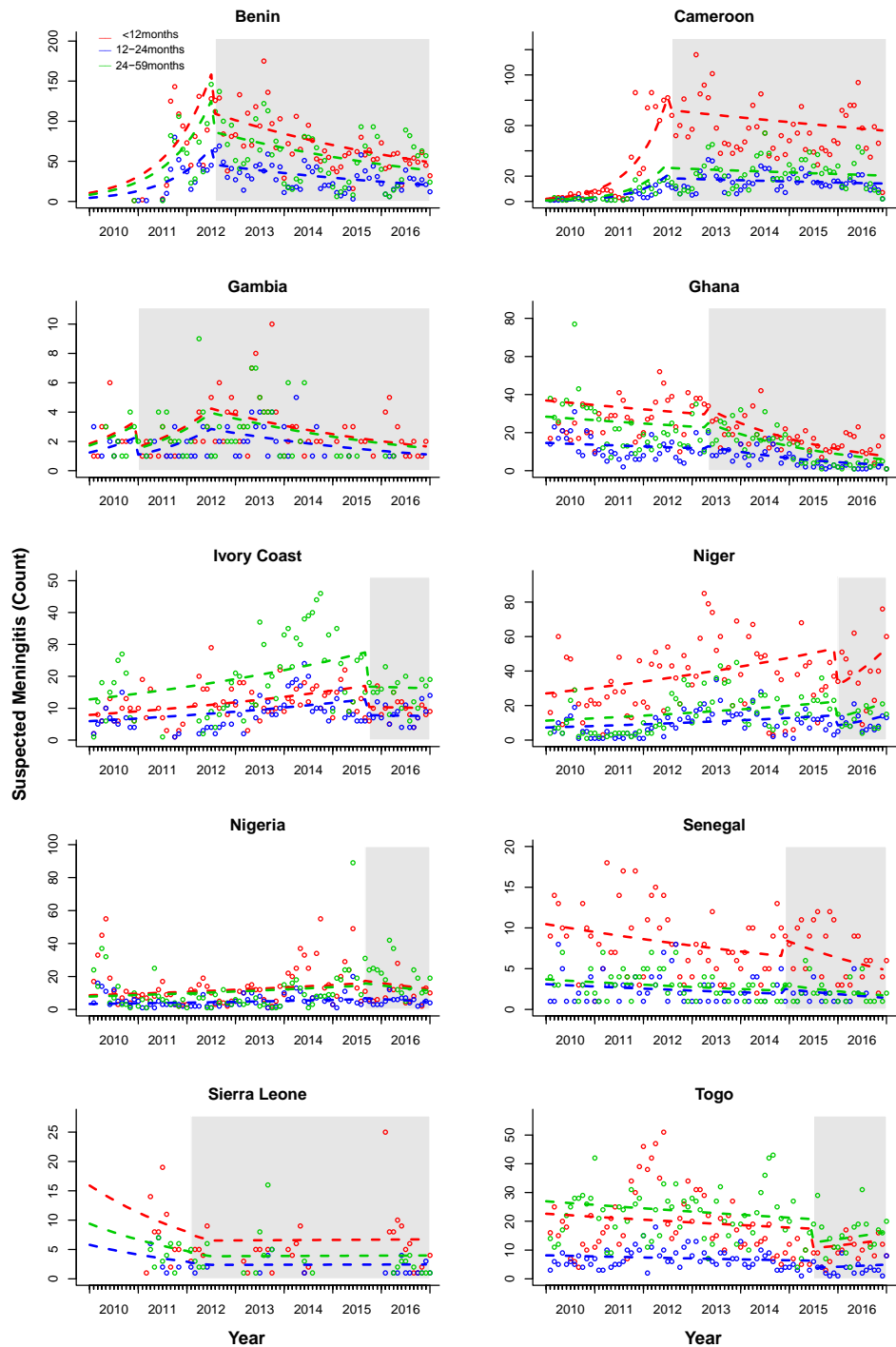
- Sharp decline in *S. pneumoniae* meningitis cases and deaths
- Steady decline in *N. meningitidis* cases and deaths
- *H. influenzae* counts are stable
- Decline in meningitis caused by PCV13 types

Modelling pre and post PCV introduction trends in suspected meningitis (2010-2016)



- *PCV* impact appears variable across different countries
 - Benin and Ghana (high)
 - Nigeria and Niger (low)
 - Short surveillance period post *PCV* implementation

PVC impact by age (2010 – 2016)



- Modelling pre and post PCV introduction trends in suspected meningitis by age

- Red: 0-11 months
- Blue: 12-23 months
- Green: 23 – 59 months

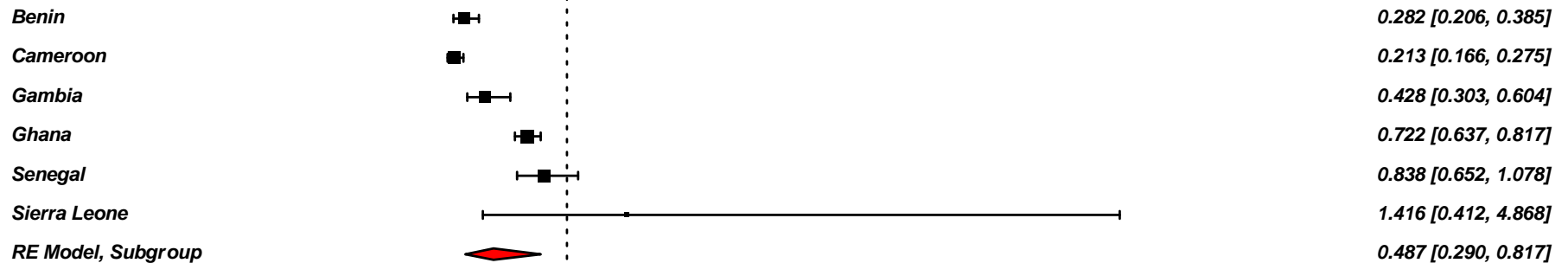
- *PCV* impact appears consistent across age strata < 5 years old

Trend estimates for PCV impact across West and Central Africa (2010 – 2016)

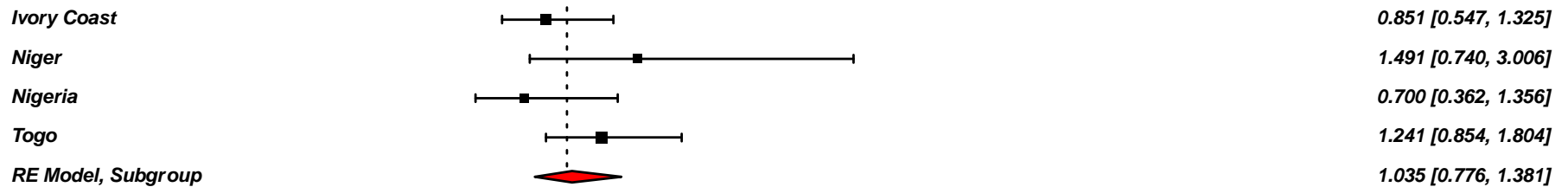
A) Suspected Meningitis

Ratio [95% CI]

Long post vaccine follow up



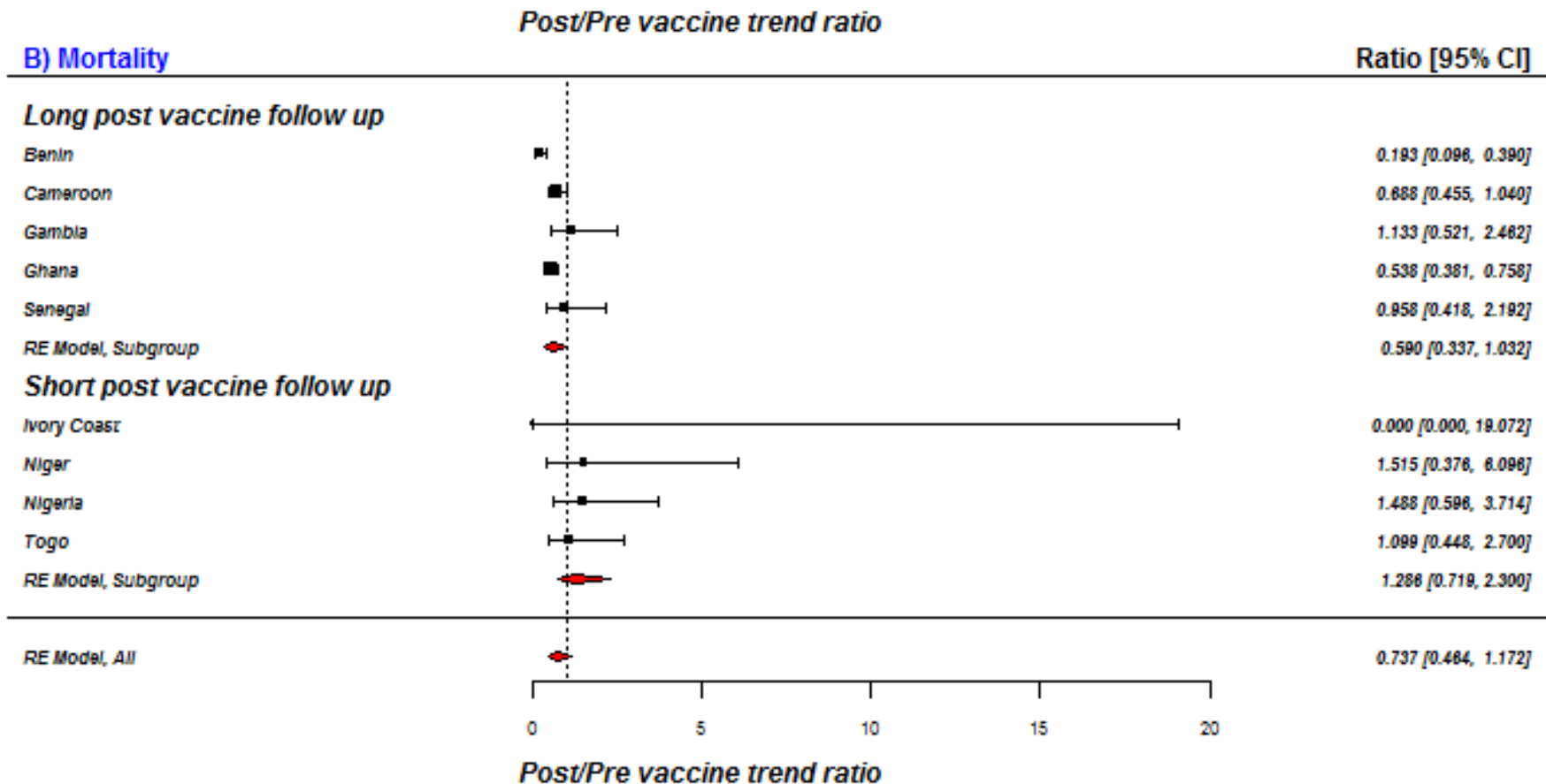
Short post vaccine follow up



RE Model, All



Trend estimates for PCV impact on mortality across West and Central Africa (2010 – 2016)

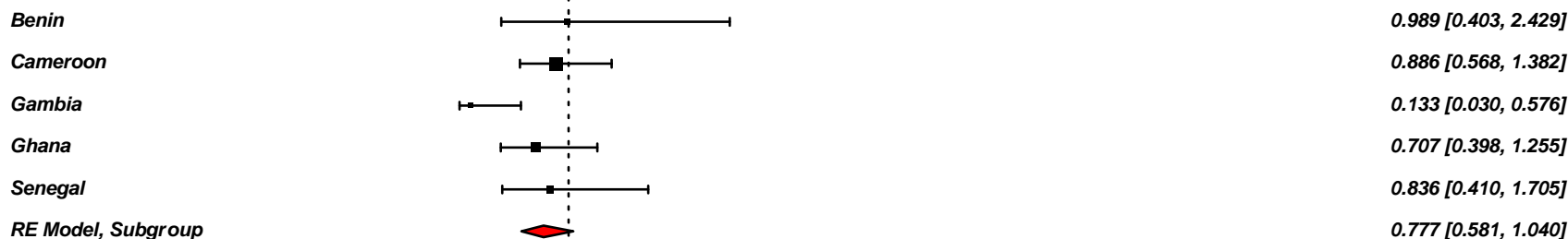


Trend estimates for PCV impact on mortality across West and Central Africa (2010 – 2016)

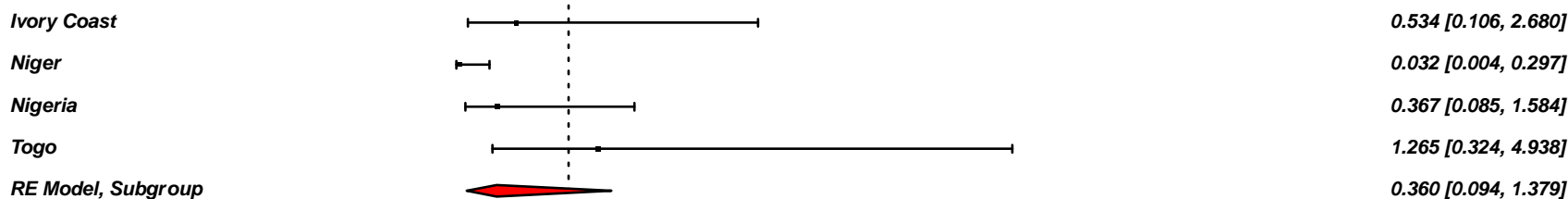
C) Confirmed Meningitis

Ratio [95% CI]

Long post vaccine follow up

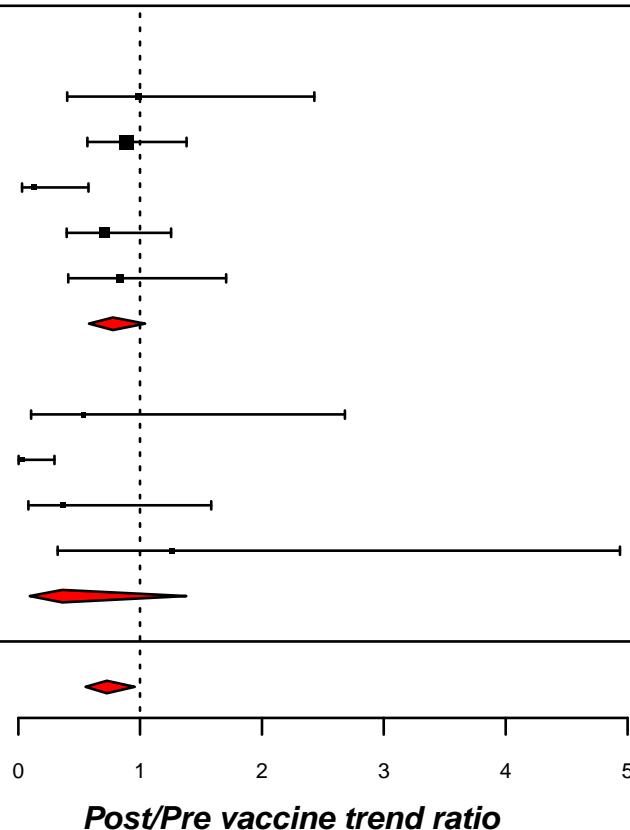


Short post vaccine follow up



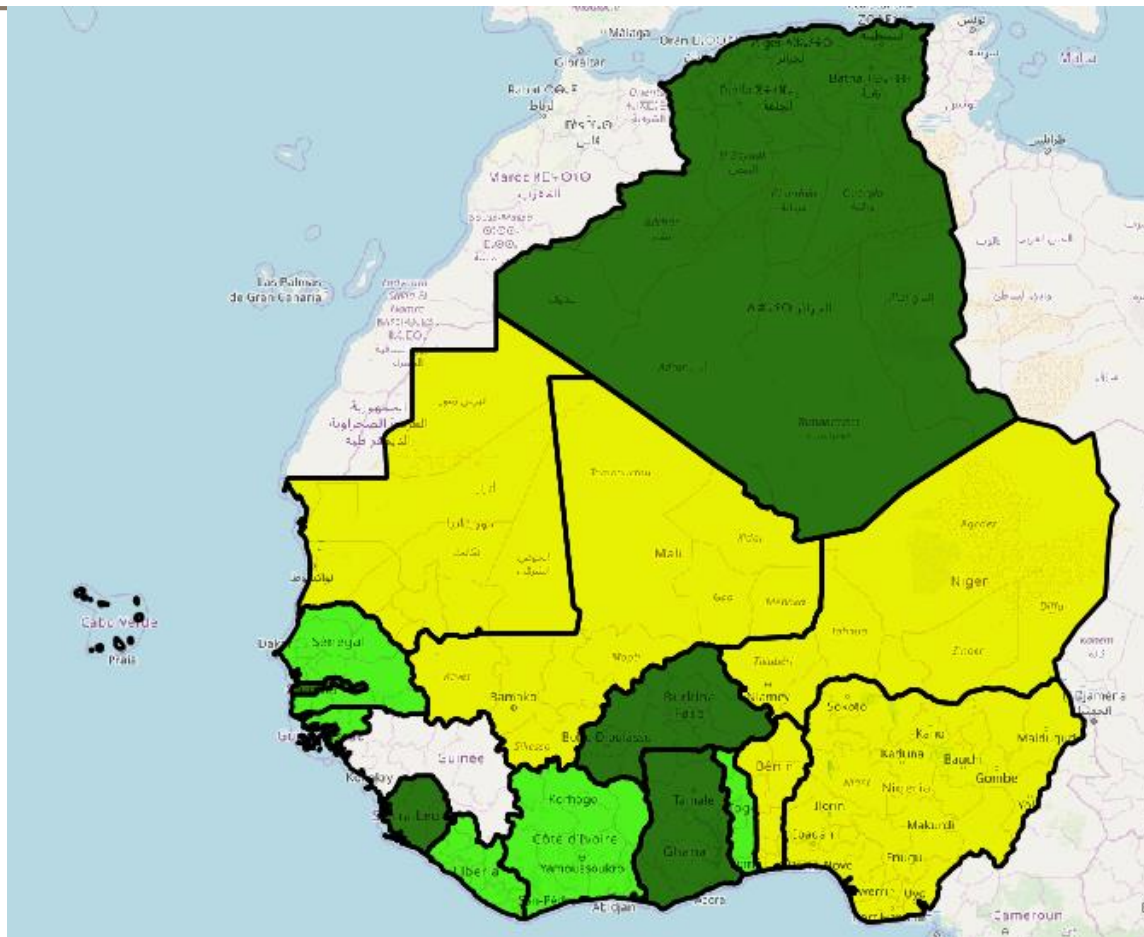
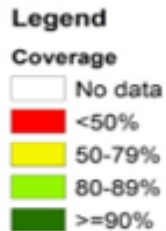
RE Model for All Countries

0.728 [0.554, 0.957]

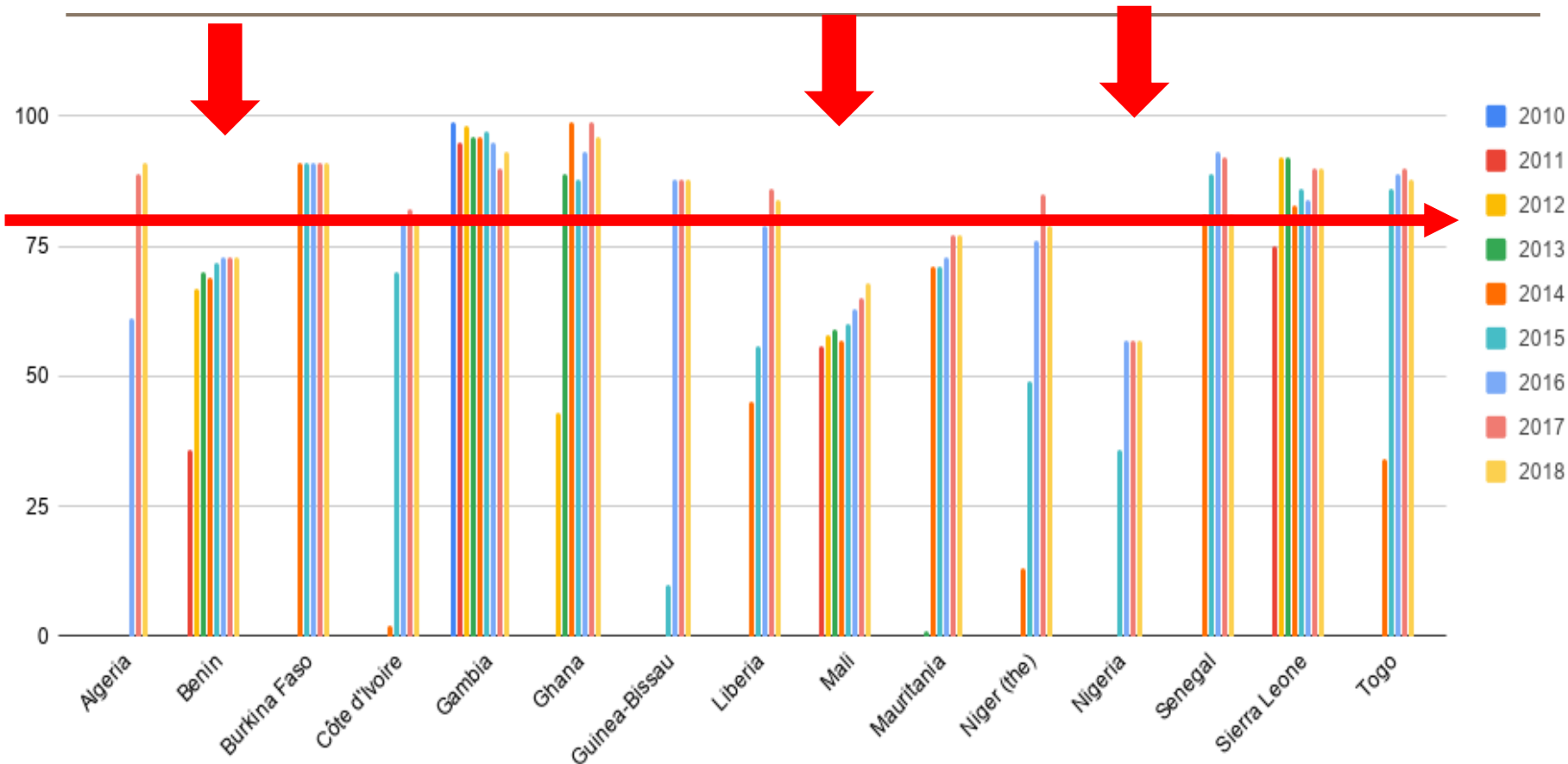


PCV vaccine introduction and coverage in WA 2018 (WUENIC)

PCV in
15/17 countries except
Guinee: Gavi country
Capo Verde: Non Gavi country



PCV vaccine introduction and coverage in WA 2018 (WUENIC)



Concluding remarks

- PCV has had an impact on suspected meningitis and mortality among across the sub-region
 - The impact is greater in some countries than others
 - Short post-PCV surveillance in some countries is a problem
- Overall, counts of *N. meningitidis* meningitis have also declined while *H. influenzae* has remained stable.

**Love them
or loathe them**

Martin Antonio, Isaac Adewole, Chikwe Ihekweazu



UK Secretary of State for Foreign and Commonwealth Affairs Rt Hon Boris Johnson MP visits MRC Unit The Gambia



UK Secretary of State for Foreign and Commonwealth Affairs Rt Hon Boris Johnson MP visits MRC Unit The Gambia



MRC Unit The Gambia at the London School of Hygiene & Tropical Medicine

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