Epidemiology of Meningococcal Disease Outbreaks in the United States

Advisory Committee on Immunization Practices

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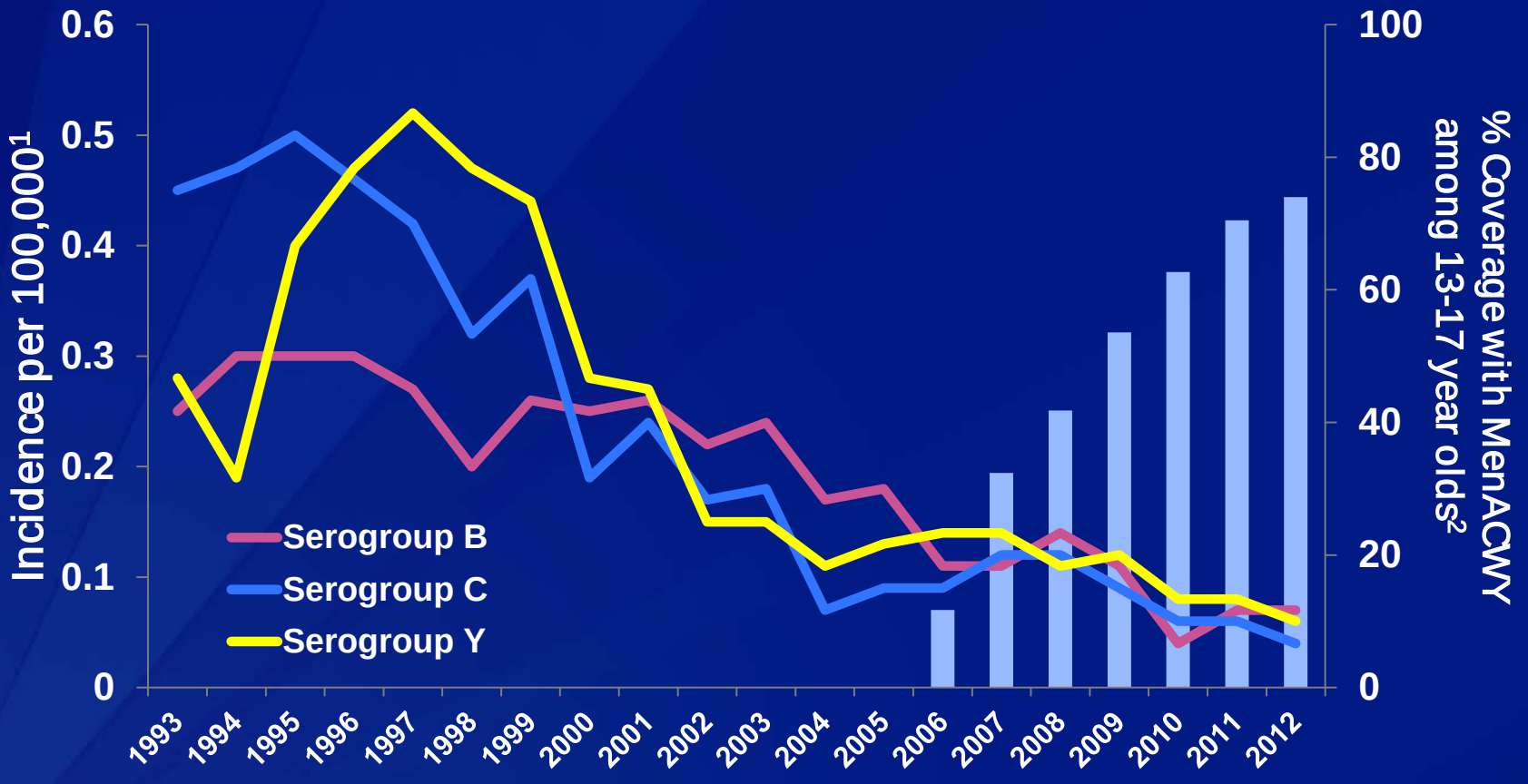
National Center for Immunization & Respiratory Diseases
Meningitis and Vaccine Preventable Diseases Branch

Agenda

- Epidemiology of meningococcal disease
- Meningococcal disease outbreaks
- Recent evaluation of clusters and outbreaks in organizational settings

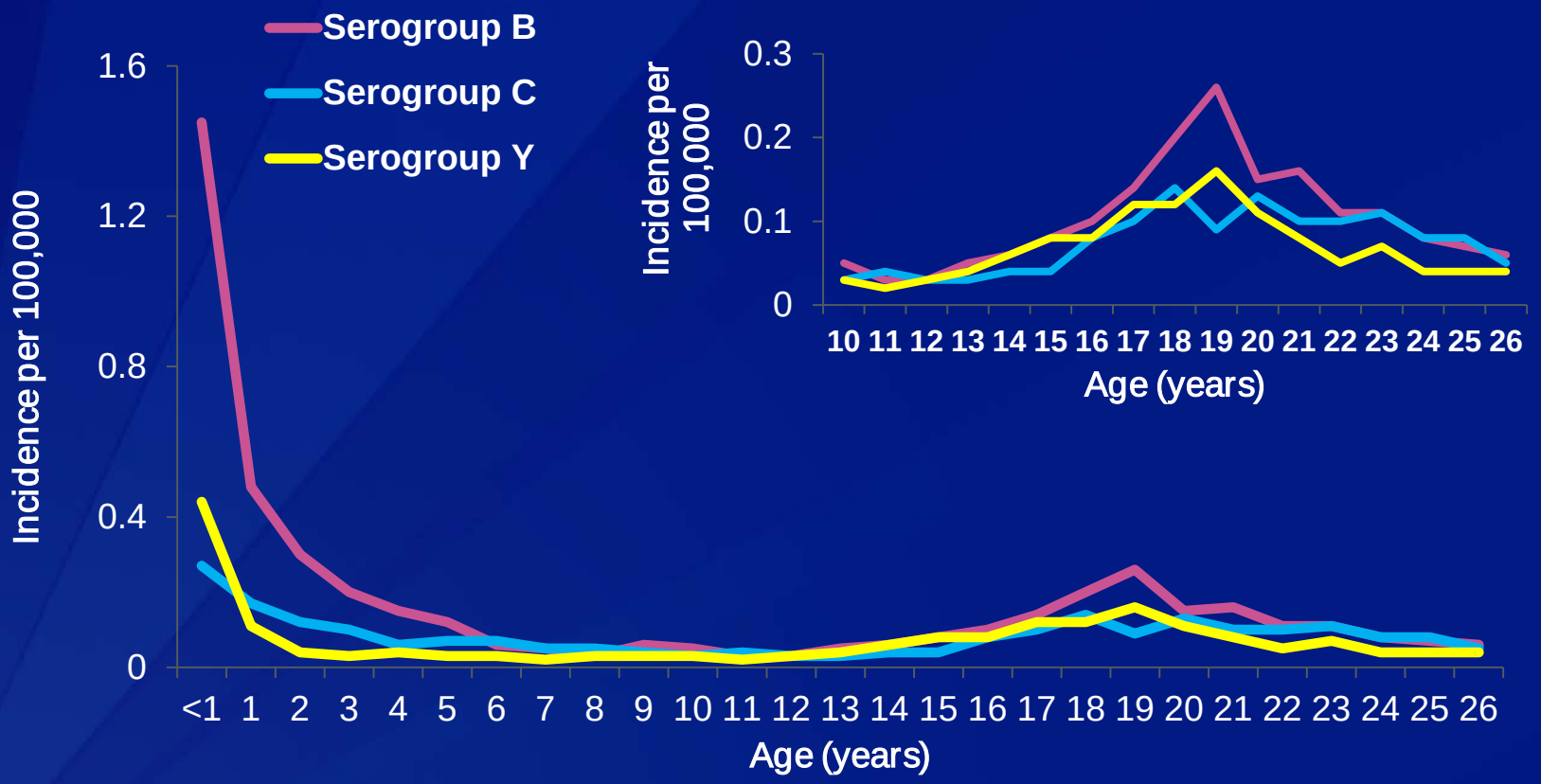
EPIDEMIOLOGY OF MENINGOCOCCAL DISEASE

Meningococcal Disease Incidence by Serogroup and Vaccine Coverage, United States, 1993-2012



[1]Source: ABCs cases from 1993-2012 estimated to the U.S. population with 18% correction for under reporting
[2]National Immunization Survey – Teen; 2006-2012

Incidence of Meningococcal Disease by Age and Serogroup, United States, 2005-2012*



*Source: National Notifiable Diseases Surveillance System (NNDSS) with additional serogroup data provided by state and local health departments

Average Annual Cases of Serogroup B Meningococcal Disease in Three Time Frames

	Age Group	1997-1999 "High Incidence Years"	1993-2012	2010-2012 "Low Incidence Years"
Serogroup B	<5 years	304	258	93
	11-24 years	142	106	29
	All ages	660	531	187

Average annual cases of meningococcal disease
1993-2012 ABCs data estimated to U.S. population with 18% correction for under reporting

MENINGOCOCCAL DISEASE OUTBREAKS

Outbreaks of Meningococcal Disease

- Meningococcal outbreaks are rare, historically causing ~2-3% of US cases of meningococcal disease[1]
- Reports of school and organization-based clusters/outbreaks are uncommon in published peer-review literature[2,3]

[1] National Notifiable Diseases Surveillance System

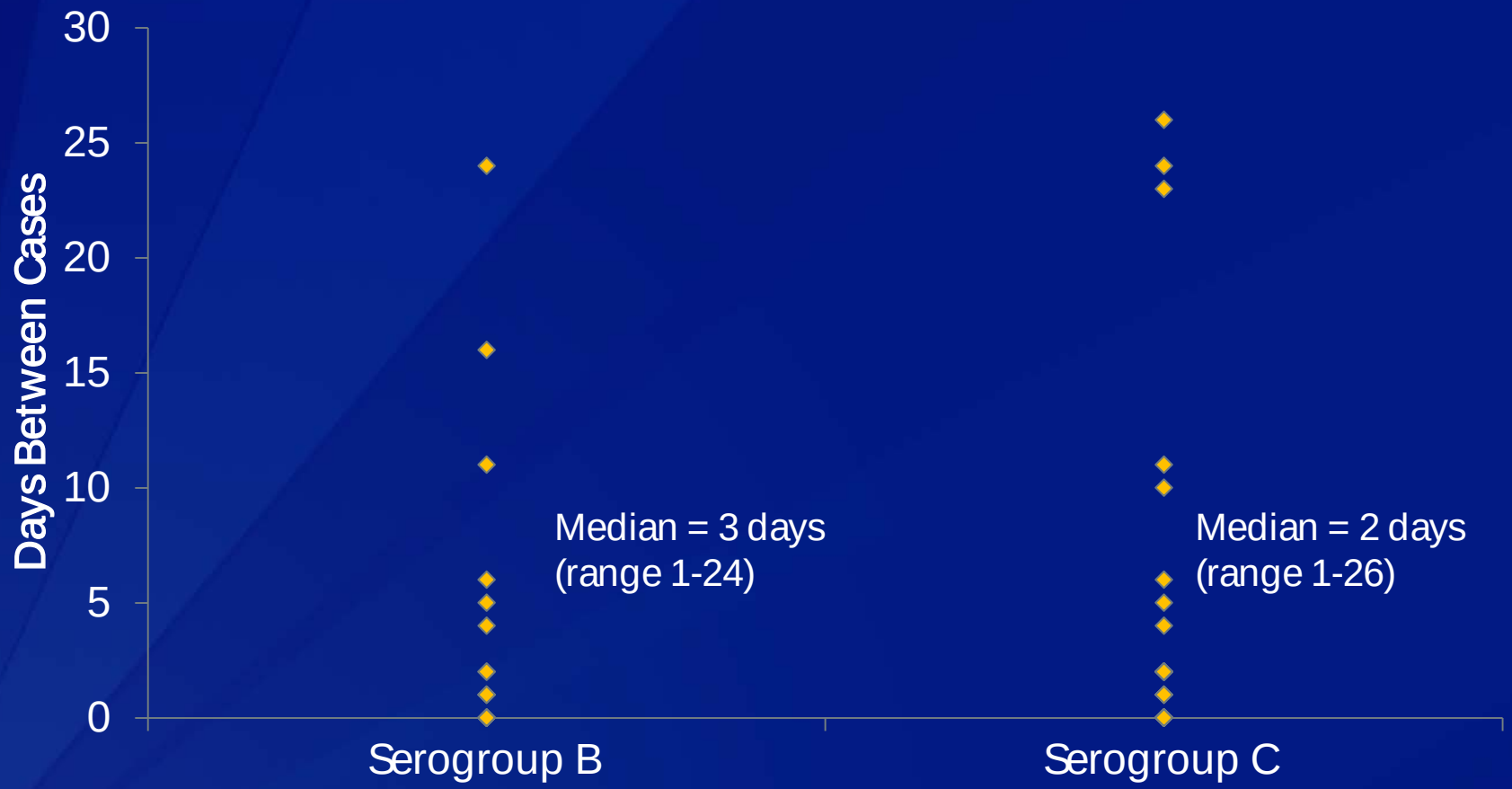
[2] Zangwill KM, et al. School-based clusters of meningococcal disease in the United States. Descriptive epidemiology and a case-control analysis. JAMA, 1997. 277(5):389-395

3Brooks R, et al. Increased case-fatality rate associated with outbreaks of *Neisseria meningitidis* infection, compared with sporadic meningococcal disease, in the United States, 1994-2002. CID, 2006. 43:49-54

Serogroup B and C School-Based Outbreaks by Size, 1989-2004

[1] Zangwill KM, et al. School-based clusters of meningococcal disease in the United States. Descriptive epidemiology and a case-control analysis. JAMA, 1997. 277(5):389-395

Interval Between Reported Cases in School-Based Serogroup B or C Outbreaks, 1989-2004



[1] Zangwill KM, et al. School-based clusters of meningococcal disease in the United States. Descriptive epidemiology and a case-control analysis. JAMA, 1997. 277(5):389-395

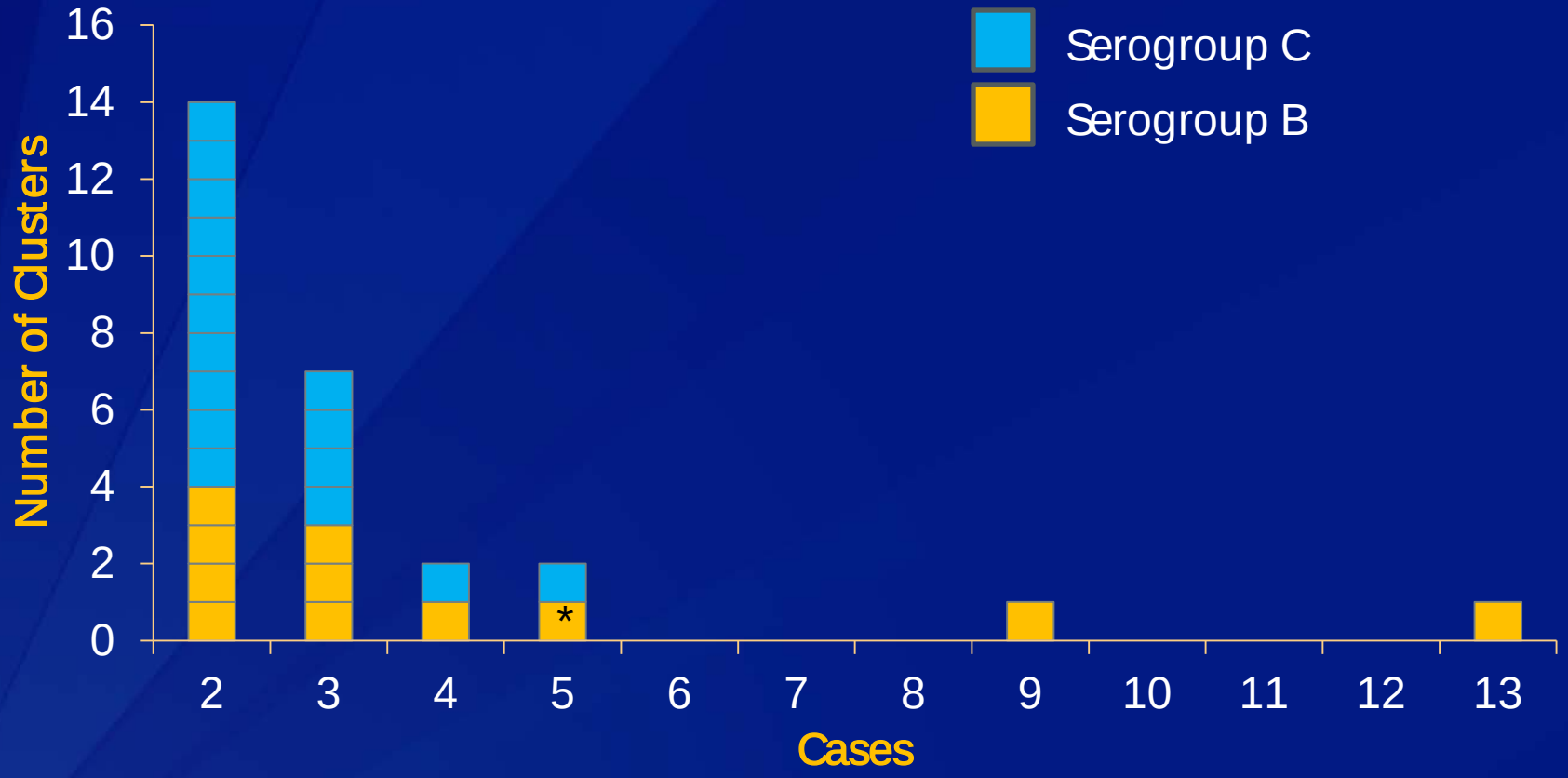
Recent University Based Serogroup B Clusters/Outbreaks†

University	Outbreak Period	Number of cases
University 1	Feb – Mar 2009	4
University 2	Nov 2011	2
University 3	Jan 2008 – Nov 2010	13
Princeton University	Mar 2013 – Mar 2014	9
University of California— Santa Barbara	Nov 2013	4*

†Where CDC consulted

*1 additional associated case identified after retrospective case review

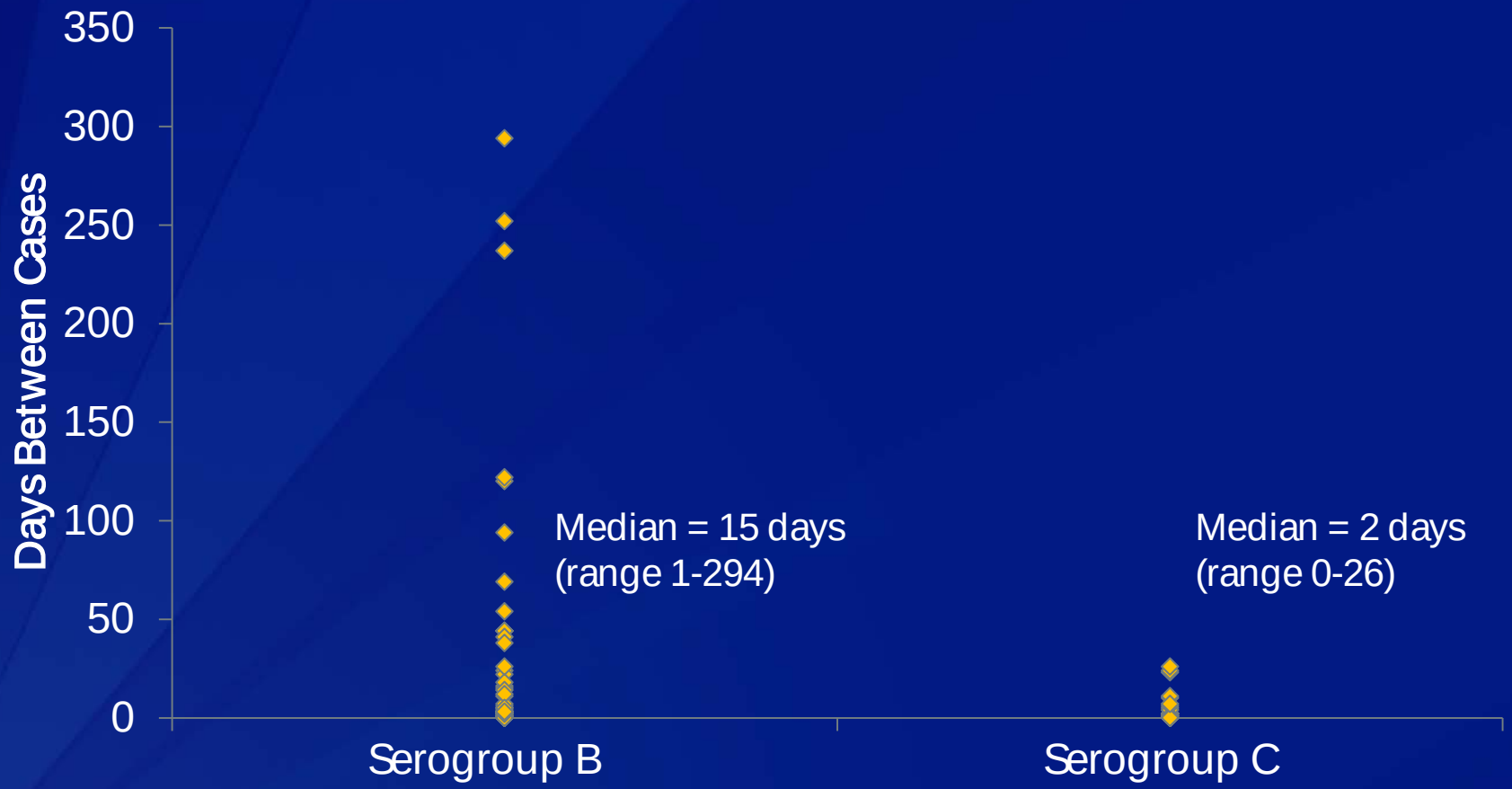
Serogroup B and C School-Based Outbreaks by Size, 1989-2004 and 2009-2013



Includes 22 school based clusters reported by Zangwell et. al , a serogroup C elementary school outbreak (MMWR, April 2012. 61(13);217-221) and recent serogroup B school-based outbreaks where CDC was consulted (n=5)

*Includes 4 outbreak cases and 1 outbreak associated case that was identified retrospectively

Interval Between Reported Cases in School-Based Serogroup B or C Outbreaks, 1989-2004 and 2009-2013



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Summary of Meningococcal Outbreaks

- Serogroup C meningococcal outbreaks are less frequently reported since high adolescent coverage with the MenACWY vaccine has been achieved
- The 3 most recent university-based serogroup B outbreaks appeared atypical compared to previously reported serogroup B outbreaks, with greater numbers of cases reported and longer intervals between cases

EVALUATION OF RECENT CLUSTERS AND OUTBREAKS IN ORGANIZATIONAL SETTINGS

Meningococcal Cluster Ascertainment

- **Information on outbreak associated cases is collected through NNDSS, but reporting is likely not complete**
  - Complete and systematically collected data on clusters and outbreaks of meningococcal disease occurring in the U.S. is important when evaluating outbreak guidelines
- **A retrospective review of meningococcal cases reported since January 1, 2009, was conducted by state health departments and CDC to identify clusters and outbreaks of meningococcal disease:**
  - Epi-X announcement posted on January 24, 2014
  - Follow-up by questionnaires to all state health departments after Epi-X announcement
    - 48 states, Philadelphia, NYC, and Washington DC have responded

Cluster/Outbreak Definitions

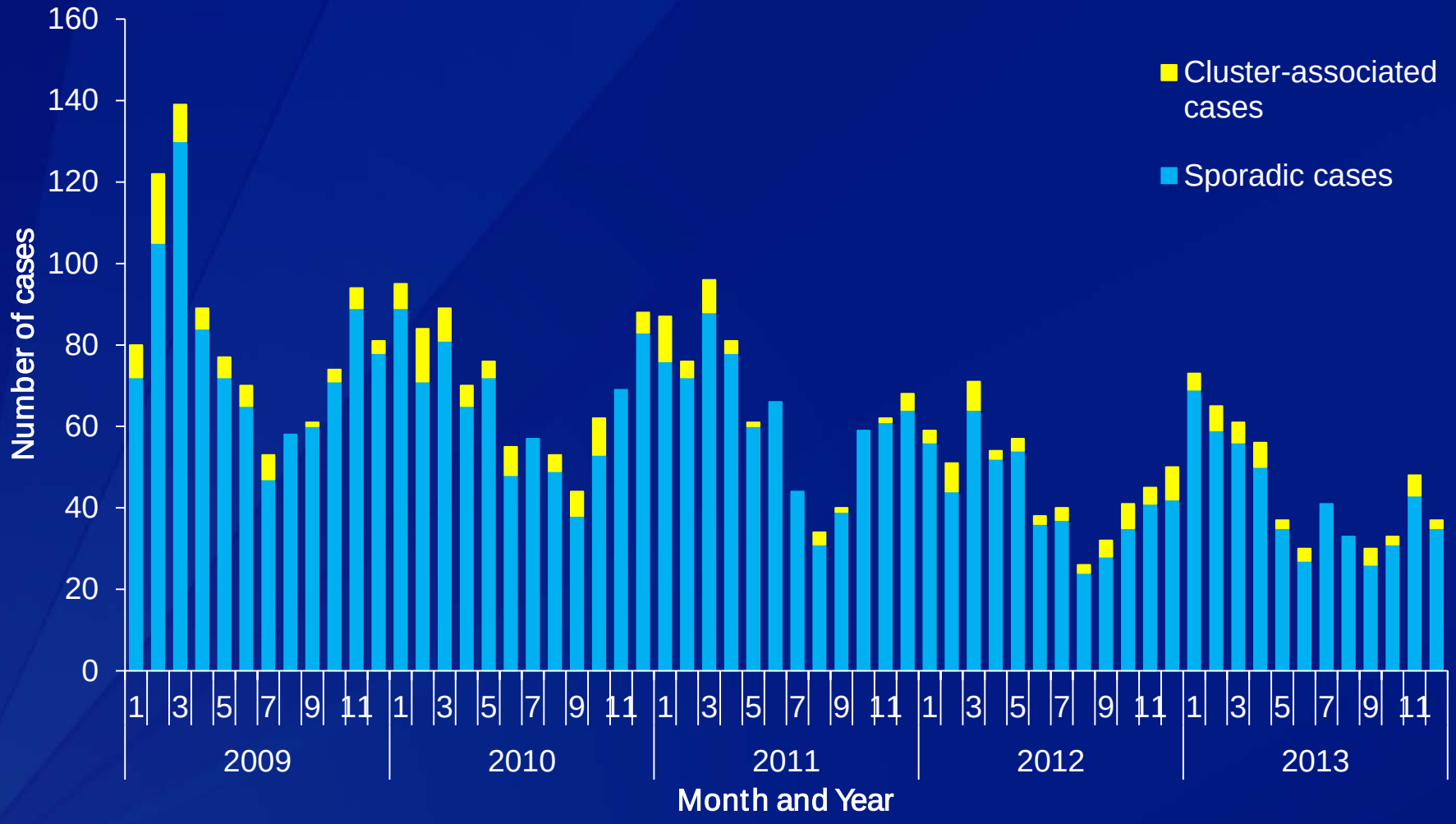
- **A meningococcal cluster was defined as:**
  - 2 or more cases of the same serogroup in an organization in ≤3 months (not including secondary cases) **OR**
  - An increase in disease rates of the same serogroup in a community or a specific population in a community (rate 2 times the rate during the same time period in prior years)
- **A meningococcal outbreak is defined as:**
  - 3 or more cases of the same serogroup in ≤ 3 months
- **Clusters/outbreaks were classified as organization vs. community-based**

Reported Cases and Clusters in the US: January 1, 2009 – December 31, 2013

- 3,745 cases of meningococcal disease were reported to NNDSS during this time period
- 18 states reported 71 clusters or outbreaks through the Epi-X announcement
- 52 clusters met the cluster definition (207 cases, 5.5% of all US cases)
  - Among these, 22 clusters also met the outbreak definition (146 cases, 3.9% of all US cases)

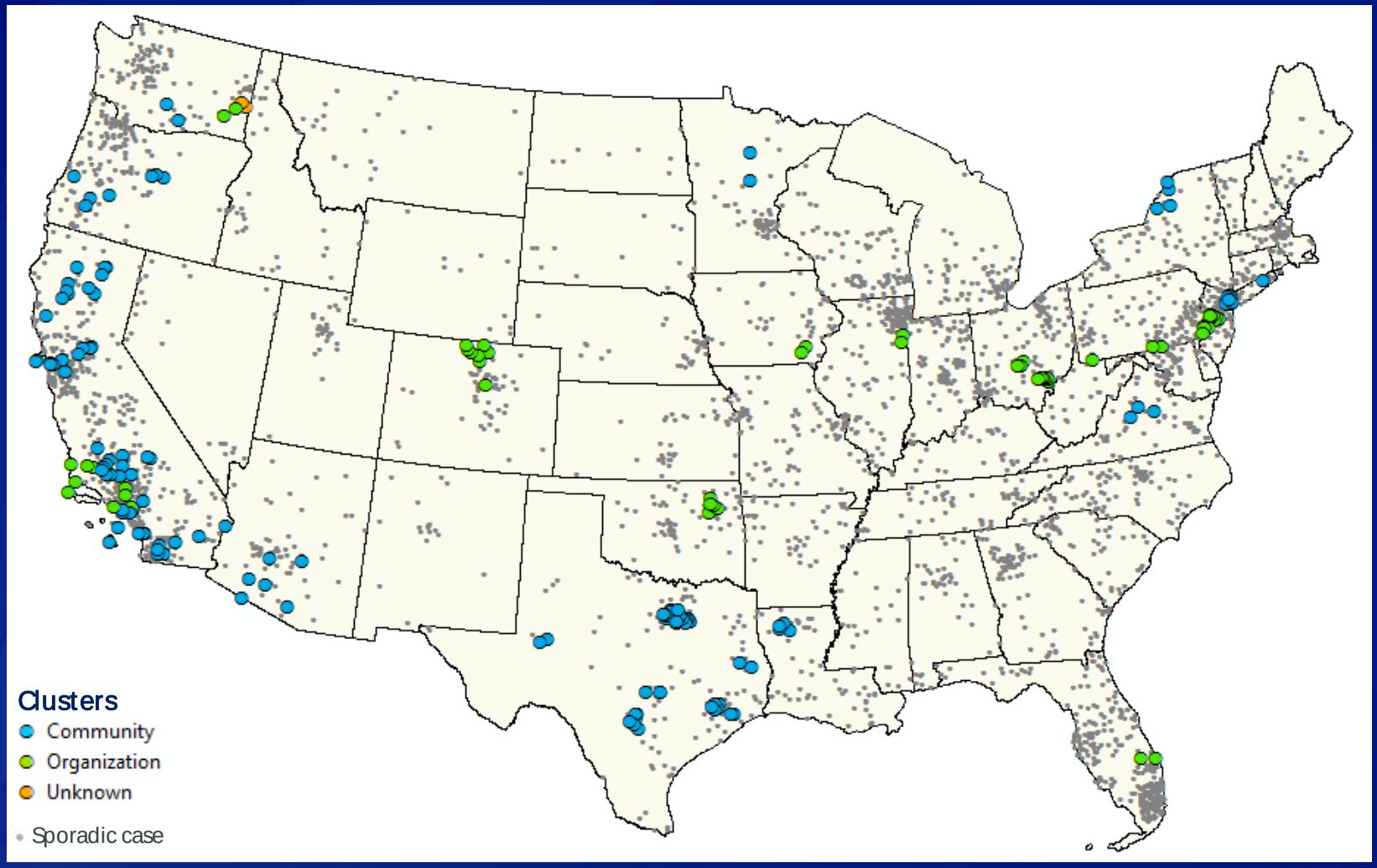
All subsequent analyses represent primary cases from clusters meeting the cluster definition

Sporadic* and Cluster-Associated Cases in the United States by Month, 2009-2013



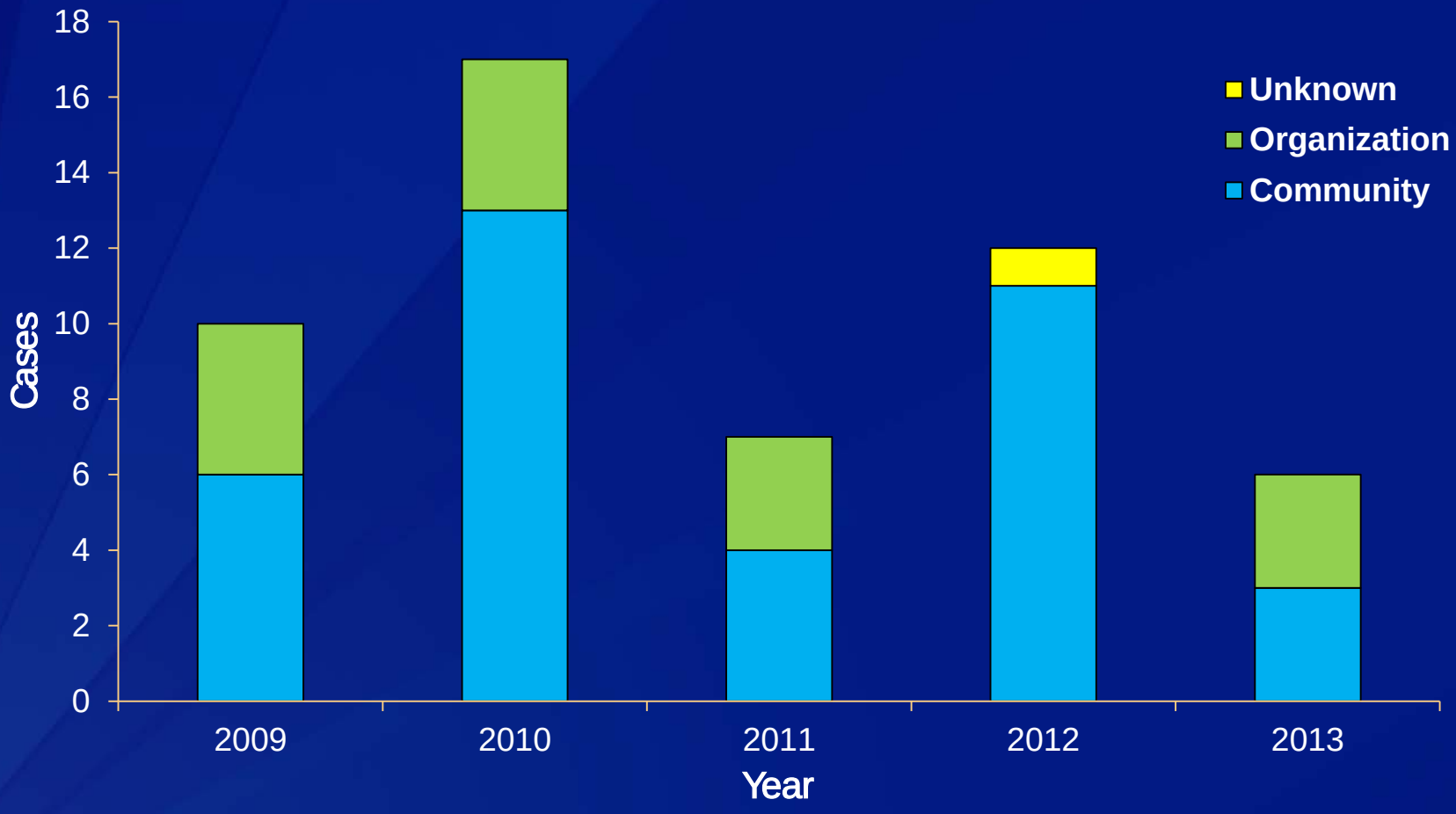
* Cases reported to NNDSS that were not part of a reported cluster

Geographic Distribution of Cluster-Associated and Sporadic Meningococcal Cases by County in the US, 2009- 2013



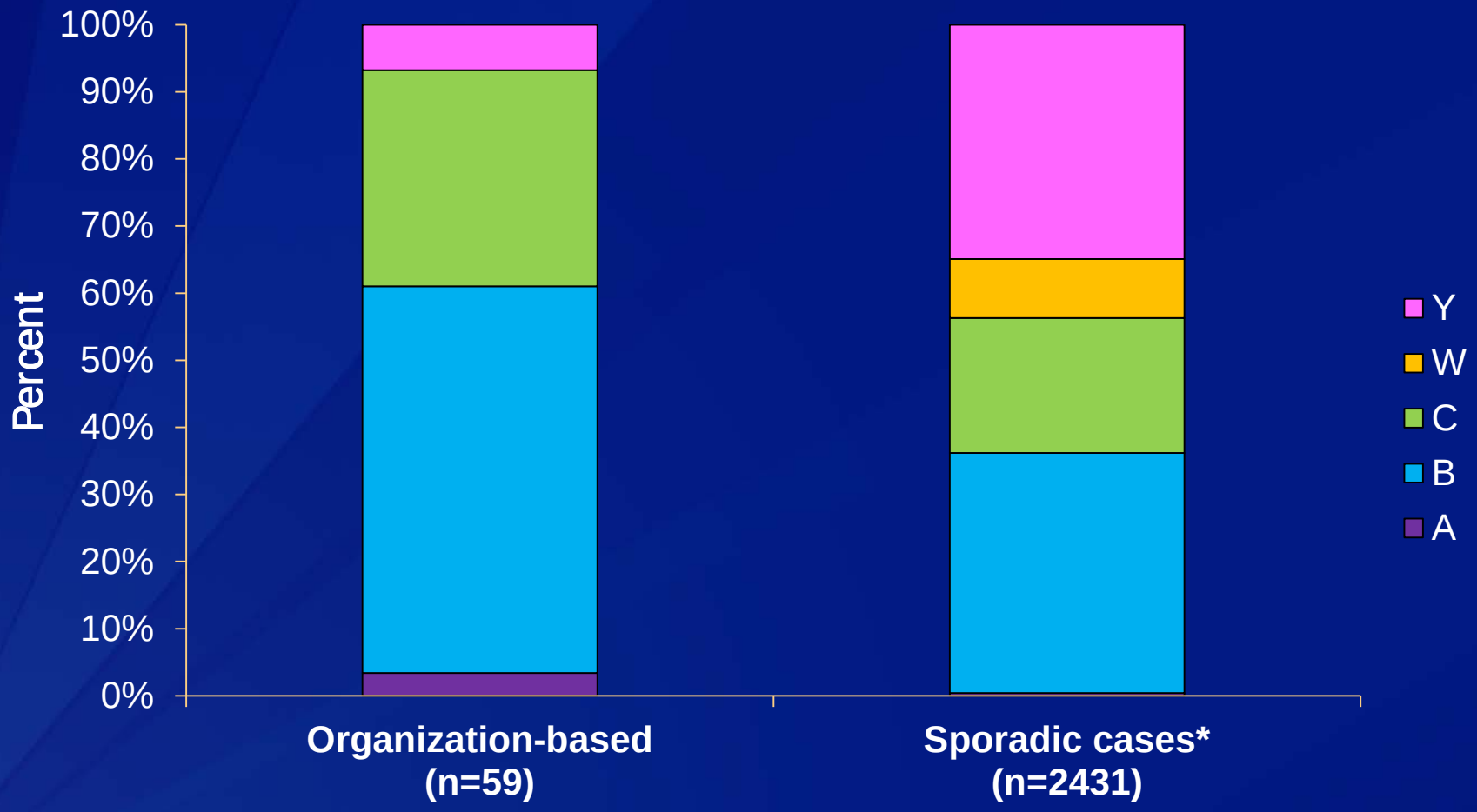
*Alaska and Hawaii not shown. No clusters reported in either state.

Number of Clusters by Year and Type, 2009-2013



37 community clusters, 14 organization clusters, 1 unknown

Serogroup Distribution of Organization-Based Cluster-Associated vs. Sporadic Meningococcal Cases, 2009-2013



*Sporadic cases with known serogroup reported to NNDSS and not reported in association with a cluster

Characteristics of Organization-Based Clusters

Characteristic	Median (range)
Population size of cluster	**14,432** (900-57,466)
Number of cases/cluster	**3** (2-10)
Duration of cluster in days	**48.5** (2-616)
Age	**19** (1-92)
Case-fatality ratio*	**17.0%**

* Among cases with known outcome

Organization-Based Clusters by Type of Organization (n=14), 2009-2013

Population	Serogroup	N	Cases/ cluster	Duration (days)
University	B, C, Y	7	4 (2-10)*	75 (25-616)*
Fraternity party	B	1	2	2
Long-term care facility	Y	1	2	3
Correctional facility	B	1	2	7
Meditation Center	A	1	2	22
Homeless shelter	C	1	4	23
Elementary school	C	1	5	7
Hockey League	C	1	8	245

* Median (range)

University Outbreaks by Year and Serogroup, 2009-2013

Year	Serogroup	Number of Cases	Median Days Between Cases (Range)	Duration of cluster (Days)
2009	B	4	**3** (0-22)	**25**
2009	B	10	**43** (0-237)	**616**
2009	C	2	**75** (75-75)	**75**
2010	Y	2	**73** (73-73)	**73**
2011	B	2	**72** (72-72)	**72**
2013	B	9	**22** (4-90)	**243**
2013	B	5	**9.5** (2-252)	**273**

Case-Fatality Ratio in Organization-Based Clusters by Serogroup, 2009-2013

Serogroup	Case-fatality ratio
A	0% (0/2)
B	6.1% (2/33)
C	42.9% (6/14)
Y	25% (1/4)
All	17.0% (9/53)

Summary of Meningococcal Clusters

- In the setting of historically low cases of meningococcal disease, meningococcal clusters account for a greater proportion of cases than in years past
- A substantial proportion of organization-based clusters are associated with universities and due to serogroup B
- Three recent serogroup B university-based clusters have appeared atypical compared to clusters in years past in terms of number of case and duration
  - However, the course of a cluster is unpredictable

Discussion

- Comparison of current meningococcal cluster/outbreak epidemiology to historical data has limitations:
  - Differences in definitions, recognition, and reporting of meningococcal clusters
  - Advances in molecular genotyping
- Regardless, meningococcal disease clusters and outbreaks cause substantial concern necessitating a public health response

Conclusions

- Serogroup B organization-based clusters are rare and heterogeneous, limiting the ability to make definitive interim vaccination recommendations based on data alone
- Interim guidelines for use of serogroup vaccines under a CDC-sponsored IND should provide concrete guidance yet allow for the flexibility to evaluate each outbreak on a situational basis

Acknowledgements

- State and Local Health Departments
- Meningococcal Outbreak Working Group