

Lessons from Covid 3: lessons for healthcare systems and supply chains

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Although the COVID-19 response is ongoing and contexts are constantly evolving, the purpose of the following research paper is to flag lessons learnt from the Covid-19 pandemic to assist PSI staff and affiliates in formulating policies for healthcare systems and their supply chains.

The paper builds on research done by a team of researchers at Public Services International Research Unit (PSIRU) for Public Services International (PSI) in 2020, available online in two working papers at the University of Greenwich.⁴ The ongoing research investigates what factors and policies have helped or hindered protection against Covid-19 as well as support for economic well-being and the environment. It analyses the unequal impact of the pandemic, the policies, and the role of business interests during the pandemic.

This is the third paper in a series on lessons from Covid-19. The first is a paper on the key lessons from Covid-19; the second is about why countries expected to succeed did badly. There will be a forthcoming paper on Covid-19 and economic recovery.

Table of Contents

Lesson 1:	Capacity building by training and employing workers directly	1
Lesson 2:	Develop local control over supply and production and distribution of	2
Lesson 3:	Public funding and solidarity for vaccine R&D, production and distribution	3

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⁴ Wegmann, V., Nguyen, T. and Hall, D. (2020) *Lessons from COVID-19. Mapping COVID: PSIRU working papers for PSI August 2020*. [Working Paper]. Available at: <https://gala.gre.ac.uk/id/eprint/32126/>; and Nguyen, T., Wegmann, V. and Hall, D. (2020) *COVID-19: Country case studies Mapping COVID: PSIRU working papers for PSI*. [Working Paper]. Available at: <https://gala.gre.ac.uk/id/eprint/32127/>

Lesson 1: Capacity building by training and employing workers directly

Building public healthcare capacity

Public health systems need sufficient trained workers to provide services, including the public health functions necessary to deal with unforeseen epidemics. The experience with Covid-19 has demonstrated once again that public sector institutions with direct permanent employees are the most reliable way of ensuring adequate capacity, and that outsourcing creates problems of poor coordination and performance. Government as a whole also depends on reliable directly employed civil servants to provide policy advice without distortion by private interests.

A new report from UNDP and UCL academics makes strong recommendations that governments should:

“Build institutions that enable the implementation of resilience-driven developmental plans.... Build in-house capabilities and skills focused on adaptability and learning....”. It refers to the success of the Indian state of Kerala in controlling the epidemic, as based on long-term commitment to public education and participatory government, and also “the institutional memory from the successful management of two major floods and an outbreak of a virus in 2018 resulted in a series of effective emergency management protocols that have become baked into the way government works.”⁵

Country examples:

This capacity of public healthcare systems enabled countries as diverse as **Germany, South Korea, Vietnam, and Rwanda** to control the first waves of the epidemic effectively.⁶

- **Rwanda**, a low income country, nevertheless managed to keep the Covid mortality rate low because it “provides nearly universal health care to its 13 million citizens. All the testing and treatment for the virus is provided free of charge, health workers call or visit every potential contact of someone who has tested positive.... medical staff started screening at border entry points and nationwide testing was implemented almost a month before the first case was registered... which also triggered a systematic tracing campaign utilising community health-care workers, police and college students”.⁷

⁵ Mazzucato, Mariana, Rainer Kattel, Giulio Quaggiotto, and Milica Begovic. 2021. ‘COVID-19 and the Need for Dynamic State Capabilities’: UNDP DEVELOPMENT FUTURES SERIES WORKING PAPERS. <https://www.ucl.ac.uk/bartlett/public-purpose/news/2021/may/iipp-and-undp-publish-new-report-covid-19-and-need-dynamic-public-sector-capabilities>.

⁶ Mazzucato, Mariana, and Rainer Kattel. 2020. ‘COVID-19 and Public-Sector Capacity’. *Oxford Review of Economic Policy* 36 (Supplement_1): S256–69. <https://doi.org/10.1093/oxrep/graa031>.

⁷ Mazzucato, Mariana, Rainer Kattel, Giulio Quaggiotto, and Milica Begovic. 2021. ‘COVID-19 and the Need for Dynamic State Capabilities’: UNDP DEVELOPMENT FUTURES SERIES WORKING PAPERS. <https://www.ucl.ac.uk/bartlett/public-purpose/news/2021/may/iipp-and-undp-publish-new-report-covid-19-and-need-dynamic-public-sector-capabilities>.

- By contrast, the UK had cut back the public health capacity of the NHS, and sought to rely on outsourcing to deal with the pandemic, with very poor results.⁸
- Like other countries, the pandemic has forced **Peru** to make big short-term increases in the number of workers dealing with the pandemic. Through temporary employment, one-off payments, collaboration with university staff, volunteers, and outsourcing. International researchers argue that this creates an opportunity for Peru to permanently employ these staff and develop capacity through “a longer-term planning perspective based on understanding the likely skills requirement of health systems and developing this type of health and care provision policy”.⁹
- **South Africa** has committed to rebuilding state capacity, staffed by permanent directly employed professional civil servants, reversing a policy of using external consultants such as McKinseys. President Ramaphosa has said: “We want to focus on professionalising the public service, bringing in more qualified young people we’ve seen how outsourcing has weakened our state and how those entities we tended to outsource to were themselves captured and deeply involved in the challenges that we had to face of corruption... Through that, the financial capability was weakened. ... The accountability and discipline that is needed immediately just goes down and there is a loss of focus.”¹⁰

Conditions of employment

The pandemic has shown that decent pay and conditions for public service workers should be treated as key investment in public service capacity and employment. This is particularly clear in relation to some specific conditions such as the right of workers to proper PPE protection¹¹, and paid sick leave.

- **Workers and pay as public investments**

In the **USA**, President Biden’s American Jobs Plan in March 2021, treats good pay, conditions and union rights as a core part of investments in public services: “Our workers will ... be trained for well-paying... good-quality jobs that pay prevailing wages in safe and healthy workplaces while ensuring workers have a free and fair choice to organize, join a union, and bargain collectively with

⁸ ‘How a Decade of Privatisation and Cuts Exposed England to Coronavirus’. 2020. The Guardian. 31 May 2020. <http://www.theguardian.com/world/2020/may/31/how-a-decade-of-privatisation-and-cuts-exposed-england-to-coronavirus>.

⁹ Rees, Gareth H., Felipe Peralta Quispe, and Cris Scotter. n.d. ‘The Implications of COVID-19 for Health Workforce Planning and Policy: The Case of Peru’. *The International Journal of Health Planning and Management* n/a (n/a). Accessed 7 April 2021. <https://doi.org/10.1002/hpm.3127>.

¹⁰ Meiring, Pieter. 2021. ‘Government to Rebuild State Capability’. *Cape Business News* (blog). 25 March 2021. <https://www.cbn.co.za/featured/government-to-rebuild-state-capability/>.

¹¹ Graham, Luke D. 2021. ‘The Right to Clothing and Personal Protective Equipment in the Context of COVID-19’. *The International Journal of Human Rights* 0 (0): 1–20. <https://doi.org/10.1080/13642987.2021.1874939>.

their employers.”¹² The AJP also emphasises the equality impact of such a policy, stating that workers in care homes “the majority of whom are women of colour – have been underpaid and undervalued for too long.”¹³ The **USA** government also proposed in April 2021 to introduce for the first time a legal right to paid leave for sickness and family reasons, but this will take years to implement.¹⁴ (But it is nevertheless far better than the hopelessly weak guidance still being issued by the ILO and WHO in 2021, which just calls for employers to ‘establish flexible sick leave policies’, and for workers to ‘stay home if unwell’.¹⁵).

Key resources:

Weghmann, V., Nguyen, T. and Hall, D. (2020) *Lessons from COVID-19. Mapping COVID: PSIRU working papers for PSI August 2020*. [Working Paper]. Available at: <https://gala.gre.ac.uk/id/eprint/32126/>

Nguyen, T.,Weghmann, V. and Hall, D. (2020) *COVID-19: Country case studies Mapping COVID: PSIRU working papers for PSI*. [Working Paper]. Available at: <https://gala.gre.ac.uk/id/eprint/32127/>

Mazzucato, Mariana, Rainer Kattel, Giulio Quaggiotto, and Milica Begovic. 2021. ‘COVID-19 and the Need for Dynamic State Capabilities’: UNDP DEVELOPMENT FUTURES SERIES WORKING PAPERS. <https://www.ucl.ac.uk/bartlett/public-purpose/news/2021/may/iipp-and-undp-publish-new-report-covid-19-and-need-dynamic-public-sector-capabilities>.

‘FACT SHEET: The American Jobs Plan’. 2021. The White House. 31 March 2021. <https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/>.

¹² ‘FACT SHEET: The American Jobs Plan’. 2021. The White House. 31 March 2021. <https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/>.

¹³ ‘FACT SHEET: The American Jobs Plan’. 2021. The White House. 31 March 2021. <https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/>.

¹⁴ Zhou, Li. 2021. ‘This Could Be the Year Federal Paid Leave Finally Passes’. Vox. 28 April 2021. <https://www.vox.com/2021/4/28/22405362/joe-biden-paid-leave-american-families-plan>.

¹⁵ ‘COVID-19: Occupational Health and Safety for Health Workers’. 02 Feb 2021. https://www.who.int/publications-detail-redirect/WHO-2019-nCoV-HCW_advice-2021.1.

Lesson 2: Develop local public control over services and production of key supplies

Countries which relied on emergency outsourcing to private contractors for public health functions to test and track infected people have experienced disastrous levels of inefficiency and incompetence. Nearly all countries have suffered problems with inability to get key supplies, such as personal protective equipment (PPE). And many countries have come to realise the limited technical options available from manufacturers of medical equipment such as ventilators.

In the words of a UNDP/UCL report, countries “have been largely constrained in their options by previous investments (or lack thereof) in core services and capacity building.”¹⁶ What is needed is adequate public sector capacity to ensure the supply of these necessary goods and services: to “support the creation or conservation of industrial commons, that is, the knowledge and capacities lost through outsourcing and offshoring”.¹⁷

The supreme negative experience in this respect was the **UK**, where the government outsourced every possible part of the new resources needed to control the Covid19 epidemic, instead of strengthening the capacity of the NHS. This includes PPE, testing, tracking and tracing, and led to repeated problems:

- o the warehouse stockpiling PPE for just such an emergency was unable to deliver to hospitals, with workers describing the system as ‘chaotic’ and insufficient, out of date stock.
- o The government gave an emergency contract to Deloitte to sort out the system, but this was described even by suppliers as [a “disaster”, with Deloitte trying to source PPE from China and ignoring offers from local communities](#), universities and small businesses in the UK, who all reacted rapidly to offer to start producing PPE locally.
- o A new system to supply PPE to care homes and GPs was outsourced to a company whose CEO is a leading donor and supporter of the Conservative Party: but the system was too slow, and care homes and councils were still [“not able to access sufficient supplies of PPE”](#).
- o Contracts to operate drive-through coronavirus testing centres were awarded without competition to Deloitte, which sub-contracted other outsourcing specialists Serco, Mitie, G4S and Sodexo to manage the centres. [These arrangements have failed, with the centres being reported as “too far away”](#), the wrong tests being sent out, results being lost and others being sent to the wrong person.
- o The track and trace work in England has been outsourced to Serco, under yet another uncompetitive contract, which Serco hope will [“cement the position of the private](#)

¹⁶ Mazzucato, Mariana, Rainer Kattel, Giulio Quaggitto, and Milica Begovic. 2021. ‘COVID-19 and the Need for Dynamic State Capabilities’: UNDP DEVELOPMENT FUTURES SERIES WORKING PAPERS. <https://www.ucl.ac.uk/bartlett/public-purpose/news/2021/may/iipp-and-undp-publish-new-report-covid-19-and-need-dynamic-public-sector-capabilities>.

¹⁷ Jan Grumiller / Hannes Grohs. 2021. ‘Increasing Security of Supply for Critical Medical and Pharmaceutical Goods in the EU: Lessons from the COVID-19 Pandemic’. Briefing Paper 29. Vienna: OFSE. <https://www.oefse.at/en/publikationen/detail/publication/show/Publication/critical-medical-and-pharmaceutical-goods-in-the-eu/>.

sector” in the NHS. This too has proved a disaster, [failing to contact thousands of people in the worst-affected areas](#), while ignoring the potential role of local councils.

- o The government issued a contract for a tracking app to a software firm with links to the prime ministers special adviser. The app failed to work, [and has been cancelled](#).¹⁸

Lesson 2.1 Develop local public control over test, track and trace (TTT)

Countries could control the pandemic much more effectively where they had built and maintained sufficient local public health capacity to operate systematic test, track and trace (TTT) of infections.

- It was this existing public capacity which enabled **Singapore** and **South Korea** to deploy digital tracking applications, and for Germany and South Korea to operate high levels of rapid testing through their existing public laboratories, supplied with the required safety equipment and chemicals by established local producers.¹⁹
- **Thailand** managed TTT very effectively, partly because its healthcare system has a “long-term strategy to boost its public health function and has invested in field epidemiologists since 1980”. This includes the building of laboratory capacity in every part of the country, with a target of establishing at least one laboratory with capacity for 10 000 RT-PCR tests per day in each of its 77 provinces. In April 2020, 80 certified laboratories were already available – 39 in Bangkok and 41 elsewhere – and by June a further 30 laboratories had been set up, with 12 regional laboratories providing back-up testing with a turnaround time of 24 hours for those provinces still without their own lab.²⁰ The **Maldives** was helped by the WHO to extend laboratory facilities, train staff, set up quality assurance, and supply test kits, so that the country can analyse 700 tests per day.²¹

Lesson 2.2: Develop local public control local/public sourcing of equipment e.g. PPE, tests, equipment

The pandemic has also showed the problems of dependency on global supply chains based on ‘just in time’ manufacturing and delivery for vital supplies such as PPE, and the limitation of depending on commercial interests for designing and manufacturing key equipment, such as ventilators.

¹⁸ Nguyen, T., Wegmann, V. and Hall, D. (2020) *COVID-19: Country case studies Mapping COVID: PSIRU working papers for PSI*. [Working Paper]. Available at: <https://gala.gre.ac.uk/id/eprint/32127/>; ‘Privatised and Unprepared: The NHS Supply Chain’. 2020. We Own It. 18 May 2020. <https://weownit.org.uk/privatised-and-unprepared-nhs-supply-chain>.

¹⁹ Mazzucato, Mariana, and Rainer Kattel. 2020. ‘COVID-19 and Public-Sector Capacity’. *Oxford Review of Economic Policy* 36 (Supplement_1): S256–69. <https://doi.org/10.1093/oxrep/graa031>

²⁰ **COVID-19 Health System Response Monitor THAILAND** September 2020 <https://apps.who.int/iris/handle/10665/334146>

²¹ ‘WHO Helps Maldives Build Laboratory Capacity to Test COVID-19’. n.d. Accessed 23 April 2021. <https://www.who.int/southeastasia/news/feature-stories/detail/who-helps-maldives-build-laboratory-capacity-to-test-covid-19>.

Governments now recognise the need to increase stockpiles of vital equipment and medicines and develop public sector, or at least local, capacity to manufacture such items.

Global supply chains failed to provide enough PPE for China at the start of the pandemic in Jan/Feb 2020, so China responded by using state-owned enterprises (SOEs) to produce materials, masks and gloves in the quantities required. The USA got masks and PPE from China because China had controlled the virus early and so had capacity for exports: “China’s rapid recovery was hence a stroke of luck for the US in those products”.²² The clear solution to avoid future problems with supply chains is “a shift to nationalized production.”²³

- The **USA** has learned the lesson of Covid: president Biden’s ‘American jobs plan’ announced in March 2021 includes building capacity to: “Protect Americans from future pandemics. through major new investments in medical countermeasures, manufacturing; research and development.... investments to shore up our nation’s strategic national stockpile; accelerate the timeline to research, develop and field tests and therapeutics for emerging and future outbreaks.... train personnel for epidemic and pandemic response; and onshore active pharmaceutical ingredients”²⁴ **China’s** new 5-year plan also pays attention to the problem of global supply chains and the need to ensure local sourcing of key supplies.²⁵

Public sector capacity is also important in designing and manufacturing key medical equipment, and can do so more rapidly than commercial developers.

- Public sector university engineers in the **UK** have played a vital and rapid role in manufacturing new and better equipment for treating Covid patients, and made the technology freely available globally. In March 2020, as the UK was experiencing the first wave of Covid, intensive therapy units in NHS hospitals were being overwhelmed by the number of patients needing ventilators. Engineers at University College London (UCL), working with doctors at their sister hospital UCLH, and with engineers at Mercedes Power Trains with whom the university already had working relations, realised that a simpler and less intrusive breathing aid, known as a CPAP²⁶, which does not require intubation and oxygen supplies under intensive pressure, could be modified to help many Covid patients. It took the engineers just 4 days from the initial meeting to develop the device so it could be mass manufactured for treating Covid patients. The plans and details required to make the device were also made available for every country in the world to download at no cost: within just two days, nearly 700 requests to access the information, from governments, health professionals, non-profits, and research institutes in 25 countries, had been approved. The

²² Hitt, Michael A., R. Michael Holmes, and Jean-Luc Arregle. 2021. ‘The (COVID-19) Pandemic and the New World (Dis)Order’. *Journal of World Business*, March, 101210. <https://doi.org/10.1016/j.jwb.2021.101210>.

²³ Dallas, Mark P., Rory Horner, and Lantian Li. 2021. ‘The Mutual Constraints of States and Global Value Chains during COVID-19: The Case of Personal Protective Equipment’. *World Development* 139 (March): 105324. <https://doi.org/10.1016/j.worlddev.2020.105324>.

²⁴ ‘FACT SHEET: The American Jobs Plan’. 2021. The White House. 31 March 2021. <https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/>.

²⁵ ‘China: Report on the Work of the Government’. 2021. http://english.www.gov.cn/premier/news/202103/13/content_WS604b9030c6d0719374afac02.html.

²⁶ Continuous Positive Airway Pressure

CPAPs have been widely used in the UK, Italy, China and India, and reduced the demand for ventilators and intensive care by as much as 50%.²⁷

Key resources:

Weghmann, V., Nguyen, T. and Hall, D. (2020) *Lessons from COVID-19. Mapping COVID: PSIRU working papers for PSI August 2020*. [Working Paper]. Available at: <https://gala.gre.ac.uk/id/eprint/32126/>

Nguyen, T., Weghmann, V. and Hall, D. (2020) *COVID-19: Country case studies Mapping COVID: PSIRU working papers for PSI*. [Working Paper]. Available at: <https://gala.gre.ac.uk/id/eprint/32127/>

UCL. 2020. 'About UCL-Ventura'. UCL Institute of Healthcare Engineering. 5 April 2020. <https://www.ucl.ac.uk/healthcare-engineering/covid-19/ucl-ventura-breathing-aids-covid19-patients/about-ucl-ventura>

Hitt, Michael A., R. Michael Holmes, and Jean-Luc Arregle. 2021. 'The (COVID-19) Pandemic and the New World (Dis)Order'. *Journal of World Business*, March, 101210. <https://doi.org/10.1016/j.jwb.2021.101210>.

Mazzucato, Mariana, and Rainer Kattel. 2020. 'COVID-19 and Public-Sector Capacity'. *Oxford Review of Economic Policy* 36 (Supplement_1): S256–69. <https://doi.org/10.1093/oxrep/graa031>

²⁷ UCL. 2020. 'About UCL-Ventura'. UCL Institute of Healthcare Engineering. 5 April 2020. <https://www.ucl.ac.uk/healthcare-engineering/covid-19/ucl-ventura-breathing-aids-covid19-patients/about-ucl-ventura>; UCL. 2021. 'UCL-Venturas Sent to India to Help with COVID-19 Surge'. UCL News. 26 April 2021. <https://www.ucl.ac.uk/news/2021/apr/ucl-venturas-sent-india-help-covid-19-surge>.

Lesson 3: Public funding and solidarity for vaccine R&D, production and distribution

Covax versus market power

Covax was set up in 2020 to ensure fair access to vaccines across the globe. Covax is co-led by the WHO, the Global Vaccine Alliance (Gavi) and the Coalition for Epidemic Preparedness Innovations (Cepi), and Unicef is a key implementation partner. So far around 50 million vaccine doses have been delivered through Covax.²⁸ However, by April 2021 only 0.3% of the vaccines administered around the world had gone to people in low-income countries. Due to vaccine monopolies the vaccine prices are too high for many countries around the world. For example, Oxfam research shows the price **Uganda** paid for its vaccines so far means that to vaccinate the entire country is double of the country's entire healthcare budget.

Through advanced purchase commitments, many high-income countries have prioritised vaccinating their own populations undermining a more holistic approach of protecting the most vulnerable people around the world.

Intellectual Property Rights

The World Trade Organization longstanding agreement designed to protect intellectual property, known as the Trade-Related Aspects of Intellectual Property Rights, or TRIPS, prevents countries to produce and use all anti COVID-19 technologies.²⁹ India and South Africa are advocating for a TRIPS waiver. Richer nations have so far opposed this waiver, yet the US recently changed position and declared its support for a patent waiver. By the time of writing (early May 2021) the European Union and Switzerland are, however, still resisting the TRIPS waiver.³⁰

Without public funding no vaccines

In the debate on intellectual property rights around vaccines is often forgotten that vaccine development is based on government funding. It is public sector funding that allows the business of vaccine to operate, as the private sector finds it too risky. During the Covid-19 pandemic the unprecedented public funding helped companies to develop vaccines in less than a year.

There is a high degree of secrecy over the prices of vaccines, the risk of a high degree of abuse over pricing or unfair pricing is high. Companies want to play countries off against each other, so aren't very incentivised of making the contracts transparent, and democratic governments do not want their public to know if they had a bad deal or rival countries had a better deal.

Country examples of international vaccine rollout

The Serum Institute of India (SII) is the world's largest vaccine producer by volume. In 2020 the SII agreed to supply an initial 200 million vaccine doses to Covax to ensure availability to low and middle income countries. The SII was expected to deliver the first 100 million doses between February and

²⁸ BBC (4 May 2021) Covax: How will Covid vaccines be shared around the world? *BBC*. Available at: <https://www.bbc.co.uk/news/world-55795297>

²⁹ Kuchler, H. (7 May 2021) Will a suspension of Covid vaccine patents lead to more jobs? *The Financial Times*. Available at: <https://www.ft.com/content/b0f42409-6fdf-43eb-96c7-d166e090ab99>

³⁰ Borger, J. (5 May 2021) US declares support for patent waiver on Covid-19 vaccines. *The Guardian*. Available at: <https://www.theguardian.com/world/2021/may/05/us-declares-support-for-patent-waiver-on-covid-19-vaccines>

May. But India who is currently suffering from a severe Covid outbreak so far (by May 2021) only delivered 30 million (this includes 10 million set aside for India itself under Covax).³¹

Cuba is in the process of developing two vaccines.³² Venezuela has begun clinical trials of the Cuban coronavirus vaccine candidate and plans to produce enough doses locally to vaccinate four million people.

The UK decided before the pandemic to create a large new public sector capacity for manufacturing vaccines because it recognised the inadequacy of the private sector.

The same vulnerabilities have already been seen in widespread and repeated shortages of medicines including “medicines for cancer treatments, heart disease, nervous system disorders, hypertension, as well as antibiotics and vaccines” which have increased exponentially in OECD countries alone in the last 20 years, the major structural cause of which is “globalized and decentralized production networks”

Key resources:

Weghmann, V., Nguyen, T. and Hall, D. (2020) *Lessons from COVID-19. Mapping COVID: PSIRU working papers for PSI August 2020*. [Working Paper]. Available at: <https://gala.gre.ac.uk/id/eprint/32126/>

Nguyen, T., Weghmann, V. and Hall, D. (2020) *COVID-19: Country case studies Mapping COVID: PSIRU working papers for PSI*. [Working Paper]. Available at: <https://gala.gre.ac.uk/id/eprint/32127/>

The Financial times (March 2021) Vaccine Economics. [Documentary film] Available at: <https://www.ft.com/video/e6f487f4-a7d9-4e90-b9cb-ef8d25803bec>

Yaffe, H. (31 March 2021) Cuba’s five COVID-19 vaccines: the full story on Soberana 01/02/Plus, Abdala, and Mambisa. LSE blog. Available at: <https://blogs.lse.ac.uk/latamcaribbean/2021/03/31/cubas-five-covid-19-vaccines-the-full-story-on-soberana-01-02-plus-abdala-and-mambisa/>

³¹ Meonon, S. (29 April 2021) India coronavirus: Can it make enough vaccines to meet demand? BBC. Available at: <https://www.bbc.co.uk/news/world-asia-india-55571793>

³² Yaffe, H. (31 March 2021) Cuba’s five COVID-19 vaccines: the full story on Soberana 01/02/Plus, Abdala, and Mambisa. LSE blog. Available at: <https://blogs.lse.ac.uk/latamcaribbean/2021/03/31/cubas-five-covid-19-vaccines-the-full-story-on-soberana-01-02-plus-abdala-and-mambisa/>