Adverse Event

Surveillance of Adverse Events Following Immunization

All immunization programmes should monitor at least the following AEFIs:
(1) All injection site abscesses.
(2) All cases of BCG lymphadenitis
(3) All deaths that are thought by health workers, or the public, to be related to immunization.
(4) All cases requiring hospitalization that are thought by health workers, or the public, to be related to immunization.
(5) Other severe or unusual medical incidents that are thought by health workers, or the public, to be related to immunization.

With respect to the third, fourth, and fifth events, health workers may relate the event to immunization because it occurred within a month of an immunization, as its case definition indicates. However, some medical incidents can be related to immunization even if they have a delayed onset.

Surveillance of Adverse Events Following Immunization

For mild problems, health workers should comfort and advise parents and treat the patient. It is not necessary to report these reactions, except for BCG lymphadenitis and injection site abscesses, unless parents' concerns are significant.

Global Advisory Committee on Vaccine Safety, 910 June 2005

The (GACVS) concluded that the isolation and identification of a low level of isoniazid resistance of BCG strains from 5 patients presenting with lymphadenitis do not justify a change in standard policy.

Cold Chain Equipment

Thermostability of vaccines

Experimental evidence indicates that (BCG vaccine) viability is unaffected by storage at -20C or -30C or by freezing and thawing up to 10 times.

Contraindications

BCG vaccine (WHO position paper)

Infants and children with symptomatic human immunodeficiency virus (HIV) or those known to have other immunodeficiency states should not be BCGvaccinated.
**BCG vaccine (WHO position paper)**

HIV-positive infants may receive BCG vaccine only when asymptomatic and living in areas where TB is highly endemic. Long-term follow-up of such children following vaccination is desirable. HIV-positive, asymptomatic infants in low-burden areas should not be BCG-vaccinated. Indications for vaccination of groups likely to contract HIV should always be considered carefully. The efficacy of BCG vaccination in HIV-infected infants is not known.

**Global Advisory Committee on Vaccine Safety, 34 December 2003**

There are few population-based data on the effectiveness, or otherwise, of BCG vaccine in preventing severe tuberculosis in HIV-positive infants. Given the high prevalence of HIV and tuberculosis in certain countries and of the current development of new tuberculosis vaccines, some of which are based on BCG, GACVS advises no change in the current recommendations for BCG immunization of infants in countries with a high prevalence of tuberculosis and that population-based studies should be undertaken to determine the efficacy and safety of BCG and related vaccines in HIV-negative and HIV-positive children in countries with a high endemic rate of tuberculosis.

**BCG vaccine (WHO position paper)**

BCG vaccination is indicated

- for all infants living in areas where TB is highly endemic (concerning HIV, see below);
- for infants and children at particular risk of TB exposure in otherwise low-endemic areas;
- for persons exposed to multidrug-resistant Mtb (impact not established.)

BCG vaccination is contraindicated

- for persons with impaired immunity symptomatic HIV infection, known or suspected congenital immunodeficiency, leukaemia, lymphoma or generalized malignant disease);
- for patients under immunosuppressive treatment (corticosteroids, alkylating agents, antimetabolites, radiation);
- in pregnancy.
DPT

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

WHO recommended vaccine storage conditions (Appendix 17_3).

**Vaccine introduction guidelines. Adding a vaccine to a national immunization programme: decision and implementation**

WHO recommends the following schedule for infants (Appendix 39_5).

**Temperature sensitivity of vaccines**

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 -15oC and -25oC. Freeze-dried vaccines (i.e., BCG, measles, MMR and yellow fever) may also be kept frozen at -15oC to -25oC 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 +2oC and +8oC. All other vaccines should be stored at between +2oC and +8oC 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.

**Diphtheria**

**Temperature sensitivity of vaccines**

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 -15oC and -25oC. Freeze-dried vaccines (i.e., BCG, measles, MMR and yellow fever) may also be kept frozen at -15oC to -25oC 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 +2oC and +8oC. All other vaccines should be stored at between +2oC and +8oC 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.
### GACVS

**Global Advisory Committee on Vaccine Safety, 910 June 2005**

The (GACVS) concluded that the isolation and identification of a low level of isoniazid resistance of BCG strains from 5 patients presenting with lymphadenitis do not justify a change in standard policy.

**Global Advisory Committee on Vaccine Safety, 34 December 2003**

There are few population-based data on the effectiveness, or otherwise, of BCG vaccine in preventing severe tuberculosis in HIV-positive infants. Given the high prevalence of HIV and tuberculosis in certain countries and of the current development of new tuberculosis vaccines, some of which are based on BCG, GACVS advises no change in the current recommendations for BCG immunization of infants in countries with a high prevalence of tuberculosis and that population-based studies should be undertaken to determine the efficacy and safety of BCG and related vaccines in HIV-negative and HIV-positive children in countries with a high endemic rate of tuberculosis.

### General

**Proper handling and reconstitution of vaccines avoids programme errors**

Reconstituted BCG, measles and yellow fever vaccines must be kept cooled and must be discarded after 6 hours after reconstitution.

**Proper handling and reconstitution of vaccines avoids programme errors**

It is no longer necessary to ship and store freeze-dried vaccines (measles, yellow fever and BCG) at 20°C. Instead, they may be refrigerated at +2 to +8°C.

**Proper handling and reconstitution of vaccines avoids programme errors**

WHO no longer recommends that freeze-dried vaccines (measles, yellow fever, Hib and BCG) be shipped and stored at 20°C. Storing them at 20°C is not harmful but is unnecessary and uses up valuable storage space in the deep-freeze. Instead, they should be kept in refrigeration and transported at +2 to +8°C.

**Thermostability of vaccines**

Reconstituted vaccines against measles, yellow fever and tuberculosis (BCG) are unstable vaccines; they should be used as soon as possible after reconstitution, be kept in a ice bath during the immunization session and should be discarded at the end of the session.
Surveillance of Adverse Events Following Immunization

All immunization programmes should monitor at least the following AEFIs:
(1) All injection site abscesses.
(2) All cases of BCG lymphadenitis
(3) All deaths that are thought by health workers, or the public, to be related to immunization.
(4) All cases requiring hospitalization that are thought by health workers, or the public, to be related to immunization.
(5) Other severe or unusual medical incidents that are thought by health workers, or the public, to be related to immunization.

With respect to the third, fourth, and fifth events, health workers may relate the event to immunization because it occurred within a month of an immunization, as its case definition indicates. However, some medical incidents can be related to immunization even if they have a delayed onset.

Surveillance of Adverse Events Following Immunization

For mild problems, health workers should comfort and advise parents and treat the patient. It is not necessary to report these reactions, except for BCG lymphadenitis and injection site abscesses, unless parents’ concerns are significant.

Thermostability of vaccines

An ADT (accelerated degradation test) should be conducted on each lot of BCG vaccine. The number of culturable particles in vaccine incubated at 37°C for 28 days should be not less than 20% of that in the vaccine stored at 4°C.

Thermostability of vaccines

Experimental evidence indicates that (BCG vaccine) viability is unaffected by storage at -20°C or -30°C or by freezing and thawing up to 10 times.

Thermostability of vaccines

Freeze-dried BCG vaccines, regardless of their substrain, are sensitive to ultraviolet and fluorescent light. They should be packed in ampoules made from a substance of low light transmittance, such as amber glass, and should be protected from light when used.

Thermostability of vaccines

Reconstituted BCG vaccine is very unstable and should be used during one working session of five to six hours. Residual vaccine should be discarded at the end of the session.
Getting started with vaccine vial monitors

Opened vials of measles, yellow fever, BCG and freeze-dried Hib vaccine cannot be used after an initial immunization session, (even if the VVM has not reached the discard point.). They must be discarded within six hours of reconstitution or at the end of the session, whichever comes first. The VVMs for these vaccines are attached to the vial caps and should be discarded when the vaccine is being reconstituted.

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

WHO recommended vaccine storage conditions (Appendix 17_3).

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

WHO no longer recommends that freeze-dried vaccines (measles, yellow fever, Hib and BCG) be shipped and stored at -20C. Storing them at -20C is not harmful but is unnecessary. Instead, these vaccines should be stored and transported at +2C to +8C.

BCG vaccine (WHO position paper)

Unfortunately, the (BCG) vaccine does not fully meet the essential requirement of having a significant impact against the most common manifestation of TB, namely pulmonary disease. Despite the shortcomings of this vaccine, WHO continues to recommend that a single dose of BCG be given to neonates or as soon as possible after birth in countries with a high prevalence of TB.

BCG vaccine (WHO position paper)

Since severe adverse effects of BCG vaccination are extremely rare even in asymptomatic, HIV-positive infants, all healthy neonates should be BCG-vaccinated, even in areas endemic for HIV. However, where resources permit, long-term follow-up of BCG-vaccinated infants of known HIV-positive mothers is desirable for early treatment, should disseminated BCG disease occur in children with rapid development of immunodeficiency.

BCG vaccine (WHO position paper)

Infants and children with symptomatic human immunodeficiency virus (HIV) or those known to have other immunodeficiency states should not be BCG vaccinated.

BCG vaccine (WHO position paper)

In cases where infants have been exposed to smear-positive pulmonary TB shortly after birth, BCG vaccination should be delayed until completion of 6 months of prophylactic isoniazid treatment.
BCG vaccine (WHO position paper)

Countries with a low burden of TB may choose to limit BCG vaccination to neonates and infants of recognized high-risk groups for the disease or to skin-testnegative older children. In some low-burden populations, BCG vaccination has been largely replaced by intensified case detection and supervised early treatment.

BCG vaccine (WHO position paper)

There is no proven benefit of repeated BCG vaccination against TB. This also applies to revaccination of BCG-vaccinated individuals who remain negative by subsequent tuberculin testing.

BCG vaccine (WHO position paper)

The BCG vaccine should be manufactured according to the current recommendations published in the report of the WHO Expert Committee on Biological Standardization.

BCG vaccine (WHO position paper)

Improved TB vaccines are widely seen as a key element for successful TB control, and the development of efficient, safe and affordable vaccines against TB must remain a global priority.

BCG vaccine (WHO position paper)

WHO recommends intradermal application of the (BCG) vaccine, preferably on the deltoid region of the arm using syringe and needle, although other application methods such as the multiple puncture technique are practised in some countries. Newborn vaccinees normally receive half the dose given to older children. BCG vaccine can be given simultaneously with other childhood vaccines.

BCG vaccine (WHO position paper)

In the absence of a scar in children in high-burden countries, BCG vaccination is indicated.

BCG vaccine (WHO position paper)

In low-burden countries, good protection against primary TB may also be achieved following vaccination of skin-test-negative adults. BCG vaccination of skin-testpositive individuals, whether induced by environmental mycobacteria, Mtb or BCG does not improve immunity to TB.
BCG vaccine (WHO position paper)

HIV-positive infants may receive BCG vaccine only when asymptomatic and living in areas where TB is highly endemic. Long-term follow-up of such children following vaccination is desirable. HIV-positive, asymptomatic infants in low-burden areas should not be BCG-vaccinated. Indications for vaccination of groups likely to contract HIV should always be considered carefully. The efficacy of BCG vaccination in HIV-infected infants is not known.

BCG vaccine (WHO position paper)

Given the high risk of acquiring TB and the low risk of serious adverse events following BCG vaccination of HIV-exposed neonates, WHO maintains that, in HIV-infected areas, all neonates be given BCG. Older infants or children suspected of being HIV-infected should not be vaccinated if they have symptomatic disease or other evidence of immunosuppression.

BCG vaccine (WHO position paper)

To change from general to selective BCG vaccination, an efficient notification system must be in place in addition to the following criteria: an average annual notification rate of smear-positive pulmonary TB cases below 5 per 100 000; or an average annual notification rate of tuberculous meningitis in children aged under five years below 1 per 10 million population during the previous five years; or an average annual risk of tuberculous infection below 0.1%.

Global Advisory Committee on Vaccine Safety, 910 June 2005

The (GACVS) concluded that the isolation and identification of a low level of isoniazid resistance of BCG strains from 5 patients presenting with lymphadenitis do not justify a change in standard policy.

Global Advisory Committee on Vaccine Safety, 34 December 2003

There are few population-based data on the effectiveness, or otherwise, of BCG vaccine in preventing severe tuberculosis in HIV-positive infants. Given the high prevalence of HIV and tuberculosis in certain countries and of the current development of new tuberculosis vaccines, some of which are based on BCG, GACVS advises no change in the current recommendations for BCG immunization of infants in countries with a high prevalence of tuberculosis and that population-based studies should be undertaken to determine the efficacy and safety of BCG and related vaccines in HIV-negative and HIV-positive children in countries with a high endemic rate of tuberculosis.
The use of opened multi-dose vials of vaccine in subsequent immunization sessions (WHO Policy Statement)

The revised (multi-dose vial) policy does not change recommended procedures for handling vaccines that must be reconstituted, that is, BCG, measles, yellow fever, and some formulations of Hib vaccines. Once they are reconstituted, vials of these vaccines must be discarded at the end of each immunization session or at the end of six hours, whichever comes first.

Vaccine introduction guidelines. Adding a vaccine to a national immunization programme: decision and implementation

WHO recommends the following schedule for infants (Appendix 39_5).

Temperature sensitivity of vaccines

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.

Temperature sensitivity of vaccines

An ADT should be conducted on each lot of BCG vaccine. The number of CPs (culturable particles) in vaccine incubated at 37°C for 28 days should be not less than 20% of that in the vaccine stored at 4°C.

Temperature sensitivity of vaccines

Reconstituted BCG vaccine is very unstable, must be kept cold, and must be discarded within six hours of reconstitution. The reasons for these precautions are as follows:
1. There is a risk of contamination because BCG vaccine, like other lyophilized live vaccines, does not contain any bacteriostatic agent. For this reason, WHO recommends that reconstituted lyophilized vaccine should be kept cold and discarded at the end of six hours.
2. There is a loss of potency.

Once reconstituted, all BCG vaccines should be kept cold and discarded within six hours, regardless of how many doses remain in the vial or ampoule.
Temperature sensitivity of vaccines

Freeze-dried BCG vaccines, regardless of their substrain, are sensitive to ultraviolet and fluorescent light. They should be protected from light when used.

Ensuring the quality of vaccines at country level: Guidelines for health staff

At the higher levels of the cold chain, i.e. at the national (central) and regional or provincial levels, OPV must be kept frozen between -15C and -25C.

Freeze-dried vaccines, i.e. BCG, measles, MMR and yellow fever vaccines, may also be kept in this temperature range (-15C and -25C) if there is sufficient space in the cold chain, but this is neither essential nor recommended. At other levels of the cold chain these vaccines should be stored between +2C and +8C. All other national immunization service vaccines should be stored between +2C and +8C at all levels of the cold chain.

Temperature sensitivity of vaccines

Freeze-dried BCG vaccines, regardless of their substrain, are sensitive to ultraviolet and fluorescent light. They should be protected from light when used.

State of the art of new vaccines: research and development

Since 1974, BCG vaccination has been included in the WHO Expanded Programme on Immunization (EPI).

BCG vaccine (WHO position paper)

BCG vaccination is indicated
- for all infants living in areas where TB is highly endemic (concerning HIV, see below);
- for infants and children at particular risk of TB exposure in otherwise low-endemic areas;
- for persons exposed to multidrug-resistant Mtb (impact not established.)

BCG vaccination is contraindicated
- for persons with impaired immunity symptomatic HIV infection, known or suspected congenital immunodeficiency, leukaemia, lymphoma or generalized malignant disease);
- for patients under immunosuppressive treatment (corticosteroids, alkylating agents, antimetabolites, radiation);
- in pregnancy.
In areas where routine childhood vaccination coverage with meningococcal A conjugate vaccine is less than 60%, periodic campaigns could be considered to complement routine vaccination, as herd protection may not be sufficient to protect those who are not immunized.

**HIV/AIDS and immunosuppression**

**BCG vaccine (WHO position paper)**

Since severe adverse effects of BCG vaccination are extremely rare even in asymptomatic, HIV-positive infants, all healthy neonates should be BCG-vaccinated, even in areas endemic for HIV. However, where resources permit, long-term follow-up of BCG-vaccinated infants of known HIV-positive mothers is desirable for early treatment, should disseminated BCG disease occur in children with rapid development of immunodeficiency.

**BCG vaccine (WHO position paper)**

Infants and children with symptomatic human immunodeficiency virus (HIV) or those known to have other immunodeficiency states should not be BCG-vaccinated.

**BCG vaccine (WHO position paper)**

Given the high risk of acquiring TB and the low risk of serious adverse events following BCG vaccination of HIV-exposed neonates, WHO maintains that, in HIV-infected areas, all neonates be given BCG. Older infants or children suspected of being HIV-infected should not be vaccinated if they have symptomatic disease or other evidence of immunosuppression.

**Global Advisory Committee on Vaccine Safety, 34 December 2003**

There are few population-based data on the effectiveness, or otherwise, of BCG vaccine in preventing severe tuberculosis in HIV-positive infants. Given the high prevalence of HIV and tuberculosis in certain countries and of the current development of new tuberculosis vaccines, some of which are based on BCG, GACVS advises no change in the current recommendations for BCG immunization of infants in countries with a high prevalence of tuberculosis and that population-based studies should be undertaken to determine the efficacy and safety of BCG and related vaccines in HIV-negative and HIV-positive children in countries with a high endemic rate of tuberculosis.
BCG vaccine (WHO position paper)

BCG vaccination is indicated

- for all infants living in areas where TB is highly endemic (concerning HIV, see below);
- for infants and children at particular risk of TB exposure in otherwise low-endemic areas;
- for persons exposed to multidrug-resistant Mtb (impact not established.)

BCG vaccination is contraindicated

- for persons with impaired immunity symptomatic HIV infection, known or suspected congenital immunodeficiency, leukaemia, lymphoma or generalized malignant disease);
- for patients under immunosuppressive treatment (corticosteroids, alkylating agents, antimetabolites, radiation);
- in pregnancy.

Hepatitis B

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

WHO recommended vaccine storage conditions (Appendix 17_3).

Vaccine introduction guidelines. Adding a vaccine to a national immunization programme: decision and implementation

WHO recommends the following schedule for infants (Appendix 39_5).

Temperature sensitivity of vaccines

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 -15oC and -25oC. Freeze-dried vaccines (i.e., BCG, measles, MMR and yellow fever) may also be kept frozen at -15oC to -25oC 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 +2oC and +8oC. All other vaccines should be stored at between +2oC and +8oC 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.
Proper handling and reconstitution of vaccines avoids programme errors

WHO no longer recommends that freeze-dried vaccines (measles, yellow fever, Hib and BCG) be shipped and stored at 20°C. Storing them at 20°C is not harmful but is unnecessary and uses up valuable storage space in the deep-freeze. Instead, they should be kept in refrigeration and transported at +2 to +8°C.

Getting started with vaccine vial monitors

Opened vials of measles, yellow fever, BCG and freeze-dried Hib vaccine cannot be used after an initial immunization session, (even if the VVM has not reached the discard point.). They must be discarded within six hours of reconstitution or at the end of the session, whichever comes first. The VVMs for these vaccines are attached to the vial caps and should be discarded when the vaccine is being reconstituted.

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

WHO recommended vaccine storage conditions (Appendix 17_3).

WHO no longer recommends that freeze-dried vaccines (measles, yellow fever, Hib and BCG) be shipped and stored at -20°C. Storing them at -20°C is not harmful but is unnecessary. Instead, these vaccines should be stored and transported at +2°C to +8°C.

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

The revised (multi-dose vial) policy does not change recommended procedures for handling vaccines that must be reconstituted, that is, BCG, measles, yellow fever, and some formulations of Hib vaccines. Once they are reconstituted, vials of these vaccines must be discarded at the end of each immunization session or at the end of six hours, whichever comes first.

Vaccine introduction guidelines. Adding a vaccine to a national immunization programme: decision and implementation

WHO recommends the following schedule for infants (Appendix 39_5).
Temperature sensitivity of vaccines

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.

MMR

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

WHO recommended vaccine storage conditions (Appendix 17_3).

Temperature sensitivity of vaccines

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.

Ensuring the quality of vaccines at country level: Guidelines for health staff

At the higher levels of the cold chain, i.e. at the national (central) and regional or provincial levels, OPV must be kept frozen between -15°C and -25°C.

Freeze-dried vaccines, i.e. BCG, measles, MMR and yellow fever vaccines, may also be kept in this temperature range (-15°C and -25°C) if there is sufficient space in the cold chain, but this is neither essential nor recommended. At other levels of the cold chain these vaccines should be stored between +2°C and +8°C. All other national immunization service vaccines should be stored between +2°C and +8°C at all levels of the cold chain.
### Measles

**Proper handling and reconstitution of vaccines avoids programme errors**  
Reconstituted BCG, measles and yellow fever vaccines must be kept cooled and must be discarded after 6 hours after reconstitution.

**Proper handling and reconstitution of vaccines avoids programme errors**  
It is no longer necessary to ship and store freeze-dried vaccines (measles, yellow fever and BCG) at 20C. Instead, they may be refrigerated at +2 to +8C.

**Proper handling and reconstitution of vaccines avoids programme errors**  
WHO no longer recommends that freeze-dried vaccines (measles, yellow fever, Hib and BCG) be shipped and stored at 20C. Storing them at 20C is not harmful but is unnecessary and uses up valuable storage space in the deep-freeze. Instead, they should be kept in refrigeration and transported at +2 to +8C.

**Thermostability of vaccines**  
Reconstituted vaccines against measles, yellow fever and tuberculosis (BCG) are unstable vaccines; they should be used as soon as possible after reconstitution, be kept in a ice bath during the immunization session and should be discarded at the end of the session.

**Getting started with vaccine vial monitors**  
Opened vials of measles, yellow fever, BCG and freeze-dried Hib vaccine cannot be used after an initial immunization session, (even if the VVM has not reached the discard point.). They must be discarded within six hours of reconstitution or at the end of the session, whichever comes first. The VVMs for these vaccines are attached to the vial caps and should be discarded when the vaccine is being reconstituted.

**WHO-UNICEF effective vaccine store management initiative: Modules 1 - 4**  
WHO recommended vaccine storage conditions (Appendix 17_3).

**WHO-UNICEF effective vaccine store management initiative: Modules 1 - 4**  
WHO no longer recommends that freezedried vaccines (measles, yellow fever, Hib and BCG) be shipped and stored at -20C. Storing them at -20C is not harmful but is unnecessary. Instead, these vaccines should be stored and transported at +2C to +8C.
The use of opened multi-dose vials of vaccine in subsequent immunization sessions (WHO Policy Statement)

The revised (multi-dose vial) policy does not change recommended procedures for handling vaccines that must be reconstituted, that is, BCG, measles, yellow fever, and some formulations of Hib vaccines. Once they are reconstituted, vials of these vaccines must be discarded at the end of each immunization session or at the end of six hours, whichever comes first.

Vaccine introduction guidelines. Adding a vaccine to a national immunization programme: decision and implementation

WHO recommends the following schedule for infants (Appendix 39_5).

Temperature sensitivity of vaccines

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 -15oC and -25oC. Freeze-dried vaccines (i.e., BCG, measles, MMR and yellow fever) may also be kept frozen at -15oC to - 25oC 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 +2oC and +8oC. All other vaccines should be stored at between +2oC and +8oC 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.

Ensuring the quality of vaccines at country level: Guidelines for health staff

At the higher levels of the cold chain, i.e. at the national (central) and regional or provincial levels, OPV must be kept frozen between -15C and - 25C.

Freeze-dried vaccines, i.e. BCG, measles, MMR and yellow fever vaccines, may also be kept in this temperature range (-15C and -25C) if there is sufficient space in the cold chain, but this is neither essential nor recommended. At other levels of the cold chain these vaccines should be stored between +2C and +8C. All other national immunization service vaccines should be stored between +2C and +8C at all levels of the cold chain.
Meningococcal

Temperature sensitivity of vaccines

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.

Mumps

Temperature sensitivity of vaccines

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.

Open Vials

Getting started with vaccine vial monitors

Opened vials of measles, yellow fever, BCG and freeze-dried Hib vaccine cannot be used after an initial immunization session, (even if the VVM has not reached the discard point.). They must be discarded within six hours of reconstitution or at the end of the session, whichever comes first. The VVMs for these vaccines are attached to the vial caps and should be discarded when the vaccine is being reconstituted.
The use of opened multi-dose vials of vaccine in subsequent immunization sessions (WHO Policy Statement)

The revised (multi-dose vial) policy does not change recommended procedures for handling vaccines that must be reconstituted, that is, BCG, measles, yellow fever, and some formulations of Hib vaccines. Once they are reconstituted, vials of these vaccines must be discarded at the end of each immunization session or at the end of six hours, whichever comes first.

Pentavalent

Temperature sensitivity of vaccines

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.

Policy

Proper handling and reconstitution of vaccines avoids programme errors

Reconstituted BCG, measles and yellow fever vaccines must be kept cooled and must be discarded after 6 hours after reconstitution.

Proper handling and reconstitution of vaccines avoids programme errors

It is no longer necessary to ship and store freeze-dried vaccines (measles, yellow fever and BCG) at 20°C. Instead, they may be refrigerated at +2 to +8°C.

Proper handling and reconstitution of vaccines avoids programme errors

WHO no longer recommends that freeze-dried vaccines (measles, yellow fever, Hib and BCG) be shipped and stored at 20°C. Storing them at 20°C is not harmful but is unnecessary and uses up valuable storage space in the deep-freeze. Instead, they should be kept in refrigeration and transported at +2 to +8°C.
Thermostability of vaccines

Reconstituted vaccines against measles, yellow fever and tuberculosis (BCG) are unstable vaccines; they should be used as soon as possible after reconstitution, be kept in an ice bath during the immunization session and should be discarded at the end of the session.

Surveillance of Adverse Events Following Immunization

All immunization programmes should monitor at least the following AEFIs:
1. All injection site abscesses.
2. All cases of BCG lymphadenitis.
3. All deaths that are thought by health workers, or the public, to be related to immunization.
4. All cases requiring hospitalization that are thought by health workers, or the public, to be related to immunization.
5. Other severe or unusual medical incidents that are thought by health workers, or the public, to be related to immunization.

With respect to the third, fourth, and fifth events, health workers may relate the event to immunization because it occurred within a month of an immunization, as its case definition indicates. However, some medical incidents can be related to immunization even if they have a delayed onset.

Thermostability of vaccines

An ADT (accelerated degradation test) should be conducted on each lot of BCG vaccine. The number of culturable particles in vaccine incubated at 37°C for 28 days should be not less than 20% of that in the vaccine stored at 4°C.

Freeze-dried BCG vaccines, regardless of their substrain, are sensitive to ultraviolet and fluorescent light. They should be packed in ampoules made from a substance of low light transmittance, such as amber glass, and should be protected from light when used.

Reconstituted BCG vaccine is very unstable and should be used during one working session of five to six hours. Residual vaccine should be discarded at the end of the session.
Getting started with vaccine vial monitors

Opened vials of measles, yellow fever, BCG and freeze-dried Hib vaccine cannot be used after an initial immunization session, (even if the VVM has not reached the discard point.). They must be discarded within six hours of reconstitution or at the end of the session, whichever comes first. The VVMs for these vaccines are attached to the vial caps and should be discarded when the vaccine is being reconstituted.

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

WHO recommended vaccine storage conditions (Appendix 17_3).

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

WHO no longer recommends that freezedried vaccines (measles, yellow fever, Hib and BCG) be shipped and stored at -20C. Storing them at -20C is not harmful but is unnecessary. Instead, these vaccines should be stored and transported at +2C to +8C.

BCG vaccine (WHO position paper)

Unfortunately, the (BCG) vaccine does not fully meet the essential requirement of having a significant impact against the most common manifestation of TB, namely pulmonary disease. Despite the shortcomings of this vaccine, WHO continues to recommend that a single dose of BCG be given to neonates or as soon as possible after birth in countries with a high prevalence of TB.

BCG vaccine (WHO position paper)

Since severe adverse effects of BCG vaccination are extremely rare even in asymptomatic, HIV-positive infants, all healthy neonates should be BCG-vaccinated, even in areas endemic for HIV. However, where resources permit, long-term follow-up of BCG-vaccinated infants of known HIV-positive mothers is desirable for early treatment, should disseminated BCG disease occur in children with rapid development of immunodeficiency.

BCG vaccine (WHO position paper)

Infants and children with symptomatic human immunodeficiency virus (HIV) or those known to have other immunodeficiency states should not be BCGvaccinated.

BCG vaccine (WHO position paper)

In cases where infants have been exposed to smear-positive pulmonary TB shortly after birth, BCG vaccination should be delayed until completion of 6 months of prophylactic isoniazid treatment.
Countries with a low burden of TB may choose to limit BCG vaccination to neonates and infants of recognized high-risk groups for the disease or to skin-test-negative older children. In some low-burden populations, BCG vaccination has been largely replaced by intensified case detection and supervised early treatment.

There is no proven benefit of repeated BCG vaccination against TB. This also applies to revaccination of BCG-vaccinated individuals who remain negative by subsequent tuberculin testing.

The BCG vaccine should be manufactured according to the current recommendations published in the report of the WHO Expert Committee on Biological Standardization.

Improved TB vaccines are widely seen as a key element for successful TB control, and the development of efficient, safe and affordable vaccines against TB must remain a global priority.

WHO recommends intradermal application of the (BCG) vaccine, preferably on the deltoid region of the arm using syringe and needle, although other application methods such as the multiple puncture technique are practised in some countries. Newborn vaccinees normally receive half the dose given to older children. BCG vaccine can be given simultaneously with other childhood vaccines.

In the absence of a scar in children in high-burden countries, BCG vaccination is indicated.

In low-burden countries, good protection against primary TB may also be achieved following vaccination of skin-test-negative adults. BCG vaccination of skin-test-positive individuals, whether induced by environmental mycobacteria, Mycobacterium tuberculosis (Mtbb) or BCG does not improve immunity to TB.
BCG vaccine (WHO position paper)

HIV-positive infants may receive BCG vaccine only when asymptomatic and living in areas where TB is highly endemic. Long-term follow-up of such children following vaccination is desirable. HIV-positive, asymptomatic infants in low-burden areas should not be BCG-vaccinated. Indications for vaccination of groups likely to contract HIV should always be considered carefully. The efficacy of BCG vaccination in HIV-infected infants is not known.

BCG vaccine (WHO position paper)

Given the high risk of acquiring TB and the low risk of serious adverse events following BCG vaccination of HIV-exposed neonates, WHO maintains that, in HIV-infected areas, all neonates be given BCG. Older infants or children suspected of being HIV-infected should not be vaccinated if they have symptomatic disease or other evidence of immunosuppression.

BCG vaccine (WHO position paper)

To change from general to selective BCG vaccination, an efficient notification system must be in place in addition to the following criteria:

- an average annual notification rate of smear-positive pulmonary TB cases below 5 per 100 000; or
- an average annual notification rate of tuberculous meningitis in children aged under five years below 1 per 10 million population during the previous five years; or
- an average annual risk of tuberculous infection below 0.1%.

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

The revised (multi-dose vial) policy does not change recommended procedures for handling vaccines that must be reconstituted, that is, BCG, measles, yellow fever, and some formulations of Hib vaccines. Once they are reconstituted, vials of these vaccines must be discarded at the end of each immunization session or at the end of six hours, whichever comes first.

Vaccine introduction guidelines. Adding a vaccine to a national immunization programme: decision and implementation

WHO recommends the following schedule for infants (Appendix 39_5).
Temperature sensitivity of vaccines

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 -15oC and -25oC. Freeze-dried vaccines (i.e., BCG, measles, MMR and yellow fever) may also be kept frozen at -15oC to -25oC 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 +2oC and +8oC. All other vaccines should be stored at between +2oC and +8oC 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.

Temperature sensitivity of vaccines

An ADT should be conducted on each lot of BCG vaccine. The number of CPs (culturable particles) in vaccine incubated at 37C for 28 days should be not less than 20% of that in the vaccine stored at 4C.

Temperature sensitivity of vaccines

Reconstituted BCG vaccine is very unstable, must be kept cold, and must be discarded within six hours of reconstitution. The reasons for these precautions are as follows:
1. There is a risk of contamination because BCG vaccine, like other lyophilized live vaccines, does not contain any bacteriostatic agent. For this reason, WHO recommends that reconstituted lyophilized vaccine should be kept cold and discarded at the end of six hours.
2. There is a loss of potency.

Once reconstituted, all BCG vaccines should be kept cold and discarded within six hours, regardless of how many doses remain in the vial or ampoule.

Temperature sensitivity of vaccines

Freeze-dried BCG vaccines, regardless of their substrain, are sensitive to ultraviolet and fluorescent light. They should be protected from light when used.
Ensuring the quality of vaccines at country level: Guidelines for health staff

At the higher levels of the cold chain, i.e. at the national (central) and regional or provincial levels, OPV must be kept frozen between -15C and -25C.

Freeze-dried vaccines, i.e. BCG, measles, MMR and yellow fever vaccines, may also be kept in this temperature range (-15C and -25C) if there is sufficient space in the cold chain, but this is neither essential nor recommended. At other levels of the cold chain these vaccines should be stored between +2C and +8C. All other national immunization service vaccines should be stored between +2C and +8C at all levels of the cold chain.

Temperature sensitivity of vaccines

Freeze-dried BCG vaccines, regardless of their substrain, are sensitive to ultraviolet and fluorescent light. They should be protected from light when used.

State of the art of new vaccines: research and development

Since 1974, BCG vaccination has been included in the WHO Expanded Programme on Immunization (EPI).

BCG vaccine (WHO position paper)

BCG vaccination is indicated

- for all infants living in areas where TB is highly endemic (concerning HIV, see below);
- for infants and children at particular risk of TB exposure in otherwise low-endemic areas;
- for persons exposed to multidrug-resistant Mtb (impact not established.)

BCG vaccination is contraindicated

- for persons with impaired immunity symptomatic HIV infection, known or suspected congenital immunodeficiency, leukaemia, lymphoma or generalized malignant disease);
- for patients under immunosuppressive treatment (corticosteroids, alkylating agents, antimetabolites, radiation);
- in pregnancy.

Polio

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

WHO recommended vaccine storage conditions (Appendix 17_3).
Vaccine introduction guidelines. Adding a vaccine to a national immunization programme: decision and implementation

WHO recommends the following schedule for infants (Appendix 39_5).

Temperature sensitivity of vaccines

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 -15oC and -25oC. Freeze-dried vaccines (i.e., BCG, measles, MMR and yellow fever) may also be kept frozen at -15oC to -25oC 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 +2oC and +8oC. All other vaccines should be stored at between +2oC and +8oC 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.

Ensuring the quality of vaccines at country level: Guidelines for health staff

At the higher levels of the cold chain, i.e. at the national (central) and regional or provincial levels, OPV must be kept frozen between -15C and -25C.

Freeze-dried vaccines, i.e. BCG, measles, MMR and yellow fever vaccines, may also be kept in this temperature range (-15C and -25C) if there is sufficient space in the cold chain, but this is neither essential nor recommended. At other levels of the cold chain these vaccines should be stored between +2C and +8C. All other national immunization service vaccines should be stored between +2C and +8C at all levels of the cold chain.
Pregnant Women

**BCG vaccine (WHO position paper)**

**BCG vaccination is indicated**

- For all infants living in areas where TB is highly endemic (concerning HIV, see below);
- For infants and children at particular risk of TB exposure in otherwise low-endemic areas;
- For persons exposed to multidrug-resistant Mtb (impact not established.)

**BCG vaccination is contraindicated**

- For persons with impaired immunity: symptomatic HIV infection, known or suspected congenital immunodeficiency, leukaemia, lymphoma or generalized malignant disease;
- For patients under immunosuppressive treatment (corticosteroids, alkylating agents, antimetabolites, radiation);
- In pregnancy.

**Program Management**

**BCG vaccine (WHO position paper)**

To change from general to selective BCG vaccination, an efficient notification system must be in place in addition to the following criteria:

- An average annual notification rate of smear-positive pulmonary TB cases below 5 per 100,000; or
- An average annual notification rate of tuberculous meningitis in children aged under five years below 1 per 10 million population during the previous five years; or
- An average annual risk of tuberculous infection below 0.1%.

**Research**

**BCG vaccine (WHO position paper)**

Improved TB vaccines are widely seen as a key element for successful TB control, and the development of efficient, safe and affordable vaccines against TB must remain a global priority.
Global Advisory Committee on Vaccine Safety, 34 December 2003

There are few population-based data on the effectiveness, or otherwise, of BCG vaccine in preventing severe tuberculosis in HIV-positive infants. Given the high prevalence of HIV and tuberculosis in certain countries and of the current development of new tuberculosis vaccines, some of which are based on BCG, GACVS advises no change in the current recommendations for BCG immunization of infants in countries with a high prevalence of tuberculosis and that population-based studies should be undertaken to determine the efficacy and safety of BCG and related vaccines in HIV-negative and HIV-positive children in countries with a high endemic rate of tuberculosis.

Rubella

Temperature sensitivity of vaccines

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 -15oC and -25oC. Freeze-dried vaccines (i.e., BCG, measles, MMR and yellow fever) may also be kept frozen at -15oC to -25oC 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 +2oC and +8oC. All other vaccines should be stored at between +2oC and +8oC 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.

Schedule

BCG vaccine (WHO position paper)

Unfortunately, the (BCG) vaccine does not fully meet the essential requirement of having a significant impact against the most common manifestation of TB, namely pulmonary disease. Despite the shortcomings of this vaccine, WHO continues to recommend that a single dose of BCG be given to neonates or as soon as possible after birth in countries with a high prevalence of TB.

BCG vaccine (WHO position paper)

Since severe adverse effects of BCG vaccination are extremely rare even in asymptomatic, HIV-positive infants, all healthy neonates should be BCG-vaccinated, even in areas endemic for HIV. However, where resources permit, long-term follow-up of BCG-vaccinated infants of known HIV-positive mothers is desirable for early treatment, should disseminated BCG disease occur in children with rapid development of immunodeficiency.
BCG vaccine (WHO position paper)
In cases where infants have been exposed to smear-positive pulmonary TB shortly after birth, BCG vaccination should be delayed until completion of 6 months of prophylactic isoniazid treatment.

BCG vaccine (WHO position paper)
Countries with a low burden of TB may choose to limit BCG vaccination to neonates and infants of recognized high-risk groups for the disease or to skin-test negative older children. In some low-burden populations, BCG vaccination has been largely replaced by intensified case detection and supervised early treatment.

BCG vaccine (WHO position paper)
There is no proven benefit of repeated BCG vaccination against TB. This also applies to revaccination of BCG-vaccinated individuals who remain negative by subsequent tuberculin testing.

Global Advisory Committee on Vaccine Safety, 34 December 2003
There are few population-based data on the effectiveness, or otherwise, of BCG vaccine in preventing severe tuberculosis in HIV-positive infants. Given the high prevalence of HIV and tuberculosis in certain countries and of the current development of new tuberculosis vaccines, some of which are based on BCG, GACVS advises no change in the current recommendations for BCG immunization of infants in countries with a high prevalence of tuberculosis and that population-based studies should be undertaken to determine the efficacy and safety of BCG and related vaccines in HIV-negative and HIV-positive children in countries with a high endemic rate of tuberculosis.
Vaccine introduction guidelines. Adding a vaccine to a national immunization programme: decision and implementation

WHO recommends the following schedule for infants (Appendix 39.5).

State of the art of new vaccines: research and development

Since 1974, BCG vaccination has been included in the WHO Expanded Programme on Immunization (EPI)

BCG vaccine (WHO position paper)

BCG vaccination is indicated

- for all infants living in areas where TB is highly endemic (concerning HIV, see below);
- for infants and children at particular risk of TB exposure in otherwise low-endemic areas;
- for persons exposed to multidrug-resistant Mtb (impact not established.)

BCG vaccination is contraindicated

- for persons with impaired immunity symptomatic HIV infection, known or suspected congenital immunodeficiency, leukaemia, lymphoma or generalized malignant disease);
- for patients under immunosuppressive treatment (corticosteroids, alkylating agents, antimetabolites, radiation);
- in pregnancy.

Tetanus

Temperature sensitivity of vaccines

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 -15oC and -25oC. Freeze-dried vaccines (i.e., BCG, measles, MMR and yellow fever) may also be kept frozen at -15oC to -25oC 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 +2oC and +8oC. All other vaccines should be stored at between +2oC and +8oC 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.
## Vaccine Administration

### BCG vaccine (WHO position paper)

WHO recommends intradermal application of the (BCG) vaccine, preferably on the deltoid region of the arm using syringe and needle, although other application methods such as the multiple puncture technique are practised in some countries. Newborn vaccinees normally receive half the dose given to older children. BCG vaccine can be given simultaneously with other childhood vaccines.

### Vaccine Handling

#### Proper handling and reconstitution of vaccines avoids programme errors

Reconstituted BCG, measles and yellow fever vaccines must be kept cooled and must be discarded after 6 hours after reconstitution.

#### Proper handling and reconstitution of vaccines avoids programme errors

It is no longer necessary to ship and store freeze-dried vaccines (measles, yellow fever and BCG) at 20°C. Instead, they may be refrigerated at +2 to +8°C.

#### Proper handling and reconstitution of vaccines avoids programme errors

WHO no longer recommends that freeze-dried vaccines (measles, yellow fever, Hib and BCG) be shipped and stored at 20°C. Storing them at 20°C is not harmful but is unnecessary and uses up valuable storage space in the deep-freeze. Instead, they should be kept in refrigeration and transported at +2 to +8°C.

#### Thermostability of vaccines

Reconstituted vaccines against measles, yellow fever and tuberculosis (BCG) are unstable vaccines; they should be used as soon as possible after reconstitution, be kept in a ice bath during the immunization session and should be discarded at the end of the session.

#### Thermostability of vaccines

Freeze-dried BCG vaccines, regardless of their substrain, are sensitive to ultraviolet and fluorescent light. They should be packed in ampoules made from a substance of low light transmittance, such as amber glass, and should be protected from light when used.
Thermostability of vaccines

Reconstituted BCG vaccine is very unstable and should be used during one working session of five to six hours. Residual vaccine should be discarded at the end of the session.

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

WHO recommended vaccine storage conditions (Appendix 17_3).

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

WHO no longer recommends that freezedried vaccines (measles, yellow fever, Hib and BCG) be shipped and stored at -20C. Storing them at -20C is not harmful but is unnecessary. Instead, these vaccines should be stored and transported at +2C to +8C.

Temperature sensitivity of vaccines

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 -15oC and -25oC. Freeze-dried vaccines (i.e., BCG, measles, MMR and yellow fever) may also be kept frozen at -15oC to -25oC 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 +2oC and +8oC. All other vaccines should be stored at between +2oC and +8oC 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.

Temperature sensitivity of vaccines

Reconstituted BCG vaccine is very unstable, must be kept cold, and must be discarded within six hours of reconstitution. The reasons for these precautions are as follows:

1. There is a risk of contamination because BCG vaccine, like other lyophilized live vaccines, does not contain any bacteriostatic agent. For this reason, WHO recommends that reconstituted lyophilized vaccine should be kept cold and discarded at the end of six hours.

2. There is a loss of potency.

Once reconstituted, all BCG vaccines should be kept cold and discarded within six hours, regardless of how many doses remain in the vial or ampoule.
**Temperature sensitivity of vaccines**

Freeze-dried BCG vaccines, regardless of their substrain, are sensitive to ultraviolet and fluorescent light. They should be protected from light when used.

**Ensuring the quality of vaccines at country level: Guidelines for health staff**

At the higher levels of the cold chain, i.e. at the national (central) and regional or provincial levels, OPV must be kept frozen between -15C and -25C.

Freeze-dried vaccines, i.e. BCG, measles, MMR and yellow fever vaccines, may also be kept in this temperature range (-15C and -25C) if there is sufficient space in the cold chain, but this is neither essential nor recommended. At other levels of the cold chain these vaccines should be stored between +2C and +8C. All other national immunization service vaccines should be stored between +2C and +8C at all levels of the cold chain.

**Vaccine Quality**

**Thermostability of vaccines**

An ADT (accelerated degradation test) should be conducted on each lot of BCG vaccine. The number of culturable particles in vaccine incubated at 37C for 28 days should be not less than 20% of that in the vaccine stored at 4C.

**BCG vaccine (WHO position paper)**

The BCG vaccine should be manufactured according to the current recommendations published in the report of the WHO Expert Committee on Biological Standardization.

**Temperature sensitivity of vaccines**

An ADT should be conducted on each lot of BCG vaccine. The number of CPs (culturable particles) in vaccine incubated at 37C for 28 days should be not less than 20% of that in the vaccine stored at 4C.
Yellow Fever

Proper handling and reconstitution of vaccines avoids programme errors

Reconstituted BCG, measles and yellow fever vaccines must be kept cooled and must be discarded after 6 hours after reconstitution.

Proper handling and reconstitution of vaccines avoids programme errors

It is no longer necessary to ship and store freeze-dried vaccines (measles, yellow fever and BCG) at 20C. Instead, they may be refrigerated at +2 to +8C.

Proper handling and reconstitution of vaccines avoids programme errors

WHO no longer recommends that freeze-dried vaccines (measles, yellow fever, Hib and BCG) be shipped and stored at 20C. Storing them at 20C is not harmful but is unnecessary and uses up valuable storage space in the deep-freeze. Instead, they should be kept in refrigeration and transported at +2 to +8C.

Thermostability of vaccines

Reconstituted vaccines against measles, yellow fever and tuberculosis (BCG) are unstable vaccines; they should be used as soon as possible after reconstitution, be kept in a ice bath during the immunization session and should be discarded at the end of the session.

Getting started with vaccine vial monitors

Opened vials of measles, yellow fever, BCG and freeze-dried Hib vaccine cannot be used after an initial immunization session, (even if the VVM has not reached the discard point.). They must be discarded within six hours of reconstitution or at the end of the session, whichever comes first. The VVMs for these vaccines are attached to the vial caps and should be discarded when the vaccine is being reconstituted.

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

WHO recommended vaccine storage conditions (Appendix 17_3).

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

WHO no longer recommends that freezedried vaccines (measles, yellow fever, Hib and BCG) be shipped and stored at -20C. Storing them at -20C is not harmful but is unnecessary. Instead, these vaccines should be stored and transported at +2C to +8C.
The use of opened multi-dose vials of vaccine in subsequent immunization sessions (WHO Policy Statement)

The revised (multi-dose vial) policy does not change recommended procedures for handling vaccines that must be reconstituted, that is, BCG, measles, yellow fever, and some formulations of Hib vaccines. Once they are reconstituted, vials of these vaccines must be discarded at the end of each immunization session or at the end of six hours, whichever comes first.

Vaccine introduction guidelines. Adding a vaccine to a national immunization programme: decision and implementation

WHO recommends the following schedule for infants (Appendix 39_5).

Temperature sensitivity of vaccines

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.

Ensuring the quality of vaccines at country level: Guidelines for health staff

At the higher levels of the cold chain, i.e. at the national (central) and regional or provincial levels, OPV must be kept frozen between -15°C and -25°C.

Freeze-dried vaccines, i.e. BCG, measles, MMR and yellow fever vaccines, may also be kept in this temperature range (-15°C and -25°C) if there is sufficient space in the cold chain, but this is neither essential nor recommended. At other levels of the cold chain these vaccines should be stored between +2°C and +8°C. All other national immunization service vaccines should be stored between +2°C and +8°C at all levels of the cold chain.