

# METHODS AND DATA AVAILABILITY TO ESTIMATE PNEUMOCOCCAL MENINGITIS BURDEN IN PERSONS ≥5 YEARS BY GEOGRAPHIC REGION: THE AGEDD STUDY

Cristina R. Garcia<sup>1</sup>, Sassan Noazin<sup>1</sup>, Maria Deloria-Knoll<sup>1</sup>, Barend A. S. Nonyane<sup>1</sup>, Orin S. Levine<sup>2</sup>, Katherine L. O'Brien<sup>1</sup>, Hope L. Johnson<sup>3</sup>

on behalf of the AGEDD Pneumococcal Burden Study Team

1. International Vaccine Access Center, The Johns Hopkins Bloomberg School of Public Health (JHSPh), Baltimore MD, USA. 2. Global Development Program, Bill & Melinda Gates Foundation, Seattle WA, USA (formerly of JHSPh). 3. Monitoring & Evaluation Policy & Performance, GAVI Alliance, Geneva, Switzerland. (formerly of JHSPh)

## INTRODUCTION

- The burden of invasive pneumococcal disease (IPD) in young children is well established, but few reviews have assessed disease burden in persons ≥5 years.
- These data are essential to project the potential impact of pneumococcal conjugate vaccines (PCV) through direct & indirect effects of vaccination.
- The objective of the Adult Global Estimation of Disease Burden and Distribution of Serotypes of Serious Pneumococcal and Meningococcal disease (AGEDD) project is to estimate the global & regional morbidity, mortality, and serotype/serogroup distribution of IPD in older children and adults and of meningococcal disease in all ages through a systematic review of published & unpublished data.
- Here we assessed the data available to estimate one component, pneumococcal (SP) meningitis, by geographic region pre-PCV introduction using direct and indirect models.

## METHODS

- Relevant models and outcomes for estimating SP meningitis cases include:

- A.  $\text{SP Meningitis Incidence} \times \text{Population} = \text{Cases}$
- B.  $\text{IPD Incidence} \times \text{\% IPD that is Meningitis} \times \text{Population} = \text{Cases}$
- C.  $\text{Bacterial Meningitis Incidence} \times \text{\% Bacterial Meningitis that is SP} \times \text{Population} = \text{Cases}$

- Africa Model C is stratified by meningitis belt (MB) v. non-meningitis belt (Non-MB)
- We systematically searched 16 databases to identify studies conducted 1980 – 2010 reporting cases and incidence for IPD, SP meningitis, and acute bacterial meningitis among persons age 5 years and older.
- Additionally, we abstracted data from national surveillance reports from Australia, Canada, New Zealand, South Africa, United States, and several European countries not identified in the literature search.
- Data were eligible for quantitative analysis if the study reported relevant outcome data from:
  - ≥40 lab-confirmed cases among persons ≥5 years
  - pre-PCV introduction
  - pneumococci isolated from specimens from sterile sites
  - study population representative of the general population
  - quality assessment with a low risk of bias
  - data were available by age: 5-19, 20-64, ≥65 years
- Models to estimate SP meningitis cases were deemed 'feasible' for a given region and age group if at least one study was available for all model inputs.

## RESULTS

- Literature search yielded 53 studies with eligible data for SP meningitis model inputs; however, few studies had data for multiple age groups
- Data for adults ≥20 years were unavailable in Asia and sparse in Africa and LAC.
- At least one model was feasible for at least one age group for every region (Table), and for all age groups except Asia where no model was feasible in adults 20-64 or 65+ years (Figure).
- For most regions, SP meningitis cases can be estimated directly (Model A).
- SP meningitis incidence and IPD incidence data often came from the same study, resulting in similar/same estimates using Models A and B.
- African Model C inputs are affected by varying meningitis incidence and surveillance sensitivity and methods during meningococcal epidemics in the meningitis belt, requiring further stratification of already sparse data.

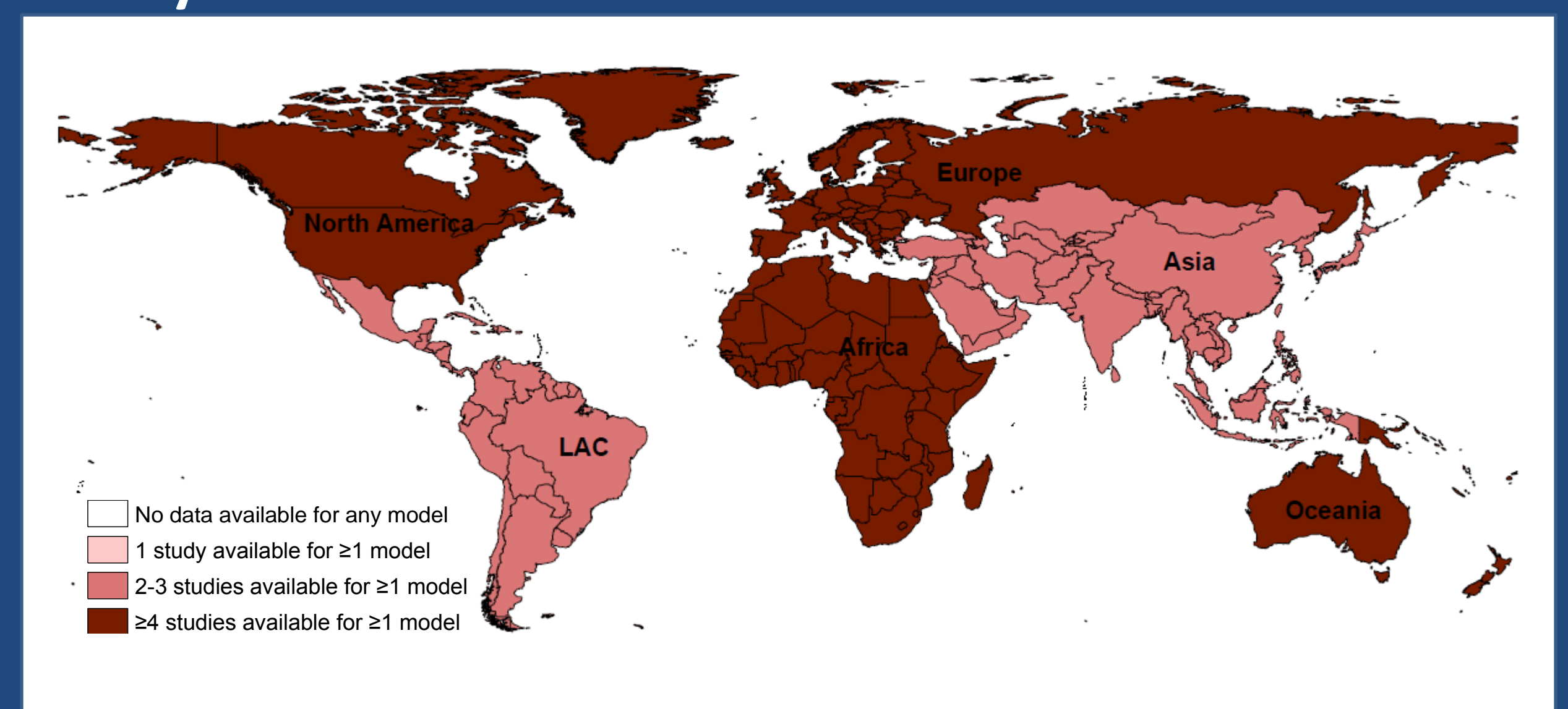
TABLE: Number of studies (countries) with relevant model input data for estimating SP meningitis cases

Region	Model A		Model B		Model C	
	SP Meningitis Incidence	IPD Incidence	% of IPD that is Meningitis	Bacterial Meningitis Incidence	% Bacterial Meningitis that is SP	
Africa	6 (5)	1 (1)	0 (0)	MB: 1 (1) Non-MB: 1 (1)	MB: 11 (7) Non-MB: 4 (4)	
Asia	0 (0)	2 (2)	2 (2)	2 (2)	7 (5)	
Europe	8 (7)	8 (7)	5 (5)	5 (2)	7 (4)	
LAC	4 (2)	4 (2)	16 (14)	4 (2)	3 (2)	
N. America*	2 (2)	2 (2)	1 (1)	1 (1)	1 (1)	
Oceania*	1 (1)	3 (2)	1 (1)	0 (0)	1 (1)	

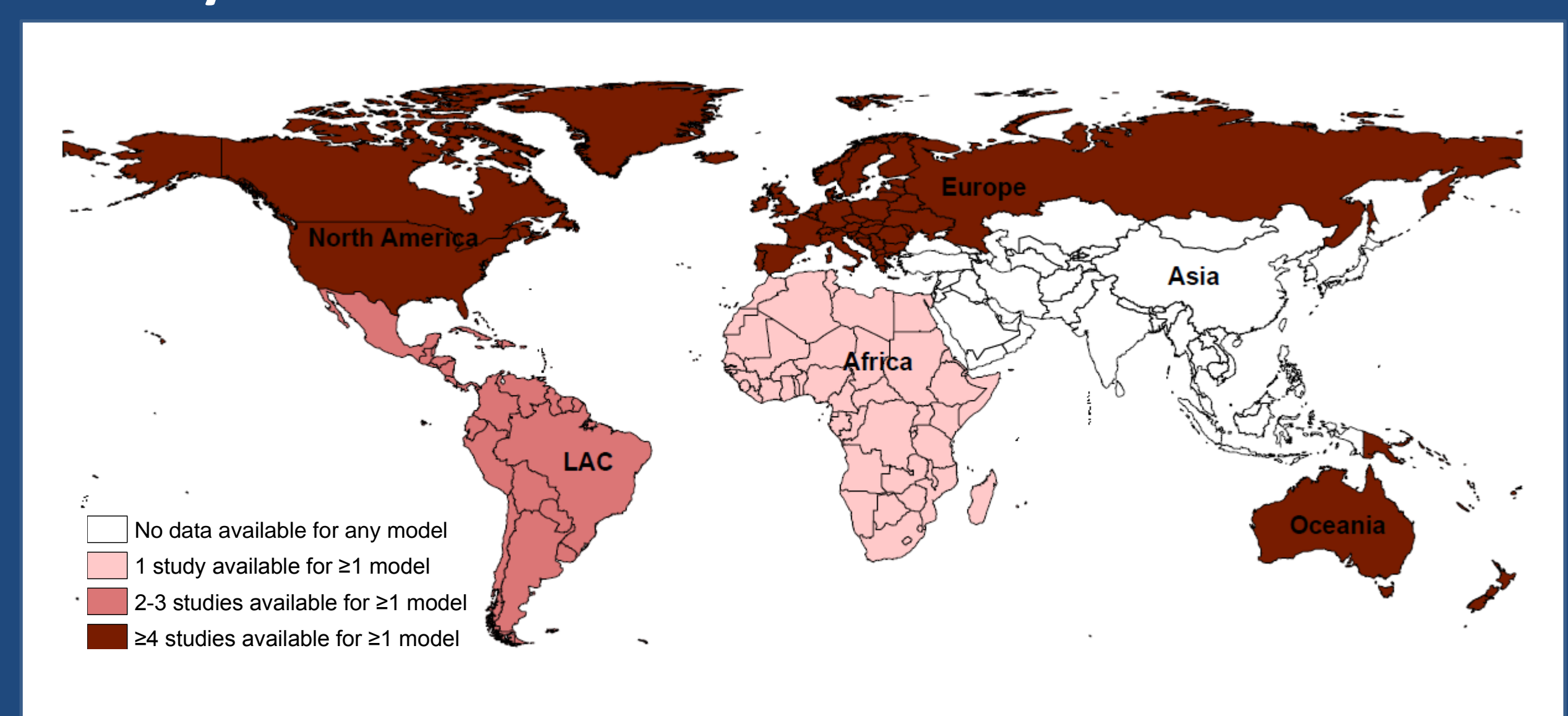
\*Detailed, multi-year national surveillance data. Bold = data for all age-strata available.

FIGURE: Data availability to estimate SP meningitis cases by geographic region and age group

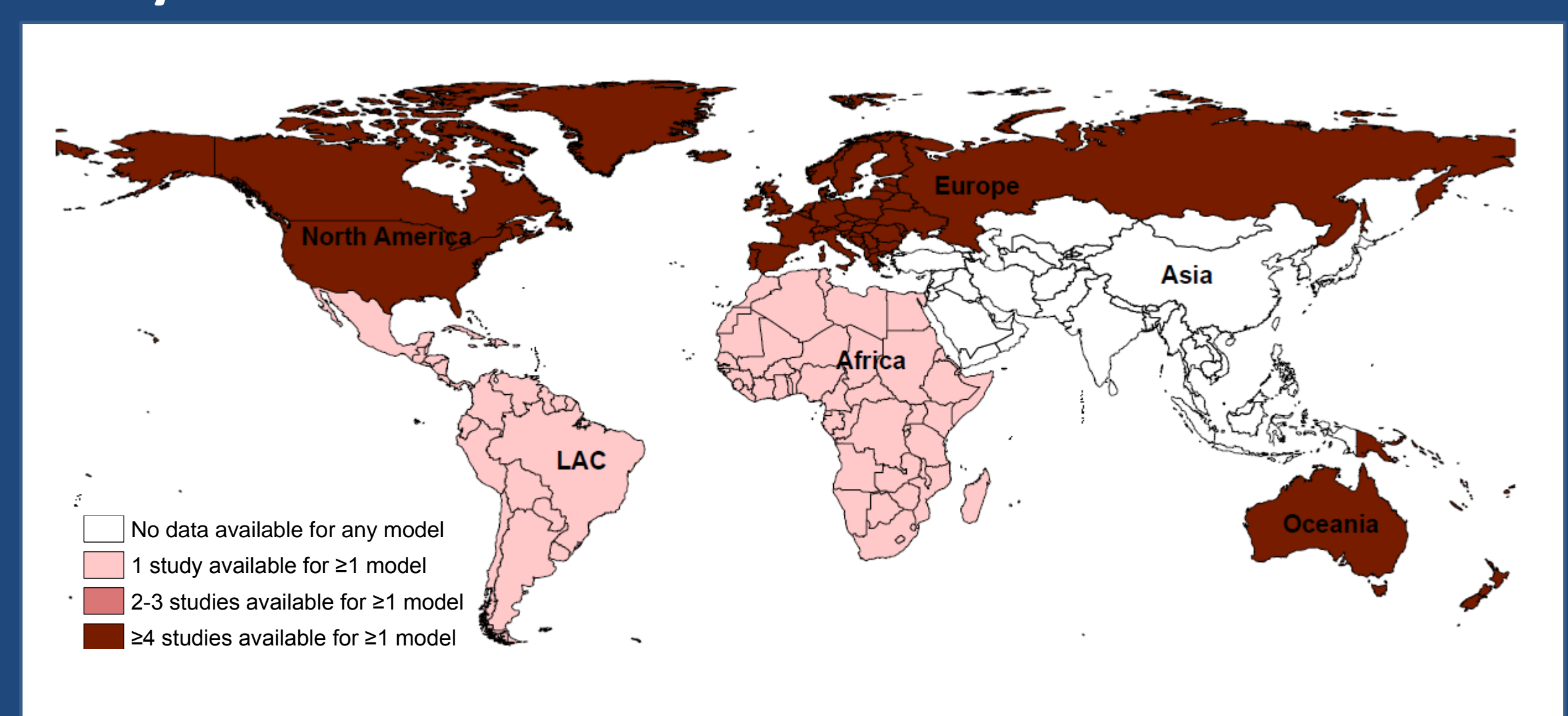
### A. 5-19 year olds



### B. 20-64 year olds



### C. ≥65 year olds



## CONCLUSIONS

- Data to estimate SP meningitis disease burden in persons ≥5 years were limited or unavailable from Asia, Africa, and LAC, especially among adults ≥20 years old.
- No single model approach is possible for all regions to estimate SP meningitis.
- No model is possible for Asia for 20-64 and ≥65 year age groups.
- Indirect models (B and C) compound potential biases because they apply results from one type of study to another type that likely used different surveillance methodology.
- Estimating the burden for 20-64 year olds and ≥65 year olds in Asia requires extrapolating estimates from the age-stratified patterns of other regions.
- Further adjustments to account for potential biases due to insensitive study methods (i.e., choice of specimen sources and laboratory tests) will be necessary.