Epidemiology of Serogroup B Meningococcal Disease, United States

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Advisory Committee on Immunization Practices
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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

2013: 564 cases (0.18/100,000)\(^3\)

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

Serogroup B  Serogroup C & Y

Incidence per 100,000

<1 year  1-4 years  5-10 years  11-14 years  15-18 years  19-22 years  23-26 years  27-64 years  65+ years

67% (Proportion serogroup B)

63%  43%  39%  41%  45%  39%  28%  16%

*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

<table>
<thead>
<tr>
<th>Age Group</th>
<th>1997-1999 “High Incidence Years”¹</th>
<th>2010-2012 “Low Incidence Years”²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serogroups B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5 years</td>
<td>367</td>
<td>78-92</td>
</tr>
<tr>
<td>11-24 years</td>
<td>161</td>
<td>48-56</td>
</tr>
<tr>
<td>All ages</td>
<td>767</td>
<td>197-237</td>
</tr>
<tr>
<td>Serogroups C &amp; Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5 years</td>
<td>335</td>
<td>39-46</td>
</tr>
<tr>
<td>11-24 years</td>
<td>370</td>
<td>63-74</td>
</tr>
<tr>
<td>All ages</td>
<td>1,490</td>
<td>321-386</td>
</tr>
</tbody>
</table>

Average annual cases of meningococcal disease

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

²Range 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

Case-fatality ratio:
All serogroups = 15.7%
Serogroups C & Y = 16.6%
Serogroup B = 12.5%

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*

7% high school drop out rate: [http://nces.ed.gov/fastfacts/display.asp?id=16](http://nces.ed.gov/fastfacts/display.asp?id=16)
# Estimated Annual Cases and Deaths from Serogroup B Meningococcal Disease in 18-23 Year Olds

<table>
<thead>
<tr>
<th></th>
<th>College Students</th>
<th>All 18-23 year olds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases(^2)</td>
<td>Deaths(^3)</td>
</tr>
<tr>
<td>1998-2002</td>
<td>27</td>
<td>3</td>
</tr>
<tr>
<td>2003-2007</td>
<td>24</td>
<td>3</td>
</tr>
<tr>
<td>2008-2012</td>
<td>11</td>
<td>1</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>University</th>
<th>Outbreak Period</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>University 1</td>
<td>Feb – Mar 2009</td>
<td>4</td>
</tr>
<tr>
<td>University 2</td>
<td>Nov 2011</td>
<td>2</td>
</tr>
<tr>
<td>University 3</td>
<td>Jan 2008 – Nov 2010</td>
<td>13</td>
</tr>
<tr>
<td>Princeton University</td>
<td>Mar 2013 – Mar 2014</td>
<td>9</td>
</tr>
<tr>
<td>University of California—Santa Barbara</td>
<td>Nov 2013</td>
<td>4*</td>
</tr>
</tbody>
</table>

†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\(^3\)

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\(^2\) 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](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**
  - 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**

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1Cohn 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

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\(^1\) National Notifiable Diseases Surveillance System

## Summary of Groups at Increased Risk for Meningococcal Disease

<table>
<thead>
<tr>
<th>Group</th>
<th>Estimated persons aged ≥10 years</th>
<th>Risk</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistent complement component deficiencies</td>
<td>0.03%¹ ~80,000 persons</td>
<td>• Up to 10,000 fold increased risk² • High risk of recurrent disease²</td>
<td>6 cases ABCs (none serogroup B)</td>
</tr>
<tr>
<td>Anatomic or Functional Asplenia (including sickle cell)</td>
<td>Sickle cell ~90,000-100,000 (all ages)³</td>
<td>• Risk not well defined² • Higher risk of mortality (40-70%)⁵</td>
<td>11 cases ABCs (2 serogroup B)</td>
</tr>
<tr>
<td>Microbiologists</td>
<td>~100,000 clinical; 400 research</td>
<td>• 13/100,000² • Higher risk of mortality²</td>
<td>22 cases worldwide 1985-2014⁴</td>
</tr>
<tr>
<td>Outbreak at-risk populations</td>
<td>60,000 in 5 university outbreaks</td>
<td>• Up to 1400 fold increased risk (Princeton)</td>
<td>32 cases combined</td>
</tr>
</tbody>
</table>

²Cohn et al. Prevention and Control of Meningococcal Disease. MMWR. March 22, 2013; 62 (RR-2)
³http://www.cdc.gov/ncbddd/sicklecell/data.html
⁵Updated 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