

Public Policy Responses to COVID-19: Health Systems and Supply Chains

Briefing Paper

Faced with the Covid-19 pandemic, or its imminent threat, national supply chains and health systems have been disrupted and rapidly restructured as the virus exposes weaknesses and places stress on systems. This briefing paper highlights a variety of transferrable "best-practice" responses employed to meet the new demands on health systems and supply chains. An index of "preparedness" is used to give an overview of the pre-pandemic landscape and provide relevant advice for countries with different initial capacities and infrastructure. It is important to note that no matter how "prepared" a country, most suffered severe shocks to both health systems and supply chains as a result of the pandemic. With regards to health systems, "prepared" countries' best practices tend to be resource intensive, and rely heavily on pre-existing infrastructure and robust financial, and Information and Communications (ICT) networks. "Underprepared" countries offer some alternative best practices, which are not as resource-intensive, suggesting that leveraging know-how from previous health crises and relying heavily on innovative technological approaches can help bridge fundamental resource and infrastructure shortcomings. The globalised nature of supply chains meant many countries experienced shortages; local production often stepped in to meet these, although it is clear that in the longer-term supply chains will need to be reevaluated. Regardless of supply chain and health systems preparedness, this briefing paper strongly advocates for the centering of ethical considerations, proposing some key approaches to developing ethical frameworks and ensuring that ethical considerations are not subsumed by the crisis.

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Definitions

Understanding the context in which a crisis unfolds is crucial for tailoring and evaluating a national response. This briefing paper categorized countries into those which were expected to be “prepared” and “underprepared” for crises and uses them to analyze practices in context.

This division is based on the **Global Health Security Index**, which assesses countries on six categories: prevention, detection and reporting, rapid response, health system, compliance with international norms, and risk environment. In this briefing a country is labeled as “prepared” if it ranks as “most prepared” or “more prepared” within category 4: sufficient and robust health system to treat the sick and protect health workers. It is labeled as “underprepared” if it ranks as “least prepared” within the same category. A table with a list of countries assigned to both categories is provided in **Appendix A**.

It is important to note that this is an **imperfect proxy** for crisis preparedness. Firstly, there are substantially varying levels of preparedness within a single label. Secondly, there is not a full agreement on measures included in the index. However, while there are several frameworks for preparedness assessment, the Global Health Security index is one of the only concrete available rankings.^{1, 2, 3} A specific metric for COVID-19 preparedness is difficult to define given limited necessary country-level data (for example on ventilators and ICU capacity).

Overview

A **health system** consists of all the organizations, institutions, resources and people whose primary purpose is to **deliver preventive, promotive, curative and rehabilitative interventions through a combination of public health actions and the pyramid of health care facilities that deliver personal health care** — by both State and non-State actors.⁴ The WHO framework describes health systems in terms of six core components which are: (i) service delivery, (ii) health workforce, (iii) health information systems, (iv) access to essential medicines, (v) financing, and (vi) leadership/governance.⁵

An important aspect of these building blocks is **supply chain management**, which involves **obtaining resources, managing supplies, and delivering quality goods and services via a number of independent stakeholders** (manufacturers, insurance companies, hospitals, providers, group purchasing organizations, and several regulatory agencies) **to providers and patients**.⁶

While functional health systems and supply chains are essential for everyday healthcare provision, **they serve as the foundation in fighting outbreaks** and pandemics, such as COVID-19. Varied health system capacities and preparedness across countries lead to heterogeneous responses to pandemics. Problems, including insufficient financial and human resources, weak health information systems, inequitable distribution of services, limited infrastructure, lack of transparency and accountability, and limited institutional capacity complicate emergency response. **These issues persist both in countries that are deemed to be “prepared” and “underprepared” for crises.** Their severity, however, is typically greater in “underprepared” countries.

Regardless of preparedness level, when a pandemic emerges, a national government **must create both short and long term plans to manage the crisis.** While COVID-19 specific information on health systems and supply chains remains scarce, this report aims to provide insights on a range of national measures that could be taken by governments in response to the current crisis. Specifically, the briefing examines practices and draws conclusions about 1) supporting the healthcare workforce, 2) altering service provision, and 3) managing supply chains.

Here it is important to state three features of this particular report:

1) This briefing is **not comprehensive**. Additional measures and ‘best practices’ on Supply Chains and Health Systems can be found in the recently published OECD reports. This briefing specifically aims to cover grounds that were not discussed in detail in the OECD briefings and that are applicable on the **national level**.

2) Health system and supply chain measures are secondary in significance to **public health strategies**. Without them, interventions at the health system and supply chain levels are likely to be ineffective.

3) The **data and information on best practices are scarce. Conclusions are drawn from what typically would be considered as non-robust evidence.** However, given the need for decisive action, the report makes educated inferences and provides concrete policy advice.

Pre-Pandemic Landscape

This section outlines the pre-pandemic landscape, with a focus on the health workforce, service delivery and supply chains.

I. Healthcare Workforce

A healthcare workforce consists of individuals, “whose job it is to **protect and improve the health of their communities.**”⁷ While attention is typically given to doctors and nurses, the healthcare workforce is **occupationally diverse** (Figure 1). Leaders must closely monitor and regularly revise the ever-changing map of their healthcare workforce to identify realistic capacity, manage workers effectively, provide adequate support, and efficiently mobilize necessary capability.^{8, 9}

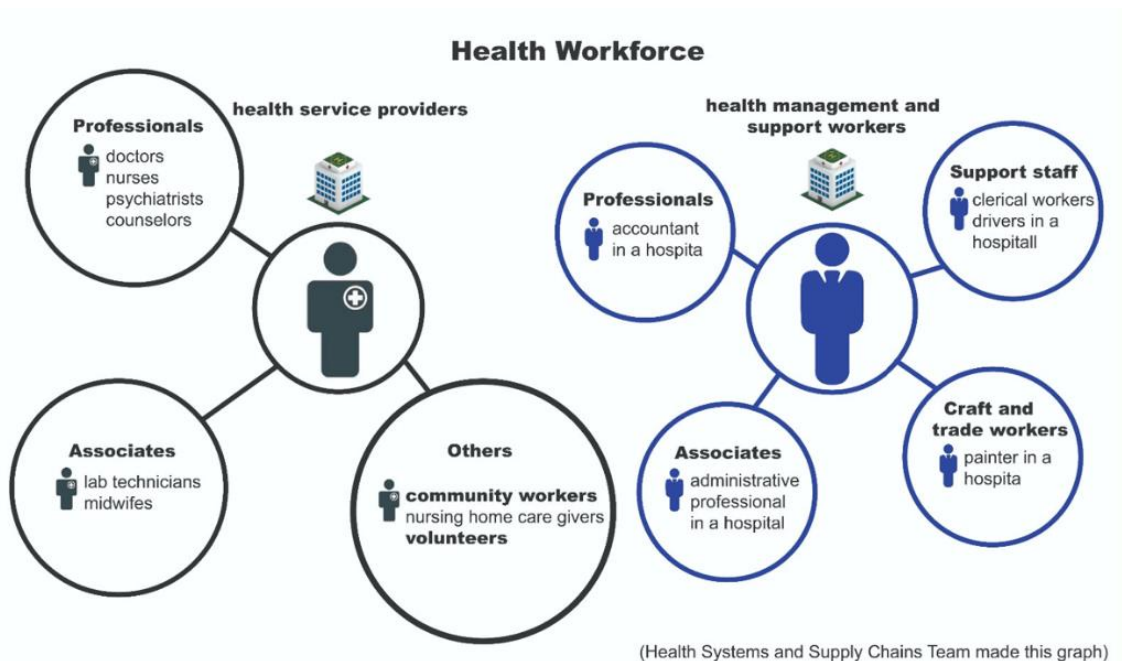
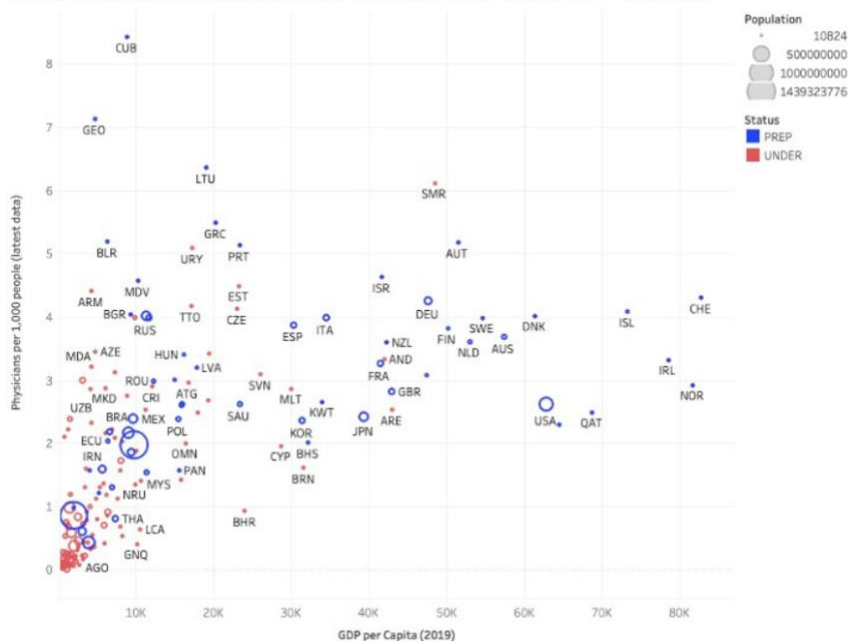


Figure 1: Occupational diversity within a health workforce

Health systems cannot function without an adequate number and equitable distribution of the health workforce. Globally, there is a shortage of health workers: the WHO estimates a shortfall of 18 million health workers by 2030, mostly in low and lower-middle income countries. There are many imbalances within the healthcare workforce, and shortages are more severe in “underprepared” countries and in rural and areas (Figure 2).¹⁰ Acknowledging such shortages is important because a health workforce that is **spread thin pre-pandemic will be less resilient to any external shock** and will **require extensive support**.

Previous encounters with the Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), H1N1 and Ebola outbreaks have urged governments to formulate and **adopt emergency protocols**, which include advice for enhancing the capability and resilience of the health workforce during crises.^{11, 12, 13}

Variation in Physician Numbers Across "Prepared" and "Unprepared" Countries



Guidelines have emphasized the need to 1) obtain sufficient PPE to ensure safety, 2) establish a “safety climate” within healthcare facilities, 3) train and educate workforce to respond to emergencies, 4) build social capital in the health system, and 5) develop robust systems of communication.¹⁴ However, research shows that, given limited accountability, compliance with such ‘best practices’ remains highly variable.¹⁶ This has **left most countries around the globe de facto underprepared to face a pandemic.**

Figure 2: Physician number per capita in "prepared" vs. "unprepared" countries. Data combined from WHO, World Bank, and World O Meter

II. Health Service Delivery

Health service delivery is concerned with the access, coverage, equity, and quality of care. Globally, it is being shaped by growing public demand for access to and utilisation of novel technologies, new drugs, newer models of care, and increasing expectations of quality and safe care. Additionally, health service delivery is impacted by emerging and re-emerging diseases, ageing populations burdened with multiple comorbidities, increasing prevalence of chronic ailments, and globalisation.^{17, 18}

Many health systems in “underprepared countries” are characterised by neglect, inadequate financing, and poor leadership and governance, resulting in highly fragmented and dysfunctional health service delivery. These systems’ focus tends to be on promotive and curative services, with high out-of-pocket expenditure.¹⁹ Nevertheless, after facing health care emergencies such as Ebola and SARS, a number of countries including Nigeria, Liberia, Ghana, Sierra Leone, Rwanda, Vietnam and Taiwan have enhanced their capacity in service delivery and pandemic preparedness.²⁰ Rwanda, in particular, has developed a strong capacity to deal with crises (Figure 3).

The majority of health systems within the “prepared” category cover nearly the entire population for a comprehensive basket of healthcare benefits (preventive, promotive, curative, rehabilitative, and palliative services) funded by the National Health Service, Social Health Insurance, or Private Health Insurance systems. Yet, even in countries with near universal coverage, access to healthcare is variable, with high costs and long waiting times creating barriers to access. Certain population groups, such as ethnic minorities, those living in deprived areas, undocumented persons, and asylum seekers, also experience a disparity in access to service.

In a rapidly evolving context of the COVID-19 pandemic, alternative modes of health delivery enable adaption. Examples of this include substituting care provided by a highly trained health professional with care by a less specialised health worker, using technology in service delivery (telemedicine), or providing care in group settings rather than to individuals. Indeed, the current crisis highlights the need to reevaluate how we approach health service delivery, with a focus on

building health systems that are resilient, even in the face of devastating events. A fundamental approach to achieving this would be to refocus on bolstering primary care, while being cognisant of local contextual factors.^{21, 22}

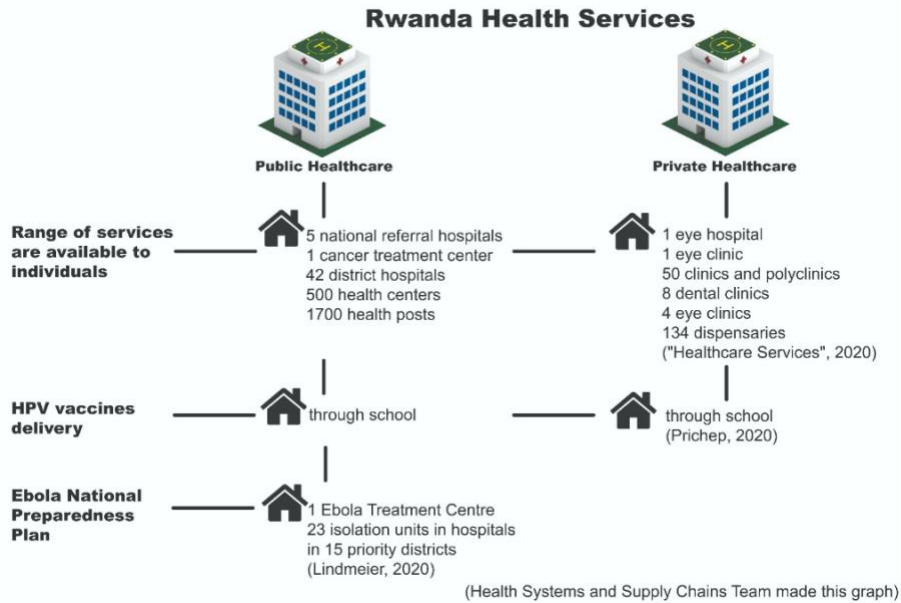


Figure 3: An illustration of health services in Rwanda

III. Supply Chains

Fighting a pandemic largely depends on the confidence and trust of the people in health systems which in most countries **is dependent on a complex and fragmented supply chain**. The healthcare supply chain involves the flow of many different product types and the participation of several stakeholders (Figure 4). Based on their functions, stakeholders in the healthcare supply chain can be divided into three major groups: **producers, purchasers, and providers**.

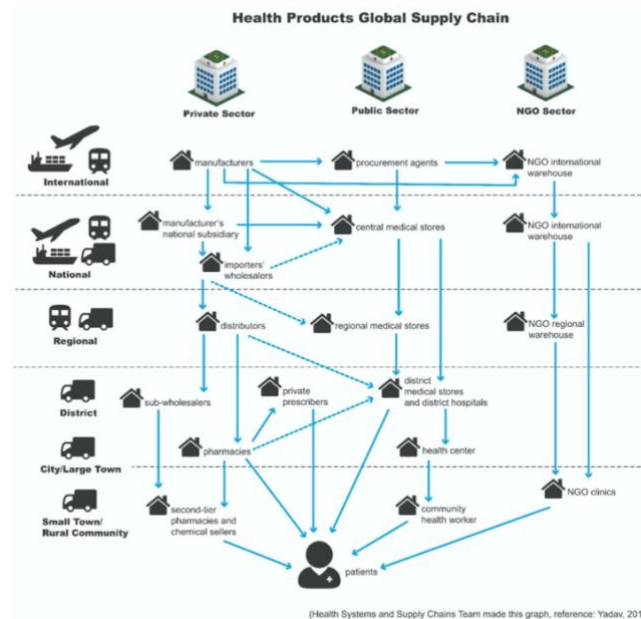


Figure 4: An illustration of the complexity of a supply chain

The relationship between these stakeholders is made complex due to the presence of public, private and NGO sectors who are key players in servicing the various cadres of the health system.



Due to this complexity, **there is no silver bullet to removing inefficiencies to drive down costs and ensure constant availability.** A major drawback is in the fragmented nature of supply chains, which creates information asymmetries, misaligned activities and prevents it from working as a cohesive system.²³ This makes managing the Covid-19 pandemic exceptionally difficult.

In its 2019 annual report on global health emergencies, the Global Preparedness Monitoring Board highlighted the insufficient preparation for managing supply chains as one of the most persistent challenges and obstacles to effective crisis management.²⁴ Despite recommendation, the majority of countries did not replenish their stockpiles after previous emergencies, including the H1N1 Swine Flu outbreak in 2009.²⁵

Good Practices in Context

This section showcases good responses to the pandemic, ranging from the expected to the innovative and spanning across country preparedness. It draws out good practice with regard to the healthcare workforce, highlights innovative practice in altering health service delivery, and provides some key practices for managing and strengthening disrupted supply chains.

I. Supporting the Healthcare Workforce

“The health and safety of emergency workers is a fundamental element of every emergency response.”²⁶ The need to provide significant support to healthcare workers was true during the SARS, MERS, H1N1, and Ebola outbreaks, and remains true during the current pandemic, especially in countries that already face significant health worker shortages.^{27 28 29}

Hospitals and governments across the globe have instituted several measures to support the healthcare workforce. Through the Project Wingman, Oxford University Hospitals NHS Foundation Trust engaged the services of volunteer airline professionals trained in compassionate listening and stress reduction techniques to provide “first class lounge” treatment for staff members, to aid their mental wellbeing.³⁰ In Lagos Nigeria, an isolation and treatment center was exclusively reserved to provide care for infected health care workers.³¹ Support was also provided to the families of the health care workers in some countries. For example, the Scottish government enacted a policy that ensured that children of frontline workers were prioritized at childcare facilities.³² Knowing the importance of continuous training to medical practice, the UK government supported health workers by organizing virtual trainings on intensive care and covid-19 for workers.³³ Many of these examples come from countries considered to be “prepared” for a health crisis. This is because there is 1) limited data on initiatives taken and 2) staggering differences in health system capacities of “prepared” vs. “underprepared” nations.

In “prepared” nations, a range of support measures were implemented, although their success and effectiveness are difficult to evaluate at this stage. Whether they were creative initiatives to boost the morale of exhausted health workers, effective rationing of PPE, VR technologies for training redeployed healthcare workers, partnerships with hotels to provide accommodation, child care provision, or additional compensation, these practices had one thing in common: they were resource intensive. It is difficult to imagine how “underprepared” countries can enact similar measures. For example, countries with already strained health workforces and limited mental health resources will not have the capacity to develop and provide mental health support to its key workers during a pandemic.

However, there have been a range of less-resource intensive practices that can be readily translated to and benefit both “underprepared” and “prepared” countries. These measures include prioritizing COVID-19 testing for frontline workers to ensure their well-being and tailor their work schedules, recruiting final year medical students to provide childcare for health workers and respond to hotlines for vulnerable patients, mobilizing volunteers to make PPE, and upholding clear communication practices. Practices, including testing prioritization and effective communication should, ideally, be ingrained in national guidelines and routine practice of health care facilities. If absent, however, these are tools that leaders can choose to employ and rely on with minimal additional costs.

One of the advantages of many “underprepared” countries is that they typically have a robust community-based healthcare workforce, which has been educated to respond to emergencies and implement initiatives led by international organizations alongside formal health workers in the past.^{34 35 36} Thus, the government could train them at very low cost to provide additional services, such as testing and contact tracing, which can significantly ease the burden off formal health workers.

Key Lesson: Supporting health workers during a pandemic is of **utmost importance to maintain their presence and morale**. Leaders may be reluctant to push for the provision of such services due to perceived high costs. However, if leaders map their full health workforce landscape and develop a plan that leverages the advantages that their systems have (for example, an effective network of community health workers in many “underprepared” nations), they can **devise a range of low-cost**

measures. These measures should be 1) tailored to the needs of a country's unique health workforce, 2) be effectively communicated, and 3) be specific to ensure targeted outcomes.

II. Altering Health Service Delivery

As COVID-19 spread globally, countries were forced to create sufficient capacity to accommodate a surge in COVID-positive patients, while avoiding preventable deaths from other causes. Across both "prepared" and "unprepared" countries, governments worked to strike this fair balance through a variety of interventions, most notably including 1) refining their triage protocols, 2) using public-private partnerships and 3) constructing field hospitals.

Modified triage protocols helped manage hospital capacity and protect health workers

Across the globe, countries **rapidly refined their 'triage' protocols** to accommodate rising demands of COVID-positive patients. New protocols recommended 1) cancelling non-urgent hospitalisations, medical appointments, and surgeries, 2) transferring primary care and non-urgent activities to alternative platforms (telephone and online), and 3) strengthening community and home-based care. In general, non-critical COVID-19 cases were managed remotely to further reduce the physical strain on hospitals.³⁷ These measures **increased capacity in hospitals** in order to treat the most severe cases, while **protecting non-emergent patients and medical staff** from contracting and spreading the virus.

Since COVID-19 was declared a pandemic, the majority of non-essential medical consultations were conducted remotely, via telehealth or telemedicine. The shift to online medicine was, arguably, swifter for "prepared" countries with largely well-organized, integrated health systems and robust ICT infrastructure; however, many "underprepared" countries in many cases followed suit. While effective in the short-term, the new triage protocols have caused significant delays to in-person appointments and non-essential surgeries. Governments must prepare to deal with these backlogs.

Public-private partnerships were essential to managing a surge in healthcare demand

Many Governments turned to the private sector in order to accommodate a rapidly increasing flow of patients. Such **public-private partnerships were crucial** to securing additional beds, attaining vital equipment (for example, ventilators), and ensuring that a sufficient number of health workers were available to respond. In Singapore, Government activated a close collaboration between private and public hospitals to transfer Covid-19 patients to selected private hospitals to decrease the burden on the public sector.³⁸ In Australia, Government secured 30,000 hospital beds and 105,000 nurses and staff from the private sector to help with the COVID-19 response.³⁹ These public-private partnerships proved to be **especially important in countries**, such as South Africa, with **large disparities in private versus public sector resources**.^{40, 41}

Field hospitals scaled response capacity in countries across the globe

Constructing field hospitals was a popular measure taken to ease the pressure off of health service providers and to scale a country's capacity to respond to unprecedented patient levels. In China Government built the Fangcang hospitals as early as in February 2020. Similar measures were taken in Washington, Russia and South Africa.^{42, 43, 44} These temporary and often large-scale facilities were smartly constructed by converting existing venues, such as stadiums, factories, and exhibition centres.^{45, 46}

Modified service delivery is most effective when tailored to local needs and clearly communicated

The ability to rapidly adapt to alternative modes and channels of health service delivery **depends on the cooperation of both healthcare providers and the public**. Support for such changes amongst healthcare workers should be galvanised by effectively engaging local professional bodies such as medical doctors' associations, nurses' associations, and community health extension workers' associations in "unprepared" countries. Governments should seek to involve healthcare workers, who are familiar with their local contexts, in decision making to tailor modifications to specific needs and build trust. Finally, Governments must continue to **clearly and concisely communicate** any decisions to its civil service, health workforce and citizens.

Key Lesson: Strong infrastructure and robust ICT capability should be capitalised upon to create the necessary capability to address a Covid-19 surge while maintaining essential health services through other streams. Although "underprepared" countries may not have the same infrastructure and resources, it is imperative that they build on know-how from previous experience of health crises rather than reinvent the wheel. The innovative use of technology and infrastructure is a cost-effective way for all countries to bridge the gap between infrastructure development and health care capacity. It also plays an effective role in containing the spread of Covid-19, thereby protecting already fragile health systems from being overwhelmed.

III. Managing Supply Chains Amidst a Crisis

An efficient supply chain is critical to an effective health system. The COVID-19 pandemic has **created and revealed gaps of varying degrees in the supply chain** of both "prepared" countries, such as the USA and the UK, as well as "underprepared" countries, like Nepal.⁴⁷ The scarcity of personal protective equipment (PPE) and ventilators is an obvious example of such gaps.⁴⁸

The 'lean' global supply chain model that has been widely adopted in order to 1) reduce costs through efficient allocation of production to low-cost regions, 2) utilize just-in-time methodologies in manufacturing, and 3) hold lower levels of inventory throughout the supply chain has been a major factor in supply chain disruption.⁴⁹

The pandemic caused a surge in global demand for consumables such as testing kits and PPE, with a resulting shortage in supply. This left many countries, especially those "underprepared" (the majority of which were import dependent), stranded and forced to **develop innovative ways to mitigate these shortages**. Senegal, for example, addressed this disruption by partnering with a UK company to locally produce **\$1 testing kits** in Dakar which were able to produce results in about 10 minutes.⁵⁰ Other countries produced face masks from locally sourced materials. For example, **local fabrics** called Ankara were used in mask production in Nigeria.⁵¹ Yet other countries, like Ghana, minimized disruptions in conventional supply chain systems by using **drone services** to deliver kits and results in rural areas.⁵² Innovation was also necessary in "prepared" countries, with the UK beginning to **3D print** face shields using PLA.⁵³ These solutions allowed countries to **deploy limited healthcare supplies to essential frontline workers through 'informal' channels**, thus reducing complexity and ensuring timely response.

These measures give insight into practical strategies that governments should take if they face strains in their supply chains during a crisis. Firstly, using **locally produced substitutes** to augment conventional products (for production of medical supplies, such as production of face masks and hand sanitizers) is effective as an immediate response to supply chain disruption and shortages.

Government should not only **mobilize citizens to help with the effort**, but also **provide specific safety guidelines** to ensure that produced supply meet regulation standards. Secondly, examples of supply chain management at the organization level point to the need of mapping and **digitizing supply chain systems at a national level**. Organizations that invested in mapping of their supply networks pre-COVID-19 emerged better than those that did not. National governments should utilize a similar framework to ensure that real time information is acquired and evidence-based

decisions can be made. This, of course, will require **significant investment, a long time, and political will.**

Key Lesson: The international nature of the supply chain means many countries have had to turn to innovative solutions to meet shortages resulting from global disruption. Short term best practices from both “prepared” and “underprepared” have been those which have mined local capacity and innovation. Longer term, countries will have to invest heavily in developing a more holistic understanding of the national supply chain, and develop local industry for vital supplies.

Collaboration in a Time of Crisis

The global response to COVID-19 has been largely characterized by a dearth of meaningful collaboration and coordination. Precisely because this pandemic is by far the most challenging crisis of the 21st century, however, governments must find better ways to learn from each other and work collectively. This is particularly crucial for “underprepared” countries, which are already strained in resources, and would benefit significantly from information on good practices. Similarities in resource profiles and health system and supply chain challenges across many such countries provide an opportunity to effectively share and implement practical insights.

At the core of harnessing effective collaboration lies the ability to establish a clear and consistent flow of information between countries. Instead of reinventing the wheel, governments should more proactively exploit pre-existing channels to enable real-time information sharing, including the World Health Organization (WHO) and its regional bodies; sub-regional health organizations, such as the Africa Centres for Disease Control (Africa CDC), West African Health Organization (WAHO), East Central and Southern African health Committee (ECSA-HC); and other intergovernmental health organizations. These organizations can serve as avenues for governments to learn from the experiences of other countries with similar contexts, and to efficiently implement chosen programs. In addition, they will help build resilience for future events that may lead to global disruptions of health systems and supply chains and require intensive government responses.

Ethics

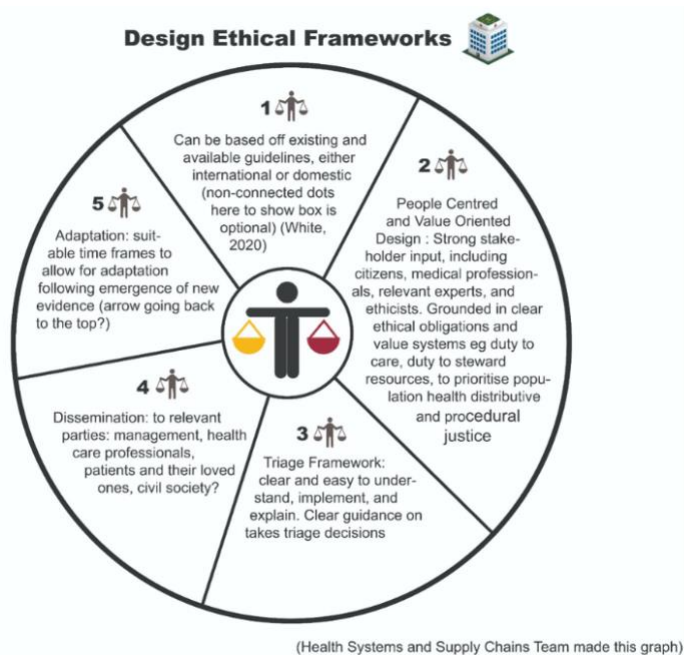
Faced with the reality of the pandemic, many health systems and supply chains have found their ethical frameworks either unsuitable or non-existent. Much work is now being done to rectify this, **to ensure critical decisions are guided by ethics**, and to **engender trust and accountability** within the strained health systems and supply chains.

Three of the most pressing questions in need of a clear ethical framework are:

1. **How does the health system steward scarce resources and treatment to the affected population?**
2. **What is the health system's duty of care towards health care workers?**
3. **What is an ethical approach to distributing scarce resources from the supply chain towards hospitals?**

Evidence based triage protocols that classify patients according to priority levels are largely accepted as best practice for deciding which patients get treatment in the instance that resources are insufficient.⁵⁴ This has been done in Italy, where pre-coronavirus Italian emergency health care operated on a 'first come, first served' criterion, which proved inadequate face with the virus.⁵⁵ Faced with difficult decisions about how to ration scarce resources such as ventilators, Lombardy's physicians began seeking ethical counsel in early March.⁵⁶ In response, the Italian College of Anesthesia, Analgesia, Resuscitation, and Intensive Care issued recommendations better suited to address the reality on the ground, and mitigate the moral burden of physicians.⁵⁷

In countries which do not have the capacity to design such frameworks rapidly, pre-existing frameworks such as the broadly utilised "Allocation of Scarce Resources During A Public Health Emergency" guidance (University of Pittsburgh, 2020) can be adapted to the local context. This is the approach South Africa took, as it became clear that guidances, issued as recently as 2019, were unfit for the context of COVID-19.⁵⁸ This framework should ensure that non-COVID cases are receiving high quality of care and sufficient resources, despite the emphasis on the pandemic.



Similar frameworks should be in place to address the latter two questions. A flow chart of key processes is presented in Figure 6. Once designed, any ethical framework **must be disseminated amongst policy makers**, health system executives, health care professionals, patients and their loved ones. This ensures 1) effective implementation and 2) transparency surrounding decisions made. These ethical frameworks must be **reviewed regularly and adapted**, as new evidence on COVID-19 emerges.

Figure 5: An illustration of the process for

devising and implementing ethical frameworks

In addition to developing effective ethical frameworks, governments across the globe should support WHO's "Solidarity Call to Action" initiative which established a COVID-19 patent pool to help make the response to COVID-19 a public good.⁵⁹ Patent pools help gather licenses into a bundle to lower production costs and improve access to care.⁶⁰ This mechanism has been previously used to successfully bridge gaps in access to care for HIV, Hepatitis and Tuberculosis.⁶¹ The COVID-19 voluntary patent pool aims to "collect patent rights, regulatory test data, and other information that could be share for developing drugs, vaccines, and diagnostics to combat COVID-19."⁶² So far, however, it only has 37 signatories. Countries, such as the US, UK, China, Germany and Russia that are leading in vaccine development are absent from this list, in part due to a big push against involvement from large, influential pharmaceutical companies.^{63, 64}

Joining this patent pool will, undoubtedly, be a difficult decision for countries with sufficient resources, as the collaboration is likely to negatively impact profitability. However, it is in this moment, that governments must remember that a pandemic knows no borders – unless all countries develop the capacity to stop the spread of COVID-19, its devastating impact will continue to be felt across the globe. Equity and fairness, therefore, must lie at the heart of their decisions. Governments of countries, where the concept of 'responsible business' is increasing in significance as a result of COVID-19, can use this opportunity to urge pharmaceutical / biotech companies to agree to enter into the patent pool.

Key Lessons and Recommendations

Despite their significant toll, crises provide an opportunity for governments to reflect on existing systems and make improvements. While in the short term focus should be placed on dampening any negative effects of a pandemic, in the long run governments should aim to **create and maintain resilient health systems and supply chains**. This section lists several key recommendations for the short term, phasing-out stage, and the long run.

In the short term governments should:

1. Rapidly **assess the country's health workforce**, identify actors to mobilize, and provide necessary **support**.
2. Explore how **technology** can close gaps in services by **persuading stakeholders** to adopt innovative tools.
3. Assess **feasibility of national production** for commodities that are short in supply, and **invest in partnerships / local R&D** to rapidly **build capability**.

4. Revise or formulate **ethical guidelines** based on available information about the pandemic.
5. Give clear guidelines on technical aspects of a crisis and encourage **innovation and adaptation of existing strengths** to develop a response. **It should not try to “reinvent the wheel,”** where not necessary.

When phasing out policies governments should...

1. Assess which of the **implemented crisis strategies are beneficial** and should be integrated into everyday practice (e.g. telehealth).
2. Develop an **action plan for addressing backlog** created by shifting to crisis planning and practice. This applies both to service delivery and supply chains.
3. Open **public dialogue around national values and ethical considerations** undergirding decision making during pandemic.

In the long term governments should...

1. Develop an **accountability mechanism** (e.g. an independent advisory board) to ensure crisis management preparation and guidelines are implemented to adequately respond to future crises.
2. Keep and iterate on **practices which provided support** for health workers.
3. Maintain and develop technological capabilities which supplement in- person care delivery, and **integrate these services** into the existing workflow within a health system.
4. **Re-evaluate reliance on ‘lean’ supply chains.** Once supply chain strategy formed, digitize the system, perform stress tests, and revise emergency response protocols using lessons learned from COVID-19.

Conclusion: Every crisis is different; it is impossible to be fully prepared for a specific one. However, several best practices recommended above can serve as a starting point to develop national capacity for any emergency response. To ensure success, governments must 1) understand the importance of preparing, 2) learn from lessons of COVID-19, and 3) commit to making an impactful change.

Appendix A

Country categories used for discussion and analysis in this briefing paper.

"Prepared" Countries	"Underprepared" Countries
<p>US, Thailand, Netherlands, Canada, Denmark, Australia, Switzerland, France, Finland, Belgium, UK, Spain, South Korea, Norway, Malaysia, Serbia, Portugal, Argentina, Slovenia, Sweden, Poland, Germany, Latvia, Mexico, Austria, Japan, Croatia, Iceland, Nicaragua, China, Turkey, New Zealand, Brazil, Peru, Saudi Arabia, India, Israel, Singapore, Bulgaria, Belarus, Ireland, Indonesia, Chile, Qatar, Bosnia and Herzegovina, Georgia, Philippines, Luxembourg, Slovakia, Greece, Russia, Cuba, Czech Republic, Italy, Romania, Hungary, Kuwait, Moldova, Albania, Ecuador, Panama, Iran, Lithuania, Colombia</p>	<p>South Africa, Estonia, Liechtenstein, Monaco, Mongolia, Kyrgyz Republic, Montenegro, Morocco, Ethiopia, Vietnam, Paraguay, Nepal, Kazakhstan, Bhutan, Jordan, Bahrain, Armenia, North Macedonia, Oman, Sierra Leone, El Salvador, Costa Rica, Syria, Brunei, Rwanda, Uruguay, Tunisia, Lebanon, Trinidad and Tobago, Malta, Gambia, Ghana, Ukraine, United Arab Emirates, Cyprus, Niger, Cameroon, Afghanistan, Kenya, Lesotho, Tajikistan, Zambia, Liberia, Nigeria, Pakistan, Seychelles, Myanmar, Laos, Madagascar, St. Vincent and The Grenadines, Micronesia, Senegal, Maldives, Azerbaijan, Côte d'Ivoire, Mauritania, Mozambique, Sri Lanka, Suriname, San Marino, Cabo Verde, Dominican Republic, Uzbekistan, Egypt, Malawi, Mauritius, Bolivia, Bangladesh, Zimbabwe, Turkmenistan, Cook Islands, Sudan, South Sudan, Botswana, Algeria, Mali, Venezuela, Central African Republic, Solomon Islands, Guyana, North Korea, Cambodia, Honduras, Nauru, Tuvalu, Congo, Iraq, Papua New Guinea, Uganda, Palau, Guatemala, Gabon, Angola, Haiti, Grenada, Namibia, Jamaica, Togo, Belize, Eritrea, Timor-Leste, Comoros, Djibouti, Andorra, Samoa, Libya, Niue, Burundi, Barbados, Dominica, Tanzania, Guinea, Bahamas, Yemen, Fiji, Tonga, Antigua and Barbuda, Kiribati, Marshall Islands, Sao Tome and Principe, St. Kitts and Nevis, Chad, Vanuatu, Swaziland, Brazzaville, St. Lucia, Benin, Burkina Faso, Equatorial Guinea, Guinea-Bissau, Somalia</p>

Appendix B

An Interview with a Consultant Interventional Radiologist at JR Hospital about Good Practices

Q: Was sufficient training was provided during the COVID-19 for the medical staff?

A: Yes, both in person, on line and via email. Updates were provided by the trust at least weekly.

Q: What was the redeployment strategy at the hospital? Any successes and/or failures?

A: Radiology: 1st year registrars redeployed to ITU for line placement; other junior doctors who were due to rotate to a different attachment didn't rotate - this meant they were working in a familiar environment. Clearly this was a disappointment for some (left on community psychiatry for example!) but was sensible from a safety view point. Radiology consultants moved to a 'hot week' on site, followed by 3 'cold weeks' (working off site). Most consultants have home reporting workstations so this worked well. The interventional team switched to a 'Covid' rota - 2 days on site, 2 days off site, 1 day off. It worked because we are a small team, and cooperate well to cross cover each other.

Q: What was done to address the mental health issues/burnout of the medical workers?

A: The weekly emails alerted staff about how to access help.

Q: Was any housing provided for medical staff in order to ease the commute to hospital/limit contact with the vulnerable members of the household?

A: Yes - available by contacting managers, and implemented very quickly, using on site accommodation and local hotels.

Q: Was the supply of PPE sufficient?

A: Yes, mostly -- although other departments were 'stealing' our supplies.

Q: Did the hospital do enough testing for medical workers?

A: A bit mixed - only available if you were symptomatic until recently. Serology taken from 1st May, but not processed yet!

Q: Were there any volunteers/medical students recruited to ease the burden of the medical workers? How was the training process for them?

A: Yes - the final year (post exam student) were recruited as F0. Others were recruited to help with childcare for nurses/ key workers, others were recruited to help GP's phone vulnerable patients.

Q: Can you give your opinion on some key lessons that we could learn from in regards to the healthcare workforce treatment during the crisis?

A: Across the Trust, the workforce worked extremely well to be flexible, moving wards, operating theatres, working days they don't normally work, making HDU and ITU capacity. The extent of the pre-peak preparation was amazing and I am so impressed that everyone worked so well to make



this possible. It was a big plus that the trust provided free parking, without permits, making it easy to be at work when you needed to but to leave as soon as you could.

Q: What could have the hospital/government done better?

A: We should have continued with community testing throughout the crisis, we could have done this if we had used the capacity available in the university labs across the city/ country. It seems criminal that these labs were shut down when they could have helped (small ships of Dunkirk etc!). I think other public sector workers should have been redeployed at an early stage and trained to be contact tracers - all the council and city workers, parking attendants, etc.

Q: Was any housing provided for medical staff in order to ease the commute to hospital/limit contact with the vulnerable members of the household?

A: Yes - available by contacting managers, and implemented very quickly, using on site accommodation and local hotels.

Q: Any other insights that you would like to share?

A: I think the university was blinkered into only supporting research from a limited group of individuals - there was lack of transparency and I don't think they gave sufficient consideration to the evidence provided when selecting which trials to support. Even now, when hydroxychloroquine has been shown to be ineffective and to increase mortality, the Trust have not retracted this arm of the Recovery trial and Oxford Health and the NHS continue to support the Principle trial.

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