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Good Storage and Good Distribution Practices of Pharmaceuticals in India and the USA With Regulatory Enforcement

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ABSTRACT

The distribution of pharmaceutical products is critical to the success of an integrated supply chain management system. It is essential that the concepts of Good Distribution Practices (GDP) and Good Storage Practices (GSP) are followed in all aspects of pharmaceutical product distribution and storage operations. Due to the fact that they are both components of the pharmaceutical product management chain and, as such, are closely related, the terms GSP and GDP are sometimes used interchangeably.

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INTRODUCTION

The distribution of pharmaceutical products is critical to the success of an integrated supply chain management system. Good Distribution Practices (GDP) and Good Storage Practices (GSP) must be followed in all aspects of pharmaceutical product distribution and storage operations. Because they are both components of the pharmaceutical product management chain and, as such, are closely related, the terms GSP and GDP are sometimes used interchangeably. Wholesale distributors must adhere to Good Distribution Practices to safeguard the quality and integrity of drugs along the supply chain. Good Storage Practices is a word used in quality assurance to describe the procedures and methods used to ensure that a pharmaceutical product's quality is maintained throughout its Storage [1].

Pharmacovigilance-related businesses, organizations, and institutions all have vital roles to play in pharmacovigilance. Medications' potency and physical integrity will be preserved and maintained if they are kept in an appropriate environment. It is expected that the storage conditions from materials and commodities will be in compliance with the product labelling and that they will also prevent deterioration. GDP principles should be incorporated into national legislation and standards to protect the integrity of the supply chain from Manufacturer to dispensing organization. Collaboration between regulators, law enforcement, customs agencies, pharmaceutical makers, dealers, and pharmacies is required to move medications forward and backward in the distribution chain [Figure 1] [2].

This part of the study begins by focusing on improper Storage at various storage points by way of distribution from the manufacturing premises to the patient shelf, which may affect the stability of the products. In the simple models popular with industry analysts, the Indian drug distribution system has a small number of layers. The possible storage areas for the pharmaceuticals are detailed below.

1. Warehouse in the manufacturing premises
2. Clearing and forwarding agents

3. Government warehouse
4. Wholesalers
5. Hospital/Nursing homes
6. Retail/Chemist stores
7. Patient's storage/cabinet

The pharmaceutical products are stocked at the following storage points listed above.

Warehouse in the manufacturing premises

Room temperatures in the warehouse at pharmaceutical manufacturing units are not frequently/adequately monitored; in summer, the temperature in the room may exceed 30°C. Some of the warehouses possess metal as best sheets as roofing. Air conditioning is also provided only in a separate area where drugs that require being stored in a relaxed environment are stocked. Formulations with Ampicillin, Cephalexin, Erythromycin, Gentamycin, Tetracycline, etc. Only in some warehouses are generators provided in case of power failure [3] [Figures 2 and 3].

Clearing and forwarding agents

Primary pharmaceutical distributors purchase prescription medicines and other medical products directly from manufacturers and store them in warehouses and distribution centres. Healthcare providers order the medications and items packaged and shipped daily from manufacturers [Figures 4 and 5].

It is observed that the temperature is not monitored for drugs at the C&F level, so necessary corrections are not adopted to maintain a uniform temperature [Figure 6].

The Government warehouse's storage facilities are not different from other warehouses. The various storage conditions required are usually not provided in the warehouse.

Wholesalers

Wholesalers usually store the consignment in storage areas without proper light, ventilation, and temperature control. These pictures depict how they stack the pharmaceuticals due to different constraints and issues [4].

Hospitals/ Nursing Homes

One of the few places where the Storage of pharmaceuticals is commendable is Hospitals and Nursing. Generally, all medications are appropriately stored/stacked in racks for easy identification and quick retrieval. In addition, the drugs which require cold Storage are refrigerated, and most of the drugs are stored in a controlled environment [5, 6] [Figure 7].

Retail/ Chemist outlets

Retail Chemist shops are distributed throughout the country in all the temperature zones from Hot and Dry Areas, Hot and Humid areas, Highly Humid areas, Coastal regions, High Rainfall areas, etc. Rule 64 of Drugs and Cosmetics Rules, Condition to be fulfilled before a license in (Form 20, 21, 20-F, 20-G, 20-B, 21-B) is granted/renewed, specifies that the area for Retail license should be not less than 10 square meters. For wholesale support, the site should be not less than 10 square meters. If permission is sought, the site should be not less than 15 square meters. The retailer wholesale premises with this dimension may have an RCCR offing or a Sheet with false roofing. During summer, in the Hot and Dry zones, the temperature may rise to above 30°C. Drugs stored at this temperature for more extended may lose their potency order grade chemically [7, 8] .

Thousands of formulations are stocked in retail or wholesale premises with no control over temperature or protection from light and humid environments. This is the prime area of concern since the pharmaceuticals are stored long in abnormal temperatures and humidity, which can adversely affect the drug products [Figure 8].

Several studies were conducted to see how storage conditions affected the potency and efficacy of stored formulations. The following are the study's specifics: Studies have shown that improper Storage of Drugs at retail stores reduces drug potency. Drugs in India lose 3-4 % of their strength at Chemist's shops because they are not stored correctly, as indicated by the results of a recent study.

The year-long study by the Delhi Pharmaceutical Trust, or DPT, a body of pharmaceutical scientists and senior pharmacists, shows that degradation occurs in medicines before they reach the expiry dates (printed on the label) due to uncontrolled temperature, exposure to light and moisture, and, among other things, when they are transported from the manufacturing site to retail points and retail shops. The focus was on selected brands of four drugs; cephalexin, ranitidine, rifampicin, and the ampicillin-cloxacillin combination, manufactured by reputed drug makers. The trust has made recommendations to the Indian Pharmacopoeial Commission, which brings out the drug standards that indicate the quality and efficacy of drugs in India, alerting it to the need to change the pharmacopoeia's general chapters regarding drug storage. The survey was conducted to scientifically

capture the variations in temperature and humidity levels observed at various chemist outlets in New Delhi and investigate the real-time effect of pharmaceutical product storage and stability. The drugs have shown different levels of degradation in potency, far higher than the permissible limit, at the outlets that did not maintain specified temperature, light, or humidity levels. Since these products are made by only big and reputed firms, which generally ensure proper drug stability while manufacturing and packing, degradation in drugs manufactured by small companies could be much more significant. Currently, there are no codified norms in India on storage practices, though guidelines in the pharmacopoeia, such as GSP and GPP, talk about temperature, moisture, and light-controlled storage requirements in warehouses and Chemist outlets. In 2003, R.A. Mashelkar, former General Director at the Council of Industrial and Scientific Research, proposed the incorporation of the Drugs and Cosmetics Act into this directive to a scientific committee on pharmaceutical quality. This would require wholesale and retail storage regulations, but the administration refused to implement them due to strong opposition from traders who were afraid of higher costs.

A 2007 order from the central drug regulator to state food and drug authorities, asking them to enforce air conditioning in all drug outlets, also faced strong protests from the wholesale and retail traders.

Though most retail outlets in cities and towns use one or two refrigerators to keep drugs such as vaccines and injections that bear a tag of below 20^{o}C temperature, it is not often followed by many. Also, such arrangements may not bead equate to storing all such packs. Chemist outlets tend to avoid storage specifications because of high electricity costs. A study was also carried out to see how temperature affects insulin's potency and pharmacological action. Thermolabile drugs and vaccines are known to lose their strength if not kept at controlled temperatures. Insulin is a labile medicine sensitive to extreme sunlight and temperatures that must be kept chilled between 2 to 8° C. Insulin, according to previous studies, is degraded by hydrolytic reactions or converted into higher molecular clin vials should be kept cooled to 2°C to 8°C and kept away from light if not in use. The study aimed to see if wrong weather storage time impacted the strength of the three formulations evaluated for insulin since proper handling is needed to perform the insulin.

Patient's home

A hot, humid environment can speed up the breakdown of drugs and kill their potency. Chennai, especially during summer, is anything but a cool, dry place, and your drug might end up doing the opposite of what they are expected to do. Experts say antibiotics and biological medicines stored at home during summer also the season of power cuts – are most prone to damage. For most Indians, the popular spots for storing medicines are kitchen or bathroom cabinets, which are the worst storage areas as the places are exposed to heat and humidity [9, 10] [Figure 9].

Every formulation is prescribed specific storage conditions by the Indian Pharmacopoeia, the sole authority for all drugs manufactured and sold in India. The medicine may become inert before its expiration date if it is not followed.

The potency period of drugs about storage conditions specified by the Indian Pharmacopoeia is dealt with in Schedule P of the Drugs and Cosmetic Rules. People who store medicines at home stack them carelessly, whereas trained pharmacists follow the storage protocol. Some patients, especially elderly persons living alone, buy large quantities of medicines to avoid frequent pharmacies. Most antibiotics and biological drugs get spoilt if not stored under specified conditions for a prolonged period, say, for over a month," said an expert from the pharmaceutical industry. Insulin, for example, should be stored in a refrigerator, at 2-8°C. "Insulin loses its potency if not stored properly, and it will not be able to reduce sugar levels. Several families hold over-the-counter drugs at home. I always keep some standard tablets and cough syrups at home. In fact, I keep the syrups in my kitchen.

Making things worse are the power cuts. Madhava Naidu, a resident of Vadapalani who had suffered seizures, said he got flustered every time there was an outage. I have a separate mini-refrigerator to store my medicines. But when there is no power for hours, there is little that you can do, he said. Aspirin tablets, for example, can break down into acetic acid (vinegar) and salicylic acid in a hot environment (kitchen cabinet, card ash board), causing stomach irritation. Ampicillin, Amoxicillin, Cephalexin, Chloramphenicol, Cloxacillin, Doxycycline, Erythromycin, Rifampicin, all Penicillin drugs, Tetracycline, and Gentamycin, are some of the common medicines that must be stored at room temperature (25degreesCelsius). These are antibiotics that are commonly used. Vaccines must be kept in a cooler at 2-8°C. The temperature inside a non – AC room in Chennai can touch 32°C. Oral antibiotics are usually marketed as dry powders that must be reconstituted. To get the most out of the drug, several reconstituted antibiotic suspensions should be held cooled. But for a variety of reasons, a lack of

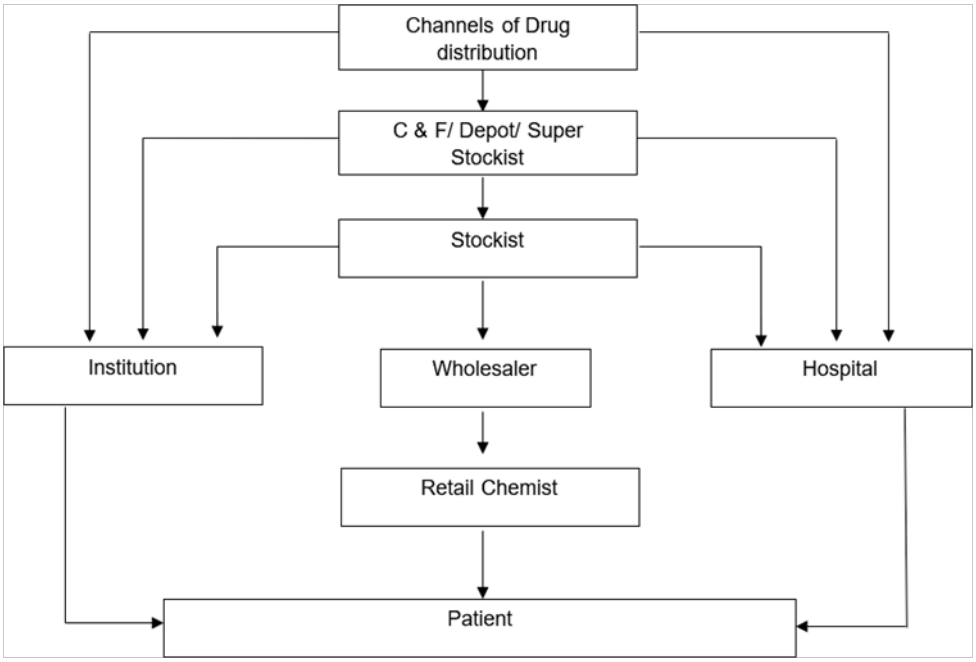

Figure 1: Channels of drug distribution

Figure 2: Storage of finished products in Warehouses at manufacturing locations

refrigeration or in stable power supply, which leads to a variance in the degree of product deterioration, many patients don't adhere to the storage conditions specified. As a result, pharmacists have to warn patients if refrigeration or intermittent control is insufficient for cooling.

This study has examined the stability of the potassium suspension by amoxicillin-clavulanate under simulated domestic unpredictable power and cooling conditions.

Amoxicillin-clavulanate suspensions were replenished and processed in three various home storage conditions at temperatures of 5–29°C for 10 days. For the study of suspension samples, a validated HPLC approach was used.

The concentrations of potassium amoxicillin-clavulanate were greater than 90% until the fifth day. Still, depletion by 70 days and concentrations of amoxicillin dropped below 80% under two circumstances, and concentrations of clavulanate fell below 70% under all three conditions.

A healthy 5-day at room temperature (27-29°C) reconstituting amoxicillin-clavulanate potassium; discourages reconstitution of the suspension which has not cooled adequately after the fifth day.

From the above studies conducted, it is obvious that degradation occurs in medicines in medicines much before their expiry date printed on the label due to uncontrolled temperature, exposure to light, and moisture.

This is because of improper Storage at various levels of storage points and during the transportation from

Sl. No	Name of the Drug/ formulation	Period in months (unless otherwise specified) between date of manufacture and date of expiry which the labelled potency period of the drug shall not exceed under the condition of storage specified in Column No 4	Conditions of Storage
1.	Chloramphenicol Sodium Succinate Injection	36	Cool Place
2.	Ampicillin Capsules	24	
3.	Framycetin Sulphate Eye drops	24	well closed container with temperature not exceeding 30°C
4.	Carbenicillin Sodium Powder	24	At temperature not exceeding 5°C
5.	Insulin Injection	24	2˚ C to 8˚C, must not be allowed to freeze
6.	Frozen Plasma	60	Deep freezer
7.	Paraldehyde Injection	6	Cool place protected from light

Figure 3: Storage conditions and the life cycle of the drugs detailed within the schedule

Figure 4: Storage of pharmaceuticals in C & F agents

the Manufacturer to the retailer [Figure 10].

Ware House Storage of Pharmaceuticals

1. Storage places must be preserved/built to meet good storage practices.
2. Storage areas must be well protected, sound structurally, and sufficiently wide for safe Storage and handling.
3. Sufficient lighting is needed in storage areas to ensure accurate and secure operation.
4. Cautions must be taken to avoid the entry into storage areas of unauthorized people.
5. Quarantined biological products, released, discharged, sent, goods as well as alleged spurious, must remain in separate areas.
6. Storage areas shall be clean, dry, and maintained within a reasonable temperature, built or adapted to guarantee adequate and suitable conditions of Storage. Biological products must be held off the ground and correctly spaced to allow cleaning and inspection. Clean and in good condition, pallets must always be preserved.
7. Regular cleaning of buildings and storage areas is required.

Figure 5: Storage of finished products in C & F agents (Air conditioned for Storage of certain drugs)

Figure 6: Government Warehouse facility for Storage of Finished products

Figure 7: View of Hospital/ nursing home pharmacy

Figure 8: View of drug storage in Retail pharmacy store

Figure 9: Drug cabinet/shelf at home

No.	Name of the Drug	Shelf life Period in months (unless otherwise specified)	Conditions of storage
1	2	3	4
ANTIBIOTICS			
1.	Adramycin	30	In a cool Place
2	Ampicillin	36	In a cool Place
3.	Ampicillin Capsules	24	In a cool Place
4.	Ampicillin Dry Syrups	24	In a cool Place
5.	Ampicillin Injection	24	In a cool Place
6.	Ampicillin Sodium	36	In a cool Place
7.	Ampicillin Trihycrate	30	At temp. not
8.	Amoxycilin Trihydrate	36	exceeding 5° C
9.	Amoxycilin Trihydrate Capsules	24	At temp. not
10.	Amoxycilin Trihydrate Dry Syrup	18	exceeding 5° C
11.	Bacitracin	18	In a cool Place
12.	Bacitracin or Zinc Bacitracin Tablets	12	In a cool Place
13.	Bacitracin Lozenges	12	In a cool Place
14.	Carbenicillin Sodium Injection	24	In a cool Place
15.	Carbenicillin Sodium Powder	24	In a cool Place
16.	Cephalexin	24	In a cool Place
17.	Chloramphenicol	60	In a cool Place
18.	Chloramphenicol Capsules	48	Protected from Light
19.	and Tablets	48	In a cool Place
20.	Chloramphenicol Palmitate	36	In a cool Place
21.	Chloramphenicol Palmitate Oral	24	In a cool Place
22.	Suspension	24	In a cool Place
23.	Chloramphenicol Eye Drops	48	In a cool Place
24.	Chloramphenicol Sodium Succinate	36	In a cool Place
25.	Powder	60	In a well closed
26.	Chloramphenicol Sodium Succinate	60	Container with temp.
27.	Injection	24	not exceeding 30°C

VITAMINS			
1.	Vitamin A Injection	24	
2.	Vitamin B1 Injection	24	
3.	Thiamine Mononitrate Tablets	36	In a well closed container protected from light in a cool place.
4.	Thiamine Hydrochloride	48	
5.	Thiamine Mononitrate	48	
6.	Riboflavin	60	----do----
7.	Riboflavin 5 Phosphate	24	----do----
8.	Riboflavin Tablets	36	----do----
9.	Vitamin B2 Injection	24	In a well closed container protected from light in a cool place.
10.	Vitamin B6	60	
11.	Vitamin B6 Tablets	36	In a well closed container protected from light in a cool place.
12.	Cyanacobalamin	48	
13.	Hydroxycobalamin	48	----do----
14.	Vitamin B12 Injection	36	In a well closed container protected from light in a cool place.
15.	Calcium Pantothenate	36	
16.	Vitamin C Injection	24	
17.	Calcium Pantothenate Tablets	36	
18.	Vitamin C	48	
19.	Vitamin D2 D3	36	
20.	Vitamin E or E-Acetate	60	
21.	Folic Acid	60	
22.	Folic Acid Tablets	36	
23.	Vitamin K	60	
24.	Vitamin K Injection	36	
25.	Niacinamide	60	
26.	Niacinamide Tablets	36	
27.	D- Panthenol	60	

INSULIN PREPARATIONS			
1.	Golbulin Zinc Insulin Injection	24	
2.	Insulin Injection	24	At temp. between 2°C and 8°C, must not be allowed to freeze.
3.	Insulin Zinc suspended	24	
4.	Insphane Insulin Injection	24	
5.	Human Insulin Injection	30	
NORMAL HUMAN PLASMA			
1.	Anti-Haemophilic Human Globulin	12	In a cool Place
2.	Dried Plasma	60	At a temp. not exceeding 25°C
3.	Dried Normal Human Serum Albumin	60	-----do-----
4.	Frozen Plasma	60	In deep freeze
5.	Liquid Normal Human Serum Albumin	24	In a cold place
6.	Whole Human Blood-	60	In a cold place
7.	• Collected in ACD	21 days	At temp between
	• Collection in CPDA	35 days	4°C solution and 6°C.
SERA TOXIN AND TOXOID			
1.	Alum Precipitated Diphtheria Toxoid	24	
2.	Alum Precipitated Diphtheria and	18	In a cold Place
3.	Tetanus Toxoid and Pertussis Vaccine	24	In a cold Place
4.	combined	24	In a cold Place
5.	Alum Precipitated Tetanus Toxoid	18	In a cold Place
6.	Aluminium Hydroxide Absorbed	24	In a cold Place
7.	Diphtheria Toxoid	24	In a cold Place
8.	Aluminium Hydroxide Absorbed	18	In a cold Place
9.	Diphtheria Tetanus Toxoid and Pertusis	12	In a cold Place
10.	Vaccine combined	3	In a cold Place
11.		24	

ANTITOXIN (For serum extracted Preparations)			
	20% Excess Potency	12	In a cold Place
	30% Excess Potency	24	In a cold Place
	40% Excess Potency	36	In a cold Place
	50% Excess Potency	48	In a cold Place
	(For enzyme Preparations)	12	In a cold Place
	5 % Excess Potency	24	In a cold Place
	10 % Excess Potency	36	In a cold Place
	15 % Excess Potency	48	In a cold Place
	20% Excess Potency		
MISCELLANEOUS DRUGS			
1.	Adrenaline for Injection	12	In a cold Place
2.	Chorionic Gonadotrophin for Injection	36	In a cold Place
3.	(Lyophilised)	24	In a cold Place
4.	Corticotrophin	36	In a cold Place
5.	Corticotrophin Lyophilised	36	In a cold Place
6.	Heparin Injection	12	In a cold Place
7.	Liquid Extract of Ergot	24	In a cold Place
8.	Liver Extract Crude Injection	24	In a cold Place
9.	Oxytocin Injection	6	In a cold Place
10.	Paraldehyde Injection	24	In a cold Place
11.	Pituitary Injection	24	In a cold Place
	Vasopressin Injection		

Figure 10: Life cycle Duration of drugs (a few examples)

Figure 11: Storage shelves for pharmaceuticals in a modern pharmacy

Labelling statements	Storage conditions
Freezer	– 25ºC to – 10ºC
Refrigerator	Usually, 2 to 8ºC. Excursions between 0 – 15ºC are acceptable if the MKT is less than 8ºC Short term spikes of up to 25ºC for maximum 24 hours are allowed if permitted by the manufacturer. For excursions exceeding 24 hours, transient spikes have to be supported by stability data
Cool place	8 to 15ºC
Controlled room temperature	Usually 20 – 25ºC. Excursions between 15 – 30ºC are acceptable if the MKT is less than 25ºC Short term spikes of up to 40ºC not exceeding 24 hours are allowed if permitted by the manufacturer. Short term spikes of more than 40ºC have to be supported by stability data

Figure 12: Storage conditions and labelling statements in the US

Sl. No	US FDA	European Commission	Regulatory provisions in India
1.	Controlled Room Temperature Usually 20 – 25°C. Excursions between 15 – 30°C are acceptable if the MKT is less than 25°C Short term spikes of up to 40°C not exceeding 24 hours are allowed if permitted by the manufacturer. Short term spikes of more than 40°C have to be supported by stability data	Room Temperature 15 - 25°C	Not Available
2.	Cool place. 8 to 15°C	Not Available	The term "cool place" means place having a temperature between 10°C and 25 °C.
3.	Refrigerator Usually 2 to 8°C. Excursions between 0-15°C are acceptable if the MKT is less than 8°C Short term spikes of up to 25°C for maximum 24 hours are allowed if permitted by the manufacturer. For excursions exceeding 24 hours, transient spikes have to be supported by stability data	In a refrigerator: 2 – 8°C	The term "cold place" means a place having a temperature not exceeding 8° C.
4.	Freezer – 25°C to – 10°C	In a deep freeze < - 15°C	Not Available
5.	Storage Conditions is based on the result of stability studies undertaken	Storage Conditions is based on the result of stability studies undertaken	Storage Conditions is based on the result of stability studies undertaken
6.	**Cool, Cold Refrigerator and Freezing** • A temperature profiling study is to be used to establish areas for storing Pharmacopeial articles designated to be stored under these conditions • Equipment used for storing Pharmacopeial articles at these low	**Cold storage system:** The following to be taken into consideration: - • The nature of the products and the volumes/quantities to be stored. – • The level of electronic control of the refrigerator unit, i.e. the ability of the unit to control temperature within specified limits. – • The power back-up facilities for the unit itself	Not Available
7	**PERSONNEL TRAINING** • Suitable training should be provided for personnel who handle Pharmacopeial articles with special storage temperature requirements. • Personnel should know how to monitor temperatures and how to react to situations where adverse temperatures are identified. • There should be written procedures in place such that the adverse temperatures are	**TRAINING** • Appropriate training should be provided for all staff members involved in the storage and distribution of medicinal products, including delivery drivers. • Each employee should receive a general introduction to Good Distribution Practice and this should be supplemented by training relevant to their specific responsibilities. • Training on relevant items contained within this guidance document should be included in the training program. • There should be a written procedure which	
8	Comply	**WRITTEN PROCEDURES AND RECORDS** • Procedures concerning temperature monitoring should include the frequency of monitoring (i.e., daily), location of devices (e.g., map of the area with locations of temperature monitoring devices identified on the map), acceptable temperature limits for the various storage areas, records, calibration of monitoring devices, temperature mapping, alarms and action to be taken in the event of a temperature excursion. • All records should be readily retrievable and be in such a form as to make it possible to identify any temperature excursions. All records should be reviewed and the review should be recorded	

Figure 13: Comparative Regulatory Guidelines for Distribution of Pharmaceuticals

8. A written pest control policy must also be developed, and the pest control agents used must be safe without the risk of contaminating biological products. Adequate clean-up protocols must be designed to ensure that any chance of pollution is removed.
9. Contamination and contamination must be prevented if the sampling is performed in the storage room. Sampling areas must be cleaned up procedures.
10. The receiving and dispatch bays must be protected from the elements since they contain biological materials. Receipt areas must be constructed and equipped so that incoming organic containers are cleaned before being stored, if at all possible.
11. Organic goods must be treated and processed to ensure that deprivation, mixing, and cross-infection are prevented. A scheme must be in place to ensure the first sale and/or distribution of biological products expires (FEFO). There may be exceptions if required, given that appropriate regulations are in place to avoid the sale of products which have passed.
12. Plan to remove broken or damaged goods and store them separately from unusable supplies [11].

Pharmaceutical Storage in Retail Pharmacies

The Storage of drugs is among the most essential tasks of pharmacists. Consequently, adequate procedures must be developed to ensure compliance with these obligations. The medications must be handled as accurately as possible so they do not get contaminated and decay. The product's stability is beyond the context of processing and use. The effects of air, humidity, light, and heat must be carefully considered. One of the main problems of medical care is the treatment of pharmaceutical drugs. The conditions of production and Storage of pharmaceutical products can significantly affect their quality. The main degradation factors are relative humidity and high temperature (RH). Several factors can affect a product's final quality and, thus, its stability to sell, such as temperature, humidity, air pollution, and the time it takes to make the product. A cooling plant is also used in a wide range of items that must be kept at a specific temperature and monitored at all times. An auditable and secure inventory must be maintained. All should be in good working order with light, humidity, air, temperature, and safety. In compliance with the Manufacturer's instructions and terms of product authorization, all medicinal products must be processed. In conditions suitable for the product's quality and stability, the pharmaceutical stock should be processed. Defending against pollution, UV radiation, dampness, and extreme temperatures should be given priority. It is best to keep medicines in their original packaging when storing them. All instances in which drugs are processed during delivery must adhere to proper handling rules [12].

Pharmaceutical items should be packaged in a hermetically sealed container to avoid contamination by foreign materials, liquids, or vapours and product loss under typical handling and storage conditions. For proper Storage, the following considerations should be taken:

1. Cleanliness
2. Ambient temperature
3. Brightness
4. Humidity
5. Proper ventilation
6. Segregation

LABEL STORAGE CONDITION

In compliance with labelling, pharmaceuticals, and materials centred on the findings of stability analysis shall be processed. It is necessary to specify and explain the product storage conditions on the label. According to label directions, all drugs should be processed. When indicated in the mark, a check should be carried out for humidity, light, and other factors. Storing is as it should be built or modified to ensure suitable storing environments. Specific storing conditions must be indicated on the brand of the product. Written instructions should be accessible to out-of-label storage situations specifying what to do during temperature excursions. Any departures from the labelled storage conditions shall be thoroughly investigated, and the stock in question shall be disposed of using proof (for example, stability data and technical justification). Stability tests determine the consistency of the medicinal matter or product, allowing for the prediction of shelf life, the establishment of proper storage settings, and the provision of labelling requirements, all of which are affected by environmental influences [13].

United States of America (USA)

It describes how to preserve the integrity of preparation, including its appearance, in the correct storage environment before it reaches the customer. The marking of most items shows the conditions for

Storage. Articles of pharmacopoeia shall be stored at locations that satisfy the specification of the Manufacturer [14].

Warehouses

To create a helpful temperature profile that includes temperature changes and conditions in different areas of the warehouse, it is essential to track temperature variations in a warehouse over time. These findings have details and knowledge on the positions of stocking and Storage of various items.

Temperature Profiles Establishment

The required amount of thermometers or other temperature recording devices may be used to develop temperature profiles. The warehouse should be split into parts, and maximum and minimum temperatures should be registered in 3 consecutive cycles of 24 hours. In the temperature profiling process, the following variables are to be considered, some of which may cause extreme temperatures: room size, the position of space warmers, sun-facing walls, low ceilings or towers, and the geographical location of the warehouse.

Labelling, Storage, and stability

In the design of stability studies for pharmacopoeia articles, the conduct, characteristics, and stability of the medication product, as well as the knowledge from clinical formulation studies. To cover the store, shipping, delivery, and subsequent use, the study duration and storage conditions in a Pharmacopeia paper should be enough. The ICH effects of quick testing in an intermediate environment can be utilized to determine the impact of brief excursions outside label storage settings, for example, during delivery.

Storage statements should be based on stability assessments of pharmacopeial drug substances and must comply with applicable national and international standards [Figure 11].

Pharmaceutical companies consider various factors when developing medications, including the most effective dose, side effects, the method of administration (oral, injection, transdermal etc.), and the results of overdosing, safety, and efficacy. Understanding the impact of Storage on the preparation takes a significant amount of time. These tests will determine whether the medication is stable at room temperature, requires refrigeration, or must be frozen, as well as any degradation during Storage. We'll gonna journey to see how this applies to pharmacies. Suppose no condition of Storage of prescription medicine is set. In that case, the medication may, as specified in the official compendium, be stored at the "regulated" room temperature to ensure the identification, potency, efficiency, and purity of the product are not affected. Adequate manual, electromechanical or electronic humidity and temperature monitoring instruments or logs should be used to record the proper Storage of prescription medicines.

For all stored drugs, the record-keeping requirements must be followed:

Any organization must identify its storage locations to ensure adequate controls are in place. Examples of such sites include warehouses, stock-housing or holding areas, original warehouses of suppliers, warehouses of contractors, wholesale distribution stores, postal or retail pharmacy storage areas, hospital storage areas, and border storage areas of customs. Two fundamental processes will take place in these areas. Accepting a prescription product into a facility is to be obtained for Storage, while transfer means transferring a drug product within or from a facility. Second, the storage and servicing phase in the supply chain refers to the temporary ownership of a drug product during which no effect is transferred.

Buildings and Facilities Storage:

The drug product storage temperature shall be kept within the product label-defined limits. Construction and structures used for storing, storing, and/or holding drug products should be reasonably large for the intended use. These installations should prevent overcrowding that can lead to pollution. The building and facility should be built wherever possible to monitor environmental conditions and create materials that can be easily cleaned. Procedures for sanitation and pest control, including frequency of cleaning, products used, and procedures, should be reported. If the software is used for managing storage conditions, the software must be sufficiently trained for the mission. Tests should be installed in installations to minimize risks, including fire, water, or explosion. Certain drug products can, and should be stored as such, pose these dangers [Figures 12 and 13].

Storage of Pharmaceuticals in Retail Pharmacy

Areas for Storage

Safety procedures for evacuating unauthorized individuals from the warehouses should be taken. Warehouse areas should be wide enough to allow for proper stocks of various materials and types of items, including startup or package materials, intermediate products, bulk and finished products, quarantined products, and products that have been launched, denied, retrieved, or retrieved. Humidity levels should be kept warm and tidy and in appropri-

ate conditions. Specifies, monitors, and records particular storage area conditions (e.g., relative humidity, temperature) on the mark. The storage space must be clean and free from scraps and parasites, and the pallets must be maintained clearly and well-built. Stock and floor shall store materials and pharmacological articulations with adequate room for cleaning and inspection. There represents the regularity of washing and cleaning approaches in the buildings and storage zones. A written pest management strategy must also be drawn up. The controllable pesticide should be inert and not be contaminated by pharmaceuticals or products. There must be proper measures to ensure that any risk of contagion is eliminated [15, 16].

Conditions of Storage

In compliance with labelling, pharmaceutical products and materials based on analysis of stability testing shall be processed.

Storage conditions are being monitored.

The temperature control data recorded should be accessible. It is necessary to inspect the monitoring systems and to report and sustain the results in appropriate predetermined intervals. All monitoring records for at least one year should be kept or retained as material or commodities as long as existing law permits.

Needs for Storage

Documentation requires written orders and records.

Written instructions and documents should be available to record all operations, including how the stock has been handled in storage areas. In product recall, the methods for storing the inventory, pharmaceuticals, and information through the organization shall be appropriately described and defined.

Containers and labelling

Pharmaceutical and material goods should be stored in containers that do not affect the integrity of the materials or products and provide enough protection from external influences. All containers should be appropriately marked with the drug's name, batch number, expiration date or return date, storage conditions, and a reference to the pharmacopoeia, if applicable. Using acronyms, phrases, or codes that have not been approved is not permitted in the workplace.

Cold Chain / Cold Storage

Many medicines need regulated storage and transport conditions of 2°C to 8°C. These medicines must be held within a small temperature range above a freezing point in the supply chain. The 'cold chain' refers to the temperature conditions under which medicines must be maintained during this period, and the Manufacturer, the shipping agent, the wholesaler, and the pharmacist must guarantee these conditions. The four stages of a temperature mapping workout are as follows: Prepare a first phase mapping protocol. b. Complete the operation for mapping. C. Make a mapping report.

d. Implement their commendations by completing the corrective measures and other measures specified in the mapping study. To ensure successful remedial measures, a follow-up mapping exercise may be necessary. Recommendations and Suggestions for effective implementation of Good Storage Practices and Good Distribution Practices for the required amendment under Schedule M of the Drugs and CosmeticsAct,1940, and rules there under:

CONCLUSION

In the present study, the regulatory status of the Storage and distribution of pharmaceuticals in India and the USA has been unveiled from available official documents. An attempt has been made to compare the regulatory status of storage and distribution practices in India and the USA. Though the regulations across the selected countries vary to a greater extent, the principles on which they are envisaged remain the same. India, a country with diversified temperatures and climates, needs practical yet implementable regulations for better Storage and distribution of pharmaceuticals. Some recommendations/suggestions have also been made to sharpen the statute and to ensure the quality and safety of medicines in India.

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