

Annex 7

Good storage and distribution practices for medical products

1. Introduction	158
2. Scope	159
3. Glossary	159
4. General principles	165
5. Quality management	165
6. Quality risk management	166
7. Management review	167
8. Complaints	167
9. Returned goods	168
10. Recalls	169
11. Self-inspection	169
12. Premises	170
13. Stock control and rotation	174
14. Equipment	174
15. Qualification and validation	175
16. Personnel	175
17. Documentation	176
18. Activities and operations	178
19. Outsourced activities	183
20. Substandard and falsified products	184
21. Inspection of storage and distribution facilities	184
References	185
Further reading	186
Appendix 1 Recommended storage conditions	188



1. Introduction

- 1.1 Storage and distribution are important activities in the supply chain management of medical products. Various people and entities may be responsible for the handling, storage and distribution of medical products. Medical products may be subjected to various risks at different stages in the supply chain, for example, purchasing, storage, repackaging, relabelling, transportation and distribution.
- 1.2 Substandard and falsified products are a significant threat to public health and safety. Consequently, it is essential to protect the supply chain against the penetration of such products.
- 1.3 This document sets out steps to assist in fulfilling the responsibilities involved in the different stages within the supply chain and to avoid the introduction of substandard and falsified products into the market. The relevant sections should be considered as particular roles that entities play in the storage and distribution of medical products.
- 1.4 This guideline is intended to be applicable to all entities involved in any aspect of the storage and distribution of medical products, from the premises of the manufacturer of the medical product to his or her agent, or the person dispensing or providing medical products directly to a patient. This includes all entities involved in different stages of the supply chain of medical products; manufacturers and wholesalers, as well as brokers, suppliers, distributors, logistics providers, traders, transport companies and forwarding agents and their employees.
- 1.5 The relevant sections of this guideline should also be considered for implementation by, amongst others, governments, regulatory bodies, international procurement organizations, donor agencies and certifying bodies, as well as all health-care workers.
- 1.6 This guideline can be used as a tool in the prevention of distribution of substandard and falsified products. It should, however, be noted that these are general guidelines that may be adapted to suit the prevailing situations and conditions in individual countries. National or regional guidelines may be developed to meet specific needs and situations in a particular region or country.
- 1.7 To maintain the quality of medical products, every party that is active in the supply chain has to comply with the applicable legislation and regulations. Every activity in the storage and distribution of medical products should be carried out according to the principles of good manufacturing practices

(GMP) (1) or applicable standard such as ISO 13485 for medical devices (2); good storage practices (GSP) (3); and good distribution practices (GDP) (4), as applicable.

- 1.8 This guideline does not deal with dispensing to patients, as this is addressed in the *Joint FIP/WHO* (International Pharmaceutical Federation/World Health Organization) *guidelines on good pharmacy practice* (GPP) (5).
- 1.9 This guideline should also be read in conjunction with other WHO guidelines, for example those listed at the end of the document under [References](#) and [Further reading](#).

2. Scope

- 2.1 This document lays down guidelines for the storage and distribution of medical products. It is closely linked to other existing guidelines recommended by the WHO Expert Committee on Specifications for Pharmaceutical Preparations, for example those listed at the end of the document under [References](#) and [Further reading](#).
- 2.2 Depending on the national and regional legislation, these guidelines may apply equally to pharmaceutical products for human and veterinary use, and other medical products, where applicable.
- 2.3 The document does not specifically cover GMP aspects of finished products in bulk, distribution of labels, or packaging, as these aspects are considered to be covered by other guidelines. The principles for the distribution of starting materials (active pharmaceutical ingredients [APIs] and excipients) are also not covered here. These are laid down in the WHO document *Good trade and distribution practices for pharmaceutical starting materials* (6).

3. Glossary

The definitions given below apply to the terms used in this guideline that are not defined in existing WHO terms and definitions databases. They may have different meanings in other contexts and documents.

active pharmaceutical ingredient (API). Any substance or mixture of substances intended to be used in the manufacture of a pharmaceutical dosage form and that, when used in the production of a drug, becomes an active ingredient of that drug. Such substances are intended to furnish pharmacological activity or other direct effect in the diagnosis, cure, mitigation, treatment or prevention of disease, or to affect the structure and function of the body.

auditing. An independent and objective activity designed to add value and improve an organization's operations by helping it to accomplish its objectives, using a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control and governance processes.

batch. A defined quantity of pharmaceutical products processed in a single process or series of processes, so that it is expected to be homogeneous.

batch number. A distinctive combination of numbers and/or letters that uniquely identifies a batch, for example, on the labels, its batch records and corresponding certificates of analysis.

broker. A person or organization that arranges transactions in relation to the sale or purchase of medical products that consist of negotiating, independently and on behalf of another legal or natural person, and that do not include physical handling.

consignment. The quantity of medical products supplied at one time in response to a particular request or order. A consignment may comprise one or more packages or containers and may include pharmaceutical products belonging to more than one batch.

container. The material employed in the packaging of a medical product. Containers include primary, secondary and transportation containers. Containers are referred to as primary if they are intended to be in direct contact with the product. Secondary containers are not intended to be in direct contact with the product.

contamination. The undesired introduction of impurities of a chemical or microbiological nature, or of foreign matter, into or onto a starting material, intermediate or pharmaceutical product during handling, production, sampling, packaging or repackaging, storage or transportation.

contract. Business agreement for the supply of goods or performance of work at a specified price; this may include quality elements in the agreement, or in a separate contract.

corrective and preventative actions (CAPA). A system for implementing corrective and preventive actions resulting from an investigation of complaints, product rejections, non-conformances, recalls, deviations, audits, regulatory inspections and findings and trends from process performance and product quality monitoring.

cross-contamination. Contamination of a starting material, intermediate product or finished pharmaceutical product or medical product with another starting material or product, during production, storage and transportation.

distribution. The procuring, purchasing, holding, storing, selling, supplying, importing, exporting or movement of medical products, with the exception of dispensing or providing medical products directly to a patient or his or her agent.

excipient. A substance, other than the active ingredient, which has been appropriately evaluated for safety and is included in a drug delivery system, to aid in the processing of the drug delivery system during its manufacture; protect, support or enhance stability, bioavailability, or patient acceptability; assist in product identification; or enhance any other attribute of the overall safety and effectiveness of the drug during storage or use.

expiry date. The date given on the individual container (usually on the label) of a medical product, up to and including the date on which the product is expected to remain within specifications if stored correctly. It is established for each batch by adding the shelf-life to the date of manufacture.

falsified product. A product that has been deliberately and/or fraudulently misrepresented as to its identity, composition or source. Such deliberate/fraudulent misrepresentation refers to any substitution, adulteration or reproduction of an authorized product, or the manufacture of a product that is not an authorized product.

“Identity” shall refer to the name, labelling or packaging or to documents that support the authenticity of an authorized product. “Composition” shall refer to any ingredient or component of the product in accordance with applicable specifications authorized/recognized by the national regulatory authority (NRA). “Source” shall refer to the identification, including name and address, of the marketing authorization holder, manufacturer, importer, exporter, distributor or retailer, as applicable (7).

first expiry/first out (FEFO). A distribution procedure that ensures that the stock with the earliest expiry date is distributed and/or used before an identical stock item with a later expiry date is distributed and/or used.

forwarding agent. A person or entity engaged in providing, either directly or indirectly, any service concerned with clearing and forwarding operations in any manner to any other person; this includes a consignment agent.

good distribution practices (GDP). That part of quality assurance that ensures that the quality of a medical product is maintained by means of adequate control of the numerous activities that occur during the trade and distribution process, as well as providing a tool to secure the distribution system from falsified, unapproved, illegally imported, stolen, substandard, adulterated and/or misbranded medical products.

good manufacturing practices (GMP). That part of quality assurance that ensures that pharmaceutical products are consistently produced and controlled to the quality standards appropriate to their intended use and as required by the marketing authorization.

good pharmacy practice (GPP). The practice of pharmacy aimed at providing and promoting the best use of medicines and other health-care services and products by patients and members of the public. It requires that the welfare of the patient is the pharmacist's prime concern at all times.

good practices (GXP). The group of good practice guides governing the preclinical, clinical, manufacture, testing, storage, distribution and post-market activities for regulated medical products, such as good laboratory practices (GLP), good clinical practices (GCP), good manufacturing practices (GMP), good pharmacy practice (GPP), good distribution practices (GDP) and other good practices.

good storage practices (GSP). That part of quality assurance that ensures that the quality of medical products is maintained by means of adequate control throughout the storage thereof.

heating, ventilation and air conditioning systems. Heating, ventilation and air conditioning, also referred to as environmental control systems.

importation. The act of bringing or causing any goods to be brought into a customs territory (national territory, excluding any free zone).

intermediate product. Partly processed product that must undergo further manufacturing steps before it becomes a bulk finished product.

labelling. The process of identifying a medical product, including the following information, as appropriate: name of the product; active ingredient(s), type and amount; batch number; expiry date; special storage conditions or handling precautions; directions for use, warnings and precautions; and names and addresses of the manufacturer and/or supplier.

manufacture. All operations of purchase of materials and products, production, packaging, labelling, quality control, release, and storage of medical products and the related controls.

marketing authorization. A legal document issued by the NRA for the purpose of marketing or free distribution of a product after evaluation for safety, efficacy, performance (where applicable) and quality. It must set out, inter alia, the name of the product, the pharmaceutical dosage form; the quantitative formula

(including excipients) per unit dose (using International Nonproprietary Names or national generic names where they exist); the shelf-life and storage conditions; and packaging characteristics, or other details as required by the product category. It specifies the information on which authorization is based (e.g. “The product(s) must conform to all the details provided in your application and as modified in subsequent correspondence”). It also contains the product information approved for health professionals and the public, the sales category, the name and address of the holder of the authorization and the period of validity of the authorization. Once a product has been given marketing authorization, it is included on a list of authorized products – the register – and is often said to be “registered” or to “have registration”. Market authorization may occasionally also be referred to as a “licence” or “product licence”.

material. A general term used to denote starting materials (APIs and excipients), reagents, solvents, process aids, intermediates, packaging materials and labelling materials.

medical products. Products including, but not limited to, finished pharmaceutical products, medical devices including in vitro diagnostic medical devices, and vaccines.

packaging material. Any material, including printed material, employed in the packaging of a medical product, but excluding any outer packaging used for transportation or shipment. Packaging materials are referred to as primary or secondary, according to whether or not they are intended to be in direct contact with the product.

pedigree. A complete record that traces the ownership of, and transactions relating to, a medical product as it is distributed through the supply chain.

pharmaceutical product. Any product intended for human use, or veterinary product intended for administration to food-producing animals, presented in its finished dosage form, which is subject to control by pharmaceutical legislation in either the exporting or the importing state and includes products for which a prescription is required; products that may be sold to patients without a prescription; biologicals; and vaccines. It does not, however, include medical devices.

product recall. A process for withdrawing or removing a medical product from the distribution chain because of defects in the product, complaints of serious adverse reactions to the product and/or concerns that the product is or may be falsified. The recall might be initiated by the manufacturer, importer, wholesaler, distributor or a responsible agency.

production. All operations involved in the preparation of a medical product, from receipt of materials through processing, packaging and repackaging, labelling and relabelling, to completion of the finished product.

quality assurance. A wide-ranging concept covering all matters that individually or collectively influence the quality of a product. It is the totality of the arrangements made with the object of ensuring that medical products are of the quality required for their intended use.

quality risk management. A systematic process for the assessment, control, communication and review of risks to the quality of medical products in the supply chain.

quality system. An appropriate infrastructure, encompassing the organizational structure, procedures, processes, resources and systematic actions necessary to ensure adequate confidence that a product (or services) will satisfy given requirements for quality.

quarantine. The status of medical products isolated physically or by other effective means while a decision is awaited on their release, rejection or reprocessing.

retest date. The date when a material should be re-examined to ensure that it is still suitable for use.

sampling. Operations designed to obtain a representative portion of a medical product, based on an appropriate statistical procedure, for a defined purpose, for example, acceptance of consignments or batch release.

self-inspection. An internal procedure followed to evaluate the entity's compliance with GSP and GDP, as well as GXP in all areas of activities, designed to detect any shortcomings and to recommend and implement necessary corrective actions.

shelf-life. The period of time during which a medical product, if stored correctly, is expected to comply with the specification as determined by stability studies on a number of batches of the product. The shelf-life is used to establish the expiry date of each batch.

standard operating procedure (SOP). An authorized written procedure giving instructions for performing operations that are not necessarily specific to a given product but of a more general nature (e.g. equipment operation, maintenance and cleaning, validation, cleaning of premises, environmental control, sampling and inspection).

storage. The storing of medical products up to the point of use.

substandard products. “Substandard” medical products (also called “out of specification”) are authorized by NRAs but fail to meet either national or international quality standards or specifications – or, in some cases, both.

supplier. A person or entity engaged in the activity of providing products and/or services.

transit. The period during which medical products are in the process of being carried, conveyed or transported across, over or through a passage or route to reach their destination.

vehicles. Trucks, vans, buses, minibuses, cars, trailers, aircraft, railway carriages, boats and other means that are used to convey medical products.

4. General principles

4.1 There should be collaboration between all entities, including governments, customs agencies, law enforcement agencies, regulatory authorities, manufacturers, distributors and entities responsible for the supply of medical products to patients, to ensure the quality and safety of medical products; to prevent the exposure of patients to substandard and falsified products; and to ensure that the integrity of the distribution chain is maintained.

4.2 The principles of GSP and GDP should be included in national legislation and guidelines for the storage and distribution of medical products in a country or region, as applicable, as a means of establishing minimum standards. The principles of GSP and GDP are applicable to:

- medical products moving forward in the distribution chain from the manufacturer;
- medical products that are moving backwards in the chain, for example, as a result of the return or recall thereof; and
- donations of medical products.

5. Quality management

5.1 Entities involved in the storage and distribution of medical products should have a comprehensively designed, documented and correctly implemented quality system that incorporates GSP, GDP, principles of quality risk management and management review.

- 5.2 Senior management has the ultimate responsibility to ensure that an effective quality system is established, resourced, implemented and maintained.
- 5.3 The quality system should ensure that:
- GSP and GDP are adopted and implemented to ensure that the quality of medical products is maintained throughout their shelf-life in the supply chain; and medical products are appropriately procured, stored, distributed and delivered (in compliance with the legislation) to the appropriate recipients (see [Section 18.1](#));
 - operations are clearly specified in written procedures;
 - responsibilities are clearly specified in job descriptions;
 - all risks are identified and necessary, effective controls are implemented;
 - processes are in place to assure the management of outsourced activities;
 - there is a procedure for self-inspection and quality audits;
 - there is a system for quality risk management;
 - there are systems for managing returns, complaints and recalls; and
 - there are systems to manage changes, deviations and corrective and preventive actions (CAPAs).
- 5.4 There should be an authorized, written quality policy describing the overall intentions and requirements regarding quality. This may be reflected in a quality manual.
- 5.5 There should be an appropriate organizational structure. This should be presented in an authorized organizational chart. The responsibility, authority and interrelationships of personnel should be clearly indicated.
- 5.6 Roles and responsibilities should be clearly defined and understood by the individuals concerned, and recorded as written job descriptions.
- 5.7 The quality system should include appropriate procedures, processes and resources.

6. Quality risk management

- 6.1 There should be a system to assess, control, communicate and review risks identified at all stages in the supply chain.
- 6.2 The evaluation of risk should be based on scientific knowledge and experience and ultimately be linked to the protection of the patient.

- 6.3 Appropriate controls should be developed and implemented to address all risks. The effectiveness of the controls implemented should be evaluated at periodic intervals.

7. Management review

- 7.1 There should be a system for periodic management review. The review should include at least:
- senior management;
 - review of the quality system and its effectiveness by using quality metrics and key performance indicators;
 - identification of opportunities for continual improvement; and
 - follow-up on recommendations from previous management review meetings.
- 7.2 Minutes and related documentation from management review meetings should be available.

8. Complaints

- 8.1 There should be a written procedure for the handling of complaints. In the case of a complaint about the quality of a medical product or its packaging, the original manufacturer and/or marketing authorization holder should be informed as soon as possible.
- 8.2 All complaints should be recorded and appropriately investigated. The root cause should be identified, and the impact (e.g. on other batches or products) risk-assessed. Appropriate CAPAs should be taken.
- 8.3 Where required, the information should be shared with the NRA and a recall initiated where appropriate.
- 8.4 A distinction should be made between complaints about a medical product or its packaging and those relating to distribution.
- 8.5 The relevant information, such as the results of the investigation of the complaint, should be shared with the relevant entities.
- 8.6 Medical product quality problems and suspected cases of substandard or falsified products identified should be handled according to relevant authorized procedures. The information should be shared with the manufacturer and appropriate national and/or regional regulatory authorities, without delay.

9. Returned goods

- 9.1 Returned medical products should be handled in accordance with authorized procedures.
- 9.2 All returned medical products should be placed in quarantine upon receipt. The status of the goods should be clear. Precautions should be taken to prevent access and distribution until a decision has been taken with regard to their disposition. The particular storage conditions applicable to the medical products should be maintained until their disposition.
- 9.3 Medical products returned should be destroyed unless it is certain that their quality is satisfactory, after they have been critically assessed in accordance with a written and authorized procedure.
- 9.4 The nature of the medical product, any special storage conditions it requires, its condition and history and the time lapse since it was issued, should all be taken into account in this assessment. Where any doubt arises over the quality of the medical product, it should not be considered suitable for reissue or reuse. Any action taken should be appropriately recorded.
- 9.5 When handling returned goods, the following considerations at least should be taken:
 - a risk-based process should be followed when deciding on the fate of the returned goods. This should include, but not be limited to, the nature of the product, storage conditions, condition of the product history, time-lapse since distribution and the manner and condition of transport while being returned;
 - the terms and conditions of the agreement between the parties; and
 - examination of the returned goods, with decisions taken by suitably qualified, experienced and authorized persons.
- 9.6 Where products are rejected, authorized procedures should be followed, including safe transport.
- 9.7 Destruction of products should be done in accordance with international, national and local requirements regarding disposal of such products, and with due consideration to the protection of the environment.
- 9.8 Records of all returned, rejected and destroyed medical products should be kept for a defined period, in accordance with national requirements.

10. Recalls

- 10.1 There should be a written procedure, in compliance with national or regional requirements, to effectively and promptly recall medical products.
- 10.2 The effectiveness of the procedure should be checked annually and updated as necessary.
- 10.3 The original manufacturer and/or marketing authorization holder, or other relevant contract party, should be informed in the event of a recall.
- 10.4 Information on a recall should be shared with the appropriate national or regional regulatory authority.
- 10.5 All recalled products should be secure, segregated, transported and stored under appropriate conditions. These should be clearly labelled as recalled products. The particular storage conditions applicable to the product should be maintained where possible.
- 10.6 All customers and competent authorities of all countries to which a given medical product may have been distributed should be informed promptly of the recall of the product.
- 10.7 All records, including distribution records, should be readily accessible to the designated person(s) responsible for recalls. These records should contain sufficient information on products supplied to customers (e.g. name, address, contact detail, batch numbers, quantities and safety features – including exported products).
- 10.8 The progress of a recall process should be recorded and a final report issued, which includes a reconciliation between delivered and recovered quantities of medical products.

11. Self-inspection

- 11.1 The quality system should include self-inspections. These should be conducted to monitor the implementation, compliance with and effectiveness of SOPs, as well as compliance with regulations, GSP, GDP and other appropriate guidelines.
- 11.2 Self-inspections should be conducted periodically, according to an annual schedule.

- 11.3 The team conducting the inspection should be free from bias and individual members should have appropriate knowledge and experience.
- 11.4 The results of all self-inspections should be recorded. Reports should contain all observations made during the inspection and presented to the relevant personnel and management.
- 11.5 Necessary CAPAs should be taken and their effectiveness should be reviewed within a defined timeframe.

12. Premises

General

- 12.1 Premises should be suitably located, designed, constructed and maintained, to ensure appropriate operations such as receiving, storage, picking, packing and dispatch of medical products.
- 12.2 There should be sufficient space, lighting and ventilation to ensure required segregation, appropriate storage conditions and cleanliness.
- 12.3 Sufficient security should be provided and access should be controlled.
- 12.4 Appropriate controls and segregation should be provided for products requiring specific handling or storage conditions, such as radioactive materials, products containing hazardous substances and products to be stored under controlled temperature and relative humidity conditions.
- 12.5 Where possible, receiving and dispatch bays should be separate, to avoid mix-ups. Bays should protect products from weather conditions.
- 12.6 Activities relating to receiving and dispatch should be done in accordance with authorized procedures. Areas should be suitably equipped for the operations.
- 12.7 Premises should be kept clean. Cleaning equipment and cleaning agents should not become possible sources of contamination.
- 12.8 Premises should be protected from the entry of birds, rodents, insects and other animals. A rodent and pest control programme should be in place.
- 12.9 Toilets, washing, rest and canteen facilities should be separate from areas where products are handled. Food, eating, drinking and smoking should be prohibited in all areas where medical products are stored or handled.

Receiving area

- 12.10 Each incoming delivery should be checked against the relevant documentation, to ensure that the correct product is delivered from the correct supplier. This may include, for example, the purchase order, containers, label description, batch number, expiry date, product and quantity.
- 12.11 The consignment should be examined for uniformity of the containers and, if necessary, should be subdivided according to the supplier's batch number should the delivery comprise more than one batch. Each batch should be dealt with separately.
- 12.12 Each consignment should be carefully checked for possible contamination, tampering and damage. A representative number of containers in a consignment should be sampled and checked according to a written procedure. Any suspect containers or, if necessary, the entire delivery, should be quarantined for further investigation.
- 12.13 Receiving areas should be of sufficient size to allow the cleaning of incoming medical products.
- 12.14 When required, samples of medical products should be taken by appropriately trained and qualified personnel and in strict accordance with a written sampling procedure and sampling plans. Containers from which samples have been taken should be labelled accordingly.
- 12.15 Following sampling, the goods should be subject to quarantine. Batch segregation should be maintained during quarantine and all subsequent storage.
- 12.16 Materials and products requiring transport and storage under controlled conditions of temperature and relative humidity, as applicable, should be handled as a priority. The transportation temperature data, where appropriate, should be reviewed upon receipt, to ensure that the required conditions had been maintained. Where applicable, cold-chain materials and products should be handled according to the approved conditions by the authority, or as recommended by the manufacturer, as appropriate.
- 12.17 Medical products should not be transferred to saleable stock until an authorized release is obtained.
- 12.18 Measures should be taken to ensure that rejected medical products cannot be used. They should be segregated and securely stored while awaiting destruction or return to the supplier.

Storage areas

- 12.19 Precautions should be taken to prevent unauthorized persons from entering storage areas.
- 12.20 Storage areas should be of sufficient capacity to allow orderly storage of the various categories of medical products.
- 12.21 Storage areas should be appropriately designed, constructed, maintained or adapted. They should be kept clean and there should be sufficient space and lighting.
- 12.22 Storage areas should be maintained within acceptable and specified temperature limits. Where the labels show special storage conditions are required (e.g. temperature, relative humidity), these should be provided, controlled, monitored and recorded.
- 12.23 Materials and medical products should be stored off the floor, away from walls and ceilings, protected from direct sunlight and suitably spaced, to permit ventilation, cleaning and inspection. Suitable pallets should be used and kept in a good state of cleanliness and repair.
- 12.24 A written sanitation programme should be available, indicating the frequency of cleaning and the methods to be used to clean the premises and storage areas.
- 12.25 There should be appropriate procedures for the clean-up of any spillage, to ensure complete removal of any risk of contamination.
- 12.26 Where the status is ensured by storage in separate areas, these areas should be clearly marked and their access restricted to authorized personnel. Any system replacing physical separation and labelling or demarcation should provide equivalent security. For example, computerized systems can be used, provided that they are validated to demonstrate security of access (8).
- 12.27 Sampling should be done under controlled conditions and conducted in such a way that there is no risk of contamination or cross-contamination. Adequate cleaning procedures should be followed after sampling.
- 12.28 Certain materials and products, such as highly active and radioactive materials, narcotics and other hazardous, sensitive and/or dangerous materials and products, as well as substances presenting special risks

of abuse, fire or explosion (e.g. combustible liquids and solids and pressurized gases), should be stored in a dedicated area that is subject to appropriate additional safety and security measures, and in accordance with national legislation.

- 12.29 Materials and medical products should be handled and stored in such a manner as to prevent contamination, mix-ups and cross-contamination.
- 12.30 Materials and medical products should be stored in conditions that assure that their quality is maintained. Stock should be appropriately rotated. The “first expired/first out” (FEFO) principle should be followed.
- 12.31 Narcotic medical products should be stored in compliance with international conventions, national laws and regulations on narcotics.
- 12.32 Broken or damaged items should be withdrawn from usable stock and separated.
- 12.33 There should be a written procedure for fire control, including prevention of fire, fire detection and fire drills. Fire-detection and firefighting equipment should be available and should be serviced regularly.

Storage conditions

- 12.34 The storage conditions for medical products should be in compliance with their labelling and information provided by the manufacturer.
- 12.35 Heating, ventilation and air conditioning systems should be appropriately designed, installed, qualified and maintained, to ensure that the required storage conditions are upheld (9).
- 12.36 Mapping studies for temperature, and relative humidity where appropriate, should be done, for example in storage areas, refrigerators and freezers (10).
- 12.37 Temperature and relative humidity, as appropriate, should be controlled and monitored at regular intervals. Data should be recorded and the records should be reviewed. The equipment used for monitoring should be calibrated and be suitable for its intended use. All records pertaining to mapping and monitoring should be kept for a suitable period of time and as required by national legislation.

Note: See [Appendix 1](#) for recommended storage conditions.

13. Stock control and rotation

- 13.1 Records of stock levels for all medical products in store should be maintained, in either paper or electronic format. These records should be updated after each operation (e.g. entries, issues, losses, adjustments). These records should be kept for a suitable period of time and as required by national legislation. Periodic stock reconciliation should be performed at defined intervals, by comparing the actual and recorded stock.
- 13.2 The root cause for stock discrepancies should be identified and appropriate CAPAs taken to prevent recurrence.
- 13.3 When damaged containers are received, this should be brought to the attention of the person responsible for quality. Any action taken should be documented. (These containers should not be issued unless the quality of the medical products has been shown to be unaffected.)
- 13.4 All stock should be checked at regular intervals, to identify those items that are close to their retest or expiry date. Appropriate action should be taken, such as removal of these items from useable stock.

14. Equipment

- 14.1 Equipment, including computerized systems, should be suitable for its intended use. All equipment should be appropriately designed, located, installed, qualified and maintained.
- 14.2 Computerized systems should be capable of achieving the desired output and results.
- 14.3 Where electronic commerce (e-commerce) is used, i.e. electronic means for any of the steps, defined procedures and adequate systems should be in place to ensure traceability and confidence in the supply chain and products concerned.
- 14.4 Electronic transactions (including those conducted via the Internet) relating to the distribution of medical products should be performed only by authorized persons, according to defined and authorized access and privileges.
- 14.5 Where GXP systems are used, these should meet the requirements of WHO or other appropriate guidelines on computerized systems (8, 11).

15. Qualification and validation

- 15.1 The scope and extent of qualification, and validation where appropriate, should be determined using documented risk management principles.
- 15.2 Premises, utilities, equipment and instruments, processes and procedures should be considered.
- 15.3 Qualification and validation should be done following procedures and protocols. The results and outcome of the qualification and validation should be recorded in reports. Deviations should be investigated and the completion of the qualification and validation should be concluded and approved.

16. Personnel

- 16.1 There should be an adequate number of personnel.
- 16.2 Personnel should have appropriate educational qualification, experience and training relative to the activities undertaken.
- 16.3 A designated person within the organization, with appropriate qualification and training, should have the defined authority and responsibility for ensuring that a quality management system is implemented and maintained. This person should preferably be independent from the person responsible for operations and should ensure compliance with GSP and GDP.
- 16.4 Personnel should have the authority and resources needed to carry out their duties and to follow the quality systems, as well as to identify and correct deviations from the established procedures.
- 16.5 There should be arrangements in place to ensure that management and personnel are not subjected to commercial, political, financial or other pressures or conflict of interest that may have an adverse effect on the quality of service provided or on the integrity of medical products.
- 16.6 Safety procedures should be in place relating to all relevant personnel and property, environmental protection and product integrity.
- 16.7 Personnel should receive initial and continued training in accordance with a written training programme. The training should cover the requirements of GSP and GDP (as applicable), as well as on-the-job training. Other topics should be included, such as product security, product identification and the detection of falsified products.

- 16.8 Personnel dealing with hazardous products (such as highly active materials, radioactive materials, narcotics and other hazardous, environmentally sensitive and/or dangerous pharmaceutical products, as well as products presenting special risks of abuse, fire or explosion) should be given specific training.
- 16.9 Personnel should be trained in, and observe high levels of, personal hygiene and sanitation.
- 16.10 Records of all training, attendance and assessments should be kept.
- 16.11 Personnel handling products should wear garments suitable for the activities that they perform. Personnel dealing with hazardous pharmaceutical products, including products containing materials that are highly active, toxic, infectious or sensitizing, should be provided with protective garments as necessary.
- 16.12 Appropriate procedures relating to personnel hygiene, relevant to the activities to be carried out, should be established and observed. Such procedures should cover health, hygiene and the clothing of personnel.
- 16.13 Procedures and conditions of employment for employees, including contract and temporary staff, and other personnel having access to medical products, must be designed and implemented to assist in minimizing the possibility of such products coming into the possession of unauthorized persons or entities.
- 16.14 Codes of practice and procedures should be in place to prevent and address situations where persons involved in the storage and distribution of medical products are suspected of, or found to be implicated in, any activities relating to the misappropriation, tampering, diversion or falsification of any product.

17. Documentation

- 17.1 Documentation includes all procedures, records and data, whether in paper or electronic form. Documents should be appropriately designed, completed, reviewed, authorized, distributed and kept as required. Documents should be readily available.
- 17.2 Written procedures should be followed for the preparation, review, approval, use of and control of all documents relating to the policies and activities for the process of storage and distribution of medical products.

- 17.3 Documents should be laid out in an orderly fashion and be easy to complete, review and check. The title, scope, objective and purpose of each document should be clear.
- 17.4 All documents should be completed, signed and dated as required by authorized person(s) and should not be changed without the necessary authorization.
- 17.5 Documentation should be prepared and maintained in accordance with the national legislation and principles of good documentation practices (11).
- 17.6 Records should be accurate, legible, traceable, attributable and unambiguous. Electronic data should be backed-up in accordance with written procedures. Records should be maintained for the back-up and restoration of data.
- 17.7 Procedures for the identification, collection, indexing, retrieval, storage, maintenance, disposal of and access to all applicable documentation should be followed.
- 17.8 Documents should be reviewed regularly and kept up-to-date. When a document has been revised, a system should exist to prevent inadvertent use of the superseded version.
- 17.9 All records should be stored and retained using facilities that prevent unauthorized access, modification, damage, deterioration and/or loss of documentation during the entire life-cycle of the record. Records must be readily retrievable.
- 17.10 Comprehensive records should be maintained for all receipts, storage, issues and distribution. The records should include, for example:
- date (e.g. receipt or dispatch, as appropriate);
 - name and description of the product;
 - quantity received, or supplied;
 - name and address of the supplier and customer;
 - batch number(s);
 - expiry date;
 - suitability of the supplier;
 - qualification of suppliers; and
 - customer qualification.

- 17.11 All containers should be clearly labelled with at least the name of the medical product, batch number, expiry date or retest date, and the specified storage conditions.

18. Activities and operations

- 18.1 All activities and operations should be conducted in accordance with national legislation, GSP, GDP and associated guidelines.
- 18.2 Storage and distribution of medical products should be done by persons authorized to do so, in accordance with national legislation.
- 18.3 Activities and operations should be performed in accordance with documented procedures.
- 18.4 Automated storage and retrieval systems and operations should comply with current GSP, GDP and GXP guidelines, as well as the recommendations in this guideline.

Receipt

- 18.5 Medical products should be procured from appropriately authorized suppliers.
- 18.6 Deliveries should be examined for damage, seal intactness, signs of tampering, labelling, completeness of order and other related aspects (e.g. availability of a certificate of analysis, where applicable), at the time of receiving.
- 18.7 Containers and consignments that do not meet acceptance criteria at the time of receipt should be labelled, kept separate and investigated. This includes suspected falsified products.

Storage

- 18.8 Medical products requiring specific storage conditions, or controlled access (e.g. narcotics), should be processed without delay and stored in accordance with their requirements.
- 18.9 Appropriate controls should be implemented to prevent contamination and/or mix-ups during storage.
- 18.10 Controls and procedures should be in place to prevent and handle spillage and breakage.

Repackaging and relabelling

- 18.11 Repackaging and relabelling of materials and products are not recommended. Where repackaging and relabelling occur, these activities should only be performed by entities appropriately authorized to do so and in compliance with the applicable national, regional and international requirements, and in accordance with GMP.
- 18.12 Procedures should be in place for the controlled disposal of original packaging, to prevent re-use thereof.

Distribution and transport

- 18.13 Medical products should be transported in accordance with the conditions stated on the labels and described by the manufacturer. The risk to the quality of the medical product during transport and distribution should be eliminated or minimized to an acceptable level.
- 18.14 Product, batch and container identity should be maintained at all times.
- 18.15 All labels should remain legible.
- 18.16 Distribution records should be sufficiently detailed to allow for a recall when required.
- 18.17 Drivers of vehicles should be identified and present appropriate documentation to demonstrate that they are authorized to transport medical products.
- 18.18 Vehicles should be suitable for their purpose, with sufficient space and appropriately equipped to protect medical products.
- 18.19 The design and use of vehicles and equipment must aim to minimize the risk of errors and permit effective cleaning and/or maintenance, to avoid contamination, build-up of dust or dirt and/or any adverse effect on the quality of the products.
- 18.20 Where feasible, consideration should be given to adding technology, such as global positioning system (GPS) electronic tracking devices and engine-kill buttons to vehicles, which would enhance the security and traceability of vehicles with products.
- 18.21 Where possible, dedicated vehicles and equipment should be used for medical products. Where non-dedicated vehicles and equipment are used, procedures should be in place to ensure that the quality of the

products will not be compromised. Defective vehicles and equipment should not be used. These should either be labelled as such or removed from service.

- 18.22 There should be procedures in place for the operation and maintenance of all vehicles and equipment.
- 18.23 Equipment and materials used for the cleaning of vehicles should not become a source of contamination or have an adverse effect on product quality.
- 18.24 Vehicles used for transportation of medical products should be qualified, where applicable, to demonstrate their capability to maintain the required transport conditions. There should be a maintenance programme for the cooling/heating system.
- 18.25. Appropriate environmental conditions should be maintained, monitored and recorded. All monitoring records should be kept for a defined period of time, as required by national legislation. Records of monitoring data should be made available for inspection by the regulatory or other oversight body.
- 18.26 Instruments used for monitoring conditions, for example, temperature and humidity, within vehicles and containers should be calibrated at regular intervals.
- 18.26 Rejected, recalled and returned products, as well as those suspected as being falsified, should be securely packaged, clearly labelled and accompanied by the appropriate supporting documentation.
- 18.27 Measures should be in place to prevent unauthorized persons from entering and/or tampering with vehicles and/or equipment, as well as to prevent the theft or misappropriation thereof.
- 18.28 Shipment containers should have no adverse effect on the quality of the medical products and should offer adequate protection to materials and these products. Containers should be labelled indicating, for example, handling and storage conditions, precautions, contents and source, and safety symbols, as appropriate.
- 18.29 Special care should be taken when using dry ice and liquid nitrogen in shipment containers, owing to safety issues and possible adverse effects on the quality of medical products.

- 18.30 Written procedures should be available for the handling of damaged and/or broken shipment containers. Particular attention should be paid to those containing potentially toxic and hazardous products.

Dispatch

- 18.31 There should be documented, detailed procedures for the dispatch of products.
- 18.32 Medical products should only be sold and/or distributed to persons or entities that are authorized to acquire such products in accordance with the applicable national legislation and marketing authorization. Written proof of such authorization, or an import permit or equivalent where there is no marketing authorization, must be obtained prior to the distribution of products to such persons or entities.
- 18.33 Dispatch and transportation should be undertaken only after the receipt of a valid order, which should be documented.
- 18.34 Records for the dispatch of products should be prepared and should include information such as, but not limited to:
- date of dispatch;
 - complete business name and address (no acronyms), type of entity responsible for the transportation, telephone number, names of contact persons;
 - status of the addressee (e.g. retail pharmacy, hospital or community clinic);
 - a description of the products, including, for example, name, dosage form and strength (if applicable);
 - quantity of the products, i.e. number of containers and quantity per container (if applicable);
 - applicable transport and storage conditions;
 - a unique number to allow identification of the delivery order; and
 - assigned batch number and expiry date (where not possible at dispatch, this information should at least be kept at receipt, to facilitate traceability).
- 18.35 Records of dispatch should contain sufficient information to enable traceability of the product. Such records should facilitate the recall of a batch of a product, if necessary, as well as the investigation of falsified

or potentially falsified products. In addition, the assigned batch number and expiry date of products should be recorded at the point of receipt, to facilitate traceability.

- 18.36 Vehicles and containers should be loaded carefully and systematically on a last-in/first-out (LIFO) basis, to save time when unloading, to prevent physical damage and to reduce security risks. Extra care should be taken during loading and unloading of cartons, to avoid damage.
- 18.37 Medical products should not be supplied or received after their expiry date, or so close to the expiry date that this date is likely to be reached before the products are used by the consumer (12).
- 18.38 Medical products and shipment containers should be secured in order to prevent or to provide evidence of unauthorized access. Vehicles and operators should be provided with additional security where necessary, to prevent theft and other misappropriation of products during transportation.
- 18.39 Medical products should be stored and transported in accordance with procedures such that:
- the identity of the product is not lost;
 - the product does not contaminate and is not contaminated by other products;
 - adequate precautions are taken against spillage, breakage, misappropriation and theft; and
 - appropriate environmental conditions are maintained, for example, using cold-chain for thermolabile products.
- 18.40 Written procedures should be in place for investigating and dealing with any failure to comply with storage requirements, for example, temperature deviations. If a deviation has been noticed during transportation, by the person or entity responsible for transportation, this should be reported to the supplier, distributor and recipient. In cases where the recipient notices the deviation, it should be reported to the distributor.
- 18.41 Transportation of products containing hazardous substances or narcotics and other dependence-producing substances, should be transported in safe, suitably designed, secured containers and vehicles. In addition, the requirements of applicable international agreements and national legislation should be met.

- 18.42 Spillages should be cleaned up as soon as possible, in order to prevent possible contamination, cross-contamination and hazards. Written procedures should be in place for the handling of such occurrences.
- 18.43 Damage to containers and any other event or problem that occurs during transit must be recorded and reported to the relevant department, entity or authority and investigated.
- 18.44 Products in transit must be accompanied by the appropriate documentation.

19. Outsourced activities

- 19.1 Any activity relating to the storage and distribution of a medical product that is delegated to another person or entity should be performed by the appropriately authorized parties, in accordance with national legislation and the terms of a written contract.
- 19.2 There should be a written contract between the entities. The contract should define the responsibilities of each entity (contract giver and contract acceptor) and cover at least the following:
- compliance with this guideline and the principles of GSP and GDP;
 - the responsibilities of all entities for measures to avoid the entry of substandard and falsified products into the distribution chain;
 - training of personnel;
 - conditions of subcontracting subject to the written approval of the contract giver; and
 - periodic audits.
- 19.3 The contract giver should assess the contract acceptor before entering into the contract, e.g. through on-site audits, documentation and licensing status review.
- 19.4 The contract giver should provide to the contract acceptor all relevant information relating to the material and medical products.
- 19.5 The contract acceptor should have adequate resources (e.g. premises, equipment, personnel, knowledge, experience and vehicles, as appropriate) to carry out the work.
- 19.6 The contract acceptor should refrain from performing any activity that may adversely affect the materials or products handled.

20. Substandard and falsified products

- 20.1 The quality system should include procedures to assist in identifying and handling medical products that are suspected to be substandard and/or falsified.
- 20.2 Where such medical products are identified, the holder of the marketing authorization, the manufacturer and the appropriate national, regional and international regulatory bodies (as appropriate), as well as other relevant competent authorities, should be informed.
- 20.3 Such products should be stored in a secure, segregated area and clearly identified to prevent further distribution or sale. Access should be controlled.
- 20.4 Records should be maintained reflecting the investigations and action taken, such as disposal of the product. Falsified products should not re-enter the market.

21. Inspection of storage and distribution facilities

- 21.1 Storage and distribution facilities should be inspected by inspectors authorized by national legislation. This should be done at determined, periodic intervals.
- 21.2 Inspectors should have appropriate educational qualifications, knowledge and experience (13).
- 21.3 An inspection should normally be conducted by a team of inspectors.
- 21.4 Inspectors should assess compliance with national legislation, GSP, GDP and related guidelines (GXP), as appropriate.
- 21.5 Inspections should cover the premises, equipment, personnel, activities, quality system, qualification and validation and other related aspects, as contained in this guideline.
- 21.6 An inspection report should be prepared and provided to the inspected entity within a defined period of time from the last day of the inspection. Observations may be categorized based on risk assessment.
- 21.7 CAPA for observations listed as non-compliances in the inspection report, with the national legislation and guidelines, should be submitted for review by the inspectors within the defined period, as stated by the inspectors.

21.8 Inspections should be closed with a conclusion after the review of the CAPAs.

References

1. WHO good manufacturing practices for pharmaceutical products: main principles. In: WHO Expert Committee on Specifications for Pharmaceutical Preparations: forty-eighth report. Geneva: World Health Organization; 2014: Annex 2 (WHO Technical Report Series, No. 986; https://www.who.int/medicines/areas/quality_safety/quality_assurance/TRS986annex2.pdf accessed 5 December 2019).
2. ISO 13485:2016(en). Medical devices – quality management systems – requirements for regulatory purposes (<https://www.iso.org/obp/ui/#iso:std:iso:13485:ed-3:v1:en>, accessed 5 December 2019).
3. Guide to good storage practices for pharmaceuticals. In: WHO Expert Committee on Specifications for Pharmaceutical Preparations: thirty-seventh report. Geneva: World Health Organization; 2003: Annex 9 (WHO Technical Report Series, No. 908; <https://apps.who.int/medicinedocs/documents/s18675en/s18675en.pdf>, accessed 5 December 2019).
4. WHO good distribution practices for pharmaceutical products. In: WHO Expert Committee on Specifications for Pharmaceutical Preparations: forty-fourth report. Geneva: World Health Organization; 2010: Annex 5 (WHO Technical Report Series, No. 957; https://www.who.int/medicines/areas/quality_safety/quality_assurance/GoodDistributionPracticesTRS957Annex5.pdf, accessed 5 December 2019).
5. Joint FIP/WHO guidelines on good pharmacy practice: standards for quality of pharmacy services. In: WHO Expert Committee on Specifications for Pharmaceutical Preparations: forty-fifth report. Geneva: World Health Organization; 2011: Annex 8 (WHO Technical Report Series, No. 961; <https://apps.who.int/medicinedocs/documents/s18676en/s18676en.pdf>, accessed 5 December 2019).
6. Good trade and distribution practices for pharmaceutical starting materials. In: WHO Expert Committee on Specifications for Pharmaceutical Preparations: fiftieth report. Geneva: World Health Organization; 2016: Annex 6 (WHO Technical Report Series, No. 996; <http://apps.who.int/medicinedocs/documents/s22403en/s22403en.pdf>, accessed 5 December 2019).
7. Member State mechanism on substandard/spurious/falsely-labelled/falsified/counterfeit medical products. Report by the Director-General. In: Seventieth World Health Assembly, Geneva, 22–31 May 2017. Geneva: World Health Organization; 2017 (A70/23; http://apps.who.int/gb/ebwha/pdf_files/WHA70/A70_23-en.pdf, accessed 6 December 2019).
8. Good manufacturing practices: guidelines on validation. Appendix 5. Validation of computerized systems. In: WHO Expert Committee on Specifications for Pharmaceutical Preparations: fifty-third report. Geneva: World Health Organization; 2019: Annex 3 (WHO Technical Report Series, No. 1019; https://www.who.int/medicines/areas/quality_safety/quality_assurance/WHO_TRS_1019_Annex3.pdf?ua=1, accessed 29 January 2020).
9. Guidelines on heating, ventilation and air-conditioning systems for non-sterile pharmaceutical products. Part 2: Interpretation of Guidelines on heating, ventilation and air-conditioning systems for non-sterile pharmaceutical products. In: WHO Expert Committee on Specifications for Pharmaceutical Preparations: fifty-third report. Geneva: World Health Organization; 2019: Annex 2 (WHO Technical Report Series, No. 1019; https://www.who.int/medicines/areas/quality_safety/quality_assurance/WHO_TRS_1019_Annex2.pdf?ua=1, accessed 5 December 2019).

10. Model guidance for the storage and transport of time- and temperature-sensitive pharmaceutical products. In: WHO Expert Committee on Specifications for Pharmaceutical Preparations: forty-fifth report. Geneva: World Health Organization; 2011: Annex 9 (WHO Technical Report Series, No. 961; <http://apps.who.int/medicinedocs/documents/s18683en/s18683en.pdf>, accessed 5 December 2019).
11. Guidance on good data and record management practices. In: WHO Expert Committee on Specifications for Pharmaceutical Preparations: fiftieth report. Geneva: World Health Organization; 2016: Annex 5 (WHO Technical Report Series, No. 996; https://www.who.int/medicines/publications/pharmprep/WHO_TRS_996_annex05.pdf, accessed 5 December 2019).
12. Policy on remaining shelf life of medical products. Geneva: World Health Organization; 2019 (working document QAS/19.788; https://www.who.int/medicines/areas/quality_safety/quality_assurance/QAS19_788_Rev1_Remaining_Shelf_Life_of_Medical_Products.pdf, accessed 5 December 2019).
13. Quality systems requirements for national inspectorates. Geneva: World Health Organization; 2019 (working document QAS/19.811/Rev.1; https://www.who.int/medicines/areas/quality_safety/quality_assurance/qas19_811_quality_systems_requirements_for_pharmaceutical_inspectorates.pdf?ua=1, accessed 5 December 2019).

Further reading

- WHO guidelines on quality risk management. In: WHO Expert Committee on Specifications for Pharmaceutical Preparations: forty-seventh report. Geneva: World Health Organization; 2013: Annex 2 (WHO Technical Report Series, No. 981; https://www.who.int/medicines/areas/quality_safety/quality_assurance/Annex2TRS-981.pdf, accessed 5 December 2019).
- ICH harmonised tripartite guideline. Quality risk management Q9. Geneva: International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use; 2005 (https://database.ich.org/sites/default/files/Q9_Guideline.pdf, accessed 5 December 2019).
- ISO 31000:2018(en). Risk management – guidelines (<https://www.iso.org/obp/ui/#iso:std:iso:31000:ed-2:v1:en>, accessed 5 December 2019).
- ISO 14971:2019(en). Medical devices – application of risk management to medical devices (<https://www.iso.org/obp/ui/#iso:std:iso:14971:ed-3:v1:en>, accessed 5 December 2019).
- WHO guidance on testing of “suspect” falsified medicines. In: WHO Expert Committee on Specifications for Pharmaceutical Preparations: fifty-second report. Geneva: World Health Organization; 2018: Annex 5 (WHO Technical Report Series, No. 1010; <http://apps.who.int/medicinedocs/documents/s23452en/s23452en.pdf>, accessed 5 December 2019).
- Guidelines on import procedures for pharmaceutical products. In: WHO Expert Committee on Specifications for Pharmaceutical Preparations: fifty-third report. Geneva: World Health Organization; 2019: Annex 5 (WHO Technical Report Series, No. 1019; https://www.who.int/medicines/areas/quality_safety/quality_assurance/WHO_TRS_1019_Annex5.pdf?ua=1, accessed 29 January 2020).
- Good practices of national regulatory authorities in implementing the collaborative registration procedures for medical products. In: WHO Expert Committee on Specifications for Pharmaceutical Preparations: fifty-third report. Geneva: World Health Organization; 2019: Annex 6 (WHO Technical Report Series, No. 1019; https://www.who.int/medicines/areas/quality_safety/quality_assurance/WHO_TRS_1019_Annex6.pdf?ua=1, accessed 29 January 2020).

- Guidelines for medicine donations, 3rd ed. Geneva: World Health Organization; 2011 (https://apps.who.int/iris/bitstream/handle/10665/44647/9789241501989_eng.pdf?sequence=1, accessed 5 December 2019).
- Guidelines for safe disposal of unwanted pharmaceuticals in and after emergencies: interagency guidelines. Geneva: World Health Organization; 1999 (WHO/EDM/PAR/99.2; https://www.who.int/water_sanitation_health/medicalwaste/unwantpharm.pdf, accessed 5 December 2019).
- Model quality assurance system for procurement agencies. In: WHO Expert Committee on Specifications for Pharmaceutical Preparations: forty-eighth report. Geneva: World Health Organization; 2014: Annex 3 (WHO Technical Report Series, No. 986; <http://apps.who.int/medicinedocs/documents/s21492en/s21492en.pdf>, accessed 5 December 2019).
- Good manufacturing practices: guidelines on validation. In: WHO Expert Committee on Specifications for Pharmaceutical Preparations: fifty-third report. Geneva: World Health Organization; 2019: Annex 3 (WHO Technical Report Series, No. 1019; https://www.who.int/medicines/areas/quality_safety/quality_assurance/WHO_TRS_1019_Annex3.pdf?ua=1, accessed 29 January 2020).
- Guidelines on the international packaging and shipping of vaccines. Geneva: World Health Organization; 2019 (https://www.who.int/immunization_standards/vaccine_quality/Vaccines_Shipping_Guidelines082019.pdf?ua=1, accessed 5 December 2019).

Appendix 1

Recommended storage conditions

Note: Appropriate conditions should be provided for medical products during storage and distribution. Conditions should be maintained as stated on their labels (or as described by the manufacturers as applicable) during storage and distribution. Statements such as “store at ambient conditions” should be avoided. Where possible, actual limits should be specified by the manufacturers, such as “store below 25 °C”. See Table A7.1 below.

Table A7.1

Recommended limits for descriptive storage conditions^a

Label description	Recommended limits
Store at controlled room temperature	15 to 25 °C
Store in a cold or cool place	8 to 15 °C
Store in a refrigerator	5 ± 3 °C
Store in a freezer	-20 ± 5 °C
Store in deep freezer	-70 ± 10 °C
Store in a dry place	No more than 60% relative humidity
Protect from moisture	No more than 60% relative humidity
Store under ambient conditions	Store in well-ventilated premises at temperatures of between 15 °C and 30 °C and no more than 60% relative humidity. Extraneous odours, other indications of contamination and intense light must be excluded.
Protect from light	To be maintained in the original manufacturer's light-resistant containers.
Chilled	5 ± 3 °C

^a These limits are recommended values and are based on pharmacopoeia limits and guidelines.