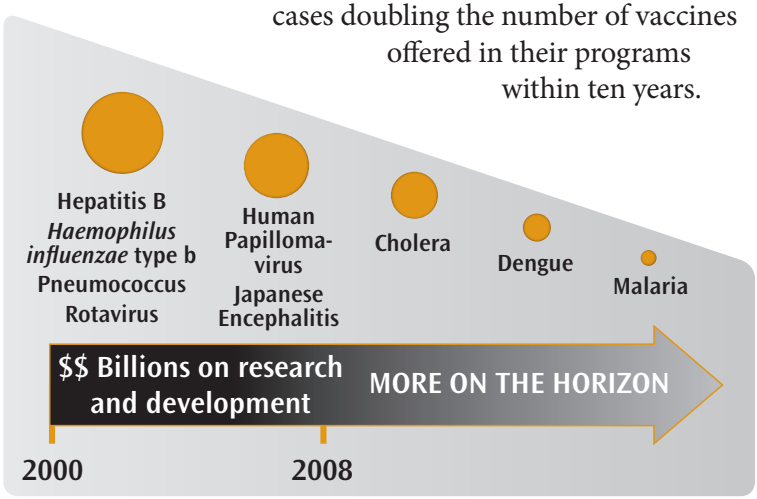
Optimizing vaccine supply chains

More and more vaccines are becoming available

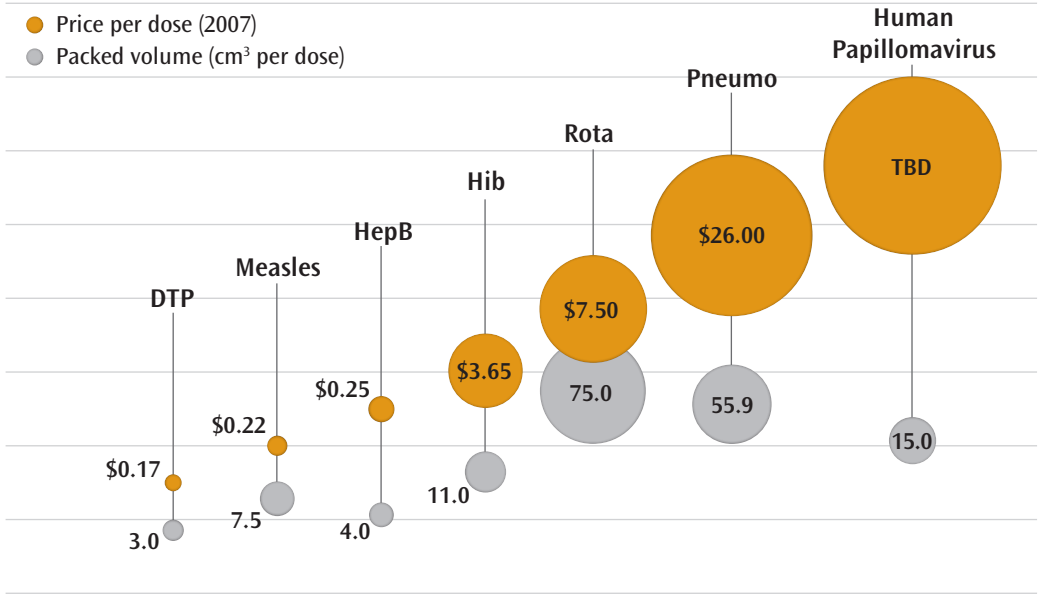
Since immunization programs were launched worldwide in the mid-1970s, most countries have been using the same standard package of six vaccines—measles, tetanus, diphtheria, whooping cough (pertussis), tuberculosis, and polio—in their national immunization schedule. In the last decade, however, as the public health impact of vaccines has become increasingly clear, interest in and funding for new vaccine development has surged. Throughout the next decade, countries will have opportunities to introduce many new lifesaving vaccines into their standard immunization programs—in some cases doubling the number of vaccines offered in their programs within ten years.



The vaccine pipeline is full of new vaccines, many of which are now available in low- and middle-income countries.

New vaccines cost more than traditional vaccines

Traditional vaccines, such as measles, diptheria-tetanus-pertussis (DTP), and polio have been in existence for so long, with so many producers around the world, that their cost is low, often between US$0.10 and US$0.25 per dose. The cost of newer vaccines is significantly higher, between US$3.65 and US$15.00 per dose and sometimes more. Although their prices are expected to drop over time, new vaccines may never reach the low prices of traditional vaccines.

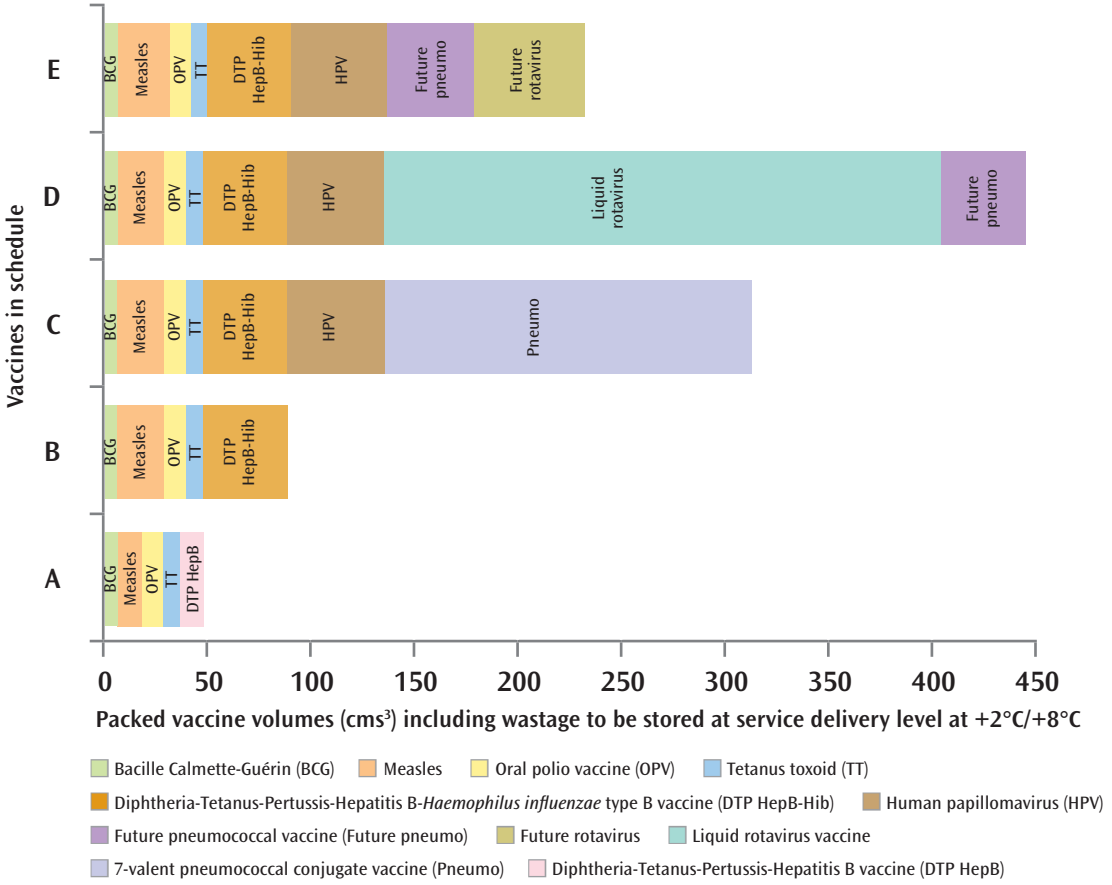


New vaccines, such as those that protect against *Haemophilus influenzae* type B (Hib), pneumococcus (Pneumo), rotavirus, and human papillomavirus (HPV) are much more expensive and much bulkier than traditional vaccines such as DTP, measles, and hepatitis B (HepB) vaccines.

New vaccines require more space than traditional vaccines

In part because of their higher cost, new vaccines are packaged differently. Traditional vaccines often come in 10- and 20-dose vials, resulting in a high rate of vaccine wastage. New vaccines are simply too expensive to use this way. As a result, new vaccines are often packaged in 1- and 2-dose vials to minimize wastage. In some cases, vaccines are also integrated or bundled with syringes or other delivery devices, such as nasal sprays or oral droppers to ensure proper delivery of the dose. As a result, new vaccines are much bulkier, requiring upwards of 500 times the amount of physical space in cold storage.

Annual volume of vaccine needed per fully immunized child



An average-sized country using only traditional vaccines requires an annual gross capacity of 43.1 cm^3 of space per fully immunized child at the central level. With the introduction of just a few new vaccines, this level will increase fivefold, and most countries will require upwards of 300 cm^3 of space per fully immunized child.

Assumptions:

- Volume of vaccines per fully immunized child = Σ(packed volume x no. of doses x wastage factor).
- Available cold chain per child = total gross capacity / annual birth.

Consequences of supply chain failure are greater

Governments and donors that invest in new, higher-cost vaccines understand the urgent need to streamline distribution, minimize waste, improve forecasting, and maintain equipment so that fewer vaccines are spoiled, wasted, or sitting on shelves longer than necessary. A refrigerator full of new vaccines that suddenly breaks down or accidentally falls below freezing for a few hours could now destroy thousands—instead of hundreds—of dollars of vaccines.

New vaccines can require much more space in the cold chain

4,100 doses* of traditional vaccine (polio and measles vaccines pictured here).

$635.50**

625 doses* of new vaccine (rotavirus vaccine pictured here).

$4,687.50**

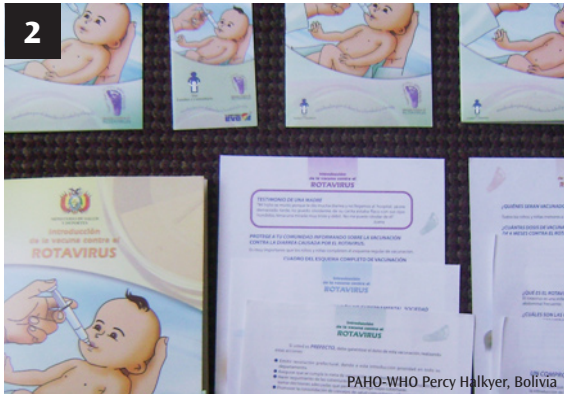
A refrigerator full of 4,100 doses of traditional vaccine valued at US$635.50 compared to a refrigerator full of 625 doses of a new vaccine valued at US$4,687.50. The value of vaccines in the refrigerator on the right is worth more than the refrigerator itself

*Source: World Health Organization (WHO). *Guidelines on the International Packaging and Shipping of Vaccines*. WHO/V&B/01.05. Geneva: WHO; 2001.

**Based on US$7.50/dose for Rotarix and US$0.155 per dose for polio and measles.

Countries have had to adjust quickly

Countries that have already begun introducing new vaccines such as pentavalent (DTP-HepB-Hib), rotavirus, and pneumococcal vaccines have had to make major modifications to their existing vaccine cold chain and logistics systems. Some have rented out large storage facilities, built multiple new cold rooms at the central and intermediate levels, and increased the number and frequency of delivery routes to subnational stores. Logistics managers, cold chain mechanics, supervisors, and health personnel have required additional training and support. Vaccination registers have been reprinted. Health workers have had to carry larger volumes of vaccines to outreach sessions.



New vaccines impact every level of the health system:

1. Central store (Turkey)
2. New training materials (Bolivia)
3. Vaccine carrier (Bolivia)
4. New vaccination register (Rwanda)
5. Health center refrigerator (Bolivia)

Quick fixes do not solve persistent supply chain problems

The vaccine cold chain and logistics systems used in most countries were developed 30 years ago, prior to the availability of computers and sophisticated tracking equipment in developing countries, and before vaccines cost more than US$1 per dose. Until today, many persistent logistics and cold chain problems could be overcome by maintaining high stock levels and tolerating high wastage rates. But with the rising cost of vaccines and the enormous storage capacity now required at each level of the cold chain, managers must be able to maintain lower stock levels, reduce wastage, accurately forecast vaccine demand, and prevent equipment breakdowns or malfunctions.

New ideas are needed—now

Optimize's goal is to make sure that future vaccine supply chains can safely and efficiently handle rapidly changing vaccine and delivery technologies and at the same time reliably function in challenging situations. Putting technological and scientific advances to work, Optimize will examine the original vaccine supply chain and logistics model; test new processes, systems, and technologies that can improve it; work with industry to innovate the presentation and packaging of vaccine products; and tap into new ideas wherever possible—including sectors outside of public health.

Over the next several years, Optimize and country partners will work together to develop and test solutions to anticipated supply chain challenges. We hope to stimulate planning and forecasting in all countries that are considering the adoption of new vaccines and provide insights and tools to help those countries better manage the changes ahead.

Which vaccines is your country likely to introduce over the next ten years? Has your country estimated the volume impact of those vaccines on the supply chain? How does your country anticipate meeting the demands of new vaccines on the supply chain?