

A REVIEW ON VACCINE STORAGE: KEEPING VACCINES SAFE WHEN THEY ARE IN HIGHEST DEMAND

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ABSTRACT

Vaccines are important for the development of global population. For vaccines to be effective it is essential that they are stored and preserved under refrigeration. Pharmaceutical products require controlled storage conditions in order to ensure that their quality is not compromised. Proper environmental control (i.e.; proper temperature, light, and humidity, conditions of sanitation, ventilation and segregation) must be maintained wherever drugs and supplies are stored in the premises. One of the biggest problems faced by laboratories and clinics is improper and mismanaged vaccine refrigeration. Vaccines save three million lives per year. According to the report of U.S. federal vaccines for children program, over \$20 million worth of vaccines are wasted annually due to improper vaccine refrigeration. This article focuses on vaccine storage with minimal disposal of vaccines.

KEYWORDS: Vaccine storage, Vaccine refrigeration, Cold chain, Transport

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INTRODUCTION

Drug storage is among the pharmacist's most important responsibilities. Therefore, adequate methods to assure that these responsibilities are met must be developed and implemented. The pharmaceutical are to be stored under conditions that prevent contamination and, as far as possible, deterioration. The stability of product retain within the specified limit, throughout the period of storage and use.⁽¹⁾Precautions that should be taken in relation to the effects of the atmosphere, moisture, heat and light are indicated. During storage of the pharmaceutical products is one of the fundamental concerns in patient care.⁽²⁾ The conditions under which pharmaceutical products are manufactured and stored can have a major impact on their quality. High temperature and relative humidity (RH) are the most important factors involved in drug degradation.⁽³⁾ Factors such as temperature, humidity, air quality, time and production process characteristics can all have a significant impact on the final quality of products. For many products requiring storage in cool conditions, refrigeration plant is widely used, which needs to be carefully monitored to ensure that the correct temperatures are maintained. Stock must be stored in appropriate and auditable environmental conditions.⁽⁴⁾

A number of factors influence whether vaccines stored in a refrigerator remain within the prescribed temperature range. Vaccine storage trays can obstruct refrigerator air flow, creating areas pockets

of colder or warmer air. Vaccines stored in certain locations, such as near the refrigerator cooling unit, may be kept significantly colder than if placed in the main body of the refrigerator. Some factors may vary drastically between different refrigerators (e.g. dorm style, freezer less or pharmaceutical grade). Parameters such as temperature control stability, air circulation, defrost cycles, and long-term drift of the temperature set point can play a major role in determining whether a refrigerator maintains suitable vaccine storage conditions. Because of this, simply setting a refrigerator to a temperature between 2 °C to 8 °C may not actually result in stored vaccines being kept within that temperature range.⁽⁵⁾

Temperatures for refrigerated and frozen vaccines need to be maintained within a strict range, with refrigerated vaccines requiring between 2 and 8 °C and frozen vaccines between -50 and -15 °C. Vaccines such as H1N1 influenza rely on a tight temperature range (2-8 °C), with a desired average temperature of 40 °F (5 °C) and must have temperatures measured twice daily. It is recommended to also use a secondary source of temperature monitoring for maximum product security and peace of mind, such as the Thermo Scientific Smart-Vue™ wireless monitoring system (**Thermo FisherScientific**, Milford, MA). Smart-Vue provides independent, secondary monitoring, and comes with the ability to text, e-mail, or call a staff member if the

temperature rises or falls outside of the desired range. ⁽⁶⁾



Smart-Vue wireless monitoring system

PROPER VACCINE STORAGE AND MANAGEMENT

Vaccines should be stored in refrigerators that are large enough to accommodate the highest demand to avoid overloading the unit. Vaccines should not be stacked or positioned where they may fall out of the unit when the door is opened. One should allow for proper air circulation by storing vaccines away from the walls of the refrigerator or freezer.⁽⁷⁾

During the flu season, poor weather conditions can lead to power failures. In events like these, it is important to have an emergency plan in place. The plan should include alternate sites for vaccine storage, a list of necessary packing materials, and a proper method of vaccine transportation. Each packing container should have a

calibrated thermometer inside of it to monitor the vaccine during transport.⁽⁸⁾

Appropriate vaccine management begins with knowledgeable staffs who understand how to use the correct equipment for storage and handling of vaccines. Vaccines should be stored at the correct temperature in refrigerators or freezers designated as “vaccine-only”. This means that food or drink should not be stored in the same unit as vaccines stored. All staff members need to be aware of the guidelines provided by the manufacturer. Staff handling vaccines should maintain a detailed inventory log, including information such as vaccine name, the date of the vaccine was created, the condition of the vaccine upon distribution, and the vaccine expiration date.⁽⁹⁾

Domestic refrigeration units cannot maintain the uniform temperatures

needed to avoid freezing or thawing of vaccines, given that the airflow in these units is neither consistent nor constant. The temperature of a commercial unit can fluctuate as much as 10° during normal use. Purpose-built laboratory refrigerators

and freezers have forced air circulation that maintains an even temperature throughout the unit, ensuring that products will see little to no temperature fluctuation during use.⁽¹⁰⁾



Thermo Fisher Scientific High-Performance Refrigerator

SAFE VACCINE TRANSPORT

The cold chain must be maintained during transport. Vaccines should be kept in an insulated cooler. Frozen ice packs or refrigerated packs should be used as needed to maintain the temperature between 2 and 8 °C. The temperature in the cooler should be monitored and logged immediately before and after

transport. A layer of insulation should be tucked between the vaccine box and the ice packs to prevent direct contact, which could result in freezing temperatures in vaccine vials. The cooler should be kept in the passenger cabin of the vehicle; temperatures in a trunk or truck bed could get too hot in summer or too cold in winter.

CONCLUSION

Maintaining proper storage conditions at pharmacies is essential to reduce the problems caused by environmental factors. The pharmaceutical products were found to retain their potency when stored in pharmacies having good storage facilities. Hence it is important to highlight the importance of maintaining proper storage conditions in pharmacies by the authorities. All vaccines are sensitive biological substances which are susceptible to heat, light and/or freezing. They will lose their potency with time but this becomes more rapid if vaccines are not continuously stored at the temperature appropriate for them from the time they are manufactured till the time of use.

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