Monitoring the vaccine cold chain

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Abstract

Maintaining the vaccine cold chain is an essential part of a successful immunisation programme. A continuous electronic temperature monitor helped to identify breaks in the cold chain in the community and the study led to the issue of proper guidelines and replacement of faulty equipment.

(*Arch Dis Child* 1993; 69: 600-601)

Vaccine manufacturers clearly state that they do not guarantee the potency of the vaccines if they have not been stored at the temperatures recommended in the data sheet, which for most vaccines is between +2°C and +8°C. Yet monitoring the cold chain is not routinely carried out in most temperate climates and there is a dearth of appropriate guidelines for staff handling the vaccine. This study used electronic technology that is used in the food industry to measure core fluid temperatures. By obtaining a continuous record of temperature and time we were able to identify when the cold chain was broken.

Methods

A record of vaccine movement from the unit pharmacy to the local storage refrigerators and then to the outlying immunisation clinics was obtained by asking staff handling the vaccine to mark the times of movement of the vaccine and the type of container used on a standard proforma. After completion the monitors that had travelled inside the containers and refrigerators with the vaccine were attached to a reader unit and temperature/time printouts were obtained either as tables or graphs. The outside

temperatures were also recorded. This study was carried out during the months of May and June 1992 when the ambient temperatures reached +22°C on several days.

Results

Vaccine is transported from the local wholesaler by courier service within one hour to the pharmacy refrigerator. From the pharmacy the vaccine is delivered by van to the seven local storage refrigerators. This delivery run took 2 hours 15 minutes during which time the temperature of the vaccine rose from +4.5°C (pharmacy fridge) to +15°C (last delivery). Table 1 shows the maximum temperatures to which the vaccine was exposed during transfer from the pharmacy. However, this trip was fraught with delays and delivery times were frequently greater than three hours.

The transfer of vaccine from the local refrigerator to the peripheral clinic was carried out using a range of containers varying from a coolbox with cold blocks to plastic bags. Table 2 shows that in five out of the seven clinics the cold chain was not maintained.

Continuous temperature recording over a 24 hour period in each of the 11 peripheral storage refrigerators showed that the prescribed storage temperatures were not maintained in five of them. The audit also identified refrigerators that did not have a named person responsible for them or did not have thermometers indicating maximum and minimum temperatures.

The temperature rise in the coolboxes and coolbags used to transport vaccine from refrigerator to clinic was monitored using bottles of liquid to simulate the vaccine. Of two coolboxes and six coolbags in the unit only one coolbox was shown to be efficient.

Discussion

There have been several recent reports that comment on the quality of care of vaccines in Europe.¹⁻⁴ The present study demonstrates that there were a number of potentially serious defects in our local system. As a result of this audit, in-service training for vaccine handlers with written guidelines have been produced, a designated responsible person has been identified to supervise vaccine distribution and safe handling, and efficient refrigerators, coolboxes and maximum-minimum thermometers have been purchased. It is proposed that the audit will be repeated at intervals to ensure effective and safe vaccine transport.

I wish to thank my colleagues in community child health, Professor Forrester Cockburn, University Department of Child Health, and Elm Electronics, Glasgow for their help with this study.

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Accepted 9 August 1993

Table 1 Transport from pharmacy to local storage refrigerator

Local storage refrigerator	Maximum temperature (°C)	Journey time (min)
A	5.5	10
B	6.7	25
C	7.8	35
D	9.0	45
E	12.0	90
F	12.9	105
G	15.0	135

Table 2 Transport from local storage refrigerator to clinic

Clinic	Refrigerator temperature (°C)	Highest temperature (°C)	Time outside refrigerator (min)	Container used
1	2.6	18.7	225	Plastic bag
2	8.9	19.2	195	Coolbox without cold block
3	4.7	10.1	180	Coolbox with cold block
4	7.2	7.9	190	Coolbox with cold block
5	11.6	15.6	160	Polystyrene box
6	0.5	12.6	180	Coolbag with cold block
7	3.1	7.4	80	Coolbag with cold block

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