

Path Interview Findings
Vaccine Cold Chain Refrigeration Technologies:
Assessment of the Public-Sector Market
August 2005

Objectives

In an attempt to better understand the current public-sector market and future potential of vaccine refrigeration technologies, PATH interviewed refrigerator manufacturers, policymakers, purchasers, immunization programs, and other key influencers to gather data. Specifically, PATH wanted to learn more about the current size of the public-sector market, the key suppliers and key buyers, how purchasing decisions are made, and which trends could affect the market for refrigeration technologies in the future. Thirteen interviews were conducted (see Appendix A for a list of interviewees). This report highlights the general findings from these interviews. Individuals are not quoted in order to protect confidentiality.

Summary of Key Findings

- We estimate that the public-sector market for the vaccine cold chain accounts for less than 1 percent of total refrigerator sales. Approximately 200,000 vaccine refrigerators are in use in immunization programs in the developing world. UNICEF is the main public-sector buyer, accounting for about 85 percent of public-sector sales. Country governments and specific donors are the other buyers.
- There are four key suppliers in this market which account for the majority of WHO-prequalified refrigerators and freezers for vaccine storage listed in the Product Information Sheets (PIS): Dometic (formerly Electrolux Luxembourg), Vestfrost, Sibir International AB, and Zero Appliances.
- The WHO PIS, which provides information on approved equipment, will be replaced in 2006 with a new Performance, Quality, and Safety prequalification system (PQS).
- UNICEF will only procure cold chain equipment listed in the PIS. Other buyers, such as ministries of health (MOHs) and nongovernmental organizations (NGOs), do not always buy products included in the PIS. Instead, they may source their vaccine refrigerators from domestic sources.
- There does not seem to be a uniform replacement plan for equipment for the vaccine cold chain. Instead, purchase decisions are based on financing cycles and available resources. The main drivers of purchases of cold chain equipment are upcoming large immunization campaigns; availability of emergency funding (which will sometimes be used for cold chain equipment); and availability of post-conflict funds, which also are sometimes used for periodic replacement of cold chain equipment.

- In the future, new vaccines could be developed that are less temperature sensitive, thereby reducing the need for the cold chain. Alternatively, vaccines provided by the Global Alliance for Vaccines and Immunization (GAVI), such as tetravalent and pentavalent vaccines, may result in required expansion of the cold chain due to increased volume needs (as a result of smaller vial sizes being used in order to reduce wastage of costly vaccine). Furthermore, there could be an increasing demand for refrigerators that reduce the risk of inadvertent freezing of vaccine.

Supply

Products

There are two main types of refrigerators: compression and absorption. Some refrigerators have a door on top (chest-type appliances); others have a door at the front (upright refrigerators). Top-opening refrigerators have the advantage of not letting out as much cold air when the door is opened. Most refrigerators have a target product life of at least ten years, with warranties of usually five years. However, individual country climates can greatly affect product performance.

Compression refrigerators have an electric compressor. These refrigerators are either powered from the grid (AC current) or by solar energy (DC current). The solar refrigerator runs on a battery charged by photovoltaic cells which convert sunlight to electricity. If the supply of electricity is available, but not continuous, ice-lined refrigerators are used to maintain vaccine storage temperature for up to five days. Absorption refrigerators have a heating unit in the back. There are three types of absorption refrigerators: kerosene (paraffin), gas, and electric (the electric element is different than a compressor).

WHO Product Information Sheets (PIS)

The PIS has been produced by the WHO Department of Vaccines and Biologicals in collaboration with the UNICEF Supply Division on a regular basis since 1979. The PIS provide general information on the choice of equipment, together with specific technical and purchasing data for individual selected items. In order to be included in the PIS, each item of equipment must be independently tested in accordance with standard test procedures and found to meet established specifications for performance. This testing can be a time-consuming and resource-intensive process for the manufacturer.

The 2000 edition of the PIS, which is the most recently published edition in hard copy (although updates have been posted on the internet site), lists a total of 37 refrigerators and freezers. They are divided into three categories: compression (15 approved products), absorption (13 approved products), and solar (9 approved products). In 2006, the new PQS will replace the current PIS. The system will incorporate technical specifications, standardized test procedures, and post-marketing monitoring. A key difference in approach between the PQS and the PIS system is a greatly increased emphasis on user feedback and field testing.

Manufacturers

There are four key manufacturers in this market, which account for the majority of approved refrigerators and freezers for vaccine storage in the PIS: Dometic (formerly Electrolux Luxembourg, 14 total products in the PIS), Vestfrost (Denmark, 7 total products in the PIS),

Sibir International AB (Sweden, 4 products in the PIS), and Zero Appliances (South Africa, 3 products in the PIS). Dometic owns part of Sibir. The solar category is not dominated by a single player. Competition is within the product category: compression, absorption, or solar. Only one of these key players, Dometic, has items listed in all three product categories in the PIS. Some companies have a stronghold in different world regions. Companies conduct direct marketing to MOHs and local UNICEF offices and spend time out in the field with technicians to educate people about their products.

Market size

We estimate that the public-sector market for the vaccine cold chain accounts for less than 1 percent of total refrigerator sales. Sales of equipment for use in the cold chain are not a significant portion of total sales for most suppliers and generally account for less than 10 percent of a company's total sales. The majority of manufacturers expressed frustration with not having much insight regarding potential yearly demand from the buyers. According to UNICEF, approximately 200,000 vaccine refrigerators are in use in immunization programs in the developing world. It is estimated that about 10 percent of the vaccine cold chain market is solar. Total UNICEF expenditures from 1997 to 2003 on refrigerators and freezers were US\$77 million; 85 percent was funded from UNICEF resources and about 15 percent from procurement services for governments, often via other donors (low, US\$7.9 million in 1999; high, US\$14.9 million in 1998).

According to UNICEF, 32 percent of products supplied are absorption refrigerators fueled by kerosene. Sales of kerosene-only refrigerators totaled 9,772 from 1997 to 2003, and averaged 1,400 units yearly, with the largest order for 5,000 units. Furthermore, from 1997 to 2003, UNICEF bought 3,043 solar refrigerators, averaging 430 units yearly (high, 876 units in 1997).

Given the limited market opportunity, the process involved in qualifying a product for inclusion in the PIS, and the fact that public-sector purchases are erratic and difficult to predict, the industry probably will not see the entry of many new players unless there are new incentives provided by the public sector. This also reduces technical innovation, given the expense of research and development and the small size of the market.

Demand

Public-sector buyers

UNICEF is the major public-sector buyer of cold chain refrigerators and freezers, accounting for 85 percent of public-sector sales. The largest orders come from the UNICEF Supply Division in Copenhagen, although these central orders are usually in response to field office requests.

MOHs can also use UNICEF as a procurement agency. Not all countries are equally knowledgeable about refrigeration and what they are requesting UNICEF to buy. Some countries know exactly what they want, while others seek advice from UNICEF.

UNICEF negotiates long-term arrangements with suppliers to lock in discounts for certain quantities purchased. When buying equipment, UNICEF sends out competitive tenders and needs a minimum of three valid bids. UNICEF only buys refrigerators that are WHO

prequalified and are in the PIS—which limits the number of candidate products. UNICEF usually organizes the shipping and sends units directly from the manufacturers.

The remaining 15 percent of public-sector sales come directly from country MOHs (which do not buy through UNICEF), especially India and Indonesia; other donors—notably Japan; and NGOs, such as Doctors Without Borders and the Red Cross. These other buyers do not always buy products included in the PIS. MOHs, for example, are less strict and are more open to buying other domestically manufactured products not listed in the PIS. When an MOH puts out a tender, the inquiries to suppliers will come from trading companies—up to six to eight per tender, for example.

When buying products for developing countries, some individual donor countries may buy products that are not in the PIS. Other donor countries may only donate the products supplied by their local manufacturers (e.g., Denmark would only supply Vestfrost products, and Luxembourg would only supply Dometic products).

South American countries, in particular, are not major users/buyers of products listed in the PIS. Instead, they source their cold chain refrigerators from domestic sources, often using refrigerators that are intended for home (kitchen) use. This trend may be expanding to other world regions as well. Interest in solar refrigerators may also be growing in South America. Although some of these domestic refrigerators may not be of the same quality as the products listed in PIS, the ultimate effect of buying domestic cold chain equipment (not listed in the PIS) may be to drive down prices of PIS equipment.

Most suppliers have distributors in developing countries. Distributors often handle orders for MOHs and other donors besides UNICEF. Installation assistance is provided by the distributors as well.

Buyer behavior

Purchase decisions are based on financing cycles and available resources. Many decisions are made in the fourth quarter. Countries usually do not spend more than 10 percent of their EPI expenses on cold chain equipment.

The main drivers of purchases of equipment for the cold chain are:

- Donor funds available.
- Upcoming large immunization campaigns.
- Availability of GAVI cash assistance, which is sometimes applied to financing of cold chain equipment.
- Availability of emergency funding, which needs to be spent quickly. (Such funds will sometimes be used on cold chain equipment. In this way, emergency funds are legitimately used for nonemergency items.)
- Availability of post-conflict funds, which are sometimes used for renewal of the cold chain.
- Type of setting in which the product will be used (rural or urban), the level of infrastructure available, and whether the unit needs to be stationary or mobile.

Buying behavior is often a purchase of habit. Decisions are made based on company and device reputation; national program managers' insights; and on-the-ground, in-country, or neighboring-country experiences. Although in general most buyers are relatively price sensitive, price is not always the driving factor. (Japan, for example, is considered one of the least price sensitive buyers.) Instead, reliable field experience is often a more important factor. National program manager meetings are an important source of information for many people.

There is a general feeling by manufacturers as well as by some public-sector officials that in-country there is a lack of information on the cold chain and cold chain equipment, and a lack of technical expertise because buyers stick to their previous habits. They may not be open to trying new products. To remedy this situation, WHO and UNICEF could make more information available on the importance of the cold chain, all products included in the PIS and the importance of quality in general, as well as the experiences of people in different world regions, so that countries could learn from each other. Educating potential buyers and health workers using cold chain equipment on the evolving quality and technical standards (PQS) is a crucial role for these public-sector organizations.

UNICEF does, in fact, organize business seminars in-country to inform MOHs how to procure from UNICEF. Furthermore, staff at UNICEF are responsible for keeping technical data on products updated and making sure there is a sufficient supply of certain products in the UNICEF warehouse in Copenhagen.

Potential Future Trends

There are a number of potential developments that could affect the cold chain market in the future. For example, new vaccines could be developed so that they are less temperature sensitive, thereby reducing the need for the cold chain. Vaccine vial monitors, which are available for some vaccines, may reduce cold chain requirements for hard-to-reach settings.

Yet demand for cold chain equipment could also increase. GAVI-provided vaccines, such as tetravalent and pentavalent vaccines, may result in required expansion due to increased volume needs. Furthermore, based on recent evidence that freezing of vaccine is a common problem in the cold chain, there could be an increasing demand for refrigerators that reduce the risk of inadvertent vaccine freezing.

Increased availability of energy could reduce the need for absorption refrigerators. And since kerosene refrigerators are difficult to control, there is a trend toward LPG refrigerators in situations where absorption refrigerators are used. There is also a likelihood of a decreasing need for icemakers, given WHO is moving towards the use of water packs instead of frozen ice packs for vaccine transport, and because polio campaigns are declining. Finally, CFC refrigerators are to be phased out by 2006, and thus, existing CFC refrigerators will eventually need to be replaced.

In the area of solar technology, a new approach is being developed—the Solar Chill. If the SolarChill technology is proven, there will be an alternative to battery-operated solar refrigerators. The SolarChill project aims to help deliver vaccines and refrigeration to regions of

the world without electricity or with inadequate electrical supply. SolarChill is developing a versatile refrigeration technology that is environmentally sound, battery free, technologically reliable, affordable, and multisource powered. SolarChill prototypes are currently being field-tested in Senegal, Indonesia, and Cuba. Once the field tests are deemed to be reliable, the SolarChill technology will be freely made available to the world and will be in the public domain. The project is supported by the United Nations Environmental Programme, Greenpeace, UNICEF, and PATH.

Other Findings

Some manufacturers noted that there is not much feedback after a request for quotation has been issued by UNICEF and that it would be helpful to hear back from UNICEF about which company won the tender and why. UNICEF advised that all awards are posted on its website and thus publicly available.

Some also said that it is difficult to test new products in developing countries and that it would be helpful to know which countries are good testing grounds.

Manufacturers also gave feedback on a variety of technical issues, especially with regard to solar refrigerators. Specifications for solar refrigerator power systems should be tighter. For example, requirements for the number of sunlight hours and autonomous days (days without sunlight) should be specified as should the battery quality. Some say that batteries are the weak link in the solar refrigerator system. Battery quality and availability for solar refrigerators is a big issue, and there are batteries of varying quality out in the field. Furthermore, batteries heavily influence the price of a system. Storage temperature ranges could also be extended.

Appendix A: Interview List

UNICEF

- Annika Salovaara, Contracts Officer, Immunization Team, UNICEF Supply
- Paulo Froes, UNICEF Americas
- Bob Davis, UNICEF Kenya

WHO

- Michel Zaffran

Cold Chain Refrigerator Manufacturers

- Bjarne Nielsen, Vestfrost
- Pascal Vannier, Dometic
- Ted Orbrink, Sibir
- Johann Gouws, Zero Appliances
- Larry Schlusser, Sun Frost

Country Government Buyers

- MOH China

Other

- Steve McCarney, Consultant to WHO PQS
- Soren Spanner, Cold Chain Consultant
- Terry Hart, IT Power