

# PNEUMOCOCCAL MENINGITIS INCIDENCE AND CASES IN CHILDREN >5 YEARS AND ADULTS BY GEOGRAPHIC REGION: THE AGEDD STUDY

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## INTRODUCTION

- The global burden of pneumococcal disease has been established in children <5 years of age but not in those ≥5 years.
- These data are essential to project the potential impact of pneumococcal conjugate vaccines (PCV) through direct & indirect effects of vaccination
- This analysis aims to estimate one component, pneumococcal meningitis cases and deaths, globally & regionally in adults and children ≥ 5 years of age prior to the introduction of PCV vaccines.**

## METHODS

### DATA

- We systematically searched 16 databases to identify studies conducted 1980 – 2010 reporting SP meningitis cases, incidence and case fatality ratios (CFR) for cases ≥5 years.
- 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 if the study reported:
  - ≥40 lab-confirmed cases among persons ≥5 years
  - pneumococci isolated from specimens from sterile sites
  - study population representative of the general population
  - data from pre-PCV introduction
  - data were available by age: 5-19, 20-64, ≥65 years

### ANALYSIS

- We estimated incidence, CFR, cases and deaths due to SP meningitis.
- Incidence:** Meta-analysis: for regions whose majority of studies reported std. errors. Median of incidence: used otherwise (only in Africa). Asia: interpolated from regional meta-estimates for Africa & Europe. Estimates for all ≥5 years of age were age-standardized.
- CFR:** Estimated by meta-analysis. Oceania: The North American CFR used as a proxy.
- Risk of bias: assessed based on case ascertainment, denominator value or lab testing.

## RESULTS

### SP Meningitis Incidence:

- 21 studies from 17 countries had meningitis incidence data (Table 1).
- 2 studies, both in Africa, were assessed as poor quality (due to insufficient access to care). These are included but removing them did not change results.
- Meta-estimates of incidence were based on meta analysis in all regions except Africa where median of reported values was used (meta-analysis of Africa studies with SE produced similar result: median=4.9, meta-analysis=4.1 for ≥5 years of age).

### SP Meningitis CFR

- 21 studies from 15 countries had SP meningitis CFR data (Table 2)
- African and Asia had the greatest number of studies and countries represented

### Regional Burden

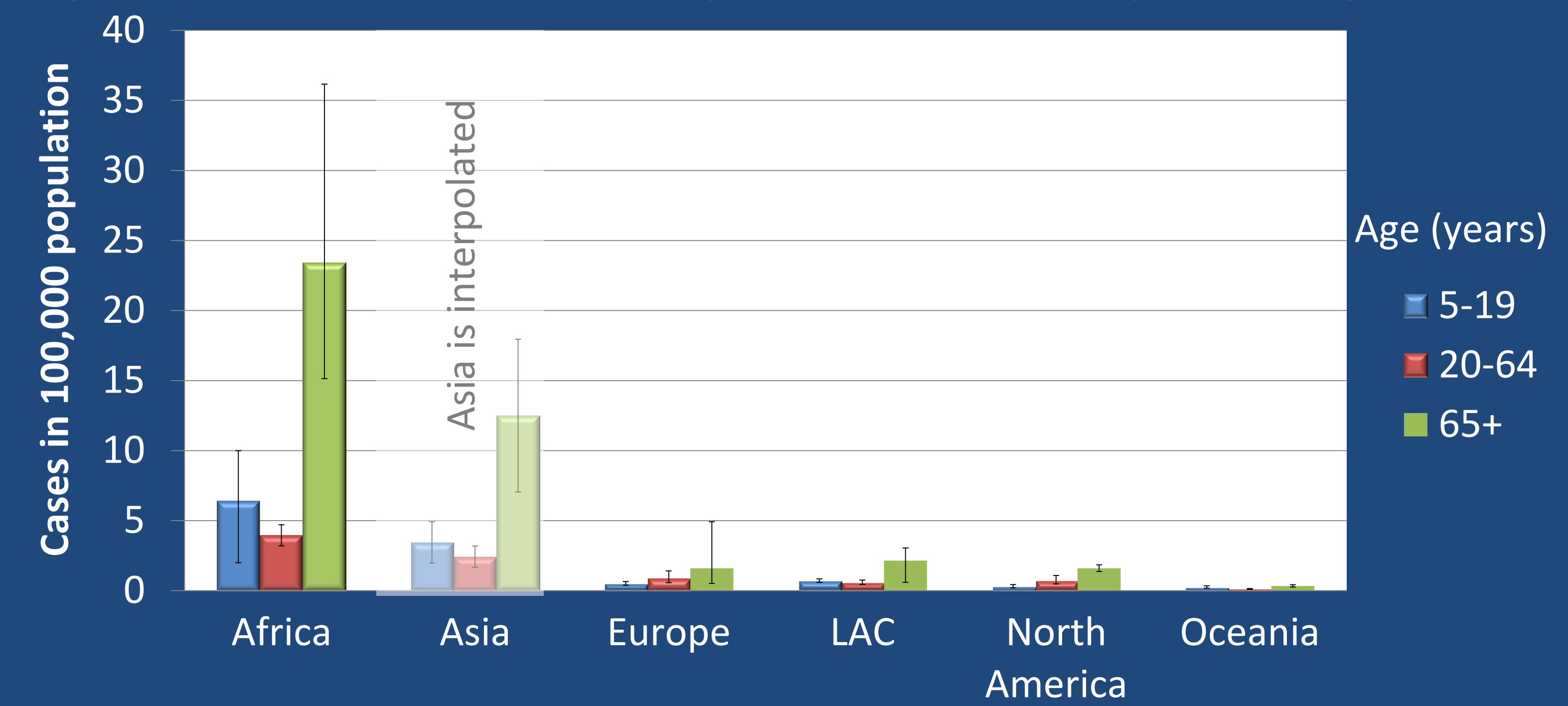
- Meningitis incidence, CFR and numbers of cases and deaths were highest in Africa and Asia (Figures 1-3 and Table 2).
- Incidence was highest in 65+ age group in all regions, but number of cases and deaths was largest in the 20-64 year age group, except in Africa where the largest burden was in children 5-19 years (Figures 2 and 3).

**Table 1: Number of studies (countries) reporting age-stratified pneumococcal meningitis incidence data**

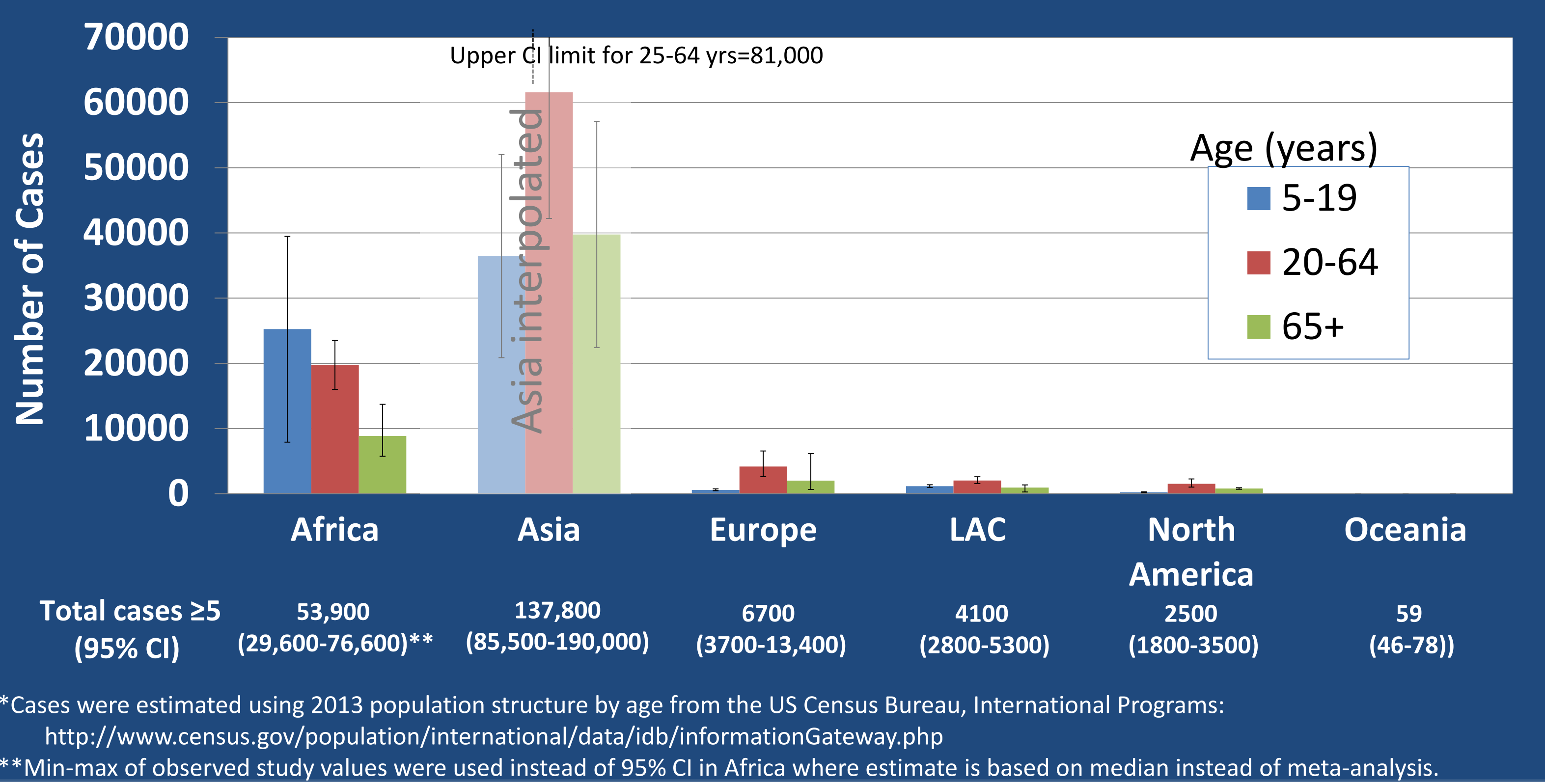
All incidence estimates	Africa	Asia	Europe	LAC	North America*	Oceania*	Total
5-19 years	5 (4)	0	6 (5)	4 (2)	2 (2)	1 (1)	
20-64 years	1 (1)	0	5 (5)	1 (1)	2 (2)	1 (1)	
65+ years	1 (1)	0	6 (6)	1 (1)	2 (2)	1 (1)	
All ≥5 years	6 (5)	0	8 (7)	4 (2)	2 (2)	1 (1)	21 (17)
<b>Estimates with SE of estimate available</b>							
5-19 years	4 (3)	0	4 (4)	3 (2)	2 (2)	1 (1)	
20-64 years	0 (0)	0	4 (4)	1 (1)	2 (2)	1 (1)	
65+ years	1 (1)	0	5 (5)	1 (1)	2 (2)	1 (1)	
All ≥5 years	5 (4)	0	6 (6)	3 (2)	2 (2)	1 (1)	17 (15)

\*Detailed, multi-year national surveillance data.

**Figure 1: Pneumococcal Meningitis Incidence by Age and Region**

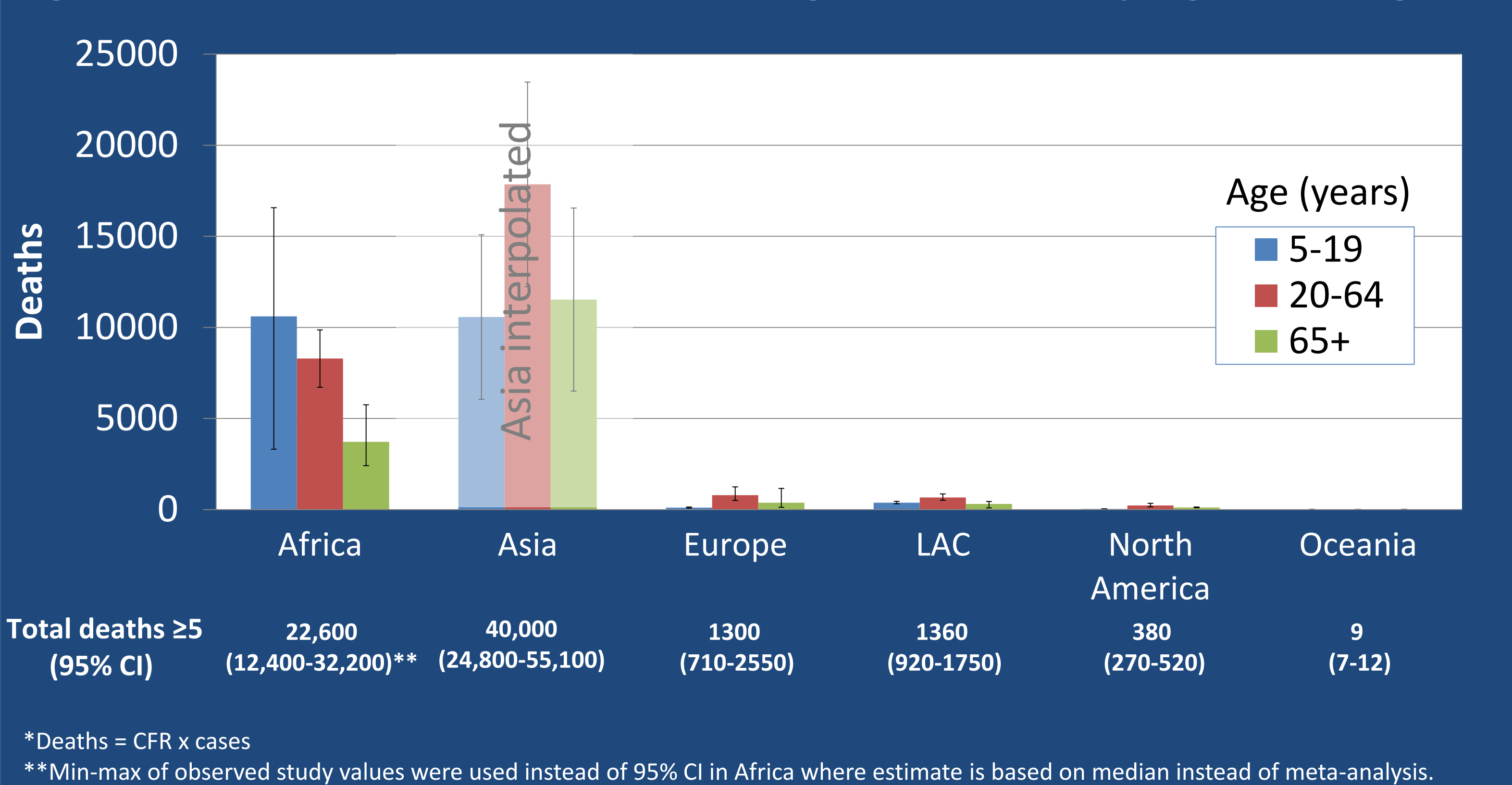


**Figure 2: No. of Pneumococcal Meningitis Cases\* by Age and Region**



\*Cases were estimated using 2013 population structure by age from the US Census Bureau, International Programs: <http://www.census.gov/population/international/data/idb/informationGateway.php>  
\*\*Min-max of observed study values were used instead of 95% CI in Africa where estimate is based on median instead of meta-analysis.

**Figure 3: No. of Pneumococcal Meningitis Deaths\* by Age and Region**



\*Deaths = CFR x cases  
\*\*Min-max of observed study values were used instead of 95% CI in Africa where estimate is based on median instead of meta-analysis.

**Table 2: Regional case fatality ratio meta-estimates and data availability**

	Africa	Asia	Europe	LAC	North America	Oceania	Global
CFR estimate*	42%	29%	19%	33%	15%	N/A	32%**
(95% CI)	(29-61%)	(18-48%)	(15-25%)	(20-54%)	(2-29%)	N/A	
N of Studies (Countries)	6 (4)	7 (6)	4 (3)	2 (1)	2 (1)	0	21 (15)

\*CFRs are for all ≥5 years of age.  
\*\*Global CFR estimated by total global Sp meningitis deaths / cases.

## CONCLUSIONS

- Adult pneumococcal meningitis incidence data were sparse in all regions except North America; Asia will have to be estimated using other methods, e.g., interpolation as we did here, or potentially more reliable estimation based on the proportion of bacterial meningitis or invasive pneumococcal disease due to pneumococcal meningitis.
- Globally, SP meningitis causes 200,000 cases (95% CI: 124,000-289,000) and 66,000 deaths (95% CI: 39,000-92,000) each year.
- Available data suggest the largest meningitis disease burden is in Africa (possibly also Asia).
- While the highest incidence was among adults over age 65+ years in all regions, most cases and deaths were among those 5-64 years of age due to larger population size.
- Incidence estimates for each age stratum among persons ≥5 years were lower than the incidence in children <5 years<sup>1</sup> estimated previously, except adults >65 years in Asia which was similar to <5 incidence. The total number of cases and deaths were lower in persons ≥5 years compared to children <5 years in all regions except Africa (cases) and Asia (cases & deaths).
- We expect our results to under-estimate the true burden of pneumococcal meningitis due to limitations in access to care and surveillance methodology (insensitive diagnostics).

Reference: <sup>1</sup>O'Brien KL1, Wolfson LJ, Watt JP, et. al. Burden of disease caused by Streptococcus pneumoniae in children younger than 5 years: global estimates. Lancet. 2009; 374:893-902.