LEVERAGING PRIMARY HEALTH CARE FOR COVID-19 VACCINATION EFFORTS

Vaccination will be essential to ending the COVID-19 pandemic.[1] The urgency of the pandemic has instigated unprecedented scientific speed and collaboration[2–4] as well as substantial investment–by August 2020 roughly $40 billion in funding had been committed for vaccine research and development alone.[5] As of April 2021, 13 novel vaccines are in use around the world and more than 270 are in preclinical or clinical development.[6,7] The percentage of the world that is vaccinated is rising daily.[8]

As COVID-19 vaccination efforts get underway, they are the subject of intense attention and focus, with rapid innovation occurring and billions of dollars being committed by governments and donors alike. Best practices for COVID-19 vaccination have been established by many bodies, including the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC), and are being

A COVID-19 Partners Platform has been established as a repository for guidance on country implementation of the updated COVID-19 Strategic Preparedness and Response Plan, which now includes a newly added pillar covering COVID-19 vaccination.[14,15] Through this platform, countries can upload their National Vaccine Deployment Plan and request technical and resource support for implementing their COVID-19 vaccination strategy.

In addition to this strategy on Leveraging PHC for the COVID-19 vaccine rollout users can explore related Improvement Strategies for COVID-19 response and recovery efforts at www.improvingphc.org/covid-19, including:

- **Strengthening PHC via COVID-19 vaccination efforts**
- **Maintaining access to routine and essential services**
- **Surveillance, response, and management of COVID-19**

continually updated as new evidence and vaccines arrive.[1,9,10] Support for countries planning vaccination efforts is also available from the WHO, World Bank and the Global Fund.[11–13]

As people's first and most trusted point of contact with the health care system, Primary Health Care (PHC) has a vital role to play in vaccination efforts.[14] This document takes global guidance and best practices as a starting point to suggest actionable ways in which PHC can be leveraged for COVID-19 vaccination.

PHC should be leveraged to support the rapid, equitable rollout of COVID-19 vaccination

With multiple COVID-19 vaccines approved for use and becoming increasingly available, the challenge countries now face is to get vaccines distributed to entire populations as rapidly and equitably as possible to limit transmission, reduce hospitalizations and deaths, and slow the development of new, deadlier variants. There are four key action areas in which PHC can be leveraged for successful vaccination efforts:[17]

1. Reduce vaccine hesitancy and build interest and trust in COVID-19 vaccination;
2. Design an equitable COVID-19 vaccination strategy;
3. Safely distribute and administer quality vaccines; and
4. Verify coverage and monitor vaccine program implementation.

For vaccination campaigns to effectively manage the COVID-19 pandemic, high population coverage will be required. Because of its community orientation, PHC provides an important platform for achieving this goal. Additionally, in many countries, PHC systems are the primary source of health system capacities, including workforce and facility infrastructure, that will need to be harnessed for vaccination efforts. A good understanding of PHC capacity– through measurement tools like the **Vital Signs Profiles** – is crucial for weighing the options and tradeoffs inherent in selecting and executing on a vaccine strategy.

Potential pathways for leveraging PHC for each key step of vaccination program rollout are described below.

1. Reduce vaccine hesitancy and build interest and trust in COVID-19 vaccination

Even prior to COVID-19, vaccine hesitancy was identified as one of the top 10 global health threats in 2019.[18] Although the situation is still evolving, early indications show that a significant proportion of the population around the globe is skeptical of the safety and utility of COVID-19 vaccines.[19] Furthermore, findings from the World Bank in March 2021 indicate that only 27% of countries have created social mobilization and public engagement strategies to encourage people to get vaccinated.[11] Barriers to vaccination acceptance are context-specific, and often due to perceptions of low severity of vaccine-preventable diseases; beliefs that vaccines do not work or are unsafe; overall lack of information; or other religious, cultural, gender, or socio-economic factors.[20,21] PHC can be leveraged to build confidence in and demand for vaccines through existing mechanisms for local priority setting and engaging communities and building on long-term, respectful, trusting relationships to support shared-decision making between PHC providers and individuals and communities.

Respect and Trust

Trust is a key component for building acceptance for new interventions like the COVID-19 vaccine.[16] Effective PHC providers who have developed longitudinal, trusting relationships with their patients and communities have a key role to play in building demand for vaccines by transparently communicating both the advantages and possible side effects of vaccination, addressing misinformation around the vaccine, and tailoring messages in order to respect patients' beliefs and preferences. Strong recommendations from trusted PHC providers may improve vaccine confidence, reduce concerns about safety, and improve uptake of the COVID-19 vaccine. To play this role, health providers should have access to appropriate training and education resources on communication and messaging such as these materials from the CDC, Mayo Clinic, and the Immunization Action Coalition.[22–25] Strategies to build **patient-provider respect and trust** around COVID-19 vaccination could include adding **COVID-19-related risk communication** content to existing, trusted PHC and public health communication strategies and platforms such as shared decision-making and vaccine education during acute and routine PHC consultations, community or facility-based information sessions or radio spots, and/or individual outreach from care providers to their patients via phone calls, text messages, or in-person visits.

Addressing vaccine hesitancy and building demand for the COVID vaccine via partnerships with faith-based organizations, civil society, and volunteers in Rwanda

Rwanda has efficiently distributed vaccines to date, exhausting its initial supply of approximately 400,000 COVID-19 vaccine doses since the launch of its vaccination campaign in March 2021.[26] This success may in part be attributed to Rwanda's campaign to educate its citizens about the vaccine. When Rwanda launched its COVID-19 vaccination campaign, it explicitly included efforts to educate citizens about the vaccine and to offer spaces for individuals to address concerns, report side effects, and share positive experiences from their COVID-19 vaccination.[26] In collaboration with volunteers, faith-based organizations, civil society, and local leaders, Rwanda disseminated a one-page fact sheet about the COVID-19 vaccine into communities.[27] The Minister of Health and other health sector leaders spoke further about the vaccine in televised interviews that are now available on YouTube.[28] A toll free number set up by the Rwandan government allows citizens to report on vaccine side effects and to share positive outcomes from their vaccine registration and vaccine appointment.

Overcoming COVID-19 vaccine resistance in Afghanistan

To build public confidence in the COVID-19 vaccine, Afghanistan is drawing on historical approaches developed to support polio vaccination. For nearly ten years, partners in the Islamic Advisory Group for Polio Eradication (IAG) have used various measures to spread awareness and increase public confidence in the polio vaccine, including the issuance of fatwas–a formal ruling or interpretation on a point of Islamic law given by a qualified legal scholar–supporting the use of the vaccination, condemning attacks against vaccinators and health workers, and spreading pro-polio messages to their communities during religious sermons.[29,30-34] When it comes to getting doses into arms, vaccine teams can read from the polio fatwa book and on some occasions, local religious leaders may accompany teams to help spread awareness and reassure families that Islamic law allows the vaccine.[31,35] As COVID-19 vaccination efforts begin, Afghanistan–along with several other Muslim majority communities and countries in Pakistan, Indonesia, and the UK–are adopting similar approaches to increase public confidence and protect the safety of vaccinators. Already, in many places Islamic leaders have issued fatwas in favor of the vaccine, including during Ramadan.[35–39]

Community Engagement

[Community engagement](#) mechanisms established for the delivery of routine PHC can be utilized to understand potential concerns and relevant dynamics that influence the demand for the COVID-19 vaccine. Existing PHC strategies that may be utilized to build broad support for vaccination efforts and overcome vaccine hesitancy may include:[13,40]

- Developing community engagement and communication plans, including mapping marginalized populations to engage with culturally-appropriate messages
- Piloting messages through participatory processes and deploying key opinion leaders to deliver them
- Routine consultation with community health councils or committees
- Adopting community engagement frameworks

Generating demand for the COVID-19 vaccine via a vast community health network in Thailand

Thailand's 1 million village health volunteers (VHV) are expected to be key for vaccine rollout.[41,42] Over the past four decades, VHVs have been a key part of Thailand's PHC system for implementing surveillance, health education, and community engagement initiatives. Throughout the course of the pandemic, these volunteers have supported community-based prevention, detection, and reporting of COVID-19.[41] Their meticulous records of the medical histories of community members have been essential for contact tracing and monitoring population perceptions on COVID-19. Additionally, VHVs have been critical in health education and addressing misconceptions around the COVID-19 vaccine. Their success in building community respect and trust is reflected by Thailand's 83% public willingness to be vaccinated, the highest globally.[42]

2. Design an equitable COVID-19 vaccination strategy

This set of actions entails the procurement of vaccines and planning for how vaccines will be distributed to a population, much of which strong PHC systems can facilitate most effectively. COVID-19 vaccine procurement and allocation is complicated by the wide array of vaccine types under development, including inactivated virus, live-attenuated, viral vectors, mRNA/DNA, and protein

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subunit-based.[6] Available vaccines also differ in the number of doses required (one or two) and cold-chain requirements, with mRNA-based vaccines requiring ultra-cold storage and others needing only simple refrigerators.[43–45] Adequately planning for these variations will be essential to the design of an effective vaccination strategy.

WHO guidance on COVID-19 vaccine allocation suggests that COVID-19 vaccines must be a global public good and be **equity enhancing.**[46] Despite the urgency to fully vaccinate the whole population, the limited global vaccine supply will force immunization programs to prioritize certain populations. To aid in this decision, the WHO released a roadmap to inform planning and prioritization based on epidemiologic factors and COVID-19 vaccine supply scenarios.[47] The roadmap suggests prioritization of populations that protect the continuing functioning of essential services and populations (e.g. health workers, older people and those with underlying health conditions) that are of high risk of death and disease burden due to age and/or comorbidities.[48]

To achieve equitable coverage, distribution plans should be tailored to **local priorities and resources**, which in turn requires knowledge and data on system capacity and **population health needs** to allocate the right number and type of vaccines to the right places. Successful procurement also requires **leadership** that recognizes the importance of vaccines and proactively works with manufacturers and partners like the COVAX facility to secure vaccine supplies, as well as flexible **financing** arrangements to make it possible to purchase vaccines and redeploy the resources needed to get vaccines into communities and administered to individuals.[49,50] PHC participation in planning will help make plans feasible and equitable, and would allow mitigating potential challenges down the line.

Understanding Population Health Needs

An effective vaccination strategy requires knowledge about who the population is, who is most vulnerable, and where people are located.[51] Strong PHC systems are best-suited to accomplish this via two foundational sources of this information:

- Existing PHC surveillance platforms can be a source of data for understanding population demographics and distribution. Information from other PHC vaccination programs could also provide insight on community vaccine-related behavior.[52] For example, understanding existing immunization schedules, national and sub-national population coverage, pharmacovigilance processes, and regulatory systems through surveillance platforms like the WHO vaccine-preventable diseases monitoring system can support the strategic design of the COVID-19 vaccination plan.[51,52]
- Empanelment systems are also crucial sources of information about individuals within specific populations that can be used from planning to distribution to verification. At their most robust, empanelment systems can serve as a census to both determine the size of populations as well as identify the relevant health needs and risk profiles of the individuals within that population in order to prioritize, identify, contact, and follow-up with identified individuals. In the absence of robust empanelment, registries–such as for specific diseases or health conditions–can also be used to identify and target priority individuals for vaccination.

Efficient delivery of the COVID-19 vaccine through empanelment and digital solutions in Estonia

Every Estonian is empaneled to a family doctor who is connected to information systems that support primary care and management. To leverage this empanelment system for vaccine distribution, a partnership between the Estonian state and the private sector led to the development of an application that has since been adopted by the Health Insurance Fund and physicians.[53] The digital application facilitates the distribution of vaccines to 700 family physicians in Estonia based on existing empanelment data.[54] Information that is shared with family physicians includes the expected number of doses to be delivered and groups that are at increased risk for COVID-19 infection. Physicians may then plan out their vaccine roll out strategy–including proactive outreach to patients to schedule appointments either by phone or via the e-patient portal–and order the appropriate number of vaccine doses.[55,56] The app also provides information on the status of a vaccine order once it has been placed.[54]

To be effective, COVID-19 vaccination strategies require alignment with local policies and resources. **Local priority setting** mechanisms in place to support routine PHC organization and service delivery can be leveraged to identify specific health priorities, epidemiological profiles, relevant resources and services, and socio-economic factors that will inform the development of a suitable COVID-19 vaccination strategy, both locally and nationally.

Governance and Leadership, including Multisectoral Action

Clear policies and strategies are necessary to ensure timely and equitable access to the COVID-19 vaccine. This can be accomplished by aligning COVID-19 policy processes with existing **PHC-centered approaches to policy making** and **prioritization**, such as participatory leadership, evidence-based policy making, and a "Health in All Policies" approach.[57,58] The vaccine distribution and administration strategy must have an explicit equity focus, where the most vulnerable populations are prioritized to receive the vaccine.

Multisectoral action across the health, transport, travel, trade, finance, and security sectors will be particularly important.[57,59,60] For example, the transportation sector could be engaged by leveraging their infrastructure to speed equitable access to vaccines to rural and remote areas, while the education sector could be engaged to build knowledge of and demand for vaccinations and even leverage school building infrastructure for vaccination sites. The private sector could also support the vaccination program by augmenting the immunization workforce and current logistical capacities, for example cold storage, supply chain, vaccination venues.

Private sector support for COVID-19 vaccine delivery in India

In early January the Indian government launched a campaign to administer the COVID-19 vaccine to 1.3 billion people, in what officials call "the world's biggest vaccination drive". [61] As an effort to speed-up the distribution and augment community efforts for vaccine roll-out, local private airlines have joined the effort by facilitating the transportation of COVID-19 vaccines across India.[62,63] From major distribution sites in Mumbai and Pune, airlines have delivered vaccines across the nation, from Goa to Varanasi to Cochi to Chandigarh.

Countries should leverage their existing **quality management infrastructure** to incorporate quality into the planning, implementation, and monitoring of COVID-19 vaccination efforts to ensure vaccine safety. Regulatory standards and processes should be followed, both locally and nationally, and systems to prevent substandard, spurious, falsely labelled, falsified, and counterfeit products from entering the market should be integrated in the vaccination strategy.[64]

Lastly, decision-making and planning should also be accompanied by **social accountability** measures at the PHC level to ensure transparency and accountability of government actions, equitable access to the COVID-19 vaccine, the protection of privacy and human rights, and promotion of **person-centered care**. With the vaccination strategy requiring prioritization of at-risk populations, attention must be paid to striking the right balance between top-down responsiveness and bottom-up representation in decision making.(65) PHC information management mechanisms such as adaptive learning and management or **innovation and learning** systems can also be adopted to promote transparency the ability to adapt to change.

Financing

As an effort to consolidate global efforts in addressing the COVID-19 pandemic, the ACT-Accelerator partnership was established to streamline efforts on diagnostics, treatment, vaccines, and health systems strengthening.(9) This includes global procurement

and allocation of COVID-19 vaccines through the COVAX facility, which is the primary source of vaccines for low- and middle-income countries (LMIC).[49,50] In addition to these global efforts, countries must still continue to prepare for the short- and long-term implications of shifting priority attention and financing to vaccination efforts. Flexible PHC **financing** arrangements will be necessary to ensure the continued availability of resources for PHC to ensure that **access to routine and essential services** is maintained.[16] Existing PHC budgeting and financing processes could also support costing of COVID-19 vaccine-specific interventions and shared costs with existing health system delivery mechanisms. COVID-19 and PHC planning departments should collaborate as a way to efficiently use system-wide resources, minimize undue verticality, and ensure sustainability of resources.[66]

Resource mobilization and strategic purchasing approaches (e.g., pooled funds, capitation, performance-based financing) could be used to cover population-based expenses linked to the vaccine strategy. For example, the Global Fund supports funding requests for urgent, targeted system strengthening activities for the vaccination program implementation that will support both COVID-19 and HIV, TB, and malaria responses.[13] Additionally, the World Bank approved $12 billion financing for purchasing vaccines as well as strengthening primary health care systems to deliver the vaccines. Through the COVID-19 Vaccine Introduction Readiness Assessment Tool (VIRAT/VRAF 2.0), countries can determine their eligibility and readiness to receive assistance for their vaccination strategy based on:[11,67]

- Estimated financial and human resources needs (including surge capacity requirements) to conduct the deployment and vaccination operations in the designated points and in the required number of days
- Identified funding mechanisms in collaboration with relevant stakeholders including Inter-Agency Coordinating Committee (ICC), if available at country
- Budgeted micro-plans for vaccination including plans for other relevant components such as demand generation, risk communications and safety surveillance
- Defined mechanisms to release and distribute funds to lowest levels for operations

Particular attention must also be paid to the **financial accessibility** of COVID-19 vaccination. Multiple mechanisms may be explored to ensure equitable access, including community-based health insurance, removal or reduction of user fees, conditional cash transfers, and/or voucher programs.

3. Safely distribute and administer quality vaccines

This set of actions entails acting on distribution plans to get vaccines into communities and administered to individuals. Some countries are using PHC **facility infrastructure** as the primary venue for distribution of vaccines, while in other countries, **proactive population outreach** is being leveraged to provide some vaccines as a community-based service. Either way, most countries are mobilizing a mixed cadre of both facility-based and community PHC **workforce** to be primary vaccinators. No matter the venue for vaccination, effective **drug and supply** management systems as well as functional **information systems** are essential ingredients to all vaccination efforts.

Drugs and Supplies
Once the COVID-19 vaccine arrives in-country, an effective supply chain mechanism is necessary to ensure effective storage, handling, and stock management. The COVID-19 vaccine requires rigorous temperature control in the cold chain, with long-term storage temperatures for the most prevalent vaccine formulations ranging from -25°C (requiring ultra-cold freezers) to as high as 8°C, which can utilize simple refrigerators.(44) (43,68) The ability or inability of countries to supply ultra-cold freezers at scale may dictate which vaccines they choose to procure or accept, and where vaccines can be administered to individuals. For example, distributing vaccines which require ultra-cold freezers in remote health posts may simply not be feasible, while using mass vaccination sites may be a more economical use of this scarce resource.

Drug and supply management systems—including procurement, inventory strategy, warehousing, and distribution—used for routine PHC service delivery could serve as the foundation for COVID-19 vaccine distribution. Data from existing logistics management information systems (LMIS) may also be used to inform tailoring of the implementation strategy based on identified prescribing and dispensing practices in the community.[69] Existing PHC programs that are experienced in handling cold chain products (for example, EPI, diabetes, food and malnutrition) could be utilized for packaging, storing, and transporting COVID-19 vaccines.[70] Cold chain innovations like solar-powered refrigerators and cold boxes can help protect vaccines from excess heat or cold in communities while awaiting distribution.[45]

Information Systems

Efficient vaccine distribution relies on strategic use of health **information systems** for tracking vaccine supply, monitoring population coverage, and strengthening care coordination.[71] Existing LMIS can be leveraged to facilitate tracking and analysis of supply and demand data and inform distribution-related logistics and decisions.[69,72] HRH management information systems (HRHIS), including geographic information systems to monitor the location and activities of health workers could be utilized to identify and contact health frontliners that are a priority vaccination population.[73] Empanelment and appointment scheduling systems can also be utilized for scheduling of COVID-19 vaccine doses, as well as for spreading vaccine-related communication.[72] Finally, where they are available, electronic medical records also offer a powerful tool for supporting scheduling, patient-provider communication, adverse event reporting, and patient follow-up to ensure safety and compliance during vaccine program implementation.[74]

Utilizing existing community health networks and geospatial technology innovations to speed up COVID-19 rollout in Nigeria

As part of its historic, continuous effort to eradicate polio, Nigeria has worked with global partners to establish a vast network of frontline providers and program infrastructure, including Emergency Operations Centers (EOCs), that fulfill a wide range of public health functions, including disease surveillance, training and capacity building, data management, immunization, and emergency preparedness and response for polio and other diseases. This trusted outreach network has already been used to support Nigeria's COVID-19 response over the past year, such as via contact tracing and maintaining access to essential services and immunizations. As Nigeria kicks off its vaccine rollout, this network is expected to play a critical role in the equitable delivery of vaccines for COVID-19 and other preventable diseases in a post-pandemic world.[75–78]

In addition, Nigeria is using geospatial technology, or geographic information systems (GIS), to help implement its mass vaccination campaign for COVID-19. Nigeria originally introduced this technology to support polio vaccination planning and outreach as a part of the GRID 3 program.[79] The GRID3 Nigeria project, conducted with Nigeria's National Primary Health Care Development Agency, combines microcensus household surveys with satellite imagery and geographic information to make population estimates across Nigeria; these maps also identified health centers so that providers would be able to identify sites to deliver vaccines and other care.[80] Public health workers are using these maps to support micro-level planning for the delivery of COVAX vaccines.[81] The GRID3 maps allow health workers to identify potential vaccination sites at hospitals and local clinics, and also how much vaccine each ward will need. The maps may also integrate population density information, allowing public health workers to adjust vaccine demand based on co-morbidities and for areas in which vaccine demand may be low.[81]

Workforce

A competent, motivated, and equitably distributed **workforce** is important for successful COVID-19 vaccination roll out. The pandemic has already reduced and stretched the health workforce tremendously, and the addition of a mass vaccination roll-out on top of the continuing provision of COVID-19 treatment and routine and essential services is likely to require reallocation of the existing workforce through task-shifting, re-assignment, and changes to workforce rostering.[82,83] In some cases, the existing health workforce may need to be augmented by the hiring of new cadres of workers to support COVID-19 vaccination efforts. To ensure quality and safety, both the existing and new health workforce must be trained on proper vaccination protocols and infection control guidelines, as well as equipped with the necessary supplies and personal protective equipment (PPE) to safely carry out their tasks.[84,85] Workforce training for vaccination –including capacity building on procedures, logistics, health education, communication, and safety– can be integrated into existing PHC platforms for strengthening **provider competence** as well as supplemented by other stakeholders such as vaccine manufacturers.[73,86]

To avert further diminishing **provider availability**, existing infection prevention and control (IPC) measures must be adhered to and/or strengthened. Priority vaccination of the health workforce both prevents further disease transmission, and **motivates providers** to continue providing health services.[46] In addition, PHC workforce management strategies that support mental health and compensation needs of health providers may help prevent further workforce burnout during the vaccination efforts.[87,88] Vaccination efforts will also benefit from a **team-based care organization** which maximizes the diverse capacities of the PHC workforce to provide coordinated and efficient health services. For example, physicians and nurses may be assigned to clinical assessment and administering the vaccine, while community health workers could be tasked to provide health education and observe patients for potential adverse events. In some settings, community health workers may be able to administer vaccines themselves, ideally with backup from the remainder of the PHC team available for referral of complications or when there is uncertainty about safe administration. Particular efforts should be made to ensure that any new workforce hired to support COVID-19 activities are integrated into care teams to maximize coordination and continuity of care.

Facility Infrastructure, Operations, and Management

Because of its close physical proximity to communities, using PHC facility infrastructure for vaccination efforts may support the goal of equitable access to COVID-19 vaccination.[12] In some cases, this may require reconfiguring **facility infrastructure** and logistics to allow for safe and effective vaccination in addition to the provision of **routine and essential health care services**.

Using PHC facilities as vaccination centers will require expanding capacity by updating facility operation guidelines, safety protocols, and triaging and referral policies.[89] The baseline state of infrastructure and equipment–including facility amenities, design, equipment, and funds–will inform how much flexibility facilities have to make changes and which changes are most urgent.[90,91] Baseline information on **facility infrastructure**, density, and distribution will also be helpful in determining potential gaps in the vaccine roll out and logistics needs that could be supported by other sectors. Facilities which do not have basic amenities in place before COVID-19 will be required to make more significant adaptations than those that do. (70) Existing PHC protocols for infection prevention and control measures including PPE must be updated to minimize exposure risk during immunization sessions. Facility staff should also be retrained on IPC protocols to ensure safety of both patients and workforce.[72] Additional supplies and equipment, such as refrigerators for storing vaccines, and additional PPE for the workforce would also need to be organized at the facility-level. To promote **timeliness** and safety of access, facility operational hours could be extended to accommodate patients coming in after office hours and to distribute the flow of patients coming in for vaccination to reduce overcrowding.

Strong **facility management capability and leadership** is necessary to implement structural and cultural shifts in facility procedures and priorities.[95,96] To enable the shifts required for implementing the COVID-19 vaccination strategy, strong managers will be essential to help coordinate and develop new inputs and procedures into existing facility structures. Managers should be properly trained and equipped with the **knowledge and resources to promote facility success**; this includes the ability to organize

facility operations, deploy resources, react to new challenges, and motivate staff.(97,98) The number and distribution of qualified managers may be an important factor in determining whether facility-based or proactive population outreach strategies are most appropriate for a given context.

A mixture of vaccine delivery models that maximizes health facility capacity in the UK

With the aim of having safe, convenient, and equitable access to the COVID-19 vaccine, the UK has devised multiple COVID-19 vaccine delivery models for that can be selected based on local demographics as well as facility capacity, including size and make-up of the facility workforce, availability of consumables and other equipment, accessibility to patients via public and private transport, and safety.[92]

Vaccination centres	Local vaccination services	Hospital hubs
Large accessible venues, e.g., conference centres, sports venues able to provide fixed location for high volume, extended hours	Local GP networks and Pharmacy sites as well as mobile vaccinators visiting locations, such as care homes, and individual addresses for housebound	Network of NHS Hospital sites providing access to vaccination

UK's vaccine efforts started in hospital hubs to accommodate cold-chain requirements.[93] Public Health England has secured 58 special Twin Guard ultra-low temperature freezers that provide sufficient storage for these vaccines. Since the special freezers are not portable, authorities then focused on large-scale distribution points–such as football stadiums and arenas–where they could implement mass vaccination and prevent vaccines being wasted. As the vaccine campaign progressed, and more temperature-stable vaccines arrived, primary care facilities, private physician clinics, and pharmacies were utilized for the vaccination roll-out. So far, COVID-19 vaccines have been distributed through 206 hospital hubs, 50 large-scale centers, and 1,200 local vaccination service sites, that consist of primary care networks and community pharmacies.[94]

Competing, data-savvy Health Insurance Funds speed vaccine rollout in Israel

The national health insurance system of Israel guarantees universal health coverage to all citizens, provided by one of four state-mandated Health Funds, known as Kupat Cholim. Kupat Cholim are competing nonprofit health insurance companies and medical service organizations; each provides a similar standardized package of services and members can freely switch between Funds, which has built-in competition to provide the highest quality and most accessible services to retain members.[99–101]

In the context of COVID-19, The Kupat Cholim's close proximity to patients, nationwide digital data networks, and years of competing with each other to provide the best quality care have been central to the efficient rollout of the COVID-19 vaccine, all at no cost to Israel's citizens. Kupat Cholim are undertaking special measures to reach the most members while cutting waste, such as by organizing vaccine "pop-ups" on busy streets and using integrated digital health systems to quickly organize lists of vaccine candidates by priority and alert patients to their first and second appointments, by text message, phone call, or email.[101–106] Thanks in part to these efforts, over half of Israel's population have been fully vaccinated.[106–108]

Proactive Population Outreach

In addition to the provision of vaccines through primary care facilities, community-based services and proactive population outreach are likely to be effective means of achieving equitable vaccine distribution. By extending vaccine administration directly into homes and communities, community-based services can help speed vaccination efforts and reach vulnerable communities who routinely face difficulties accessing quality care.[109–111] Community Health Workers can also be valuable resources for extending vaccination services to the community level.

Utilizing mobile and community-based vaccination sites to reach minority and underserved communities in the USA

In Minnesota, the Department of Health coordinated with organizers in the Vietnamese American community to plan and publicize a vaccination drive for low-wage workers in the seafood industry.[112] Social media posts about the vaccination drive and communications with churches and Buddhist temples helped spread the word and nearly 300 members of the Vietnamese American community were vaccinated. Nurses at another mobile vaccination clinic operating out of a bus vaccinated 250 residents in rural Colorado.[113] The Federal Emergency Management Agency has held at least 500 mobile vaccination drives, operating out of buses and recreational vehicles, and hopes to expand these mobile clinics to address and eliminate barriers related to geographic access and timely access to care.

In the context of COVID-19 vaccination, proactive population outreach may entail either community-by-community and household-by-household vaccination or the establishment of mass vaccination sites at prominent community venues, such as sport stadiums. Mass vaccination sites can be an efficient way to maximize scarce infrastructure and human resources while still taking vaccination efforts closer to the people in need. However, they may also entail greater risk of adverse events and safety protocol and logistics must be carefully considered.[114]

As described above, empanelment systems offer essential information about individuals within populations. Where empanelment is in place, it can be used to drive proactive population outreach efforts and ensure that vaccination campaigns achieve full coverage and leave no one behind. In the absence of empanelment, disease registries, community census data, school enrollment information, and many other sources may be used to ensure that vaccination efforts are as comprehensive as possible.

Leveraging community-participation and outreach networks (Guardians of Peace) to rollout the COVID-19 vaccine in remote communities in Bhutan

Two weeks after initiating its vaccination campaign, Bhutan had vaccinated 93 percent of adults.[115] This remarkable speed was facilitated by strong primary health care networks across the country, partnerships with local government officials to reach citizens in even the most remote parts of the country, and a historically strong national immunization programme that reached universal childhood vaccination in the 1980s. With fewer than 40 medical doctors, and nearly 3,000 full-time healthcare workers, volunteers who had completed the De-suung Integrated Training Programme, a popular national civil volunteer training program, traveled in teams with a few healthcare workers to deliver and administer COVID-19 vaccines across the nation.[116,117] These civil volunteers, also known as Guardians of Peace, carried oxygen tanks and set up vaccination tents, and located citizens who were late to their vaccine appointments. Data from local governments and village leaders helped Bhutan's Ministry of Health (MoH) determine the number of vaccines to distribute to each area, and vehicles from both the MoH and local sectors, including a helicopter, facilitated the delivery of COVID-19 vaccines to even the most remote villages and communities.[115,118]

4. Verify coverage and monitor vaccine program implementation

This final set of actions entails tracking how much of the population has been vaccinated, measuring progress in implementing the vaccination strategy, and monitoring for adverse events. It is important to ensure that the vaccines have been distributed to target populations appropriately, and that there is **continuity** of care following the vaccination, particularly for vaccine formulations which require a second dose at a specific time interval. Failure in implementation may lead to a missed opportunity to interrupt virus transmission and protect at-risk populations.[17]

At its core, this set of actions is reliant on robust **information systems** at both the population and individual levels, making strong PHC systems very well-suited to accomplish these goals. At the population level, timely and accurate data is necessary to monitor whether phased vaccine coverage targets are being met and to inform prioritization and allocation of resources.[46,48] Pre-existing disease **surveillance** systems such as the WHO vaccine-preventable diseases monitoring system can be used as a framework for long-term tracking of the COVID-19 vaccination program.(51) Geographic information systems (GIS) can also be utilized to monitor ongoing immunization efforts with respect to vaccination coverage, disease forecasting, prediction of resurgence, identification of disease clusters or hotspots, and to evaluate different strategies to further prevent community spread of COVID-19.[119]

At the individual level, information systems are essential for continuity between vaccine doses, when more than one is needed. Where available, unique identifiers for every person that are linked, at a minimum, to vaccination records and personal contact information can greatly aid efforts to reduce loss-to-follow-up between multi-dose vaccination regimens. It also remains to be seen whether boosters beyond the core regimen are needed for long-term COVID-19 immunity and/or to protect against emerging virus variants, and such information systems would aid repetitive outreach to individuals over time.

Ensuring coverage and monitoring rollout via a national immunization registry in Chile

Chile's vaccination campaign has been heralded as a global brightspot.[120] This success has been due in part to the country leveraging its robust, pre-existing electronic national immunization registry to monitor vaccine delivery.[121] Chile's immunization registry allows users, including frontline primary care providers, to register and track vaccinations in real time by vaccine dose, geographic area, and target population group.[122] Information about vaccine timing and type for all vaccinated individuals is included in the same registry, which is accessible at any of the country's nearly 1400 vaccination sites.[123] In the context of the pandemic, public health officials and frontline providers have used the registry to get a real-time count of the total population that has received one or both doses of the vaccine, ensure the first and second doses of the vaccine are appropriately spaced out, and deliver/distribute doses based on community needs and demand. It has also helped avoid the need for complicated scheduling systems–because their vaccination history is easily accessible, Chileans are able to attend any vaccination location in the country when they are due for their second dose.[124]

Relevant Resources

World Health Organization
- COVID-19 Vaccines
- COVID-19 Vaccine-Specific Courses (in multiple languages)
- The Access to COVID-19 Tools (ACT) Accelerator
- The COVAX Facility
- Vaccine Introduction Readiness Assessment Tool (VIRAT)
- WHO SAGE Roadmap for Prioritizing Uses of COVID-19 Vaccines in the Context of Limited Supply
- Coronavirus disease (COVID-19): Vaccine access and allocation
- COVID-19 Strategic Preparedness and Response Plan (2021 Update)
- Health Services Learning Hub for Maintaining Essential Health Services During the Pandemic and Post-Covid recovery
- COVID-19 vaccination training for HRH
- WHO vaccine-preventable diseases: monitoring system

The World Bank
- Assessing Country Readiness for COVID-19 Vaccines : First Insights from the Assessment Rollout

UNICEF
- UNICEF Framework for Health Systems Strengthening and COVID-19 Vaccine Delivery and Program Implementation
- Rapid Guidance for Strengthening Human Resources for Health in the context of COVID-19
- COVID-19 vaccination: supply and logistics guidance
- https://www.corecommitments.unicef.org/latest-covid-19-guidance

CDC
- COVID-19 Vaccination
- COVID-19 Vaccine Checklist
- COVID-19 Vaccine Training Modules

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