Bacterial Meningitis in adults and children

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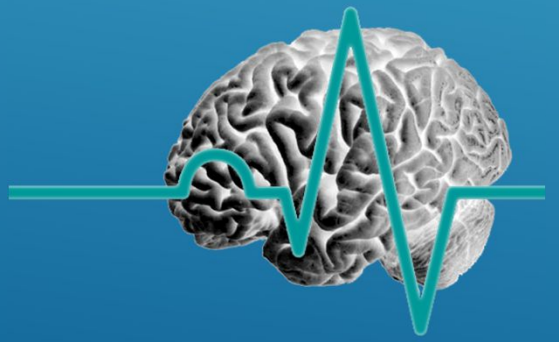

Acute Bacterial Meningitis may be

- ➔ **Community Acquired Meningitis**
- ➔ **Hospital Acquired Meningitis**

Clinical Epidemiology

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REVIEW

Meningococcal disease: changes in epidemiology and prevention

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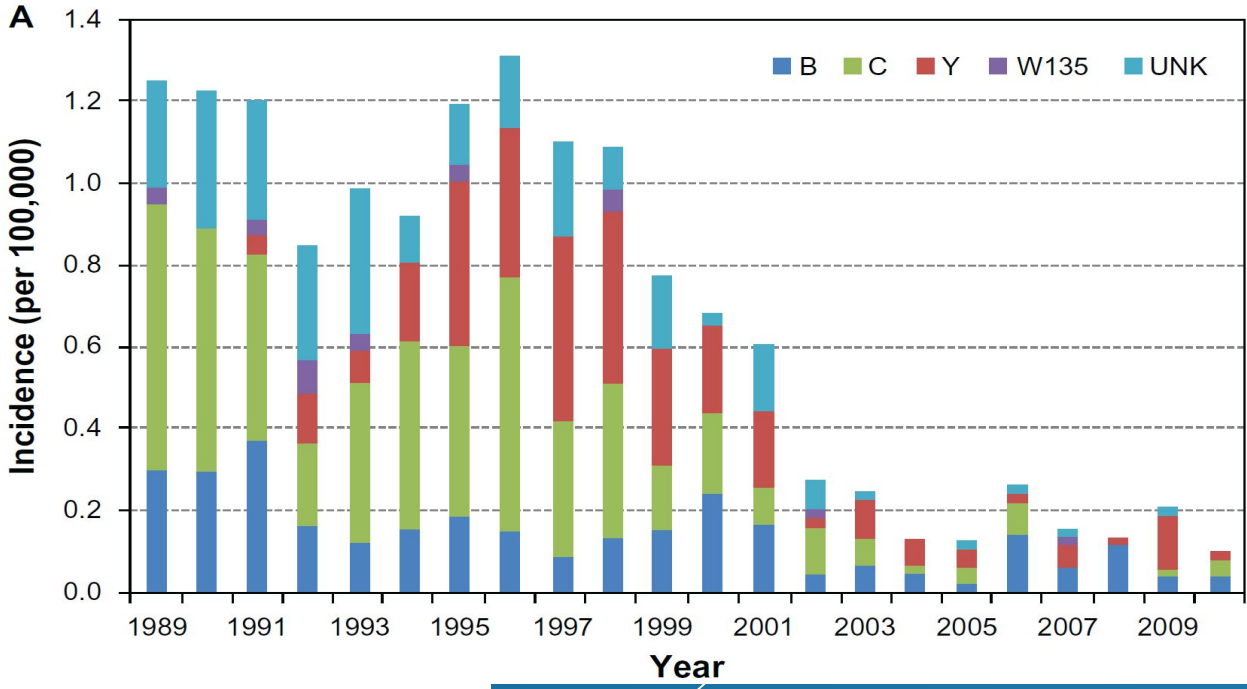

Clinical Epidemiology 2012:4 237–245

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Bacterial Meningitis in the United States, 1998–2007

Michael C. Thigpen, M.D., Cynthia G. Whitney, M.D., M.P.H., Nancy E. Messonnier, M.D., Elizabeth R. Zell, M.Stat., Ruth Lynfield, M.D., James L. Hadler, M.D., M.P.H., Lee H. Harrison, M.D., Monica M. Farley, M.D., Arthur Reingold, M.D., Nancy M. Bennett, M.D., Allen S. Craig, M.D., William Schaffner, M.D., Ann Thomas, M.D., Melissa M. Lewis, M.P.H., Elaine Scallan, Ph.D., and Anne Schuchat, M.D., for the Emerging Infections Programs Network

N Engl J Med 2011;364:2016-25.

Table 1. Incidence of Bacterial Meningitis in the United States, 1998–2007, Stratified According to Age Group, Race, and Pathogen.*

Characteristic	1998–1999	2000–2001	2002–2003	2004–2005	2006–2007	Percent Change, 2006–2007 vs. 1998–1999 (95% CI)
	no. of cases per 100,000 population (95% CI)					
Age group						
<2 Mo	73.46 (56.45 to 94.35)	88.28 (69.69 to 109.95)	56.59 (42.13 to 74.45)	77.27 (60.58 to 96.90)	80.69 (63.53 to 101.42)	10 (1 to 20)
2–23 Mo	14.20 (11.85 to 16.91)	11.49 (9.45 to 13.92)	6.56 (5.06 to 8.38)	6.95 (5.47 to 8.89)	6.91 (5.30 to 8.77)	−51 (−55 to −48)
2–10 Yr	1.55 (1.20 to 1.96)	1.48 (1.16 to 1.88)	0.94 (0.68 to 1.27)	1.07 (0.79 to 1.43)	0.56 (0.36 to 0.82)	−64 (−68 to −59)
11–17 Yr	1.03 (0.71 to 1.43)	0.87 (0.60 to 1.22)	0.62 (0.39 to 0.94)	0.56 (0.34 to 0.86)	0.43 (0.25 to 0.71)	−58 (−64 to −51)
18–34 Yr	0.99 (0.79 to 1.22)	0.86 (0.68 to 1.07)	0.70 (0.54 to 0.89)	0.76 (0.59 to 0.97)	0.66 (0.50 to 0.86)	−33 (−38 to −27)
35–49 Yr	1.23 (1.01 to 1.48)	1.30 (1.08 to 1.55)	1.08 (0.89 to 1.31)	0.91 (0.74 to 1.13)	0.95 (0.76 to 1.16)	−23 (−29 to −17)
50–64 Yr	2.15 (1.75 to 2.57)	1.83 (1.49 to 2.21)	2.09 (1.75 to 2.48)	1.79 (1.49 to 2.14)	1.73 (1.44 to 2.06)	−19 (−25 to −14)
≥65 Yr	2.64 (2.13 to 3.16)	2.20 (1.76 to 2.72)	2.21 (1.78 to 2.71)	1.51 (1.16 to 1.94)	1.92 (1.53 to 2.38)	−27 (−32 to −22)
All ages	2.00 (1.85 to 2.15)	1.82 (1.69 to 1.97)	1.49 (1.38 to 1.62)	1.41 (1.30 to 1.54)	1.38 (1.27 to 1.50)	−31 (−33 to −29)
						to −23)
						to −37)
						to −64)
Pathogen						
Streptococcus pneumoniae	1.09 (0.98 to 1.20)	1.03 (0.93 to 1.13)	0.93 (0.83 to 1.03)	0.76 (0.68 to 0.85)	0.81 (0.72 to 0.90)	−26 (−29 to −23)
Neisseria meningitidis	0.44 (0.37 to 0.51)	0.37 (0.31 to 0.44)	0.23 (0.19 to 0.29)	0.22 (0.17 to 0.27)	0.19 (0.14 to 0.24)	−58 (−61 to −54)
Group B streptococcus	0.24 (0.20 to 0.30)	0.30 (0.25 to 0.36)	0.21 (0.17 to 0.26)	0.27 (0.22 to 0.32)	0.25 (0.21 to 0.31)	4 (−3 to 12)
Haemophilus influenzae	0.12 (0.09 to 0.17)	0.10 (0.07 to 0.14)	0.10 (0.07 to 0.13)	0.10 (0.07 to 0.14)	0.08 (0.05 to 0.11)	−35 (−42 to −27)
Listeria monocytogenes	0.10 (0.08 to 0.16)	0.03 (0.01 to 0.05)	0.03 (0.01 to 0.05)	0.05 (0.04 to 0.10)	0.05 (0.03 to 0.08)	−46 (−53 to −39)

aged <2 months: mild **increase in incidence**

all **other age groups**, i.e. toddlers, children, elderlies: **decreased** incidence

BIG FOUR, i.e. Meningococci, Pneumococci, HiB, Listeria spp: **decreased** incidence

* CI denotes confidence interval.

† Race was obtained from medical records. "Other" includes American Indian or Alaska Native, Asian or Pacific Islander, or other race. Within a site and age group, cases with missing data for race were assumed to have a distribution of race similar to that among cases with available data.

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Review

The everchanging epidemiology of meningococcal disease worldwide and the potential for prevention through vaccination

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World Health Organization

African countries to introduce new meningitis vaccine

2008

A Vaccine Meets Its Promise: Success in Controlling Epidemic Meningitis in Sub-Saharan Africa

Luis Sambo,[1] Margaret Chan,[2] Steve Davis,[3] Anthony Lake,[4] Seth Berkley,[5] Cyrus Poonawalla,[6] and Christopher J. Elias[7]

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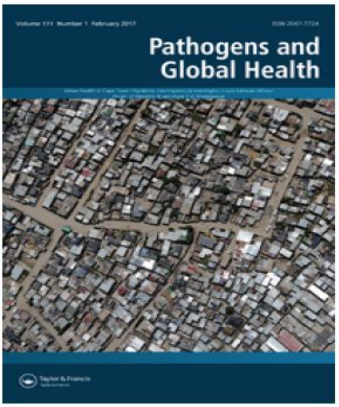
Clinical Infectious Diseases® 2015;61(S5):S387–8

The vaccine was introduced in Burkina Faso, Mali, and Niger in December 2010 and was enthusiastically accepted. By the end of that month, almost 20 million persons aged 1–29 years had been vaccinated, and the following epidemic season showed a dramatic reduction in group A meningococcal disease in all 3 countries. Vaccination campaigns have continued, and as of the end of 2014, >217 million Africans have been immunized in 15 countries. The vaccine has been shown to be safe and has generated herd protection, with control and near-elimination of group A meningococcal disease wherever it has been used [2–4].



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Pathogens and Global Health

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Emergence and control of epidemic meningococcal meningitis in sub-Saharan Africa

Idris Mohammed, Garba Iliyasu & Abdulrazaq Garba Habib

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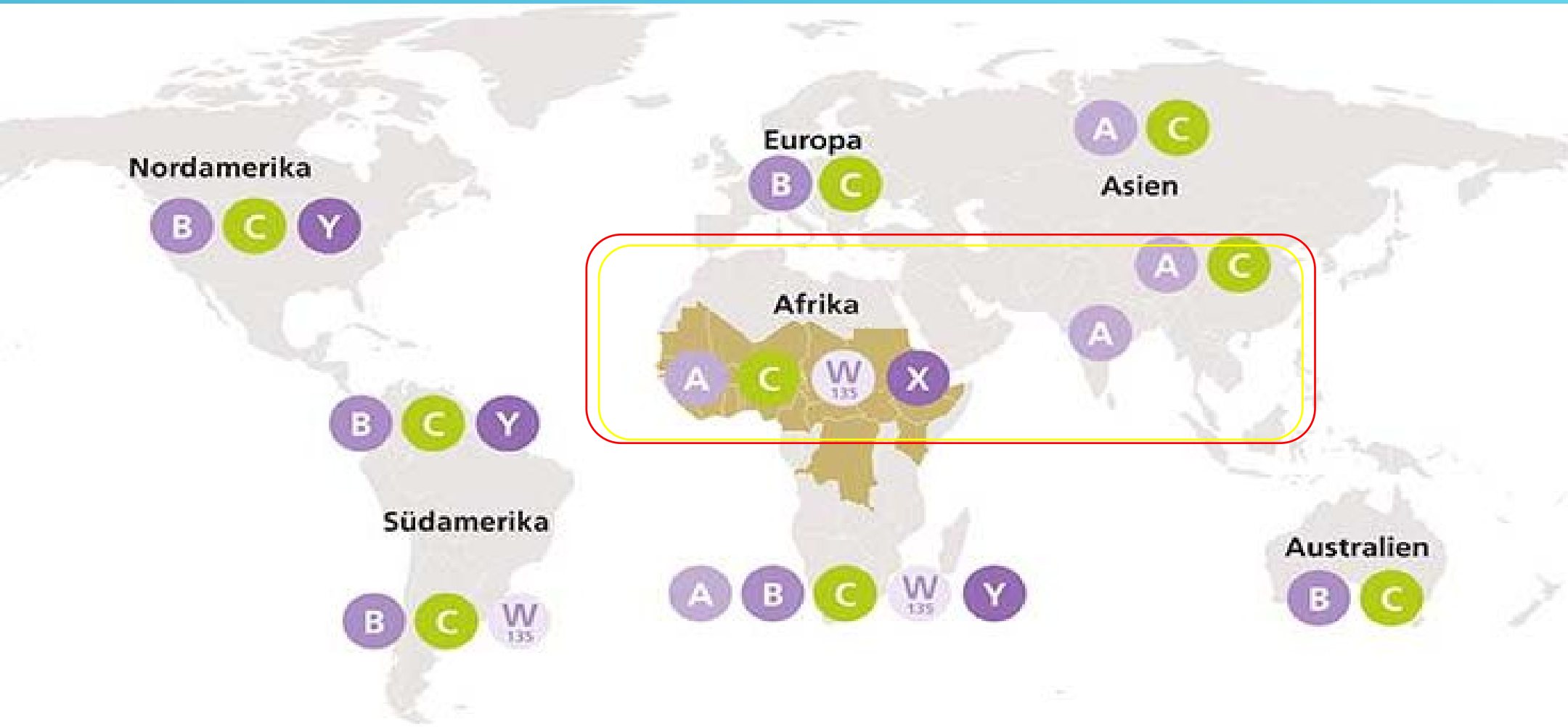
Table 1. Major epidemics in sub-Saharan Africa over the past 40 years.

Country	Year	Number of cases	CFR	Serotype
Before MenAfriVac Campaign				
Nigeria[15]	1977	1257	8.3	A
Rwanda[16]	1978	1182	4.8	A
Burkina Faso[17]	1979	538	10.2	C
Côte d'Ivoire[18]	1983	414	NA	A
	1985	251	8.5	A
	1985	367	8.5	A
Chad[19]	1988	4542	9.5	A
Sudan[20]	1988	32,016	NA	A
Ethiopia[21,22]	1981	50,000	2.0	A
	1989	41,139	3.9	A
Kenya[23]	1989	3800	9.4	A
Burundi[24,25]	1992	1615	8.0	A
Burkina Faso[26]	1996	42,129	10.0	A
	1997	22,305	11.3	A
Mali[25]	1996	7254	11.5	A
	1997	11,228	10.1	A
Niger[27,28]	1995	41,930	8.7	A
	1996	16,145	9.9	A
Nigeria[29]	1996	109,580	11.2	A
Burkina Faso[30]	2002	13,000	8.7	W
Nigeria[31]	2009	55,626	4.1	A
Niger[31]	2009	12,604	4.0	A
After MenAfriVac Campaign				
Burkina Faso[32]	2012	2825	16.9	W
Chad[32]	2012	5808	4.4	A
Nigeria[33]	2015	6394	5.0	C
Niger[34]	2015	8500	6.7	C

CFR: Case Fatality Rate

Conclusion

The introduction of MenAfriVac which is affordable, effective, long-lasting conjugate vaccine against Group A meningococcus offers extraordinary hope for wiping out epidemics of group A meningococcal meningitis in sub-Saharan Africa. However, the emergence of new serogroups coupled with the increasing number of population at risk as a result of lack of routine vaccination has posed a serious challenge toward achieving this goal. ..... virtually eliminating group A meningococcal disease and carriage in large regions of sub-Saharan Africa, has highlighted the need for a polyvalent vaccine to achieve the same for groups C, W, X, and Y. The current effort to develop an affordable, heat-stable, pentavalent conjugate meningococcal vaccine targeting all meningitis strains in Africa is hope to eventually put meningitis-free Africa within reach.



„MENINGITIS BELT“

Epidemiologische News 28.4.2022

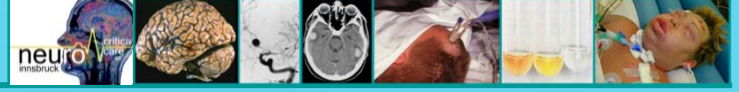
Expertenkomitee für Reisemedizin
Comité d'experts pour la médecine des voyages
Comitato di esperti per la medicina di viaggio
Expert committee for travel medicine

Art der Meldung	Neue Richtlinien/Empfehlungen	Epidemiologische Aktualitäten	Autor: Olivia Veit

Titel	**Afrika: Meningitis, Kalenderwoche 12-15**
	In der Kalenderwoche 12 bis 15 des Jahres 2022 (21.3.-17.4.2022) teilten 16 Länder ihre epidemiologischen Daten. In folgenden Ländern wurden Warn (Alert)- bzw. Epidemiemeldungen registriert (frühere Meldungen siehe EpiNews 25.3.2022 und Meningitis Daeshboard WHO Africa): - **Benin:** Alert in der Region Alibori (Distrikt Gogounou) und Alert in der Region Borgou (Distrikt Sinende) - **Kamerun:** Alert in der Region Littoral (Distrikt Njombe Penja) - **Niger:** Epidemie in der Region Tahoua, Alert in der Region Zinder (Distrikt Magaria und Dungass) - **Senegal:** Epidemie in der Region Nothern Bahr El Ghazal, Alert in der Region Dakar (Distrikt Diamniadio) Angaben zu den Erregertypen sind beschränkt. Seit Jahresbeginn 2022 wurden von 6'185 Verdachtsfällen in 2'569 Fällen Liquor-Proben untersucht, von denen 2'071 Proben ein negatives Resultat aufwiesen. In den positiv getesteten Proben (n=461): Nachweis von *N. meningitidis* C (231, 50% der Fälle) *S. pneumoniae* (163 Fälle, 35%) *N. m.* X (14 Fälle, 3%), *N. m.* W (8 Fälle, 1.7%), Hib (22 Fälle, 4.8%), andere (21 Fälle); noch in Untersuchung (35 Fälle).
Folgen für den Reisenden	Die Impfung mit einem quadrivalenten Meningokokken-Konjugatimpfstoff (Menveo® oder Nimenrix®) wird empfohlen: ▸ Bei Aufenthalten > 30 Tagen bzw. ▸ Bei kürzerer Aufenthaltsdauer je nach individuellem Risiko (z. B. enge Personenkontakte, Arbeit in Gesundheitseinrichtungen, stark belegte Unterkünfte, Epidemiegefahr). ▸ Bei Alert und/ oder Epidemien wird eine Impfung bei Aufenthalt > 7 Tage oder engem Kontakt zur Bevölkerung empfohlen.

1 month: 461 proven cases of ABM:

Nm C: 50%
Nm X: 3%
Nm W:1,7%
HiB: 4,8%
Pneumococci : 35%



EPIDEMIOLOGY

Resurgence of pneumococcal meningitis in Europe and Northern America

Diederik L.H. Koelman, Matthijs C. Brouwer, Diederik van de Beek

Clinical Microbiology and Infection, 05/2019

… the **promising decline** in the incidence of **pneumococcal meningitis following the introduction of vaccination** seems to have been **temporary**.

… replacement by **non-vaccine serotypes** illustrates pneumococcal meningitis continues to pose a **major challenge**.

We need **new approaches to prevention**, **new vaccines** and **continued effort** to **improve treatment for patients with pneumococcal meningitis**.

PLOS ONE

PLOS ONE | https://doi.org/10.1371/journal.pone.0265299 August 10, 2022

RESEARCH ARTICLE

Childhood meningitis in rural Gambia: 10 years of population-based surveillance

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Conclusions

Gambian children continue to experience substantial morbidity and mortality associated with suspected meningitis, especially acute bacterial meningitis. Such severely ill children in sub-Saharan Africa require improved diagnostics and clinical care.

Table 2. a: Incidence per 100,000 population of clinically suspected meningitis, suspected non-bacterial meningitis and acute bacterial meningitis among children ≤14 years of age (2008–2017), by year (n = 1427). b: Incidence per 100,000 population of clinically suspected meningitis, suspected non-bacterial meningitis and acute bacterial meningitis among children ≤14 years of age (2008–2017), by age (n = 1427).

Year	Clinically Suspected Meningitis (n = 1,049)			Suspected Non-Bacterial Meningitis (n = 209)			Acute Bacterial Meningitis (n = 169)		
	Cases	Incidence	95% CI	Cases	Incidence	95% CI	Cases	Incidence	95% CI
2008	97	279.5	227–341	12	34.6	18–60	8	23.1	10–45
2009	126	167.0	139–199	1	1.3	03–07	12	15.9	8–28
2010	122	154.7	128–185	13	16.5	09–28	16	20.3	12–33
2011	155	189.6	161–222	29	35.5	24–51	18	22.0	13–35
2012	101	118.4	96–143	35	41.0	29–57	54	63.3*	48–83
2013	89	102.4	82–126	30	34.5	23–49	13	15.0	8–26
2014	112	127.1	105–153	22	24.9	16–38	23	26.1	17–39
2015	103	117.5	96–143	39	44.5	32–61	17	19.4	11–31
2016	77	87.4	69–109	17	19.3	11–31	4	4.5	1.2–12
2017	67	75.5	58–96	11	12.4	06–22	4	4.5	1.2–12
Total	1049	125.9	118–134	209	25.1	22–29	169	20.3	17–24
Age in Month	**Clinically Suspected Meningitis (n = 1,049)**			**Suspected Non-Bacterial Meningitis (n = 209)**			**Acute Bacterial Meningitis (n = 169)**		
	Cases	Incidence	95% CI	Cases	Incidence	95% CI	Cases	Incidence	95% CI
<2	115	616.6	509–740	29	155.5	104–223	27	144.8	95–210
2–23	405	345.7	313–381	83	70.8	56–87	65	55.5	43–71
24–59	439	227.5	207–249	70	36.3	28–46	50	25.9	19–34
60–168	90	17.8	14–22	27	5.4	04–08	27	5.4	4–8
Total age	1049	125.9	118–134	209	25.1	22–29	169	20.3	17–24

Note: Only 234 days of surveillance in 2008, from 12 May– 31 Dec.

*Higher incidence due to the epidemic of *Neisseria meningitidis* W135.

https://doi.org/10.1371/journal.pone.0265299.t002

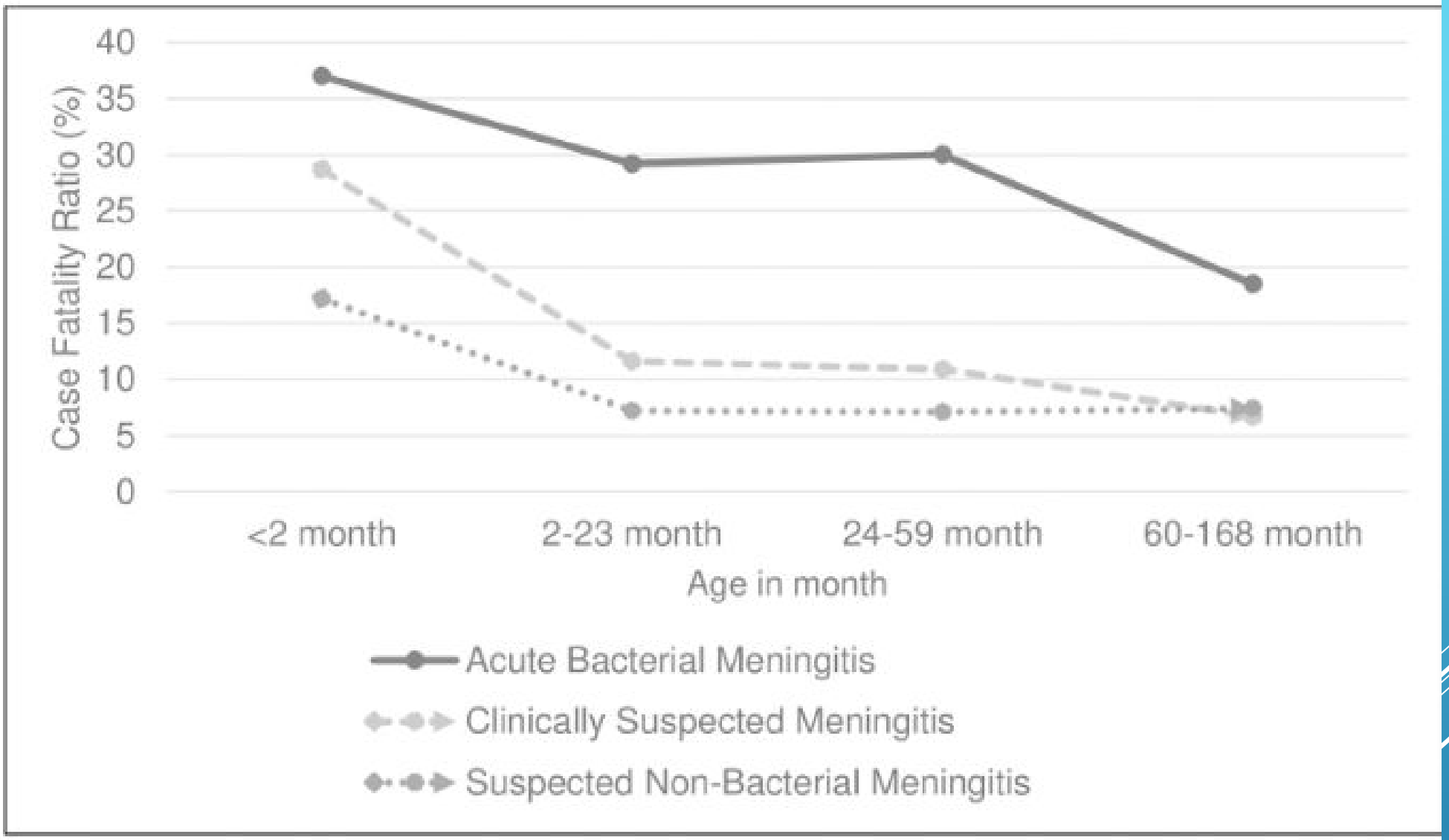


Fig 3. Age Strata Case Fatality Ratio of Clinically Suspected Meningitis (CSM), Suspected Non-Bacterial Meningitis (SNBM) and Acute Bacterial Meningitis (ABM) among children aged 1 day -14 years in Upper River Region Gambia, 2008–2017.

https://doi.org/10.1371/journal.pone.0265299.g003

ABM: a disease of dry season

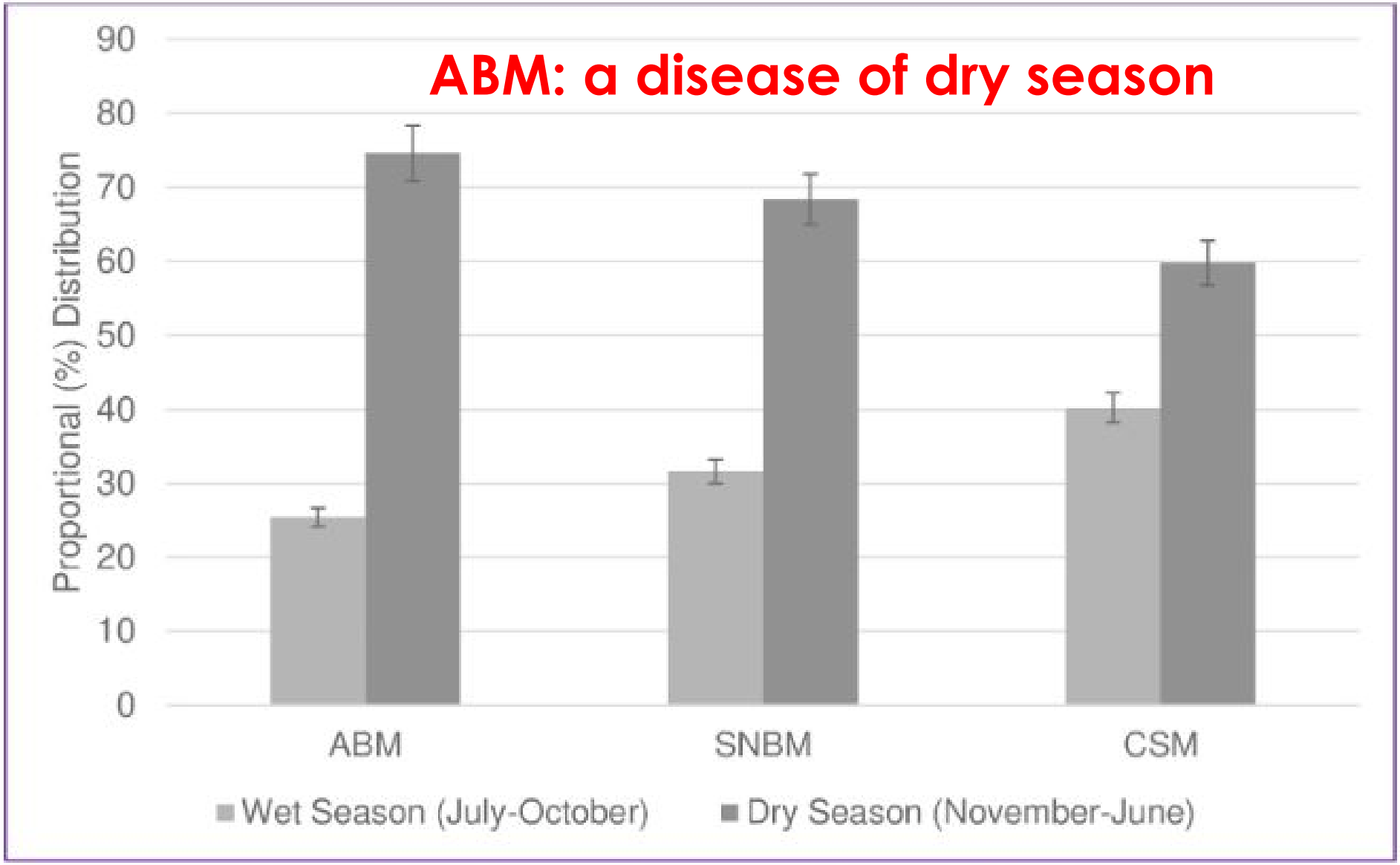


Fig 4. Seasonal Distribution of Clinically Suspected Meningitis (CSM), Suspected Non-Bacterial Meningitis (SNBM) and Acute Bacterial Meningitis (ABM) Over 10 Years in Upper River Region Gambia, 2008–2017.

https://doi.org/10.1371/journal.pone.0265299.g004

Table 4. Frequency of bacteria isolated from blood and CSF cultured and corresponding case fatality ratio (CFR) caused among children in Upper River Region Gambia, 2008–2017 (n = 169).

Bacteria	Total N	Blood N	CSF N	No. of Death	CFR %	95% CI
All Bacteria	169	77	92	49	29	21.4% - 38.3%
Streptococcus pneumoniae	44	16	28	15	34.1	19.1% - 56.2%
Neisseria meningitidis W	42	10	32	9	21.4	9.8% - 40.7%
Other GNR*	26	20	6	5	19.2	6.2% - 44.9%
Staphylococcus aureus	16	13	3	6	37.5	13.8% - 81.6%
H. influenzae type b	12	1	11	3	25	5.2% - 73.1%
Non-Typhoidal Salmonella	12	8	4	4	33.3	9.1% - 85.3%
non-type b *H. influenzae*	6	1	5	1	16.7	0.4% - 92.9%
Klebsiella pneumoniae	6	6	0	4	66.7	18.2% -170.7%
Escherichia coli	5	2	3	2	40	4.8% - 144.5%

*GNR–Gram Negative Rods that include *Pseudomas luteola, Pseudomanas stuteria, Pseudomonas floreense, Serratia marcenscens, Chromosoma violacum, Enterococcus faecalis, Stentrophomonas maltophilia*

https://doi.org/10.1371/journal.pone.0265299.t004

Table 5. Distribution of twenty-one pneumococcal serotypes causing pneumococcal meningitis (n = 44).

Vaccine Serotype (n = 22)			
Serotype (n = 6)	Pre-PCV13 N (%) [No. Dead]	Post-PCV13 N (%) [No. Dead]	Total N (%) [No. Dead]
1	4 (18.2) [1]	2 (9.0) [0]	6 (27.3) [1]
5	4 (18.2) [1]	0 (0)	4 (18.2) [1]
14	4 (18.2) [1]	0 (0)	4 (18.2) [1]
6A	2 (9.0) [1]	0 (0)	2 (9.0) [1]
19F	2 (9.0) [1]	0 (0)	2 (9.0) [1]
23F	2 (9.0) [1]	2 (9.0) [1]	4 (18.2) [2]
Total	**18 (82) [6]**	**4 (18) [1]**	**22 (100) [7]**

Non-Vaccine Serotype (n = 22)			
Serotype (n = 15)	Pre-PCV13 N (%) [No. Dead]	Post-PCV13 N (%) [No. Dead]	Total N (%) [No. Dead]
2	0 (0)	2 (9.0) [1]	2 (9.0) [1]
21	0 (0)	1 (4.5)	1 (4.5)
46	1 (4.5)	0 (0)	1 (4.5)
9A	1 (4.5) [1]	0 (0)	1 (4.5) [1]
10F	0 (0)	1 (4.5)	1 (4.5)
12B	2 (9.0) [1]	0 (0)	2 (9.0) [1]
12F	2 (9.0) [2]	1 (4.5)	3 (13.6) [2]
15A	1 (4.5)	0 (0)	1 (4.5)
15B	1 (4.5)	0 (0)	1 (4.5)
16F	1 (4.5)	0 (0)	1 (4.5)
17F	1 (4.5) [1]	1 (4.5)	2 (9.0) [1]
18A	0 (0)	1 (4.5) [1]	1 (4.5) [1]
23B	0 (0)	1 (4.5)	1 (4.5)
25F	0 (0)	2 (9.0) [1]	2 (9.0) [1]
35B	1 (4.5)	1 (4.5)	2 (9.0)
Total	**11 (50) [5]**	**11 (50) [3]**	**22 (100) [8]**

NB: Pre-PCV13 vaccine is defined as occurrence of cultured confirmed pneumococcal meningitis from May 12, 2008, to December 31, 2012. Whilst post-PCV13 is defined as occurrence of cultured confirmed pneumococcal meningitis from January 1, 2013, until December 31, 2017.

Table 6. Bacterial antimicrobial resistance patterns against nine antibiotics.

Bacteria	Number of Isolates	Antimicrobial Resistance, n (%)								
		AMP N (%)	CTX N (%)	CHL N (%)	CIP N (%)	SXT N (%)	ERY N (%)	PEN N (%)	TET N (%)	CN N (%)
S. pneumoniae	44	0 (0)	0 (0)	6 (14)	12 (27)	28 (64)	4 (9)	0 (0)	18 (41)	N/A
N. meningitidis	42	5 (12)	0 (0)	3 (7)	0 (0)	27 (64)	2 (5)	2 (5)	4 (10)	N/A
Other GNR	26	7 (27)	4 (15)	5 (19)	3 (12)	9 (35)	N/A	N/A	6 (23)	8 (31)
Staphylococcus aureus	16	*OX 5 (31)	N/A	0 (0)	N/A	6 (38)	2 (13)	12 (75)	4 (25)	3 (18)
H. influenzae type b	12	2 (17)	1 (8)	4 (33)	0 (0)	8 (67)	6 (50)	3 (25)	4 (33)	N/A
NTS	12	5 (42)	0 (0)	1 (8)	1 (8)	1 (8)	N/A	N/A	1 (8)	1 (8)
non-type b H. influenzae	6	0 (0)	0 (0)	3 (50)	0 (0)	0 (0)	1 (17)	0 (0)	3 (50)	N/A
K. pneumoniae	6	1 (17)	2 (33)	1 (17)	0 (0)	1 (17)	N/A	N/A	0 (0)	0 (0)
Escherichia coli	5	2 (40)	0 (0)	2 (40)	0 (0)	1 (20)	N/A	N/A	1 (20)	2 (40)

Key: AMP Ampicillin, CTX Cefotaxime, CHL Chloramphenicol, CIP Ciprofloxacin, SXT Cotrimoxazole, ERY Erythromycin, PEN Penicillin, TET Tetracycline, CN Gentamycin and OX Oxacillin, GNR Gram-negative rod, N/A Not Applicable and GNR–Gram Negative Rod.

Note: Disk diffusion methods were used following standard guidelines (CLSI 2012, M100-S22, Vol. 32 No.3).

Journal of Infection (2008) **57**, 449—454

www.elsevierhealth.com/journals/jinf

Antibiotic treatment delay and outcome in acute bacterial meningitis

Rasmus Køster-Rasmussen [a,*], André Korshin [b], Christian N. Meyer [c]

in 2022: even more important:

➔ **AVOID DELAY** OF **APPROPRIATE** ANTIBIOTIC TREATMENT **!!**

Gams Massi *et al.*
Egypt J Neurol Psychiatry Neurosurg (2022) 58:18
https://doi.org/10.1186/s41983-022-00454-0

The Egyptian Journal of Neurology, Psychiatry and Neurosurgery

RESEARCH Open Access

Spectrum of central nervous system infections in a tertiary health care centre in Cameroon

Daniel Gams Massi[1,2*], Marcel Roger Rodrigue Mintyene Mintyene[3], Annick Mélanie Magnerou[3,4], Seraphine Mojoko Eko[1], Caroline Kenmegne[2], Salomon Mbahe[2], Prince Eliot Sounga Bandzouzi[5], Hugo Bertrand Mbatchou Ngahane[2,3] and Njankouo Yacouba Mapoure[2,3]

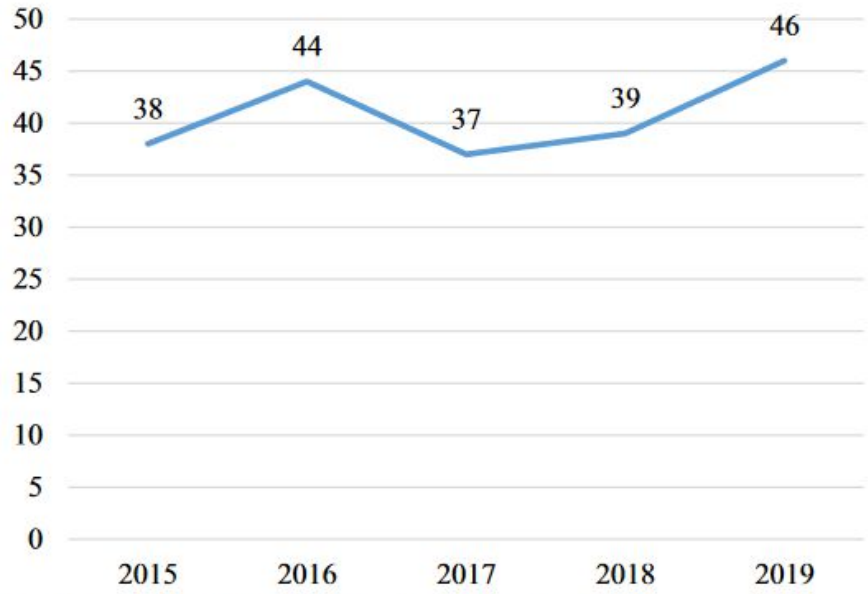


Fig. 1 Trends of CNS infection from 2015 to 2019

Table 2 Clinical manifestations in patients with CNS infections

Clinical signs	*n*	%
Neurological signs		
Headaches	140	68.6
Impaired consciousness	90	44.1
Meningeal signs	79	38.7
Seizures	74	36.3
Focal neurological deficits	59	28.9
Extra-neurological signs		
Altered general state	190	93.1
Fever	173	84.8
Vomiting	73	35.8
Respiratory distress	52	25.5
Gastro-intestinal tract signs	42	20.6
Dehydration	28	13.7
Clinical anaemia	17	8.3
Skin rash	7	3.4

neurological signs and symptoms AND extra-neurological signs and symptoms

Journal of Infection (2008) **57**, 449—454

ELSEVIER

www.elsevierhealth.com/journals/jinf

Antibiotic treatment delay and outcome in acute bacterial meningitis

A

therefore, in ABM: earliest possible diagnosis essential:
History, clinical signs and symptoms, lumbar puncture
Blood lab e.g. leucos, CRP, coagulation, thrombos, kidney, cultures

If lumbar puncture not possible: immediate adequate iv antibiotic tx

CSF: cells, glucose, protein, lactate, Gramstain, culture

if pretreated with antibiotics (even oral): PCR in CSF extremely helpful

Journal of Infection (2008) 57, 449–454

BRITISH INFECTION SOCIETY

www.elsevierhealth.com/journals/jinf

Antibiotic treatment delay and outcome in acute bacterial meningitis

Rasmus Køster-Rasmussen [a,*], André Korshin [b], Christian N. Meyer [c]

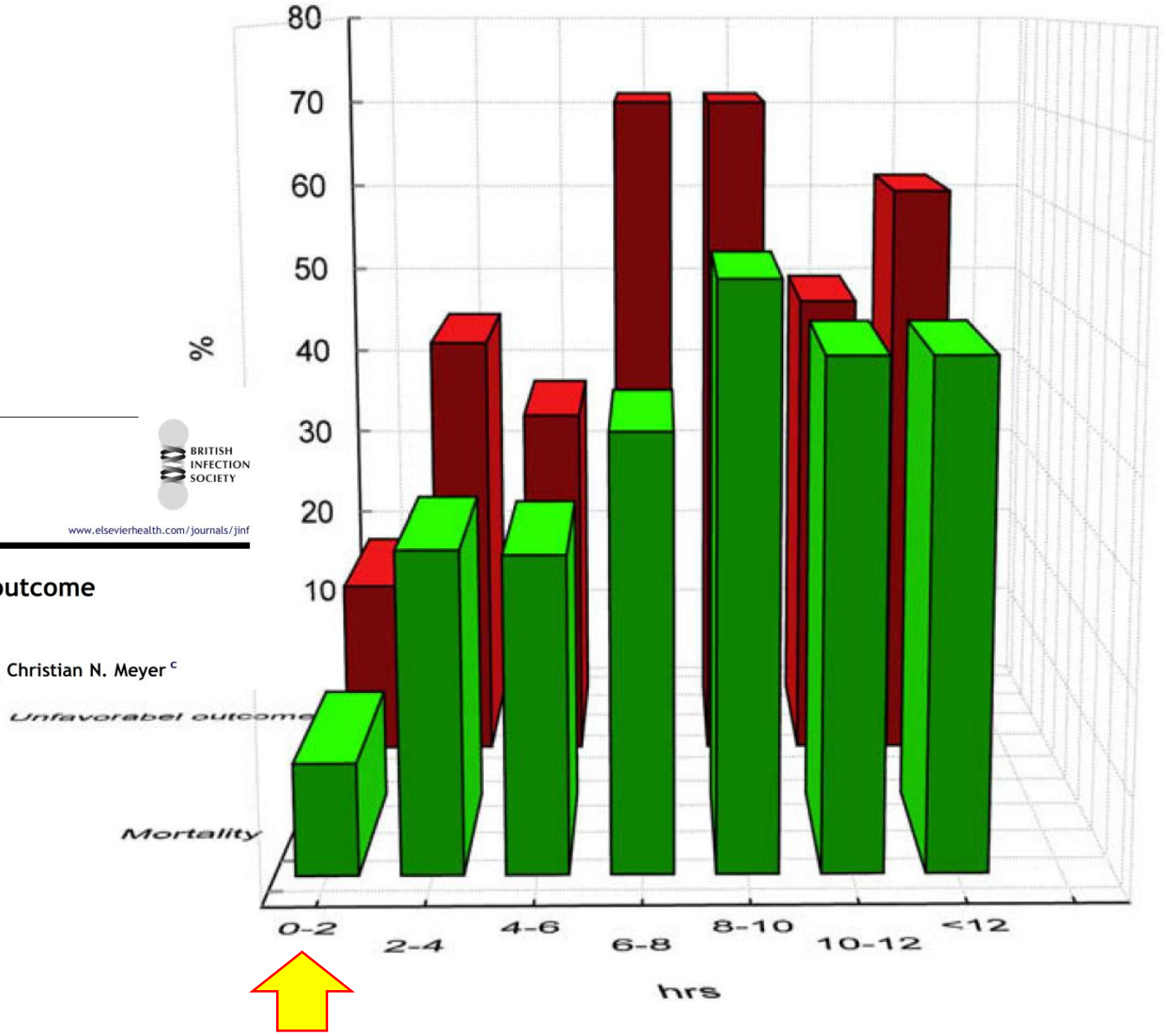


Figure 2 Rate of mortality and unfavourable outcome according to the treatment delay in time interval in acute bacterial meningitis.

METAANALYSIS

Adjunctive dexamethasone in bacterial meningitis: a meta-analysis of individual patient data

Diederik van de Beek, Jeremy J Farrar, Jan de Gans, Nguyen Thi Hoang Mai, Elizabeth M Molyneux, Heikki Peltola, Tim E Peto, Irmeli Roine, Mathew Scarborough, Constance Schultsz, Guy E Thwaites, Phung Quoc Tuan, A H Zwinderman

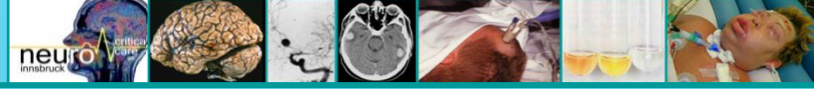
Lancet Neurol 2010; 9: 254–63

Published Online February 4, 2010

Summary

Background Dexamethasone improves outcome for some patients with bacterial meningitis, but not others. We aimed to identify which patients are most likely to benefit from dexamethasone treatment.

Europeans
55 years of age
(➔ pneumococci !!!)



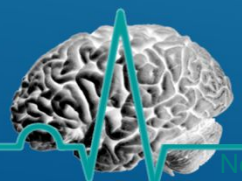
Gudina *et al. BMC Neurology* (2016) 16:153
DOI 10.1186/s12883-016-0678-0

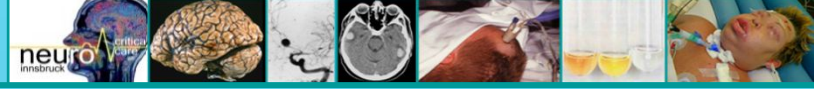
BMC Neurology

RESEARCH ARTICLE Open Access

Adjunctive dexamethasone therapy in unconfirmed bacterial meningitis in resource limited settings: is it a risk worth taking?

Esayas Kebede Gudina[1,2*], Markos Tesfaye[2,3], Aynishet Adane[4], Kinfe Lemma[5], Tamiru Shibiru[6], Andreas Wieser[7,8,9], Hans-Walter Pfister[10] and Matthias Klein[10]





Conclusion

Adjuvant dexamethasone use in management of suspected but unproven cases of bacterial meningitis in teaching hospitals in Ethiopia was associated with an increased mortality and poor discharge GOS. These findings re-affirm the lack of evidences for its broad use for presumed meningitis in low income countries and show that there are potential deleterious effects in unconfirmed cases. Physicians practising under such circumstances should abide with the current recommendations and defer the use of adjuvant corticosteroid in clinically suspected cases of bacterial meningitis without CSF alterations that support the diagnosis.

Viallon *et al. Critical Care* 2011, **15**:R136
http://ccforum.com/content/15/3/R136

CRITICAL CARE

RESEARCH Open Access

Meningitis in adult patients with a negative direct cerebrospinal fluid examination: value of cytochemical markers for differential diagnosis

Alain Viallon[1*], Nicolas Desseigne[1], Olivier Marjollet[1], Albert Birynczyk[1], Mathieu Belin[1], Stephane Guyomarch[1], Jacques Borg[2], Bruno Pozetto[3], Jean Claude Bertrand[1] and Fabrice Zeni[1]

Key messages

Am. J. Trop. Med. Hyg., 88(1), 2013, pp. 127–131
doi:10.4269/ajtmh.2012.12-0447

Handheld Point-of-Care Cerebrospinal Fluid Lactate Testing Predicts Bacterial Meningitis in Uganda

Albert Majwala, Rebecca Burke, William Patterson, Relana Pinkerton, Conrad Muzoora, L. Anthony Wilson, and Christopher C. Moore*

Department of Internal Medicine, Mbarara Regional Referral Hospital, Faculty of Medicine, Mbarara University of Science and Technology, Mbarara, Uganda; Department of Medicine, Duke University School of Medicine, Durham, North Carolina; Department of Laboratory Medicine, University of Virginia School of Medicine, Charlottesville, Virginia; Division of Infectious Diseases and International Health, Department of Medicine, University of Virginia, Charlottesville, Virginia

- Cerebrospinal fluid lactate and procalcitonin are easy to determine
- Cerebrospinal fluid lactate and procalcitonin are the best markers for differentiating between bacterial and viral meningitis

OPEN ACCESS Freely available online

PLoS one

Incorporation of Real-Time PCR into Routine Public Health Surveillance of Culture Negative Bacterial Meningitis in São Paulo, Brazil

Claudio T. Sacchi[1]*, Lucila O. Fukasawa[1], Maria G. Gonçalves[1], Maristela M. Salgado[1], Kathleen A. Shutt[2], Telma R. Carvalhanas[3], Ana F. Ribeiro[3], Brigina Kemp[4], Maria C. O. Gorla[5], Ricardo K. Albernaz[3], Eneida G. L. Marques[6], Angela Cruciano[7], Eliseu A. Waldman[8], M. Cristina C Brandileone[5], Lee H. Harrison[2], São Paulo RT-PCR Surveillance Project Team[¶]

1 Division of Medical Biology, Department of Immunology, Instituto Adolfo Lutz, São Paulo, Brazil, **2** Infectious Diseases Epidemiology Research Unit, University of Pittsburgh Graduate School of Public Health and School of Medicine, Pittsburgh, Pennsylvania, United States of America, **3** Center for Epidemiologic Surveillance, São Paulo, Brazil, **4** Center for Epidemiologic Surveillance, Campinas, Brazil, **5** Division of Medical Biology, Department of Bacteriology, Instituto Adolfo Lutz, São Paulo, Brazil, **6** Bacteriology Area, Department of Medical Biology, Instituto Adolfo Lutz Regional Laboratory of Campinas, Campinas, Brazil, **7** Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, United States of America, **8** Faculdade de Saúde Pública, Universidade de São Paulo, São Paulo, Brazil

Table 4. Multivariable analysis of risk factors for being a RT-PCR positive, culture-negative case-patient, using culture positive patients as controls.

Risk Factor	OR	95% CI	p-value
Hospital 3, 6, or 11	4.3	2.1–8.6	<0.0001
Antibiotic in CSF	12.2	5.9–25.0	<0.0001
Age ≥18 years	2.8	1.3–5.8	0.006
N. meningitidis	3.3	1.5–7.7	0.005

There were a total of 103 case-patients and 142 controls.
OR, odds ratio; CI, confidence interval; CSF, cerebrospinal fluid.
doi:10.1371/journal.pone.0020675.t004

Glycerol adjuvant therapy in adults with bacterial meningitis in a high HIV seroprevalence setting in Malawi: a double-blind, randomised controlled trial

Katherine M B Ajdukiewicz, Katharine E Cartwright, Matthew Scarborough, James B Mwambene, Patrick Goodson, Malcolm E Molyneux, Eduard E Zijlstra, Neil French, Christopher J M Whitty, David G Lalloo

Lancet Infect Dis 2011; 11: 293–300

Summary

Background S

infection. Mo

co-

ids.

Department of Medicine, College of Medicine, Chichiri, Blantyre, Malawi (K M B Ajdukiewicz MRCP, K E Cartwright MRCP, M Scarborough PhD, J B Mwambene Dip Med Sci, P Goodson Dip Med Sci, M E Molyneux Dip Med Sci, E E Zijlstra PhD); **Monsall Unit, Department of Infectious Diseases and Tropical Medicine, North Manchester General Hospital, Delaunays Road, Manchester, UK** (K M B Ajdukiewicz);

Microbiology, Leicester Royal Infirmary, Infirmary Square, Leicester, UK (K E Cartwright); **Microbiology, John Radcliffe Hospital, Headington, Oxford, UK** (M Scarborough); **Liverpool School of Tropical Medicine, Pembroke Place, Liverpool, UK** (M E Molyneux, D G Lalloo FRCP); **Department of Internal Medicine, Erasmus Medical Centre, Rotterdam, The Netherlands** (E E Zijlstra);

Karonga Prevention Study, Chilumba, Malawi (N French FRCP); **Department of Clinical Research, London School of Tropical Medicine and Hygiene, Keppel St, London, UK** (N French, C J M Whitty FRCP)

Correspondence to:
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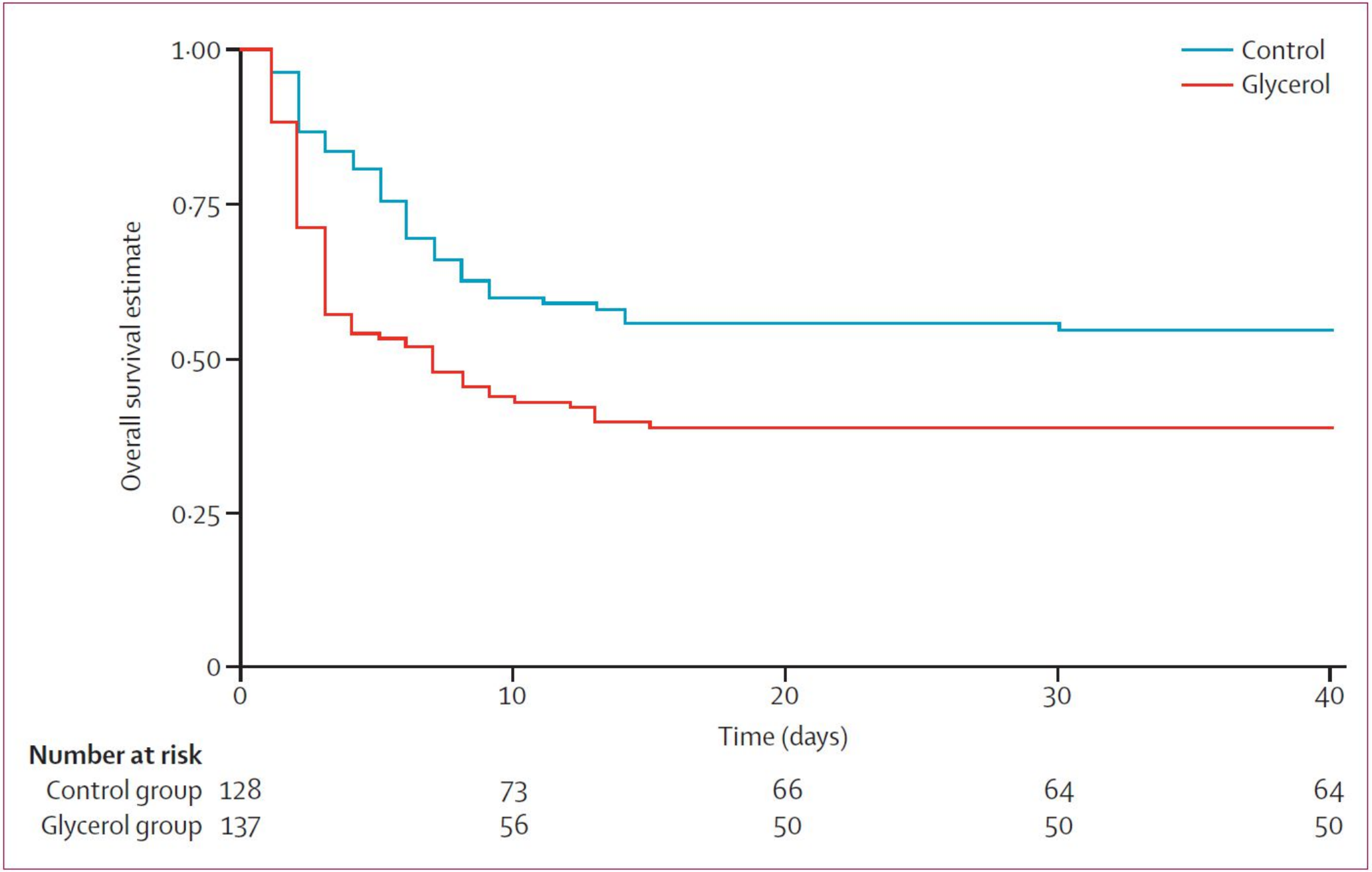


Figure 2: **Kaplan-Meier survival estimates for glycerol *vs* control**

Slow initial β-lactam infusion and oral paracetamol to treat childhood bacterial meningitis: a randomised, controlled trial

Tuula Pelkonen, Irmeli Roine, Manuel Leite Cruzeiro, Anne Pitkäranta, Matti Kataja, Heikki Peltola

Summary

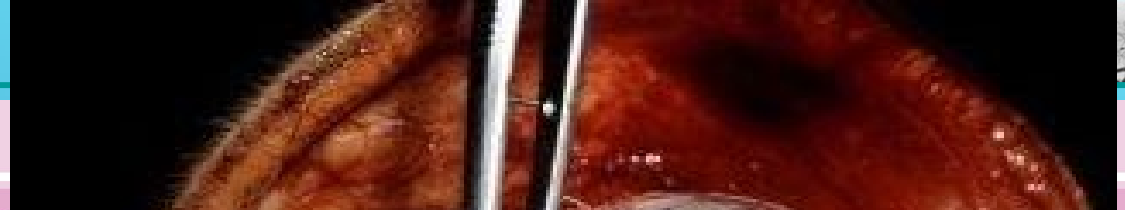
Background New antimicrobials or adjunctive treatments have not substantially reduced mortality from acute childhood bacterial meningitis. Paracetamol seems to have beneficial effects in bacteraemic adults and some experts recommend initial slow β-lactam infusion. We investigated whether these treatments had benefits in children with bacterial meningitis.

Lancet Infect Dis 2011; 11: 613–21

Published Online May 6, 2011 DOI:10.1016/S1473-

YES, SHOULD BE STRONGLY CONSIDERED

➔ **fastest possible initiation but slow infusion rate**



Journal of Infection (2016) **73**, 18—27

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BIAM British Infection Association

www.elsevierhealth.com/journals/jinf

Neurological sequelae of bacterial meningitis

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Accepted 10 April 2016
Available online 19 April 2016

Table 1 Neurologic sequelae of bacterial meningitis in high-resource countries.

Sequelae	Pneumococcal meningitis	Meningococcal meningitis	References
Focal deficits			
Children	3—14%	3%	
Adults	11—36%	2—9%	
Hearing loss			
Children	14—32%	4%	
Adults	22—69%	3—40%	
Seizures			
Children	15—48%	2%	
Adults	31%	6%	
Hydrocephalus			
Children	4—21%	—	
Adults	4%	3%	
Cognitive impairment			
Children	—	12—19%	
Adults	32%	32%	

Center, PO Box 22660, 1100DD Amsterdam, T

Accepted 10 April 2016
Available online 19 April 2016

Table 2 Neurologic sequelae of bacterial meningitis in low-resource countries.

Sequelae	Pneumococcal meningitis	Meningococcal meningitis	References
Focal deficits			
Children	12%	2—4%	9,25
Adults	—	4%	28
Hearing loss			
Children	25%	19—23%	11,25,39
Adults	40%	—	41
Seizures			
Children	45—63%	17—33%	39,46
Adults	—	—	—
Hydrocephalus			
Children	0%	0%	25
Adults	—	—	—
Cognitive impairment			
Children	4—41%	4%	11,25
Adults	—	—	—

Transcranial Doppler Ultrasonographic Evaluation of Cerebrovascular Abnormalities in Children With Acute Bacterial Meningitis

*Yudy Fonseca[1], Taty Tshimanga[2], Stephen Ray[3], Helen Malhotra[4], Jean Pongo[5], Joseph Bodi Mabiala[2], Montfort Bernard Gushu[6], Tusekile Phiri[6], Bertha Mekiseni Chikaonda[6], Davin Ambitapio Musungufu[7], Mananu Uchama[7] and Nicole Fortier O'Brien[8]**

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Transcranial Doppler Ultrasonographic Evaluation of Cerebrovascular Abnormalities in Children With Acute Bacterial Meningitis

Yudy Fonseca[1], Taty Tshimanga[2], Stephen Ray[3], Helen Malhotra[4], Jean Pongo[5], Joseph Bodi Mabiala[2], Montfort Bernard Gushu[6], Tusekile Phiri[6], Bertha Mekiseni Chikaonda[6], Davin Ambitapio Musungufu[7], Mananu Uchama[7] and Nicole Fortier O'Brien[8]

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Admission TCD:

Normal
High flow/normal PI
High flow/low PI
Low flow

PI: Pulsatility Index

Poor outcome:
High flow/low PI
Low flow

Introduction: Bacterial meningitis (BM) is a global public health concern that results in significant morbidity and mortality. Cerebral arterial narrowing contributes to stroke in BM and may be amenable to intervention. However, it is difficult to diagnose in resource-limited settings where the disease is common.

Methods: This was a prospective observational study from September 2015 to December 2019 in sub-Saharan Africa. Children 1 month–18 years of age with neutrophilic pleocytosis or a bacterial pathogen identified in the cerebrospinal fluid were enrolled. Transcranial Doppler ultrasound (TCD) of the middle cerebral arteries was performed daily with the aim to identify flow abnormalities consistent with vascular narrowing.

Results: Forty-seven patients were analyzed. The majority had *Streptococcus pneumoniae* (36%) or *Neisseria meningitides* (36%) meningitis. Admission TCD was normal in 10 (21%). High flow with a normal pulsatility index (PI) was seen in 20 (43%) and high flow with a low PI was identified in 7 (15%). Ten (21%) had low flow. All children with a normal TCD had a good outcome. Patients with a high-risk TCD flow pattern (high flow/low PI or low flow) were more likely to have a poor outcome (82 vs. 38%, $p = 0.001$).

Conclusions: Abnormal TCD flow patterns were common in children with BM and identified those at high risk of poor neurological outcome.

› Arch Neurol. 1993 Jan;50(1):98-101. doi: 10.1001/archneur.1993.00540010092024.

Time course of cerebral blood flow velocity in central nervous system infections. A transcranial Doppler sonography study

H P Haring [1], H K Rötzer, H Reindl, K Berek, A Kampfl, B Pfausler, E Schmutzhard

Affiliations – collapse

Affiliation

1 Department of Neurology, Neuro Intensive Care Unit, University Hospital, Innsbruck, Austria.

PMID: 8418808 DOI: 10.1001/archneur.1993.00540010092024

in adults

Abstract

In a 3-year period, 110 patients with central nervous system infections of various causes were examined serially by means of transcranial Doppler sonography. In viral-induced infections, no changes of flow velocity in basal cerebral arteries were seen, whereas in bacterial meningitis, a significant increase of blood flow velocity in the middle cerebral artery was recorded. Its extent was mainly associated with the type of the infectious agent, most frequently observed in pneumococcal meningitis (77%). The increase was up to 100% of the baseline values and was reversible in all cases. All patients were offered full-scale neurointensive care, and all subjects with bacterial meningitis were fully heparinized.

Eur J Neurol. 1998 Jan;5(1):75-81. doi: 10.1046/j.1468-1331.1998.510075.x.

Cerebral blood flow velocity and perfusion in purulent meningitis: a comparative TCD and 99M-TC-HMPAO-SPECT study

H Haring [1], A Kampfl, G Grubwieser, E Donnemiller, B Pfausler, E Schmutzhard

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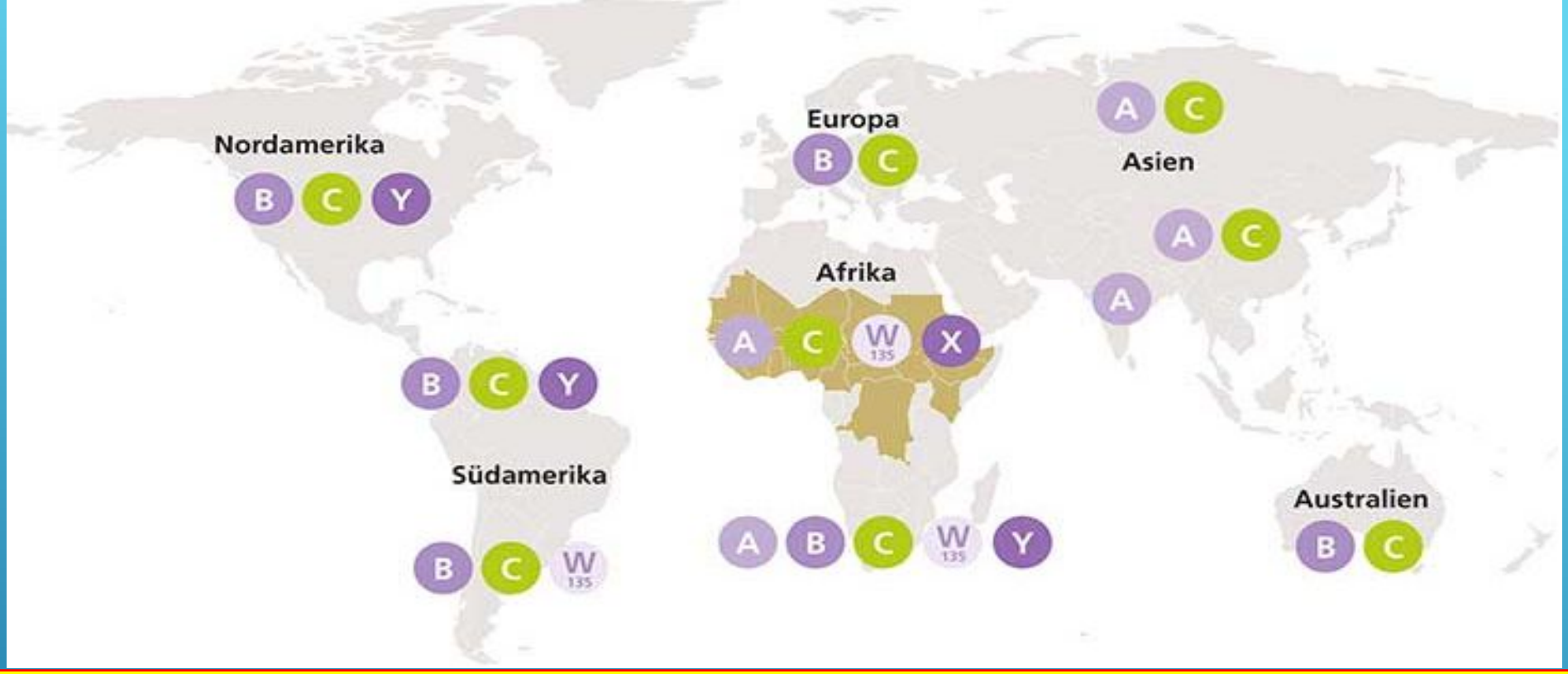
PMID: 10210815 DOI: 10.1046/j.1468-1331.1998.510075.x

… elevated cerebral bloodflow-velocity does **not** reflect cerebral hyperemia ….

Abstract

In 15 patients (median age 33 years; range 17-74 years) suffering from acute pneumococcal (10 cases) and meningococcal (five cases) meningitis, cerebral blood flow velocity (CBFV) was measured in the M1 - segment of the middle cerebral artery (MCA) by transcranial Doppler sonography, and cerebral perfusion changes were evaluated by 99m-Tc-hexamethylpropylene amine oxime single photon emission computed tomography (HMPAO SPECT). The objective of the study was to test whether increased CBFV during the acute phase of purulent meningitis reflects hyperemia, and to evaluate focal perfusion abnormalities and their correlation to CBFV changes. In eight patients with marked side-differences in CBFVs during the acute phase of the disease SPECT scans were normal in five. In three patients unilateral perfusion defects correlated with the side of higher CBFV. In seven patients presenting with symmetrically elevated CBFV, SPECT scans were normal in four and revealed focal abnormalities in the remaining three. Follow up SPECT scans were normal in 14/15 patients. The results of our study suggest that elevated CBFV in acute bacterial meningitis does not reflect cerebral hyperemia. Focal cerebral perfusion defects occur independently from functional alterations in the cerebral macrovasculature. A causative pathophysiologic relationship of high CBFV and focal perfusion defects cannot be drawn from these data.



Essential in all over the world, particularly in SubSaharan African countries:

…. easier availabilty of

➔tetravalent meningococcal vaccines (A,C, Y, W135)

➔Haemophilus B vaccine

➔Pneumococcal vaccine(s)

International Journal of Infectious Diseases 122 (2022) 1056–1066

Contents lists available at ScienceDirect

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journal homepage: www.elsevier.com/locate/ijid

Case-fatality and sequelae following acute bacterial meningitis in South Africa, 2016 through 2020

Susan Meiring[1,2,*], Cheryl Cohen[2,3], Linda de Gouveia[3], Mignon du Plessis[3,4], Vanessa Quan[1], Jackie Kleynhans[2,3], Colin Menezes[5,6], Gary Reubenson[7], Halima Dawood[8,9], Maphoshane Nchabeleng[10,11], Mohamed Said[12,13], Nomonde Mvelase[14,15], Prasha Mahabeer[14,15], Rispah Chomba[16,17], Ruth Lekalakala[18,19], Trusha Nana[16,20], Vindana Chibabhai[16,20], Marianne Black[16,20], Anne von Gottberg[3,4,**], for GERMS-SA

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Prognosis of ABM: long-term morbidity and mortalitiy

Risk factors for mortality:

initial GCS

comorbidities

non-directed antibiotic therapies

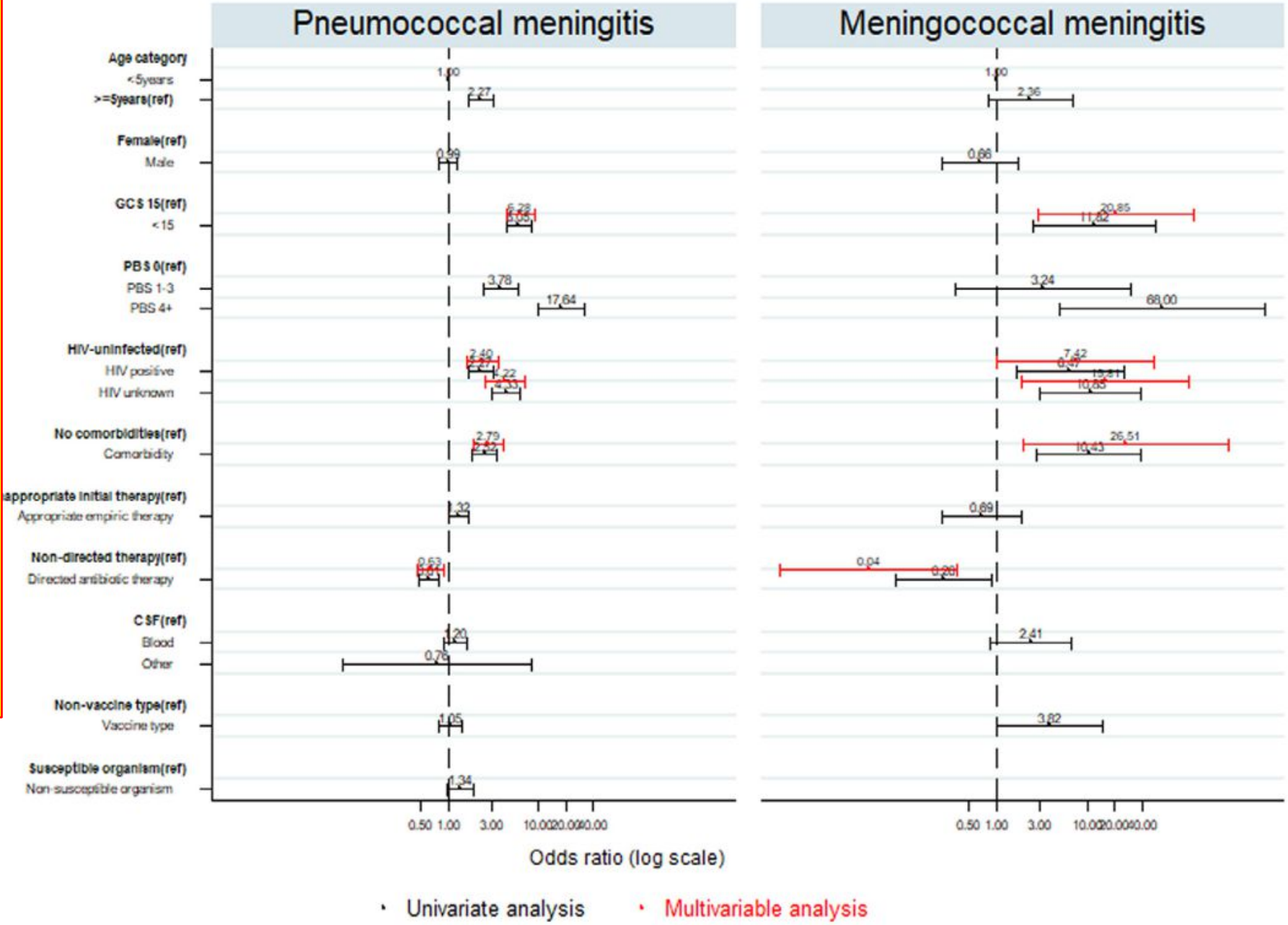

Figure 3. Forest plot: univariate and multivariable analysis of risk factors for mortality following pneumococcal and meningococcal meningitis, 2016-2020
Abbreviations: GCS: Glasgow coma score; PBS: Pitt bacteremia score for severity of illness.

Thank you