

The impact of COVID-19 “Unlock-I” on L V Prasad Eye Institute Network in Southern India

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Purpose: The aim of this study was to report on the impact of COVID-19 “Unlock-I” on Network of Eye Centers in Southern India. **Methods:** Our eye health pyramid model has a network of eye care centers in four Indian states. The network constitutes a center of excellence (CoE) at the apex followed by tertiary care centers (TC) located in urban areas, secondary care centers (SC), and primary care vision centers (VC) at the base located in rural areas. We collected data on patients seen between June 2019 and June 2020, which included age, gender, total patients seen (new or follow-up), and socioeconomic status (paying and nonpaying). A comparative study was done between the data for outpatients and surgeries performed pre-COVID-19 and during Unlock-I in COVID-19 period. **Results:** There was a 36.71% reduction in the overall outpatients seen in June 2020 ($n = 83,161$) compared to June 2019 ($n = 131,395$). The reduction was variable across different levels of the pyramid with the highest reduction in CoE (54.18%), followed by TCs (40.37%), SCs (30.49%) and VCs (18.85%). Similar pattern was seen for new paying patients with the highest reduction in CoE (54.22%), followed by TCs (25.86%) and SCs (4.9%). A 43.67% reduction was noted in the surgeries performed in June 2020 ($n = 6,168$), compared to June 2019 ($n = 10,950$). Reduction in paying services was highest in CoE (47.52%), followed by TCs (15.17%) and SCs (4.87%). There was no significant change in the uptake of services by gender in the network. **Conclusion:** Highest reduction in patient footfalls during “Unlock-I” was noted in urban centers. Going forward, there is a need to develop strategies to provide eye care closer to the doorsteps.

Key words: Coronavirus, COVID-19, India, lockdown

World Health Organization (WHO) declared coronavirus infection (COVID-19) as a pandemic on March 11, 2020.^[1] To control the spread, many countries had imposed lockdown, and either restricted or suspended travel. The Government of India initiated nationwide lockdown from March 23 to April 14 (lockdown I), further extended from April 15 to May 3 (lockdown II).^[2] During this period, the hospitals across the country discontinued regular outpatient and inpatient services, provided only emergency services; and initiated Telemedicine services. This situation applied to eye hospitals too.^[3-6] Outpatient services dropped by more than 95%, and a

significant number of emergency conditions did not receive adequate care.^[7,8] Subsequently, lockdown was eased to some extent from May 4 to May 31 (lockdown III and IV).^[2] During this period, hospitals were allowed to provide regular care. From June 1, a gradual process of relaxing lockdown began; and public movement increased after The Ministry of home affairs issued guidelines for a phased resumption of activities outside containment zones.^[9] Though the impact of lockdown on eye hospitals has been reported, there are no reports on the impact of easing of lockdown.^[7,8] It was expected that there would be surge in footfalls in eye hospitals post lockdown. In this study, we report the impact of “Unlock-I” On L V Prasad Eye Institute network in South India.

Methods

L V Prasad Eye Institute (LVPEI) eye health pyramid model has a center of excellence (CoE) at the apex catering to 50 million population followed by tertiary centers (TC), each serving a population of 5 million. At the next level, secondary centers (SC)

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cover 0.5–1 million population, followed by vision centers (VC) at the primary level for 50,000 population. At present, the network covers four Indian states, Andhra Pradesh (AP), Telangana state (TS), Odisha, and Karnataka state (KS).^[10] CoE and TCs are in urban locations whereas SCs and VCs are in rural areas. In this study, we report the impact of “Unlock-I” on our network of one CoE (TS), 3 TCs (two in AP and one in Odisha), 19 rural SCs (5 in TS; 9 in AP; 4 in Odisha and 1 in KS) and 149 VCs (31 in TS; 105 in AP; 7 in Odisha and 6 in KS) in four states. Some of the VCs were nonfunctional (due to lockdown and being in containment zones), so the data from 149 functional VCs were included.

A retrospective analysis was done for patients seen during June 2020, a month after unlock-I started, across the network. All clinical staff used the defined personal protective equipment and followed the protocols to mitigate COVID-19 risk, including physical distancing.^[11,12] The patients were also asked to wear masks all the time during the hospital visit. The patients were triaged at the main entrance by administering a questionnaire to both patients and their attendants to check if they were exposed to COVID-19 or had related symptoms of COVID-19. The patients or their attendants, who had fever, cough, or cold, or had contact with persons who are isolated, were asked to reschedule their eye examination if there was no emergency.

The data were collected from EyeSmart™ our indigenous Electronic medical records.^[13] Data included the location of the centers, age, gender, total patients seen (new or follow-up), surgeries performed, and socioeconomic status (paying and nonpaying). All surgeries were day-care procedures. These data were compared with data from June 2019 for the same centers and based on same parameters.

Results

We saw 131,395 outpatients (52.93% paying) in June 2019, whereas, we saw 83,161 outpatients (54.57% paying) in June 2020. The mean age of patients examined was 42.66 years (SD: 21.16 years) in June 2019 and 43.54 years (SD: 21.86 years) in June 2020. Table 1 compares the paying and nonpaying outpatients at different levels of the pyramid and in different states in 2019 and 2020. Overall, there was 36.71% reduction in outpatient services with a higher reduction in nonpaying services (38.91%) compared paying services (34.75%). The reduction was variable across different level of pyramid with highest in CoE (54.22%), followed by TCs (40.37%), SCs (30.49%), and VCs (18.85%), suggesting as we move down the pyramid, the reduction was less significant.

Fig. 1 shows the change in percentages of patients coming from different states between June 2019 and June 2020. It could be seen that between June 2019 and June 2020, most patients came from the local area, rather than from far places.

For analysis of new and follow-up patients, the VCs were excluded as they had only new patients. At CoE, TCs and SCs, we examined 30,265 (30.01%) new patients and 70,584 (69.99%) follow-up patients in June 2019 whereas in June 2020, we examined a total 58,372 patients, 20,611 (35.31%) new and 37,761 (64.69%) follow-up patients. Table 2 shows the difference in new and follow-up patients at various level of the pyramid in different states in 2019 and 2020. In June 2020, the reduction in new paying patients was variable across different level of the pyramid with highest in CoE (54.22%), followed by TCs (25.86%) and SCs (4.9%). In terms of paying follow-up patients, there was again a significant drop in CoE (53.3%) followed by TCs (36.11%) and SCs (19.94%). In terms of new

Table 1: Outpatient services at different levels of the eye health pyramid in different states and the percentage (%) reduction

State	Paying		% decrease	Nonpaying		% decrease	Total		% decrease
	2019	2020		2019	2020		2019	2020	
Center of Excellence (Telangana)									
Telangana	25791	11978	53.56	10234	4530	55.74	36025	16508	54.18
Tertiary centers (TC)									
TC 1 (AP)	9639	6752	29.95	2294	759	66.91	11933	7511	37.06
TC 2 (AP)	4533	3136	30.82	3399	1423	58.13	7932	4599	42.02
TC 3 (Odisha)	9143	5735	37.27	3326	1475	55.65	12469	7210	42.18
All TCs	23315	15623	32.99	9019	3657	59.45	32334	19280	40.37
Secondary centers									
Telangana	8129	8063	0.81	3555	1290	63.71	11684	9353	19.95
Andhra Pradesh	6783	5399	20.4	6054	2646	56.29	12837	8045	37.33
Odisha	4306	3434	20.25	1736	627	63.88	6042	4061	32.79
Karnataka	1224	880	28.1	703	245	65.15	1927	1125	41.62
Total	20442	17776	13.04	12048	4808	60.09	32490	22584	30.49
Vision centers									
Telangana	-	-	-	9517	8142	14.45	9517	8142	14.45
Andhra Pradesh	-	-	-	19242	14754	23.32	19242	14754	23.32
Odisha	-	-	-	614	841	(-36.97)	614	841	(-36.97)
Karnataka	-	-	-	1173	1052	10.32	1173	1052	10.32
Total	-	-	-	30546	24789	18.85	30546	24789	18.85
Overall	69548	45377	34.75	61847	37784	38.9	131395	83161	36.71

AP: Andhra Pradesh

and nonpaying follow-up patients, there was no significant difference across different levels of the pyramid, suggesting that the reduction in paying patients was less as we move down the pyramid, whereas for nonpaying, the drop was almost the same across different levels of pyramid.

Table 3 shows the difference in paying and nonpaying surgeries in different states in 2019 and 2020. The mean age of the operated patients was 60.10 years (SD, 11.5) in June 2019 and 54.15 years (SD, 16.28) in June 2020. We operated on 10,950 patients (55.25% paying) in June 2019, and 6,168 patients (71.37% paying) in June 2020. Overall, there was a 43.67% reduction in surgical services, higher in nonpaying (63.96%) compared to paying services (27.24%). The reduction in paying services was variable across different levels of the pyramid with the highest reduction in CoE (47.52%), followed by TCs (15.17%) and SCs (4.87%). The reduction in nonpaying services was the converse to that of paying, that

is, highest in SCs (73.52%) followed by TCs (60.47%) and CoE (55.22%).

Table 4 shows the percentage of outpatient services and surgeries provided to females at different levels of the pyramid and in different states in 2019 and 2020. Overall, there was no significant difference in the uptake of services by gender across different levels of pyramid. Uptake of services by females was higher at SCs during 2019 as well as 2020.

Discussion

As compared to June 2019 (pre-COVID), there was an overall reduction of 36.71% in the total number of patients seen during June 2020 (post-COVID). The reduction was higher among patients belonging to lower socio-economic strata (nonpaying; 38.9%), compared to patients from higher-economic group (paying; 34.75%).

Table 2: New and follow-up outpatient services at different levels of the eye health pyramid in different states and the percentage (%) reduction

State	New paying		% decrease	New nonpaying		% decrease	Follow-up paying		% decrease	Follow-up nonpaying		% decrease
	2019	2020		2019	2020		2019	2020		2019	2020	
Center of Excellence (Telangana)	7196	3294	54.22	1417	661	53.35	18595	8684	53.30	8817	3869	56.12
Tertiary centers (TC)												
TC 1 (AP)	2822	2299	18.53	417	118	71.7	6817	4453	34.68	1877	641	65.85
TC 2 (AP)	1502	1124	25.17	728	447	38.6	3031	2012	33.62	2671	976	63.46
TC 3 (Odisha)	2768	1835	33.71	621	256	58.78	6375	3900	38.82	2705	1219	54.94
All TCs	7092	5258	25.86	1766	821	53.51	16223	10365	36.11	7253	2836	60.9
Secondary centers												
Telangana	3634	3807	(-4.76)	871	309	64.52	4495	4256	5.32	2684	981	63.45
Andhra Pradesh	2948	2853	3.22	1781	1068	40.03	3835	2546	33.61	4273	1578	63.07
Odisha	2369	1822	23.09	649	245	62.25	1937	1612	16.78	1087	382	64.86
Karnataka	447	452	(-1.12)	95	21	77.89	777	428	44.92	608	224	63.16
Total	9398	8934	4.94	3396	1643	51.62	11044	8842	19.94	8652	3165	63.42
Overall	23686	17486	26.18	6579	3125	52.5	45862	27891	39.18	24722	9870	60.08

AP: Andra Pradesh

Table 3: Surgery at different levels of the eye health pyramid in different states and the percentage (%) reduction

State	Paying		% decrease	Nonpaying		% decrease	Total		% decrease
	2019	2020		2019	2020		2019	2020	
Center of Excellence (Telangana)	2727	1431	47.52	1532	686	55.22	4259	2117	50.29
Tertiary centers (TC)									
TC 1 (AP)	814	704	13.51	372	124	66.67	1186	828	30.19
TC 2 (AP)	292	296	(-1.37)	488	211	56.76	780	507	35
TC 3 (Odisha)	740	566	23.51	582	235	59.62	1322	801	39.41
All TCs	1846	1566	15.17	1442	570	60.47	3288	2136	35.04
Secondary centers									
Telangana	588	786	(-33.67)	570	189	66.84	1158	975	15.8
Andhra Pradesh	641	402	37.29	952	231	75.74	1593	633	60.26
Odisha	126	116	7.94	285	61	78.6	411	177	56.93
Karnataka	122	101	17.21	119	29	75.63	241	130	46.06
Total	1477	1405	4.87	1926	510	73.52	3403	1915	43.73
Overall	6050	4402	27.24	4900	1766	63.96	10950	6168	43.67

AP: Andra Pradesh

Table 4: Percentage of outpatient and surgeries provided to females at different levels of the eye health pyramid in different states in 2019 and 2020

State	Outpatient		Surgeries	
	2019	2020	2019	2020
Center of Excellence (Telangana)	14736 (40.90)	6452 (39.08)	1771 (41.58)	795 (37.55)
Tertiary centers (TC)				
TC 1 (AP)	5191 (43.50)	3138 (41.78)	471 (39.71)	304 (36.71)
TC 2 (AP)	3652 (46.04)	1876 (40.79)	383 (49.1)	213 (42.01)
TC 3 (Odisha)	4661 (37.38)	2619 (36.32)	492 (37.22)	286 (35.71)
All TCs	13504 (41.76)	7633 (39.59)	1346 (40.94)	803 (37.59)
Secondary centers				
Telangana	6377 (54.58)	5028 (53.76)	703 (60.71)	623 (63.9)
Andhra Pradesh	7494 (58.38)	4179 (51.95)	994 (62.4)	365 (57.66)
Odisha	2956 (48.92)	1788 (44.03)	256 (62.29)	92 (51.98)
Karnataka	1131 (58.69)	578 (51.38)	152 (63.07)	82 (63.08)
Total	17958 (55.27)	11573 (51.24)	2105 (61.86)	1162 (60.68)
Vision centers				
Telangana	4427 (46.52)	3696 (45.39)	-	-
Andhra Pradesh	9071 (47.14)	6330 (42.9)	-	-
Odisha	192 (31.27)	319 (37.93)	-	-
Karnataka	506 (43.14)	414 (39.35)	-	-
Total	14196 (46.47)	10759 (43.40)	-	-

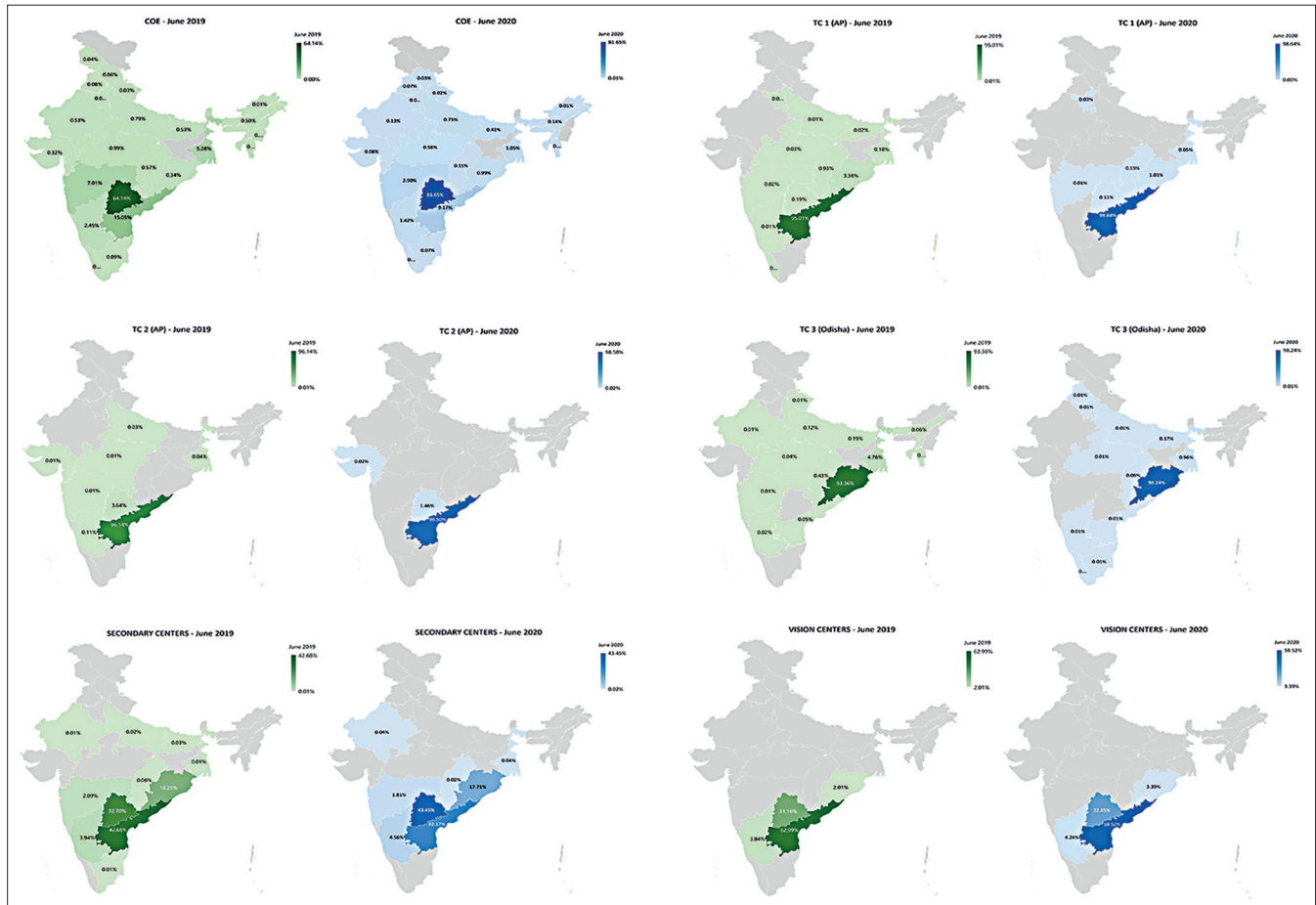


Figure 1: Change in percentages of patients coming from different states between June 2019 and June 2020

The reduction was variable across different levels of pyramid with the highest in CoE, followed by TCs, SCs, and VCs in that order. At the CoE, patients come from all over the country. With the COVID-19 pandemic, an element of fear to travel may have set in. Thus, the patients were more likely to seek care within their state, and closer to home. Apart from this, all forms of public transport were significantly hampered, contributing to the drop in out of state patients at the CoE. Lack of hotel facilities in the urban areas may have been another reason for the drop. Similar factors contributed to the reduction in numbers in TCs. However, as SCs and VCs are located in rural areas and work as a unit, with VCs' referrals directed to SCs, a minimal drop was noted in the footfalls at SCs and VCs.

In terms of paying and nonpaying services, the new and follow-up paying services showed a similar pattern, that is, the highest reduction at the CoE level followed by TCs and SCs. This again can be attributed to travel restrictions, lack of availability of public transport, and fear of contracting COVID. As far as nonpaying patients are concerned, there was a significant drop across all levels of the pyramid. This is likely due to cessation of the community program activities as well as lack of availability of public transport.

Looking at the SCs and VCs as a unit, at the SC level, the reduction was variable between states with the lowest reduction seen in the state of Telangana (19.95%) and highest in the state of Karnataka (41.62%). This could be related to number of COVID-19 cases reported in June in the locations where these SCs are situated. The number of COVID-19 cases in June 2020 was the lowest reported in districts in Telangana as compared to other states.^[14] Variability in the reduction of numbers at VCs is related to the number of functional VCs in these states.

We noted a 43.67% reduction in surgical services, more in the nonpaying services (63.96%) as compared to paying services (27.24%). The reduction was highest at the CoE (50.29%) followed by SCs (43.73%) and TCs (35.04%). The reduction in SCs was more than TCs due to difference in the pattern of nonpaying patients who seek care. Nonpaying surgeries in SCs are mainly from community outreach and referrals from VCs, with a few direct walk-ins. However, nonpaying surgeries at CoE and TCs are mainly complicated referrals from other places and a few direct walk-ins. In terms of paying surgeries, the reduction was maximum at CoE level (47.52%) followed by TCs (15.17%) and SCs (4.87%). In SCs, there was a 33.67% increase in paying surgical services in the centers in Telangana, thus skewing the data for SCs. Also the reduction of paying outpatients in the centers in Telangana was only 0.81%. This implies a higher conversion rate for surgeries in some locations. There are several plausible reasons for this. Most likely the lockdown in April and May 2020 would have affected those patients who were planning to get their surgeries done at that time, resulting in a surge in June during Unlock-1. In addition, due to the commencement of the monsoons in July-August coupled with the agricultural work, some patients would have preferred surgery in June as opposed to the subsequent months. It would be interesting to see if this trend continues in future. Thirdly, some patients who would have preferred to go to a higher center in urban areas may have sought surgery locally to avoid the risk of long travel as well as to mitigate the risk of contracting COVID-19 as there was a surge of COVID-19 cases in urban areas. An additional reason could be the limited

number of COVID-19 cases reported in June in the rural parts of Telangana where these secondary centers are located.

We also explored the data related to gender assuming that fewer female patients will avail services as we have stopped active screening programs in the community. However, to our surprise, this did not change significantly at any level of the pyramid and SCs continued to serve more female patients as earlier suggesting that there was no impact of lockdown or COVID-19 on gender.

One of the limitations of our study was that we did not include data from the teleophthalmology services in June 2020. In COVID-19 era, the role of telemedicine in providing care is being recommended.^[5,15-17] However, our teleophthalmology services have just started and the patients are still getting used to it. The use of the teleophthalmology services in rural areas was also limited in this time period. However, going forward, as the pandemic is evolving, we will have more robust data on the teleophthalmology component from our network. The role of artificial intelligence as well as the development of new ideas to provide virtual care should be explored further.^[18,19] As we move ahead, providing eye care closer to the doorstep and use of technology such as telemedicine and artificial intelligence would have a significant role to play.

Overall, it was encouraging to see the increase in uptake of services in our network of hospitals especially in rural India. As mentioned above, this increase was likely due to less number of COVID-19 cases being reported from rural areas and availability of services closer to communities, thus avoiding the risk of long-distance travel and mitigating the risk of contracting COVID-19. Apart from this, during the lockdown, none of the staff was fired from the job as this would have reduced the morale of other staff. The strategy was to reduce the expenditure but not at the cost of quality. As most of the surgeries performed were day care surgeries, cost on inpatient services were reduced. Similarly, reduction in travel also reduced some costs. Apart from this new recruitments were frozen.

Conclusion

Our study documented highest reduction in patient footfalls during "Unlock-1" at the apex urban centers, and lowest at the bottom of the pyramid vision centers. As the COVID-19 pandemic evolves in India, it is likely that in future, most patients would prefer to avail services closer to their home rather than travel long distances. Hence, going forward, there is a need to develop permanent care facilities closer to the communities. Similarly, as it was difficult for many of the nonpaying patients to travel and the conventional way of carrying out outreach program may not be a viable option, there is a need to re-design eye care delivery programs, including use of technology to provide patient care services.

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Conflicts of interest

There are no conflicts of interest.

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