Mid-Level Management Course for EPI Managers

BLOCK III: Logistics

Module 9: Immunization safety

World Health Organization
REGIONAL OFFICE FOR Africa

Mid-Level Management Course for EPI Managers

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BLOCK III: Logistics

Module 9: Immunization safety

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ISBN 978-929023382-4

Suggested citation. Module 9: Immunization safety.
Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO.

Cataloguing-in-Publication (CIP) data. CIP data are available at http://apps.who.int/iris.

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Acknowledgements

The WHO Regional Office for Africa is grateful to all the resource persons from WHO headquarters, regional, subregional and country offices who have contributed to the revision of the Mid-Level Management training modules, and also to partners, especially, the United Nations Children's Fund (UNICEF); United States Agency for International Aid (USAID); John Snow, Inc.; Centers for Disease Control and Prevention (CDC), Atlanta; the Bill & Melinda Gates Foundation (BMGF) and the Network for Education and Support in Immunisation (NESI) for their contribution in this revision exercise.

Abbreviations and acronyms

AD	auto-disable (syringes)
ADR	acute drug reactions
AEFI	adverse events following immunization
AFP	acute flaccid paralysis
CIOMS	Council for International Organizations of Medical Sciences
cMYP	comprehensive multi-year plan
CSF	cerebrospinal fluid
DHMT	district health management team
DIO	district immunization officer
DT	diphtheria and tetanus vaccine
DTP	diphtheria-tetanus-pertussis-containing vaccine
EPI	Expanded Programme on Immunization
GAPPD	Global Action Plan for the Prevention and Control of Pneumonia and Diarrhoea
Gavi	Global Alliance for Vaccines and Immunization
GLP	good laboratory practices
GMP	good manufacturing practices
GVAP	Global Vaccine Action Plan (2011–2020)
HepB	hepatitis B vaccine
HHE	hypotonic-hyporesponsive episode
Hib	*Haemophilus influenzae* type b vaccine
HIV/AIDS	human immunodeficiency virus/acquired immunodeficiency syndrome
IVD	immunization and vaccine development
LAV	live attenuated vaccine
LRF	laboratory request form
MDVP	multi-dose vial policy
MOH	ministry of health
MR	measles, rubella (vaccine)
NGO	nongovernmental organization
NID	national immunization day
NIP	national immunization programme
NITAG	National Immunization Technical Advisory Group
NRA	national regulatory authority
OPV	oral polio vaccine
PATH	Programme for Appropriate Technology in Health

Penta	Pentavalent vaccine (e.g. DTP-HepB-Hib)
RED/REC	Reaching Every District/Reaching Every Community
RI	routine immunization
RSPI	Regional Strategic Plan for Immunization (2014–2020)
SIDS	sudden infant death syndrome
TSS	toxic shock syndrome
TST	time, steam and temperature (control spot)
V&B	Department of Vaccines and Biologicals (WHO/HQ)
VAPP	vaccine-associated paralytic polio
VPD	vaccine-preventable disease
VVM	vaccine vial monitor
WHO	World Health Organization

Glossary

AEFI	Adverse events following immunization – the World Health Organization defines an AEFI as any untoward medical occurrence which follows immunization and which does not necessary have a causal relationship with usage of the vaccine. The adverse event may be any unfavourable or unintended sign, abnormal laboratory finding, symptom or disease.
AEFI cluster	A cluster involves several AEFIs that occur within the same time frame with unusual frequency, by vaccine, by type of reaction or by locality or health facility.
AEFI investigation	A systematic process which includes epidemiological, statistical, laboratory methods and observations to find out the cause of AEFIs and to implement corrective or preventive measures.
Bundling/bundle	Bundling has been chosen to define the concept of a theoretical bundle, which must consist of each of the following items: good quality vaccines, AD (auto-disable) syringes, safety boxes. None of the component items can be considered alone; each component must be considered as part of a bundle containing the other two. Bundling does not necessarily mean that the items are actually packaged together in the same container however.
Causality	The relationship between two events (the cause and the effect), where the second event is a consequence of the first. A direct cause is a factor in absence of which the effect would not occur (necessary cause). Sometimes, there are multiple factors that can precipitate or function as co-factors for the effect (event) to occur.
Causality assessment	Determining if cause and effect relationship exists and if so to what extent.
Contraindication	A condition or a disease which makes an individual temporarily or definitely unfit for a specific vaccination.
Programme error	An error which is health worker related and is often caused by improper use of safety procedures or injection techniques: handling, reconstitution or administration of vaccine.
Reconstitution of vaccine	To restore to former condition and ready to use of freeze-dried/lyophilized vaccines using specific diluent for that vaccine.
Trigger event	Severe AEFI or unusual medical incident which stimulates a response: investigation, hospitalization, reporting.

Vaccine	Biological product prepared from killed or attenuated (weakened) virus or bacteria or their toxins, used for vaccinating people to induce specific immunity against an infectious disease.
Vaccine pharmacovigilance	The science and activities relating to the detection, assessment, understanding and communication of adverse events following the use of vaccine(s) and other vaccine- or immunization-related issues, and to the prevention of untoward effects of the vaccine or immunization.

1. Introduction

1.1 Context

The Expanded Programme on Immunization (EPI) is a key global health programme. Its overall goal is to provide effective and quality immunization services to target populations. EPI programme managers and staff need to have sound technical and managerial capacities in order to achieve the programme's goals.

The immunization system comprises five key operations: service delivery, communication, logistics, vaccine supply and quality, and surveillance. It also consists of three support components: management, financing and capacity strengthening.

National immunization systems are constantly undergoing change, notably those related to the introduction of new vaccines and new technologies, and programme expansion to reach broader target populations beyond young children. The EPI programme also faces external changes related to administrative decentralization, health reforms, as well as the evolving context of public-private partnerships (PPPs) for health, among others.

To ensure the smooth implementation of immunization programmes, EPI programme staff have to manage these changes. This requires specific skills in problem-solving, setting priorities, decision-making, planning and managing human, financial and material resources as well as monitoring implementation, supervision and evaluation of services.

National immunization programmes (NIPs) operate within the context of national health systems, in alignment with global and regional strategies. For the current decade, 2011–2020, the key global immunization strategies are conveyed through the Global Vaccine Action Plan (2011–2020) (GVAP) and the African Regional Strategic Plan for Immunization (2014–2020) (RSPI).

These strategic plans call on countries to:

- improve immunization coverage beyond current levels;
- complete interruption of poliovirus transmission and ensure virus containment;[1]
- attain the elimination of measles and make progress in the elimination of rubella and congenital rubella syndrome;[2] and
- attain and maintain elimination/control of other vaccine-preventable diseases (VPDs).

The key approaches for implementation of the GVAP/RSPI include:

- implementation of the Reaching Every District/Reaching Every Community (RED/REC) approach and other locally tailored approaches and move from supply-driven to demand-driven immunization services;
- extending the benefits of new vaccines to all;
- establishing sustainable immunization financing mechanisms;
- integrating immunization into national health policies and plans;
- ensuring that interventions are quantified, costed and incorporated into the various components of national health systems;
- enhancing partnerships for immunization;
- improving monitoring and data quality;
- improving human and institutional capacities;
- improving vaccine safety and regulation; and
- promoting implementation research and innovation.

The RSPI promotes integration using immunization as a platform for a range of priority interventions or as a component of a package of key interventions. Immunization is a central part of initiatives for the elimination and eradication of VPDs, and of the integrated Global Action Plan for the Prevention and Control of Pneumonia and Diarrhoea (GAPPD) by 2025.

It is understood that while implementing the above strategies, EPI managers will face numerous challenges and constraints that they need to resolve if the 2020 targets are to be met. Building national capacity in immunization service management at all levels of the health system is an essential foundation and key operational approach to achieving the goals of the global and regional strategic plans.

In view of this, the WHO Regional Office for Africa, in collaboration with key immunization partners such as the United Nations Children's Fund (UNICEF), United States Agency for International Development (Maternal and Child Survival Program) (USAID/MCSP), and the Network for Education and Support in Immunisation (NESI), have revised the Mid-Level Management Course for EPI Managers (MLM) training modules. These modules are complementary to other training materials including the Immunization in Practice (IIP) training manuals for health workers and the EPI/Integrated Management of Childhood Illnesses (IMCI) interactive training tool.

1 WHO, CDC and UNICEF (2012). Polio Eradication and Endgame Strategic Plan 2013-2018.
2 WHO (2012). Global Measles and Rubella Strategic Plan 2012-2020.

This module (9) titled *Immunization safety* is part of Block III: Logistics.

1.2 Purpose of the module

The purpose of this module is to enhance the skills of mid-level managers to guide, support and assist staff in carrying out their duties in ensuring the safety of immunizations. This training module enables the mid-level manager to ensure immunization safety through proper planning, implementation, communication, monitoring and evaluation of immunization safety at all levels.

1.3 Target audience

This module is intended for EPI managers at national and subnational level. However, any other health worker can benefit from reading this module. The module will also benefit teachers in training institutions who could include in their lesson plans immunization safety issues.

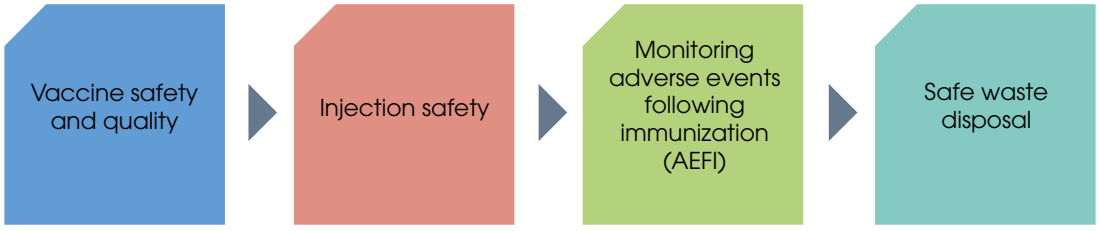
1.4 Learning objectives

At the end of this module, mid-level managers will be able to:

- understand vaccine and injection safety policies;
- apply recommended practices of vaccine and injection safety;
- manage/monitor adverse events following immunization (AEFI);
- conduct AEFI case investigation;
- communicate clearly and effectively in handling rumours and risks about vaccines and immunization; and
- apply safe waste disposal practices.

1.5 Contents of the module

This module is developed under four main sections:



1.6 How to use this module

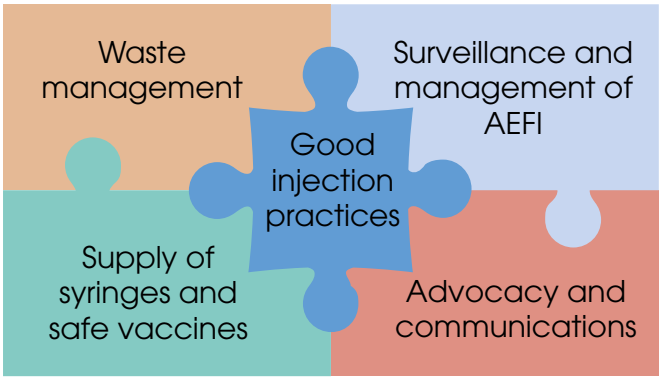
The module should be studied in small groups. Time should be given to work alone (read and complete exercises), in groups (role play) or in plenary sessions (feedback or slide presentations). Additionally, facilitators will:

- make available a set of all complementary documents for the participants;
- show the slide set on "giving safe injections";
- demonstrate the correct use of auto-disable (AD) syringes, reconstitution syringes and safety boxes; and
- optional: organize a field visit to observe waste disposal options (e.g. incineration).

2. Vaccine safety and quality

EPI managers should ensure that health workers involved in immunizations follow all the principles of immunization safety and ensure that every vaccination is given safely. They should also train the staff to be knowledgeable on how to manage waste materials, and how to monitor service delivery sufficiently, to be alert and responsive to any serious adverse event should it occur. As you can see from Figure 2.1 immunization safety is a wide subject area, ranging from good injection practices, supply of consumables, waste management to surveillance of AEFIs and advocacy and communication.

Figure 2.1 Components of immunization safety



2.1 Vaccine quality

Vaccine production is a biological process using live organisms, or their toxins, as raw material. Thus, the characteristic of each batch is subject to variation depending on growth conditions. The quality of the finished product cannot be determined solely by laboratory testing. Quality control requires full compliance with good manufacturing practices (GMP) and with good laboratory practices (GLP).

A good vaccine should have the following characteristics:

- prevent disease and infections or reduce the severity of the disease;
- give long-term protection;
- give immunity with minimal number of doses;
- contain more antigens and give protection against many diseases;
- not give many adverse events following immunization; and
- stability in extreme conditions of storage for long period.

It is essential that quality be ensured from the first step in the production process to the final packing of the product. Vaccine quality control is a complex and meticulous process and not all suppliers can assure quality. Not all private sector manufacturers in any country around the world are able to produce vaccines of a sufficient quality and quantity suitable for use in immunization programmes. Many producers make vaccines under manufacturing conditions and with product quality which does not meet WHO prequalification standards.

Vaccines are heat sensitive and must be stored and transported in a cold chain. Certain vaccines also are damaged by freezing and light. Even under the most favourable conditions, vaccines have a very limited shelf life (a maximum of two years).

Most countries now have national regulatory authorities (NRAs) to ensure that vaccines purchased are in compliance with international and national standards. The quality and efficacy of the vaccine should be maintained throughout its dispatch from manufacturers up to the time of arrival, transportation, storage and use.

Rules to observe before using vaccines

Before a health worker uses any vaccine, they must observe the following rules:
1. Check the label of the vaccine and diluent. If the label is not attached, discard the vaccine vial or diluent.
2. Check the expiry date. If the expiry date has already passed, the health worker must discard the vaccine vial or diluent.
3. Check the vaccine vial monitor (VVM). If it indicates that the vaccine has reached discard point, it must be discarded immediately.
4. If it is suspected that a freeze-sensitive vaccine has been frozen, the shake test should be performed (see Module 8: *Vaccine management*).
5. For each vaccine used. Health workers must know the:
   - Age at which each dose should be given.
   - Number of doses required and minimum intervals between doses.
   - Correct dosage (never inject or give less than the required dose of vaccine to any recipient).

2.2 The cold chain

All vaccines are heat sensitive and therefore should be stored and transported in adequate cold chain (see Module 8: *Vaccine management*). Wrong storage temperature may result in loss of vaccine potency and this in turn will reduce the strength of the immune response or result in an AEFI once administered. There are some indicators to monitor if vaccines have been exposed to heat or freezing conditions (e.g. VVM freezing indicator, 30 DTR/RMTD with alarms etc.). All programme managers should attach high priority to the maintenance of the cold chain (conditions of cold rooms, refrigerators, freezers, cold boxes, back-up generators, etc.), while storekeepers and repair technicians should receive adequate training to ensure proper functioning of the cold chain.

2.3 Multi-dose vial policy

As part of a policy to reduce vaccine wastage, WHO has developed guidelines on how to use vials of certain vaccines (not all vaccines) once they have been opened – the multi-dose vial policy (MDVP). All opened WHO-prequalified multi-dose vials of vaccines should be discarded at the end of the immunization session OR within six hours of opening, whichever comes first, UNLESS the vaccine meets all four of the criteria listed below. If the vaccine meets the four criteria, the opened vial can be kept and used for up to 28 days after opening. The criteria are:

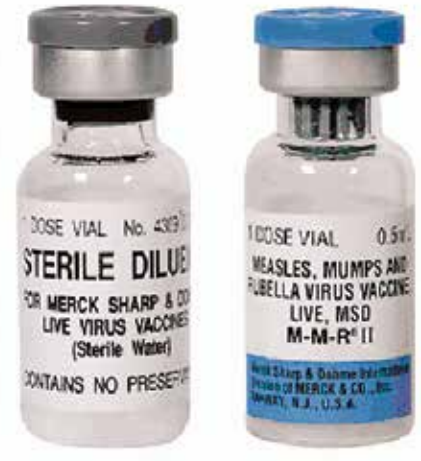
1. The vaccine is prequalified by WHO.
2. The vaccine is approved for use for up to 28 days after opening the vial, as determined by WHO (or manufacturer).
3. The expiry date of the vaccine has not passed.
4. The vaccine vial has been, and will continue to be, stored at WHO (or manufacturer) recommended temperatures; the vaccine vial monitor, if one is attached, is visible on the vaccine label and has not reached its discard point, and/or the vaccine has not been damaged by freezing.

2.4 Role of the diluent in immunization

Diluents supplied with a vaccine are part of the licensed product and are specific for each vaccine. The vaccine package is not complete without the diluent. They are specifically designed for the needs of each vaccine with respect to volume, pH and chemical properties of the final solution containing the immunizing agent. It is therefore essential that diluents for vaccines are stored, distributed and used in the proper way so that they are not the cause of damaged vaccines, adverse events or incorrect doses.

2.4.1 Basic information on diluents

Diluents vary in their composition. Not all diluents are sterile water for injection (this is a common misconception). Diluents may contain stabilizers that ensure heat stability of vaccines, bactericidal agents to maintain the sterility of the reconstituted vaccine, chemicals to assist in dissolving the vaccine into a liquid, and buffers to ensure correct pH (acid-alkali balance) is maintained.



In the past, the practice of supplying, transporting and storing diluents separately from the vaccine has caused confusion and resulted in shortages of the correct diluents in the field. Poorly labelled and identified vaccines and diluents have compounded this, as has the lack of adequate training of health workers.

Tragedies have occurred, related to reconstitution of freeze-dried vaccines with insulin, muscle relaxant and other wrong solutions. Managers should ensure that such products are NEVER stored in the same refrigerators as vaccines or in vaccine refrigerators or cold boxes. To avoid this confusion, WHO now encourages vaccines and diluents to be distributed together in what is called "bundling" (see glossary).

It is likely that many vaccines in the future will still require reconstitution with diluents. Diluents should be handled with the same care as vaccines, and vaccination staff should be trained to know the proper way to reconstitute each of the vaccines.

Recommendations for diluents

- Diluents should be shipped, stored and distributed together with the corresponding vaccine vials to be reconstituted.
- Diluents must NOT be frozen. They must be cooled to between +2°C and +8°C before reconstitution (to prevent vaccine shock due to sudden change in temperature: cold vaccine vs warm diluent).
- Do not leave the reconstitution needle in the vial; this leaves the vial open to contamination.
- Diluents for other types of vaccine or from other manufacturers must NOT be used.
- Distilled water for injection SHOULD NOT be used as a substitute for diluent.
- Check the expiry date of the diluent to make sure that it has not passed; discard it if otherwise.
- Never inject diluent for an oral vaccine. Such a diluent should be marked as suitable for oral use only.

2.4.2 Reconstitution of vaccines with diluent

Only the diluent supplied by the manufacturer should be used to reconstitute a freeze-dried vaccine. Before reconstitution read the label on the diluent carefully to confirm this. A reconstitution syringe must be used for adding the diluent to the vial or ampoule to the vaccine. Special care must be taken in opening ampoules to avoid loss of the dry vaccine. Reconstitution should be carried out as recommended by WHO, away from direct sunlight. Once reconstituted, the vaccine should be kept at cool temperature in the foam pad of the vaccine carrier to minimize the exposure to heat and light. The reconstituted vaccine must not be kept longer than six hours or must be discarded at the end of the session whichever comes first.

Some countries receive liquid DTP-HepB vaccine and lyophilized Hib vaccine as pentavalent formulation. In this case, the lyophilized Hib vaccine is reconstituted with liquid DTP-HepB vaccine. Although the lyophilized Hib vaccine can be frozen, liquid DTP-HepB vaccine should be store between +2°C to +8°C degrees, therefore the two vaccines should be stored and distributed together between +2°C to + 8°C degrees. Since the liquid DTP-HepB vaccine contains the preservative, the reconstituted vaccine DTP-HepB-Hib can be reused up to four weeks if the MDVP conditions are met.

Use of the MDVP with DTP-HepB-Hib vaccine, however, is recommended only if specific supervision and training are conducted to assure that this policy is appropriately implemented.

Cold chain officers, storekeepers and vaccinators should always:

- Include diluents in stock control.
- Check not be used and the supervisor must be notified immediately.
- Use only the diluent that is indicated for each type of vaccine.
- Withdraw all the quantity of the diluent to reconstitute the appropriate vaccine.
- Ensure that no other medication or substance, is stored in the same refrigerator with the vaccine at the immunization centre.

2.5 Contraindications to vaccinations

EPI recommends that health workers should use every opportunity to vaccinate eligible children and avoid so-called false contraindications. Based on numerous studies on this issue, the WHO confirms that there are only a few absolute or true contraindications to the EPI vaccines (see Annex 1).

Contraindications to vaccinations

- Persons with a history of anaphylactic reactions (difficulty in breathing, swelling of the mouth and throat, hypotension or shock) following egg ingestion should not receive vaccines prepared on hens' egg tissues (e.g. yellow fever and influenza vaccines).
- Children with symptomatic HIV infection/AIDS should not be immunized with yellow fever vaccine.
- According to the recommendation of Global Advisory Committee on Vaccine Safety (2010), children who are known to be HIV infected, even if asymptomatic, should no longer be immunized with BCG vaccine. (It has been established by research that these children, who later develop AIDS, are at high risk of developing "BCG disease" a type of AEFI caused by BCG vaccine itself.)
- A severe adverse event following a dose of vaccine (anaphylactic reaction) is a true contraindication to a subsequent dose of the same vaccine. A second or third dose of vaccine e.g. Penta injection should not be given to a child who has suffered such a severe anaphylactic reaction to the previous dose.

The risk of delaying an immunization because of a mild illness is that the child may not return and the opportunity is lost. Missed immunization opportunities because of false contraindications is the major cause of delay in completing the schedule, or of non-immunization at all.

Children with serious illness should be vaccinated as soon as their general condition improves and at least before discharge from hospital. Premature babies should be vaccinated on discharge.

It is particularly important to immunize children suffering from malnutrition. Low-grade fever, mild respiratory infection and other minor illnesses should not be considered as contraindications to immunization.

Conditions that are NOT contraindications to immunization

- Minor illnesses such as upper respiratory infections, or diarrhoea with fever <38.5°C.
- Allergy, asthma, hay fever or snuffles.
- Prematurity; low-birth-weight infants.
- Malnutrition.
- Child being breastfed.
- Family history of convulsions.
- Treatment with antibiotics, low-dose corticosteroids or locally acting steroids (e.g. topical or inhaled).
- Dermatoses, eczema or localized skin infections.
- Chronic diseases of the heart, lung, kidney and liver.
- Stable neurological conditions, such as cerebral palsy and Down's syndrome.
- History of jaundice after birth.

3. Injection safety

3.1 Injection safety policy

Since 1985, WHO policy is to use a sterile syringe and a sterile needle for every injection. Training materials have been developed to improve the skills of health personnel in cleaning, sterilizing and handling injection equipment. Various assessments of this policy, however, have shown that health workers often do not implement the policy due to lack of materials, knowledge or awareness of the risks. Sterilization is a time-consuming process, and its importance is not always recognized. There are other types of injection materials that are safer and simpler to use but the cost is slightly higher (AD syringe, retractable AD syringe, "Inject" etc.). WHO no longer recommends the use of standard plastic disposable injection equipment and sterilizable syringes and needles for immunization. Field workers often do not know the risk they take in recapping needles. Burning or disposing safely of waste is often considered a boring and unrewarding task.

Use a single-use auto-disable syringe and needle for each immunization or do not immunize!

The role of the EPI manager is of the utmost importance in planning, implementing, monitoring, supervising and evaluating safe immunization procedures. The commitment of management is essential to make this material available, develop health workers' skills to properly use them, make workers aware of immunization safety, improve communication and bring about positive behaviour changes. The manager is also responsible for the safety of the health personnel. They must minimize hazards to them by all means through prevention and control (good administration, correct work practices and education on safety).

A safe injection does not harm the recipient, does not expose the provider to any avoidable risk, and does not result in any waste that is dangerous for any other people.

3.2 Selection of equipment

Standard disposable syringes and needles should not be used for immunization purposes because there is no guarantee that they will be destroyed after a single use. WHO recommends the use of the following two types of injection equipment:

- single-use AD syringes
- pre-filled AD syringes.

3.2.1 Single-use AD syringes and needles

Single-use syringes and needles are appropriate for all types of immunization strategies, including use in fixed clinics, outreach sites and special campaigns. A sterile packaged AD syringe and needle must be used for each injection and they must be disposed of safely immediately after use.

The reuse of disposable syringes places the general public at high risk of disease and even death. Therefore, they are no longer recommended by WHO!

AD syringes are designed so that it is impossible to use them more than once. Consequently, they present the lowest risk of person-to-person transmission of blood-borne pathogens. AD syringes virtually eliminate the risk of patient-to-people (or carrier-to-people) transmission of blood-borne pathogens (such as hepatitis B or HIV) because they cannot be reused. Of course, they do not prevent needle stick injuries of health workers, particularly if recapping still takes place. AD syringes are now widely available at low cost. Indeed, AD syringes are currently the preferred equipment for administering vaccines, both in routine immunization (RI) and mass campaigns.

AD syringes are the preferred type of injection equipment for administering vaccines and should replace all other injection equipment. Main characteristics of AD syringes include:

- ensuring a single use only
- having a pre-set volume limit
- having a fixed needle of an appropriate gauge for immunization
- automatically becoming unusable after they have delivered a full dose.

Figure 3.1 Different types of AD syringes

Exercise 1

Task 1: During a demonstration of the use of AD syringes ask participants for their experience on possible difficulties in handling the materials.

Task 2: Conduct an open discussion on the following important points:

- There are not enough AD syringes to vaccinate all the children at the immunization session.
- After expelling air from the syringe there is no longer 0.5 ml of vaccine remaining in the syringe.

3.2.2 Pre-filled syringes

Pre-filled syringes are single-dose packets of vaccine to which a needle has been fixed by the manufacturer. This type of injection equipment can be used only once. Every pre-filled syringe and needle is sterilized and sealed in its own foil package by the manufacturer. Just before an injection, the health worker removes the foil and the cap that covers the needle. After the injection, the used syringe and needle must be disposed of safely.

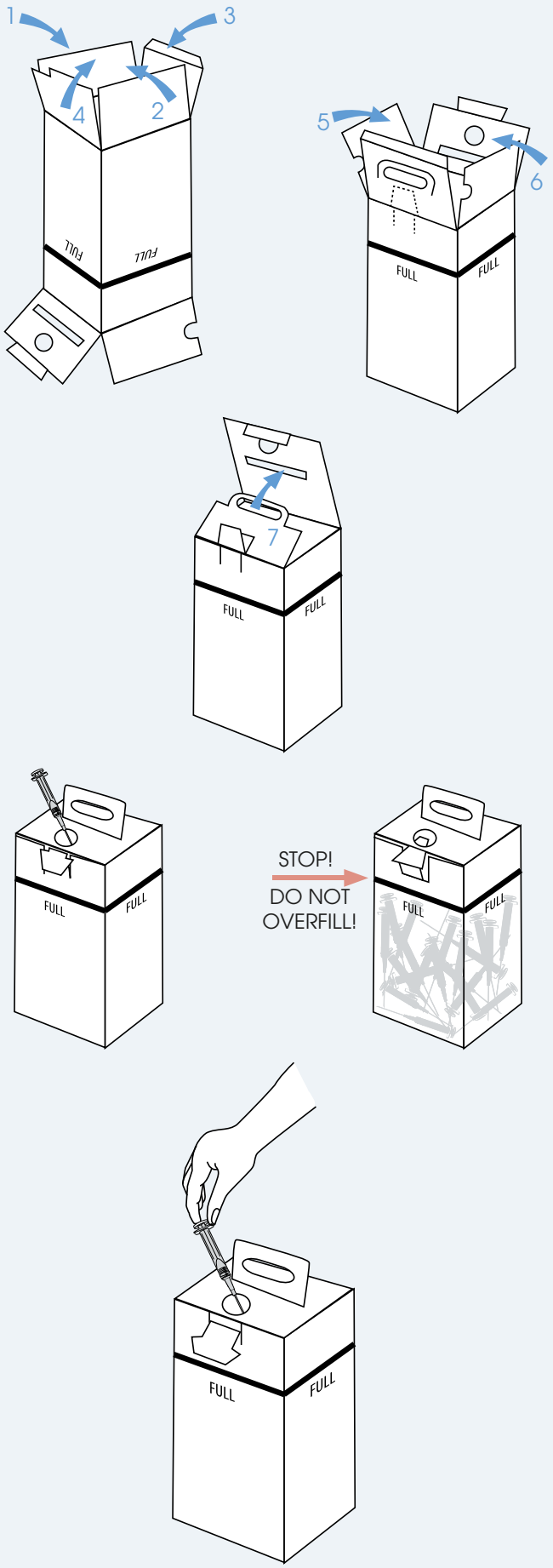
Figure 3.2 Pre-filled syringes

Currently considerable research is being conducted to introduce non-injectable immunization equipment which hopefully will make immunization much safer.

3.2.3 Safety boxes

To prevent risk of infection, the safe disposal of used needles and syringes is a critical component of any vaccination programme. Without recapping, vaccinators should place needles and syringes in safety boxes immediately after administering vaccine. To avoid an accidental needle prick during disposal, safety boxes should not be over-filled. When the safety box is nearly (approximately three quarters) full, it should be securely shut and stored in a safe place until it can be properly disposed of.

Figure 3.3 Safety box assembly and use for injection equipment



A 5-l safety box can hold approximately 100 used needles and syringes. 10-, 15- and 20-l safety boxes are also available. Before ordering the larger safety box, check that it is able to fit through the incinerator doors. These larger boxes may be appropriate for open pit burning. Consider also logistic issues (e.g. expected number of children to be vaccinated per team, physical constraints of carrying larger boxes etc.). All fixed centres and mobile teams need to be provided regularly with an adequate supply of safety boxes.

Exercise 2

Plenary session.

Demonstration of the safety box. Discussion on possible injuries while disposing of used syringes and needles.

3.3 Developing a safety plan for immunization

Effective planning and management are needed to ensure the proper use of equipment and the introduction of new equipment such as the AD syringe. Specifically, immunization systems must develop a comprehensive approach to immunization safety that includes policy statements, strategy and an annual workplan. A policy statement can be considered as a vision or overall goal for injection safety, e.g. "The Ministry of Health pursues the policy that 100% of injections given within EPI must be safe". Generally, the vision cannot be achieved in a short time. It requires a multi-year immunization safety action plan that states yearly objectives and strategies. A strategy is a general overview of how objectives will be achieved, i.e. the types of services or interventions that must be initiated. Strategies for introduction of AD syringes, injection safety and safe disposal of used injection equipment should be reflected in the plan. Activities should target all levels of the immunization service, from decision-makers to health workers and the public. This plan can be a section in the comprehensive multi-year plan (cMYP), which ensures financial back up of expenditure for safety procedures and equipment.

- Decision-makers should know the extent (i.e. magnitude and severity) of the threats to the public caused by unsafe injections, as well as the feasibility of interventions required to solve them.
- All health workers should have the knowledge, skills and proper equipment to administer injections safely and to avoid occupational hazards.
- Finally, the public must be educated on the need for all immunizations to be administered safely.

The plan or section in cMYP should include four major areas of immunization safety:

Assure vaccine safety:

- Use of WHO pre-qualified or national regulatory authority-approved vaccine and injection material.
- Ensure bundling supply: vaccine with corresponding diluent, reconstitution syringes, AD syringes and sharp disposal boxes.
- Train health-care workers in proper injection safety techniques.

Develop and implement an injection safety plan at national and subnational level:

- Identify stakeholders.
- Assess the situation as regard injection safety practices.
- Ensure that EPI is included in the national policy on injection safety.
- Ensure injection safety through education (communicating risks associated with unsafe practices).
- Make provision of supplies and specify schedules for distribution.
- Include the costs for safety component in the financial plan.
- Monitor and document implementation of the plan.
- Evaluate results and identify lessons learned.

Monitoring of AEFI:

- Detection and reporting of AEFIs.
- Initiate investigation and collect data.
- Analyse collected data.
- Take appropriate action based on your findings.

Manage disposal of used injection equipment:

- Assess local regulatory framework and options for treatment and disposal of sharps.
- Plan storage, transportation and disposal.
- Identify practical and simple solutions.
- Monitor disposal on a daily basis.

To ensure coordination and action at provincial and district levels specific immunization safety officers should be identified with responsibility for injection safety and the safe disposal of used injection equipment. These officers should be sufficiently senior (e.g. deputy EPI district manager) to carry the responsibility of all aspects of safety, since technical issues, operations and

monitoring (including cold chain and logistics) are closely linked. The designated immunization safety officers will be responsible for managing the system, ensuring adequate supplies and equipment are available at all levels, calculating requirements, maintaining inventories, and also controlling the safety of immunization injections and establishing efficient ways for disposing of used syringes and needles. At the levels where the disposal actually takes place, operators for safe disposal should also be designated and appropriately trained.

3.4 Implementation of planned activities

An adequate supply of all AD syringes, disposable reconstitution syringes and safety boxes, is essential. WHO and UNICEF policy states that all vaccine orders are bundled with AD syringes and safety boxes.

The term bundling has been chosen to define the concept of a theoretical bundle, which must consist of each of the following items: good quality vaccine and diluent specific to vaccine; AD syringes, reconstitution syringes; safety boxes.

None of the component items can be considered alone; each component must be considered as part of a bundle containing the others. Bundling does not necessarily mean that the items are actually packaged together in the same container.

3.4.1 Estimating requirements

EPI managers should ensure that health workers get the proper amount of materials needed (AD syringes, reconstitution syringes and needles, safety boxes). Estimates for equipment requirements can be calculated using the following example and should be repeated and completed for each injectable vaccine in the national immunization schedule. At the district level, the estimation of material needed for injectable vaccines is made based on the following steps:

- The number of children under one year of age and the number of pregnant women.
- The anticipated coverage targeted for vaccination in a given year.
- The number of doses of each vaccine according to the national vaccination schedule per child.
- Estimate national wastage rate.
- The buffer or minimum stock.
- The total number of doses (including buffer stock).
- The number of doses per vial.
- The total number of vials.
- The number of AD syringes required per injectable vaccine.
- Total number of AD syringes needed (including buffer stock).
- Reconstitution syringes should be equal to the number of vaccine vials plus wastage rate.
- Safety boxes.
- Number of required incinerators, burning pits (as per micro-planning exercises).
- Fuel required for incinerators and burning pits.

Exercise 3

In small groups, estimate the requirements for the first and second year for AD syringes, reconstitution syringes and safety boxes in your own district or province for Penta vaccine. Use your district data (target population, growth rate, planned coverage rate) and fill in the boxes of the table on page 12. If you do not have your district/province data, use an example of a district with the following data:

- Target population 10 000
- Growth rate 2.5%
- Planned coverage 80%

Some of the above data are already inserted in the table. Continue the exercise and fill other empty boxes. When finished, check your answers with the facilitator.

	First year	Second year
a) Number of children under one year of age	10 000	
b) Planned coverage (%)	80	
c) Number of children targeted for vaccination (a x b)		
d) Number of doses of each vaccine per child	3	
e) Estimated wastage factor for vaccines	1.02	
f) Number of doses required (c x d x e)		
g) Doses for buffer stock (f x 25%)		
h) Total number of doses (f + g)		
i) Number of doses per vial		
j) Total number of vials (h/i)	2	
k) Number of AD syringes needed = number of doses + %wastage		
l) Reconstitution syringes (disposable) (j + 10%)		
m) Safety boxes [(k + l)/100] + 10%		
For items k, l, m also estimate total cost using the following price list		
AD syringes 0.05 ml for BCG	US$ 0.06 each	
AD syringes 0.5 ml for all other vaccines	US$ 0.06 each	
Reconstitution syringes (5 ml disposable)	US$ 0.05 each	
Safety boxes	US$ 1.00 each	
It may also be useful to estimate the storage volume requirement for all these items, according to the following basic information:		
100 AD syringes (0.05 or 0.5 ml)	0.006 m^3	
1600 Reconstitution syringes (5 ml)	0.106 m^3	
25 Safety boxes	0.02 m^3	

An efficient stock management and distribution system needs to be developed to ensure continuous and sufficient availability of injection safety equipment in all health facilities. Spreadsheets should be issued at national and district level to clarify distribution procedures and ensure the correct delivery up to the point of use.

3.5 Training in injection safety

Training in injection safety and safe disposal is an essential requirement for immunization programmes. To ensure across-the-board collaboration, relevant partners such as nongovernmental organizations (NGOs) and private practitioners need to be included in training activities. Training institutions should revise their curricula to include injection safety so that the pre-service training of health professionals follows the national standards for safe injection practices.

The three main components of injection safety should be underlined – **A safe injection:**

- Does not harm the recipient.
- Does not expose the provider to any avoidable risk.
- Does not result in any waste that is dangerous for any other people.

The training should include the following communication messages on safe injection practices:

- Use an AD syringe for each injection (check the package for any possible damages).
- Use a sterile syringe and needle to reconstitute each vaccine.
- Prevent contamination of equipment and vaccines.
- For each injection, prepare a clean designated area where blood contamination is unlikely.
- Always pierce the septum of multi-dose vials with a sterile needle.
- Do not leave a needle in the stopper.
- Protect fingers with small gauze pad when opening ampoules.
- Discard a needle that has touched any non-sterile surface (hands, environmental surfaces).
- Prevent needle sticks.
- Anticipate and take measures to prevent sudden movement of the client during and after injection.
- Do not recap needles after injection.
- Collect used syringes and needles at the point of use in a safety box.
- Do not over fill safety boxes, sharps containers: seal when three quarters full.

- Prevent access to used needles.
- Put only AD and reconstitution syringes or other sharps in the safety boxes. Do not put the following materials in the box: empty vials (they may explode while burning), cotton pads, dressing material, latex gloves, etc.
- Prevent accidents in personnel in charge of waste disposal.
- Do not overload the personnel in charge of waste disposal with other work.

Seal safety boxes for transport to a secure area. Do not open or empty. Do not reuse them. Attach a sign that says CAUTION: CONTAMINATED SHARPS.

Other recommendations include:

Hand hygiene:

- Wash hands with soap before preparing vaccines and giving injections.
- Cover small cuts.
- Gloves are not needed to give injections.

Skin preparation before injection:

- Wash skin that is visibly soiled or dirty.
- Swabbing of the clean skin before giving an injection is unnecessary.
- If swabbing with an antiseptic is selected use a clean single-use swab; maintain product-specific recommended contact time, and do not use cotton balls stored wet in a multi-use container.
- Avoid giving injections on the injection site if skin integrity is compromised by local infection or weeping dermatitis.

Exercise 4

Plenary session.

Demonstration of correct and incorrect practices followed by a discussion.

3.6 Advocacy and communication

Advocacy strategies for injection safety must be developed to target not only EPI managers but also government decision-makers and other managers, health workers and the general population. The basis for safe use of injections is a behaviour change strategy that involves consumers, workers in public and private sectors and traditional healers.

Communication on injection safety should be included in the day-to-day information given by the immunization providers to **the family and the community.** Parents should know that new materials such as AD syringes are modern and safe technologies that cannot be reused and are properly disposed of after single use.

3.7 Supervision, monitoring and evaluation

Regular supervisory visits and monitoring are essential to ensure that safe injection practices are implemented. The following should be supervised in both routine and mass campaign settings:

- Adequate supplies of AD syringes, needles and safety boxes at each immunization site.
- Safety boxes are properly assembled (i.e. top is closed).
- Needles and syringes are placed immediately in safety boxes after use; needles and are not recapped.
- Empty vaccine vials are not thrown into the safety boxes.
- Safety boxes are not opened and contents are not transferred to other containers or other safety boxes.
- Safety boxes are filled only to appropriate levels (approximately three quarters full; no needles sticking out of the box) and are properly closed.

All accidents and hazardous situations should be reported and the supervisor should be informed about them. Given the importance of injection safety, the EPI manager should select a few key indicators for evaluating performance. The following are examples of indicators related to safe injection practices that could be monitored regularly and evaluated periodically:

- Adequacy of syringe and needle supplies at the health facility level:
  - Number of AD syringes equal to number of vaccine doses.
  - Proportion of facilities with adequate stock provided with AD syringes.
  - Number of dilution syringes is equal at least to number of vaccine to be reconstituted.
  - Frequency of deliveries of supplies to each facility.
- Disposal of injection equipment:
  - Number of safety boxes adequate to number of syringes (proportion should be 1/100).

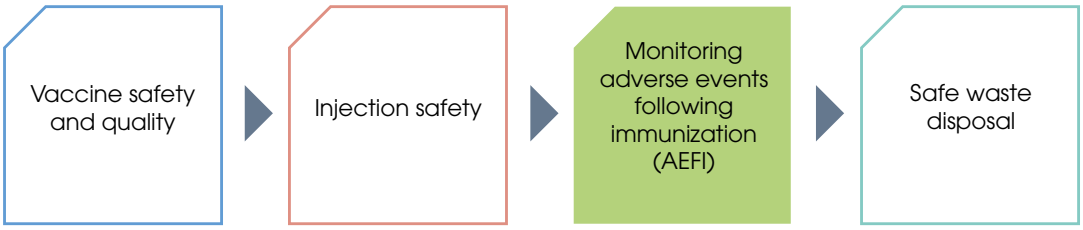
    - Proportion of health facilities with adequate stock of safety boxes.
    - Availability of appropriate waste disposal options (e.g. proportion of health facilities with incinerators for waste disposal).
    - Proportion of health facilities without any used syringes and needles around the waste.
- Proportion of AEFI monitored.
- Proportion of health workers trained in safe injection practices.
- Proportion of health facilities with focal person for injection safety.

Evaluation activities that take place after an immunization campaign can provide important clues to identify areas for improvement of injection safety. Results from the evaluation should be shared with health workers to encourage safe injection practices. Furthermore, national immunization programmes are encouraged to integrate information about injection safety in the regular, routine reporting forms. Injection safety has the same level of importance as immunization coverage rates or data on disease surveillance.

Exercise 5

Plenary discussion on the following topics:

- Do you monitor and evaluate injection safety in your province/district?
- What monitoring and evaluation methods and indicators do you use?
- How often do you monitor and evaluate injection safety issues?
- Have you encountered any shortcomings in injection safety practices in your country?
- Can you describe any violation of safety requirements in your work area?
- If yes, what are the improvements?



4. Monitoring adverse events following immunization (AEFI)

Vaccines are biological substances that are administered to individuals to elicit immunity (protection) against specific diseases. Such products are formulated together with adjuvants and/or excipients, and like all medical products, may cause adverse events following their administration to some individuals. Despite the fact that such adverse events following immunization (AEFIs) are mostly mild and very rarely severe, measures still need to be put in place to monitor and prevent their occurrence and take appropriate regulatory action(s) on the products themselves if needed.

A good vaccine is one that provides the best protection and gives rise to minimum adverse events. AEFIs can arise through a variety of reasons: these include events that could be inherent to the vaccine product; related to quality; an immunization error; immunization anxiety; or could be coincidental. A robust AEFI surveillance system in a country will help authorities to detect, manage and prevent AEFIs.

Ministries of health (MOH) operate the EPI programme through a national immunization programme (NIP) department. The NIP is responsible for setting policy guidelines and standards for selection, supply and utilization of vaccines in the country. Likewise, national regulatory authorities (NRAs) monitor the safety of all medical products including vaccines. The NRA uses a spontaneous pharmacovigilance system to collect any suspected adverse drug reactions experienced by patients. The NRA is also responsible for authorization of marketing all medicines including vaccines. All vaccine manufacturers are required by law to register their products before supplying and distributing them in the country. Reporting of AEFI and subsequent investigation may trigger regulatory action including withdrawing the marketing authorization of a vaccine, instructing vaccine manufacturers to change their product labels, restricting the use of vaccines to specific patient groups or recalling defective vaccine batches from the market.

The overall goal is the protection of the health and well-being of the entire population, particularly infants, children and pregnant women, and the general population who depend on vaccines to protect them from serious vaccine-preventable diseases.

4.1 Adverse events following immunization – types

An adverse event following immunization is any untoward medical occurrence (unfavourable or unintended sign, abnormal laboratory finding, symptom or disease) which follows immunization and which does not necessarily have a causal relationship with the usage of the vaccine. Reported adverse events can either be true adverse events, i.e. resulting from the vaccine or immunization process, or coincidental events that are not due to the vaccine or immunization process but are temporally associated with immunization. The five categories of AEFI as defined by Council for International Organizations of Medical Sciences (CIOMS) and WHO are described in Table 4.1.

Table 4.1 Five categories of AEFI

Cause-specific type of AEFI	Definition
Vaccine product-related reaction	An AEFI that is caused or precipitated by a vaccine due to one or more of the inherent properties of the vaccine product.
Vaccine quality defect-related reaction	An AEFI that is caused or precipitated by a vaccine that is due to one or more quality defects of the vaccine product, including its administration device as provided by the manufacturer.
Immunization error-related reaction (formerly "programme error")	An AEFI that is caused by inappropriate vaccine handling, prescribing or administration and thus by its nature is preventable.
Immunization anxiety-related reaction	An AEFI arising from anxiety about the immunization.
Coincidental event	An AEFI that is caused by something other than the vaccine product, immunization error or immunization anxiety, but a temporal association with immunization exists.

4.1.1 Vaccine reactions

Based specifically on cause, seriousness and frequency, vaccine reactions may be grouped into two broad categories:

- A. Cause-specific vaccine reactions.
- B. Vaccine reactions by seriousness and frequency.

A. Cause-specific vaccine reactions

Vaccine product-related reaction: This is an individual's reaction to the inherent properties of the vaccine, even when the vaccine has been prepared, handled and administered correctly. Most often the exact mechanism of a vaccine product-related reaction is poorly understood. The reaction may be due to an idiosyncratic immune mediate reaction (e.g. anaphylaxis) or to replication of the vaccine-associated microbial agent (e.g. vaccine-associated poliomyelitis following OPV which contains attenuated live virus).

Vaccine quality defect-related reaction: This is a due to a defect in a vaccine (or its administration device) that occurred during the manufacturing process. Such a defect may have an impact on an individual's response and thus increase the risk of adverse vaccine reactions. Insufficient inactivation of wild-type vaccine agent (e.g. wild polio virus) during the manufacturing process or contamination introduced during the manufacturing process could cause the vaccine quality defect-related reactions.

B. Vaccine reactions by seriousness and frequency

Most vaccine reactions are minor and subside on their own. Serious reactions are very rare and, in general, do not result in death or long-term disability. Table 4.2 describes the frequency of occurrence of reported adverse events.

Table 4.2 Frequency of occurrence of reported adverse reactions

Frequency category	Frequency in rate	Frequency in %
Very common	≥1/10	≥10%
Common (frequent)	≥1/100 and <1/10	≥1% and <10%
Uncommon (infrequent)	≥1/1000 and <1/100	≥0.1% and <1%
Rare	≥1/10 000 and <1/1000	≥0.01% and <0.1%
Very rare	<1/10 000	<0.01%

Common, minor vaccine reactions: These are caused when the recipient's immune system reacts to antigens or the vaccine's components (e.g. aluminium adjuvant, stabilizers or preservatives) contained in the vaccine. Most AEFI are minor and resolve on their own. Minor AEFI could be local or systemic. Local reactions include pain, swelling and redness at injection site. Systemic reactions include fever irritability and malaise. A successful vaccine reduces these reactions to a minimum while producing the best possible immunity. Table 4.3 describes the common minor vaccine reactions by antigen and the treatment for the same.

Table 4.3 Common minor vaccine reactions by antigen and treatment

Vaccine	Local adverse events (pain, swelling, redness)	Fever (>38°C)	Irritability, malaise and systemic symptoms
BCG[1]	90–95%	-	-
Hepatitis B	Adults up to 15% Children up to 5%	1–6%	-
Hib	5–15%	2–10%	
Measles/MR/MMR	~10%	5–15%	5% (rash)
OPV	None	Less than 1%	Less than 1%[2]
Pertussis (DTwP)[3]	Up to 50%	Up to 50%	Up to 55%
Pneumococcal conjugate†	~20%		~20%
Tetanus/DT/aTd	~10%[4]	~10%	~25%
Treatment	Cold cloth at injection site and paracetamol*	Give extra oral fluids, wear cool clothing, tepid sponge or bath and paracetamol*	Supportive treatment

[1] Local reactogenicity varies from one vaccine brand to another, depending on the strain and the number of viable antigen in the vaccine.
[2] Diarrhoea, headache and/or muscle pains.
[3] When compared with whole cell pertussis (DTwP) vaccine, acellular pertussis (DTaP) vaccine rates are lower.
[4] Rate of local reactions are likely to increase with booster doses, up to 50–85%.
* Paracetamol dose: up to 15mg/kg every 6–8 hours, maximum of 4 doses in 24 hours.
† Source: http://www.cdc.gov/vaccines/pubs/ACIP-list.htm

Rare, more severe (and serious) vaccine reactions: These are caused by the body's reaction to a particular component in a vaccine. The term "severe" is used to describe the intensity of a specific event (as in mild, moderate or severe); the event itself, however, may be of relatively minor medical significance. Severe AEFI can be disabling but are rarely life threatening. Some examples are seizures, thrombocytopenia, hypotonic-hyporesponsive episodes (HHE), prolonged crying etc.

Severe AEFI are considered serious by definition, if they:

- result in death
- are life-threatening
- require in-patient hospitalization or prolongation of existing hospitalization
- result in persistent or significant disability/ incapacity
- are associated with a congenital anomaly/birth defect.

ALL serious AEFI should be reported, investigated and the causality assessed.

The rate of occurrence of the rare and more serious reactions has been summarized in Table 4.4. Note that children less than six months or over six years of age are unlikely to have febrile seizures. If this happens, a thorough investigation should be conducted to determine the underlying cause(s).

Table 4.4 Severe vaccine reactions, onset interval and frequency

Vaccine	Reaction[1]	Onset interval	Rate per million (1 000 000) doses
BCG	Suppurative lymphadenitis	2–6 months	100–1000
	BCG osteitis	1–12 months	1–700
	Disseminated BCG infection	1–12 months	~1–2
Hib	None		
Hepatitis B	Anaphylaxis	0–1 hour	1–2
Measles/MMR/MR	Febrile seizures	6–12 days	330
	Thrombocytopenia	15–35 days	30
	Anaphylaxis	0–1 hour	~1
	Encephalopathy	6–12 days	<1
Oral poliomyelitis	Vaccine-associated paralytic polio (VAPP)	4–30 days	0.4–3 million[2]
Tetanus toxoid, DT	Brachial neuritis	2–28 days	5–10
	Anaphylaxis	0–1 hour	1–6
Pertussis (DTwP)	Persistent (>3 hours) inconsolable screaming	0–24 hours	1000–6000
	Seizures	0–3 days	80–570[3]
	Hypotonic-hyporesponsive episode (HHE)	0–48 hours	30–990
	Anaphylaxis	0–1 hour	20
	Encephalopathy	0–2 days	0–1

[1] Reactions (except anaphylaxis) do not occur if already immune (~90% of those receiving a second dose are immune): children over six years unlikely to have febrile seizures.
[2] VAPP risk is higher following the first dose (1 in 750 000 compared with 1 in 5.1 million for subsequent doses) and for adults and immunocompromised.
[3] Seizures are mostly febrile and the risk depends on age, with much lower risk in infants under the age of four months.

4.1.2 Immunization error-related reactions

The term "immunization" as used here means the "use" of a vaccine for the purpose of immunizing individuals. "Use" includes all processes that occur after a vaccine product has left the manufacturing/packaging site – i.e. handling, prescribing and administration of the vaccine. Immunization error-related reactions are usually preventable and they divert attention from the benefit of the immunization programme. Some of them are described in Table 4.5. The identification and correction of these errors in a timely manner are, therefore, of great importance.

Table 4.5 Immunization error-related reactions

Immunization error		Related reaction
Error in vaccine handling	Exposure to excess heat or cold as a result of inappropriate transport, storage or handling of the vaccine (and its diluents where applicable)	Systemic or local reactions due to changes in the physical nature of the vaccine, such as agglutination of aluminium-based excipients in freeze-sensitive vaccines
	Use of a product after the expiry date	Failure to protect as a result of loss of potency or no viability of an attenuated product
Error in vaccine prescribing or non-adherence to recommendations for use	Failure to adhere to a contraindication	Anaphylaxis, disseminated infection with a live attenuated vaccine (LAV) e.g. disseminated BCG
	Failure to adhere to vaccine indications or prescription (dose or schedule)	Systemic and/or local reactions, neurological, muscular, vascular or bony injury due to incorrect injection site, equipment or technique
Error in administration	Use of an incorrect diluent or injection of a product other than the intended vaccine	Failure to vaccinate due to incorrect diluent, reaction due to inherent properties of whatever was administered other than the intended vaccine or diluent
	Incorrect sterile technique or inappropriate procedure with a multi-dose vial	Infection at/beyond the site of injection

An immunization error-related reaction may sometimes lead to a cluster of events associated with immunization. These clusters are usually linked to a particular provider or health facility, or even to single or multiple vials of vaccine that have been contaminated or inappropriately prepared. For instance, freezing vaccine during transport may lead to an increase in local reactions. The details of an approach to investigating AEFI clusters are described later.

Basic rules to avoid immunization errors

- Reconstitute your vaccine only with the diluent supplied by the manufacturer.
- Discard reconstituted vaccines at the end of each immunization session or after six hours, whichever comes first and never retain them.
- Do not keep drugs or other substances in the vaccine refrigerator.
- Use sterile AD syringe for each injection.
- Use sterile reconstitution syringe and needle for each vial to be reconstituted.
- Full investigation of an AEFI is needed to pinpoint the cause and to correct inappropriate immunization practices.

Exercise 6

Role play.
You have been asked to give a half-hour talk to graduating nurses on how to minimize AEFIs in immunization programmes during routine and supplementary activities. List 10 points you would make in your presentation.

4.1.3 Immunization anxiety-related reactions

Individuals and groups can become stressed and may react in anticipation to, and as a result of, any kind of injection. This reaction is unrelated to the constituents of the vaccine product. Fainting (vasovagal syncope or syncope) is relatively common, particularly in children over five years of age and among adolescents. Some children who faint may have a syncopal hypoxic convulsion. Hyperventilation as a result of anxiety about the immunization leads to specific symptoms such as light-headedness, dizziness, tingling around the mouth and in the hands. This is also common in mass vaccination campaigns.

Younger children may have breath-holding and vomiting as a common symptom of anxiety. Young children may also scream or run away to avoid the injection.

Some individuals may have needle phobia. In group immunization, mass hysteria is possible, especially if one or more of those being vaccinated is observed by others to faint or have some other reaction such as itching, weakness of limbs and so on. Sometimes a fainting episode can be misdiagnosed as anaphylaxis. Careful observation and clinical judgement is necessary to differentiate.

4.1.4 Coincidental events

An event may occur coincidentally with immunization and sometimes be falsely attributed to the vaccine, i.e. a chance temporal association is falsely attributed to immunization. Such temporal associations are inevitable especially in a mass immunization campaign.

Vaccines are normally administered early in life when infections and other illnesses are common, including manifestations of underlying congenital or neurological conditions. It is, therefore, possible to encounter many events, including deaths, that can be falsely attributed to vaccine through a chance association. For example, incidence of sudden infant death syndrome (SIDS or "cot death") peaks around the age of early childhood immunization. Consequently, many SIDS cases will occur in children who have recently been immunized. However, several well designed studies have shown that the association of SIDS and immunization is coincidental and not causal.

Coincidental adverse events may be predictable. The number of events to be expected depends upon the size of the population and the incidence of disease or death in the community. Knowledge of these background rates of disease and deaths, particularly age-specific disease incidence rates, allows estimation of the expected numbers of coincidental events.

4.2 Vaccine pharmacovigilance

Vaccine pharmacovigilance is defined as "the science and activities relating to the detection, assessment, understanding and communication of adverse events following immunization and other vaccine- or immunization-related issues, and to the prevention of untoward effects of the vaccine or immunization".

4.2.1 National regulatory authorities

National regulatory authorities are responsible for ensuring that every pharmaceutical product – including vaccines used within the country is:

- of good quality
- effective
- safe for the purpose or purposes for which it is proposed.

National regulatory authorities are independent from the manufacturers and ensure the following functions – shown in Figure 4.1.

Figure 4.1 Regulatory functions for vaccine safety

<table>
<tr><th></th><th colspan="3">Source of vaccine</th></tr>
<tr><th></th><th>United Nations agency</th><th>Procure</th><th>Produce</th></tr>
<tr><td>Regulatory function</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Marketing authorization and activities licensing</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Lot release</td><td rowspan="4">Functions undertaken by WHO on behalf of United Nations agencies or producing countries</td><td>✓</td><td>✓</td></tr>
<tr><td>Laboratory access</td><td>✓</td><td>✓</td></tr>
<tr><td>Regulatory inspections</td><td rowspan="2">Functions undertaken by the producing country</td><td>✓</td></tr>
<tr><td>Supervision of clinical trials</td><td>✓</td></tr>
<tr><td>Monitoring for safety</td><td>✓</td><td>✓</td><td>✓</td></tr>
</table>

Pharmacovigilance is often conducted by national pharmacovigilance centres on behalf of/in collaboration with NRAs. Pharmacovigilance centres have a significant role in post-licensure surveillance of acute drug reactions (ADRs). They may conduct:

- post-licensure surveillance of ADRs
- data collection on AEFIs using standardized methodologies
- data analysis
- regular communications with NRA to update safety profiles.

Pharmacovigilance is the responsibility of the EPI, the NRA and the centre for pharmacovigilance. Systems must be put place for collaboration, planning and sharing of data between the three. An agreed upon flow of information is important from health facility to national level. The WHO Global vaccine safety blueprint (WHO, 2012) provides a detailed description of how to set up an AEFI monitoring system.

Figure 4.2 Pharmacovigilance surveillance cycle

4.2.2 AEFI surveillance

Surveillance for AEFI is an integral part of the NIP, and reinforces the safe use of all vaccines in the country while also helping to maintain public confidence in its immunization programme. As shown in Figure 4.2, this is done systematically.

The objectives of AEFI surveillance include:

- Rapidly detect and respond on time to the occurrence of an AEFI.
- Identify, correct and prevent immunization error related reactions.
- Facilitate AEFI causality assessment.
- Recognize clustering or unusually high rates of AEFI, including those that are mild and/or "expected".
- Identify potential safety signals (including previously unknown vaccine reactions), and generate hypotheses that may require further investigation.
- Generate information with which to effectively communicate with parents, the community, media and other stakeholders, regarding the safety of vaccines used in a country.

AEFI detection and reporting: Vaccine recipients themselves and/or parents of immunized infants/children, health-care providers at immunization facilities and staff in immunization facilities are most likely to recognize or detect AEFIs when they first occur. Any AEFI case that is therefore notified to any health-care provider working within the health-care system, should be reported to the district immunization officer (DIO) using the standard reporting form (Annex 3) through the fastest means possible. The officer should in fact be informed of any serious AEFI cases by telephone and this should be followed up by completion and submission of the reporting form.

The reportable conditions include serious AEFI, AEFI as a result of potential immunization errors, clusters, AEFI causing parental or community concern, those that are unexpected, and any that are known but occur with unexpected frequency. Table 4.6 provides case definitions of commonly reportable AEFI. However, it needs to be stressed that health workers should report all cases that are notified to them.

All vaccination staff must be able to recognize AEFIs and report them. However, accurate diagnosis of AEFIs requires staff training and education. Health-care providers also have the additional responsibility to manage AEFI and, if necessary, refer such patients for any required treatment.

Table 4.6 Case definitions of the reportable adverse events

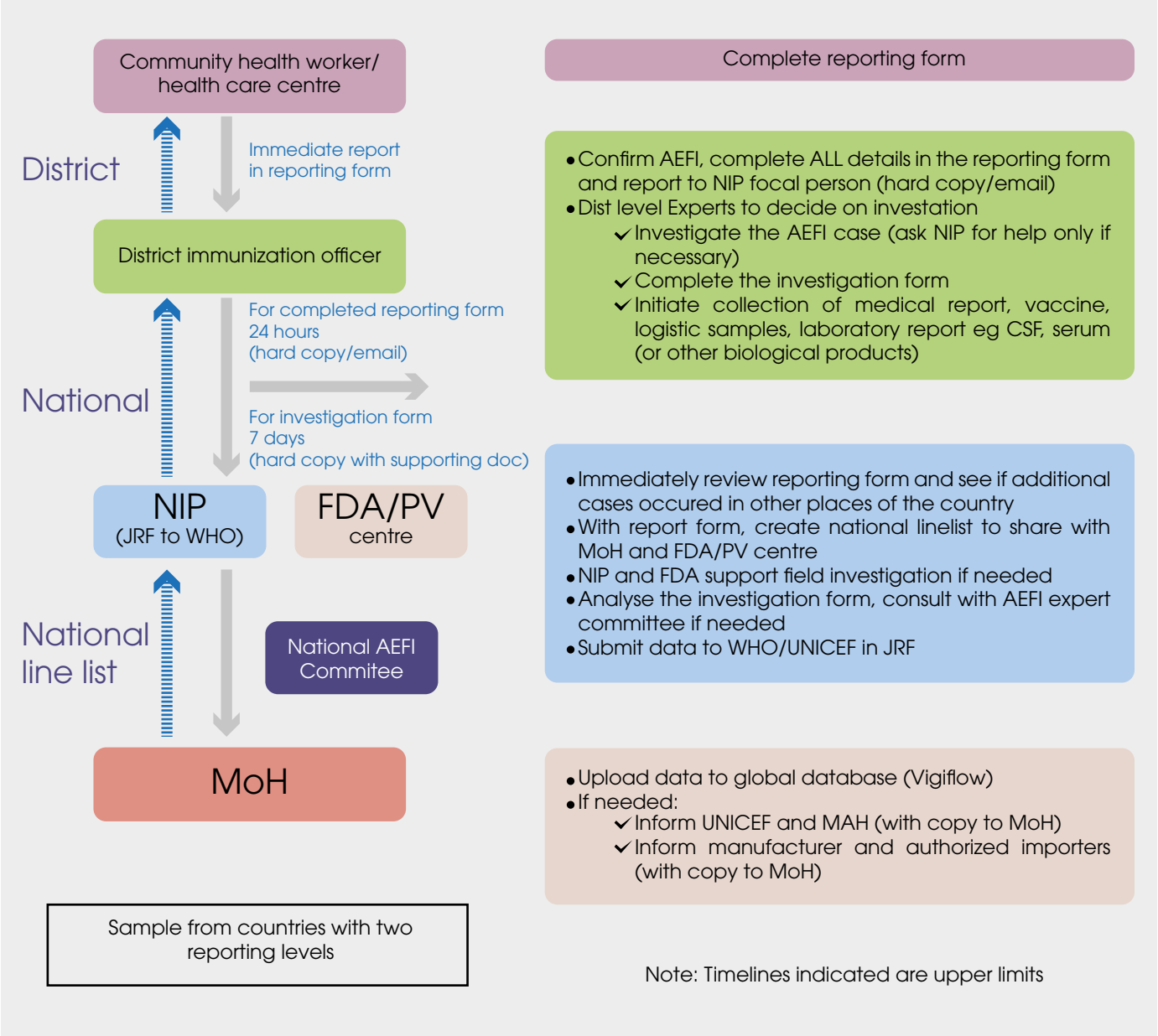
AEFI	Case definition	Vaccine
Anaphylaxis	A clinical syndrome characterized by sudden onset (within one hour), rapid progression of signs and symptoms involving multiple (more than two) organ systems: skin – urticaria (hives), angioedema (swelling of face/body); respiratory – persistent cough, wheeze, stridor; cardiovascular – low blood pressure (hypotension) or reduced circulation (fast weak pulses); gastrointestinal – vomiting, abdominal pain.	All
BCG osteitis/ osteomyelitis	Inflammation of the bone with isolation of mycobacterium bovis BCG strain.	BCG
Disseminated BCG infections	Widespread infection occurring within 1 to 12 months after BCG vaccination and confirmed by isolation of mycobacterium bovis BCG strain. Usually in immunocompromised individuals.	BCG
Encephalopathy	Acute onset of major illness characterized by depressed or altered level of consciousness and/or distinct change in behaviour lasting for one day or more.	Measles, pertussis
Fever	The fever can be classified (based on rectal temperature) such as: • Mild fever: 38–38.9°C (100.4°F–102°F) • Moderate fever: 39–40.4°C (102°F–104.7°F) • Severe fever: >40.5°C (104.7°F or higher).	All
Hypotonic hyporesponsive episode (HHE or shock-collapse)	Event of sudden onset occurring within 48 (usually less than 12) hours of vaccination and lasting from one minute to several hours, in children younger than 10 years of age. All of the following must be present: • limpness (hypotonic) • reduced responsiveness (hypo responsive) • pallor or cyanosis – or failure to observe/ recall.	Mainly DPT, rarely others
Injection site abscess	Fluctuant or draining fluid filled lesion at the site of injection. Bacterial if evidence of infection (e.g. purulent, inflammatory signs, fever, positive bacterial culture). Sterile abscess if no evidence of bacterial infection on culture. Sterile abscesses are usually due to the inherent properties of the vaccine.	All injectable vaccines
Lymphadenitis (includes suppurative lymphadenitis)	Either at least one lymph nodes enlarged to >1.5 cm in size (one adult finger width) or a draining sinus over a lymph node. Almost exclusively caused by BCG and then occurring within 2 to 6 months after receipt of BCG vaccine, on the same side as inoculation (mostly axillary).	BCG
Persistent inconsolable screaming	Inconsolable and continuous crying lasting three hours or longer accompanied by high pitched screaming.	DPT, pertussis
Seizures	Occurrence of generalized convulsions that are not accompanied by focal neurological signs or symptoms. Febrile seizures: if temperature elevated 38°C (>100.4°F) (rectal). Afebrile seizures: if temperature is normal.	All, especially Pertussis, measles
Sepsis	Acute onset of severe generalized illness due to bacterial infection and confirmed (if possible) by positive blood culture.	All injectable vaccines
Severe local reaction	Redness and/or swelling centred at the site of injection and one or more of the following: • swelling beyond the nearest joint • pain, redness and swelling of more than three days and interfering with daily activities • requires hospitalization. Local reactions of lesser intensity occur commonly and are trivial and do not need to be reported.	All injectable vaccines
Toxic shock syndrome (TSS)	Abrupt onset of fever, vomiting and watery diarrhoea within a few hours of immunization. Often leading to death within 24 to 48 hours.	All injectable vaccines
Vaccine associated paralytic poliomyelitis (presenting as AFP)	Acute onset of flaccid paralysis and neurological deficits, compatible with diagnosis of poliomyelitis, with isolation of vaccine virus and absence of wild virus in stool.	OPV
Serious AEFI – any AEFI causing: • death • hospitalization • disability, congenital anomaly • other severe and unusual events.	No time limit, if they are thought by health workers or the public to be related to immunization.	

AEFI investigation: The ultimate goal of an AEFI field investigation is to find the cause of the reported AEFI(s) and prevent recurrence. Remedial action needs to be taken promptly for immunization error-related AEFI. Even if the cause cannot be identified or the cause of the event was due to some other reason, the fact that staff had investigated the incident itself will increase public confidence in the immunization programme.

The purpose of investigating AEFI cases are:

- To confirm the reported diagnosis and/or propose other possible diagnoses as well as clarify the outcome of the medical incident comprising the AEFI.
- To ascertain the particulars, circumstances and procedures around the vaccine used to immunize the affected recipient. Most importantly, identify any potential vaccine related link to the given AEFI.
- To examine the operational aspects of the programme. Even if an event seems to be vaccine product induced or coincidental.
- To determine whether a reported event was a single incident or one of a cluster and if it is a cluster, confirm that the suspected immunizations were indeed given and the individual vaccines that were used.
- To determine whether unimmunized people are experiencing the same medical incidents.

Figure 4.3 AEFI reporting: Routing, timeline, actions



Role of subnational stakeholders

Parent/guardian: At the time of immunization, it is important for health workers to sensitise the parents about expected events such as fever and pain at injection site etc. following immunization. Parents should be advised about simple home remedies (e.g. correct positioning of the child when sleeping, increasing intake of fluids, sponging, breast feeding, antipyretics etc.) should such events occur; however, at the same time, they should also be instructed to report severe expected events (e.g. very high fever, not responding to antipyretic) or other unusual events to the health worker if they occur.

Health worker: If home remedies do not work, vaccine recipients themselves and/ or parents or guardians of immunized infants/children usually report the event to health-care providers at immunization or other health-care facilities. All such AEFI cases brought to the notice of the health-care worker or detected by the worker should be reported to the District Immunization Officer using the standard reporting form (Annex 3). Thus, the main role of the health worker is to provide primary medical care and report the basic details about the notified adverse event to the district by completing the AEFI reporting form (preceded if appropriate with a preliminary report by telephone if it is a serious event).

Role of stakeholders at district and state level

When an AEFI report is received by the district immunization officer, they should determine if the reported AEFI case meets the criteria required for a detailed investigation. The case may be considered:

- Not warranting detailed investigation if it is a minor AEFI and NOT serious AEFI; this should be indicated this on the reporting form which should be emailed/faxed to the provincial and national levels.
- Warranting a detailed investigation if it is a SERIOUS AEFI (death, hospitalization, significant disability, life threatening, or congenital anomaly/ birth defect) or part of a cluster, part of a group of events above expected rate/severity, or a suspected signal.

All serious AEFI should be investigated and a completed AEFI investigation form routed to the national level.

Reporting: The DIO should discuss the reporting form with the local experts (or technical expert committee if available) and plan for a detailed field investigation. Prior to initiating an investigation, the report should be emailed to higher levels as described above. If the district officer and the experts feel that the investigation can be done locally, they can visit the patient and locality and initiate the detailed investigation along with appropriate members of the local health-care team. If, however, assistance is required for investigation from the next or national level, this should be solicited. During field investigations, the AEFI investigation form (Annex 5) should be used as a guide to collect suitable information. The investigators should seek to document any deficiencies found in a generic way and suggest corrective measures, and not single out any individuals to blame.

The specific activities conducted at this point will include the following:

- Confirm the AEFI, assign a unique report identifying number, complete ALL details in the AEFI reporting form (in case any of them were missing when reporting) and initiate AEFI investigation.
- Convene a group of local experts (or technical expert committee if available) planning meeting prior to the investigation.
- With the experts, the district officer should visit as required the patient, the care provider(s) and the hospital; interview relevant stakeholders (parents, health worker, treating doctor, vaccine supply focal person); and conduct the investigation of the AEFI case.
- Complete the AEFI investigation form.
- Initiate collection of medical reports, a post-mortem report (if available), vaccine vials (if necessary, and kept under cold chain conditions), logistic samples, and laboratory reports e.g. cerebrospinal fluid (CSF), serum (or other biological products).

Investigator(s) may use the WHO Aide-memoire on AEFI investigation (http://www.who.int/vaccine_safety/initiative/investigation/New_aide-memoire_AEFI.pdf).

Table 4.7 Steps in an AEFI investigation

	Step	Actions
1	Confirm information in report	☐ Obtain patient's medical file (or other clinical record) ☐ Check details about patient and event from medical file and document the information ☐ Obtain any details missing from AEFI report form
2	Investigate and collect data About the patient	☐ Immunization history ☐ Previous medical history, including prior history of similar reaction or other allergies ☐ Family history of similar events
	About the event	☐ History, clinical description, any relevant laboratory results about the AEFI and diagnosis of the event ☐ Treatment, whether hospitalized and outcome
	About the suspected vaccine(s)	☐ Conditions under which the vaccine was shipped, its present storage condition, state of vaccine vial monitor and temperature record of refrigerator ☐ Storage condition of vaccine at all levels before it arrived at health facility, vaccine vial monitor ☐ The date of manufacture, lot and batch numbers of vaccine and diluent
	About other people	☐ Whether others received the same vaccine and developed illness and whether they need to be included in the investigation ☐ Whether others had similar illness (may need working case definition); if so exposure of cases to suspect vaccine(s) ☐ Discuss with other immunization service providers to obtain an idea of the local standard practices
3	Assess the service provided by asking about	☐ Vaccine storage (including open vials), distribution and disposal ☐ Diluents storage and distribution ☐ Reconstitution (process and time kept) ☐ Use and sterilization of syringes and needles ☐ Number of immunizations (greater than normal?) ☐ Details of training in immunization practice, supervision and vaccinator(s)
	Observing the service in action	☐ Refrigerator – what else is stored (note if similar containers stored next to vaccine vials which could be confused); which vaccines/diluents stored with other drugs; whether any vials have lost their label ☐ Immunization procedures (reconstitution, drawing up vaccine into the syringe, injection technique, safety of needles and syringes; disposal of opened vials) ☐ If any open vials look contaminated
4	Formulate a working hypothesis	☐ On the likely/possible cause(s) of the event
5	Test working hypothesis	☐ Does case distribution match working hypothesis? ☐ Laboratory tests may help (see text)
6	Conclude investigation	☐ Reach a conclusion on the cause ☐ Complete AEFI investigation form ☐ Take corrective action and recommend further action

Role of national stakeholders

When the NIP AEFI focal point receives the AEFI reporting form, it is essential to review it in the context of other reported AEFI received from all parts of the country, particularly in the same period of time, to see if this report may constitute a signal.

The NRA and the national AEFI committee play a key role in supporting the immunization programme for AEFI investigation and causality assessment. They also provide recommendations to the National Immunization Technical Advisory Group (NITAG), the MOH and NIP on vaccines based on their causality assessment findings. The NRA and the NIP together constitute the national AEFI secretariat and together they coordinate and provide technical/logistical support to conduct the meetings of the national AEFI committee

NIP is responsible for providing all feedback to the relevant stakeholders at subnational level. They are also responsible on following up on the actions recommended (e.g. change in logistics, cold chain, training after immunization errors etc.) and ensuring that they are implemented.

The NRA or the national pharmacovigilance centre is responsible for sharing the information with the global community by uploading the information into the global pharmacovigilance database – VigiBase®, maintained by the Uppsala Monitoring Centre under the WHO International Drug Monitoring Programme – using information available in the completed case investigation forms.

Exercise 7

Small group discussions

Two children have been admitted to the same hospital on the same day, following routine vaccination with measles vaccine. The initial telephone call indicates that one child probably had convulsions, and it is not clear why the second one was admitted. Describe in detail how you would carry out an investigation based on this report.

4.3 Laboratory testing of specimens

Laboratories have an important role in AEFI case diagnosis and case management. They also have a key role in testing the quality of the samples of vaccines and the logistics used. Laboratory tests for the purpose of AEFI case diagnosis and case management conducted on the patient (e.g. blood, urine, radiology, ECG etc.) are based on the provisional case diagnosis and recommendations of the treating physician. These tests are considered "routine" and should be performed in clinical laboratories. The results of these tests are important to confirm the case diagnosis and arrive at the "valid diagnosis" for assessing causality as described in Section 4.5.

Laboratory testing of samples of vaccines and logistics are rarely necessary. It is not mandatory following an AEFI, particularly if the cause is evident such as a coincidental event or an immunization error. However, laboratory testing of vaccines and logistics are at times required to confirm or rule out the suspected cause.

In the context of AEFI, sometimes additional specific tests on the patient, vaccines and logistics as outlined below may also be necessary to confirm the cause. The testing of additional specimens includes:

- Human specimens:
  - Histopathology, body fluids etc. can be done at laboratories identified and approved by the MOH.
  - Autopsy specimens at approved and accredited government forensic laboratories as identified by MOH.
- Vaccines and logistics:
  - Vaccines and diluents for sterility and chemical composition.
  - Syringes and needles for sterility.

Only the appropriate specimen in the correct quantity required for the investigation should be collected. Laboratory specimens should be stored and transported as recommended and accompanied by clear supporting documents, reasons for specimen collection and any additional information required by the investigators. In case laboratory investigation is required, AEFI laboratory request form (Annex 6) should be completed and sent with any specimen collected.

4.4 Data performance and analysis

4.4.1 Sources of AEFI data

Information on vaccine safety and the possible occurrence of AEFIs can be obtained from clinical examinations; interviews of health workers, parents and community leaders; review of registers at antenatal clinics, outpatient clinics; immunization, vaccine and injection log books; observation of immunization administration; vaccine handling and storage; and laboratory reports. Analysis of data on AEFIs consists of reviewing data from the following sources:

- data collated into a line list
- case investigation forms for each reported AEFI case
- laboratory information (human and vaccine related)
- records about similar events in the community
- records of the implicated vaccine.

4.4.2 Analysis of AEFI reports

It is essential that all notified cases are reported (serious and non-serious AEFI) using the AEFI reporting form (Annex 3). All reported AEFI cases should be line-listed at all levels using the AEFI line list (Annex 4). This is the first step of data management. Before the analysis, verify and reassure the data for accuracy. In addition to basic time, place and person analysis that should be done by the programme managers, other key analysis related to the performance of the surveillance system include: Timeliness and completeness of receiving AEFI forms.

- Identifying health institutions where AEFIs are not reported by checking on "zero reporting" or "nil reporting". Determine whether it is due to failure of reporting or whether there are no AEFIs to be reported.
- Assessing AEFI case reports received during stipulated time period.
- Assessing number of events and reporting rate per 1000 or 10 000 or 100 000 doses of vaccine used.
- Analyses by the type of AEFI.
- Analysing immunization errors by number and rates per 100 or 1000 doses of relevant vaccines used.
- Compare the rates with available or known background rates.

4.4.3 Data analysis at different levels

Data analysis could be carried out by the responsible focal persons at different levels in the immunization safety surveillance system. Analysis of data at district level is important to identify the immunization errors. This helps to carry out corrective action in a timely manner. Table 4.8 describes the type of analysis and the purpose.

Table 4.8 Types and purpose of data analysis at different levels

Programme implementation level	Suggested analysis	Purpose of analysis at this level
Local level (e.g. district)	• Number of reports by clinics, hospitals, villages by a given time • Reported AEFIs by place (clinics, hospitals), persons and time • Reported AEFIs by antigen	• These are programme operation indicators such as timeliness and completeness • Identify immunization errors and to lead to corrective action • Will identify vaccine reactions and coincidence
Intermediate level (province/zone/ etc.)	• Number of reports by local level • Reported AEFIs by place (clinics, hospitals), person and time • Cluster analysis • Reported AEFIs by antigen	• These are programme operation indicators (timeliness, completeness) at local level • Identify immunization (programme) errors and lead to corrective action • Cluster analysis too leads to identify immunization errors, but also coincidence and vaccine reactions • Will identify vaccine reactions and coincidence
National level	• Number of reports by intermediate levels • Reported AEFIs by place (clinics, hospitals), persons and time • Cluster analysis • Reported AEFIs by antigen	• These are programme operation indicators (timeliness, completeness) at intermediate level • Identify immunization errors and to lead to corrective action • Cluster analysis too leads to identify immunization errors, but also coincidental events and vaccine reactions • Will identify vaccine reactions including signal detection • Lead to take operational and policy decisions in the country

4.4.4 Process of data analysis

Before analysis of the line list at national level, it is important to re-check the case definitions adopted by the reporting sources. The case should fit into a case definition such as the Brighton collaboration case definitions (www.brightoncollaboration.org) or any definition selected by the national AEFI committee.

Line lists should be used to sort data by place, person and time. Analysis should be done by antigens by type of reported adverse events (e.g. high fever, abscess) after stratifying data. The number of doses administered for each antigen is the best denominator for calculating reported AEFI rates for each antigen in a given time period (by month, quarter or year). Various denominators and their limitations are described in Table 4.9.

Table 4.9 Selection of denominators and their limitations

Denominator	Limitations
Administered doses of vaccines	Most reliable, but not often available
Distributed doses	Greater than administered doses, thus may reduce rate (underestimate)
Coverage x population	May be less accurate because of variability in coverage estimates
Target population	Proxy measure for vaccine population (may also underestimate)

Multiplier: Use of the proper multiplier in data analysis is important – according to purpose and level of analysis. At local level, percentage (x 100 = %) is the best choice, whereas at state and national levels, one may use 1000, 100 000 or 1 000 000 as multiplier. For common, minor vaccine reactions, percentage is recommended and for rare serious reactions, 10 000, 100 000 or 1 000 000 can be used.

4.4.5 Interpretation of data

Available expected rates for each type of AEFI for a given antigen is provided at http://www.who.int/vaccine_safety/initiative/tools/vaccinfosheets/en/index.html. This can help to make the decision on the corrective action to be taken on reported AEFIs. It is also important to know about background rates of reported medical events in the country. Comparison of background rates with reported rates of AEFI will guide to a possible hypothesis of a coincidental event. For example, febrile seizures with bacterial or viral infection aetiologies are common among young children and may also occur following some vaccines such as DTwP. Therefore, it is important to know the rate of febrile seizures due to other reasons and expected rates following a given antigen. If the values exceed the expected background rates, then one should consider true increase or coincidence due to ongoing other diseases.

4.4.6 Monitoring and evaluating the performance of the AEFI surveillance system

The AEFI surveillance system performance needs to be regularly reviewed at all levels to ensure that the system is sensitive enough to identify and respond to AEFI rapidly. The "standard overall" indicator proposed to determine the quality of AEFI surveillance is, "AEFI reporting ratio in surviving infants from a subnational[3] area/country per year". This is calculated as:

$$\text{AEFI reporting ratio per 100 000 surviving infants per year} = \frac{\text{Number of AEFI cases reported from a subnational area/country per year}}{\text{Total number of surviving infants in the same subnational area/country per year}} \times 100\,000$$

Note: The target proposed is at least 10 reports per 100 000 surviving infants[4] per year. The subnational area/country is defined according to the functional requirements and setup of the national AEFI surveillance system.

Some of the other key indicators that help to monitor the performance of the system include:

- Timeliness and completeness of AEFI reporting:
  - Percentage of AEFI cases reported on time (< 24 hours of notification) to the national level.
  - Percentage of serious AEFI cases investigated on time (< 7 days of onset) using standard formats.
- Number (%) of AEFI investigation conclusions supported by findings of special tests (clinical specimens, post-mortem findings among AEFI deaths, laboratory findings for vaccine samples).
- Number (%) AEFI cases where final classification including causality assessment by AEFI committee is completed within 30 days of receipt of all documentation from districts.
- Number (%) AEFI cases reviewed by national AEFI committee following receipt of reported AEFI cases from region at national level.
- Number (%) AEFI cases reviewed by national AEFI committee and not assessable due to lack of information.
- Response to AEFI by the programme particularly those related to immunization error.

4.5 Brief overview of causality assessment

This section is a short introduction and practical overview of the purpose, process and classification of AEFI cases after causality assessment. A comprehensive guide and background to causality assessment has been published by WHO and can be accessed online at http://www.who.int/vaccine_safety/publications/gvs_aefi/en/

Causality assessment is the systematic evaluation of the information obtained about an AEFI to determine the likelihood that the event might have been caused by the vaccine/s received.

Causality assessment does not necessarily establish whether or not a definite relationship exists, but generally ascertains a degree of association between the reported adverse events and the vaccine/vaccination. Nevertheless, causality assessment is a critical part of

3 It is assumed that a country could have three levels of immunization safety surveillance: national (central), subnational or intermediate (state/province/region/district) and service-provider level.
4 An estimate of **surviving infants** can be calculated by subtracting the number of children who die before they reach their first birthday from the number of children born during that year. The number of children dying during the first year of their life can be estimated by dividing the number of births by 1000 times the infant mortality rate (IMR), where the infant mortality rate is expressed as number of infant deaths per 1000 live births.

AEFI monitoring and enhances confidence in the NIP. Causality assessment is important for:

- Identification of vaccine-related problems.
- Identification of immunization error-related problems.
- Excluding coincidental events.
- Detection of signals for potential follow up, testing of hypothesis and research.
- Validation of pre-licensure safety data with comparison of post-marketing surveillance safety data.

4.5.1 Case selection for causality assessment

The cases for which causality is ascertained include:

- Serious AEFI.
- Clusters and events above expected rate/severity.
- Evaluation of suspected signals.
- Other AEFI (if required) as decided by reviewing team/committee including:
  - if immunization error is suspected;
  - significant events of unexplained cause within 30 days of vaccination; and
  - events causing significant parental or community concern (e.g. HHE, febrile seizures etc.)

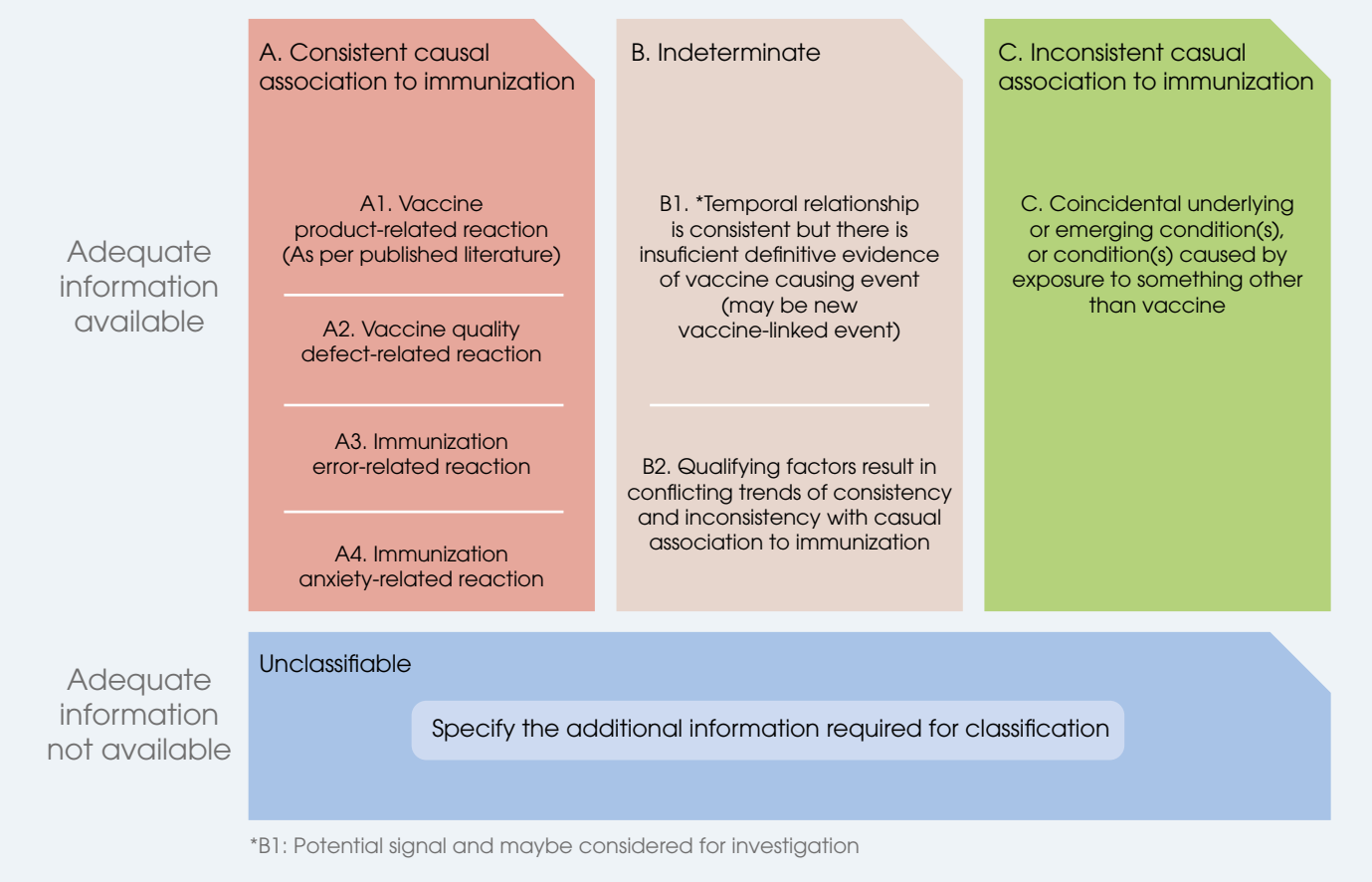
4.5.2 Preparation for causality assessment

Prior to causality assessment:

- The AEFI case investigation should have been completed.
- All details of the case such as case report form, case investigation form, completed clinical case record, laboratory reports, autopsy report, details of field investigations etc. should be available at the time of assessment.
- There must be a "valid diagnosis", i.e. the extent to which the unfavourable or unintended sign, abnormal laboratory finding, symptom or disease is defined.

With inadequate or incomplete case information, an adequate causality assessment cannot be performed or if attempted, the AEFI may be deemed unclassifiable or not assessable due to lack of information. On the other hand, even with complete information the AEFI may be categorized "indeterminate" due to the lack of clear evidence of a causal link, or conflicting external evidence or other inconsistencies. Nevertheless, these assessments should be recorded because the reporting of more cases may lead to a stronger signal and a plausible hypothesis, or stronger refutation of any link.

Figure 4.4 Final classification of cases after determining causality



4.5.3 Causality assessment team

Causality assessment is done by a national reviewing team/committee that is: independent; free of real or perceived government, industry conflicts of interest; and has a broad range of expertise in the areas of infectious diseases, epidemiology, microbiology, pathology, immunology, neurology and vaccine programmes. The committee has written terms of reference (see Table 4.10).

Table 4.10 National AEFI committee terms of reference

Expert/advisory functions	• Review serious AEFIs to assess causality. • Monitor AEFI data for potential signals. • Recommend additional studies. • Advise on safety issues affecting national policy or immunization. • Identify a spokeperson for media.
Implementation/ programmatic functions	• Provide technical advice. • Review reports and advise on analysis, reporting and causality assessment. • Assist investigation and response for serious AEFIs. • Oversee AEFI surveillance system. • Support training.

In summary, causality assessment of serious cases needs high levels of expertise and will be done by an expert committee only at the national level. An assessment usually will not prove or disprove an association between an adverse event and the immunization. It is meant to assist in determining the level of certainty of such an association. A definite causal association or absence of association often cannot be established for an individual event.

Exercise 8

Small group discussions

On quick inspection of the monthly reports of AEFI surveillance coming from the clinics in the district, the district supervisor noticed what appears to be a cluster of abscess reports. Describe in detail how they would analyse the reports from the clinics and what action should be taken as a response to these reports.

4.6 Action and response to AEFI

Responding to AEFI may involve immediate short-term activities or/and long-term follow-up activities. Follow-up activities should be based on findings of investigations, causality assessments and recommendations by the investigation/expert committees (see Table 4.11).

Proper and early treatment should be provided to patients regardless of the diagnosis. Case management and referral will vary depending on the seriousness. Mild symptoms such as mild fever and pain are likely to be of short duration and can be managed by assuring and educating parents during immunization. If parents return to seek medical attention, these cases should be documented and reported in the standard form. In case patients need hospitalization, a clear system for referral should be in place.

Table 4.11 Actions to be taken upon completion of the investigation/causality assessment

Type of AEFI	Follow-up action
Vaccine-related reaction	If there is a higher reaction rate than expected from a specific vaccine or lot, obtain information from the manufacturer and consult with the WHO state office to consider: • withdrawing that lot • investigating with the manufacturer • obtaining vaccine from a different manufacturer.
Immunization error-related	Correct the cause of the error. This may mean one or more of the following: • changing logistics for supplying the vaccine • changing procedures at the health facility • training of health workers • intensifying supervision. Whatever action is taken, it is important to review at a later date to check that the immunization error-related events have been corrected.
Coincidental	The main objective is to present the evidence showing that there is no indication that the AEFI is a vaccine-related reaction or immunization-related error and, that the most likely explanation is a temporal association between the event and vaccine/vaccination. This communication can be challenging when there is widespread belief that the event was caused by immunization. Sometimes, it may be useful to enlist further expert investigation to ensure that the event was truly coincidental. The potential for coincidental events to harm the immunization programme through false attribution is immense.

Depending on the nature of the event(s), the number of people affected and community perceptions, an investigation may be conducted. In general, it is not advisable to discontinue the immunization programme while awaiting the completion of the investigation. If AEFI causality is not established – depending on the nature of the event, its extent and whether it is ongoing – a further investigation or epidemiological study may be warranted. However, it must be accepted that in some cases the relationship to vaccine will never be clear. Communication and training are two important follow-up actions that have long-term implications.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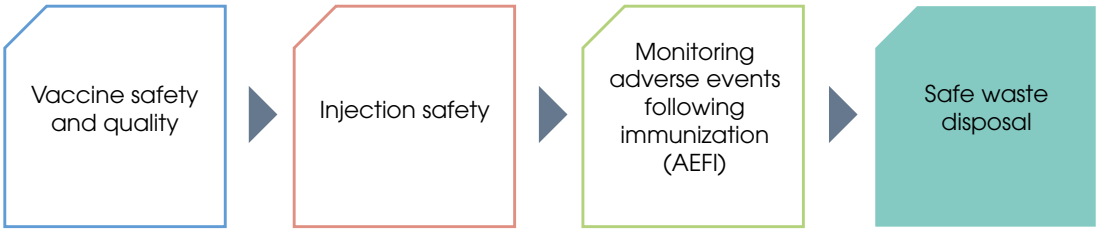


5. Safe management of injection waste

The EPI manager is responsible for overseeing the organization of the safe management of immunization waste produced by the EPI programme activities. Waste produced by the immunization activities includes sharps (used syringes), used vaccine vials, discarded coolant packs, discarded temperature devices, general packaging etc. All such waste must be properly managed according to national policies and regulations in place for these categories of waste. Because of their specificity and the high level of risk injection waste (used needles and syringes) presents to the community, the proper management and disposal of this category of waste is one of the most important issues in assuring immunization safety.

The overall objective of this chapter is to give EPI managers the tools to ensure a safe management of injection waste, specifically at district level. At the end of this section, participants should be able to evaluate the various waste management options, plan, implement, the appropriate ones in their programmes, taking into consideration the local context, monitor and supervise. They will also have skills to train staff on the topic.

5.1 Management of injection waste at district level

Adequate disposal of waste is primarily a management issue, not necessarily an equipment issue.

5.1.1 Focus group discussions

Two methods to collect used needles and syringes produced during immunization activities are described below.

A. The used syringes and needles are **collected in a safety box** immediately after the injection (without recapping). The main requirements for the safe collection using this method include:

- Adequate stock of safety boxes available in the health facility.
- Health workers know how to adequately fold the safety box, how to fill it properly and how to close it. A standard operating procedure on how to fold and fill a safety box should be accessible.

B. A device (needle cutter/remover) is used to separate the needle from the syringe immediately after the injection. The needle remains in the reservoir of the device but the syringe is immediately dropped in a safety box. The main requirements for safe collection using this method include:

- Each vaccination site should be equipped with one device; a device should not be shared by two vaccination sites.
- Adequate stock of safety boxes available in the health facility.
- Heath workers are trained to use the device.
- The health facility using the devices should be equipped with a needle pit where the reservoir of the device (containing the needles) is emptied immediately after the vaccination session or when the reservoir is full.

Note: The first method of collection (used syringes and needles collected in a safety box immediately after the injection without recapping) is the one recommended by WHO.

5.1.2 The district waste management plan

It is good practice that the DHMT, in collaboration with all the health facilities in the district, develop an annual waste management plan that guides how the treatment and disposal of the immunization waste from the different health facilities of the district will be processed. It is important, that where applicable, the plan considers streamlining the treatment and disposal of the immunization waste through existing channels of the health system waste management instead of creating a parallel channel only for the immunization waste. Implementing a standalone channel for EPI waste in some contexts may not be efficient and sustainable.

Steps for the management of routine injection waste

1. Identify facilities (district, nearby hospital, heath facilities) that have functioning waste treatment and disposal equipment (e.g. incinerators). These health facilities will treat and dispose of their injection waste on site.

⩔

2. Identify health facilities without functioning waste treatment and disposal equipment.
   - Work out an arrangement to transport the safety boxes from these health facilities where possible and without high risk (offsite transportation) to health facilities with functioning waste treatment and disposal equipment. Offsite transportation refers to an arrangement used when a health facility does not have adequate treatment and disposal equipment onsite, and the DHMT and the health facility agree that the waste from the facility should be transported to another site for adequate treatment and disposal.
   - Where this arrangement is not possible, because there is no access to a health facility with functioning treatment and disposal equipment, decide on methods of treatment and disposal onsite including assessing:
     - Building/installing new functioning equipment.
     - Local possibilities of treatment and disposal (e.g. safe burying, etc.).

⩔

3. Prepare clear instructions on the process that will be followed by each health facility. It should be clear what to do and when and who is responsible for what. Health staff in charge should include this activity in their workplan.

⩔

4. Ensure regular monitoring of compliance with these instructions.

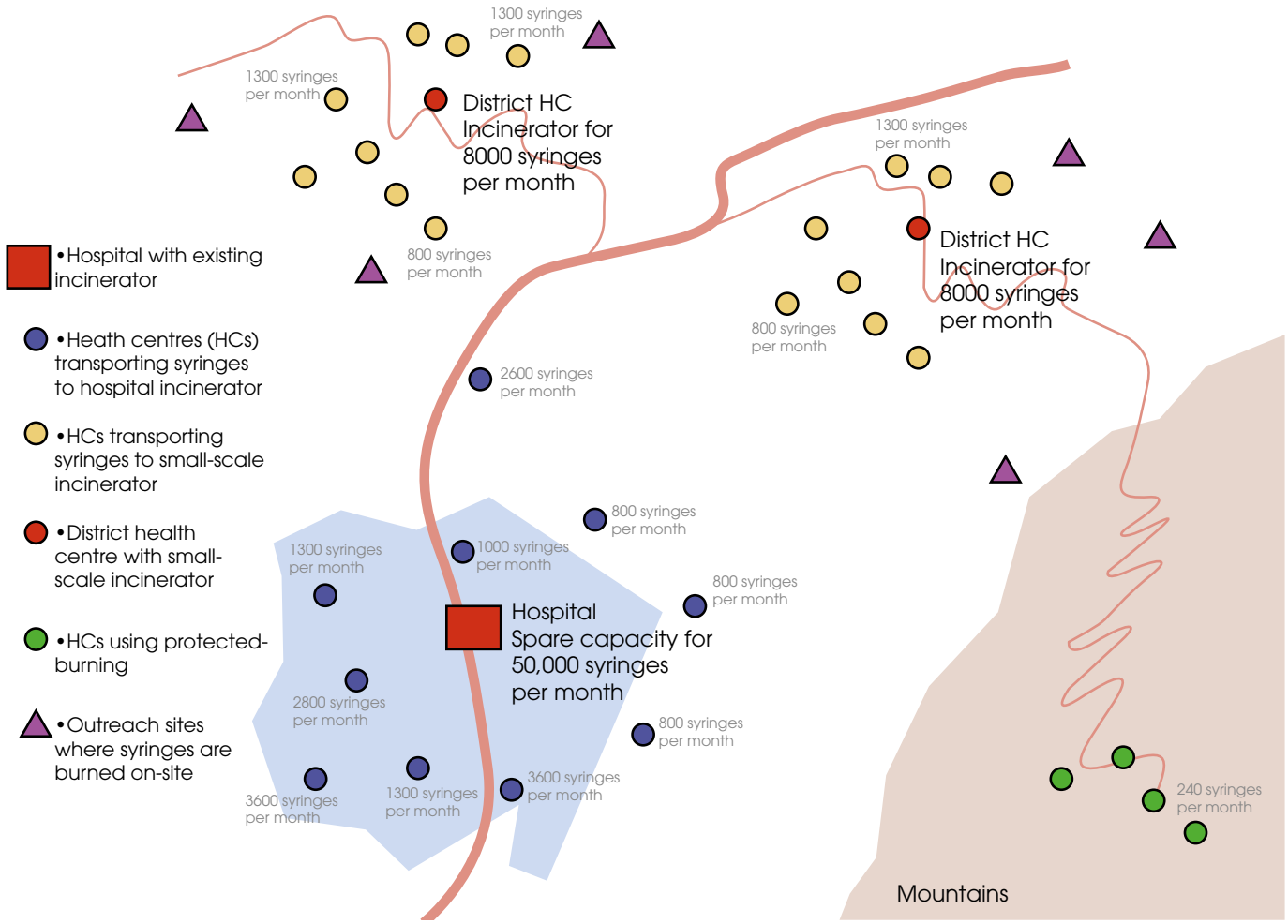
⩔

5. Elaborate the annual budget and ensure the availability of funds to implement the district waste management plan – this should include operational costs and costs for new investment.

In many countries, use of functioning equipment at the district level (functioning incinerator in the district or the nearby hospital) has proven to be a practical and effective management solution (for both RI and mass campaigns). Safety boxes containing used needles and syringes are collected from health centres having no access to functioning treatment and disposal and transported to a district either by the district during the supervisory visit to the heath facility or by the health facility during their supply visit to the district. To facilitate collection, some countries use an exchange strategy, whereby new needles, syringes and safety boxes are given in exchange for safety boxes filled with used syringes and needles.

In some countries, offsite transportation for treatment and disposal is outsourced to a private company. In such cases, a written agreement regarding the off-site transport and treatment of the waste should be available and performance should be regularly evaluated.

Figure 5.1 Example of a district waste management map



Additional steps for consideration during the planning of injection waste management during campaigns

During campaigns with injectable vaccines, the injection waste management should be strengthened to ensure the sudden increase in quantity of waste is well handled. Key aspects to be strengthened via monitoring and checklists:

- number of safety boxes to be disposed of;
- identification of additional offsite treatment and disposal sites sometimes beyond/outside the health system infrastructure;
- implementation of practical onsite solutions;
- supervision;
- training of heath staff in charge;
- budget for waste management implementation.

Exercise 9

Group work.

In this exercise you are going to prepare a waste management plan for your district. The population of your district is 420 000. The district capital has a population of 80 000. The district has three major townships with populations of 40 000–50 000 people each. One of the townships is remote and has poor road accessibility due to difficult terrain. All of them have a rural hospital each having an incinerator. However, one of them, which is close to the district capital is not functioning. Monthly reports from health centres show some increase in AEFI cases during the current year.

Last year the DHMT conducted a review of the immunization waste management status in the district, which documented that in 30% of the health centres waste disposal practices had considerable gaps. The DHMT asked you, as a focal point for immunization, to prepare a plan to improve waste management in the district. Consider local conditions, availability of functioning incinerators, disposal systems at peripheral and district level as well as availability of responsible staff to handle immunization waste. Choose the proper methods and equipment according to their advantages and disadvantages to reflect in your plan. Make practical recommendations to submit to DHMT. Will the example district map help you in your planning? When finished, share your findings with the facilitator.

5.2 Treatment and disposal of injection waste

Treatment: A technique or process for altering the biological, chemical or physical characteristics of the waste to reduce the hazards it presents and facilitate, or reduce the costs of disposal.
Disposal: Intentional placing of the treated waste material into the land (e.g. burial of incineration ashes).

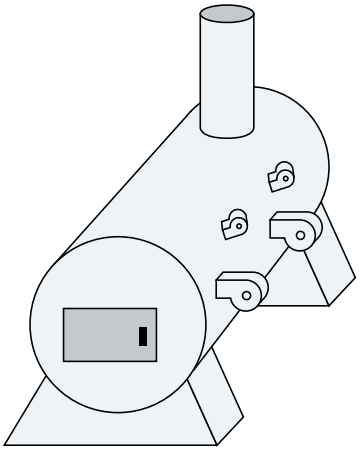
5.2.1 Common methods for treatment of injection sharp waste

Commonly used treatment methods include:

- incineration at high temperature (>800°C)
- burning in metal drums and brick furnaces (<800°C)
- encapsulation and burying without burning.

Incineration at high temperature (>800°C)
Heat treatment by incineration at high temperature can completely destroy needles and syringes by burning at temperatures above 800°C. The high temperature kills microorganisms and reduces the volume of waste to a minimum. Properly functioning incinerators with two combustion chambers ensure the most complete destruction of syringes and needles, and produce less air pollution. The incinerator should be equipped with an indicator of temperature.

Figure 5.2 An incinerator (equipped with temperature and pollution control)



Burning in metal drums and brick furnaces (<800°C)
Heat treatment at temperature that may reach 400°C or higher but generally lower than 800°C burns the waste but does not completely destroy it and produces more pollution. Metal drums or brick furnaces generally used are neither equipped with temperature control nor air pollution control devices.

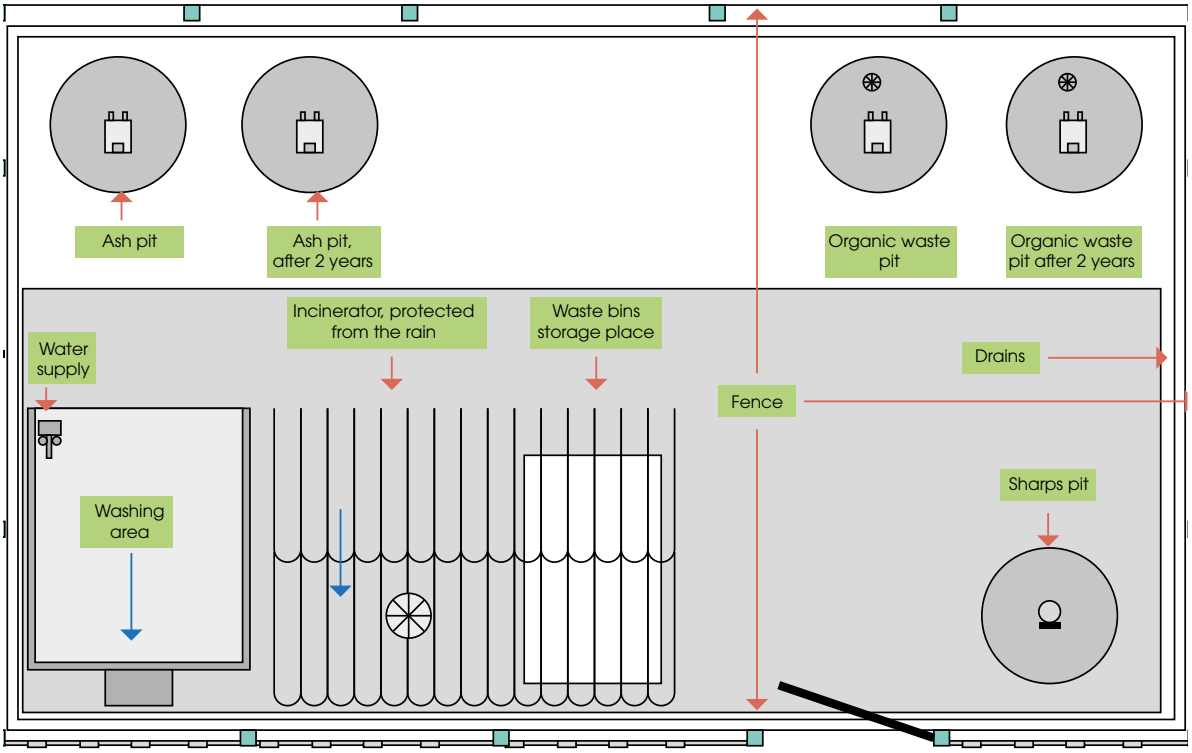
Figure 5.3 Metal drum and brick furnaces

Figure 5.4 A burying pit

Encapsulation and burying without burning

Burying filled safety boxes is an ineffective way to dispose of sharps waste. It is often difficult to find a place to bury the boxes and it may be difficult to dig a pit large enough as the boxes are bulky. If contaminated syringes somehow escape from the box and are carried into water streams or open fields, people may step on them and children may play with them. For a secured landfill, appropriate preparations of the site and a favourable geological setting (providing an isolation of wastes from the environment) are required. The deposit of waste should be controlled and the waste covered with wet concrete to encapsulate the sharps.

Figure 5.5 A well-organized waste treatment and disposal site



Organization of a treatment and disposal site

The waste treatment and disposal site should be organized to be functional, clean, secured and a pleasant work place. Figure 5.5 illustrates a well-organized waste treatment and disposal site.

Safety of the personnel in charge of handling the waste
The staff/personnel staff handling waste should be trained on recommended practices, have protective equipment and be vaccinated against HepB and tetanus.

A designated reference person in the health facility to address any injury/exposure to a risk linked to waste management (e.g. tetanus, AIDS) should be known.

Figure 5.6 Protective equipment

Table 5.1 Strengths and weaknesses of commonly used methods for treatment and disposal of injection waste

Method	Strengths	Weaknesses
Incineration (>800°C) High temperature	Almost complete combustion and sterilization of used equipment Reduces risk of toxic emissions Greatly reduces volume of immunization waste Greater compliance with local environmental laws	Relatively expensive to build, operate and maintain Requires trained personnel to operate May require fuel or dry waste to start burning May produce low levels of dioxins and furans
Burning (>400°C) Pit/drum burning Brick furnaces	Relatively inexpensive Minimum training required Reduction in waste volume Reduction in infectious material	Incomplete combustion May not completely sterilize Not environmentally friendly: results in heavy smoke High potential for toxic emissions (dioxins and furans) If not dry waste may require fuel to start burning
Waste burial pit/ encapsulation or other immobilizing material	Inexpensive Simple (low-tech) Prevents unsafe needle and syringe reuse Prevents sharps related infections/ injuries to waste handlers/scavengers	Potential of being unburied Volume of waste is not reduced Wastes are not disinfected Pit will fill quickly during campaigns Not suitable for non-sharp infectious wastes Presents a danger to the community if not properly buried Inappropriate in areas of heavy rain or if water table is near the surface

5.2.2 Uncommon methods for treatment of injection sharp waste

Acceptable, but not commonly used, methods include solar melting of syringes, autoclaving, steam sterilization, microwaving (with shredding), etc. In practice, these may not be appropriate/available at district level, as they are currently either experimental or expensive. However, they will probably play an important role in the future.

Figure 5.7 Solar melter and safety box of molten syringes

5.2.3 Unacceptable methods for treatment of injection sharp waste

Unacceptable methods of treatment and disposal of injection waste include open burning and dumping.

Open burning

Open burning of injection waste is not acceptable as needles are not completely destroyed; waste can be scattered and people could be pricked by the remaining stubs of previously burned needles.

Figure 5.8 Open burning

Dumping in open areas

Dumping is an uncontrolled and scattered deposit of non-treated waste or treated waste material; dumping of injection waste is **not acceptable.**

Figure 5.9 The risk of injection waste dumping

No option of waste management works well without properly trained staff to handle the equipment and implement the best option. The EPI manager should ensure that personnel are appointed to be in charge of waste disposal. Generally, these are either specific personnel in large health centres or hospitals, or personnel from the vaccination team in small facilities. Training should give such personnel technical skills and an awareness of the importance of their role in assuring their own safety, safety of their colleagues and the safety of the community.

5.3 Importance of advocacy and communication

The EPI manager should emphasize the importance of safe disposal of waste to health staff and the community. The health staff should be sensitized on the potential risks related to recapping needles after vaccination and the need to use safety boxes systematically. The community should be aware of the risks of manipulating used needles and syringes and of the efforts made by the health personnel to prevent accidents. The public should know that used material is stored and disposed of regularly and safely. Well-informed community members should spread the message on prevention of accidents caused by sharps among other community members, especially preventing children from playing with used sharps. School health programmes should also include talks on safe waste disposal. The prevention of accidents caused by sharps may also be an ideal educational topic for essays by school children.

5.4 Supervision, monitoring and evaluation

During every supervisory visit, safe waste disposal practices should be looked into and monitored by the EPI manager. Meetings with health personnel periodically should include an item about safe disposal of the immunization waste. This will help to sensitize the staff and offer an opportunity to share experiences on waste disposal in their work place. EPI managers should discuss problems or challenges and solve them together, then communicate those solutions to all the staff in the country using various channels of communications (newsletters, circular letters etc.). Evaluation of safe disposal practices is clearly a part of the manager's functions and it should be included in the overall evaluation exercise of safe injection practices.

The following indicators could be regularly monitored and periodically assessed in the health facilities:

- Proportion of health facilities with treatment methods for each category of waste generated in the HF that complies with national or international standards.
- Proportion of health facilities with a clear responsibility established to oversee the waste collection, transport, treatment and disposal.
- Proportion of health facilities where the supervision visit includes waste management.
- Proportion of health facilities with evidence of no used needles (i.e. syringes lying around treatment/disposal area or facility building).
- Proportion of districts/provinces with adequate supply of safety boxes.

Exercise 10

Small group discussions and plenary session.

- What are the current evaluation methods of safe waste disposal in your province/district?
- Have you registered any weaknesses in these methods and what are the possible ways of improving them?
- Review the above list of monitoring indicators and suggest three to five further indicators to monitor waste disposal practices in your district/province or country.

After you have finished the exercise, report to the plenary.

5.5 Summary of essential issues and case study examples

Immunization safety has increasingly been recognized as an important element of every immunization programme. EPI managers are responsible for safety of injections and waste disposal in their area of responsibility. They are also responsible for ensuring immunization safety through planning, implementation and training.

They should systematically include observation of immunization safety practices, interviews, control of supplies related to safe vaccine administration and safe waste management as they supervise and monitor the performance of staff in this area. By ensuring that surveillance of AEFIs is carried out properly, EPI managers are contributing to the image of the programme, especially relating to the quality of the EPI. This ensures sustainability and credibility of immunizations for a long time to come. Managers should

also promote immunization safety through advocacy aimed at both the public and the health staff. A high standard of immunization safety practice will contribute to a high quality of other services being delivered to the public, the safety of health workers and the safety of the environment.

Communication, advocacy and social mobilization in immunization are also important tasks of mid-level management. Immunization programmes need to work with other programmes, e.g. HIV/AIDS and clinical/curative care, to use appropriate communication strategies for immunization safety:

- Marketing safety to health workers and the community, using as a focus public concern about HIV/AIDS transmission and the personal benefit that health worker will gain from increased safety. The communication strategy should be adapted to the sociocultural settings.
- Strengthening communication and advocacy activities by recruiting expertise for communication campaigns.
- Strengthening capacity of interagency coordinating committees to address immunization safety.
- Emphasizing immunization safety as a priority issue in WHO regional and inter-country as well as at EPI managers' meetings.
- Capitalizing on the WHA resolution on patient safety to raise awareness of health personnel on safety issues.

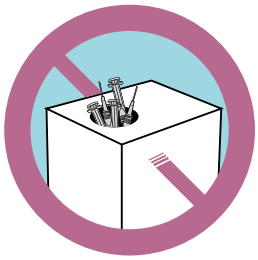
Immunization safety issues should have the same level of importance in the evaluation and monitoring of an immunization programme as the immunization coverage and the surveillance of diseases, because they characterize the quality of the programme.

Unsafe immunization practices

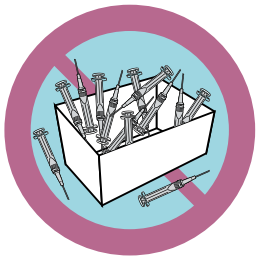
Do not touch the needle.

Do not recap the needle.

Do not leave the needle inside the vial



Do not overfill the safety box.



Do not dispose of used needles in an open cardboard box.

Case studies on AEFI

In 2012 in country A, four separate AEFI clusters of collapse occurred up to five minutes following immunization with measles vaccines. All 14 cases presented with hypotonia; 11 became pale; seven cases had cyanosis, dyspnea and increased saliva secretion; three patients had depressed respiration and one patient died; others recovered in less than one hour. In two of the clinics, vials that contained muscle relaxant were found stored with vials containing vaccine diluent, and of the same size and shape; labels on a number of vials recovered could not be read. Infrared spectrophotometry of the urine of one of the cases and thin layer chromatographic analysis of a reconstituted vaccine from one of the implicated vials showed the presence of muscle relaxant.

Cause: Use of muscle relaxant instead of diluent

In one hospital in 2011 in country B, five neonates collapsed a few minutes following immunization with BCG and OPV. Four were resuscitated and one died. Muscle relaxant was found in the refrigerator.

Cause: Use of insulin instead of Penta vaccine

In 2011 in country C, 21 infants died out of 70 supposedly given Penta vaccine. Insulin was stored in similar vials and in the same refrigerator as Penta vaccine.

Cause: Non-sterile injection

Three infants died in 2010 in country D, after administration of measles vaccine. Symptoms, developing within five hours post-immunization were; fever, rash, vomiting, and diarrhoea, described by the attending health worker as toxic shock syndrome. Reconstituted vaccine was routinely kept until it was used, and syringes were never sterilized, but washed with ordinary water and wiped with cotton wool. No testing could be done.

Cause: Non-sterile injection (contaminated reconstituted vaccine)

In 2011 in country E, four children died and a fifth was hospitalized after receiving measles vaccine from the same vial. Vial was not refrigerated, and was transported house to house for immunization. Reactions began four to five hours after vaccination, with vomiting, unconsciousness, and meningeal irritation. *Staphylococcus aureus* was cultivated from the incriminated vial.

Cause: Coincidental event

In response to a severe diphtheria outbreak in country F in 2009, DT was delivered to children in a mass campaign. The death of a seven-year-old girl, two to three days following immunization was reported. The symptoms reported included convulsions that might have been attributable to a vaccine reaction. Upon investigation, it was found that the girl had a history of convulsions and neurological symptoms unrelated to immunization.

Cause: Coincidental event

In 2010, a mass measles immunization campaign in children from 6 months to 15 years was piloted in an area. AEFI reporting and investigation was instituted for the programme. Of the 30 reports of AEFIs, nearly half were anxiety reactions, and of the other 16 events that were investigated, a further 11 events also were found to be anxiety reactions.

Recommended reading

PATH (2006). Proper handling and disposal of auto-disable syringes and safety boxes. A training module for clinic managers and immunization providers. Prototype for in-country adaptation. Seattle (WA): PATH. Available at: http://www.path.org/vaccineresources/files/AD_and_Safety_Box_Disposal.pdf (accessed 20 April 2017).

USAID (2003). Immunization essentials: A practical field guide. Office of Health, Infectious Diseases, and Nutrition, Bureau for Global Health. United States Agency for International Development. Available at: http://pdf.usaid.gov/pdf_docs/pnacu960.pdf (accessed 5 December 2016).

WHO (2002). "First, do no harm" Introducing auto-disable syringes and ensuring injection safety in immunization systems of developing countries. WHO/V&B/02.26. Geneva: World Health Organization. Available at: http://apps.who.int/iris/bitstream/10665/67612/1/WHO_V-B_02.26_eng.pdf (accessed 20 April 2017).

WHO (2005). Management of solid health-care waste at primary health-care centre: A decision-making guide. IVB. Geneva: World Health Organization.

WHO (2008). Implementing the Reaching Every District approach: A guide for district health management teams. Regional Office for Africa: World Health Organization. Available at: http://www.who.int/immunization/programmes_systems/service_delivery/AFRO-RED_Aug2008.pdf (accessed 5 December 2016).

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WHO (2014). Safe management of wastes from health-care activities. 2nd edition. Y Chartier et al (editors). Geneva: World Health Organization.

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WHO (2015). Immunization in practice: A practical guide for health staff. Module 3: Ensuring safe injections. Geneva: World Health Organization.

WHO (2015). Regional Strategic Plan for Immunization 2014–2020. Regional Office for Africa: World Health Organization. Available at: https://www.aho.afro.who.int/en/ahm/issue/19/reports/regional-strategic-plan-immunization-2014–2020 (accessed 5 December 2016).

WHO, UNICEF (2005). GIVS Global Immunization Vision and Strategy 2006–2015. Available at: http://apps.who.int/iris/bitstream/10665/69146/1/WHO_IVB_05.05.pdf (accessed 18 January 2017).

WHO WRPO (2013). Immunization safety surveillance: Guidelines for immunization programme managers on surveillance of adverse events following immunization. Manila: WHO Regional Office for the Western Pacific. Available at: http://www.wpro.who.int/topics/immunization_safety/ImmunizationSafetySurveillance.pdf (accessed 20 April 2017)

Websites

Centers for Disease Control and Prevention – Vaccine safety:
https://www.cdc.gov/vaccinesafety/index.html

WHO – Health-care waste:
http://www.who.int/mediacentre/factsheets/fs253/en/

WHO – Injection safety:
http://injectionsafety.org

WHO – Immunization, Vaccines and Biologicals (IVB resources):
http://www.who.int/immunization/documents/en/

WHO – Immunization, Vaccines and Biologicals (Vaccines and diseases):
http://www.who.int/immunization/diseases/en/

Annex 1: Contraindications to EPI vaccines

The risk of delaying an immunization because of an intercurrent illness is that the child may not return and the opportunity is lost. Throughout the world, missed immunization opportunities because of false contraindications are a major cause of delay in completing the schedule, or of non-immunization.

In general, the EPI recommends that health workers should use every opportunity to immunize eligible children; vaccines should be given to all eligible children attending outpatient clinics. Children who are hospitalized should be immunized as soon as their general condition improves and at least before discharge from hospital. In areas of measles transmission, measles vaccine should be given on admission to hospital because of the risk of nosocomial measles transmission.

Normally, live vaccines should not be given to individuals with immune deficiency diseases or to individuals who are immuno-suppressed due to malignant disease, therapy with immuno-suppressive agents or irradiation. Both measles and oral poliomyelitis vaccines should be given to an HIV-infected person however. Children with symptomatic HIV infection should not be immunized with yellow fever vaccines. Individuals with moderate immune deficiency have generally been recommended to have the measles vaccine if there is even a low risk of contracting wild measles from the community. Nevertheless, a child who is already severely affected by the HIV virus may be considered in the same way as any child who is seriously ill: it makes sense to avoid immunization. If the child dies soon after administration of the vaccines, it may incorrectly be assumed that the vaccine caused death. By the revised recommendation of Global Advisory Committee on Vaccine Safety (2010), children who are known to be HIV infected, even if asymptomatic, should no longer be immunized with BCG vaccine. These children, who later develop AIDS, are at high risk of developing BCG disease.

A severe adverse event following a dose of vaccine (anaphylactic reaction) is a true contraindication to a subsequent dose of the same vaccine. Such events can be recognized easily by the mother and the health worker.

A second or third DTP injection should not be given to a child who has suffered such a severe anaphylactic reaction to the previous dose. Because these events are so rare, it is not known which component of the combined DTP (or additional antigens in the combination vaccines) is responsible for allergic reactions. Therefore, no further dose of any of the vaccine components should be given unless assessment implicates the responsible antigen.

The pertussis component has often been incriminated in the past. High fever within 48 hours after vaccination attributed to vaccination and not to intercurrent illness indicates the likelihood of recurrence of fever with subsequent doses. Febrile convulsions may be more likely in a susceptible child who develops high fever. Acetaminophen prophylaxis reduces the incidence of fever and may reduce febrile convulsions temporally related to pertussis vaccination. Persistent, inconsolable crying and an unusual high-pitched cry after pertussis vaccination are not associated with any sequelae and are likely pain response at the site of injection in young infants. These reactions do not preclude further pertussis vaccination. Acetaminophen prophylaxis may reduce discomfort with subsequent doses. Hypotonic-hyporesponsive episodes are not a contraindication to the use of pertussis vaccine. Continued immunization with all antigens is recommended. Onset of encephalopathy temporally related to pertussis vaccination does not indicate that the vaccine was the cause. Encephalopathy itself, from whatever cause, is not a contraindication to pertussis vaccination. Deferral of pertussis immunization for children with evolving neurological conditions is no longer necessary, because of the availability of acellular pertussis vaccine.

Persons with a history of anaphylactic reactions (difficulty in breathing, swelling of the mouth and throat, hypotension or shock) following egg ingestion should not receive vaccines prepared on hen's egg tissues (e.g. yellow fever and influenza vaccines). Vaccine viruses propagated in chicken fibroblast cells (measles or combined measles-mumps-rubella vaccines) can usually be given to such individuals without problems. Allergies to measles vaccine have rather been shown to be related to the hydrolyzed gelatin used as a stabilizer.

Before immunization, check for contraindication by asking about known allergies and previous adverse reactions to vaccines. In the case of a possible serious allergy, check with the appropriate supervisor before giving vaccine. This procedure will minimize the occurrence of anaphylaxis but will not remove the risk altogether. Recognition and treatment of anaphylaxis is described in *Immunization safety surveillance: Guidelines for managers of immunization programmes on reporting and investigating adverse events following immunization* (WHO WRPO, 2013).

Anaphylaxis is a rare and potentially life-threatening allergic complication of vaccination that should be anticipated in every vaccine injection. Prevention is the best approach. To identify this contraindication, pre-

vaccination examination should include questions about possible allergy to any component of the product being considered. As avoidance is not always possible, every vaccine provider should be familiar with the symptoms of anaphylaxis and be ready to initiate management and administer the appropriate medications. Anaphylaxis is one of the rarer events reported in the surveillance system and range from 0.11 to 0.31 reports per 100 000 doses of vaccines distributed. In the case of anaphylaxis, changes develop over several minutes and usually involve multiple body systems (affecting the skin, respiration, blood circulation).

The cardinal features of anaphylaxis are:

- Itchy, urticarial rash (in over 90% of cases).
- Progressive, painless swelling (angioedema) about the face and the mouth, which may be preceded by itchiness, tearing, nasal congestion or facial flushing.
- Respiratory symptoms, including sneezing, coughing, wheezing and laboured breathing; upper way swelling (indicated by hoarseness and/or difficulty swallowing) possibly causing airway obstruction.
- Hypotension, which generally develops later in the illness and can progress to cause shock and collapse.

It must be differentiated from fainting, anxiety and breath holding which are more common and benign reactions.

The main steps of management of anaphylaxis are:

- Place the patient in a recumbent position (elevated feet).
- Establish an oral air way if necessary.
- Check respiration and pulse.
- Promptly administer 0.01 ml/kg (maximum 0.5 ml) of aqueous epinephrine 1:1000 by subcutaneous or intramuscular injection in the limb (opposite limb to where the vaccination was given); speedy intervention is of paramount importance. Dosing can be repeated at 20-minute intervals if necessary.
- Monitor vital signs and reassess the situation frequently, to guide medication use.
- Arrange for rapid transportation to an emergency department.

Since anaphylaxis is rare, epinephrine vials and other emergency supplies should be checked on a regular basis and replaced if outdated. **False contraindications** – many immunization programmes have long lists of contraindications, most of which are inappropriate. Low-grade fever, mild respiratory infections and other minor illnesses **should not** be considered as contraindications to immunization. Diarrhoea should not be considered a contraindication to OPV. It is particularly important to immunize children suffering from malnutrition.

Annex 2: How to use safe disposal equipment

Container burning

1. Choose an unused part of the compound for the container-burning site, as far from the buildings as possible.
2. Fence off and clear the area.
3. Make the drum incinerator:
    - Place four bricks on the ground in a square pattern.
    - Place a metal screen or grate on top of the bricks.
    - Remove both ends of a 210-l steel drum. This will allow more air to flow through the drum and better burn the contents. The cylinder could also be constructed from sheet metal, bricks or clay. You can add a chimney to the (removable) top end of the drum.
    - Place the drum on top of the metal screen.
4. Take the filled safety boxes to the burning site just before burning.
5. Place the filled safety boxes into the metal drum. Mix paper, leaves, or other flammable material among the safety boxes to help them burn.
6. Sprinkle a small amount of kerosene on the boxes and other material in the drum, if available.
7. Place a fine metal screen over the top of the drum to reduce flying ash.
8. Place wood, paper or other flammable material under the drum and ignite it.
9. Warn people to stay away and to avoid smokes and fumes from the fire.
10. Allow the fire to burn until all the boxes have been destroyed.
11. Once the fire is out and the residue at the bottom of the drum has cooled, dig a small pit and bury the residue. Handle the residue carefully, since it contains needles and other sharps. Cover the residue with at least 13 cm of soil. Be sure to select a site where people will not dig to plant crops or establish latrines. When the pit is full cover the site with concrete to prevent digging in the future.
12. Container burning should always be carried out under the supervision of a qualified staff member. Do not leave this vital task to unqualified people!

Open burning

If open burning must be done, health workers should:

1. Choose an unused part of the compound for burning site, as far from buildings as possible. Be sure to select a site where people will not dig to plant crops or establish latrines.
2. Fence off and clear the area.
3. Dig a pit at least 1 m deep.
4. Take the filled safety boxes to burning site just before burning. Do not open or empty the boxes.
5. Place the filled safety boxes into the pit. Mix paper, leaves or other flammable material among the safety boxes to help them burn.
6. Sprinkle a small amount of kerosene on the boxes in the pit, then ignite the fire.
7. Warn people to stay away and avoid smoke and fumes from the fire.
8. Allow to burn until all the boxes have been destroyed.
9. Once the fire is out and the residue at the bottom of the pit has cooled, cover the residue with at least 13 cm of soil. Cover the site with concrete when the pit is full to prevent digging in the future.
10. Open burning should always be carried out under the supervision of a qualified staff member. Do not leave this vital task to unqualified people!

Burying without burning

If you cannot burn your safety boxes prior to burying:

1. Choose a site where people will not dig or establish latrines in the future.
2. Fence off and clear the area.
3. Dig a pit at least 2 m deep. Make sure that the material will not escape from the pit (during the rainy season, for example).
4. Take the filled safety boxes to pit site just before burying. Do not open or empty the boxes.
5. Place the filled safety boxes into the pit.
6. Cover the boxes with at least 30 cm of soil. When the pit is full cover the site with concrete to prevent digging in the future.
7. Burying without burning should always be carried out under the supervision of a qualified staff member. Do not leave this vital task to unqualified people!

Annex 3: AEFI case reporting form

AEFI reporting ID number: ***Patient name*:** ***Patient's full address*:** Telephone: Sex: ☐M ☐ F ***Date of birth (DD/MM/YYYY)*: _ _/_ _/_ _ _ _** *OR Age at onset:* ☐☐*Years* ☐☐ *Months* ☐☐☐ *Days* *OR Age group:* ☐*<1 Year* ☐ *1 to 5 Years* ☐ *>5 Years*	***Reporter's name*:** Institution: Designation & department: Address: Telephone & e-mail: Date event notified to health system (DD/MM/YYYY): _ _/_ _/_ _ _ _ Today's date (DD/MM/YYYY): _ _/_ _/_ _ _ _

Health facility (or vaccination centre) name:								
Vaccine						***Diluent***		
***Name**	***Date of vaccination**	***Time of vaccination**	Dose (1st, 2nd, etc.)	***Batch/lot number**	Expiry date	***Batch/ lot number**	Expiry date	Time of reconstitution

Adverse event (s): ☐ Severe local reaction ☐ *>3 days* ☐ *beyond nearest joint* ☐ Seizures ☐ *febrile* ☐ *afebrile* ☐ Abscess ☐ Sepsis ☐ Encephalopathy ☐ Toxic shock syndrome ☐ Thrombocytopenia ☐ Anaphylaxis ☐ Fever ≥38°C ☐ Other (specify)..... Date & time AEFI started (DD/MM/YYYY): __ __ / __ __ / __ __ __ __ ""☐☐ Hr ☐☐Min	Describe AEFI (signs and symptoms):
Serious: Yes / No: ➔ If Yes ☐ Death ☐ Life threatening ☐ Disability ☐ Hospitalization ☐ Congenital anomaly	
Outcome: ☐ Recovering ☐ Recovered ☐ Recovered with sequelae ☐ Not recovered ☐ Unknown ☐ Died. If died, date of death (DD/MM/YYYY): __ __ / __ __ / __ __ __ __ Autopsy done: ☐Yes ☐No ☐ Unknown	
Past medical history (including history of similar reaction or other allergies), concomitant medication and other relevant information (e.g. other cases). *Use additional sheet if needed:*	

First decision-making level to complete:

Investigation needed: ☐ Yes ☐ No	If yes, date investigation planned (DD/MM/YYYY): _ _ /_ _ / _ _ _ _

National level to complete:

Date report received at national level (DD/MM/YYYY): _ _ /_ _ / _ _ _ _	AEFI worldwide unique ID**:**
Comments:	

**Compulsory field*

Name/ID	Village/ Town/ District	Date of birth (dd/ mm/yyyy) an age	Date of immunization (dd/mm/yyyy)	Reaction type (code) [1] Minor [2] Severe/ serious	Outoome (recovered disability/ died)	Suspect vaccine (name and dose, e.g. Penta-2)	Vacinne batch/lot number	Diluent batch number	Onset time interval (hours, days, weeks)	Date reporting (dd/mm/ yyyy)	Investigated? (if yes, date)	Final diagnosis	Cause (code)

Establishing codes for area, reaction type, cause of AEFI, and certainty of cause will facilitate recording, data entry and analysis. Because of the potential for coding errors, the code should be double checked.

Coding for cause of AEFI:

[A1] Vaccine-related	[A2] Immunization error-related	[A3] Immunization anxiety-related	[B] Indeterminate	[C] Coincidental	[D] Inadequate information to classify

Annex 5: AEFI investigation form

(Only for serious adverse events following immunization-Death/disability /hospitalization/cluster)

Section A — Basic details

Province/state **District** **Case ID**

Place of vaccination (✓): ☐ Government health facility ☐ Private health facility ☐Other (specify) _____
Vaccination in (✓): ☐ Campaign ☐ Routine ☐ Other (specify) _____

Address of vaccination site:

Name of reporting officer:

Date of investigation: __ __ / __ __ / __ __ __ __
Date of filling this form: __ __ / __ __ / __ __ __ __

Designation / Position:

This report is: ☐ *First* ☐ *Interim* ☐ *Final*

Telephone # landline (with code): Mobile: e-mail:

Patient name Sex: ☐M ☐ F

(use a separate form for each case in a cluster)

Date of birth (DD/MM/YYYY): __ __ / __ __ / __ __ __ __

OR *Age at onset: __ __ years __ __ months __ __ __ days* ***OR*** *Age group:* ☐ *<1 year* ☐ *1–5 years* ☐ *>5 years*

Patient's full address with landmarks *(street name, house number, locality, phone number etc.)*:

Name of vaccines/diluent received by patient	Date of vaccination	Time of vaccination	Dose (e.g. 1st, 2nd, etc.)	Batch/lot number	Expiry date
				Vaccine	Vaccine
				Diluent	Diluent
				Vaccine	Vaccine
				Diluent	Diluent
				Vaccine	Vaccine
				Diluent	Diluent
				Vaccine	Vaccine
				Diluent	Diluent
				Vaccine	Vaccine
				Diluent	Diluent

Type of site (✓) ☐ Fixed ☐ Mobile ☐ Outreach ☐ Other _____

Date of first/key symptom *(DD/MM/YYYY)*: __ __ / __ __ / __ __ __ __ Time of first symptom (*hh/mm):* __ __ / __ __
Date of hospitalization *(DD/MM/YYYY)*: __ __ / __ __ / __ __ __ __
Date first reported to the health authority *(DD/MM/YYYY)*: __ __ / __ __ / __ __ __ __

Status on the date of investigation (✓): ☐ Died ☐ Disabled ☐ Recovering ☐ Recovered completely ☐Unknown

If died, date and time of death *(DD/MM/YYYY)*: __ __ / __ __ / __ __ __ __ *(hh/mm):* __ __ / __ __
Autopsy done? (✓) ☐ Yes (date)_____ ☐ No ☐ Planned on (date)_____ Time_____
Attach report (if available)

Section B Relevant patient information prior to immunization

Criteria	Finding	Remarks (If yes provide details)
Past history of similar event	Yes / No / Unkn	
Adverse event after previous vaccination(s)	Yes / No / Unkn	
History of allergy to vaccine, drug or food	Yes / No / Unkn	
Pre-existing illness (30 days)/congenital disorder	Yes / No / Unkn	
History of hospitalization in last 30 days, with cause	Yes / No / Unkn	
Patient currently on concomitant medication? (If yes, name the drug, indication, doses and treatment dates)	Yes / No / Unkn	
Family history of any disease (relevant to AEFI) or allergy	Yes / No / Unkn	

For adult women

- Currently pregnant? Yes (weeks) _____ / No / Unknown
- Currently breastfeeding? Yes / No

For infants

The birth was ☐ full-term ☐ pre-term ☐ post-term. Birth weight:

Delivery procedure was ☐ normal ☐ caesarean ☐ assisted (forceps, vacuum etc.) ☐ with complication (specify)

Section C Details of first examination** of serious AEFI case

Source of information (✓ *all that apply*): ☐ **Examination by the investigator** ☐ **Documents** ☐ **Verbal autopsy** ☐ **Other**_____ *If from verbal autopsy, please mention source* _____

Name of the person who first examined/treated the patient:_____
Name of other persons treating the patient: _____
Other sources who provided information (specify): _____

Signs and symptoms in chronological order from the time of vaccination:

Name and contact information of person completing these clinical details:	Designation:	Date/time

****Instructions – Attach copies of ALL available documents (including case sheet, discharge summary, case notes, laboratory reports and autopsy reports) and then complete additional information NOT AVAILABLE in existing documents, i.e.**

- ***If patient has received medical care*** – attach copies of all available documents (including case sheet, discharge summary, laboratory reports and autopsy reports, if available) and write only the information that is not available in the attached documents below
- ***If patient has not received medical care*** – obtain history, examine the patient and write down your findings below (add additional sheets if necessary)

Provisional/final diagnosis:

Section D	**Details of vaccines provided at the site linked to AEFI on the corresponding day**									
Number immunized for each antigen at session site. Attach record if available.	Vaccine name									
	Number of doses									

a)	When was the patient immunized? (✓ the ☐ below and respond to ALL questions)	
	☐ Within the first vaccinations of the session ☐ Within the last vaccinations of the session ☐ Unknown	
	In case of multi-dose vials, was the vaccine given ☐ within the first few doses of the vial administered? ☐ within the last doses of the vial administered? ☐ unknown?	
b)	Was there an error in prescribing or non-adherence to recommendations for use of this vaccine?	Yes* / No
c)	Based on your investigation, do you feel that the vaccine (ingredients) administered could have been unsterile?	Yes* / No / Unable to assess
d)	Based on your investigation, do you feel that the vaccine's physical condition (e.g. colour, turbidity, foreign substances etc.) was abnormal at the time of administration?	Yes* / No / Unable to assess
e)	Based on your investigation, do you feel that there was an error in vaccine reconstitution/preparation by the vaccinator (e.g. wrong product, wrong diluent, improper mixing, improper syringe filling etc.)?	Yes* / No / Unable to assess
f)	Based on your investigation, do you feel that there was an error in vaccine handling (e.g. break in cold chain during transport, storage and/or immunization session etc.)?	Yes* / No / Unable to assess
g)	Based on your investigation, do you feel that the vaccine was administered incorrectly (e.g. wrong dose, site or route of administration, wrong needle size, not following good injection practice etc.)?	Yes* / No / Unable to assess
h)	Number immunized from the concerned vaccine vial/ampoule	
i)	Number immunized with the concerned vaccine in the same session	
j)	Number immunized with the concerned vaccine having the same batch number in other locations. Specify locations: _____	
k)	Is this case a part of a cluster?	Yes* / No / Unkn
	i. If yes, how many other cases have been detected in the cluster?	
	a. Did all the cases in the cluster receive vaccine from the same vial?	Yes* / No / Unkn
	b. If no, number of vials used in the cluster (enter details separately)	

*_**It is compulsory for you to provide explanations for these answers separately**_

Section E	**Immunization practices <u>at the place(s) where concerned vaccine was used</u>**			
	(Complete this section by asking and/or observing practice)			
Syringes and needles used:				
• Are AD syringes used for immunization?		Yes / No / Unkn		
If no, specify the type of syringes used: ☐ glass ☐ disposable ☐ recycled disposable ☐ other _____				
Specific key findings/additional observations and comments:				
Reconstitution: (complete only if applicable, ✓ NA if not applicable)				
• Reconstitution procedure (✓)		Status		
	Same reconstitution syringe used for multiple vials of same vaccine?	Yes	No	NA
	Same reconstitution syringe used for reconstituting different vaccines?	Yes	No	NA
	Separate reconstitution syringe for each vaccine vial?	Yes	No	NA
	Separate reconstitution syringe for each vaccination?	Yes	No	NA
• Are the vaccines and diluents used the same as those recommended by the manufacturer?		Yes	No	NA
Specific key findings/additional observations and comments:				

"

Section F	Cold chain and transport *(Complete this section by asking and/or observing practice)*	
Last vaccine storage point:		
• Is the temperature of the vaccine storage refrigerator monitored?		Yes / No
○ If "yes", was there any deviation outside of 2–8° C after the vaccine was placed inside?		Yes / No
○ If "yes", provide details of monitoring separately.		
• Was the correct procedure for storing vaccines, diluents and syringes followed?		Yes / No / Unkn
• Was any other item (other than EPI vaccines and diluents) in the refrigerator or freezer?		Yes / No / Unkn
• Were any partially used reconstituted vaccines in the refrigerator?		Yes / No / Unkn
• Were any unusable vaccines (expired, no label, VVM at stages 3 or 4, frozen) in the refrigerator?		Yes / No / Unkn
• Were any unusable diluents (expired, manufacturer not matched, cracked, dirty ampoule) in the store?		Yes / No / Unkn
Specific key findings/additional observations and comments:		
Vaccine transportation:		
• Type of vaccine carrier used.		
• Was the vaccine carrier sent to the site on the same day as vaccination?		Yes / No / Unkn
• Was the vaccine carrier returned from the site on the same day as vaccination?		Yes / No / Unkn
• Was a conditioned ice-pack used?		Yes / No / Unkn
Specific key findings/additional observations and comments:		

"

Section G	Community investigation (please visit locality and interview parents/others)
Were any similar events reported within a time period similar to when the adverse event occurred and in the same locality? Yes / No / Unknown If yes, describe:	
If yes, how many events/episodes?	
Of those effected, how many are • Vaccinated:_____ • Not vaccinated:_____ • Unknown:_____	
Other comments:	

Section H	Other findings/observations/comments

Annex 6: AEFI laboratory request form

AEFI – LABORATORY REQUEST FORM (LRF)
(To be completed by _ _ _ _ _. LRF should be accompanied with specimens)

(For serious adverse events following immunization)

AEFI category (Encircle): **Death / Hospitalized / Cluster / Disability**

Province		**Case ID**	
District			
Sub district			

Name of person sending the specimen: Date of filling LRF:

Designation:

Phone number:

Case name																											
Date of birth	D	D	M	M	Y	Y	Y	Y		Age (in months)				Sex	Male	Female											
Complete address of the patient with landmarks *(street name, house number, village, block, Tehsil, PIN no., telephone no. etc.)*																											
P	H	O	N	E	-																						

Date of vaccination	D	D	M	M	Y	Y	Y	Y	Date of onset	D	D	M	M	Y	Y	Y	Y
Date of collection of specimen	D	D	M	M	Y	Y	Y	Y	Time of collection of specimen	H	H	M	M	(	AM	PM	)

Precise description of samples:

a) For vaccine/diluents specimens: (to be transported in reverse cold chain)

Mention vaccine/diluent	Quantity sent	Name of manufacturer (in BLOCK letters)	Batch no.	Manufacturing date	Expiry date

b) For logistics specimens: (AD, reconstitution, disposable syringes)

Mention logistics	Quantity sent	Name of manufacturer (in BLOCK letters)	Batch no.	Manufacturing date	Expiry date

c) For biological product specimen: (CSF, blood, urine, etc.)

2. Test requested:
3. Preliminary clinical diagnosis (working hypotheses):

4. Name and complete address of officials to whom laboratory results should be sent:

Send to	Complete address	Phone/Fax	Mobile	Email ID
National Level				
Province/ state level				
District level				
Others (specify)				

To be completed by lab officials after receiving the specimen

Date of receipt of specimen at laboratory	*D*	*D*	*M*	*M*	*Y*	*Y*	*Y*	*Y*

Name of person receiving specimen(s) at laboratory			
Condition of specimen upon receipt at lab (*encircle*)	Good	Poor	Unknown
Comments by pathologist, virologist or bacteriologist:			

Date specimen results sent from this lab	*D*	*D*	*M*	*M*	*Y*	*Y*	*Y*	*Y*

Name of laboratory professional	
Signature	
Phone number:	Email ID:

Annex 7: Aide-memoire for national strategy for safe and appropriate use of injections

WORLD HEALTH ORGANIZATION

Injection Safety

AIDE-MEMOIRE

for a national strategy for safe and appropriate use of injections

A safe injection does not harm the recipient, does not expose the provider to any avoidable risks, and does not result in any waste that is dangerous for other people. Overuse of therapeutic injections and unsafe injection practices combine to transmit bloodborne pathogens on a large scale worldwide. Among unsafe practices, re-use of syringes and/or needles without sterilization is of particular concern.

Transmission of bloodborne pathogens through injections can be prevented through a multidisciplinary strategy to reduce injection overuse and achieve injection safety. Such an integrated approach requires a national coalition and a coordinator.

The three axes of a national policy and plans for safe and appropriate use of injections below are described on the other side of this sheet:

- Behavior change among patients and healthcare workers to decrease injection overuse and achieve injection safety;
- Availability of necessary equipment and supplies;
- Management of sharps waste to ensure that disposable equipment cannot be re-used.

Words of advice

- **Secure government commitment and support to safe and appropriate use of injections**
- **Establish a national injection safety coalition coordinated by the Ministry of Health**
- **Conduct initial assessment of injection use and injection safety**
- **Change behavior among patients and healthcare workers to decrease injection overuse and achieve injection safety**
- **Ensure continuous availability of injection equipment and infection control supplies**
- **Setup a waste management system for sharps**
- **Monitor impact of activities on injection frequency, injection safety, and infections**

☑ Checklist

(See other side for details)

National safe and appropriate use of injections policy

- ❑ Injection safety coordinator
- ❑ National policy and plans
- ❑ National coalition
- ❑ Sufficient budget and trained staff
- ❑ Assessment of injection practices
- ❑ Three axes approach
- ❑ Monitoring and evaluation

Behavior change

- ❑ Behavior change coordinator
- ❑ National injection safety standard
- ❑ National communication strategy
- ❑ Safe injection practices among standards of care
- ❑ Promotion of safe technologies
- ❑ Promotion of rational use of injection
- ❑ Other behavior change components
- ❑ Monitoring

Equipment and supplies

- ❑ Technical officer
- ❑ Choice of an injection technology
- ❑ Norms and standards for equipment
- ❑ Introduction of safety boxes
- ❑ Central bulk procurement
- ❑ Central storage management
- ❑ Distribution system
- ❑ Monitoring

Management of sharps waste

- ❑ Technical officer
- ❑ Healthcare managing sharps waste
- ❑ Assessment of sharps waste management
- ❑ Choice of management solutions
- ❑ Regulatory framework
- ❑ Implementation of solutions
- ❑ Monitoring

Annex 8: Aide-memoire for the planning and management of safety during mass immunization campaigns

WORLD HEALTH ORGANIZATION

AIDE-MEMOIRE

for the planing and management of safety during mass immunization campaigns

Mass immunization campaigns pose specific safety challenges, because they aim at immunizing large populations over a short period of time. First, with respect to injection safety, the large volume of injections to be administered and the large volume of waste to be generated poses added strains on the system, increasing the probability that breaches in safety may occur. Second, with respect to adverse events following immunization (AEFI), an apparent rise in adverse events may occur. Reasons for this apparent increase include the large number of doses being given over a short period of time and the administration of vaccine to a wider, usually older, age group.

If not managed properly, these safety issues can result in damage to health, impaired public and donor confidence in the campaign, and ultimately, reduced coverage and public health impact. However, EPI managers can take simple steps to ensure safety through a systematic approach including an initial assessment of the existing situation, plans for safety appropriately financed, implementation of the safety plan, and monitoring. Managers also need to introduce a simple and fast monitoring system for adverse events as a minimum for campaigns, if not already in place. This approach, in addition to adding to the success of the campaign, provide opportunities to identify key immunization and injection safety issues that should be addressed in routine immunization activities a longer term immunization safety plan.

The three elements of a safety plan for immunization campaign are:

- Safety of vaccine delivery up to and through administration
- Sharps waste management
- AEFI monitoring and management

Words of advice

- **Identify needs and challenges through an initial assessment**
- **Clearly identify and agree on roles and responsibilities**
- **Prepare budget of the safety plan**
- **At least six month before the campaign, order vaccines, injection equipment and supplies according to the bundling policy, and explore options for sharps management**
- **Contact medical and nurse associations to co-ordinate the dissemination of safety awareness messages to staff**
- **Ensure safe vaccine delivery at the point of use through provision of equipment and supplies, through risk communication and training**
- **Manage sharps waste in a safe, efficient and environmentally friendly way**
- **Monitor adverse events following immunization**
- **Monitor and evaluate achievements through routine reporting by all vaccination sites and through a final evaluation**
- **Identify set-backs and lessons learnt**

Safety of Mass Immunization Campaigns

Checklist

Mass campaign safety plan

- ❑ Identify stakeholders
- ❑ Assess the situation
- ❑ Include the costs for safety in the financial plan
- ❑ Ensure injection safety through education and provision of supplies
- ❑ Manage sharps waste
- ❑ Manage AEFIs
- ❑ Monitor and document results
- ❑ Identify lessons learnt

Safety of vaccine delivery up to and through the point of use

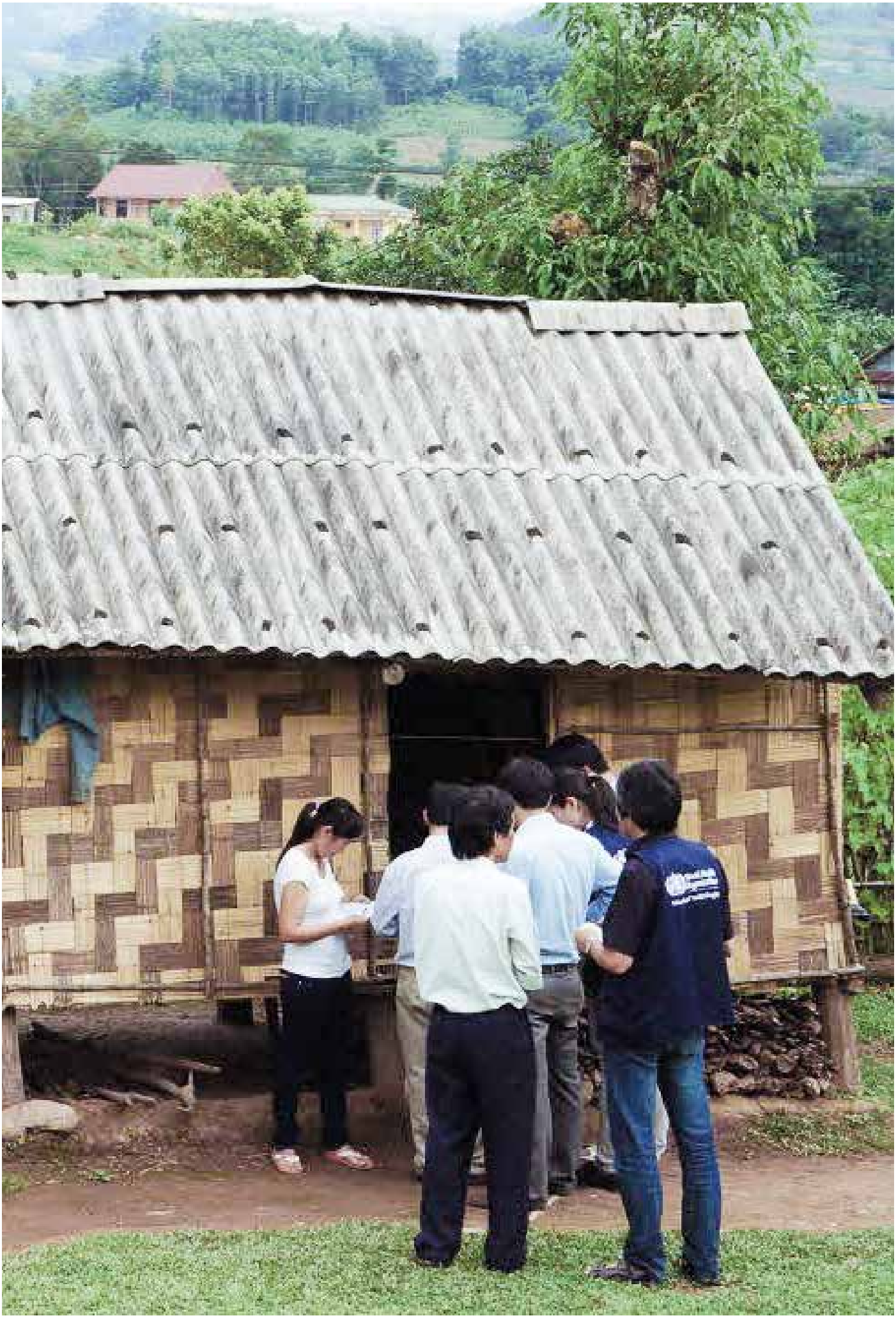
- ❑ Use pre-qualified or national regulatory authority-approved vaccine and injection material
- ❑ Bundle vaccine with corresponding diluent, reconstitution syringes, auto-disable (AD) syringes and sharps boxes
- ❑ Communicate risks associated with unsafe practices
- ❑ Train healthcare workers in proper techniques

Sharps waste management

- ❑ Assess local regulatory framework and possibilities of sharps treatment and disposal
- ❑ Plan transportation, storage and disposal before the campaign
- ❑ Identify practical, simple solutions
- ❑ Monitor disposal on a daily basis

Managing and monitoring AEFIs

- ❑ Assess or set up AEFI monitoring system
- ❑ Develop quick reporting channels
- ❑ Decide which AEFI to be reported and which contraindication to observe
- ❑ Explain campaign-associated causes of apparent rise in AEFIs, including background rates
- ❑ Form a review committee for AEFIs
- ❑ Search the country for "issues" and rumours
- ❑ Train to investigate and manage AEFIs
- ❑ Keep track of vaccine distribution by lot



World Health Organization

REGIONAL OFFICE FOR Africa

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