

## ABSTRACT

**Background:** Adjunctive steroids decrease mortality in adults with bacterial meningitis with the exception of *Listeria monocytogenes*. Steroids given within 20 minutes, 4 hours and 12 hours after the first dose of antibiotics are advocated by the Infectious Diseases Society of America (IDSA), European, and United Kingdom (UK) guidelines, respectively. Compliance with these guidelines in the US is unknown.

**Methods:** Retrospective observational study of 202 adults with community-acquired bacterial meningitis at 16 hospitals in Houston, Texas from December 2004-May 2019.

**Results:** Median age of patients was 55 years old (range 20-92) and 56.4% were male patients (n=114). Among the 202 patients with bacterial meningitis, we excluded 7 patients due to insufficient information regarding timing of steroid use. Adjunctive steroids were given to 146/195 (75%) of patients and were more likely used in patients with a positive Gram stain, those with pneumococcal etiology (87%), comorbidities, a higher CSF protein and with lower CSF glucose (P>0.05). There was no association between the use of steroids and history of immunosuppression, fever, headache, stiff neck, Glasgow coma scale, seizures, focal neurological exam or serum WBC counts (P>0.05). Out of the 146 patients that received steroids, 28 (14%), 68 (35%), and 106 (54%) received them within 20 minutes, 4 hours or 12 hours after the first dose of antibiotics as per IDSA, European and UK guidelines, respectively. Use of steroids in this study by any timeline was not associated with improved clinical outcomes.

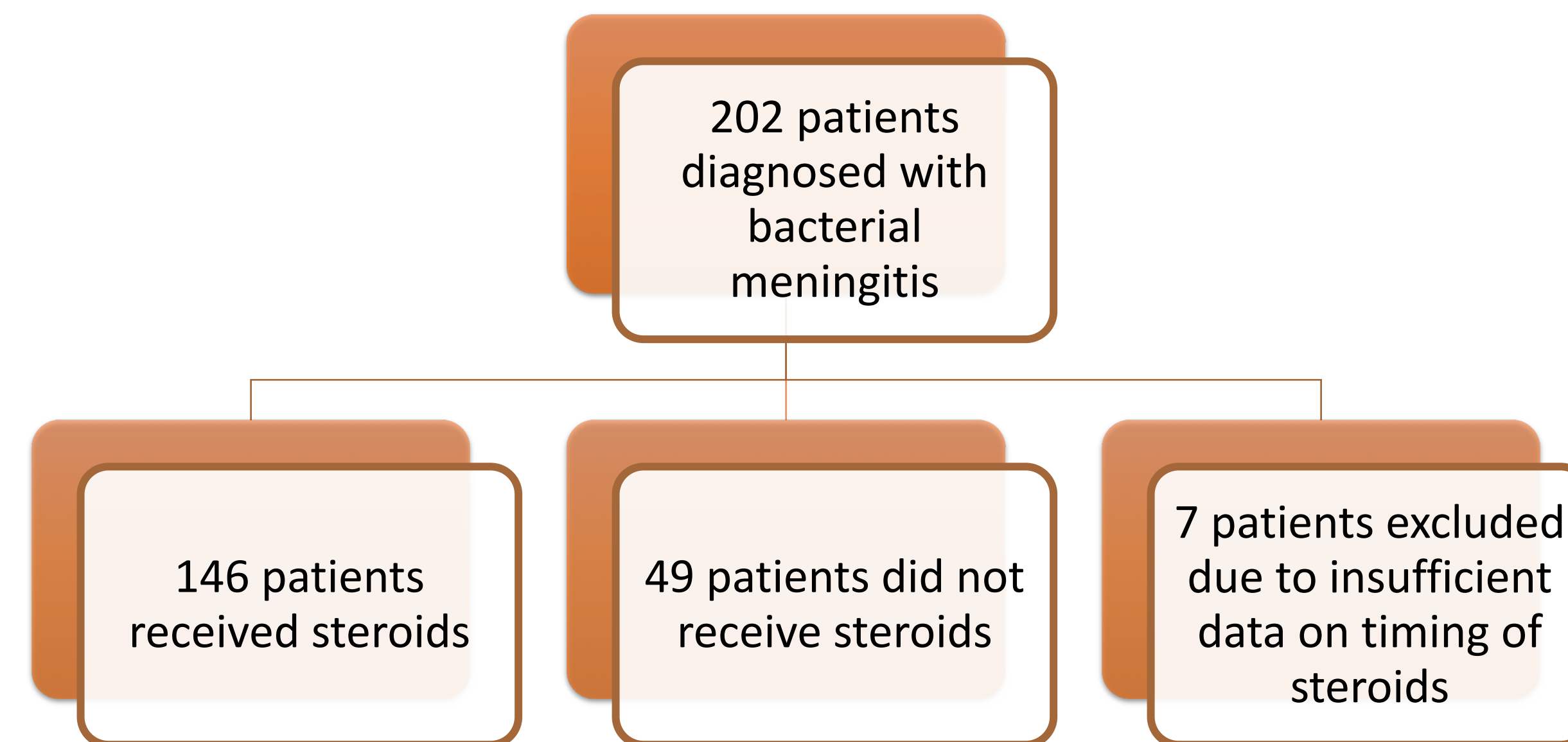
**Conclusion:** Timing and use adjunctive steroids in adults with bacterial meningitis remain suboptimal in the US and could account for the lack of impact on clinical outcomes.

## BACKGROUND

- Adjunctive steroid therapy is used to reduce inflammation in the treatment of central nervous system (CNS) infections.
- There is limited data regarding the timing of steroid administration for bacterial meningitis and compliance according to IDSA, European and UK guidelines.

## METHODS

- We identified 202 cases of bacterial meningitis in patients >18 years old at 16 hospitals in Houston, Texas from December 2004 to May 2019.
- We excluded 7 patients due insufficient information regarding timing of steroid use.
- Cases were identified by chart review based on clinical features and lumbar puncture analysis.



## RESULTS

Table 1. Baseline Characteristics, Co-existing Medical Conditions and Clinical Presentation of 202 Adults with Community Acquired Bacterial Meningitis

	N, (%)		
<b>Ethnicity</b>			
White	63 (31)		
African American	62 (30)		
Hispanic	48 (24)		
Asian	5 (3)		
Unknown	24 (12)		
<b>Variables</b>	<b>Steroids given Number (%)</b>	<b>No Steroids given Number (%)</b>	<b>p</b>
<b>Overall sample</b>	146 (75)	49 (25)	
<b>Comorbidities</b>			
Median Charlson score (range)	1 (range 0-8)	2 (range 0-11)	.036
Immunocompromised <sup>a</sup>	25/152 (16)	10/50 (20)	.565
HIV/AIDS	22/152 (14)	6/50 (4)	.661

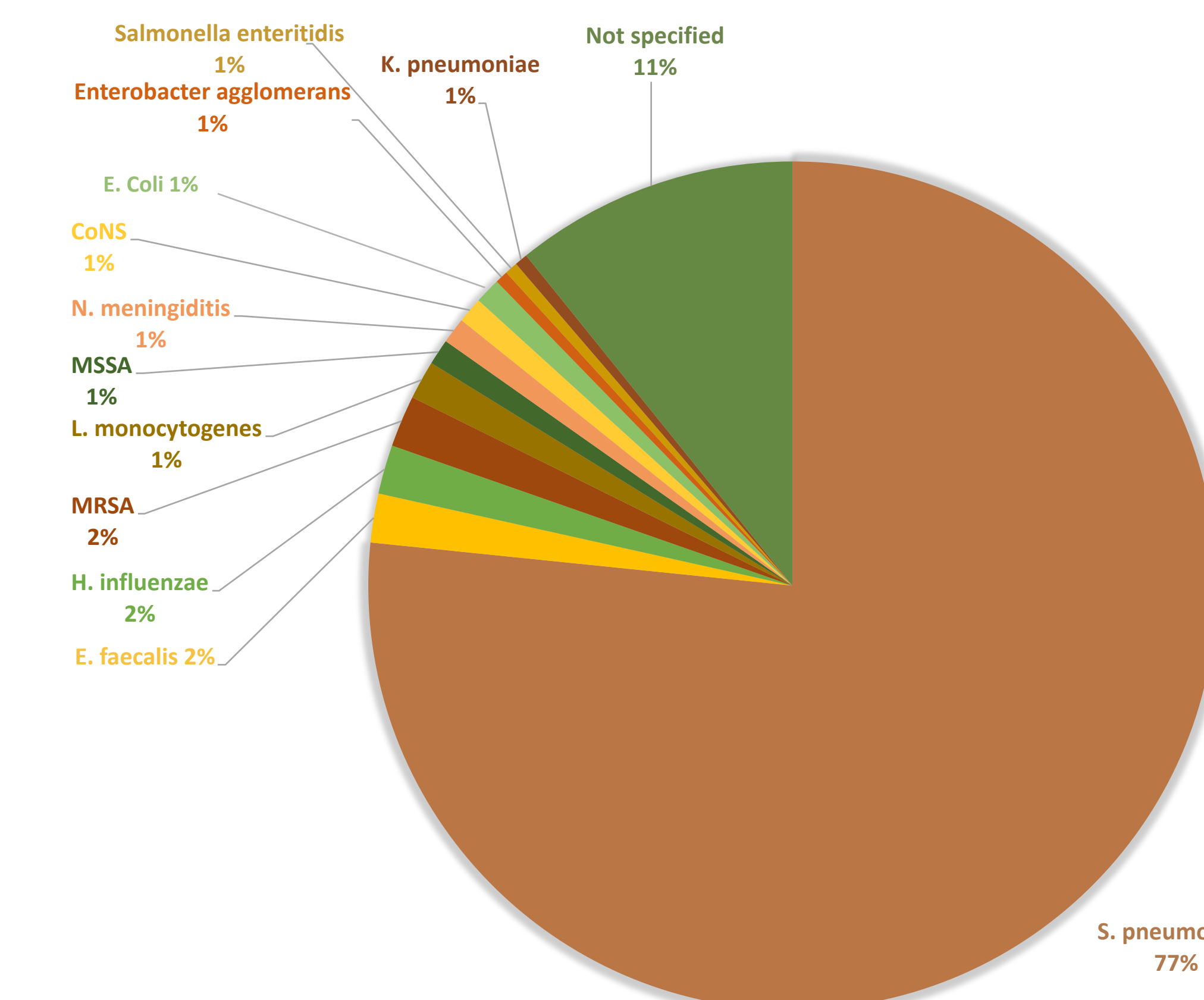
## RESULTS

Table 1. (Continued) Baseline Characteristics, Co-existing Medical Conditions and Clinical Presentation of 202 Adults with Community Acquired Bacterial Meningitis

Variables	Steroids given Number (%)	No Steroids given Number (%)	p
<b>Presenting symptoms</b>			
Fever	106/150 (71)	35/50 (70)	.929
Headache	82/150 (55)	28/50 (56)	.870
Stiff neck	43/151 (28)	11/50 (22)	.371
Nausea	54/151 (36)	17/50 (34)	.821
Photophobia	12/151 (8)	2/50 (4)	.342
Malaise	57/151 (38)	18/50 (36)	.825
<b>Presenting signs</b>			
Median GCS (range)	13 (range 3-15)	14 (7-15)	.111
Fever (>38.4 °C)	112 /151 (74)	32/50 (64)	.167
Focal neurological exam	35/150 (23)	12/50 (24)	.923
Seizures	18/151 (12)	5/50 (10)	.712
Sinusitis	24/150 (16)	11/50 (22)	.334
Otitis media	28/150 (19)	8/50 (16)	.671
Coma	6/149 (4)	0	.154
<b>Laboratory findings</b>	<b>Median (range)</b>	<b>Median (range)</b>	
CSF leukocyte (cells/ $\mu$ L)	2195 (12-44040)	527 (1-52000)	.688
Serum leukocyte (cells $\times$ 10 <sup>3</sup> / $\mu$ L)	17350 (1080-57700)	13500 (1300-39700)	.274
CSF protein (mg/dL)	357 (35-1845)	237 (30-2500)	.030
CSF glucose (mg/dL)	5 (0-482)	36 (0-421)	.007
<b>Microbiology results</b>			
Positive gram stain	87/152 (57)	13/50 (26)	<.001
Positive CSF culture	108/152 (71)	23/50 (46)	.001
<i>Streptococcus pneumoniae</i>	132/152 (87)	33/50 (66)	<.001
<b>Outcome</b>			
Median GOS (range)	5 (range 1-5)	5 (range 1-5)	.819
GOS	66/146 (45)	19/49 (39)	.432

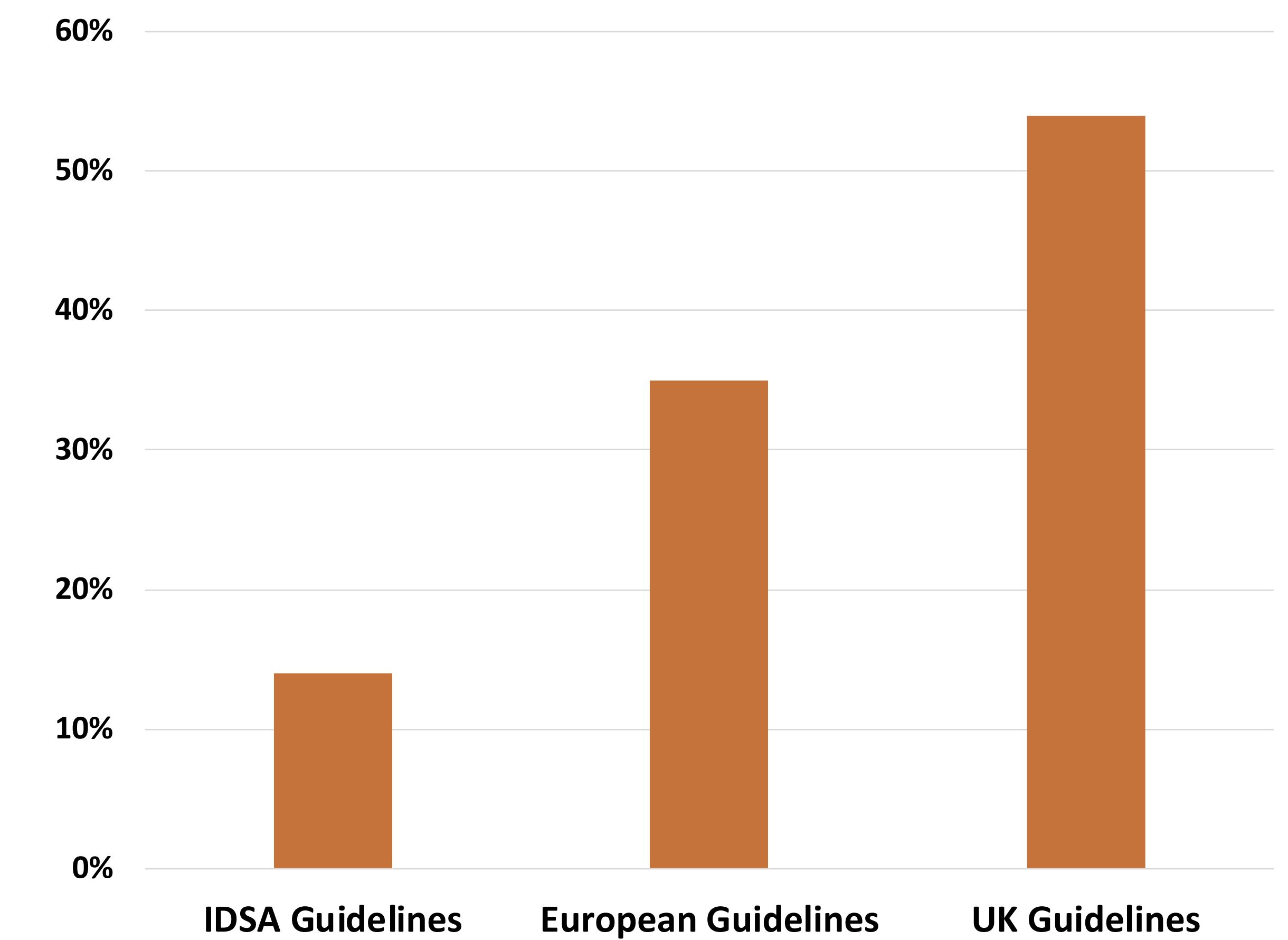
GCS Glasgow coma scale, HIV/AIDS human immunodeficiency virus, acquired immunodeficiency virus, CSF cerebrospinal fluid, GOS Glasgow outcome scale  
<sup>a</sup>Immunocompromised includes those with HIV, solid organ transplant, daily use of prednisone >20 mg, recent chemotherapy.

Figure 1. Bacterial Meningitis Etiology



## RESULTS

Figure 2. Percentage of Steroid Compliance Across Guideline Recommendations



## CONCLUSIONS

- Timing and use of adjunctive steroids in adults with bacterial meningitis remain suboptimal in the US.
- These deficiencies may account for the lack of improved clinical outcomes in this patient cohort.

## REFERENCES

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