Temperature Sensitivity of Vaccines

March 2014
Temperature sensitivity of vaccines

Heat sensitivity
Most sensitive

Freeze sensitivity
Not sensitive
Least sensitive
Most sensitive

Vaccines to the left of the line are not damaged by freezing

Freeze dried
Liquid, no adjuvant
Liquid, with alum adjuvant

*The diluent for MenA PS-PCV contains alum adjuvant and is freeze sensitive.
<table>
<thead>
<tr>
<th>Heat sensitivity</th>
<th>Vaccine</th>
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</thead>
</table>
| **Most sensitive** | Oral poliovirus  
Varicella-zoster virus  
Influenza (inactivated, split)  
Inactivated poliovirus  
Japanese encephalitis (live)  
Measles, mumps, rubella  
Cholera (inactivated)  
DTaP  
DTwP  
DTaP-hepatitis B-Hib-IPV (hexavalent)  
DTwP-hepatitis B-Hib (pentavalent)  
Hib (liquid)  
**Measles**  
Rotavirus (liquid and **freeze dried**)  
**Rubella**  
**Yellow fever** |
| **Least sensitive** | Hepatitis A  
Hepatitis B  
**Hib** (**freeze dried**)  
**Meningitis A** (**polysaccharide-protein conjugate**)  
**Meningitis C** (**polysaccharide-protein conjugate**)  
**Pneumococcal** (**polysaccharide-protein conjugate**)  
**Rabies**  
Typhoid PS |

✓ Use vaccine vial monitors to monitor heat exposure.

All freeze-dried vaccines become much more heat sensitive after they are reconstituted.

Note: Bolded vaccines are freeze dried.
# Vaccine sensitivity to freezing

<table>
<thead>
<tr>
<th>Freeze sensitivity</th>
<th>Vaccine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most sensitive</td>
<td>DTaP&lt;br&gt;DTaP-hepatitis B-Hib-IPV (hexavalent)&lt;br&gt;DTwP&lt;br&gt;DTwP-hepatitis B-Hib (pentavalent)&lt;br&gt;Hepatitis A&lt;br&gt;Hepatitis B&lt;br&gt;Human papillomavirus&lt;br&gt;Meningitis C (polysaccharide-protein conjugate)&lt;br&gt;Pneumococcal (polysaccharide-protein conjugate)&lt;br&gt;T, DT, dT&lt;br&gt;Cholera (inactivated)&lt;br&gt;Influenza (inactivated, split)&lt;br&gt;Hib (liquid)&lt;br&gt;Inactivated poliovirus&lt;br&gt;Typhoid PS&lt;br&gt;Rotavirus (liquid)*</td>
</tr>
<tr>
<td>Least sensitive</td>
<td>Meningitis A (polysaccharide-protein conjugate)†&lt;br&gt;Yellow fever&lt;br&gt;Bacillus Calmette-Guérin&lt;br&gt;Hib (freeze dried)&lt;br&gt;Japanese encephalitis (live and inactivated)&lt;br&gt;Measles&lt;br&gt;Measles, mumps, rubella&lt;br&gt;Oral poliovirus&lt;br&gt;Rabies&lt;br&gt;Rotavirus&lt;br&gt;Rubella&lt;br&gt;Varicella-zoster virus</td>
</tr>
</tbody>
</table>

These vaccines are not damaged by freezing.

Cautions:

- Never expose these vaccines to zero or subzero temperatures.
- Avoid the use of ice for transport.

* While the stability data for liquid rotavirus vaccines demonstrate some resistance to freezing, the temperature handling recommendations in the vaccine product insert should be followed.

† The diluent for MenA PS-PCV contains alum adjuvant and is freeze-sensitive.

Note: Bolded vaccines are freeze dried.
Abbreviations

BCG: bacillus Calmette-Guérin
DTaP: diphtheria, tetanus, acellular pertussis
DTwP diphtheria, tetanus, whole-cell pertussis
HepA: hepatitis A
HepB: hepatitis B
Hexavalent DTaP-hepatitis B-Hib-IPV
Hib: Haemophilus influenzae type b
HPV: human papillomavirus
Influenza: influenza (inactivated, split vaccine)

IPV: inactivated poliovirus vaccine
JE: Japanese encephalitis
Men A: meningitis A
Men C: meningitis C
MMR: measles, mumps, rubella
OPV: oral polio vaccine
Pentavalent DTwP-hepatitis B-Hib
Pneumo: pneumococcal
PS: polysaccharide
PS-PCV: PS-protein conjugate vaccine
T, DT, dT: tetanus, diphtheria tetanus, diphtheria (low-dose) tetanus

Information sources


Acknowledgments

These slides have been adapted from an original slide set produced by Julie Milstien and John Lloyd at the Technet 2006 consultation.
Extra slides for adaptation
Temperature sensitivity of vaccines

Vaccines to the left of the line are not damaged by freezing.

Heat sensitivity
- Most sensitive
- Least sensitive

Freeze sensitivity
- Not sensitive
- Least sensitive
- Most sensitive

Vaccine formulation
- Freeze dried
- Liquid, no adjuvant
- Liquid, with alum adjuvant

*The diluent for MenA PS-PCV contains alum adjuvant and is freeze sensitive.
Temperature sensitivity of vaccines

**Vaccine formulation**
- **Freeze dried**
- **Liquid, no adjuvant**
- **Liquid, with alum adjuvant**

**Heat sensitivity**
- **Most sensitive**
- **Least sensitive**

**Freeze sensitivity**
- **Not sensitive**
- **Least sensitive**
- **Most sensitive**

Vaccines to the left of the line are not damaged by freezing.

**EPI vaccines**

- **OPV**
- **Measles**
- **Rubella**
- **BCG**
- **Hib**
- **MMR**

**“Traditional” vaccines**

- **Hib**
- **HepB**
- **DTwP**
- **Penta-valent**
- **T, DT, dT**
- **Rubella**
Temperature sensitivity of vaccines

- Vaccines to the left of the line are not damaged by freezing.
- Vaccines to the right of the line are sensitive to freezing.
- Vaccines at the top are the most heat-sensitive.

Vaccines:
- OPV
- Measles
- Rubella
- MMR
- Rotavirus
- BCG
- Hib
- HPV
- DTwP
- Penta-valent
- Pneumo PS-PCV
- HepB
- Hib
- T, DT, dT

Vaccine formulation:
- Freeze dried
- Liquid, no adjuvant
- Liquid, with alum adjuvant

"Traditional" EPI and newer vaccines

Heat sensitivity:
- Most sensitive
- Least sensitive

Freeze sensitivity:
- Not sensitive
- Least sensitive
- Most sensitive
Temperature sensitivity of vaccines

Heat sensitivity

Most sensitive

Least sensitive

Freeze sensitivity

Vaccines to the left of the line are not damaged by freezing

"Traditional" EPI and regionally specific vaccines

Vaccine formulation

- Freeze dried
- Liquid, no adjuvant
- Liquid, with alum adjuvant

*The diluent for MenA PS-PCV contains alum adjuvant and is freeze sensitive.
Temperature sensitivity of vaccines

- **Heat sensitivity**: Varicella-zoster virus (Most sensitive)
- **Freeze sensitivity**: Vaccines to the left of the line are not damaged by freezing

**Vaccine formulation**
- Freeze dried
- Liquid, no adjuvant
- Liquid, with alum adjuvant

**Middle-/upper-income country vaccines**
- Influenza inactivated
- IPV
- DTaP
- Hexa-valent
- MenC PS-PCV
- HepA

**Varicella-zoster virus**
- Not sensitive

**Heat and Freeze sensitivity**
- Not sensitive
- Least sensitive
- Most sensitive