POLICY DISCUSSION BRIEF
INSTITUTE OF POLICY STUDIES OF SRI LANKA

FISCAL IMPLICATIONS OF VACCINATING SRI LANKA AGAINST COVID-19

Harini Weerasekera and Kithmina Hewage

April 2021

1. Introduction

Securing vaccines to curb the spread of COVID-19 has become a priority amongst governments worldwide, as countries seek to finally move beyond the pandemic that has disrupted lives during the past year. Whilst lockdowns and other restrictions have helped curb the spread of the virus, these have come at a considerable opportunity cost, especially in terms of economic activity. Therefore, vaccination appears to be the only sustainable means of returning to normalcy and a well-coordinated and efficient vaccination strategy would undoubtedly expedite that process. The emergence of new variants of COVID-19 has heightened the need for vaccination even further since an immunised population limits the scope for new variants of COVID-19 to emerge. Global COVID-19 vaccination efforts, however, also require careful government fiscal allocations since a vast majority of vaccines are to be self-financed by governments. In addition to assessing the proportion of vaccines required to achieve herd immunity, developing economies in particular, need to be cognizant of the variety in prices amongst the available vaccine options, freight costs and ancillary costs associated with the storage and deployment of such a mass-scale vaccination initiative. Moreover, developing countries have to contend with potential supply shocks and price changes in the future since developed economies have secured most of the initial supplies directly from vaccine developers and producers.

Similar to other countries, Sri Lanka too, has suffered severely during the past year due to COVID-19. The country, for instance, experienced an economic contraction of 3.6 per cent in 2020 and saw unemployment rates rise to unprecedented levels (Department of Census and Statistics, 2020). The continuous closure of service industries such as the tourism sector, which accounts for 4 per cent of gross domestic product (GDP), continues to burden the country's economy. Notably, the country is facing these economic challenges alongside an already challenging macroeconomic landscape, highlighted by a record level of foreign debt obligations, a growing fiscal deficit and a rapidly depreciating currency. Each of these challenges creates a greater urgency for Sri Lanka to vaccinate its populace in order to reopen the economy, whilst ensuring that fiscal allocations towards the vaccination effort do not undermine its broader public health investments or its macroeconomic position.

Against such a backdrop, this study assesses the fiscal implications of reaching a target of vaccinating 60-80 per cent of Sri Lanka's population against COVID-19. The study works with the assumption that 20 per cent of the population will be vaccinated through a combination of COVAX procured vaccines, vaccine grants and grant funding. The cost of vaccinating the remaining 40-60 per cent of the population to reach the 60-80 per cent coverage target will be approximated, and the associated fiscal trade-offs of using government budget for this purpose will be considered. Furthermore, an economic impact analysis will be conducted to simulate the impact of the vaccination strategy on national output and employment.

2. Background

2.1 Global Vaccination Initiatives

A number of COVID-19 vaccines produced by many different companies and countries have completed or have been in the process of completing the final stages of vaccination trials. Thus far, seven vaccines of varying characteristics have been deployed around the world. All the vaccines introduced thus far, barring the Johnson & Johnson vaccine, requires two doses and the cost per dose varies significantly between the AstraZeneca-Oxford vaccine (which is the cheapest) and the Moderna vaccine (which is the most expensive). The different characteristics of the vaccines make some more accessible to developing countries due to the storage infrastructure required. For instance, the AstraZeneca-Oxford, Johnson & Johnson, and

Sinopharm vaccines can easily be stored in a standard refrigerator (CNBC, 2020). However, the Moderna and Pfizer-BioNTech vaccines require colder storage facilities than what are commonly available in developing countries. Individual countries, through their respective regulatory agencies, have approved one or several of these seven available vaccines for individual use. As of mid-March 2021, the World Health Organization (WHO) approved the Pfizer-BioNTech vaccine and two versions of the AstraZeneca-Oxford vaccine produced by AstraZeneca-SKBio (South Korea) and the Serum Institute of India (WHO, 2021).

The most prominent global COVD-19 vaccination initiative currently in place is the COVAX facility, which was jointly convened by the Coalition for Epidemic Preparedness Innovations, the Global Alliance for Vaccine and Immunization (GAVI) and the WHO. COVAX is one of three pillars of the Access to COVID-19 Tools (ACT) Accelerator, launched in April 2020 by the WHO, the European Commission, and France in response to the pandemic. The facility will ensure that each country participating in the facility will receive vaccines to cover a maximum of 20 per cent of the population at no cost and the first round of allocations are expected to be distributed to countries between March and May 2021. In addition, several countries such as India, China, and Russia, have undertaken bilateral initiatives to donate vaccine doses to other developing countries. Beyond the COVAX facility and vaccine diplomacy efforts, countries need to secure further doses directly through agreements with vaccine manufacturers and developers. To this end, developed economies such as the USA, Israel, the UK, and the EU formalised vaccine agreements with developers at the early stage of testing and as part of the government's efforts to partly fund and subsidise vaccine development efforts. As a result, these countries have already secured manufacturing commitments to reserve enough vaccines to cover their respective populations. For instance, the Biden administration has announced that every adult in the USA will be able to access a vaccine by May 1 (White House, 2021). As evident in Table 2 below, the ability to secure early supply deals has allowed developed economies to vaccinate a much larger proportion of its population compared to developing economies.

Table 1:
Cost of Globally Available COVID-19 Vaccines

Vaccine Producer	Cost per Dose (USD)	Doses Required	Max Storage Period in Regular Refrigerator
Moderna	32-37	2	30 days
Pfizer-BioNTech	20	2	5 days
AstraZeneca-Oxford	3-4	2	No restriction
Johnson & Johnson	10	1	No restriction
Sinopharm	30.62	2	No restriction
Sinovac	30.62	2	No restriction
Sputnik V	10	2	No restriction

Source: CNBC, COVID Vaccine Front Runners: How Much They Cost, Who's Bought Them and How They're Stored. Accessed November 17, 2020 from CNBC: https://www.cnbc.com/2020/11/17/covid-vaccines-how-much-they-cost-whos-bought-them-and-how-theyre-stored.html

Table 2:
Percentage of Population Vaccinated (Selected Countries)

Country	Doses Administered (Total)	% of population	
		Vaccinated	Fully Vaccinated
Israel	9,491,511	59%	48%
Seychelles	88,106	63%	28%
Bahrain	566,796	22%	14%
USA	109,081,860	21%	12%
Serbia	2,040,313	18%	11%
Chile	6,994,820	25%	11%
Singapore	792,000	9.7%	4.3%
U.K.	26,063,501	37%	2.4%
India	32,947,432	2.0%	0.4%
Bangladesh	4,398,094	2.7%	-
Sri Lanka	773,011	3.5%	-

Source: New York Times, Tracking Coronavirus Vaccinations Around the World. Accessed 16 March 2021, https://www.nytimes.com/interactive/2021/world/covid-vaccinations-tracker.html.

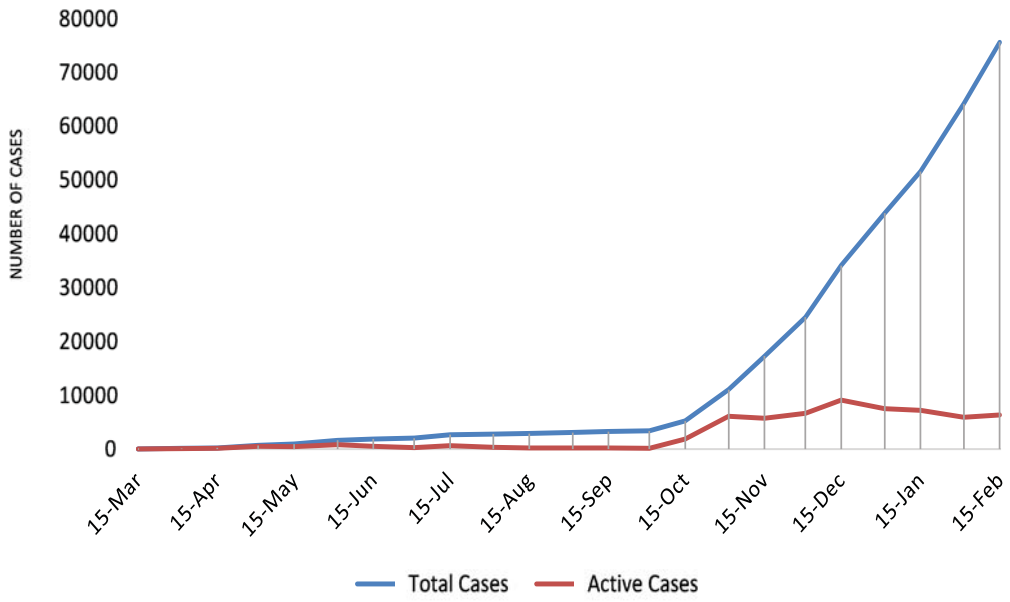
The percentage of the population required to be vaccinated for herd immunity varies from one disease to another. For COVID-19, experts agree that "a substantial proportion of the population" (WHO, 2020) would need to be vaccinated, even though the number for each country varies based on numerous factors such as population age, density, quality of health infrastructure, and the proportion of the population already infected by the virus. The American Lung Association (2020) projects that the proportion of the population that will need to be vaccinated in the USA is between 70-90 per cent of the population. The emergence of new variants of COVID-19 is likely to increase the threshold of vaccinations required to achieve herd immunity.

2.2 COVID-19 Response in Sri Lanka

At the outset of COVID-19 spread, Sri Lanka was globally heralded as a success in containing the public health and economic impacts of the pandemic. The Government of Sri Lanka (GoSL) adopted a COVID-19 eradication strategy, which led to a lockdown of the country for nearly two months between mid-March and May 2020, a complete border closure for foreigners and the implementation of a rigorous contact tracing regiment using the country's existing public health infrastructure. The absence of cases within the community (except for Sri Lankans arriving from abroad and placed in quarantine centres at the border) during August and September 2020 thus allowed the domestic economy to enter a path towards recovery. These trends are reflected by the economic indicators of the first and second quarters of 2020 that experienced a contraction in GDP by 1.65 per cent and 16.3 per cent, respectively, while the third quarter experienced a marginal positive growth of 1.5 per cent (Department of Census and Statistics, 2020). Since the emergence of the second wave of COVID-19 cases in October 2020, however, Sri Lanka has failed to replicate its initial success in containing spread (Figure 1). The fast spread of cases across the island has left the public health system burdened and simultaneously undermined the economic recovery, intensifying the need for a successful and rapid deployment of a vaccination strategy.

The country's COVID-19 response, including the imposition of lockdowns, testing and contact tracing initiatives, securing funding for vaccines, and wider costs associated with deploying the vaccination strategy, all have to be designed while recognising the country's challenging macroeconomic fundamentals. Sri Lanka suffers from having to fulfil an unprecedented debt burden, a growing fiscal deficit and a complete closure of its tourism sector which accounts for nearly 4 per cent of its GDP (Central Bank of Sri Lanka, 2020). Moreover, as a middle-income economy, Sri Lanka has less access to concessionary development finance. Each of these impediments, therefore, has required the

Figure 1: Total and Active Cases of COVID-19 in Sri Lanka



Source: *New York Times, Tracking Coronavirus Vaccinations Around the World.* Accessed 16 March 2021, https://www.nytimes.com/interactive/2021/world/covid-vaccinations-tracker.html.

government to bring together a plethora of financial options, including the WHO's COVAX facility, multilateral and bilateral financial grants, vaccine donations, and budgetary reallocations towards vaccine purchases.

As of March 2021, Sri Lanka's National Medicines Regulatory Authority (NMRA) has approved Oxford's AstraZeneca vaccine and the Russian Sputnik V vaccine for emergency use. Arrangements are being made to secure vaccinations for 20 per cent of the country's population (approximately 4.2 million) through the WHO's COVAX procurement facility, in the priority order illustrated in Table 3. At the time of writing, the country has reportedly submitted a National Vaccine Deployment Plan (NVDP) to apply for this facility. According to the WHO's Interim Distribution Forecast (2021) for the facility, Sri Lanka is expected to receive 1,692,000 doses by the end of the second quarter of the year. Some grant funding has also been offered to Sri Lanka by the Asian Development Bank (ADB) (USD 5 million) and GAVI (USD 370,000 for cold-storage facilities). Furthermore, the island-nation received 500,000 vaccine doses of the Covishield vaccine (the local name for the Astra-Zeneca vaccine) from the Government of India under its 'Neighbourhood First' policy (Al Jazeera, 2021). This donation can immunise approximately 1 per cent of the population. As such, the country's vaccination drive began with the use of the Covishield donation on 28 January 2021, starting with healthcare workers and military personnel who make up just over 1 per cent of the country's populace (Table 3). It should be noted that GoSL has not made the NVDP public and several ad-hoc policy changes have been announced periodically with regards to its stated vaccination strategy.

For instance, as of 14 February 2021, Sri Lanka had provided first doses of the vaccine to 189,394 healthcare and military frontline workers. Since this initial phase of the vaccination drive, the government has amended its previously stated strategy and has now prioritised providing as many citizens with a first dose. As such, since early February 2021, second doses for frontline workers have been reallocated towards vaccinating individuals between 30-60 years who are deemed to be residing in vulnerable areas or considered to be among 'vulnerable groups'. Moreover, Sri Lanka has made a purchasing order for 10 million Covishield doses from the Serum Institute of India, and another three million AstraZeneca doses directly from the UK. The initial batch of doses through these procurements are expected to arrive by mid-March. Concurrently, the Chinese government has pledged to donate 300,000 doses of the Sinopharm vaccine and negotiations are also taking place with Russia and China to procure doses of the Sputnik V and Sinopharm vaccines.

In a recent cabinet decision, it was announced that via a combination of the above sources, adequate doses will be secured to vaccinate 14 million people in the country - which accounts for around 60 per cent of the population. However, it remains unknown as to whether vaccine suppliers will be able to deliver on their targetted supplies of doses in the numbers promised, to governments around the world, including to Sri Lanka, in time to provide both first and second doses over 2021.

Table 3: Priority Groups to Receive COVID-19 Vaccination in Sri Lanka - January 2021

Target Group	Number	% of Population
Frontline healthcare workers	155,000	0.7
Military personnel	127,500	0.6
Persons age>60 with NCDs	3,159,800	15.0
Selected persons age 55-59	1,178,154	5.6
Total	4,620,454	22.0

Source: Authors' calculations via Ministry of Health - Sri Lanka.

Note: A formal priority list has not been published by the authorities, and the vaccine drive has begun with significant deviations to this initially announced list; NCDs=Non-communicable diseases.

Moreover, as noted earlier, the exact number of citizens that need to be vaccinated to achieve herd immunity is unclear. However, given that Sri Lanka has a relatively larger ageing population where those over 65 years account for 12 per cent of the population and cognizant of population density in urban areas and new variants of the virus, the proportion is likely to be somewhat higher. Considering these factors, this study primarily assesses the fiscal implications of vaccinating 80 per cent of the population and also discusses the cost of meeting the minimum 60 per cent threshold the government has already committed to vaccinate by the end of the year.

3. Overview of Vaccination Programmes and Vaccine Cost Data

3.1 Background to Sri Lanka's Vaccination Programmes

Sri Lanka has a well-established National Immunization Programme (NIP), which is implemented through the Epidemiology Unit (EU) of the Ministry of Health. The programme is guided by the National Immunization Policy (2014), and complemented by the Immunization Handbook (2012) and the National Guidelines on Immunization Safety Surveillance (2016). The available infrastructure for vaccine storage can broadly be categorised from the Central Level, to the Provincial Level, District Level, and subsequently, the Divisional Level. At the central level, the EU controls the country's main cold stores and has created 26 walk-in cold rooms at the district level, 80 Ice-Lined Refrigerators (ILRs) at government healthcare institutions, and 345 ILRs at the divisional level.

Notably, under this programme, vaccines are provided free of charge to the public. In the recent past, barring some exemptions, as noted in Table 4 below, funding for the NIP is almost exclusively generated by the government, with private sector funding accounting for less than 5 per cent of the total budget for immunisation services. The notable exemptions are with regards to the Hepatitis B vaccine (2004-07), Pentavalent Vaccine (2008-2014), and IPV (2015-2018), which were funded by GAVI. Sri Lanka has self-procured all its vaccines since 1995 and the budgetary allocations for the programme are made through a dedicated budget line for vaccine procurement (Ministry of Health - Sri Lanka, 2014).

Even though the COVID-19 vaccination initiative in Sri Lanka will use existing infrastructure, funding, procurement, and the deployment of the vaccine will take place outside the remit of the existing NIP. The only prior instance where such a measure was required was during the H1N1 pandemic in 2010, when GoSL created a "Deployment Plan for the Distribution of Pandemic Influenza Vaccine in Sri Lanka". As discussed below, similar to the COVID-19 vaccination initiative, this deployment plan was created to procure a stock of H1N1 vaccines donated by the WHO, to protect the most vulnerable risk groups from the pandemic. The procurement was aimed at (in order of preference), frontline healthcare workers and support staff, pregnant women, and if more stocks are available, individuals with at least one comorbidity that poses the risk of complications of the pandemic influenza. The first two groups account for 575,000 doses of vaccines, while the inclusion of all individuals in the third group increased the requirement to 3,400,000 doses. However, the WHO donation included 1,925,000 doses.

Based on prior experience with mass immunisation campaigns in Sri Lanka, the deployment plan estimated that all vaccines will be deployed to the relevant centres within seven days. The total budget required for the initiative to be deployed was USD 4,223,400 and 66 per cent of the budget was covered by the government, while the remainder was expected to be covered

Table 4:

Funding for Vaccines in Sri Lanka Since 1978

1978	1990	1995	2003-07	2008-15	2016
All EPI vaccines were donated by UNICEF	GoSL started financing vaccinations with a gradual increase	EPI vaccines were fully funded by GoSL	All EPI vaccines except the Hepatitis B vaccine was funded by GoSL	All EPI vaccines except the Pentavalent Vaccine was funded by GoSL	All EPI vaccines except IPV funded by GoSL
			Hepatitis B provided as a donation under GAVI Phase I	Pentavalent Vaccine was co-financed by GoSL and GAVI	GAVI support under polio end game scheme

Source: Gamage, D. (2017). "National Immunization Programme of Sri Lanka". Merieux Foundation. Lyon, France.

through external funding sources (Ministry of Health - Sri Lanka, 2010). This approach demonstrates that a large scale vaccination effort can be managed with government funding without undertakinga significant fiscal burden. Although, as noted before, the coverage of this initiative was much smaller (approximately 20 per cent of the population) compared to the coverage required for the COVID-19 vaccine.

3.1 Background to Sri Lanka's Vaccination Programmes

The Immunization Costing Action Network (ICAN) collates the most comprehensive database on global immunization delivery costs (IDC). ICAN's definition of IDCs refers to costs associated with delivering immunisations to target populations, exclusive of vaccine costs. Delivery costs may include any or all of the following cost categories: paid/volunteer human resources; per diem and travel allowances; cold chain equipment and their overheads (e.g. energy, maintenance, repairs); vehicles, transport, and fuel programme management; training and capacity building; social mobilisation and advocacy; adverse event following immunisation (AEFI) and disease surveillance; buildings, utilities, other overhead and shared costs; vaccine supplies (e.g. safety boxes, diluents, reconstitution syringes); waste management; other supplies and recurrent costs; and other non-vaccine costs (ThinkWell, 2020).

As lower-middle income countries (LMICs) drive toward achieving high and equitable coverage of life-saving vaccines and largely transition from donor to self-funded immunisation programmes, the availability of predictable financing for vaccine delivery is essential. Realistic and reliable IDC evidence available at the right time and in the right format would help countries better advocate, plan, budget, and make programmatic decisions (ThinkWell, 2020). This need is particularly heightened during the COVID-19 pandemic, as governments across the world scramble to budget for and deploy COVID-19 vaccinations, at a far larger/speedier pace of roll-out than seen before in other vaccination campaigns.

However, a systemic review of IDC data from their Immunization Delivery Cost Catalogue (IDCC) shows that there is no IDC data from the overwhelming majority of LMICs (100 countries that account for 73 per cent of the database). Evidence is limited from all regions other than Sub-Saharan Africa and East Asia and the Pacific. Furthermore, when considering country income level, the greatest need for cost data is from middle-income countries (such as Sri Lanka). In addition, limited data exist on the cost of delivery at private and NGO facilities and on the incremental costs of introducing vaccines (other than the HPV, PCV, and Rotavirus vaccines).

Furthermore, clearer reporting on costing methodologies is required (ThinkWell, 2020). Some of the variation shown in IDC databases, such as IDCC, may be more reflective of differences in methods and/or reporting rather than of actual cost differences. For this reason, using regional averages as proxies for specific country contexts can be problematic. However, due to the scale and urgency of the COVID-19 vaccination programme that is ongoing in 2021, new data is emerging on a rolling basis to estimate these costs at regional level.

4. Estimating Sri Lanka's Vaccination Cost: Data and Methodology

4.1 Costing Exercise

This study conducts an approximate cost estimation for distributing the COVID-19 vaccine in Sri Lanka. The study works with the assumption that 20 per cent of the population will be vaccinated through a combination of COVAX procured vaccines, vaccine grants and grant funding. Accordingly, the cost of self-financing Sri Lanka's vaccination strategy in the short-term and the long-term is estimated as follows: (i) vaccinating 40 per cent of the population to reach a 60 per cent coverage target - which is an intermediate target stated by the GoSL and (ii) the cost of vaccinating 60 per cent of the population to reach an 80 per cent coverage target- the long-term target required to reach herd immunity.

The study also works with the assumption that Oxford's AstraZeneca vaccine will be used to vaccinate the remaining 60 per cent. As discussed in Section 2, this is the most feasible vaccine to suit Sri Lanka's situation, in terms of standard storage requirements and low cost. Further, Oxford's AstraZeneca was the only vaccine to be distributed by the GoSL, as of mid-March 2021.

While the per dose costs of approved COVID-19 vaccines are publicly available, IDC data is still developing due to the novelty of these vaccines and their roll-out. IDC costs refer to all other costs incurred for vaccine deployment other than the cost of the vaccine - such as human resources, supply chain logistics, organisation and management, training etc. IDC data for regular immunisations is also not easily available for developing countries as highlighted in Section 3. For instance, in Sri Lanka, publicly available official data on IDCs for COVID-19 vaccine deployment are not yet available. However, fresh COVID-19 specific regional data is appearing as the global vaccine roll-out progresses in 2021, and these costs become better known. As such, the study uses a combination of available domestic proxy data and regional COVID-19 specific data to arrive at a cost estimate range for Sri Lanka's vaccination strategy.

First, the study uses data from the country's previous immunisation campaigns as proxies for delivery costs. The 'Deployment Plan for the Distribution of Pandemic Influenza Vaccine in Sri Lanka 2010' report by the EU of the Ministry of Health, Sri Lanka, provides cost estimates covering a similar vaccination campaign against the H1N1 influenza pandemic that took place in 2010. Further, the H1N1 vaccine is another SARS vaccine variant with similar delivery requirements as the AstraZeneca vaccine, so it works as the best available proxy for delivery cost estimates. The cost estimates for the year 2010 that are available in this document are converted to reflect current values for 2021. The analysis also draws from very recent (and still developing) data from the World Bank on per person COVID-19 vaccine deployment costs for the South Asian region, which can be used to arrive at a cost estimate range for Sri Lanka, given that the calculated estimate using domestic proxy data is likely to be an underestimate.

4.2 Assessing the Fiscal Implications of Vaccinating Sri Lanka

The above findings will be used to assess the fiscal implications of distributing the COVID-19 vaccine to 80 per cent of the Sri Lankan population, including to non-priority groups that account for approximately 60 per cent of the population. The findings will be assessed against Sri Lanka's already weak economic position, which has been further exacerbated by the pandemic. Before the pandemic, the country suffered from persistently low growth averaging at 3 per cent, which has worsened post-pandemic, resulting in the economy contracting by 3.6 per cent in 2020. Furthermore, Sri Lanka's fiscal position is weak, with slow government tax revenue generation at 9.5 per cent of GDP, a high public debt burden of 95 per cent of GDP and large fiscal deficits of near 8 per cent of GDP in 2020 (GoSL, 2020).

First, an assessment will be made about the fiscal options available for financing 40-60 per cent of the vaccination strategy. Against the fiscal background outlined above, budgetary provisions have not been made for COVID-19 vaccine deployment in Sri Lanka's 2021 budget. As such, the fiscal implications of potentially redirecting budget spend for this purpose and the associated trade-offs will be analysed, along with exploring options for generating additional government tax revenue, so that the GoSL can better prepare its fiscal space for reaching a long-term target of vaccinating 80 per cent of its population against COVID-19.

Second, an economic impact analysis will be conducted using the Department of Census and Statistics (DCS) impact analysis tool, which employs the latest Input-Output (IO) tables for Sri Lanka. The tool employs the national I-O table for the year 2010, the latest available for Sri Lanka. However, these tables can be used for analysis in the current year since the country has not experienced any major structural shifts since 2010. The national I-O table (competitive model) classifies goods into 127 sectors, where the sector of interest for this analysis is the 'human health and social work activities' sector, on which shocks will be applied under different financing scenarios. The results of these simulations will be used to justify different self-financing options that are available. The cost estimation conducted as per Section 4.1 will be imposed as shocks to the health sector to determine the impact of the vaccination strategy on national output and employment under different scenarios.

5. Analysis

5.1 Costing

As outlined in Section 4, the study provides approximate cost estimates for COVID-19 vaccine deployment in Sri Lanka to reach different coverage targets, by using both domestic and regional data.

First, a costing exercise using domestic data is conducted, using proxy data for immunisation delivery costs (IDCs); i.e. all ancillary costs that much be incurred for vaccine deployment, exclusive of the vaccine cost. As outlined in the methodology section, official domestic data on COVID-19 specific delivery costs have not yet been made publicly available. However, the cost of the AstraZeneca vaccine for the two required doses per person is available and is COVID-19 specific, and this accounts for the bulk of the total cost.

As shown in Table 5, for GoSL to self-finance vaccinations for 40 per cent of the population, to reach their stated intermediate target of 60 per cent coverage (with 20 per cent covered by COVAX) the total vaccine deployment cost amounts to USD 92.9 million for full immunisation (two doses per person). In order to extend this to reach an 80 per cent coverage target by self-financing vaccines for 60 per cent of the population, the cost amounts to USD 139.1 million. (Table 5). The latter option is a more desired target to reach herd immunity, as discussed in previous sections.

The IDCs in Table 5 have been estimated based on the 'Deployment Plan for the Distribution of Pandemic Influenza Vaccine in Sri Lanka 2010' (Ministry of Health - Sri Lanka, 2010), which was a similar emergency pandemic vaccine deployment context to the current COVID-19 context. The key difference is that previously, the pandemic wasn't as widespread and these costs had been estimated based on deploying vaccines for a smaller target population consisting of two groups - healthcare workers and pregnant women. Hence, the estimates are likely to underestimate the costs of immunising a broader group of people. Further, given difficulties in securing all necessary vaccines from a single producer (e.g. AstraZeneca) due to supply shortages, Sri Lanka will likely be required to procure a proportion of its vaccine requirements from other suppliers (e.g. Sputnik V, Sinopharm), which are more expensive than AstraZeneca, and therefore this will increase the costs involved. Furthermore, disaggregated data is not available to adjust IDCs for different coverage scenarios; as such, average proxy data is used for both scenarios. Hence, these estimates should be considered an approximation of the costs involved, given that they are based on proxy data and a rapidly evolving pandemic scenario, where factors determining parameters and assumptions are subject to change on a daily basis.

Table 5: Cost of Self- Financing Vaccine Deployment

Type of Cost	Cost Item	Cost to Cover 40% (USD)	Cost to Cover 60% (USD)
Vaccine cost	Two doses of AstraZeneca	92,400,000	138,600,000
Immunization delivery costs (IDCs)	Management and Organization of Vaccine Deployment	8,337	8,337
	Communication and Information	176,261	176,261
	Human Resources	100,040	100,040
	Public Information	144,701	144,701
	Supply Chain Logistics	88,845	88,845
	Collection and Disposal of Medical Waste	n/a	n/a
Total Vaccine Deployment Cost		92,918,984	139,118,184
% of Total Government Expenditure in 2020		0.4	0.6

Source: Ministry of Healthcare and Nutrition (2010) 'Deployment Plan for the Distribution of Pandemic Influenza Vaccine in Sri Lanka 2010'.

Note: Adjusted for inflation and reported at 2021 prices. The cost per dose of AstraZeneca is taken to be USD 5.25, which is the per dose vaccine and airfare cost for Sri Lanka.

The IDCs shown in Table 5 account for the following:

Management and Organisation: Management and organisation of vaccine deployment refer to management costs incurred by the EU of the Ministry of Health, eight provincial health ministries and 25 district level managers responsible for immunisation.

Communication and Information: Costs are estimated by taking into account the procedures for the flow of information that will occur between the central agency (i.e. the EU) and the district focal points. District focal points are expected to maintain information flow with vaccination centres (curative and preventive institutions). Exchange of information and communication at these two tiers are two-way processes. This information collected by the regional epidemiologists (REs) from vaccination centres at the district level is to be consolidated and fed back to the central focal point.

Human Resources: This cost is estimated on the assumption that additional human resources are not required to be deployed and the existing capacity of curative and preventive health institutions will suffice. The costing covers vaccine-specific training for 26 REs who should then train the respective medical officers in institutions in their areas.

Public Information: A proper communication strategy is required to inform the publicon vaccination target groups and benefits of the vaccine during a pandemic. In the current context, this will likely be led by the Health Promotion Bureau, which has been the focal institution for public communication of COVID-19 related information over the past year.

Supply Chain Logistics: Cost is estimated on the assumption that the EUs existing cold storage capacity is adequate.

Based on the above parameters for estimating delivery costs, it is likely that management, communication and information costs would remain largely the same. However, human resource costs and supply chain logistic costs are likely to be underestimated. In the above data, human resource costs are estimated on the assumption that Sri Lanka already has the human resource capacity for a 7-day deployment and that the EUs existing cold storage capacity is adequate. As such, any additional resource requirements would depend on a number of (still unknown) factors, such as the availability of vaccines, the pace of roll-out, vaccine uptake by the public, etc. Further, COVID-19 specific additional costs such as the cost of Personal Protective Equipment (PPE) kits for health workers, costs incurred by local municipal councils for vaccine sites, etc., would need to be additionally budgeted. As such, the estimated total cost of USD 140 million (approximately LKR 27 billion) for financing vaccine deployment to 60 per cent of the population, should be considered a minimum estimate.

Another area to consider is the incremental financial cost that might be incurred for any COVID- related modifications to routine immunisations. The ICAN estimates that for lower-middle income countries, when considering additional costs of PPE and training/social mobilisation, the per-facility cost represents a 3-14 per cent increase from baseline delivery costs, depending on the intensity of programme modifications. When including the additional labour cost of crowd controller/ intake screening personnel, the cost increases to 23-53 per cent of baseline delivery costs. When adding in the additional cost of hazard pay for health workers, this would translate to an approximately 36-94 per cent increase over baseline delivery costs (Immunization Costing Action Network (ICAN), 2020). Assuming a midpoint increase of 50 per cent of baseline delivery costs as shown in Table 5, this translates to an approximately USD 1 million increase in the total vaccine deployment cost.

Second, the study employs very new secondary data on regional averages that have been estimated for COVID-19 vaccine deployment costs. As discussed in previous sections, regional data has its limitations, but provides an additional source of information to arrive at a cost estimate range for Sri Lanka, using both domestic and regional data.

In a forthcoming study by the World Bank, the authors estimate that for the South Asian region, the per person vaccination cost amounts to approximately USD 12, in order to receive one dose of the COVID-19 vaccine. This estimate includes the full vaccine deployment cost per person, which includes the dosage cost along with international airfare and other delivery costs. Using this costing, financing two doses of the vaccine for 60 per cent of Sri Lanka's population would amount to USD 336 million. This is over double the minimum estimate made earlier using local proxy data. However, it should be noted that this costing is based on regional averages and not necessarily for the AstraZeneca vaccine. As such, a range of USD 140-336 million (LKR 27-66 billion) can be treated as a minimum and maximum estimate range for financing the long-term vaccination strategy in Sri Lanka, where 60 per cent is self-financed and 20 per cent is received through donations, to reach a coverage target of 80 per cent.

5.2 Fiscal Implications

5.2.1 Options to Finance Vaccination Strategy

Sri Lanka's fiscal position and macroeconomic fundamentals influence the efficacy and availability of options to finance the vaccination strategy to cover the

required populace not serviced through the COVAX procurement and other vaccine donations. However, the total expected expense of vaccinating the population accounts for a relatively small proportion of the country's total government expenditure. Even the cost estimate range of LKR 27-66 billion accounts for a range between 0.6 per cent and 1.4 per cent of total government expenditure for 2020. That said, the estimated costs range between 12-29.5 per cent of the total expenditure of the Ministry of Health for 2021. Notably, however, the government did not allocate any specific resources towards the vaccination strategy in the 2021 budget.

Within this landscape and cognizant of potential supply shortages, the GoSL has three likely means of financing its efforts to vaccinate the Sri Lankan public: (a) Reallocate existing budgetary commitments from other health sector activities or other sectors; (b) increase tax revenue in order to fund the initiative; and (c) receive multilateral and/or bilateral assistance through aid, grants, vaccine donations, etc. A combination of these options is most likely to be deployed. This section briefly outlines available options and assess their suitability for Sri Lanka.

(a) Reallocating Budgetary Commitments

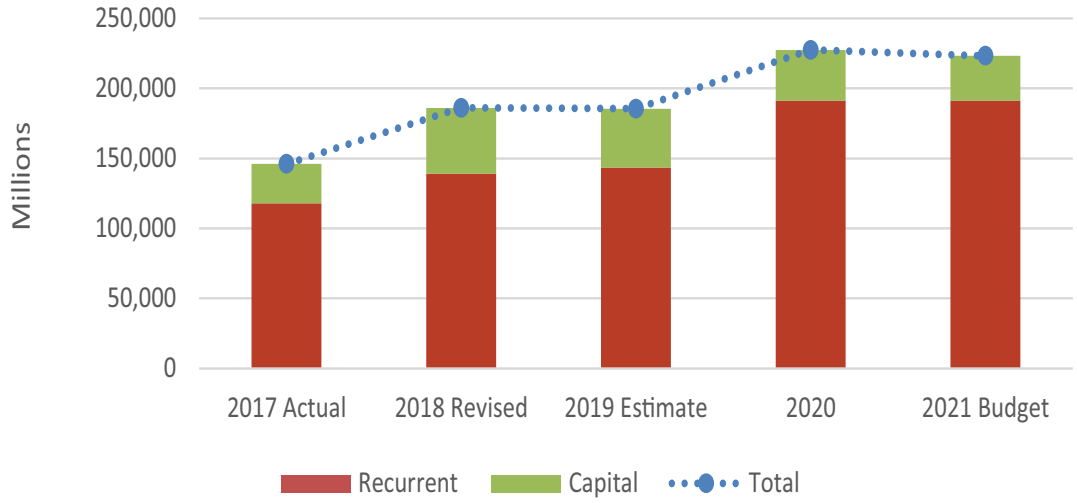
As outlined previously, 20 per cent of the population will be vaccinated through the COVAX facility and the ancillary costs will be covered by a grant through the ADB worth USD 5 million and a grant to develop cold storage facilities worth USD 380,000 from GAVI. The total cost of vaccinating the remaining 60 per cent of the total population based on local proxy data as calculated in Table 5, is USD 139.1 million or approximately LKR 27 billion. This cost approximates 12 per cent of the total expenditure dedicated to the Ministry of Health through Sri Lanka's National Budget 2021 (GoSL, 2020). Notably, the budget proposal does not include a dedicated budgetary allocation for a COVID-19 vaccination plan. Further, as illustrated in Figure 2, the budgetary allocation to the health sector in 2021 was in fact lower than that of the previous year, despite higher fiscal stresses faced by the sector in a pandemic setting.

Moreover, the vaccine will largely be made available to the public for free, with a negligible proportion potentially accessing it through private health care service providers at a cost. Therefore, the government will be required to finance the plan through an emergency budgetary allocation, similar to its efforts when deploying the H1N1 vaccine strategy, or depend exclusively on external funding (e.g. grants, donations, loans, etc.).

To accommodate this, the GOSL could potentially reallocate some funding allocated for other sectors or even reallocate funds within the health sector. These reallocations could likely occur through built-in fiscal space for public investments in the government's budget, postponements or revisions to non-essential government spending initiatives such as non-essential small-scale infrastructure projects. However, the extent to which such revisions could be incorporated is significantly limited by the economic conditions under which this vaccination initiative is taking place. Some of these small-scale infrastructure projects, for instance, are geared towards stimulating a stagnant rural economy.

Sri Lanka's economic recovery is greatly dependent on adequate government spending to stimulate growth following its contraction in 2020 due to lockdowns and other COVID-19 related impacts. Therefore, there has already been a significant amount of spending rationalisation that has taken place when making

Figure 2: Budgetary Allocations to Health Sector 2017-2021



Source: GoSL (2020), Budget Estimates 2021.

budgetary allocations. Furthermore,the government will be required to ensure that the broader public health sector is not compromised in any form simply to fund the COVID-19 vaccination initiative as that may have further severe long-term repercussions. The WHO's interim guidance document on Developing a National Deployment and Vaccination Plan for COVID-19 Vaccines states that it is essential that the budget for COVID-19 vaccines does not replace budgets of other essential health services, including the routine immunisation budget (WHO, 2020). As such, the scope for reallocations is likely to be limited.

Moreover, given vaccine supply shortages, it is likely that the vaccination drive will be completed in 2022. Therefore, expenditure allocations can be distributed across both years, reducing the proportion of finances that need to be reallocated. In such a scenario, the government can focus on self-financing to cover 40 per cent of the population in 2021 and subsequently self-financing the next 20 per cent of the population in 2022, in order to achieve the total of vaccinating 80 per cent of the population alongside the COVAX facility and other donations.

Alongside budgetary reallocations, certain segments of the country's private sector have proposed to cover the cost of vaccines for employees in their respective sectors. For example, Sri Lanka's apparel sector has notably proposed to sponsor the procurement of vaccines for all those employed in the industry, which would cover approximately 350,000 individuals (Economynext, 2021). The sector has been affected severely in recent months with regular lockdowns of factories due to COVID-19 cases. The proposal is seen as a means of expediting a return to normalcy and reducing economic costs, since vaccination is seen to be more cost-effective than continuous testing and lockdowns. Such a measure would reduce the fiscal burden on the government even further; however, the government is yet to agree to this proposal.

(b) Targetted Tax Policy Interventions

Another option to finance the COVID-19 vaccination initiative is to generate additional government revenue through taxation in order to cover a portion of the expenses. This revenue generation, however, will likely occur through an increase in indirect taxation on luxury goods and sin-taxes rather than any major direct tax revision, as the current government has indicated that tax policy will remain unchanged in the coming years (GoSL, 2020).

A tax rationalisation on luxury goods and a sin-tax rationalisation on alcohol and cigarettes could generate a significant amount of revenue that could be directed towards the vaccination effort. For instance, a recent study by the Institute of Policy Studies of Sri Lanka (IPS) estimated that government revenue could be increased by LKR 17 billion by 2021, and LKR 37 billion by 2023, if taxes on cigarettes are streamlined and raised in line with inflation (Arunatilake, Weerasekera, & Thilanka, 2020). This revenue is sufficient to finance the vaccination strategy such that it reaches the midpoint of the study's cost estimation range of LKR 20-67 billion. A targetted tax intervention, as discussed here, therefore, achieves the dual aim of raising the required funds to vaccinate the public while simultaneously reducing the tobacco/alcohol-related health cost burden borne by the government.

(c) Receive Multilateral and/or Bilateral Assistance

Sri Lanka is likely to rely on bilateral and multilateral assistance to some extent with regards to accessing adequate vaccines as well as accessing the required finance. As noted earlier, Sri Lanka is already a beneficiary of the WHO COVAX facility, India's Covishield vaccine donation, and has also received grants from the ADB and GAVI. The country could potentially benefit from a similar initiative from the government of China. In addition to direct vaccine assistance, Sri Lanka could further attempt to engage with bilateral and multilateral development partners (e.g. ABD, World Bank etc.) to secure some form of financial aid focussed towards the vaccination initiative. However, it is important to note that as a middle-income economy transitioning to upper-middle-income status, Sri Lanka's access to financial assistance is relatively limited as more initiatives are targetted at low-income economies. Having said that, the option of negotiating for debt relief in order to create more fiscal space to finance vaccinations is one that is worth exploring.

In the event that the government is reluctant to fully cover the costs of the vaccination drive through budgetary reallocations or targetted tax initiatives. and in the absence of adequate complementary donations and aid, Sri Lanka is likely to fund the balance through future borrowings. Even though this would add to the country's existing debt burden, on balance,the short and medium-term economic and public health benefits generated through an effective vaccination drive will rationalise such an undertaking. Moreover, the debt undertaking in such an instance will be very marginal compared to the country's overall debt obligations. For instance, if the median financing cost of the range calculated in the previous section were to be funded through future borrowings, the cost amounts to approximately 5 per cent of Sri Lanka's total debt repayment obligation for 2022.

5.2.2 Impact of Vaccination Strategy on National Economy

Apart from the health benefits of vaccination coverage, there is a potential economic benefit, which can be used to justify a self-financing vaccination strategy; either by redirecting government budget or by raising tax revenue, as discussed in the previous section. This section demonstrates an I-O table based economic impact analysis of vaccination deployment, where a positive shock to the health sector is simulated under different scenarios.

Scenario1: Self-financed through Targetted Budgetary Reallocation

The objective of this simulation is to demonstrate the economywide effects that take place if budgetary allocations are redirected to the health sector, from other sectors, in order to finance the vaccination strategy. For simplicity, we assume that the domestic estimate of LKR 27 billion to vaccinate 60 per cent of the population, is redirected from the construction sector towards the health sector. In the I-O analysis, this is simulated as a negative shock from the construction sector, which is re-injected as a positive shock to the health sector. The results are shown in Table 6 below.

The impact on the economy under this scenario is largely negative. The economy will lose LKR 14.4 billion in national output and experience 3,339 job losses. However, the economy will experience an extra value addition of LKR 3 billion and an additional household income of LKR 17.2 billion. Furthermore, the capital stock will decline by LKR 35 billion, due to pulling out money from the construction sector.

Ideally, budget reallocations should be made from sectors with low output multipliers to minimise the negative impact on the economy. That is, sectors with low output multipliers have a lower multiplicative effect on other sectors and on the economy as a whole. Based on national I-O tables, the construction sector has a relatively high output multiplier. Sectors with the lowest ranking output multipliers are the tobacco manufacturing sector and several agriculture-related sectors. Although budgetary allocations have not been made for the tobacco sector, the agriculture sector received the highest overall sectoral budget allocation in Budget 2021. However, it is not possible to simulate a potential redirection since several agriculture-related sub-sectors are present in the I-O format, which don't necessarily match/correlate with the budgetary allocation pattern for agriculture projects.

Scenario 2: Self-financed through Targetted Tax Revenue Generation

A positive injection/shock from implementing the COVID-19 vaccination strategy by raising funds through targetted tax revenue generation is applied and the impact on the economy is simulated. The value of the shock is the estimated minimum vaccination cost estimate of LKR 27 billion to finance vaccines for 60 per cent of the population, which amounts to 17 per cent of total health sector output. The results are shown in Table 7.

The impact on the economy from under this scenario is positive. It will generate an additional LKR 30.6 billion in national output, and an extra value addition of LKR 26 billion, where the impact will be concentrated in the

Table 6: I-O Impact Analysis for Scenario 1

	Initial Shock (LKR Mn)	Change in Output (LKR Mn)	Extra Employment Opportunities to be Generated (Number)	Extra Household Income from Compensation of Employees (LKR Mn)	Extra Value Addition Generated (LKR Mn)	Extra Demand for Imports (LKR Mn)	Extra fixed Capital Assets to Capital Stock (LKR Mn)
Agricultural Industries	-	(108.39)	(126)	(86.67)	(95.92)	12.25	(0.10)
Manufacturing Industries	(26,908.15)	(36,617.88)	(20,023)	(4,405.75)	(16,661.13)	(2,407.74)	(34,835.22)
Services	26,611.41	22,306.00	16,811	21,707.03	20,211.38	(60.45)	257.38
Total Economy	(296.74)	(14,420.27)	(3,339)	17,214.61	3,454.32	(2,455.94)	(34,577.94)

Source: Authors' calculations using DCS impact analysis tool.

Table 7: I-O Impact Analysis for Scenario 2

	Initial Shock (LKR Mn)	Change in Output (LKR Mn)	Extra Employment Opportunities to be Generated (Number)	Extra Household Income from Compensation of Employees (LKR Mn)	Extra Value Addition Generated (LKR Mn)	Extra Demand for Imports (LKR Mn)	Extra fixed Capital Assets to Capital Stock (LKR Mn)
Agricultural Industries	-	176.14	736	67.64	118.95	32.62	0.31
Manufacturing Industries	-	1,068.56	321	126.03	454.02	1,254.61	62.49
Services	27,394.10	29,322.99	21,474	23,268.43	25,287.51	58.83	1,426.92
Total Economy	27,394.10	30,567.68	22,530	23,462.09	25,860.48	1,346.06	1,489.72

Source: Authors' calculations using DCS impact analysis tool.

services sector. Spillover effects are seen in both agricultural and manufacturing sector output as well. The larger impact on manufacturing industries reflects the additional equipment manufacturing requirements that arise during a pandemic immunisation context. Furthermore, this positive shock has the potential to generate 22,530 jobs in the economy and to generate an additional household income of LKR 23.5 billion. A marginal positive increase in demand for imports and fixed capital additions to the capital stock is also generated.

However, due to the limitations of the I-O tool, the redistribution effects of tax increases are not captured. Tax increases can result in a reallocation of resources, which can in turn influence the impact of the tax revenue injection effect.

Moreover, the above analyses show that there is an economic rationale over and above the health rationale for the GoSL to invest in fully immunising the country against COVID-19 using a self-financing strategy. The I-O analysis demonstrates that raising tax revenue might be the financing option with least economic damage, in immunising a sizable proportion of Sri Lanka's population.

6. Conclusion and Recommendations

As discussed above, this study estimates the total cost of vaccinating 80 per cent of the Sri Lankan population and its fiscal implications. These implications are especially important with regards to vaccinating the 60 per cent of the population not covered through the COVAX facility and other complementary fiscal assistance measures.

The study details three possible options to finance the vaccination strategy: (i) reallocating existing budgetary commitments; (b) targetted tax interventions; and (c) external financing sources. Assessing these three potential strategies, this study recommends that the GoSL focusses on a medium-term self-financing strategy through targetted tax policy interventions while complementing these efforts with available external financing sources. As noted previously, these tax policy interventions are most likely to be successful if targetted towards luxury and sin-goods; these are quick-win revenue generation strategies, that can be implemented at no cost to the government, and in the case of sin goods, simultaneously reduces the tobacco/alcohol-related health cost burden to the government which can be redirected towards pandemic related health spending.

Even though Sri Lanka currently faces a challenging macroeconomic environment, the cost of vaccinating its population represents a small proportion of overall government costs. Therefore, self-financing the initiative is unlikely to create a significant burden whilst also accounting for the direct economic benefits demonstrated in Section 5.2.2, as well as the indirect benefits of a country that can expedite its return to a post-pandemic economy. That said, it is important for the government to be cognizant of the potential need to account for a continuous COVID-19 related vaccination cycle in the medium-term due to emerging variants and the need for vaccine boosters. Moreover, if supply disruptions and shortages create a necessity

to procure more expensive vaccine types, Sri Lanka may find self-financing options more challenging. For instance, India temporarily halted AstraZeneca vaccine exports in late March 2020, due to an unexpected surge in local cases. To account for all these factors, the government should form a clear medium-term fiscal strategy geared towards dealing with the long-term public health effects of the pandemic in order to reduce the potential for disruptions. These measures should be developed alongside macroeconomic reforms to create a more favourable fiscal space for the country.

It is important to note that a medium-term self-financing option does not require the government to secure all the funding required to vaccinate 80 per cent of the population immediately. As the WHO (2020) recommends the government would be best placed to approach its budgetary obligations in a phased manner, with an immediate focus on securing funding to vaccinate the first 20 per cent of the population and then stagger the remainder of the population sequentially in terms of reducing vulnerability over a 36-month budgetary cycle. The challenge for Sri Lanka, similar to many other developing economies, would be to secure adequate funding without compromising on its investments into broader public health and social welfare initiatives, as weaknesses on those fronts would undermine the success of vaccinating the public from COVID-19.

References

Al Jazeera. (2021, January 07). *India to Prioritise Sri Lanka when COVID Vaccine Ready for Export*. Retrieved Janaury 24, 2021, from Al Jazeera: https://www.aljazeera.com/news/2021/1/7/india-to-prioritise-sri-lanka-when-covid-vaccine-ready-for-export

American Lung Association. (2020, July 27). *From the Frontlines: Understanding Herd Immunity*. Retrieved Janaury 22, 2021, from American Lung Association: https://www.lung.org/blog/understanding-covid-herd-immunity

Arunatilake, N., Weerasekera, H., & Thilanka, C. (2020). *Elasticity Estimates for Cigarettes in Sri Lanka.* Colombo: IPS.

Central Bank of Sri Lanka. (2020). *Annual Report 2019.* Colombo: Central Bank of Sri Lanka.

CNBC. (2020, November 17). *Covid Vaccine Front-runners: How Much They Cost, Who's Bought Them and How They're Stored* . Retrieved March 14, 2021, from CNBC: https://www.cnbc.com/2020/11/17/covid-vaccines-how-much-they-cost-whos-bought-them-and-how-theyre-stored.html

Department of Census and Statistics. (2013). *Census of Population and Housing - 2012.* Colombo: Department of Census and Statistics, Sri Lanka.

Department of Census and Statistics. (2020). *Natinal Accounts Estimation of Sri Lanka.* Colombo: Department of Census and Statistics.

Economynext. (2021, February 08). *Sri Lanka Apparel Sector Ready to Pay for Worker Coronavirus Vaccines*. Retrieved February 08, 2021, from Economynext: https://economynext.com/sri-lanka-apparel-sector-ready-to-pay-for-worker-coronavirus-vaccines-78622/

Gamage, D. (2017). *National Immunization Program of Sri Lanka.* Lyon: Merieux Foundation.

Government of Sri Lanka. (2020). *Budget Estimates 2021.* Colombo: Government of Sri Lanka.

Health Promotion Bureau. (2021, January 25). *COVID-19 Dashboard*. Retrieved January 25, 2021, from Health Promotion Bureau - Ministry of Health: https://hpb.health.gov.lk/covid19-dashboard/

Hill, D. G. (2020). *From the Frontlines: Understanding Herd Immunity.* Chicago: American Lung Association.

Immunization Costing Action Network (ICAN). (2020, July). *Estimating the Additional Cost for Maintaining Facility-based Routine Immunization Programs in the Context of COVID-19.* Retrieved February 16, 2021, from Immunization Economics: http://immunizationeconomics.org/ican-home

Ministry of Health - Sri Lanka. (2010). *Deployment Plan for the Distribution of Pandemic Influenza Vaccine in Sri Lanka 2010.* Colombo: Government of Sri Lanka.

Ministry of Health - Sri Lanka. (2014). *National Immunization Policy.* Colombo: Government of Sri Lanka.

Ministry of Health and Nutrition. (2010). *Deployment Plan for the Distribution of Pandemic Influenza Vaccine in Sri Lanka 2010.* Colombo: Epidemiology Unit.

ThinkWell. (2020). *Immunization Delivery Costs in Low- and Middle-Income Countries.* Bill & Melinda Gates Foundation under the Immunization Costing Action Network.

White House. (2021). *The White House: Briefing Notes.* Washington D.C.: The White House.

World Health Organization. (2020). *Guidance on Developing a National Deployment and Vaccination Plan for COVID-19 Vaccines.* Geneva: World Health Organization.

World Health Organization. (2020). *Coronavirus Disease (COVID-19): Herd Immunity, Lockdowns and COVID-19.* Geneva: World Health Organization.

World Health Organization. (2021). *The COVAX Facility: Interim Distribution of Forecast.* Geneva: World Health Organization.

World Health Organization. (2021, February 15). *WHO Lists Two Additional COVID-19 Vaccines for Emergency Use and COVAX Roll-out*. Retrieved February 16, 2021, from World Health Organization: https://www.who.int/news/item/15-02-2021-who-lists-two-additional-covid-19-vaccines-for-emergency-use-and-covax-roll-out