

ASSESSMENT OF NATIONAL PCR TESTING CAPACITY REQUIREMENT

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Revised 6 April 2020, 2.30 p.m.

This estimates Sri Lanka's national requirements for PCR testing starting 1 May 2020.

SUMMARY

	Minimum level	Ideal level
Testing requirement		
Average daily tests	2,055	6,000
National capacity (tests/day)	4,000	9,000
High throughput machines	6	13
Cost		
Operational cost/month	Rs 321 million	Rs 936 million
Equipment purchases	Rs 492 million	Rs 1,066 million
Affordability of 12 month programme		
Rupee cost	Rs 4,340 million	Rs 12,302 million
US dollar cost	USD 23 million	USD 65 million
% of World Bank COVID loan (\$128m)	18%	51%
% of gain in tax revenues	2%	5%

Notes:

- (i) Capacity set at 200% and 150% of average testing rates since rapid testing times require decentralized network with most machines not working at full capacity. Also allows for equipment downtime and spare surge capacity.
- (ii) Equipment cost ignores any existing machines. Purchase cost is on basis of Roche machines (31 March 2020). Operational cost only considers Roche reagent costs which may be on high side, but excludes costs of sample collection, transport, time of laboratory staff and test reporting. These additional costs may increase cost estimates by 30%.
- (iii) Baseline tax revenues for 2020 based on IMF projections (Nov 2019). We conservatively assume that COVID will result in tax collection falling to 60% of this, but increasing to 70% if the testing programme is adopted.

GOALS OF NATIONAL COVID STRATEGY

1. Ensure local transmission of COVID-19 remains at near-zero levels with no community transmission.
2. Avoid national curfews or lockdowns after April 2020.
3. Normal functioning of schools and businesses after May 2020 regardless of global situation.
4. Re-opening of airport after May 2020 with adequate safeguards.

KEY ASSUMPTIONS

1. Current measures (airport closure, lockdown, social distancing) achieve zero transmission by 30th April, indicated by zero new cases in previous 14d.
2. Airport will increase arrivals consistent with the strategic goals, with an initial target of 30,000 arrivals/month, rising to 60,000 arrivals/month which would allow essential business travel, return of Sri Lankans living abroad, and some minimal tourism.
3. PCR testing will be complemented by IgG/IgM testing as appropriate.
4. Testing programme to last 12 months to April 2021, the minimum time required for vaccine to be available globally.

COVID CONTROL INTERVENTIONS

Includes all of the following interventions in combination:

1. Border controls to minimize imported cases at level that the other measures can safely handle without risking sustained community transmission.
2. Stepped-up tracing and testing of all direct and indirect contacts to reduce virus transmission.
3. Effective quarantine and isolation to handle all detected cases and exposed contacts.
4. PCR test-based surveillance of population to provide early warning of potential outbreaks.
5. Antibody (IgG/IgM) testing of specific groups where early detection is not the goal.
6. Measures to increase social distancing on permanent basis till pandemic is over.
7. Targeted school closures, internal *cordon sanitaires* and lock-downs kept in reserve to handle threatening outbreaks.

COVID TESTING PROGRAMME

*“ALL” means both public and private sectors.

1. PCR testing of all arrivals plus 14d quarantine. Arrivals to be restricted to capacity of system to test everyone. Restrictions incrementally relaxed to lift mandatory quarantine on “safe” arrivals and shifting to PCR testing of only “high risk” arrivals. Risk assessment of arrivals to be based on a combination of originating country, health screening results and other information.
2. PCR testing of all close contacts of new cases (including asymptomatic), and IgG/IgM testing of all non-close/secondary contacts.
3. PCR testing of ALL ICU admissions
4. PCR testing of ALL pneumonia/influenza admissions
5. PCR testing of ALL hospital deaths suspected to have infectious origin.
6. **EITHER** PCR testing of saliva of ALL outpatients with both fever and respiratory systems, **OR** of a systematic sample, e.g., designated surveillance sites or random sample (>20%) of relevant cases.
7. Doctors allowed to order PCR testing on basis of clinical suspicion on any case that does not fit the case criteria.
8. PCR testing/antibody testing of pneumonia clusters in community.
9. Two negative PCR tests on all recovered COVID patients before discharge

BASIS OF STRATEGY DESIGN

This strategy and testing programme outlined is informed by: (i) the approach of those countries which have proven strategies that prevent community transmission of COVID-19, i.e., Singapore, Hong Kong, Taiwan, Korea and China; and (ii) review of the latest epidemiological research. The COVID response in Singapore, Hong Kong, Taiwan and Korea benefits from their previous experience with SARS, and is informed in each case by extensive national research. In many cases, what they are doing differs from other countries and from advice of international agencies, but in each case they have solid evidence to back up their approach, and each week that passes validates their choices.

We think that the approach of these countries, in particular their strategic goal of achieving and maintaining zero local transmission, and not simply “flattening the curve” is the most appropriate for Sri Lanka, as we remain a country with limited community transmission. This strategy also offers the best environment for the Sri Lankan economy to survive in the next few months.

TESTING CALCULATIONS

1. Airport arrivals: 1,000/day increasing to 2,000/day
 - 1,000/day consistent with 1–2 daily flights each from Europe, China, other East Asia and Singapore. 2,000/day allows limited tourist inflows from select low-risk countries, such as China, Singapore, etc., subject to other policies being in place.
 - Initially, PCR test and 14d quarantine of all arrivals. Relax incrementally during Jun-Dec lifting the 14d quarantine and mandatory testing for asymptomatic cases from low risk countries.
2. Contact tracing of immediate contacts: 100/day–1,000/day
 - Epidemiology Unit reports ~20 close contacts per case till end-March.
 - Assume rate of 5 new cases/day as the safe level before tighter restrictions kick in.
3. ICU admissions: 100/day
 - Historical data indicate 40,000 ICU admissions/year in public sector. Assume another 5,000 in private sector.
 - Assume modest reduction owing to cutting non-essential surgery and decrease in road traffic accidents owing to social distancing.
4. All pneumonia/influenza admissions: 100/day
 - MOH reported 29,423 public sector admissions for pneumonia/influenza in 2017. Projecting to 2020 and adjusting for private sector gives 36,000 admissions in 2020.
 - Influenza admissions will fall in 2020 because of social distancing, but they accounted for only 12% of these admissions in 2017.
5. All hospital deaths with possible infectious cause: 30/day
 - ~43,000 hospital deaths/year (Ministry of Health, 2016). 26% of these were of infectious origin.
6. PCR surveillance of outpatients with fever/respiratory symptoms: 550–3,300/day
 - ~100 million outpatient visits/year. Of adult OPD visits: 0.2% had fever AND respiratory symptoms; 6% had fever OR respiratory symptoms (SLHAS 2019 estimate).
 - Assume all patients with narrower criteria, and 20% sampling with wider criteria.
 - Criteria may be adjusted to allow for different symptom combinations.
7. PCR testing on clinical discretion: 100–200/day
8. Pneumonia clusters in community: 25/day
 - ~70 pneumonia hospital admissions/day. Other pneumonias treated in community. Assume only one third of all pneumonias occur in clusters.
9. PCR testing to discharge COVID patients: 13–125/day
 - All patients require two negative tests before discharge, and assume average is 2.5 tests/admission
 - Assume “safe” level of new cases is 5/day (assuming higher case detection rate than now)
 - Assume peak rate of new cases is 50, since lockdowns will kick in before then.

COST CALCULATIONS

- (i) We use data available to us on the Roche Cobas 6800 analyzer for the initial estimate. We assume the machines are scrapped at end of 12 months – unit costs will be lower if they are used beyond this.
- (ii) We estimate that the per test cost is ~Rs 6,700 if the machine is used at 50% capacity and assuming the purchase cost is amortized over 12 months.

Discussion

Test unit costs are dominated by the reagent cost in a high volume scenario. The per test reagent cost may be three times higher in the Roche machine than in some of the smaller machines available

in Sri Lanka – this needs to be clarified. However, a large scale testing program will need high throughput machines linked to a laboratory management system (LMS) for automated reporting. This will minimize costs of lab staff time, minimize infection risk in lab staff, and importantly minimize reporting times. Larger machines will also reduce cost of constructing suitable biohazard facilities, since testing can be centralized in fewer sites.

We do not include any costs for sample collection, transport and reporting, lab staff time or PPE requirements, so Rs 6,700 is a reasonable first estimate of the operational cost per test. A LMS software package will be needed, but a simple system for COVID machine use with necessary barcode accessories can probably be purchased for less than Rs 100 million – currently MRI does not have barcoding facilities or a LMS. Adding these costs may increase the overall cost estimates by 30%.