Meningococcal Infections and Importance of Meningococcal Vaccination in the Middle Eastern Region

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Presentation overview

- Classification of the meningococci
- Colonization/carriage;
  - Frequency, serogroup distribution, and clinical importance
- IMD brief epidemiology;
  - Region, age, frequency, serogroup distribution
- IMD immunology
  - Briefly in regard of protection
- Clinical pictures and treatment
- Prevention, especially vaccination

Especially, in the Middle east and MENA countries
Middle East and MENA countries

Population of ~550M

Population of ~350M
Cross-Sectional View of the Meningococcal Cell Membrane.


Opacity proteins; Opa, Opc

Standart classification of meningococci

Serogroup
Serotype
Serosubtype
Immunotype

Besides; molecular typing is frequently used in epidemics

ST (sequence type)
CC (clonal complex)
Standart classification of meningococci

Serogroup; Capsule polysaccharides

Serotype; Class 2 or 3 OMP

Capsule

Serosubtype; Class 1 OMP

Immunotype; Lipopolysaccharide

Pilus

Epidemiology, NF carriage

- *Men* is a member of NF flora;
  - NF colonization in adults; 5-11%
  - It may be higher in risk groups (and children/adolescents)

- *Men* isolation in NF is not accepted as evidence of IMD

- However, colonization is generally expected before the infection

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Red book: 2012
In Denmark; 1069 military recruits
- NF colonization; 39-47%
- In the follow-up; 34%; have lost colonization or acquired new serogroups

In the UK; 2507 university students; NF colonizations
- In October; 7%, In December; 23%
- Among students in dormitories; In October; 14% In December; 34%

In Europe; in a multicentered study with 27 countries, general evaluation of colonizations;
There is wide heterogeneity between countries, regions, ages, time and serogroup distributions
The dominant serogroup is Men B
Peak age group is late adolescents
Surveillance systems for bacterial meningitis and/or meningococcal disease are in place in Egypt, Kuwait, Lebanon, Morocco, Oman, Israel, Pakistan, Qatar, and Saudi Arabia.

Meningococcal colonization in the Middle East

- **In Egypt**, general population, 1992–93; 4% (2)
- **In Israel**, general population, 1987 to 1990; 6.6% (3)
- **In Saudi Arabia**, general, in three cities, 2002; 1.1% or lower (4,5)
- **In Egypt**, pediatric data (<14 yrs); 1.2–18.8% (6-8)

Meningococcal colonization in the Middle East

Higher rates;

• In military personnel; up to 38.3%
• And students; up to 24%


In Israel, the highest carriage prevalence were;
• 11–15 year-olds; 29% and
• 1–9-year-olds; 15.3%


• However, a Mecca and Medina study reported highest carriage; <5 yrs; 8.3%

Meningococcal colonization in the Middle East is a dynamic and changeable process. Carriage rates in Middle East countries are not homogeneous; generally 1-38%.

The majority of carriage studies were undertaken in:
- Perceived risk groups,
- Targeted certain age groups, or
- In response to an outbreak.

So, it is not easy to make a homogenous conclusion.
The effect of Hajj about the carriage of *N. meningitidis*

Carriage prevalence of Iranian Hajj pilgrims, of *N. meningitidis*:

- **5.3%** before and
- **4.6%** after pilgrimage


Carriage among Turkish pilgrims (visiting Mecca annually):

- **Before pilgrimage; 13% (83% is W-135)**
- **After pilgrimage; 27% (91% is W-135)**

Spread of meningococcal serogroup W-135 cases from the Hajj in 2000

a) Worldwide and
b) The other Gulf States

Memish ZA, et al. Travel Med Infect Dis. 2011 Mar;9(2):60-6
Epidemiology, IMD

IMD may be endemic (sporadic) in nature or in epidemics

- Most of the IMDs are endemic
- Less than 5% of the cases related to epidemics, BUT they might affect incidences in some countries.

Endemic Rates;

- After 1990s in the USA 0.5-1.5 case/100 000
- In developed countries (USA, UK, Scandinavia); usually 1-3/100 000
- In Europe; by countries 0.2-14/100 000
- In developing countries; 10-25/100 000
  - Subsaharan Africa, in some epidemics; <1000/100 000

Red book: 2012
Global IMD Incidence
(Per 100,000 people, All ages)

Bahrain;
- No IMD cases were reported to the public health directorate in Bahrain from 2002 to 2009

United Arab Emirates, 2008; 1.0/100,000

Kuwait, 1998-2009; 1.1-0.23/100 000

Qatar; Average rate; 0.8/100 000
(47 IMD cases were reported from Jan 2008 to Sept 2010)

Iran, 2005 ; 0.18/100 000

Iraq, 2005; 0.14 /100 000

Saudi Arabia, 1999-2002, 729 cases; average; 0.8/100 000

Israel, 1989-2010; average 2+ 0.8/100 000

Memish ZA, et al. Travel Med Infect Dis. 2011 Mar;9(2):60-6

Average; ~0.8/100 000

~1.1/100 000

~0.07/100 000

Vaccine effect?
General and average IMD incidences in Middle Eastern countries vary; between 0.23-2/100 000
There is a tendency that IMD is decreasing
Not related to vaccination

* Per 100,000 population.
† ABCs cases from 1997–2011 estimated to the U.S. population. In 2010, estimated case counts from ABCs were lower than cases reported to NNDSS and might not be representative.

Canada, Quebec, IMD epidemiology was evaluated 10 years before MenC vaccine (2002) and 10 years later (1991-2011);

- IMD incidences in 1991-1992 were 2.2-2.3/100 000
- In 1999-2000, it dropped to 0.49/100 000 (before vaccination)


Israel, 27 paediatric services, <15y, surveillance, IMD, for 22 years (1989-2010);

- Incidence in 1989 3.7/100 000
- In 2010 a significant decrease to 1.5/100 000


Oman;

- In 2001-2008, 45 cases of IMD were reported
- Recently, the number of cases of meningococcal disease has decreased and no cases were reported between January and June 2009.


Kuwait;

- The incidence rate
  - 0.15/100,000 in 1998
  - 1.1/100,000 in 2002
- declining to 0.23/100,000 in 2008 and 2009.

Memish ZA, et al. Travel Med Infect Dis. 2011 Mar;9(2):60-6

IMD incidence is higher in infants below 2 years of age

The USA, incidence; 1991-2002

IMD incidence is higher in infants below 2 years of age

In the UK (England and Wales), 2006-2010;
Men B comprises the 87% of all IMD cases
Men B incidence is highest <6 months; 36.2/100.000
(The general incidence; 1.8/100 000)

In Poland, 2002-2011;
IMD is highest in <1 yrs; 15.7/100 000

Canada-Ontario, 2000-2010, 11-year duration;
MenB incidence is highest in babies; 3.7/100.000)

Asia (China, South Korea and Vietnam),
<5 y meninococcal menengitis;

More than 50% of Nm-PCR positive CSF samples YD and <6 months
**IMD incidence is higher in infants below 2 years of age, in the Middle East**

**Israel (1989-2010);**
IMD is highest in <1 yrs; 8.7/100 000

**Oman, 2001-08;**
The majority of cases occurred in children, with 37/45 cases of *N. meningitidis* reported in children under 5 years of age.

**Saudi Arabia, 1999-2002, 729 IMD;**
39% in children under 2 years of age,
21% in children 2–<5 years of age,
18% in children 5–14 years of age, and
22% in individuals ≥15 years of age

However, in **United Arab Emirates, 2008;**
Most patients (79%) were 15–44 years of age.
Global serogroup distribution of *N. meningitidis*

**Canada** 2006
- n=210
- B = 54%
- C = 21%
- Other SG, NG = 9%
- Y = 13%
- W-135 = 3%

**Europe** 2006
- n=4402
- B = 72%
- C = 21%
- Y = 4%
- Other SG, NG = 1%
- W-135 = 3%

**China** 1996-2007
- n=419
- A = 62%
- B = 8%
- C = 15%
- Other SG, NG = 15%
- Y = 13%

**Japan** 1999–2004
- n=82
- A = 4%
- B = 27%
- Other SG, NG = 51%
- Y = 18%

**Subsaharan Africa** 2009
- n=1783
- A = 90%
- B = 9%
- C = 1%
- Other SG, NG = 9%
- Y = 1%

**Australia** 2007
- n=242
- A = 90%
- B = 8%
- C = 1%
- Other SG, NG = 9%
- Y = 1%

**South Africa** 2008
- n=456
- A = 8%
- B = 18%
- C = 10%
- Other SG, NG = 26%
- Y = 4%

**USA** 2008
- n=123
- B = 35%
- C = 55%
- Other SG, NG = 9%
- Y = 2%

**Brazil** 2006
- B = 38%
- C = 55%
- W-135 = 5%

**Argentina** 2007
- B = 69%
- C = 11%
- Y = 7%

**South Africa** 2008
- C = 6%
- Other SG, NG = 9%

**Europe** 2006

References:
Serogroup distribution of *N. Meningitidis* in Middle Eastern countries

**Qatar:** **W-135** (38.0%), **A** (21%), **B** (12%), and **Y** (6%)

**Saudi Arabia:**
- 1995-1999; mainly, **A** and **B**
- However, after 2000; **W-135** (50%) (40% were unidentified, **A**, **B**, and **C** totally 10%)

**Oman, 2001-08:** **W-135** 25%, **A**; 21%, **C**; 16%, **Y**; 9%, **B**; 2%, (unidentified 27%)

**Kuwait, of typeable cases:**
- In 1999-2009; **B** (43.0%), **W-135** (22.1%), **A** (8.1%), **C**, **X**, **Y**, and **Z** (each 2.3%)
- From 2004 to 2009; **W-135** (48.6%), **A** (18.9%) and **B** (21.6%)

Memish ZA, et al. Travel Med Infect Dis, 2011 Mar;9(2):60-6
Table showing the incidence of meningococcal serogroups identified, outbreaks, and disease incidence in countries of MENA.

<table>
<thead>
<tr>
<th>Country</th>
<th>Meningococcal serogroups identified in grouping studies</th>
<th>Outbreaks</th>
<th>Number of cases</th>
<th>Incidence</th>
<th>Most recent incident rate available, per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan</td>
<td>No data</td>
<td>1997</td>
<td>W-135</td>
<td>4</td>
<td>0.4 (1989)</td>
</tr>
<tr>
<td>Algeria</td>
<td>No data</td>
<td>1999</td>
<td>W-135</td>
<td>7</td>
<td>0.7 (2005)</td>
</tr>
<tr>
<td>Bahrain</td>
<td>No data</td>
<td>1973-1974</td>
<td>Shift from A to B over time</td>
<td>20</td>
<td>0 (2009)</td>
</tr>
<tr>
<td>Iraq</td>
<td>No data</td>
<td>1998-1999</td>
<td>B</td>
<td>11</td>
<td>0.18 (2005)</td>
</tr>
<tr>
<td>Kuwait</td>
<td>No data</td>
<td>1999-1999</td>
<td>C</td>
<td>1</td>
<td>0.15 (1993)</td>
</tr>
<tr>
<td>Lebanon</td>
<td>No data</td>
<td>2000-2000</td>
<td>A</td>
<td>112</td>
<td>0.21 (2005)</td>
</tr>
<tr>
<td>Libya</td>
<td>No data</td>
<td>2000-2000</td>
<td>Minor A</td>
<td>112</td>
<td>0.10 (2007)</td>
</tr>
<tr>
<td>Pakistan</td>
<td>No data</td>
<td>2000-2000</td>
<td>A</td>
<td>112</td>
<td>0.73 (2006)</td>
</tr>
<tr>
<td>Palestine</td>
<td>No data</td>
<td>2000-2000</td>
<td>A</td>
<td>112</td>
<td>0.09 (2006)</td>
</tr>
</tbody>
</table>

Serogroup distribution of *N. Meningitidis* in Middle East countries

**Qatar:** W-135 (38.0%), A (21%), B (12%), and Y (6%)

**Sultanate of Oman:**
- From 1999-2001: W-135 (25%), A; 21%, C; 16%, Y; 9%, B; 2%; (unidentified 27%)

**Kuwait:** of typeable cases:
- In 1999-2009: B (43.0%), W-135 (22.1%), A (8.1%), C, X, Y, and Z (each 2.3%)
- From 2004 to 2009: W-135 (48.6%), A (18.9%) and B (21.6%)

**The Kingdom of Saudi Arabia:**
- 1995-1999: mainly, A and B
- However, after 2000: W-135 (50%); 40% were unidentified, A, B, and C totally 10%

**In Middle Eastern countries**

The most frequent serogroups are:

W-135, A, B, C

IMD Epidemiology, the Vaccine Effect

**In the UK, effect of MenC vaccine;**
MenC vaccine introduced in 1999
A few years later, Men C cases began to decrease
(50-250 cases per year to less than 50 cases per year)

Canada, Quebec, before and after MenC-Vaccine IMD epidemiology, 1991-2011;
The authors concluded after MenC vaccination;
- Serogroup C-IMD nearly disappeared
- Serogroup B-IMD (ST-269 CC) cases increased recently


Nijer; 2008-2011, MenA vaccine *(Men Afrivac)*
the effect of mass vaccination against meningococcal meningitis (confirmed by PCR);

- 2008-2009; MenA; ~98% of all IMD
- **After MenA vaccine;**
  - 2010; serogroup A 26%, (W-135 (ST11); increased; 72%)
  - 2011; Serogroup A disappeared

In the UK, effect of MenC vaccine;
MenC vaccine introduced in 1999
A few years later, Men C cases began to decrease
(50-250 cases per year to less than 50 cases per year)

Canada, Quebec, before and after MenC vaccine

The authors concluded; after MenC vaccination
• Serogroup C-IMD nearly disappeared
• Serogroup B-IMD (ST-269 CC) cases increased recently

In Saudi Arabia after MPV4 vaccine-introduction,
The number of IMD cases decreased
from 338 cases in 2000 to only 6 cases in 2009.

Memish ZA, et al. Travel Med Infect Dis. 2011 Mar;9(2):60-6


Nijer; 2008 - 2011, MenA vaccine (Men Afrivac)

2008 - 2009; MenA; ~98% of all IMD
• 2010; serogroup A 26%, (W-135 (ST11); increased; 72%)
• 2011; Serogroup A disappeared
Meningococ epidemiology, Turkey

- Colonization rates in healthy children; 1-21%
- Colonized serogroups;
  - İstanbul, 2000, 0-10yrs; Y; 53%, B; 29%
  - Manisa, 2001-02, 9-14yrs; C; 35%, B; 35%, A; 28%
  - İstanbul, 2005, 6-10y; Y/W135; 37%, A; 12.5%, B; 12.5%
  - Military recruits, 2008: Y 16%, W135; 11% (non-groupable; 55%)

Ministry of Health Statistics, 1989-2002;

- Annual incidence; 0.71-3.53/100 000
- Mortality rates of Men meningitis; 0.38-2.62/1 000 000


- IMD serogroups;
  - Ankara, 1974-81, N=205; B; 32%, A; 20%, C; 16%
  - Ankara Sami Ulus, 1987, N=41; C; 95%, B; 5%
  - İzmir Behçet Uz, 1990-91, N=41; C; 86%, B; 7%
  - Multicentric, 2005-06, N=138: W135; 43%, B; 31%, (non-groupable; 23%)
In Turkey, Serogroups causing meningococcal meningitis may change over time


Figure adapted from the reference.

Ceyhan et al. Human Vaccines & Immunotherapeutics 2014; 10
https://www.landesbioscience.com/article/29678/full_text/#load/info/all
Meningococ epidemiyology, Turkey

- Colonization rates in healthy children: 1-2%
- Colonized serogroups:
  - İstanbul, 2000, 0-10y; B; 53%, Y; 29%
  - Manisa, 2001-02, 9-14y; C; 35%, B; 35%, A; 28%
  - İstanbul, 2005, 6-10y; Y/W135; 37%, A; 12.5%, B; 12.5%
  - Military recruits, 2008: Y 16%, W135; 11% (non-groupable; 55%)

- IMD serogroups:
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  - İzmir Behçet Uz, 1990-91, N=41; C; 86%, B; 7%
  - Multicentric, 2005-06, N=138; W135; 43%, B; 31% (non-groupable; 23%)

- IMD cases are below 2 years old
- The mortality rate is on average 15%

- Colonization rates of Men meningitis; 0.38-2.62/1 000 000

- Annual incidence; 0.71-3.53/100 000

- Ministry of Health Statistics, 1989-2002; •

24-62% of IMD cases are below 2 years old

In a meningococ epidemic, Ankara; 1973-77, N=154; B; %45, A; %26

According to WHO (SAGE), Turkey is in the moderate endemicity region

IMD epidemiology is very dynamic and differs with respect to age, country and time. Also endemic-IMD epidemiology is different from epidemic-IMD epidemiology. And conjugated vaccines can affect the IMD epidemiology. Currently comprises most of IMD cases.

• Serogroup W135
• Serogroup B
• Serogroup A
• Serogroup C

These data should be taken into account regarding the national IMD prevention/vaccination policies.
Importance of circulating antibodies in protection against meningococcal disease, 
Erlich KS et al. Hum Vaccin Immunother 2012; 8: 1029-35

Importance of circulating antibodies in protection against meningococcal disease,
Erlich KS et al. Hum Vaccin Immunother 2012; 8: 1029-35

Burkino Faso, 1022 people, before MenA conjugated vaccine, menA serologic prevention levels, SBA and MenA specific IgG were studied;

- No serologic correlation related to prevention was defined
- Without vaccination or IMD, previous exposure to meningococci (colonization/carriage or maybe due to subclinical infections?) may create protective antibodies


<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
<th>Day 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bacterium Enters Body</strong>&lt;br&gt;Meningococcus incubation 3–4 days (average)</td>
<td></td>
<td></td>
<td><strong>Meningococcal Disease Onset</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Innate Immunity and Circulating Antibodies</strong>&lt;br&gt;Primary source of protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Immune Memory</strong>&lt;br&gt;Reactivation may take &gt;5 days</td>
</tr>
</tbody>
</table>
The age-dependent prevalence of meningococcal disease in relation to population immunity measured by serum bactericidal activity

IMD clinical picture and treatment summary

- Incubation time; usually <4 d (1-10d)

- Frequently, begins with sudden and high fever
- There may be maculopapular and petechial rashes
Clinical pictures of IMD can usually be

- Meningococcemia
- Meningitis
- or both of them together
- Occult bacteraemia
- Other: (complications or sometimes as a clinical picture)

Sometimes the initial clinical picture resembles influenza-like illness

The IMD can rapidly progress and lead to death as short as in 2 days

- In case of IMD suspicion; antibiotic Rx should be begun immediately
Protection, chemoprophylaxis or vaccination;

- For all persons in close contact with IMD (independent of vaccination)
- Effectiveness is 90-95%
- Should preferably begin within 24 h after the contact
- The prophylaxis given 2 weeks after the contact is not protective

- Protection can be via chemoprophylaxis;
  - Mainly after (or before) contact,
  - Short lasting

- Or Vaccination
  - (preferred)
  - Long lasting

As;
- Rifampicin
- Ceftriaxone
- Azithromycin
- Ciprofloxacin (<18 yrs)
Prevention, Men Vaccines

Men vaccines may be given:

• **To the healthy children;** (as a part of routine vaccination schedule)
  – MCV4-ACYW; For adolescents, USA…
  – MCV1; In certain countries
    • MenC; UK, Canada, …
    • MenA; Africa

• **To the risk group children**
  – Close contact with a patient with IMD
  – Traveling high risk areas
  – Deficiency of persistan complementary components (such as C5-C9, properdin, factor H, factor D)
  – Anatomical or functional asplenia
  – (Medical workers, HIV, MSM, )

• **In outbreaks**

Attack rate of exposed persons; ~4/1000 (500-800 times higher)
Polysaccharide vaccines;
- MPS4; A,C,Y,W-135
- Bivalent; A+C

Conjugated vaccines;
- Monovalent;
  - A;
  - C; (in the UK; 1999, in Canada; 2001)
  - B; (approved in Jan 2013 in Europe)
- 2-valent (C+Y; with HIB vaccine approved in the USA in 2012)
- 4-valent (A,C,Y,W-135);
  - Conjugated with diphtheria toxoid; Menactra
  - Conjugated with tetanos toxoid; Nimenrix
  - Conjugated with CRM 197 mutant diphtheria toxin; Menveo
WHO; recommendations about meningococcal vaccines

<table>
<thead>
<tr>
<th>Meningococcal</th>
<th>MenA conjugate</th>
<th>MenC conjugate</th>
<th>Quadrivalent conjugate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 dose (1-29 years)</td>
<td>2 doses (2-11 months) with booster 1 year after</td>
<td>2 doses (9-23 months)</td>
</tr>
<tr>
<td></td>
<td>1 dose (≥12 months)</td>
<td>1 dose (≥2 years)</td>
<td></td>
</tr>
</tbody>
</table>

Definition of high-risk; Vaccine options

Conjugate vaccines are preferred over polysaccharide vaccines due to their potential for herd protection and their increased immunogenicity, particularly in children <2 years of age.

Both conjugate and polysaccharide vaccines are efficacious and safe when used in pregnant women.

Monovalent MenA conjugate vaccine should be given as one single intramuscular dose to individuals 1-29 years of age. The possible need for a booster is not yet established.

For monovalent MenC conjugate vaccine one single intramuscular dose is recommended for children aged >12 months, teenagers and adults. Children 2-11 months require 2 doses administered at an interval of a least 2 months and a booster about 1 year after. If the primary series is interrupted, vaccination should be resumed without repeating the previous dose.

Quadrivalent conjugate vaccines (A,C,W135,Y-D and A,C,W135,Y-CRM) should be administered as one single intramuscular dose to individuals > 2 years. A,C,W135,Y-D is also licensed for children 9-23 months of age, and given as a 2-dose series, 3 months apart beginning at age 9 months. If the primary series is interrupted, vaccination should be resumed without repeating the previous dose.

Meningococcal polysaccharide vaccines are less, or not, immunogenic in children under 2 years of age.

Meningococcal polysaccharide vaccines can be used for those > 2 years of age to control outbreaks in countries where limited economic resources or insufficient supply restrict the use of meningococcal conjugate vaccines. Polysaccharide vaccines should be administered to individuals > 2 years old as one single dose. One booster 3-5 years after the primary dose may be given to persons considered to be a continued high risk of exposure, including some health workers. See position paper for details.
### Men Vaccines in the Middle Eastern countries

#### Immunization schedule for 4 vaccines (HibMenC, MenA, MenAC, MenACWY, MenACWY, MenC_conj)

For no specific country and for all regions. (EMRO, H). 4 rows.

<table>
<thead>
<tr>
<th>Country</th>
<th>Antigens</th>
<th>Description</th>
<th>Schedules</th>
<th>Entire country</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eastern Mediterranean</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bahrain</td>
<td>MenACWY</td>
<td>Meningococcal ACWY</td>
<td>2 years</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td>MenAC</td>
<td>Meningococcal AC</td>
<td>3, 6, 12, 15 years</td>
<td>Yes</td>
<td>military</td>
</tr>
<tr>
<td>Iran (Islamic Republic of)</td>
<td>MenAC</td>
<td>Meningococcal AC</td>
<td>2 years</td>
<td>Yes</td>
<td></td>
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<tr>
<td>Kuwait</td>
<td>MenACWY</td>
<td>Meningococcal ACWY</td>
<td>2 years</td>
<td>Yes</td>
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<tr>
<td>Libya</td>
<td>MenACWY</td>
<td>Meningococcal ACWY</td>
<td>&gt; 2 years</td>
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<tr>
<td>Oman</td>
<td>MenACWY</td>
<td>Meningococcal ACWY</td>
<td>&gt; 2 years</td>
<td>Yes</td>
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<tr>
<td>Qatar</td>
<td>MenACWY</td>
<td>Meningococcal ACWY</td>
<td>&gt; 2 years</td>
<td>Yes</td>
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<tr>
<td>Saudi Arabia</td>
<td>MenACWY</td>
<td>Meningococcal ACWY</td>
<td>&gt; 2 years</td>
<td>Yes</td>
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<tr>
<td>Syrian Arab Republic (the)</td>
<td>MenACWY</td>
<td>Meningococcal ACWY</td>
<td>&gt; 2 years</td>
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<tr>
<td>United Arab Emirates (the)</td>
<td>MenACWY</td>
<td>Meningococcal ACWY</td>
<td>&gt; 2 years</td>
<td>Yes</td>
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</tbody>
</table>
As; Men AC or MenACYW

- For; Risk groups
- Travelers, including Hajj, Omra
- Military
- Special working groups
- General risk groups

Or routinely (Saudi Arabia, Libya)

<table>
<thead>
<tr>
<th>Country</th>
<th>Antigens</th>
<th>Meningococcal AC</th>
<th>Years;</th>
<th>Military</th>
<th>Expatriate working groups</th>
<th>Hajj and Omra</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahrain</td>
<td>MenACWY</td>
<td>MeningoAC</td>
<td>3, 6, 12, 15 years;</td>
<td>Yes</td>
<td>special expatriate working groups</td>
<td>Travellers, Hajj and Omra</td>
</tr>
<tr>
<td>Egypt</td>
<td>MenAC</td>
<td>MeningoAC</td>
<td>2 years;</td>
<td>Yes</td>
<td>military</td>
<td></td>
</tr>
<tr>
<td>Iran (Islamic Republic)</td>
<td>MenAC</td>
<td>MeningoAC</td>
<td>No</td>
<td>special expatriate working groups</td>
<td>Travellers, Hajj and Omra</td>
<td></td>
</tr>
<tr>
<td>Kuwait</td>
<td>MenACWY</td>
<td>MeningoAC</td>
<td>&gt; 2 years;</td>
<td>Yes</td>
<td>High risk only</td>
<td></td>
</tr>
<tr>
<td>Libya</td>
<td>MenACWY</td>
<td>MeningoAC</td>
<td>6 years;</td>
<td>Yes</td>
<td>PILGRIMS AND ROUTINELY FROM JANUARY 2013 (CONJUGATE VACCINE)</td>
<td></td>
</tr>
<tr>
<td>Oman</td>
<td>MenACWY</td>
<td>MeningoAC</td>
<td>Yes</td>
<td></td>
<td>PILGRIMS AND ROUTINELY FROM JANUARY 2013 (CONJUGATE VACCINE)</td>
<td></td>
</tr>
<tr>
<td>Qatar</td>
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<td>MeningoAC</td>
<td>Yes</td>
<td></td>
<td>PILGRIMS AND ROUTINELY FROM JANUARY 2013 (CONJUGATE VACCINE)</td>
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</tr>
<tr>
<td>Saudi Arabia</td>
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<td>MeningoAC</td>
<td>Yes</td>
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</tr>
<tr>
<td>Syrian Arab Republic (the)</td>
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<td>MeningoAC</td>
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<td>Yes</td>
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<td></td>
</tr>
<tr>
<td>United Arab Emirates (the)</td>
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<td>MeningoAC</td>
<td>Yes</td>
<td></td>
<td>PILGRIMS AND ROUTINELY FROM JANUARY 2013 (CONJUGATE VACCINE)</td>
<td></td>
</tr>
</tbody>
</table>
### Saudi Arabian Vaccine Schedule

<table>
<thead>
<tr>
<th>Visit Date</th>
<th>Stamp</th>
<th>Name &amp; Signature</th>
<th>Date</th>
<th>Vaccine</th>
</tr>
</thead>
<tbody>
<tr>
<td>At Birth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 months</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Vaccines:***
- BCG
- Hepatitis B
- IPV
- DTaP
- Hepatitis B
- Hib
- Pneumococcal Conjugate (PCV)*
- Rota**
- MCV4
- OPV
- IPV
- DTaP
- Hib
- Pneumococcal Conjugate (PCV)*
- MCV4
- Measles
- Meningococcal Conjugate quadrivalent (MCV4)
- OPV
- MMR
- Varicella
- Hepatitis A

* Pneumococcal Conjugate (PCV13).
** Monovalent Rota vaccine.
*** Varicella vaccine.

9. months; MCV4

12. months; MCV4
<table>
<thead>
<tr>
<th>Age</th>
<th>Vaccine Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 months</td>
<td>MCV4</td>
</tr>
<tr>
<td>12 months</td>
<td>MCV4</td>
</tr>
<tr>
<td>6 yrs</td>
<td>MCV4</td>
</tr>
</tbody>
</table>
Vaccination coverage

- **In Morocco;**
  - 1998-2001, ~150 000 individuals were vaccinated annually
  - Estimates for VC; 0.45 %
    

- **In Saudi Arabia;**
  - In Riyadh, in 2002, VC; 51 % (52% of those vaccinated had received the vaccine within the previous 3 years)
  - After targeted vaccination of Hajj pilgrims and Mecca and Medina residents; VC improved in Mecca from 1% in 1991–92 to 70–73% in 1992–93
  - However, VC is still not adequate among international and Saudi pilgrims

- **In Bahrain;**
  - 2000-06, average of 39 400 vaccinations were administered annually; VC ~ 3%
  - In 2001, 2.6% of the UAE population was reported to have been vaccinated

**In Turkey;**

- 2013, ~51 000, VC; 0.07 %
- 2014, ~130 000, VC; 0.23 %

Prognosis

Average mortality rate: 10%, Higher in adults

IMD case fatality rates, USA

Age-specific incidence and case fatality ratios of meningococcal disease in Europe, 2006. Data from 27 countries participating in EU-IBIS

Erlich KS et al. Hum Vaccin Immunother 2012; 8: 1029-35.

Prognosis

Average mortality rate; 10%, Higher in adults

In Israel; average 9.9%
<1 yrs; 9.2%
• 1-4 yrs; 12 %,
• >4 yrs; 7.7%
• With meningitidis; 7.9 %
• Without meningitidis; 14.9 % (p<0.01)

In Turkey; average 15% (0-43%)

In Saudi Arabia; 26–28% (the 2000 W-135 outbreak)

In Oman; 11–21%

In Sudan; 8%
(the 2000 W-135 outbreak)

Sequellae in survivors may be between 11-19%
(such as deafness, neurologic disorders, finger or extremity amputation, skin scars)
In conclusion;

**IMD is a vaccine-preventable disease**

**IMD is very serious disease and meningococcal issues are not homogenous**

- The clinical picture can be serious and develop rapidly
  - Essential to recognize early and treat/manage immediately
- Mortality is high;
  - Especially in adolescents and elderly

**Heterogen for**

- Carriage and translation into infection
- Epidemiology (colonization and IMD);
  - Age,
  - Geographic regions,
  - Serogroup distribution
  - Conjugated vaccine effects
  - Travel and Hajj/pilgrimage effects

**IMD is a vaccine-preventable disease**
The last conclusion

Yesterday is a thing of the past my dear
Today is a fresh day to utter a new word

Indeed;
There will be more things to say about meningococcal infections tomorrow, again
Thank you for your patience