April 2022

Project summary: Solutions to address primary health care cold chain and integration bottlenecks

Pphoto: PATH

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PATH

Improving cold supply chains for PHC products will decrease maternal, newborn, and child health mortality by improving the effectiveness and reach of health services

Building on PATH's supply chain technical expertise and lessons learned from strengthening cold chain for immunization programs, we sought to:

- Identify PHC cold chain needs and promising solutions to improve the cold supply chain for non-vaccine health products.
- Inform strategies and next steps for safe integration of PHC products into vaccine cold chains.

Abbreviation: PHC, primary health care.

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WHO-UNICEF Joint Statement from 2014 (updated in 2020)

Clarifies that temperature-sensitive products such as oxytocin can be included in the vaccine cold chain where feasible, cost-effective, and best management practices are adhered to.

Despite this guidance, there has been slow uptake by national immunization programs to adopt and institute this policy.

Why?

Temperature-sensitive health products in the Expanded Programme on Immunization cold chain

A WHO-UNICEF joint statement encouraging greater health commodity supply chain integration for temperature-sensitive pharmaceuticals where appropriate

19 November 2020

unicef for every child

World Health Organization

Introduction

After officially declaring COVID-19 a public health emergency of international concern, the World Health Organization (WHO) and the Global Polio Eradication Initiative (GPEI) have released interim guidance on both routine and supplemental immunization activities. The pandemic and countries' response strain cold chain systems due to the surge capacity needed to store temperature-sensitive COVID-19 diagnostic and therapeutic products. This requires flexibility of the existing cold chain system to manage surplus vaccine and other essential health commodities and to ensure continuity of the delivery of comprehensive health care service.

The WHO and United Nations Children's Fund (UNICEF), reiterate the value of safe, feasible and cost-effective integration of temperature-sensitive health products into the Expanded Programme on Immunization (EPI) cold chain system.

This joint statement highlights integration as a practical solution and provides reference to planning tools and other existing mechanisms to design and implement a safe and efficient integrated cold chain system.

Abbreviations: UNICEF, United Nations Children's Fund; WHO, World Health Organization.

Project objectives

1 **Synthesize learnings on PHC cold chain challenges**

Main question 1: What are the barriers and lessons learned from safe integration?

Main question 2: What are PHC needs and promising solutions to improve the cold supply chain for non-vaccine health products?

Key solutions

2 **Propose solutions to resolve key bottlenecks**

Recommend opportunities to improve PHC cold chain and safe integration, focusing on three primary areas:

- Quality data and **evidence**
- Proper PHC storage and handling **practice**
- Equitable access to the benefits of cold chain **technology**

Abbreviation: PHC, primary health care.

Needs and challenges

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Literature summary on PHC cold chain challenges

The PHC cold chain is where the vaccine cold chain was before significant investments in time and money.

Challenges include:

- Inadequate **training and acknowledgment/ knowledge** of the need for PHC products to be temperature-controlled.
- Need for **users to be able to know when to use or not use** products, such as date and temperature expiration on all packaging (e.g., equivalent of VVM on each package so users can simply understand if products are “bad”).
- Inability to store products in correct temperatures.
  - Having enough **functioning equipment** at the right places and access to it (integration can partially help).
  - Lack of **active or passive containers** for temperature-controlled transport and distribution of PHC products.

PATH/Dave Simpson

Abbreviations: PHC, primary health care; VVM, vaccine vial monitor.

Quick landscape of PHC products for cold chain integration (2°C to 8°C)

Mother

- Hormone suppositories (dinoprostone/prostaglandin E2)
- Oral mineral supplement tablets (iron, folic acid)*

- Injectable uterotonics (e.g., oxytocin, ergometrine, misoprostol)

- Oral ARVs for prevention of mother-to-child transmission of HIV (e.g., tenofovir)*

Child

- Antibiotic oral suspensions (co-trimoxazole, amoxicillin/clavulanic acid)
- Oral ARV solutions (e.g., lopanivir/ritonavir)

- Oral tablets for intermittent preventive treatment for malaria in infants (sulfadoxine-pyrimethamine)*
- Oral vitamin supplements (iron, vitamin A)*
- Deworming oral tablets*

General adult

- Injectable insulin
- Injectable rabies immunoglobulin
- Injectable tetanus immunoglobulin
- Glaucoma eye drops*
- Asthma inhalers*
- COVID-19 test kit samples
- Lab samples and/or reagents (e.g., CD4 antibody reagent, chemistry reagent kits, blood typing sera)
- Injectable therapy for sleeping sickness (i.e., eflornithine)

* Recommended storage below 25°C

Abbreviations: ARV, antiretroviral; CD4, cluster of differentiation 4; PHC, primary health care.

Literature summary on PHC integration challenges

Lessons learned from integration

1. You must have **political buy-in**, which requires coordinated, comprehensive, and transparent planning with clarity of **roles and responsibilities**, and **risk mitigation** across the system.
2. There is no one-size-fits-all integration approach; you must **define and align on objectives** for integration.
3. Despite the unique characteristics of different product categories, a thoughtful and strategic analysis is required to **determine which of the same components** (financing, logistics, quantification, procurement, policies, and capacity) must be addressed to ensure integration.
4. Don’t underestimate the human challenges; **build human resource** capacity.
5. Improve **LMIS reporting forms and practices for all products in the cold chain system** for accurate assessments of cold chain capacity and for visibility of information across the system.

Key takeaways

- Most funding, policies, guidelines, training, supervision checklists, and reporting forms **do not allow for integration,** which creates **unmanaged risk.**
- There is growing interest in leveraging resources and potential cost savings from integration, although this approach increases the perception of the (1) **risks of mishandling** and (2) **considerable level of effort to implement.**


PATH/Patrick McKern

Abbreviations: LMIS, logistics management information system; PHC, primary health care.

Private-sector interventions and outsourcing cold distribution

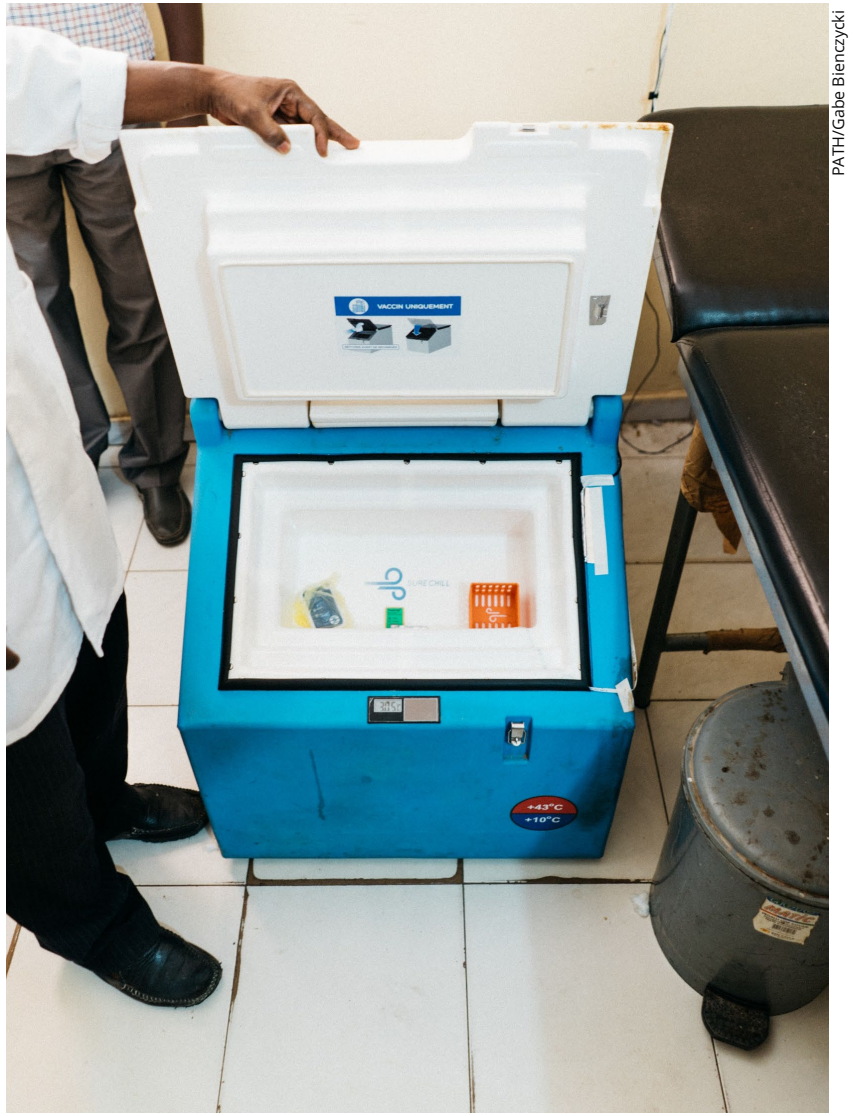
PATH also sought to understand how private-sector cold chain logistics providers can support governments in the storage and distribution of diverse PHC cold chain products, including vaccines, pharmaceuticals, and diagnostics. Advantages and disadvantages of outsourcing can be context dependent as well as dependent on the types of activities being outsourced.

What we learned – benefits of private-sector engagement:

- Government facilities are overcrowded, and private cold chain capacities are often not fully used.
- Private facilities can collect products from public health centers, relieving government distribution.
- Better access to refrigerated trucks and service centers.

Drawbacks and areas for improvement in the private sector:

- Training gaps in cold chain practices in private facilities.
- May rely on government health facilities for support when cold chain equipment fails.
- Variable costing and no minimum standard set payment.



PATH/Gabe Bienczycki

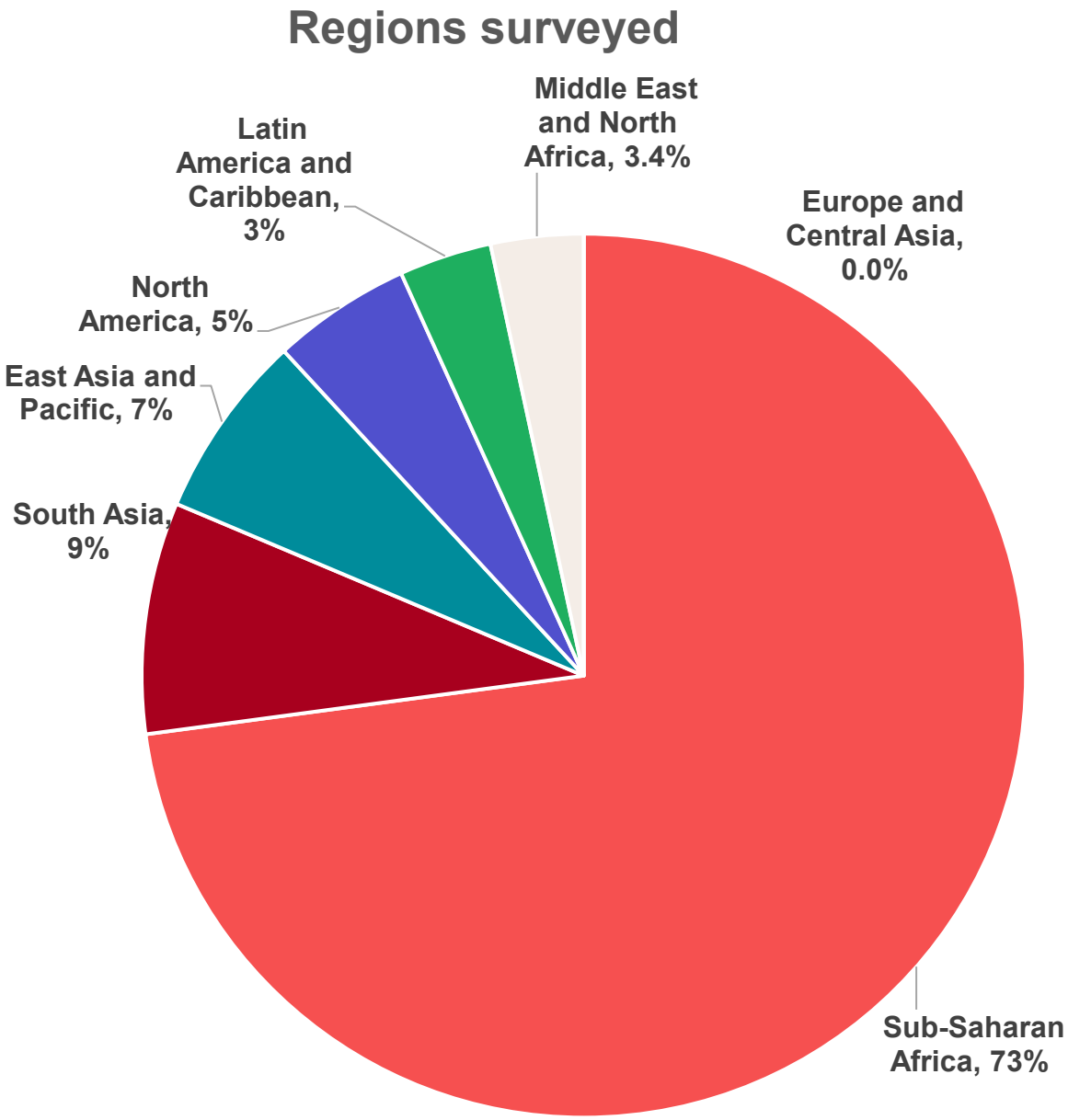
Abbreviations: LMIS, logistics management information system; PHC, primary health care.

Survey of PHC cold chain and integration challenges in LMICs

PATH surveyed experts in PHC delivery and/or cold chain management for their insights and perspectives on bottlenecks that prevent delivery of PHC services:

- Total N=56 respondents.
- 17 LMICs represented: Benin, Burkina Faso, Cameroon, Chad, Colombia, DRC, Ghana, India, Indonesia, Kenya, Liberia, Niger, Nigeria, Sierra Leone, Tanzania, Uganda, and Zambia.
- Role in supply chain: 42% pharmaceutical supply chain, 35% immunization supply chain, 23% laboratory supply chain.
- Health program: 24% malaria, TB, and NTDs; 19% maternal, newborn, and child health; 19% noncommunicable diseases; 14% diagnostics; 14% immunization, 10% nutrition.

Respondents were asked to describe the largest barriers to transporting and storing temperature-sensitive PHC products.



Abbreviations: DRC, Democratic Republic of the Congo; LMIC, low- and middle-income country; NTD, neglected tropical disease; PHC, primary health care; TB, tuberculosis.

Top PHC cold chain barriers

1. Cold chain equipment

Inability to store products in correct temperatures; inability to expand and maintain cold chain equipment for PHC products; lack of dedicated storage space, mobile cold chain facilities, dry ice, time temperature monitoring devices, frozen ice packs, remote thermometers, passive refrigeration, and containers for temperature-controlled distribution.

2. Infrastructure

Lack of electricity and facilities; difficult geography (e.g., jungle, mountains, desert).

3. Transportation

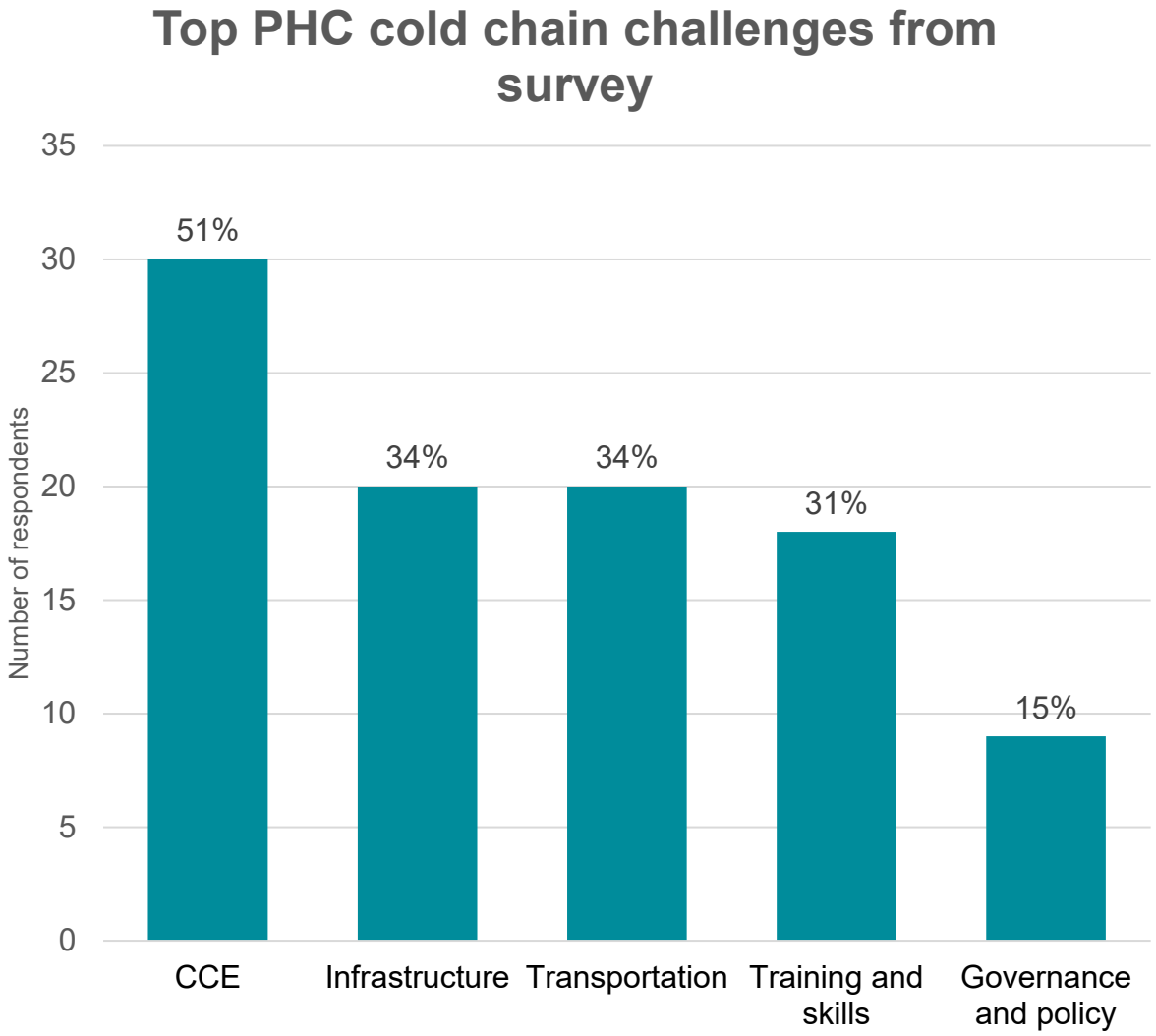
Lack of refrigerated transport and vehicles; harsh road/terrain conditions.

4. Training and skills

Lack of training and knowledge of the need for PHC products to be temperature-controlled, qualified/trained personnel.

5. Governance and policy

Lack of clarity around cold chain requirements for PHC products, lack of political will, inadequate funding for cold chain equipment.

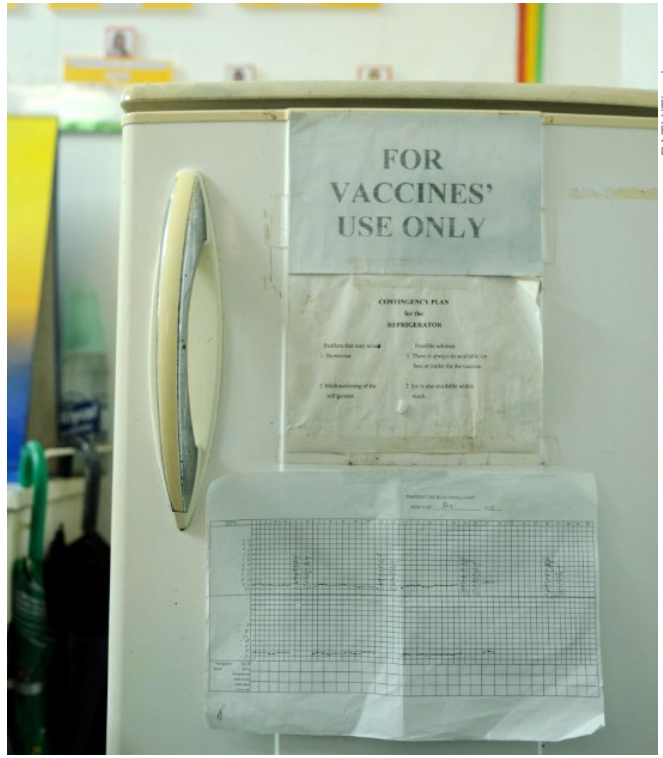


Note: Respondents were able to select all that apply.

Abbreviations: CCE, cold chain equipment; PHC, primary health care.

Integration of non-vaccine products into vaccine cold chains is one approach to address PHC cold chain shortages

Integration refers to the storage and distribution of temperature-sensitive PHC products into the traditional vaccine cold chain (2°C to 8°C) where there is adequate capacity and planning.



PATH/Tina Lorenson

- There is **growing interest** in leveraging immunization cold chain investments and potential cost savings from integration; however, **major bottlenecks to integration** have been resistance around:
  1. **Perceived safety risks** of vaccine mishandling and exposure to temperature fluctuations with frequent door openings.
  2. **Considerable level of effort** and coordination to implement.
  3. **Managing changes** to practices and reporting forms.

- Most funding, policies, guidelines, training, supervision checklists, and reporting forms **still do not allow** for integration.

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PHC products for cold chain integration

Reported as currently or previously integrated

Product	Responses (N=46)
Oxytocin*	21
Insulin*	10
Rabies immunoglobulin*	9
Laboratory reagents and kits	8
Tetanus immunoglobulin*	6
COVID-19 test kit samples	3

Ranked highest priority for integration

Product	Relative frequency	Mean importance score
Insulin*	0.52	4.0
Oxytocin*	0.46	4.8
Laboratory reagents and kits	0.30	2.4
HIV test kits (CD4, viral load, diagnostic)	0.18	2.6
Immunoglobulins*	0.16	3.8

*** = injectable**

Abbreviations: CD4, cluster of differentiation 4; PHC, primary health care.

Reports of integration by health system level

Integration is more commonly reported at **district and health facility levels**.

Product	National	Provincial/ regional	District	Health facility
Oxytocin	1	1	3	15
Insulin	1	0	2	6
Rabies immunoglobulin	2	2	2	5
Lab reagents and test kits	1	0	1	4
Tetanus immunoglobulin	2	2	2	2
COVID-19 test kit samples	0	0	1	1
Total	**7**	**5**	**11**	**33**

*Each number in the table represents the number of respondents.

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Despite support for integration, hesitancy and risk perception remain barriers for some

75% Yes or Sometimes

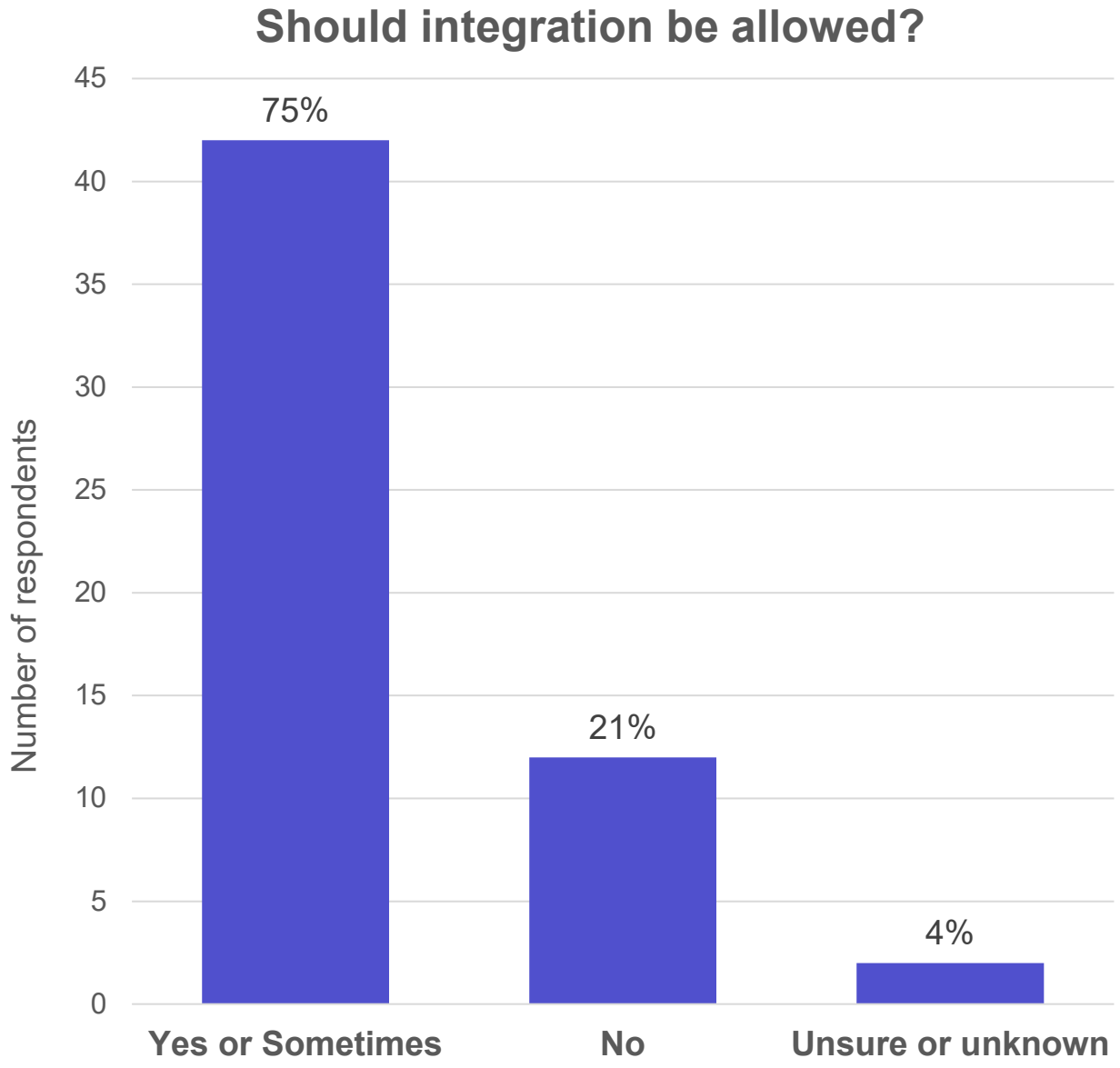
Capacity benefits, efficient use of resources, already happening, current challenges maintaining temperature of PHC products.

21% No

Adverse events, temperature control (frequent door openings, overwhelming cold chain).

4% Unsure or unknown

Insufficient resources for parallel systems, segregated management, integrate at higher levels then expand to lower, prioritize limited space for vaccines.



Abbreviation: PHC, primary health care.

Key bottlenecks to integration

1. Governance and policy

Lack of clarity around which PHC products to integrate; policies vs. actual practices; lack of political will; divergence of health directorates; different receptacles for service delivery; lack of coordination and alignment between programs; siloed funding for cold chain results in mismatched guidelines and SOPs between programs; weaknesses in management and accountability.

2. Cold chain equipment

Inability to determine/forecast actual PHC cold chain needs; overloading CCE.

3. Financing and program funding

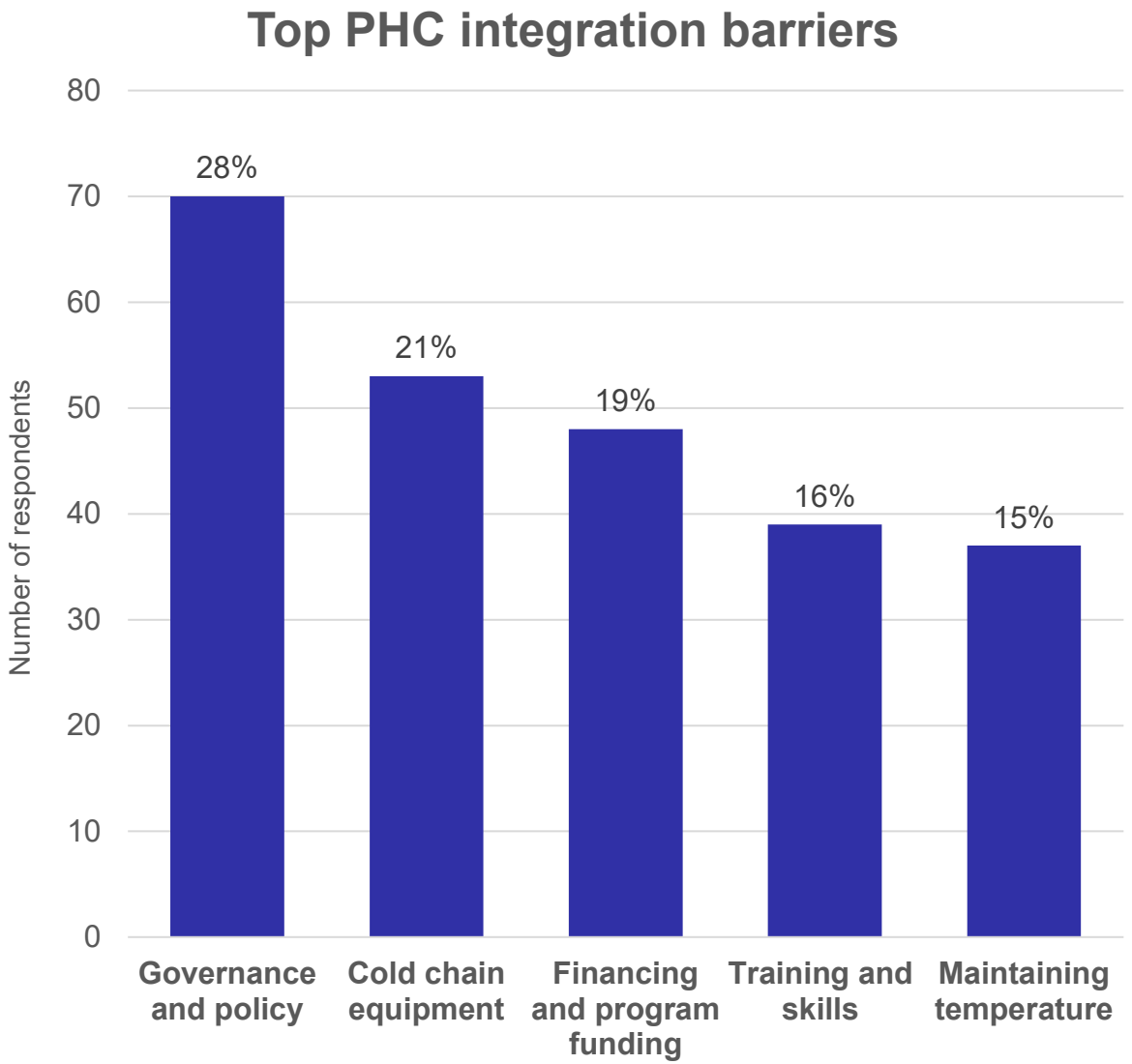
Policies are easily developed or adopted, but they are very often not adequately funded.

4. Training and skills

Lack of knowledge of guidelines and SOPs on integration; adverse events; lack of designation for cold chain logistics; different health cadres handling different cold chain items (e.g., vaccines [nurses], insulin [pharmacists], diagnostic reagents [lab technicians]).

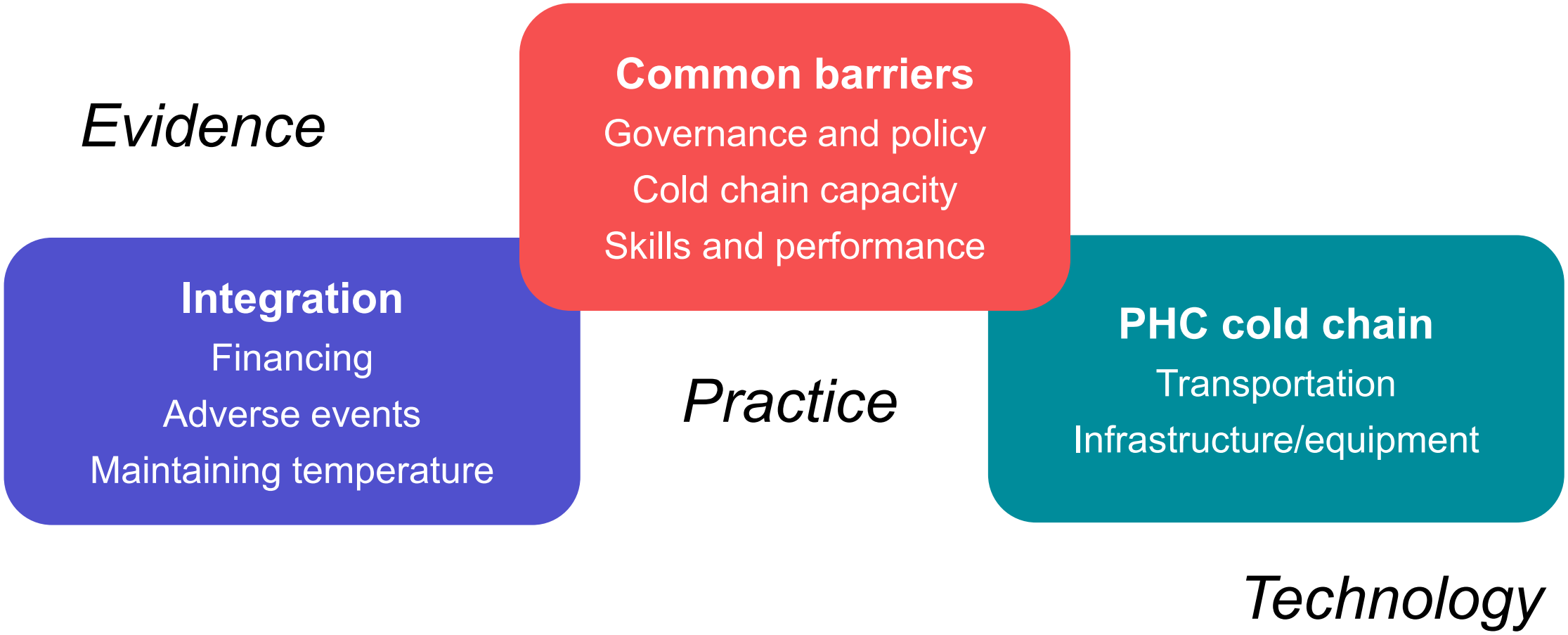
5. Maintaining temperature

Frequent door openings, unreliable data on storage capacity, wastage, excursions, improper equipment use, and compromised product quality. Handling different temperature sensitivities and the ability to store volumes required for the different products.



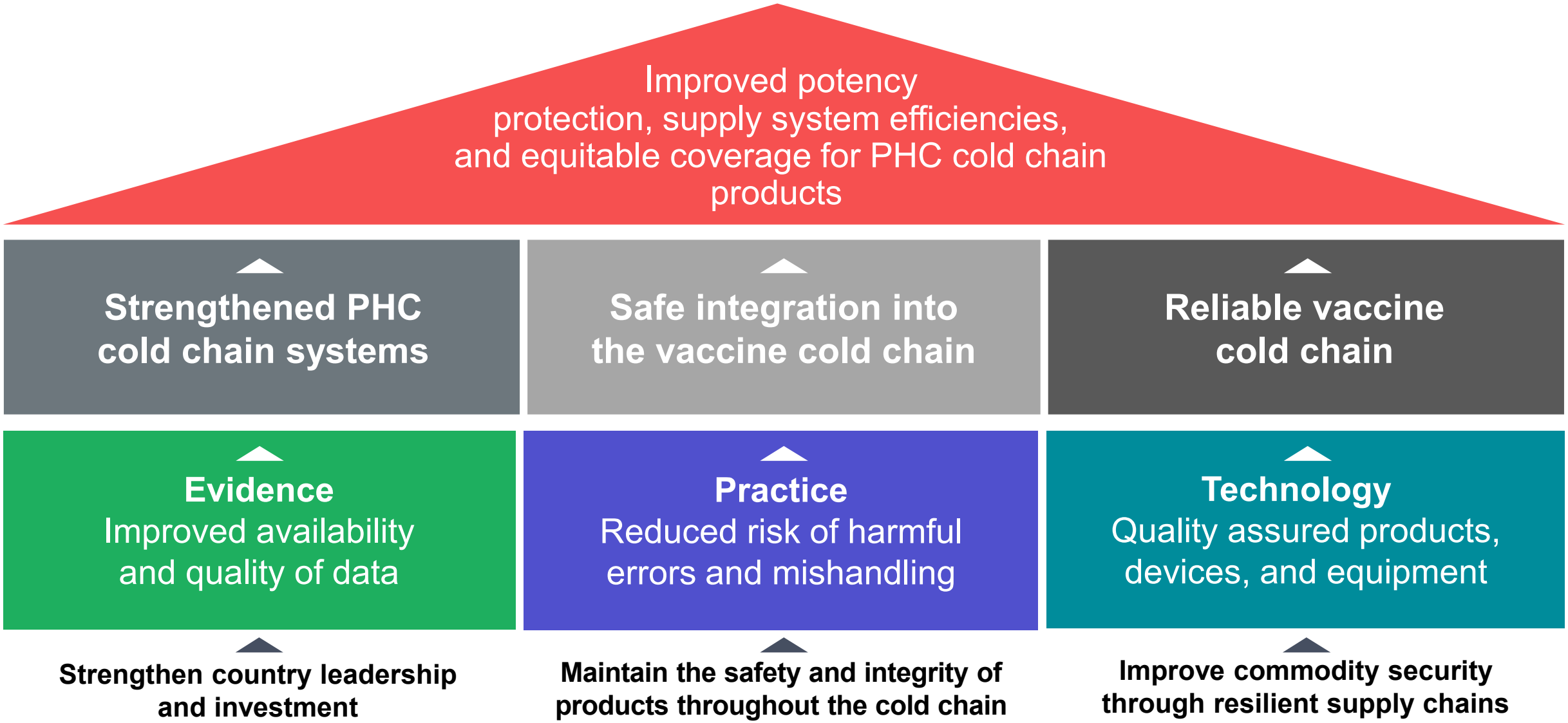
Abbreviations: CCE, cold chain equipment; PHC, primary health care; SOP, standard operating procedure.

Where to focus – largest cold chain system bottlenecks



Abbreviation: PHC, primary health care.

Groundwork for building stronger cold chain systems



Abbreviation: PHC, primary health care.

Priority solutions for improving PHC cold chain and safe integration

Evidence: Generate the evidence to improve policies for investing in PHC cold chain

Governance and policy
Globally define rules and procedures for cold chain management of PHC products to drive collaborative planning

PHC cold chain capacity
Assess PHC cold chain equipment availability and capacity needs for non-vaccine products

Financing and program funding
Demonstrate value of cold chain integration and investment to governments and donors

Practice: Assess and deploy practical and operational solutions to improve proper storage and handling of PHC cold chain products

Adverse events
Support awareness and proven solutions for mitigating the risk of product mix-ups resulting in medical errors

Maintaining temperature
Provide adequate training and tools for PHC staff on cold chain management and/or integration of non-vaccine products

Skills and performance
Standardize operational metrics for monitoring cold chain management across PHC and immunization programs

Technology: Advance and support access to basic essential utilities for high-quality and equitable delivery

Transportation
Advance inclusive distribution options and public-private logistics approaches to improve reliability of the cold chain

Infrastructure, equipment, and regulatory
Advance and assure quality and availability of adequate quantities of necessary technology

Abbreviations: PHC, primary health care; SOP, standard operating procedure.

Recommended solutions

Evidence

Improve availability and quality of data to support policies for investing in cold chain for primary health care

GOVERNANCE AND POLICY BOTTLENECK

Lack of global clarity on the PHC products that require cold chain

PROBLEM

Detailed SOPs, manuals, and monitoring systems for cold chain management have been primarily developed and targeted for vaccine cold chain. Limited global normative guidance on the PHC products that require cold chain storage and at which temperatures to support operationalizing integration.

ACTION

Integration

- Define and publicize global recommendations on the PHC products that require cold chain storage and advocate for consistent planning and messaging of integrated cold chain storage.
- Use learnings from successful integration pilots with replicable design and methods to develop policy and operational guidance on integration; ensure all levels are aware of integration policies.

PHC cold chain

- Advocate for countries to procure PQS-prequalified CCE for PHC products.
- Develop and test advocacy messages that resonate with decision-makers to support strengthening PHC cold chain systems.

OBJECTIVE

Publish global PHC cold chain management evidence-based guidance to clarify PHC storage temperature requirements.

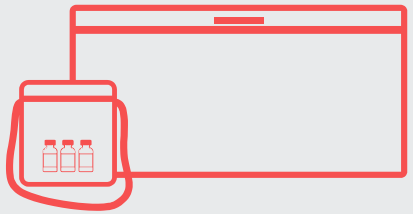
EXPECTED OUTCOME

Increased awareness and recognition on which PHC products should be prioritized for cold chain storage and safe integration.

Abbreviations: CCE, cold chain equipment; PHC, primary health care; PQS, Performance, Quality and Safety; SOP, standard operating procedure.

PHC COLD CHAIN CAPACITY BOTTLENECK

Inadequate understanding of cold chain equipment and capacity needs for non-vaccine products



PROBLEM

PATH calculation showed many facilities will need further CCE investment to ensure capacity to integrate PHC products.

ACTION

Integration

- Refine assumptions and data for PHC products to be included in the CCE forecast and expand facility-level integration analysis to more countries to understand the impact of PHC product integration on access and equity.

PHC cold chain

- Advance asset management techniques such as digital inventory tools to promote visibility and tracking of PHC equipment and drive preventive and corrective maintenance.
- Share learnings from vaccine logistics management information systems to replace paper-based stock reporting forms including application of barcode technologies.

OBJECTIVE

Work with UNDP, UNFPA, UNICEF, and WHO to build guidance on product volumes and PHC cold chain capacity.

EXPECTED OUTCOMES

More accurate inventory planning tools for non-vaccine products requiring cold chain storage and forecasting tools to assess CCE needs for non-vaccine product storage (integrated with vaccines or standalone).

Abbreviations: CCE, cold chain equipment; PHC, primary health care; UNDP, United Nations Development Programme; UNFPA, United Nations Population Fund; UNICEF, United Nations Children's Fund; WHO, World Health Organization.

CCE forecasting and analysis of PHC products

PATH has continued working on cold chain equipment analysis and needs forecasting for COVAX, CCE long-term need forecasts for Gavi 5.0 and 6.0, and demand forecasts for CCEOP 2.0 with UNICEF SD. Leveraging our models and approach, **we have begun exploring the impact of PHC integration on the vaccine cold chain**.

Impact of PHC integration of two products (oxytocin and insulin) on average health facility CCE storage capacity

- **PHC product volumes are 3X to 7X higher** than previous PHC integration analyses.
- **Many facilities will need further CCE investment** to ensure capacity to integrate PHC products.
- Future work could **refine assumptions and data for PHC products** to expand analysis to more countries to understand the impact of PHC integration, including access and equity.

	Previous analyses	Updated analysis
Oxytocin packaging volume	1 cm^3	7–10 cm^3
Insulin packaging volume	10 cm^3	45 cm^3
% cold chain volume need increase	128%	144%

Abbreviations: CCE, cold chain equipment; CHAI, Clinton Health Access Initiative; COVAX, Covid-19 Vaccines Global Access; PHC, primary health care; UNICEF SD, United Nations Children's Fund Supply Division.

“No health organization ever wants to spend money on supply chain. COVID has helped to bring some recognition of the fragility of health supply chains but even so there is little evidence that any MOH wants to invest in strengthening them.”

- Health supply chain/cold chain trainer, East Asia and Pacific and Sub-Saharan Africa regions

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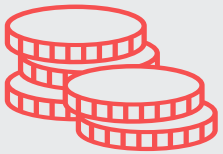
Abbreviation: MOH, ministry of health.

FINANCING AND PROGRAM FUNDING BOTTLENECK

Limited investment in PHC cold chain systems by governments and donors



PROBLEM

Lack of health impact and financial gap analysis to inform advocacy efforts to policymakers for allocating adequate resources to cold chain management of non-vaccine PHC products.

ACTION

Integration

- Generate evidence on the total cost implications of integrating versus not integrating PHC products, from the perspective of the health programs in several countries.

PHC cold chain

- Evaluate the total cost of ownership for PHC equipment.
- Evaluate the value proposition including the health and cost implications of supporting dedicated cold chain equipment for PHC products versus integration and the financial investment needed for each scenario.

OBJECTIVE

Conduct health economics analysis to inform World Bank, MOHs, USAID, and other supply chain strengthening investments.

EXPECTED OUTCOMES

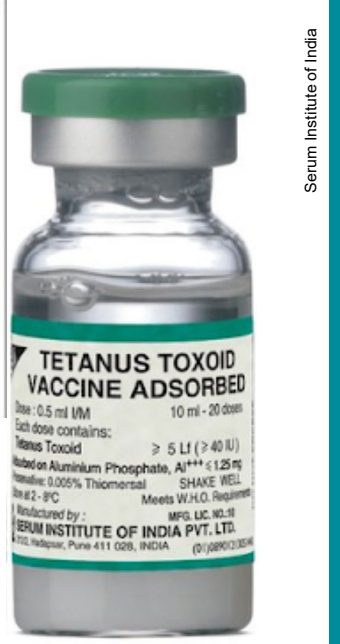
Evidence generated to inform decision-making, advocacy, and collaborative planning among donors and policymakers across programs regarding cold chain and integration.

Abbreviations: MOH, ministry of health; PHC, primary health care; USAID, US Agency for International Development.

Practice

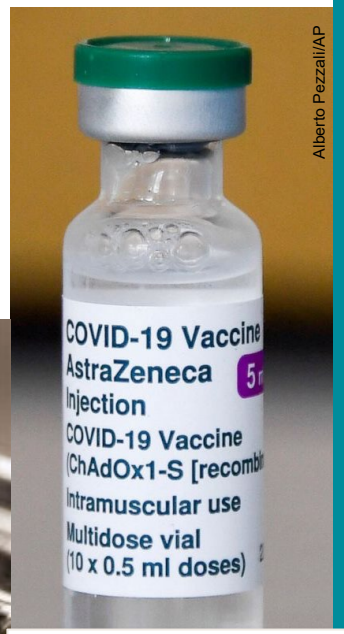
Reduce risk of mismanagement and inadequate monitoring of primary health care cold products

Errors with oxytocin

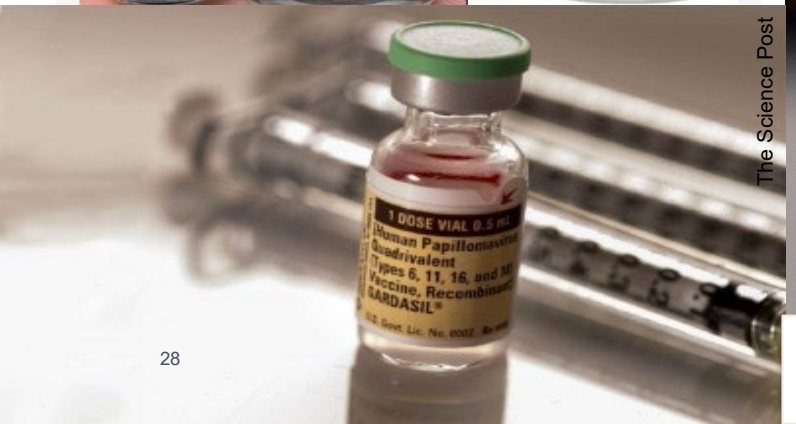


Serum Institute of India

APSF



Alberto Pezzali/AP



The Science Post

"There are chances of non vaccine products getting mixed with vaccine chain like for e.g., insulin may be confused for diluent of vaccine and if without proper pre verification can have dangerous consequences."

- UNICEF, sub-Saharan Africa

LASA = "look alike sound alike" is a well-known risk

AEs due to incorrect product delivery are likely underreported

Event date(s)	Country	AEFI	Programmatic error
–	Lesotho	5 cases (1 death, 5 collapsed)	BCG and oral polio vaccine diluted with a neuromuscular blocker.
–	Mexico	14 cases (hypotonia, cyanosis, and dyspnea); 1 death	Succinylcholine and pancuronium vials found stored with the measles vaccine and diluent.
–	United States	14 cases	Diluent and lyophilized powder had similar labels so practitioners believed either vial was acceptable to use instead of in combination. Ten infants were administered the diluent without the lyophilized powder and in four cases the lyophilized powder was reconstituted with sterile diluent intended for other vaccines.
1987	Mexico	14 cases of hypotonia (1 death)	Use of muscle relaxant instead of diluent. Succinyl choline and pancuronium bromide stored with vaccine diluent. Vials containing muscle relaxant and diluent were of the same size and shape; labels on a number of vials recovered could not be read.
1989	Kenya	6 cases (no deaths, 6 hospitalizations)	Use of muscle relaxant instead of diluent: pancuronium chloride stored with vaccine diluent.
1992	Lesotho	5 cases of neonate collapse (1 death)	Use of muscle relaxant instead of diluent: pancuronium chloride, suxamethonium bromide, and insulin stored with diluent.
1995	Kenya	2 deaths	Use of muscle relaxant instead of diluent.
1997	–	70 cases (21 deaths)	Insulin was stored with DTP vaccine.
2003		6 cases (3 deaths, 3 mild symptoms)	Use of muscle relaxant instead of diluent suxamethonium was confirmed to be used.
2010	United States	1 case	Confusion with a combination vaccine due to poor storage practices. A Hib and DTaP infant combination vaccine was dispensed instead of the intended separate vaccines DTaP and Hib plus diluent.
2010 to 2015	United States	61 cases (redness, fever, and pain)	A total of 269 recipients of MenCYW-135 received only the liquid component, and 138 recipients received only the lyophilized component, reconstituted in sterile water, saline, a different liquid vaccine, or an unspecified diluent.
2014	Syria	15 cases (15 deaths)	Measles diluent ampoules confused with look-alike ampoules of atracurium, a neuromuscular blocking agent, which is also refrigerated. The mix-up occurred either before shipment from the manufacturer or at the central area where the vaccines and diluents were stored in a refrigerator.
2018	Samoa	2 cases (2 deaths)	A muscle blocking agent was used instead of water to dilute lyophilized MMR vaccine.

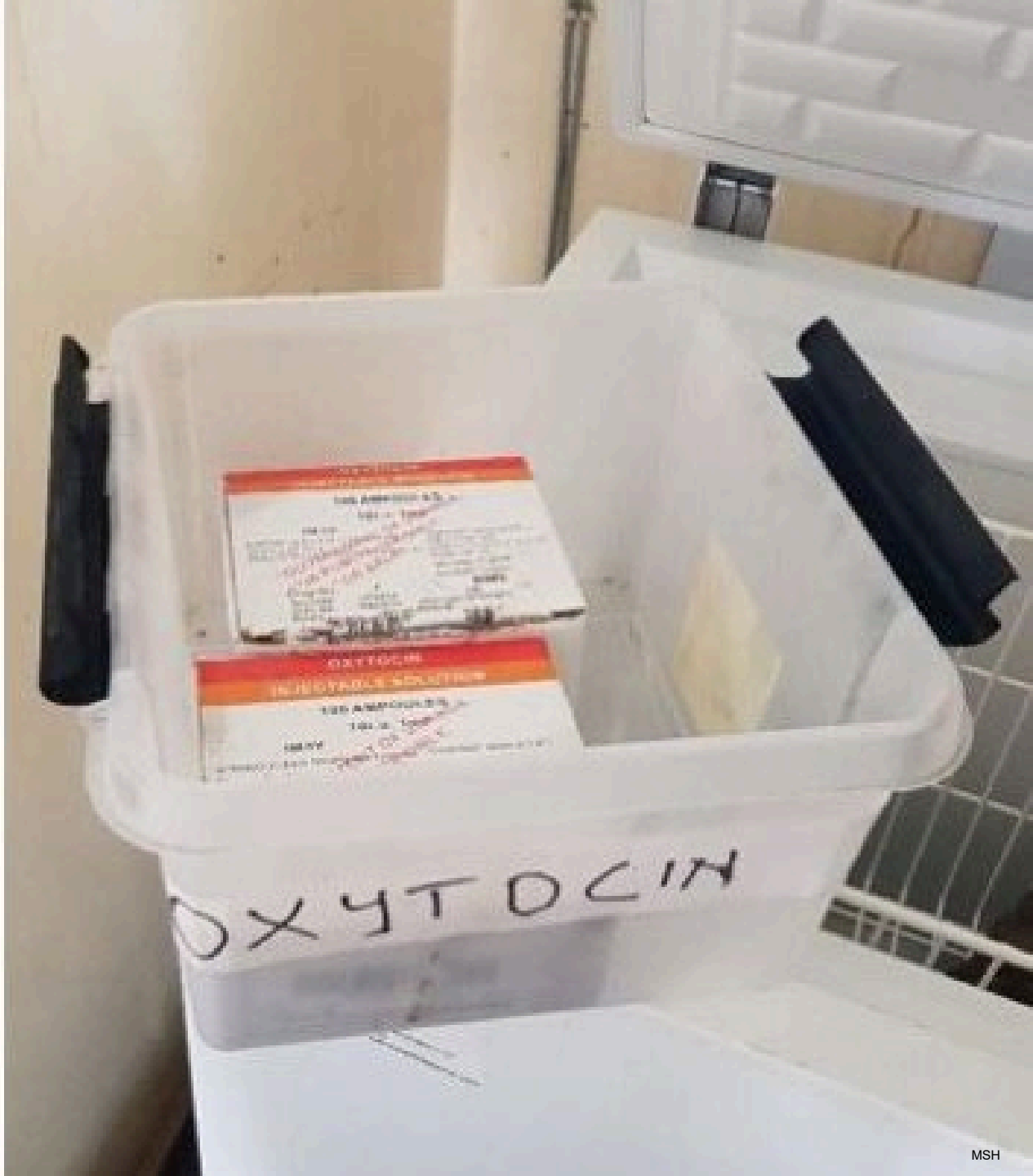
Abbreviations: AE, adverse event; AEFI, adverse event following immunization; BCG, bacillus Calmette-Guérin; DTaP, diphtheria, tetanus, acellular pertussis; DTP, diphtheria, tetanus, pertussis; Hib, Haemophilus influenzae type B vaccine; MenCYW-135, meningococcal (groups C, Y, and W-135) conjugate vaccine; MMR, measles-mumps-rubella.

ADVERSE EVENTS BOTTLENECK

Unmanaged risk of product mix-up and medical errors

PROBLEM	ACTION
Evidence for patient-safety interventions implemented in LMICs is weak. There's a need for high-quality HCD research to identify and co-design interventions that have a real impact on the prevention of avoidable errors.	Human-centered design approach with input from multi-tiered stakeholders to advance the best possible solutions for the health care worker and system: • Use evidence from risk assessment of the process and procedures of having an integrated cold chain (e.g., FMEA, HACCP) to decrease effect of subjective reactions to integration. • Assessment of efficacy, user acceptability, and feasibility of method(s) in preventing mistakes and ensuring proper storage and handling such as: - Containers or compartments for product separation - Lean and agile logistics processes - Simple and uniform visual indicators - Uniform product labeling requirements - Bundled packaging solutions - Formulation/delivery technologies - Strengthened pharmacovigilance systems
OBJECTIVE Co-design with MOHs, end users, industry, and global entities the right simple solution for avoiding mix-ups in storage and transport.	**EXPECTED OUTCOME** Evidence on interventions proven to minimize safety risks produced and communicated to global stakeholders to inform scale-up of safe integration.

Abbreviations: FMEA, failure modes and effects analysis; HACCP, hazard analysis and critical control points; HCD, human-centered design; LMIC, low- and middle-income country; MOH, ministry of health.



MSH

MAINTAINING TEMPERATURE BOTTLENECK

Inadequate cold chain training and tools for PHC staff

PROBLEM

Need for users to be able to know when to use or not use PHC products, such as date and temperature expiration on all packaging (e.g., equivalent of VVM on each package so users can simply understand if products are “bad”).

ACTION

Integration

- Update training curriculums for integration of PHC cold products into the vaccine cold chain.
- Include identification, management, and investigation of suspected adverse event cases in training.

PHC cold chain system

- Adopt vaccine storage and handling guidance and toolkits to include other PHC products for health staff to be trained on cold chain practices for PHC.

OBJECTIVE

Support WHO, UNICEF, and MOH program managers in creating updated training curriculum that supports safe integration.

EXPECTED OUTCOME

Better knowledge and awareness of handling different temperature sensitivities will lead to a reduction in avoidable wastage, temperature excursions, improper equipment use, and compromised product quality.

Abbreviations: MOH, ministry of health; PHC, primary health care; SOP, standard operating procedure; UNICEF, United Nations Children's Fund; VVM, vaccine vial monitor; WHO, World Health Organization.

SKILLS AND PERFORMANCE RECOMMENDATION

Lack of standardized cold chain indicators across programs

PROBLEM

Lack of standardized and routine operational metrics across programs to monitor cold chain performance and impact of integration results in inability to set improvement goals.

ACTION

Integration

- Reconcile WHO/UNICEF effective vaccine management indicators that do not assess and monitor non-vaccine products stored in vaccine supply chains.

PHC cold chain system

- Provide minimum recommended standards for each criteria and level of the in-country supply chain to generate evidence on performance and guide steps toward supply chain optimization.

KEY ACTORS

Coordinate with WHO, UNICEF, and MOH to adopt validated indicators for cold chain management of PHC products and safe integration.

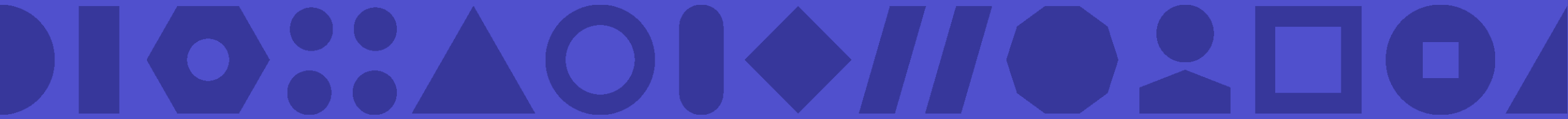
EXPECTED OUTCOME

Measurement indicators enable countries to take an approach to assessing, planning, and implementing change within their program budgeting and financing cycles and make every effort toward achieving a stronger cold chain system for PHC services.

Abbreviations: MOH, ministry of health; PHC, primary health care; UNICEF, United Nations Children's Fund; WHO, World Health Organization.

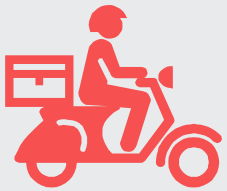
Technology

Improve reliability of quality essential equipment for equitable distribution and service delivery



TRANSPORTATION BOTTLENECK

Interruptions in distribution of PHC cold chain products



PROBLEM	ACTION
Supply chains relying on unequal access to transportation resources will inherently remain vulnerable to stockouts and delays, creating issues in ensuring supply availability, access, and equity.	**Integration** • Evaluate impact of solutions such as coordinating transportation and streamlining the number of storage levels in a system to improve efficiencies, increase stock levels, and reduce redundancies within different country archetypes. **PHC cold chain system** • Conduct assessments such as feasibility, impact, and cost-benefit analyses to evaluate new innovative modes of distribution within different country archetypes. • Assess the role of private-sector distributors in the PHC cold chain.
OBJECTIVE Assess impact of alternative transport technologies and the private sector in distribution.	**EXPECTED OUTCOME** Evidence on the impact and cost implications of optimized nodes and transportation methods in the resupply process, which can inform improved supply chain effectiveness, efficiency, responsiveness, timeliness, and accuracy.

Abbreviations: JSI, John Snow Inc.; PHC, primary health care.

INFRASTRUCTURE/EQUIPMENT/REGULATORY BOTTLENECK

Inadequate availability of quality assured technology

PROBLEM

Inadequate cold chain storage amenities, power supply, and facilities from district to primary care levels limit the ability to maintain temperature of the products in storage at the service delivery point.

ACTION

- Explore physical solutions to storage besides refrigerators for creating temperature-controlled areas and/or develop guidance on how you would create, maintain, and monitor a controlled moderate temperature (25°C) space.
- Evaluate and advance low-cost, high-impact technologies to provide basic infrastructure needs (e.g., poor-quality energy and connectivity) and build more resilient vaccine and non-vaccine PHC cold chains for improved primary care.
- Continue to assess the technology landscape of the vaccine cold chain and apply innovations and processes to the PHC cold chain, as appropriate, including the regulatory, commercial, and technical guidance that enables technology advancement.

OBJECTIVE

Conduct technology evaluations to inform WHO, UNICEF, industry, and Gavi in advancing appropriate cold chain technologies.

EXPECTED OUTCOME

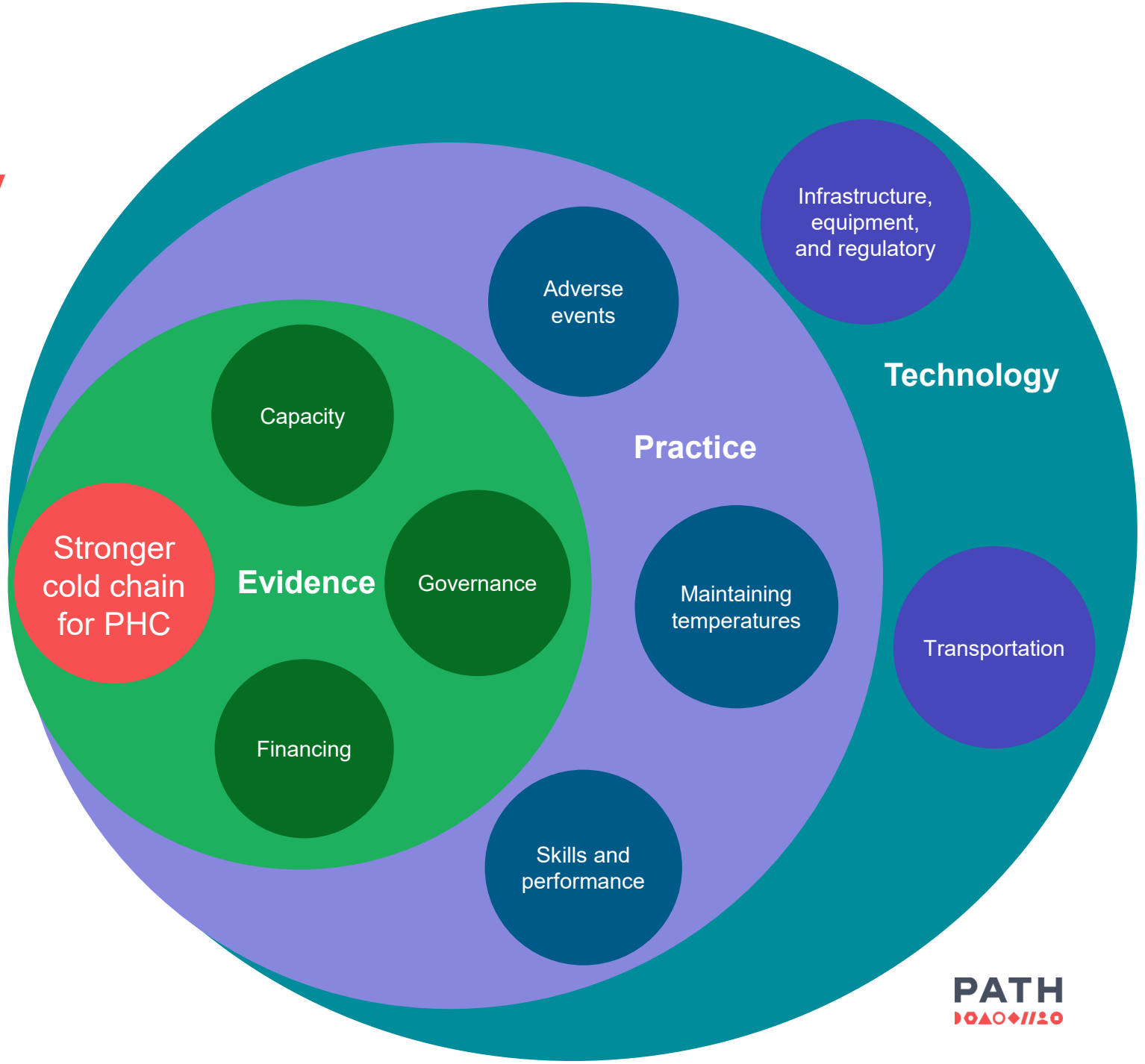
Continued advocacy and technical guidance support to advance basic package of cold chain technologies for PHC service delivery:

- Refrigerators and freezers
- Temperature monitoring and time temperature indicators
- Extended-range voltage stabilizers for mains powered equipment and energy storage
- Barcoding for identification, tracking, and recording products
- IT-enabled LMIS solutions to improve supply chain data flow
- Energy harvest control for electrification and digital inclusion
- Passive and freeze-preventive containers and coolant packs

Abbreviations: IT, information technology; LMIS, logistics management information system; PHC, primary health care; UNICEF, United Nations Children's Fund; WHO, World Health Organization.

Multi-layer action plan for strengthening supply systems for PHC cold chain commodities

Generating consistent and accurate data and analytics on PHC cold chain capacity, temperature, and investment requirements supported by rigorous evaluation and policy advocacy is an imminent and attainable need for effective planning for safe integration and stronger PHC cold chain systems.



Abbreviation: PHC, primary health care.

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