Epidemiology of Serogroup B Meningococcal Disease, United States

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National Center for Immunization and Respiratory Diseases

Division of Bacterial Diseases

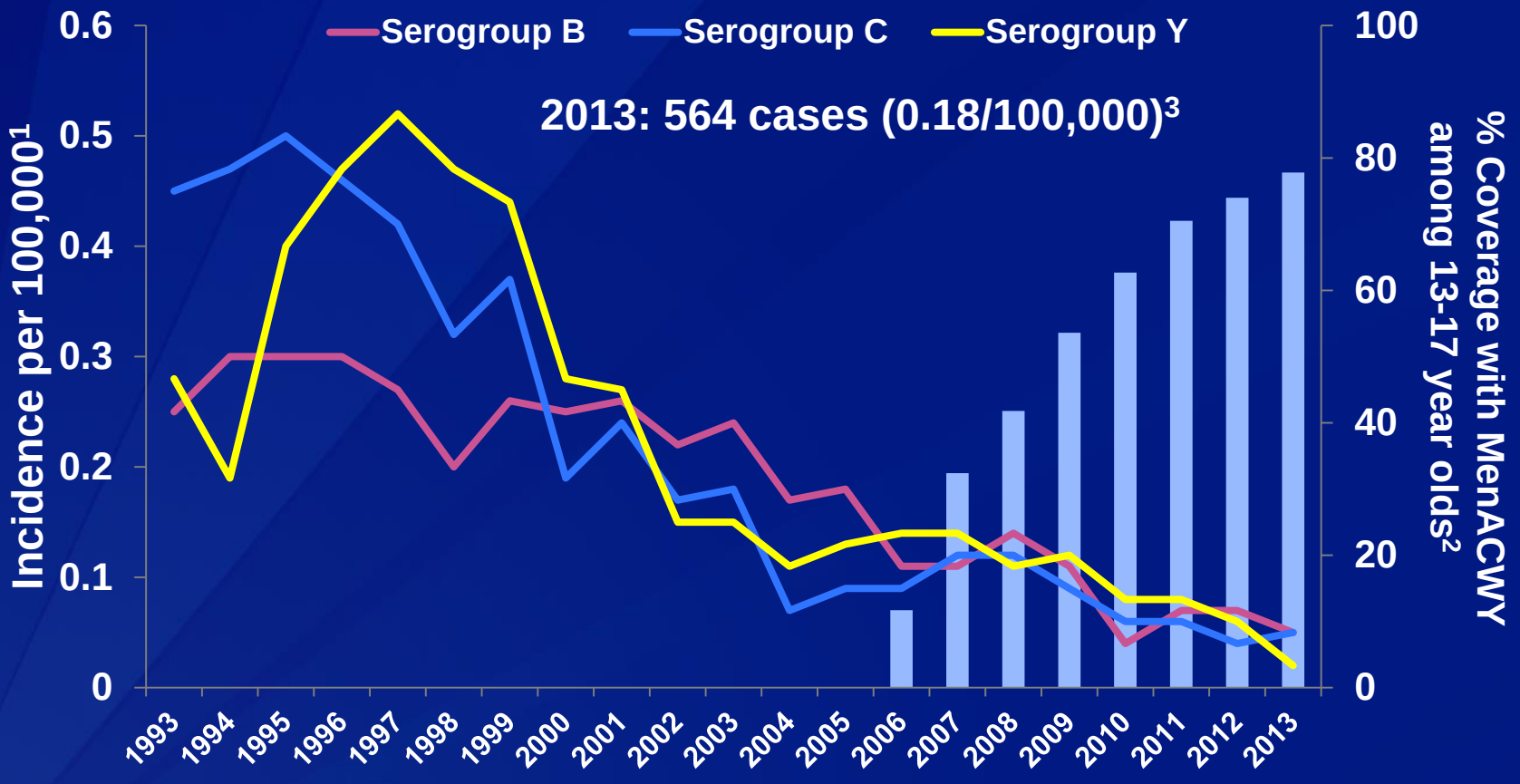
Describing the Burden

- **Epidemiology of serogroup B meningococcal disease**
  - Adolescents and young adults
  - College students
- **Groups at high-risk for serogroup B meningococcal disease**

Meningococcal Disease Surveillance

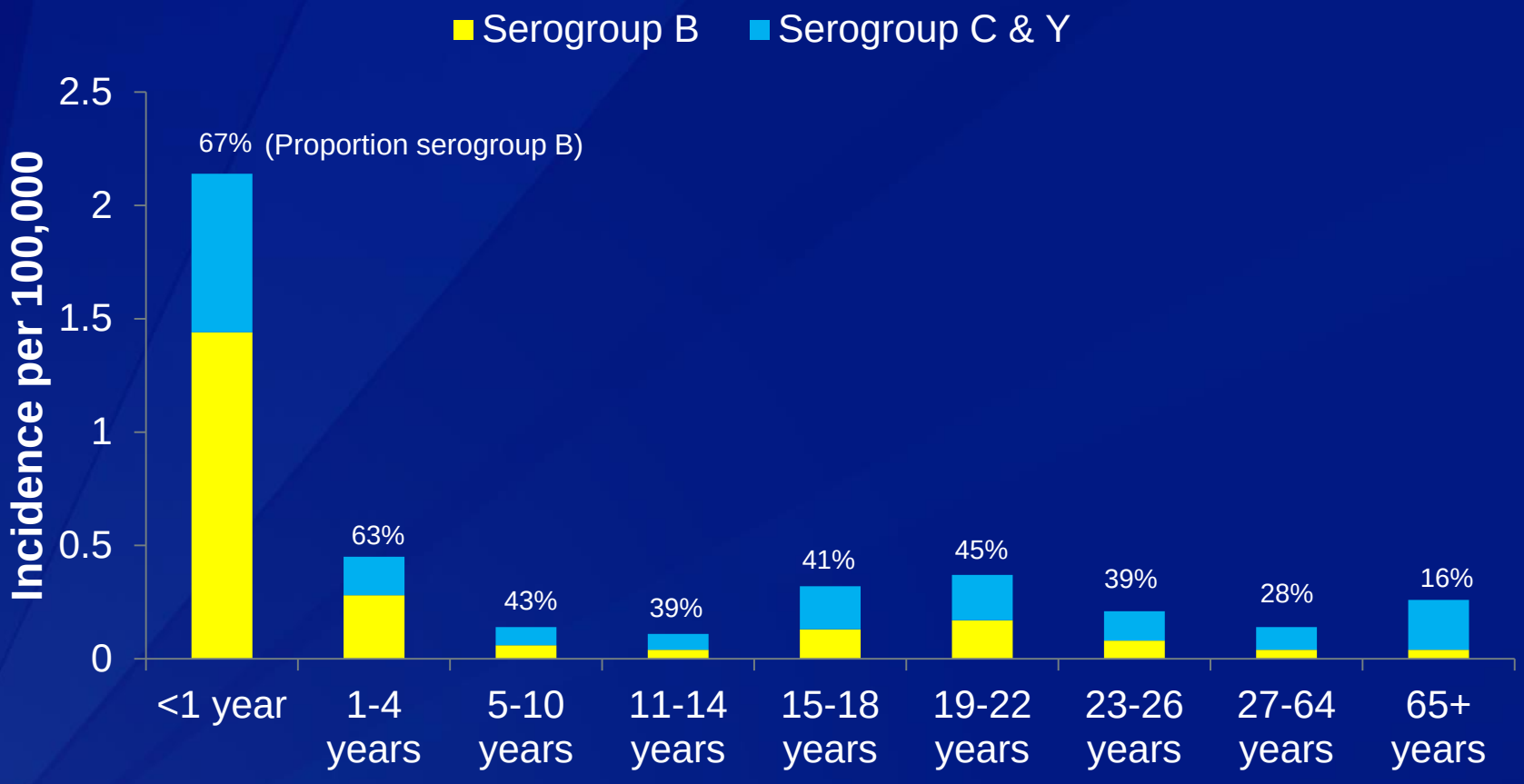
- **Active Bacterial Core surveillance (ABCs)**
  - Limited to culture confirmed cases
    - May underestimate burden by 15-20%
  - Observed cases are used to estimate incidence in the US
- **National Notifiable Diseases Surveillance System (NNDSS)**
  - Includes all cases (culture and PCR confirmed)
  - Serogroup and outcome information historically limited
    - Supplemented with information from state health departments and ABCs for 2005-2012

Meningococcal Incidence in All Ages by Serogroup and Adolescent MenACWY Vaccine Coverage, 1993-2013



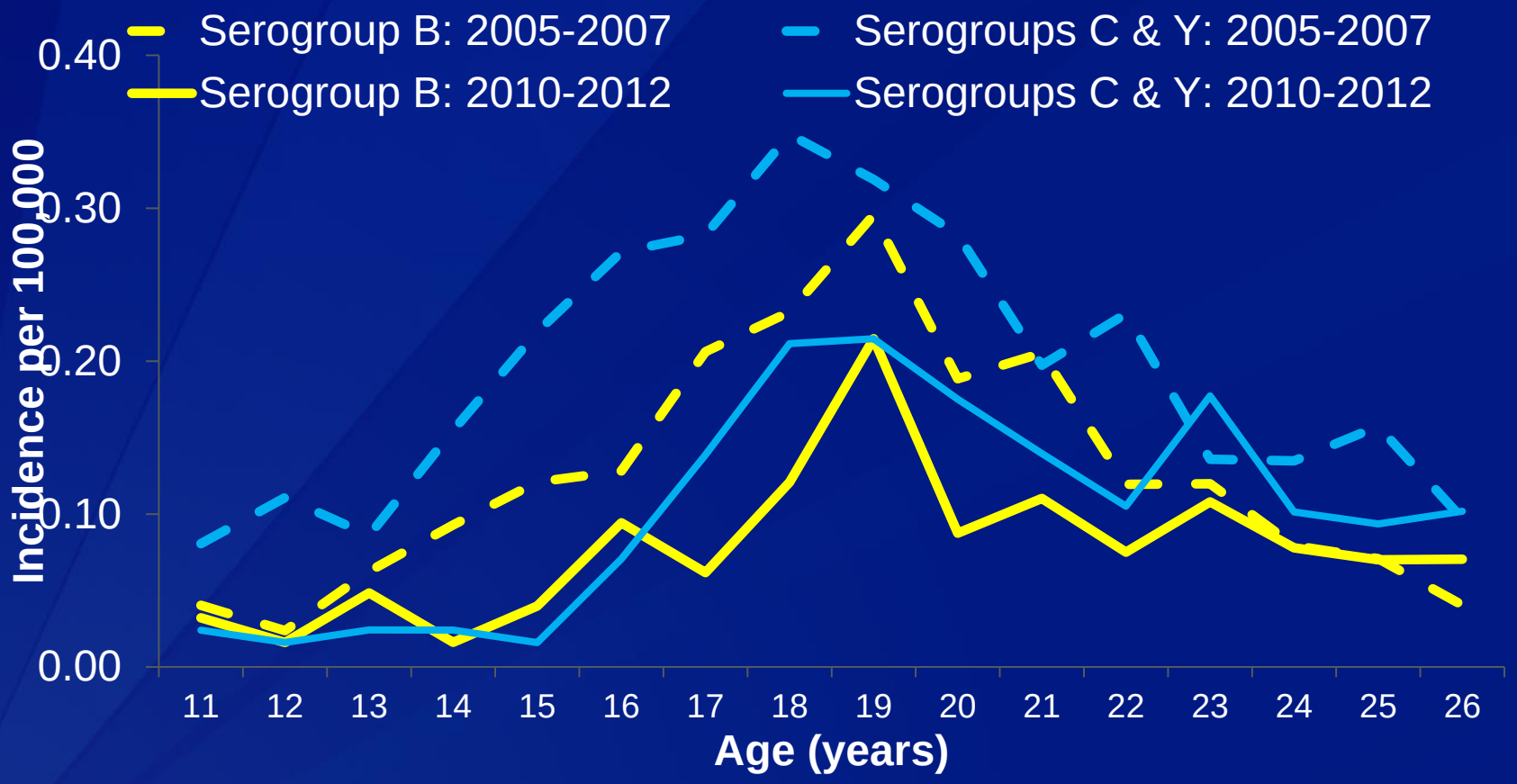
[1]Source: ABCs cases from 1993-2013 estimated to the U.S. population with 18% correction for under reporting
[2]National Immunization Survey – Teen; 2006-2013
[3]NNDSS 2013 final case count

Meningococcal Incidence by Serogroup* and Age-Group, 2005-2012



*NNDSS data with additional serogroup data from ABCs and state health departments.
Unknown serogroup (23%) and other serogroups (8%) excluded

Meningococcal Incidence in Adolescents 11-26 Years of Age by Serogroup, 2005-2012



*NNDSS data with additional serogroup data from ABCs and state health departments.
Unknown serogroup (23%) and other serogroups (8%) excluded

Estimated Average Annual Cases in Children and Adolescents During High and Low Incidence Years

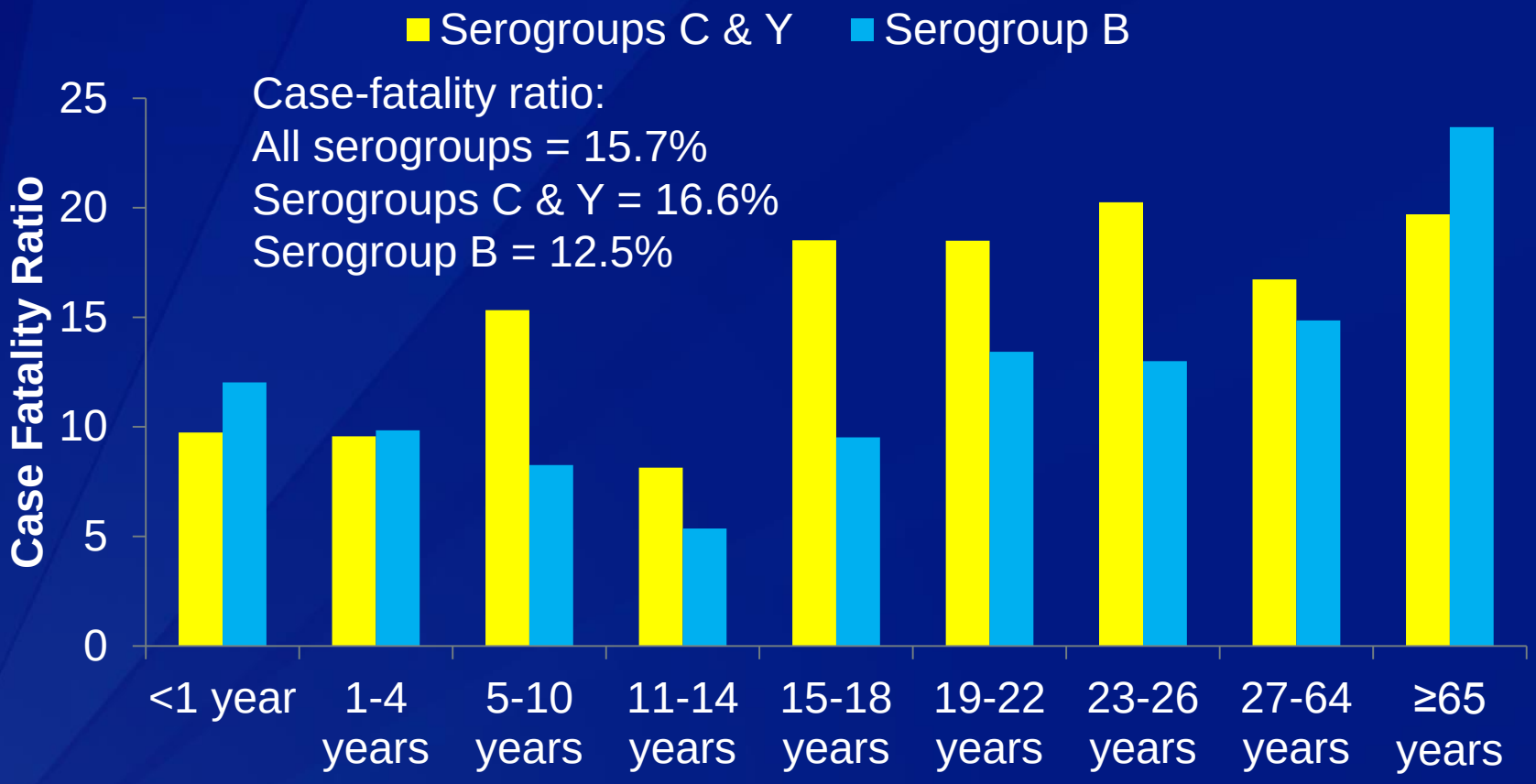
	Age Group	1997-1999 "High Incidence Years"[1]	2010-2012 "Low Incidence Years"[2]
Serogroups B	<5 years	367	78-92
	11-24 years	161	48-56
	All ages	767	197-237
Serogroups C & Y	<5 years	335	39-46
	11-24 years	370	63-74
	All ages	1,490	321-386

Average annual cases of meningococcal disease

[1]NNDSS cases from 1997-1999 with serogroup proportion from 1997-1999 ABCs data applied

[2]Range in estimated cases: Low=NNDSS data with additional serogroup data from ABCs and state health departments (2010-2012), High= NNDSS data with additional serogroup information (2010-2012) + proportion serogroup B or serogroup C&Y applied to cases with unknown serogroup (2010-2012).

Meningococcal Disease Case-Fatality Ratios by Serogroup and Age-group, 2005-2012



NNDSS data with additional outcome data from ABCs and state health departments. Unknown outcome excluded (18%)

Meningococcal Disease in College Students

- **ABCs variable collects information on college attendance for meningococcal cases age 15-24 years**
  - 29% of serogroup B cases in all 18-23 year olds occurred among college students during 1999-2012
- Estimated 16.6 million college students age 18-23 years in the United States in 2012*

*66% of high school completers enrolled in college in 2012: http://nces.ed.gov/programs/coe/indicator_cpa.asp
7% high school drop out rate: http://nces.ed.gov/fastfacts/display.asp?id=16

Estimated Annual Cases and Deaths from Serogroup B Meningococcal Disease in 18-23 Year Olds

	College Students		All 18-23 year olds	
	Cases[2]	Deaths[3]	Cases[1]	Deaths[3]
1998-2002	27	3	92	11
2003-2007	24	3	82	11
2008-2012	11	1	37	2

2008-2012 Incidence
College Students: 0.07/100,000
All 18-23 year olds: 0.14/100,000

[1]NNDSS cases from 1998-2002 with serogroup B proportion in 18-23 year olds from 1998-2002 ABCs data applied, etc.
[2]29% college students from ABCs 1998-2012
[3]Serogroup B CFR in 18-23 year olds from 1998-2002 ABCs data applied to estimated annual cases, etc.

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

Summary: Epidemiology of Serogroup B Meningococcal Disease

- **With widespread use of conjugate vaccines in adolescents and young adults, serogroup B now causes 40% of all meningococcal disease cases in this age group**
  - Approximately 50 cases annually among 11-24 year olds
- **Approximately one third of cases among 18-23 year olds occur in college students**
  - Recent outbreaks on college campuses have been due to serogroup B

Groups at High-Risk for Meningococcal Disease

- **High-risk medical conditions:**
  - Persistent complement component deficiencies
  - Functional or anatomic asplenia
- **Microbiologists**
- **Outbreak at-risk populations**

Persons with Medical Conditions at High Risk for Meningococcal Disease

- **Persistent (i.e. genetic) deficiencies in the common complement pathway (e.g. C3, properdin, Factor D, Factor H, or C5-C9)**
  - Prevalence of ~0.03%[1]
  - Up to 10,000-fold increased risk and can experience recurrent disease[2]
  - Eculizumab (Soliris®) treatment
    - Binds to C5 and inhibits the terminal portion of the complement cascade
    - 5/326 subjects in a clinical trial developed meningococcal disease despite prior vaccination with MenACWY[3]

[1]P Densen. Complement deficiencies and meningococcal disease. Clin Exp Immunol. Oct 1991; 86(Suppl 1): 57-62.
[2]Cohn et al. Prevention and Control of Meningococcal Disease. MMWR. March 22, 2013; 62 (RR-2)
[3]http://soliris.net/sites/default/files/assets/soliris_pi.pdf

Persons with Medical Conditions at High Risk for Meningococcal Disease

- **Functional and anatomic asplenia**
  - Appear to be at increased risk for meningococcal disease, however data are less compelling than for pneumococcal disease risk[1]
  - Includes sickle cell disease which affects ~90,000-100,000 persons of all ages[2]
  - Mortality rate of 40%-70%[3]

[1]Cohn et al. Prevention and Control of Meningococcal Disease. MMWR. March 22, 2013; 62 (RR-2)
[2]http://www.cdc.gov/ncbddd/sicklecell/data.html
[3]Updated recommendations for the use of meningococcal conjugate vaccines . MMWR. January 28,2011; 60(3): 72-76.

Microbiologists

- **Attack rate of 13/100,000 among microbiologists who work with *Neisseria meningitidis*[1]**
  - High case fatality ratio because of increased exposure to high concentration of organisms and highly virulent strains
  - Majority of cases occurred in clinical microbiologists who were not using respiratory protection at the time of exposure
- **An estimated 100,000 clinical microbiologists and 400 research microbiologists in the US**

[1]Cohn et al. Prevention and Control of Meningococcal Disease. MMWR. March 22, 2013; 62 (RR-2)

Outbreaks of Meningococcal Disease

- **Meningococcal outbreaks are rare, historically causing ~2-3% of US cases[1]**
- **Five serogroup B meningococcal disease clusters/outbreaks on college campuses**
  - Princeton: 1400 fold increased risk; 7,500 recommended vaccine
  - UCSB: 200 fold increased risk; 20,000 recommended vaccine
- **Threshold for vaccination for serogroup B outbreaks in institutional settings[2]**
  - 2 cases in population <5,000 persons
  - 3 cases in population ≥5,000 persons

[1] National Notifiable Diseases Surveillance System
[2] http://www.cdc.gov/meningococcal/downloads/interim-guidance.pdf

Summary of Groups at Increased Risk for Meningococcal Disease

Group	Estimated persons aged ≥10 years	Risk	Cases
Persistent complement component deficiencies	0.03%[1] ~80,000 persons	• Up to 10,000 fold increased risk[2] • High risk of recurrent disease[2]	6 cases ABCs (none serogroup B)
Anatomic or Functional Asplenia (including sickle cell)	Sickle cell ~90,000-100,000 (all ages)[3]	• Risk not well defined[2] • Higher risk of mortality (40-70%)[5]	11 cases ABCs (2 serogroup B)
Microbiologists	~100,000 clinical; 400 research	• 13/100,000[2] • Higher risk of mortality[2]	22 cases worldwide 1985-2014[4]
Outbreak at-risk populations	60,000 in 5 university outbreaks	• Up to 1400 fold increased risk (Princeton)	32 cases combined

[1]P Densen. Complement deficiencies and meningococcal disease. Clin Exp Immunol. Oct 1991; 86(Suppl 1): 57-62.
[2]Cohn et al. Prevention and Control of Meningococcal Disease. MMWR. March 22, 2013; 62 (RR-2)
[3]http://www.cdc.gov/ncbddd/sicklecell/data.html
[4]Borrow et al. Safe laboratory handling of *Neisseria meningitidis.* Journal of Infection (2014); 68: 305-312.
[5]Updated recommendations for the use of meningococcal conjugate vaccines . MMWR. January 28,2011; 60(3): 72-76.

Conclusions

- Incidence of all meningococcal serogroups are declining, including serogroup B
- In recent low incidence years, approximately 50 cases of serogroup B meningococcal disease occur in adolescents and young adults each year
- Persons in high-risk groups, who are recommended for vaccination with quadrivalent vaccines, remain at increased risk for serogroup B meningococcal disease

Thank you

For more information please contact Centers for Disease Control and Prevention
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