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GD LABS: SCALING SWAB TESTING DURING COVID-19

> Keeping the focus on "Test, Track and Treat" strategy, India has tested nearly 3.7 crore cumulative COVID-19 samples so far. . . . With 9,25,383 tests conducted in the last 24 hours, the Tests per Million have seen a sharp rise to 26,685.
>
> Ministry of Health and Family Welfare, Government of India (August 25, 2020)[1]

On September 2, 2020, Naresh Ahuja was considering the challenging task awaiting him as a senior consultant with Gangadhar Diagnostics & Laboratories Pvt. Ltd. (GD Labs), a leading pathological laboratory (lab) in Raipur, Chhattisgarh, India. Ahuja was appointed as an officer on special duty by the Chhattisgarh state government. His task was to devise a strategy for the optimal allocation of COVID-19 swabs with saliva samples to the testing labs across the state. Ahuja sat down in his chair and thought about the pressing challenges posed by the spread of the COVID-19 virus and the ensuing pandemic, which posed significant issues for the allocation of testing swabs to the labs. He formed a team to accomplish this task and decided to roll out a pilot study based on the data gathered from six testing labs within two districts.

COVID-19 TESTING SCENARIO IN INDIA

By September 4, 2020, the COVID-19 pandemic had registered over 26 million cases and the death of one million people across 220 countries around the world.[2] With the United States leading in the number of cases, followed by India, a major threat of transmission had been detected in the globalized world. The global movement of people was identified as a key reason for the spread of the virus, which led to unpredictable lockdowns across all countries. Alongside preventive measures and protocols such as face masks and social distancing, mass testing using swabs proved to be a crucial strategy for the timely identification of virus cases. This enabled prompt isolation and effective treatment of infected people to break the chain of transmission and limit the spread of infection.

[1] "Following 'TEST, TRACK, TREAT' Strategy, India Tests Nearly 3.7 Crore Rising Tests per Million (TPM) Touch 26,685," press release, Ministry of Health and Family Welfare, Government of India, August 25, 2020, https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1648431.

[2] World Health Organization, *Weekly Operational Update on COVID-19*, Health Emergencies Programme, September 4, 2020, https://www.who.int/publications/m/item/weekly-update-on-covid-19---4-september-2020.

Severely affected countries such as India devised plans to curb the spread of the virus, after lockdowns were mandated, by testing as many individuals as possible (see Exhibit 1). With the news that various potential COVID-19 vaccines were in the clinical trial stage, the sub-optimal allocation of testing capacities at the labs had proved to be a pressing operational problem that warranted immediate attention. On average, more than 13,000 swabs were being tested each day in early September 2020 in the eastern Indian state of Chhattisgarh.[3]

SWAB COLLECTION, LOGISTICS, AND TESTING OPERATIONS

Ahuja formed a team comprising a data analyst named Jeevan Joseph and a microbiologist named Lalita Chandan to oversee the execution of the pilot study. He then created a schematic diagram to track the movements of testing swabs across various labs in a particular district (see Exhibit 2). The team became engrossed in studying the data provided by the state government to understand the number of swabs with saliva samples collected and the location of testing labs across two districts in the state on a particular day (see Exhibits 3 and 4). A district collection centre (DCC) was established within each district to receive the testing swabs collected from that particular district and to track the number of swabs collected each day in that district, which were forwarded to the labs. The DCC was responsible only for swab collection and tracking. Testing was not done at the DCC. The two districts in the state of Chhattisgarh relied on six fully equipped labs for the testing, with an equal representation of both government and private testing labs.[4]

The urgency of the evolving pandemic led to the establishment of a war-room meeting of all stakeholders. Ahuja called a meeting on September 5, 2020, to examine the situation and highlight the state's primary concerns. The goal was to generate several potential scenarios for the most efficient and effective allocation of swabs with saliva samples to the available testing labs. Those who attended that meeting included Joseph and Chandan as well as the secretary to the Department of Family Health and Welfare and various members from collection, logistics, and testing teams (see Exhibit 5).

Collection Team

The collection team was responsible for handling the equipment, collecting the swabs with saliva samples, and performing the entry procedure for maintaining the data repository. The team was centrally managed at the two DCCs. Sufficient collection kits were made available to the team for handling the increasing load of swabs for testing.

Logistics Team

The logistics team looked after transporting collected swabs with saliva samples from the collection centres located across each district to the DCC and from the DCC to the allocated testing labs situated both within and outside that district. Each DCC could transfer the testing swabs only to the labs. A DCC was prohibited from transferring the swabs to another DCC to avoid overburdening other DCCs with high swab loads. The state set a budget to cover inbound transportation costs for the transfer of swabs with saliva samples from the regional collection centre to the DCC.[5]

[3] "Chhattisgarh Covid Cases & Dashboard," Covid Tracking India, accessed August 28, 2021, https://covidtracking.in/coronavirus-cases/chhattisgarh.

[4] Government labs were owned by the Government of India, and testing was carried out at subsidized rates. Private labs were owned and managed by private establishments and usually charged higher rates for testing.

[5] For the purposes of this case, only the movement of swabs from the DCCs to the labs is discussed.

Testing Team

The testing team was responsible for managing and performing the testing for all swabs with saliva samples received from the two DCCs in the state of Chhattisgarh. The team members were expected to deliver reports within an agreed schedule—in most cases, within one day.

MINUTES FROM THE WAR-ROOM MEETING

Shri Sashi Prasad, the secretary to the Department of Health and Family Welfare, Government of Chhattisgarh, opened the meeting with the following remarks:

> In the state of Chhattisgarh, more than 0.1 million swabs are tested daily across the 27 different districts through 50 testing labs, including government and privately owned labs. The government needs to roll out the increased swab collection and testing across the state. The government is willing to run a pilot project that may run for a week with a sanction of ₹18 million[6] per day.

In addition, data and details pertaining to the labs regarding maximum daily capacity and the previous test backlog were provided to all delegates at the meeting (see Exhibit 4). Information regarding the distance between the DCC and the labs and the distances between the various labs was also made available to attendees to enable them to plan for the most efficient allocation strategy (see Exhibits 6 and 7). The backlogs from the previous day would effectively act as new swabs to be tested on the next day. This determined the daily allocation of swabs that had to be tested, which would consist of new swabs received that day for testing plus the backlog of untested swabs from the previous day.

At the meeting, Ratan Ram, the senior consultant of the testing team, expressed his dissatisfaction with the process by stating, "I know we are operating at capacity in some of our labs. Surely, we can do something to improve the utilization of labs while delivering quick results." The Chhattisgarh state government had set the cost of testing in a government lab at ₹800 per swab, which was precisely half of the cost of testing at a private lab.

Aarthi Viji, the department head of microbiology at the Government Hospital, then stated,

> To support the state in tackling the pandemic situation, we have increased the testing capacity by allowing overload of labs. However, it comes at an extra cost of ₹5,000 per swab, with a strict limit of not more than 100 swabs per lab per day and only for swabs generated from the same district to which the lab belongs.

Hari Avinash, the supervisor from the logistics team, added his own viewpoint:

> The intra-district transfer of swabs can be assumed to be complimentary, given the COVID-19 circumstances. However, for out-of-district transfers, we would charge a fixed rate of ₹1,000 per set of 100 swabs per kilometre, considering the average distances between the labs outside the district and the respective DCC. If a complete set is not collected, the transportation of swabs will be at a 50 per cent premium (i.e., ₹15 per swab).

However, Ravi Rakesh, a financial analyst from the logistics team, objected with this argument:

[6] ₹ = INR = Indian rupee; ₹1 = US$0.0136 on September 5, 2020; all currency amounts are in ₹ unless otherwise specified.

> The real problem is that we are considering the transport of swabs outside the district without a fixed limit on the distance covered, which is unavoidable due to the imposed lockdown measures. This also causes a delay in swabs reaching the designated labs and affects the turnaround time for test results. To begin with, I suggest we keep the distance between any two labs outside the district capped at 20 kilometres.

At this point, Mukesh Manoj, a DCC manager, entered the discussion with his own comments:

> Under these extreme circumstances, we should also include a notional high-cost penalty on the DCCs for not allocating the swab to any lab and keeping it as a backlog in the DCC, since any COVID-19-positive patient not detected on time may result in the acute spread of infections. To this effect, we propose to levy a penalty of ₹6,000 per non-allocated swab on the DCC.

THE DILEMMA

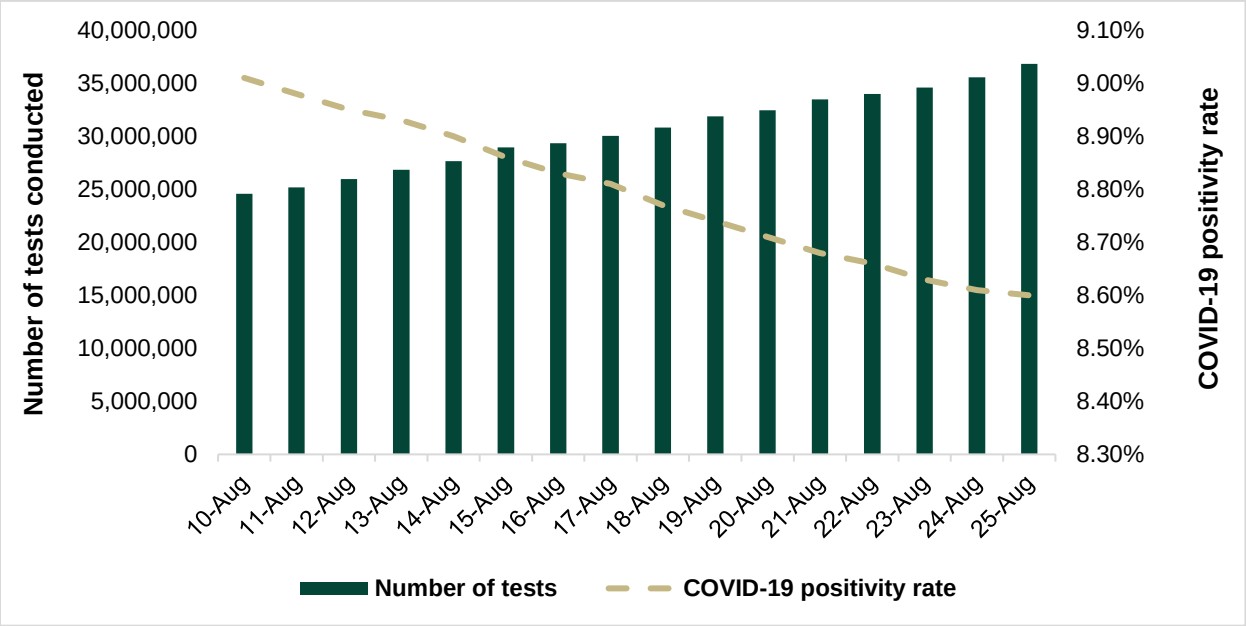
That evening, after having carefully listened to the discussions at the meeting, Ahuja was drinking some juice and pondering that day's events. "How can we optimally allocate the swabs with saliva samples to the labs? Moreover, we have to ensure speedy testing without major pitfalls, given the need to curb the transmission of the virus." While reviewing the data set and minutes of the war-room meeting, he was joined by his teammates Joseph and Chandan to discuss the task at hand, which was operationally challenging.

Joseph suggested that the team should analyze the centralized optimal allocation of swabs for both daily and weekly scenarios (over five days), given that a budget of ₹18 million per day had been allocated. However, Chandan replied,

> Under this rising pandemic situation, we can assume that the daily collection of swabs is estimated to increase at 10 per cent for our pilot study. Also, we do not seem to be utilizing the testing capacity in the districts with lower swab collection. We should consider the inter-district transfer of swabs, keeping in mind the upper limit of distance between the labs.

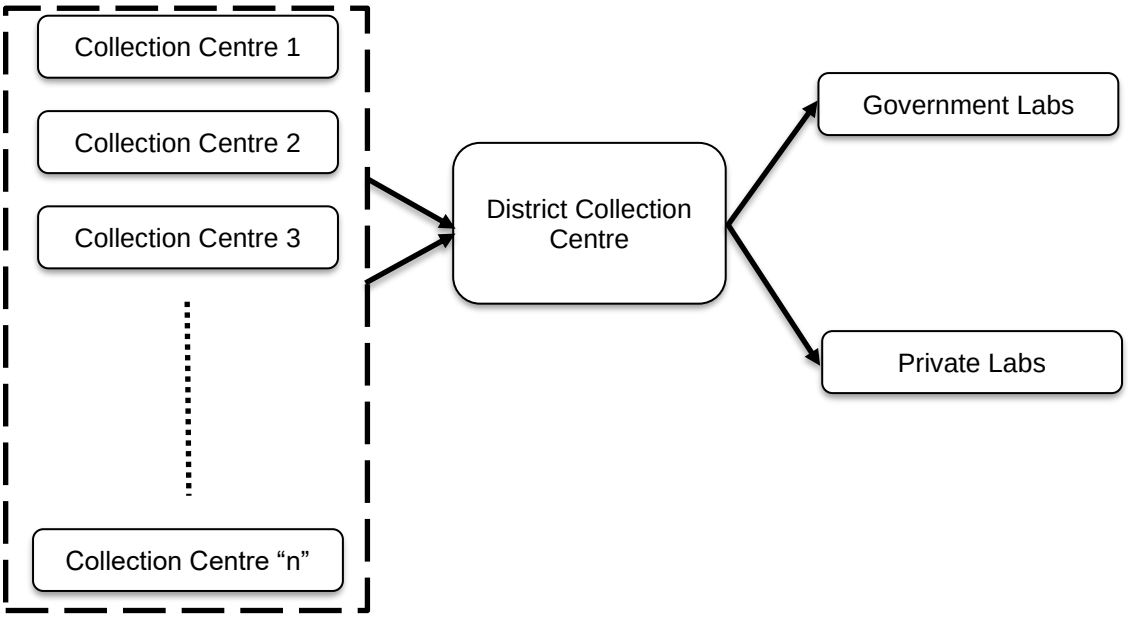
While attentively considering the suggestions from his team, Ahuja proposed the idea of effectively utilizing resources in both government and private labs to fast-track the testing of swabs. He further suggested that the team should come up with a plan with optimal swab allocations to control costs. He knew that the results of this pilot project would have far-reaching consequences in containing the spread of the COVID-19 virus throughout the state. Ahuja was also aware that the execution of this pilot study in two different districts, and its implementation across the state, would play a pivotal role in designing a draft response mechanism to handle similar pandemic outbreaks in the future.

EXHIBIT 1: TOTAL TESTS CONDUCTED AND POSITIVITY RATE



Source: Adapted from "Following 'TEST, TRACK, TREAT' Strategy, India Tests Nearly 3.7 Crore: Rising Tests per Million (TPM) Touch 26,685," press release, Ministry of Health and Family Welfare, Government of India, August 25, 2020, https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1648431.

EXHIBIT 2: SCHEMATIC REPRESENTATION OF THE FLOW OF SWABS IN A DISTRICT



Note: "n" = highest collection centre number.
Source: Created by the case authors.

EXHIBIT 3: NUMBER OF SWABS COLLECTED, BY DISTRICT

District ID	Number of Swabs Collected
05	9,468
11	2,536

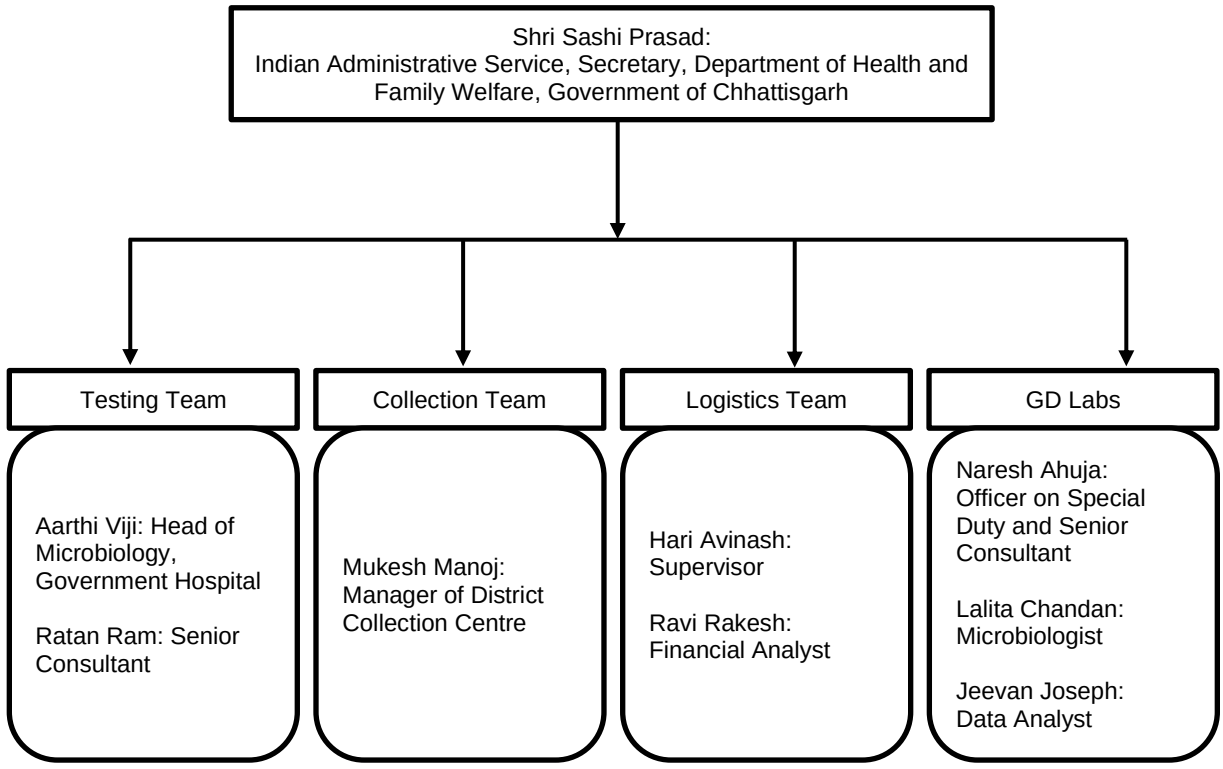
Note: ID = identification number; swabs collected as of September 4, 2020.
Source: Created by the case authors.

EXHIBIT 4: LOCATION, CAPACITY, AND BACKLOG, BY LAB

Lab ID	District ID*	Type of Lab	Testing Capacity**	Testing Backlog**
01	05	Government	4,000	1,842
12	05	Private	2,500	983
21	05	Private	2,500	824
02	05	Government	3,000	250
10	11	Government	2,000	114
28	11	Private	2,000	488

Notes: lab = laboratory; ID = identification number; *district ID = the district within which the lab is located; **testing capacity as of September 4, 2020.
Source: Created by the case authors.

EXHIBIT 5: MEMBERS PRESENT IN THE SEPTEMBER 5, 2020, MEETING



Source: Created by the case authors.

EXHIBIT 6: DISTANCES BETWEEN THE LABS (IN KILOMETRES)

	Lab 01	Lab 02	Lab 10	Lab 12	Lab 21	Lab 28
Lab 01	0.00	2.93	7.76	15.01	4.90	13.92
Lab 02	2.93	0.00	10.70	12.08	1.96	16.86
Lab 10	7.76	10.70	0.00	22.77	12.66	6.16
Lab 12	15.01	12.08	22.77	0.00	10.11	28.93
Lab 21	4.90	1.96	12.66	10.11	0.00	18.82
Lab 28	13.92	16.86	6.16	28.93	18.82	0.00

Note: lab = laboratory.
Source: Created by the case authors.

EXHIBIT 7: DISTANCES BETWEEN THE DISTRICTS AND THE LABS (IN KILOMETRES)

	District 05	District 11
Lab 01	3.31	298.35
Lab 02	1.52	296.56
Lab 10	297.64	1.99
Lab 12	11.76	297.59
Lab 21	2.59	300.12
Lab 28	293.91	9.28

Note: lab = laboratory.
Source: Created by the case authors.