Cold Chain Equipment

The freeze indicator is used to warn of freezing and is packed with vaccines that are sensitive to freezing temperatures: DTP, TT, DT, Td (freezing point of -6.5°C), hepatitis B (-0.5°C), liquid Hib and their combinations (DTP-HepB, and DTP-HepB+Hib vaccines) and JE.

Every refrigerator storing vaccines should have a freeze indicator (Freeze Watch™). It is strongly recommended that one freeze indicator be placed in each cold box during vaccine transport and distribution. This is critical in places subject to low temperatures.

Vaccine Handling

The recommended conditions for storing vaccines used in immunization programmes are shown in Appendix 81_1. This diagram also indicates the maximum times and temperatures in each case. At the higher levels of the cold chain, i.e., at national (primary), and regional or province level, OPV must be kept frozen between -15°C and -25°C. Freeze-dried vaccines (i.e., BCG, measles, MMR and yellow fever) may also be kept frozen at -15°C to -25°C if cold chain space permits, but this is neither essential nor recommended. At other levels of the cold chain (intermediate vaccine stores and health facilities), these vaccines should be stored between +2°C and +8°C. All other vaccines should be stored at between +2°C and +8°C at all levels of the cold chain. Liquid formulations of vaccines containing diphtheria, pertussis, tetanus, hepatitis B, Haemophilus influenzae type b, IPV and their combinations should not be frozen.
WHO recommends that a policy permitting the use of vaccine outside the cold chain can be implemented either generally for all routine immunization activities or on a limited basis in certain areas or under special circumstances, such as:

- national immunization days;
- hard-to-reach geographical areas;
- immunizations provided in the home;
- cool seasons;
- storage and transportation of freeze-sensitive vaccines (DTP, TT, DT, Td, hepatitis B and Hib vaccines) where the risk of freezing is greater than the risk of heat exposure.

The shake test should NOT be conducted under following circumstances and vials should be discarded immediately, without the need for any confirmatory test:

1. When a solid frozen vaccine vial(s) has been found.
2. With a vial for which a homogeneous solution CANNOT be obtained after vigorous shaking. In such cases, the white lump/sediment cannot be separated from the walls of the glass vial. This happens only with DTP vials that are exposed to subzero temperatures without freezing.

If it is suspected that adsorbed DTP, DT, or TT have been frozen they should be examined for physical changes. Where these are found the vaccines should be discarded. The amount of antigen in a non-homogeneous vaccine can vary greatly, and the administration of such a vaccine may be associated with a reduced immune response or an increased incidence of local reactions.

Liquid Hib should never be frozen, especially in combinations with DTP, as freezing may damage the immunogenicity of the product.
**DTP**

Liquid Hib should never be frozen, especially in combinations with DTP, as freezing may damage the immunogenicity of the product.

Temperature sensitivity of vaccines

WHO recommended vaccine storage conditions (Appendix 17_3).

WHO-UNICEF effective vaccine store management initiative: Modules 1 - 4

Vaccines containing tetanus toxoid:
TB/DT/Td/DTP vaccines should never be frozen. The shake test will determine if the vaccine has been damaged by freezing. If the vaccine fails the shake test you must discard it.

Immunization in practice: a practical resource guide for Health workers – 2004 update Module 2: The vaccines

The “shake test” can help give an idea whether adsorbed vaccines (DTP, DT, Td, TT or hepatitis B) have been subjected to freezing temperatures likely to have damaged them. The test should be conducted for all boxes where freeze indicators are found to be activated or temperature recordings show negative temperatures. Identify and separate all vaccines that may have been frozen and ensure that none are distributed or used.


Check the freeze indicator in the refrigerator. If it warns of freezing or you suspect that a freeze-sensitive vaccine (DTP, DT, TT, Td, HepB, DTP-HepB, liquid Hib and DTP-HepB+Hib vaccines) has been frozen, you should perform the shake test.

A policy permitting the use of vaccines outside the cold chain can be implemented either generally for all routine immunization activities or on a limited basis in certain areas or under special circumstances, such as:

- national immunization days;
- hard-to-reach geographical areas;
- immunizations provided in the home;
- cool seasons;
- storage and transportation of freeze-sensitive vaccines (DTP, TT, DT, Td, hepatitis B and Hib vaccines) where the risk of freezing is greater than the risk of heat exposure.

If more than one type of DTP is being stored, DTP that is not approved for reconstitution should not be stored where there is any chance of confusion with the DTP that is approved for reconstitution.

If it is suspected that adsorbed DTP, DT, TT or hepatitis B vaccines have been frozen they should be examined for physical changes. Where these are found the vaccines should be discarded.

In multidose formulation, liquid Hib and DTP-Hib vaccines may be used at a subsequent session, even if they have been opened, according to the WHO Policy Statement on the use of opened vials of vaccine in subsequent immunization sessions.
See "Multi-Dose Open Vial" section of the "General" chapter in this catalogue for policies relevant for DTP, DT, TT, DTP-hepB, DTP-hepB-Hib, hepatitis B, liquid formulations of Hib and OPV.

The use of opened multi-dose vials of vaccine in subsequent immunization sessions (WHO Policy Statement)

Schedule

The recommended schedule for vaccination against diphtheria varies considerably between countries. According to the WHO/EPI schedule, the primary series of DTwP- or DTaP-containing vaccines should be administered in 3 doses, starting as early as 6 weeks of age and given with a minimum interval of 4 weeks. Where resources permit, additional doses can be given after the completion of the primary series. Many national immunization programmes offer 1-2 booster doses, for example one at 2 years of age and a second at age 4-7 years.

For previously un-immunized children aged 1-7 years, the recommended schedule (for diphtheria vaccine) is 2 doses 2 months apart, and a third dose after 6-12 months using DTwP or DTaP. The recommended schedule for primary immunizations of older children, adolescents and adults using the dT combination is 2 doses - months apart and a third dose after 6-12 months. People living in low-endemic or non-endemic areas should receive booster doses of DT approximately 10 years after completing the primary series and subsequently every 10 years throughout life. Special attention should be paid to immunizing health-care workers who may have occupational exposure to C. diphtheriae. Booster responses can still be elicited after intervals of 25-30 years, so repeat primary immunization is not required when boosters are delayed.

See Appendix 83_18 for a summary table of immunizations with diphtheria–tetanus–pertussis (DTP) and diphtheria toxoid (Td) vaccines required to obtain long-term protection against tetanus
WHO recommends the following schedule for infants (Appendix 39_5).

In countries where the incidence of pertussis has been considerably reduced by successful immunization, a booster dose administered 1–6 years after the primary series is warranted. The optimal timing of this booster dose as well as the possible need for additional booster doses of DTP depends on the epidemiological situation, and should be assessed by individual national programmes.

The main aim of pertussis vaccination is to reduce the risk of severe pertussis in infancy. The vaccine is usually administered in the national childhood immunization programme as combined DTwP or DTaP vaccine, although the combination often includes additional vaccines (Haemophilus influenzae type b (Hib), hepatitis B (HepB), poliovirus vaccine (IPV)). The optimal schedule and number of immunizations are not well defined but, in most countries, 3 primary doses are administered with at least a 1-month interval to infants aged 2–6 months. A booster dose is commonly offered 1–6 years later. WHO recommends the primary series to be administered at the age of 6, 10 and 14 weeks. National recommendations vary considerably, however.

Immunizing infants and children with DTP or DT and adults with Td prevents tetanus.
**DTP**

Wait at least four weeks between doses of OPV, DTP, Hib, and HepB vaccines.


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**Vaccine Administration**

In most cases, diphtheria toxoid is administered in fixed combination with other vaccines. For childhood vaccination, DTwP or DTaP is generally used, often in combination with other antigens administered at the same time, such as Haemophilus influenzae type b, poliomyelitis, and hepatitis B vaccines, in order to reduce the number of injections. This is a positive development as long as adverse events remain infrequent and the immunogenicity of the individual components is ensured.

*Diphtheria vaccine (WHO position paper)*

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Administration summary: DTP vaccine (see Appendix 2_1)


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See Appendix 6_19 for chart entitled, "Administering vaccines to infants" BCG, DTP, DTP-HepB, HepB, measles, yellow fever, OPV"
Hib conjugate vaccine is administered by intramuscular or subcutaneous injection in the anterolateral aspect of the thigh (infants) or the deltoid muscle (older children). If given as a combination with DTP in the same syringe, it should be given intramuscularly.

DTP

Adverse Event

In most cases, diphtheria toxoid is administered in fixed combination with other vaccines. For childhood vaccination, DTwP or DTaP is generally used, often in combination with other antigens administered at the same time, such as Haemophilus influenzae type b, poliomyelitis, and hepatitis B vaccines, in order to reduce the number of injections. This is a positive development as long as adverse events remain infrequent and the immunogenicity of the individual components is ensured.

SAGE commends the work of GACVS in carefully examining the evidence on the nonspecific effects of vaccines on mortality, and endorses the conclusion reached by GACVS that on the evidence currently available an association between DTP and increased mortality has not been demonstrated.
DTP

A case investigation is usually the first major action to be taken when an AEFI is reported and should begin without delay.

On the other hand, in some programmes for certain AEFIs no further action is taken after they are reported. Illnesses known to have no causal relation to immunizations, such as pneumonia after a DPT injection, are often treated this way. However, even in these cases, if parents or other members of the community are convinced that a medical event was caused by an immunization, they must be given the opportunity to discuss their concerns with health authorities.

Immunization Coverage

At least 90% coverage with 3 doses of the diphtheria–tetanus–pertussis vaccine (DTP) in infants remains the first programme priority worldwide, particularly where pertussis still poses a serious health problem in infants and young children.