Comparison of National, Regional, and State Susceptibilities of *Streptococcus pneumoniae* to Clindamycin and Erythromycin:

Results of the Antimicrobial Resistance Management (ARM) Program, 1997-2004

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ARM Program Design

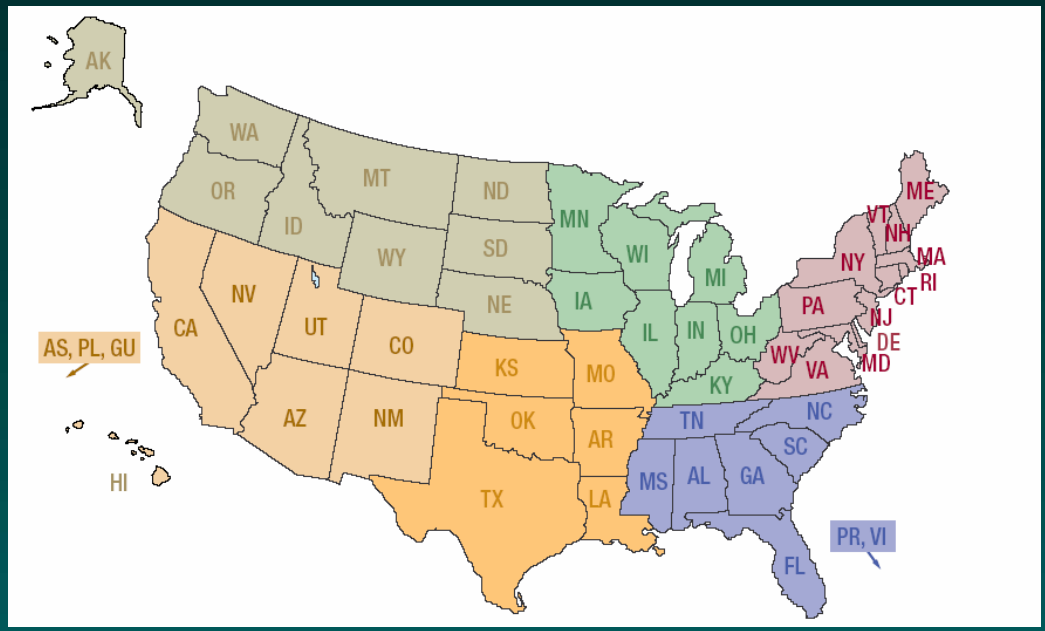
- The ARM Program (www.armprogram.com) is an ongoing antimicrobial surveillance project established in 1997
  - Document trends in antimicrobial susceptibility patterns
  - Identify relationships between antibiotic use and resistance rates
- Minimum of 3 years of antibiogram/sensitivity data is included in a national aggregate surveillance database (HIPAA-compliant non-identifying format)
- Web-based analysis tool allows comparisons between antibiotic use and resistance rates

ARM Program Design

- On-line, real-time database freely accessible
- Participating institutions receive a customized report profiling resistance patterns within the hospital/system and benchmarking to national, regional and state comparators
- As of August 1, 2005, susceptibility data on 28.5 million isolate comparisons have been submitted by 359 institutions
  - 48 antibiotics
  - 19 organisms

ARM Program Design

- 359 Hospitals *
  - 30% Southeast
  - 30% Northeast
  - 14% North Central
  - 16% South Central
  - 8% Southwest
  - 2% Northwest
- 21% Teaching
- 79% Non-academic



* As of August 1, 2005

Background and Purpose

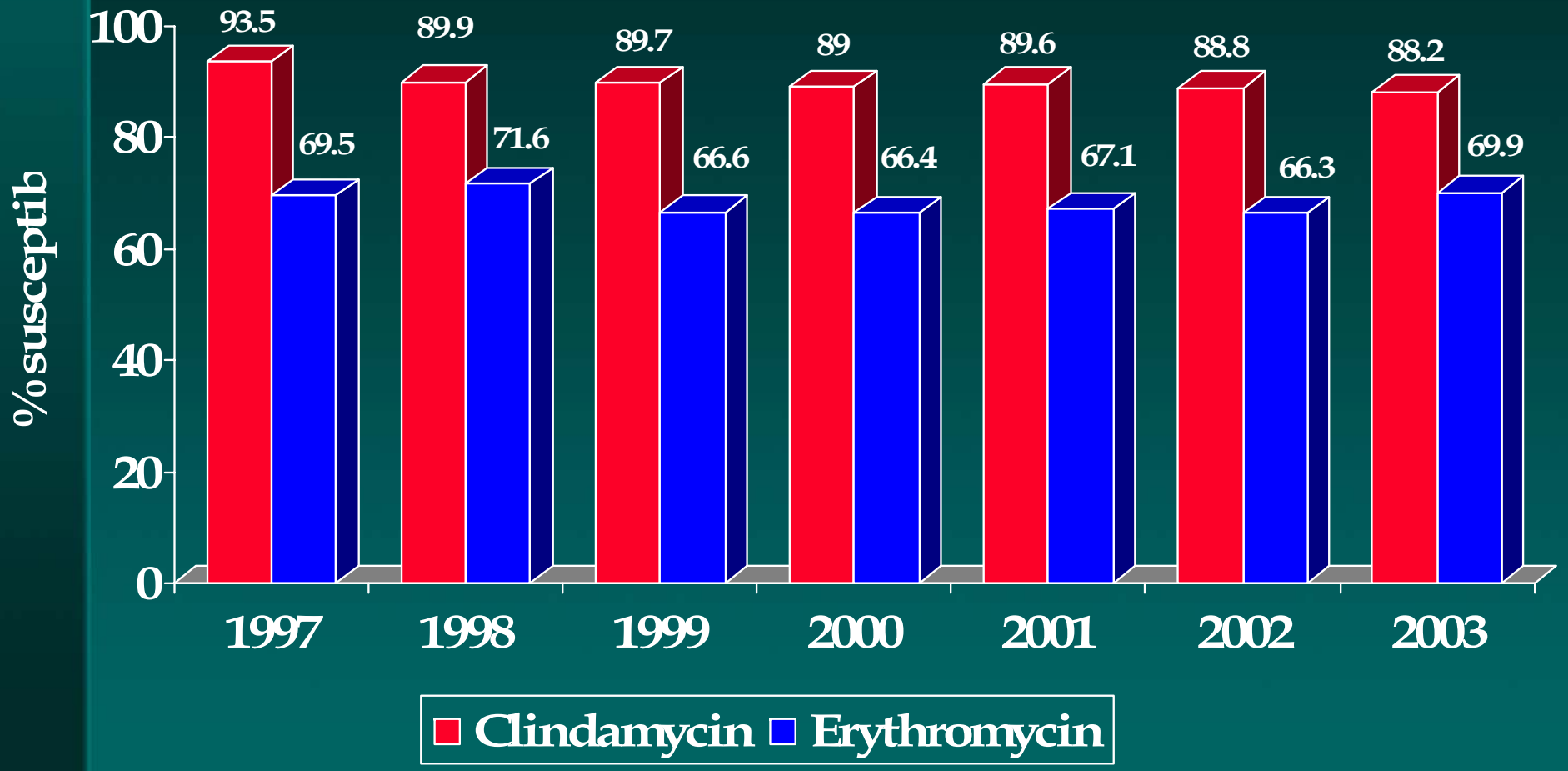
- *Streptococcus pneumoniae* is the most frequently isolated pathogen in patients with CAP[1]
- Macrolides are an integral component of in/outpatient treatment, but increasing levels of resistance are cause for concern[1,2]
  - Resistance levels vary depending on geographic location
- The mechanism of resistance, efflux or methylation, may dictate the clinical significance of in vitro resistance[4,5]
- The study objective was to determine the prevalence and mechanism of macrolide resistance at the national, regional and state level for *S. pneumoniae* isolate data submitted to the ARM program from 1997-2004

1. Mandell LA, et al. Clin Infect Dis 2003;37:1405-33.
2. Iannini PB, et al. Presented at: IDSA 2004 Annual Meeting, September 30 –October 3, 2004, Boston, MA.
3. Epstein BJ, Gums JG. Drugs 2005;65:1949-71.
4. Rzeszutek M, et al. Int J Antimicrob Agents 2004;24:95-104.
5. Lonks JR, et al J Antimicrob Chemother 2002;50 Suppl S2:87-92.

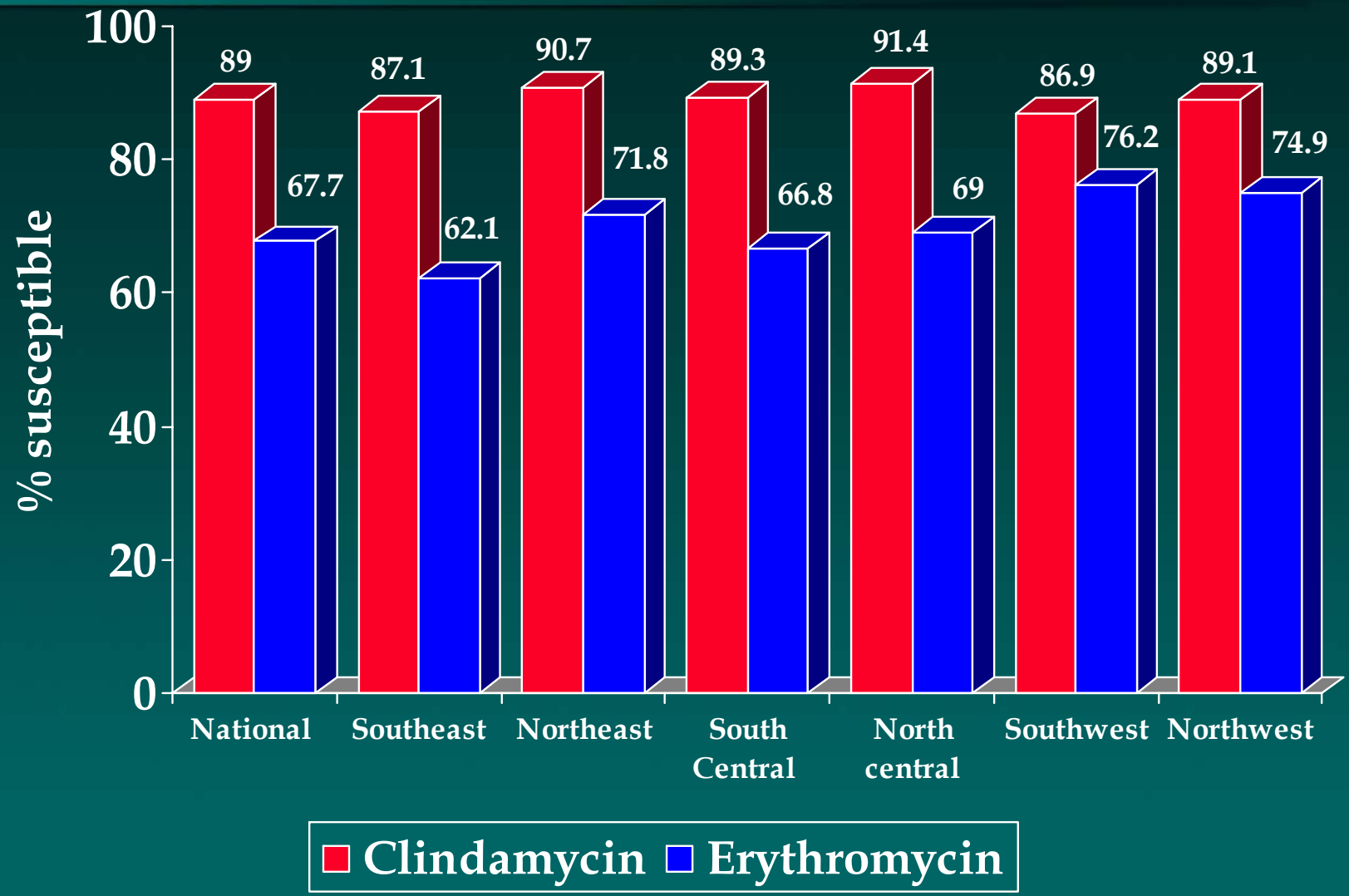
Methods

- Determined aggregate and annual resistance rates for *S. pneumoniae (n=253,053)* from 1997-2004 for:
  - Erythromycin
  - Clindamycin
- National, regional, and state trends analyzed
- Resistance mechanism determination:
  - Used erythromycin resistant/clindamycin susceptible phenotype as surrogate for the presence of efflux-mediated resistance
  - Isolates expressing clindamycin resistant phenotype harbor *erm* gene and display MLS_B profile

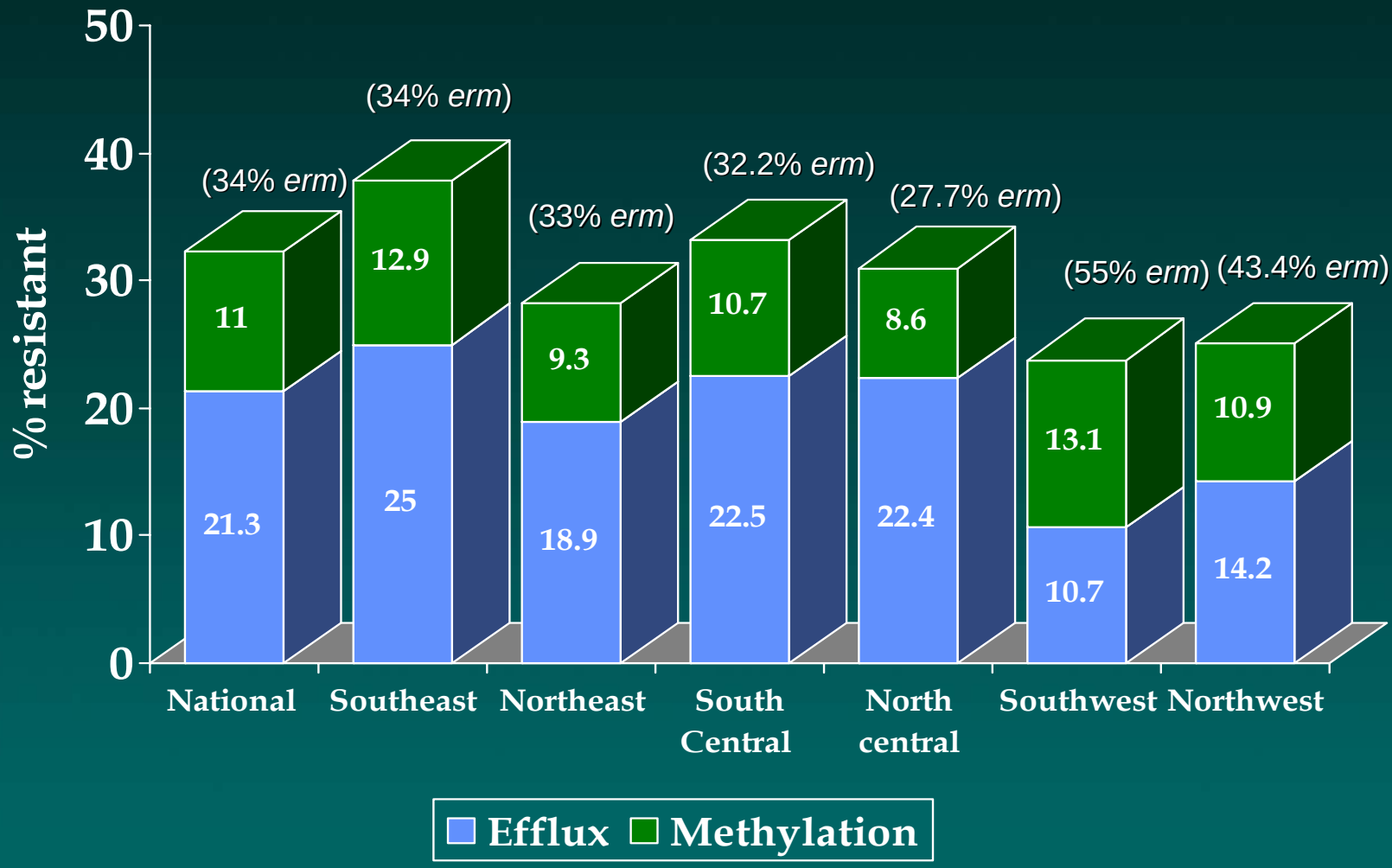
Results: National *S. pneumoniae* Susceptibility to Clindamycin and Erythromycin (1997-2004)



Results: National and Regional *S. pneumoniae* Susceptibility to Erythromycin (1997-2004)



Results: National and Regional Resistance Mechanisms among *S. pneumoniae* (1997-2004)



Results: *S. pneumoniae* Susceptibility to Erythromycin (1997-2004) Among Select States

States with highest erythromycin susceptibility		States with lowest erythromycin susceptibility	
State	**% susceptible**	**State**	**% susceptible**
Arizona	79.8	Virginia	62.7
Indiana	78.8	South Carolina	62.5
Massachusetts	78.8	Georgia	62.2
Kansas	76.4	Florida	60.5
Pennsylvania	76.1	West Virginia	57.9

Results: *S. pneumoniae* Resistance to Clindamycin (1997-2004) Among Select States

States with highest clindamycin susceptibility		States with lowest clindamycin susceptibility	
State	**% susceptible**	**State**	**% susceptible**
Illinois	97.6	Virginia	87.9
Maryland	94.9	Georgia	86.5
Tennessee	93.0	Alabama	83.9
Arkansas	92.4	Florida	83.8
West Virginia	92.0	Nevada	76.9

Conclusion

- Resistance to macrolide antibiotics has stabilized at 30%, though geographical variation is substantial
  - Resistance to macrolides
    - Highest in the Southeast and South Central
    - Lowest in North West and Southwest
- Efflux is the predominant form of resistance to macrolides except in the West, where methylation is common

Clinical Implications

- Geographical variations in macrolide activity exist and should be considered when treating patients with CAP
- Variance in resistance level and mechanism highlight the need for state-level surveillance
- Low-level macrolide resistance, conferred by *mef*, may explain the in vitro-in vivo paradox
- Surveillance databases, such as the ARM Program, facilitate efficient evaluation of large quantities of data, detection of geographical heterogeneity, and timely dissemination of results, thereby permitting strategic intervention at the institution level

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