Vaccine Storage In The Physician's Office: A Community Study

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Background: A survey was conducted of 26 physician offices and the County Health Department to determine the quality of vaccine storage.

Methods: All refrigerators were examined for secure electrical supply, firmly shut door, storage of inappropriate items, and expired vaccines. A maximum-minimum thermometer was then placed in the middle of the storage area for 24 hours, and temperatures were recorded.

Results: Of the 27 sites, only two had refrigerator temperatures in which both maximum and minimum temperatures fell within the acceptable range of 2° to 8°C. Sixty-three percent fell below minimum, 59 percent were above maximum, and 93 percent fell either below or above or both. Eight of the offices had a designated cold chain monitor, but there was no correlation with appropriate monitoring and storage of vaccines. Nine of the offices had permanent thermometers, but no correlation could be found between these sites and appropriate storage temperatures.

Conclusions: A majority of vaccines in the community have been exposed to conditions that could reduce or destroy their potency. Physicians must educate their personnel in proper storage techniques of vaccines to ensure the potency of these vaccines. (J Am Board Fam Pract 1995; 8:91-4.)

During the last decade there has been an increased emphasis by health providers on improving the delivery of vaccinations to infants, children, and teenagers. In the next decade, millions of dollars will be spent on increasing immunization coverage as the country moves toward the disease-prevention goals presented in Healthy People 2000.1 Some of this energy should be directed toward preserving the cold chain, as vaccinations might not be effective if the process of their delivery and storage at clinics is compromised.2 Recent research from general practices in Great Britain and the national cold chain system in Hungary reveals multiple weak spots in the cold chain of vaccine storage, including limited awareness of codes, improper storage conditions, and storage of outdated vaccines.3-5 A concern has arisen that these weak links in the cold chain are present in the United States as well despite the recent heightened awareness of proper vaccine storage.6,7 Are our immunization clinics and private physician's offices monitoring for breaks in the cold chain? Do we delegate this care to a designated cold chain monitor? Are temperature guidelines known and followed? Are monitors aware that freezing or heat can adversely affect a given vaccine?

Vaccines have recommended storage temperature guidelines, and failure to ensure an optimal temperature could expose them to a possible decrease or loss of potency. Vaccine manufacturers will assist physicians in clinical decision making regarding the potency of vaccines stored under nonideal temperatures. In general, all vaccines, except oral polio and unreconstituted measles, mumps, and rubella (MMR), cannot be frozen without damage. All vaccines except polio are stable for several days at room temperature.2 The specific freezing points of vaccines are not readily available. Manufacturers recommend against storage at less than 2°C and advise discarding any vaccine that was stored at less than 0°C. Oral polio virus vaccine should be stored at less than 0°C, but it may be thawed and refrozen several times under specific conditions. Physicians are urged to contact the manufacturers for more details. Current recommendations are that diphtheria, tetanus toxoid, pertussis, measles, mumps, rubella, and Hemophilus influenzae vaccines be stored between 2° and 8°C.2 To ensure that this temperature is maintained, 1 person in the office should be a designated cold chain monitor and

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Lederle-Praxis Biologicals provided maximum-minimum thermometers.
properly educated concerning vaccine storage.8,9
This person should check and record daily max-
imum and minimum storage temperatures, guard
against inappropriate uses of the refrigerator, and
monitor the expiration dates of vaccines.
This study was undertaken to determine the
quality of vaccine storage in family practice and
pediatric offices and at the County Health De-
partment in one community. The results provide
a base line for future interventions to improve the
cold chain.

Methods
A list of community physician offices was ob-
tained from the telephone directory to include all
primary care physicians in the Grand Valley of
Colorado. A total of 28 offices were participat-
ing in childhood immunization programs. A phy-
sician at each office was contacted and a request
was made to administer a questionnaire to the per-
son in charge of the care of vaccines and to moni-
tor the storage temperature of the vaccine refrig-
erator for a 24-hour period. Of the 28 offices
contacted, only one declined to participate.
An investigator then scheduled a day to visit the
office. The person who took care of vaccine stor-
age (cold chain monitor, nurse, medical office as-
sistant) was administered a brief verbal question-
naire. Included were questions concerning
possible designation of an office cold chain moni-
tor, inventory techniques of incoming vaccines as
well as vaccines on site, and what the office con-
sidered to be an ideal storage temperature. The
vaccine storage refrigerator and its contents were
examined. A maximum-minimum thermometer
probe was placed as close as possible to the center
of the refrigerator and monitored until it read be-
tween 2° to 8°C. The probe remained for at least
24 hours after which the investigator returned to
the office site and maximum and minimum tem-
peratures were recorded. Two identical thermo-
meters were used to facilitate data collection. They
were checked for accuracy by calibration from
−10° to 20°C using a standard laboratory ther-
rometer as reference. Accuracy was ±1°C. There
was no known power outage during this study.
Temperatures were recorded during weekdays so
that the refrigerator was actively in use. Freezer
temperature for storage of the oral polio virus vac-
cine was not monitored. One office did not have a
freezer; it also did not store oral polio virus.

Results
Eight of 27 offices (30 percent) had a designated
cold chain monitor. Nine of 27 offices (33 per-
cent) had a refrigerator thermometer. Two ther-


meters were never read, six were read daily,

and one was read weekly. Of the eight offices with

a designated monitor, seven offices had a refrigera-
tor thermometer, and temperatures were moni-
tored on a daily or weekly basis.

Respondents in 13 offices said that 2° to 8°C is
the ideal storage temperature for most childhood
children. Fourteen responded either incorrectly
or did not know. All respondents knew that heat
can harm vaccine potency; 5 answered “false” to
the statement, “Freezing can harm certain vac-
cines.” (“True” is the correct answer.)

Twenty-six refrigerators contained items other
than vaccines, including food in 11 and blood
products in 6.

Six refrigerators had automatic defrost fea-
tures. The remainder were defrosted by office
personnel every month to every 4 years. Two of-
ices reported defrosting when the temperature
became unstable, and both of these offices had re-
frigerator temperatures that exceeded the ac-
ceptable range.

Seventeen percent of the refrigerators had a
permanent electrical hookup, ensuring against ac-
cidental disconnection and compromise of the
cold chain. All refrigerator doors were found to
shut firmly; however, one door was ajar at the
onset of the inspection.

One person stated that the office had a written
protocol should the refrigerator temperature ex-
ceed the specified range. Although all of the moni-
tors reported that they discarded vaccine vials not
used within the manufacturer’s recommended
time, 10 offices had refrigerators that contained
expired vaccines, including several vaccines that
were more than 1 year out of date and in one in-
stance more than 2 years out of date.

Of the 27 sites, only two were found to have re-
frigerator temperatures in which both maximum
and minimum temperatures fell within the ac-
ceptable range of 2° to 8°C (Figure 1). Neither of
these offices had a cold chain monitor. Sixty-three
percent of office refrigerators had temperatures
that fell below the minimum, and 50 percent were
higher than the maximum; 93 percent registered
either above or below or both. Twenty-six percent
fell below 0°C, severely compromising the po-
amine and log refrigerator temperatures daily to assess any possible breaks in the required temperature range. Vaccines that have been inappropriately frozen must be discarded. A cold chain monitor could ensure that the refrigerator is used properly. Storage of any items other than vaccines should be limited. The more the refrigerator door is opened and closed, the more likely there will be wide fluctuations in temperature quite possibly exceeding the acceptable range. The refrigerator should also be monitored on a timely basis for defrosting and for the condition of the door seals. A permanent electrical hookup is necessary to avoid inadvertent disconnection.

This study monitored vaccines only from the time of arrival at the physician's office to the time of administration to the patient. In our community vaccines are shipped without temperature indicators and could well have been damaged before reaching the physician's office.\textsuperscript{10,11} This important issue requires further study. Although the physician might have less direct control over what happens to vaccines before arrival at the office, there are numerous ways to monitor storage of vaccines on site to ensure that the extensive amount of time and money spent in promoting a healthy

**Table 1. Rules for Care of Vaccines.**

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<thead>
<tr>
<th>Rule</th>
<th>Description</th>
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<td>1.</td>
<td>Designate a cold chain monitor and an alternate person to assume responsibility when the monitor is away.</td>
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<td>2.</td>
<td>Place a maximum-minimum thermometer as close as possible to the center of refrigerator and freezer storage areas.</td>
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<td>3.</td>
<td>Check refrigerator and freezer temperatures daily and record them on a graph. The correct temperatures are 2-8°C in the refrigerator and &lt;0°C in the freezer.</td>
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<td>4.</td>
<td>Keep the freezer free of excessive ice build up. Check weekly. Store vaccines properly when defrosting freezer.</td>
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<td>5.</td>
<td>Check all vaccines on arrival for evidence of heat damage or freezing. Ask the supplier to include a temperature indicator within the shipment packing.</td>
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<td>6.</td>
<td>Monitor vaccine expiration dates monthly. Expired or damaged vaccines should be discarded.</td>
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<td>7.</td>
<td>Do not use the refrigerator for storage of items other than vaccines and medications.</td>
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<td>8.</td>
<td>Provide the refrigerator with a permanent electrical hookup.</td>
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<td>9.</td>
<td>Close the refrigerator door promptly.</td>
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childhood through timely vaccination schedules is worthwhile and efficacious. Although this study was small, the results could apply to other locations. A state or regional cold chain study would help to determine whether improper vaccine storage is a concern and whether children remain at risk for immunization-preventable diseases.

We thank the pediatricians and family physicians in Grand Junction and vicinity who participated in this study.

References