

# Examining COVID-19 impact on Indian pharma production

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## Introduction

India produces a third of the world’s drugs by volume, 20% of the global demand for generic drugs and over 60% of its vaccines and Antiretrovirals (ARVs). It fulfils 40-70% of the World Health Organisation’s (WHO) demand for Diphtheria, Tetanus and Pertussis (DPT) and Bacillus Calmette Guerin (BCG) vaccines and 90% of the global demand for the measles vaccine.<sup>1 2</sup>

Further, Indian firms account for over 90% of the antiretroviral (ARV) procurement in LMICs funded through donor procurement. Two-thirds of drugs used by international groups such as Médecins Sans Frontières (MSF) to treat HIV, tuberculosis and malaria, and treatments for tropical diseases are generics produced in India. The country also supplies 70% of the UNICEF’s demand for pentavalent vaccines.<sup>3</sup>

The country produces 67% (379) of the 563 WHO prequalified pharmaceutical products for conditions including diarrhoea (1), hepatitis (13), HIV/AIDS (197), influenza (10), malaria (41), neglected tropical diseases (3), reproductive health (21), and tuberculosis (93). 130 of these products are made from Active Pharmaceutical Ingredients (APIs) imported from China.

Around 30% of the country’s pharmaceutical exports are to North America, 16% to Europe and 17% to Africa.<sup>4</sup>

India imports 53 APIs and Key Starting Materials (KSMs) exclusively from China. Of these, the imports of 16 molecules were reported to be particularly affected by COVID-19, including antibiotics such as Chloramphenicol, Erythromycin, Azithromycin, Clarithromycin, Amoxicillin, Vitamins A B, E, C and E, Progesterone, and Metronidazole.

Industry experts have reported that the impact of pandemic, including lockdowns in both China and India, as well as border tensions between the countries is more likely to harm smaller players ‘compared to larger firms with diversified drug portfolios’.<sup>5</sup>

The first phase of the lockdown in India in March affected freight movement, disrupted supply chains and reduced the number of available contractual workers, pushing down output. Throughout the lockdown period, Indian pharmaceutical companies have been operating at ~50% per cent of their total capacity.<sup>6</sup>

In India, while pharmaceutical manufacturing was exempted from the lockdown as being part of “essential services”, production and output was still disrupted because of the non-availability of labour, physical distancing norms, and logistical challenges including blockages in transportation for ingredients and packing material, and shipping delays.<sup>7</sup>

Production was also impacted by a lack of coordination between different levels of administration, as evidenced from the fact that while drug production was permitted to continue, production and transport of ancillary supplies such as bottles and caps were not allowed “since they don’t fall under the essential services category exempted from the ongoing nationwide lockdown.”<sup>8</sup> This administrative confusion also resulted in some manufacturing plants being shut down during the lockdown period despite government directions.<sup>9</sup>

National and regional lockdowns within the country implemented in several phases between March and June 2020 impacted the movement of raw materials and ready stocks to and from manufacturing hubs; availability of raw materials within the country decreased by 50% because of the lockdown on roads.<sup>10</sup>

Production also suffered because the ban on public transportation prevented labourers and trucks carrying coal from reaching manufacturing plants.<sup>11 12</sup>

As a result of the COVID-19 pandemic, in the short run, pharma importers in India will suffer due to supply-chain disruptions, increase in input costs, and logistical challenges, while exporters will suffer because of trade restrictions. However, there is a fair chance of Indian companies (especially those focused on drug export) overcoming these challenges as the pandemic passes because demand remains robust.<sup>13</sup>

On the other hand, long run challenges will hinge on how successful India is at boosting domestic production of key molecules, and also how Indo-China relations will play out in the coming months.

Sector experts have said that institutional markets for medicines in LMICs might be the most vulnerable to the shock of this period of destabilisation.

**Table 1: Pharma exports FY19 vs FY20: India’s exports by Month (in millions of US\$)**

Data for Tables 1-4 provided Dr. Dinesh Dua, Chairman, Pharmaceutical Export Promotion Council of India (Pharmexcil):<sup>14</sup>

Month	FY19	FY20	Change %	Change in Revenue
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April	1,428	1,523	7	95
May	1,518	1,683	11	165
June	1,583	1,830	16	247
July	1,414	1,711	21	297
August	1,688	1,671	-1	-17
September	1,657	1,790	8	133
October	1,513	1,693	12	180
November	1,484	1,779	20	295
December	1,660	1,866	12	206
January	1,586	1,772	12	186
February	1,610	1,734	8	124
<b>March</b>	<b>1,997</b>	<b>1,533</b>	<b>-23</b>	<b>-464</b>

**Table 2: Quarter-wise export figures (in millions of US\$)**

Quarter	FY19	FY20	Change %	Change in Revenue
April-June	4,529	5,037	11	508
June-September	4,758	5,172	9	414
October-December	4,657	5,338	15	682
<b>January-March</b>	<b>5,194</b>	<b>5,039</b>	<b>-3</b>	<b>-154</b>

Where

- “Almost 4.5-5% of April-January FY20 is actual loss due to COVID-19, which is US\$ 776-866 million when extrapolated to normal circumstances” (ibid.)
- “India's import of Bulk Drugs declined by 24% due to the pandemic and its reliance on China” (ibid.)

**Table 3: Category-wise exports (in millions of US\$)**

Category	FY19	FY20	Change %	Change in Revenue
Ayush	147	147	-0.04	-0.06
Bulk Drugs and Drug Intermediates	3,895	3,867	-0.73	-28
Drug formulations and Biologicals	13,504	14,782	9.47	1278
Herbal Products	301	281	-6.62	-20
Surgicals	570	630	10.47	60
Vaccines	720	579	22.05	159

“Where bulk Drugs export decreased by \$168 million (38%) in March 2020. It decreased by 14% in the African region, 11% in Asean countries and 11% in Oceania.” (ibid.)

**Table 4: Generic formulations (in millions of US\$)**

Month	FY19	FY20	Change %	Change in Revenue
April	983	1,101	12.05	118
May	1,038	1,168	12.48	130
June	1,131	1,312	16.04	181
July	1,007	1,231	22.23	224
August	1,219	1,196	-1.9	-23
September	1,190	1,292	8.62	102
October	1,072	1,210	12.88	138
November	1,061	1,276	20.32	216
December	1,154	1,362	17.03	198
January	1,117	1,269	13.64	152
February	1,149	1,250	8.78	101
<b>March</b>	<b>1,373</b>	<b>1,113</b>	<b>-18.89</b>	<b>-259</b>

## Timeline: COVID-19 and pharma production

- Lockdown 1.0: 24 March-14 April 2020
- Lockdown 2.0 (in some states only): 14 April-3 May
- Lockdown 3.0: 1 May-17 May
- Lockdown 4.0: 17 May-31 May
- Lockdown 5.0 (only for containment zones): 31 May-31 June

**Table 5**

Month	Notes
End of 2019 and early 2020	<ul style="list-style-type: none"> <li>• Cost of raw materials imported from China starts increasing.<sup>15</sup></li> <li>• API supplies from China become erratic as the Chinese government shut down factories till mid-February.<sup>16 17</sup></li> </ul>
February	<ul style="list-style-type: none"> <li>• Pharma companies report they have stocks that will last till mid-February.<sup>18</sup> “However, if [the lockdown in China] goes beyond that, 70% of industry will get impacted,” said Arjun Juneja, Director, Mankind Pharma.</li> </ul>
March	<ul style="list-style-type: none"> <li>• Between mid-February and early March, APIs and KSMs from China began to arrive in India again<sup>19</sup></li> <li>• March 3: The Directorate General of Foreign Trade (DGFT) of India restricts the exports of 26 bulk drugs (most of them antibiotics) and their formulations.<sup>20</sup> This includes paracetamol, along with 12 other APIs: Tinidazole, Metronidazole, Acyclovir, Vitamin B1, Vitamin B6, Vitamin B12, Progesterone,</li> </ul>

	<p>Chloramphenicol, Neomycin, Erythromycin Salts, Clindamycin Salts, and Ornidazole.</p> <ul style="list-style-type: none"> <li>• Mid-March: Some domestic API manufacturers report that their inventories would last at least till this time.<sup>21</sup></li> <li>• Mid-March: Indian Drugs Manufactures Association (IDMA) informs the National Pharmaceutical Pricing Authority (NPPA) that there is no dearth of API stocks.<sup>22</sup></li> <li>• End of March: Likely that stocks start running low at this point.<sup>23</sup></li> <li>• 24 March: Lockdown 1.0 imposed nation-wide. Pharma production estimated to be at ~20-30% of full capacity in the early days of the lockdown. And only 30-35% of workers – mostly employees living close to the plant – reported for duty during this time.<sup>24</sup></li> </ul>
April	<ul style="list-style-type: none"> <li>• April 6: DGFT allows export of some APIs such as vitamins B1, B6 and B12, tinidazole, metronidazole, acyclovir, progesterone and chloramphenicol, among others. Paracetamol exports continue to be restricted.<sup>25</sup></li> <li>• April 12: 50 drug manufacturing units in Baddi, Himachal Pradesh, halt operations as area is declared a containment zone</li> <li>• April 14: First phase of lockdown ends, but some states extend it to a second phase till 3 May</li> </ul>
May	<ul style="list-style-type: none"> <li>• Early May: Manufacturing units in Baddi start reopening</li> <li>• Around May 4: Partial lockdown is lifted, but several companies continue to operate at a low level. However, Dr Reddy’s reports it is operating at “near capacity” now.<sup>26</sup></li> <li>• Mid-May: All units at the Baddi pharma hub reported to be functional.</li> <li>• Mid-May: Some reports say pharma firms are operating at 50-60% capacity at this point.<sup>27</sup> Others report 70-80% of capacity. Shipments of raw material continue to be stuck at ports.</li> <li>• May 28: DGFT lifts restrictions on the export of paracetamol<sup>28</sup>.</li> <li>• May-end: Many companies had reported they had stocks to last at least up till this time.<sup>29</sup></li> </ul>
June	<ul style="list-style-type: none"> <li>• June: Lyka Labs (a smaller business from the production hub in Ankleshwar, Gujarat) is reportedly still operating at 40% capacity.<sup>30</sup></li> </ul>

	<ul style="list-style-type: none"> <li>• June-end: Supplies from China still affected, stuck at ports because of extensive checks after escalating Indo-China tensions. “Clearance delays of shipments at JNPT, which handles about 60% of India’s containerised freight including pharmaceuticals, and at Ahmedabad, Chennai and Delhi airports have become a cause of concern.”<sup>31</sup></li> <li>• June-end: Some larger drug manufacturers had reported they had stocks till this time</li> </ul>
July	<ul style="list-style-type: none"> <li>• July 1: Indian government lifts restrictions on Chinese API imports at ports.<sup>32</sup></li> </ul>

## Facility shutdowns

Indian pharma companies importing APIs from China that have been reported to be particularly affected by the lockdown include Dr Reddy’s, Lupin, Glenmark, Sun Pharma, Mylan, Zydus, Pfizer, Divi’s Labs, Solara Active, Laurus Labs., Granules, Aurobindo Pharma, Abbott Laboratories. Several of these were either partially or fully shut down during the lockdown period.<sup>33</sup>

### Production trends during lockdown of major pharmaceutical manufacturing hubs:

#### 1. Baddi, Himachal Pradesh

- Accounts for 35-40% of the nation’s pharma output and ~35% of pharma formulation demand of Asia
- Consists of roughly 750 units of pharma in the Solan and Sirmaur area of the state
- Around 80% of production was hampered during the lockdown periods, according to the Federation of Indian Chambers of Commerce & Industry.<sup>34</sup>
- This was because the government allowed industries to engage only 50% of their staff during the period. But “many pharma units shut down entirely as most of their workforce resides in neighbouring states of Haryana and Punjab.”<sup>35</sup>
- On April 12, 50 drug manufacturing units in Baddi, Himachal Pradesh, halted operations while others are operating at significantly reduced capacities after the region was declared a containment zone. Pharma units that were affected included Wockhardt, USV Pharma, Abott Laboratories, Dr. Reddy’s and Sun Pharmaceuticals.<sup>36</sup>
- To help keep the facilities running at full capacity, the Indian government allowed a one-time movement of employees from Chandigarh state to Baddi to help staff the plants, as well as a resumption of intra-district movement within the state.<sup>37</sup>
- Production resumed at the end of April.<sup>38</sup>
- By mid-May, all pharma units were reported functional

#### 2. Telangana

- a. Bulk drug capital of India, which accounts for 40% of the country's total bulk drug production
- b. Consists of around 800 life sciences companies employing about 1.20 lakh people.
- c. Bulk drug and pharmaceutical production mainly takes place in Hyderabad and surrounding districts of Rangareddy, Medchal, and Sangareddy.<sup>39</sup>
- d. Bulk drug manufacturers in the hub were reported to be functioning at 50% capacity since March till May.<sup>40</sup>

### 3. Gujarat

- a. Accounts for 35% of India's pharma production and exports.<sup>41</sup>
- b. In the first week of May, Cadila Pharmaceuticals shut down its operations for about 15 days after 26 employees tested positive; three Cadila employees died of the infection later that month.<sup>42</sup>
- c. In mid-July, Lupin Ltd shut down at least one of its 11 manufacturing sites in Gujarat after 18 workers tested positive for Covid. The plant produces tuberculosis drugs.<sup>43</sup>
- d. In June, Lyka Labs (a smaller business from the production hub in Ankleshwar, Gujarat) was reportedly still operating at 40% capacity.<sup>44</sup>
- e. On 2 July, Sun Pharma shut down its Dadra facility after 17 employees tested positive.<sup>45</sup>

## API import disruption

India is highly dependent on China for APIs. Nearly 70% of all APIs are imported from the country; for antibiotics (especially those manufactured by the fermentation route such as penicillin, cephalosporins and macrolides), antipyretics, cardiovascular (e.g. Digoxin and Losartan), respiratory (e.g. TB medicines like Isoniazid and Streptomycin) and diabetes (e.g. Metformin and Glimperide) medicines, the dependence is "near total".<sup>46 47 48</sup>

Other APIs that India depends on China for include Vitamin E, Progesterone, HIV drugs Lopinavir and Ritonavir, and Valsartan.

### Key dependences in % of imports from China <sup>49 50</sup>

- Oxytetracycline (antibiotic): 100%
- Paracetamol: 100%
- Metformin: 100%
- Ampicillin: 100%
- Ciprofloxacin: 100%
- Tetracycline (antibiotic): 99.8%
- Azithromycin (antibiotic): 99.4%
- Nofloxacin (antibiotic): 98.5%
- Vitamin B12: 93.5%
- Amoxicillin: 90-95%
- Neomycin (antibiotic): 91.9%
- Ibuprofen: 80-95%

- Heparin (anticoagulant, cardiac medicine): 86.3%
- Gentamicin (antibiotic): 85.4%
- Vitamin B6: 77.4%
- Vitamin B1: 73.6%
- Erythromycin (and its derivatives, including salts of Erythromycin, Roxithromycin, Azithromycin, Clarithromycin and others): 63%
- Doxycycline (antibiotic): 57.5%

### Company dependence on China <sup>51</sup>

- **IOL Chemicals:** Nearly 35-40% of its APIs and intermediates come from Wuhan province in China
- **Cipla:** Company significantly dependent on China
- **Granules:** Company significantly dependent on China. 30-35% of sales affected by paracetamol import disruption
- **Solara:** Depends on China for ~30% of its raw material. The company is focused on reducing dependence on China
- **IPCA:** A lot of KSMs come from China. The company is focused on reducing dependence on China for 7-8 key intermediates
- **Alembic:** Depends on China for 15% of its overall imports
- **Aurobindo:** A major portion of the Company's raw material sourcing comes from China

Indian manufacturing companies have said that they usually maintain stockpiles to last till March (anticipating supply disruption due to the Chinese Lunar New Year holidays) under normal circumstances.<sup>52</sup> For instance, Cipla said that it stored about two months stock of APIs and intermediates as part of inventory holding norms, but noted that drug production could be impacted if its plants did not start by end of February.<sup>53</sup>

In February, a pharma advocacy group member said that stocks in most of the bigger pharma companies was enough to last for about three months (till ~May), while small and medium companies had stocks for 20-25 days (till ~mid-March, at most), and importers who traded only in raw materials had enough for the next 40-45 days (till ~April).<sup>54</sup>

Faced with restricted imports during the lockdown in China, in February, India identified 57 APIs of crucial antibiotics, vitamins, and hormones or steroids could go out of stock in case of a prolonged lockdown in China. The list contains antibiotics like Azithromycin, Amoxicillin, Ofloxacin, Metronidazole, Gentamicin, Gabapentin, vitamins B12, B1, B6, and E, progesterone, and Atorvastatin.<sup>55</sup>

Later that month, a government committee also told the Department of Pharmaceuticals (DoP) that 32 critical and essential drugs could run out if Chinese lockdown continued. These included amoxicillin, moxifloxacin, doxycycline and tuberculosis (TB) rifampicin, potassium clavulanate, ceftriaxone sodium sterile, piperacillin tazobactam, meropenam, vancomycin, gentamycin and ciprofloxacin.<sup>56</sup>



## Rise in prices of raw materials

Even though supply of raw materials from China resumed after lockdowns from January to March, input costs rose steeply for many chemicals. Costs of Chinese APIs and KSMs rose, on average, by 20-30%,<sup>57</sup> while prices of fermentation-based KSMs and APIs rose by ~30%, in part because of increased freight costs.

The lockdown in China left manufacturers in the country with low supplies due to traffic restrictions and staff shortages, leading to an increase in prices. “We are charging our Indian clients about twice as high as we did before the outbreak. That’s in part because we are running out of raw material,” said an official at Jinan Finer Chemical Co, a Chinese maker of pharmaceutical ingredients.<sup>58</sup>

### Price rise for specific APIs<sup>59 60 61 62 63 64 65</sup>

- Isopropyl alcohol (IPA) prices increased by 100%
- Nimesulide prices increased 189%, from Rs 450 to Rs 1,300 per kg between January and April 2020
- Azithromycin prices increased from Rs 7,200 to Rs 16,000 per kg between January and April 2020. As a result of supply shortage, Sun Pharma, a key supplier, has almost doubled the price of Azithromycin.<sup>66</sup>
- Cephalexin prices increased from Rs 3,300 to Rs 4,800 per kg between January and April 2020
- Cefixime prices increased from Rs 8,200 to Rs 10,000 per kg between January and April 2020
- Chloroquine Phosphate prices increased from Rs 1,600 to Rs 11,000 per kg between January and April 2020.
- Doxycycline prices increased from Rs 5,200 to Rs 7,500 per kg between January and April 2020.
- Erythromycin thiocyanate prices increased by 10% which led to increase in prices of erythromycin stearate and erythromycin estolate by 10%.
- Hydroxychloroquine costs increased from Rs 7,800 to Rs 75,000 per kg between January and April 2020.
- Paracetamol prices increased by 62% from Rs 220 to Rs 425 per kg between January and April 2020.
- Para amino phenol (PAP, a KSM for paracetamol) prices increased by 27%
- Oseltamivir prices increased from 1,00,000 to Rs 1,70,000 per kg between January and April 2020.
- Tetracycline, gentamicin, norfloxacin, and tramadol prices increased by 12-20% between January and April
- Tinidazole, amoxicillin, ceftriaxone, clav avicel, diclofenac sodium, ofloxacin, clav syloid, clotrimazole, ciprofloxacin and dexamethasone sodium prices increased by 24-38% between January to April.

- Montelukast sodium prices increased from Rs 33,000-38,000 per kg before the lockdowns to Rs 52,000 and Rs 58,000 per kg
- Vitamins and penicillin prices increased by 40-50%
- 6APA (a chemical used to manufacture antibiotics) prices increased by more than 360%, from Rs 400 to Rs 1,875 per kg from January to February
- Penicillin G (raw material used to manufacture antibiotics) prices increased by over 50% from Rs 487 to Rs 750 per kg from January to February <sup>67</sup>

“Some of the scare is also due to [the] artificial shortage of APIs created by traders who started hoarding APIs as soon as they heard about the onset of the epidemic,” B R Sikri, chairman of the Federation of Pharmaceutical Entrepreneurs has said.<sup>68</sup>

Dilip Sanghvi, Sun Pharma said, “The alleged near-80% price increase in some raw materials (that may be almost entirely dependent on China) is not justified and speculative buying would have raised these prices.”<sup>69</sup>

“There was a gap in API production in China as the production units were shut due to an outbreak there from January to March. Now they have opened up with bulk orders in hand... Also, due to Covid-19, the global demand for medicine is higher than usual which has pushed China to increase the prices even more,” said Arjun Juneja, chief operating officer, Mankind Pharma.

An industry official working for a Mumbai-based pharmaceutical firm said, “The hike can also be credited to the increase in price of dollar while additional cost of landing charges such as freight cost has also gone up.”<sup>70</sup>

Indeed, air freight charges have increased from US\$ 2 per kg to US\$ 5-6 per kg. The average cost of shipping a container from China to India has increased from US\$ 750 to US\$ 1,200-1,300.<sup>71</sup>

In India, NPPA drug prices regulations are designed to absorb changes in raw material prices for listed essential drugs. It might be worth examining how much a sustained increase in KSMs and APIs will translate into higher prices of drugs exported to LMICs.

## How is India placed to weather future shocks?

The Indian government plans to increase self-reliance in the area of API and KSM production and decrease dependence on China.<sup>72</sup>

One of the plans for this is the proposed Production Linked Incentive (PLI) scheme<sup>73</sup> notified in early June, which seeks to encourage domestic manufacturing of 53 critical bulk drugs – 26 fermentation based and 27 chemical synthesis-based bulk drugs, which include:

- |                                   |                            |
|-----------------------------------|----------------------------|
| 1. Amoxicillin                    | 5. Cefoperazone            |
| 2. Azithromycin                   | 6. Cefixime                |
| 3. Erythromycin Stearate/Estolate | 7. Cephalexin              |
| 4. Ceftriaxone                    | 8. Piperacillin Tazobactam |

9. Sulbactam
10. Dexamethasone
11. Prednisolone
12. Metformin
13. Gabapentin
14. Rifampicin
15. Vitamin B1
16. Vitamin B6
17. Clindamycin Phosphate
18. Clindamycin HCL
19. Streptomycin
20. Neomycin
21. Gentamycin
22. Doxycycline
23. Potassium Clavulanate
24. Oxytetracycline
25. Tetracycline
26. Clarithromycin
27. Betamethasone
28. Ciprofloxacin
29. Losartan
30. Telmisartan
31. Artesunate
32. Norfloxacin
33. Ofloxacin
34. Metronidazole
35. Sulfadiazine
36. Levofloxacin
37. Meropenem
38. Paracetamol
39. Tinidazole
40. Ornidazole
41. Ritonavir
42. Doclofinac Sodium
43. Aspirin
44. Levetiracetam
45. Carbidopa
46. Levodopa
47. Carbamazepine
48. Oxcarbazepine
49. Valsartan
50. Olmesartan
51. Atorvastatin
52. Acyclovir
53. Lopinavir

## Annex 1: Drug List

Key	Notes	On list for domestic production?
ACICLOVIR	Was among 26 drugs the export of which was briefly restricted by the Directorate General of Foreign Trade (DGFT) in early March.	
Allopurinol		
AMIKACIN	Price hike in API import from China	
AMIODARONE		
Amitriptyline		
AMLODIPINE TELMISARTAN		Yes but only telmisartan
AMPHOTERICIN B		
AZATHIOPRINE		
BECLOMETASONE		
Betamethasone		Yes
Budesonide		
Bupivacaine	Auromedics (U.S. subsidiary of Aurobindo Pharma) faces supply shortage of bupivacaine injection, as piperacillin, a KSMs supply is disrupted. This might affect the price of Bupivacaine.	
CALCIUM FOLINATE		
CARBAMAZEPINE	Recognised as an “essential medicine” for COVID therapy; The state drug controllers have been asked to ensure the availability of these drugs with assured quality at affordable prices. <sup>74</sup>	Yes
Cefotaxime		
Ceftriaxone	Ceftriaxone sodium sterile was identified as one of the APIs used to make critical and essential drugs that do not have alternatives.	Yes
CIPROFLOXACIN	Identified as an essential drug that could run out if Chinese lockdown continues. Import dependence on China > 90%	Yes
CLOXACILLIN	Highly import dependent on China -- witnessed API import price increase of 20-40%	
DAPSONE		
DEXAMETHASONE	In early July, the National Pharmaceutical Pricing Authority (NPPA) asked drug manufacturing associations to ensure sufficient availability of low molecular weight Heparin, (e.g. Enoxaparin and Dexamethasone) across the country. Manufacturers expect API import price to go up by 10-30% after it was proven effective in treating COVID symptoms. <sup>75</sup>	Yes
DIGOXIN		
Doxycycline	Identified as an essential drug that could run out if Chinese lockdown continues. A Karnataka-based	Yes

	manufacturer identified problems in procuring Doxycycline Hyclate. <sup>76</sup>	
ENALAPRIL		
Fluconazole		
FLUOXETINE		
Gentamicin	Identified as an essential drug that could run out if Chinese lockdown continues.	
HYDRALAZINE   Oral Solid		
HYDRALAZINE   Parenteral	The Indian Central Drugs Standard Control Organisation (CDSCO) in May issued a letter to all drug manufacturers associations informing them of low supply of Hydralazine among 14 other drugs essential for COVID treatment. <sup>77</sup>	
HYDROCHLOROTHIAZIDE		
HYDROCORTISONE	Highly import dependent on China.	
Ibuprofen	Import dependence on China > 80-95%. Some manufacturers worried that stocks might last less than a month. <sup>78</sup>	
Levonorgestrel / Ethinylestradiol		
Lisinopril		
MEROPENEM	Identified as one of the APIs used to make critical and essential drugs that do not have alternatives. This is also one of the APIs India is looking to manufacture domestically. <sup>79</sup>	Yes
METHYLPREDNISOLONE	In early July, the National Pharmaceutical Pricing Authority (NPPA) asked drug manufacturing associations to ensure sufficient availability of Methylprednisolone (IV) across the country.	
METOCLOPRAMIDE		
Metronidazole	Identified as an essential drug that could run out if Chinese lockdown continues. Was among 26 drugs the export of which was briefly restricted by the Directorate General of Foreign Trade (DGFT) in early March. <b>I'm not sure which formulation of Metronidazole this information pertains to (or if it applies for both)</b>	Yes
METRONIDAZOLE   Oral Liquid	Identified as an essential drug that could run out if Chinese lockdown continues. Was among 26 drugs the export of which was briefly restricted by the Directorate General of Foreign Trade (DGFT) in early March. <b>I'm not sure which formulation of Metronidazole this information pertains to (or if it applies for both)</b>	Yes
MIFEPRISTONE MISOPROSTOL	Shortages reported due to supply chain disruption from manufacturers in China <sup>80</sup> .	
MORPHINE		
MUPIROCIN		
NALOXONE		
Nevirapine		
Norethisterone		

OMEPRAZOLE		
OXYTOCIN		
Paclitaxel		
Paracetamol	100% import dependence on China. Some manufacturers worried that stocks might last less than a month. <sup>81</sup> Was among 26 drugs the export of which was briefly restricted by the Directorate General of Foreign Trade (DGFT) in early March.	Yes
PHENOBARBITAL		
Prednisolone	Identified as one of the APIs used to make critical and essential drugs. NPPA asks drug manufacturers to ensure availability.	Yes
PYRIDOSTIGMINE		
RANITIDINE		
RIFAMPICIN	Identified as an essential drug that could run out if Chinese lockdown continues.	Yes
Salbutamol	Found to be in low supply in the market. <sup>82</sup> NPPA asks drug manufacturers to ensure availability.	
Sofosbuvir		
Sofosbuvir / Velpatasvir		
SPIRONOLACTONE		
SULFADIAZINE	API manufactured only in China. Also identified as essential drug and Indian DGCA asks drug manufacturers to ensure availability for at least three months. <sup>83</sup>	Yes
Sulfamethoxazole Trimethoprim		
Telmisartan	Highly import dependent on China.	Yes
Tetracycline	Highly import dependent on China.	Yes
VALPROIC ACID		
Vitamin A / Retinol		
Vitamin B Complex	Vitamins B1, B6, and B12 were among 26 drugs the export of which was briefly restricted by the Directorate General of Foreign Trade (DGFT) in early March. Vitamins B12, B1, B6 were also identified as essential drugs that could run out if Chinese lockdown continues.	Yes: Vitamin B1, B6

## References

- <sup>1</sup> <https://www.europeanpharmaceuticalreview.com/article/117413/the-covid-19-pandemic-and-the-indian-pharmaceutical-industry/>
- <sup>2</sup> <https://www.mycii.in/KmResourceApplication/65793.IndianAPIIndustryReachingthefullpotentialKPMGCIIThoughLeadershipreport2020.pdf>
- <sup>3</sup> [https://f1000researchdata.s3.amazonaws.com/manuscripts/25454/51d8da66-f6a2-45a3-be2f-0132a95b9a4f\\_23057\\_-\\_philippe\\_guerin.pdf?doi=10.12688/f1000research.23057.1&numberOfBrowsableCollections=24&numberOfBrowsableInstitutionalCollections=5&numberOfBrowsableGateways=24](https://f1000researchdata.s3.amazonaws.com/manuscripts/25454/51d8da66-f6a2-45a3-be2f-0132a95b9a4f_23057_-_philippe_guerin.pdf?doi=10.12688/f1000research.23057.1&numberOfBrowsableCollections=24&numberOfBrowsableInstitutionalCollections=5&numberOfBrowsableGateways=24)
- <sup>4</sup> [https://economictimes.indiatimes.com/news/economy/foreign-trade/govt-frees-exports-of-all-apis-formulations-except-paracetamol/articleshow/75017469.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](https://economictimes.indiatimes.com/news/economy/foreign-trade/govt-frees-exports-of-all-apis-formulations-except-paracetamol/articleshow/75017469.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)
- <sup>5</sup> <https://www.mycii.in/KmResourceApplication/65793.IndianAPIIndustryReachingthefullpotentialKPMGCIIThoughLeadershipreport2020.pdf>
- <sup>6</sup> <https://theprint.in/health/why-india-saw-only-4-pharma-products-launched-in-april-its-lowest-count-ever/426161/>
- <sup>7</sup> [http://ficci.in/spdocument/23233/FICCI-Report\\_COVID-19-Impact%20on%20-Regional-Industry-Economy.pdf](http://ficci.in/spdocument/23233/FICCI-Report_COVID-19-Impact%20on%20-Regional-Industry-Economy.pdf)
- <sup>8</sup> <https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/drugs-essential-ancillaries-not-so-means-supplies-take-a-hit/articleshow/75038462.cms>
- <sup>9</sup> <https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/covid-19-forget-healing-touch-pharma-gets-it-rough/articleshow/74820419.cms>
- <sup>10</sup> [http://ficci.in/spdocument/23233/FICCI-Report\\_COVID-19-Impact%20on%20-Regional-Industry-Economy.pdf](http://ficci.in/spdocument/23233/FICCI-Report_COVID-19-Impact%20on%20-Regional-Industry-Economy.pdf)
- <sup>11</sup> [http://ficci.in/spdocument/23233/FICCI-Report\\_COVID-19-Impact%20on%20-Regional-Industry-Economy.pdf](http://ficci.in/spdocument/23233/FICCI-Report_COVID-19-Impact%20on%20-Regional-Industry-Economy.pdf)
- <sup>12</sup> <https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/drugs-essential-ancillaries-not-so-means-supplies-take-a-hit/articleshow/75038462.cms>
- <sup>13</sup> [https://www.business-standard.com/article/sme/pharma-smes-will-overcome-short-term-disruptions-crisis-sme-tracker-120070601229\\_1.html](https://www.business-standard.com/article/sme/pharma-smes-will-overcome-short-term-disruptions-crisis-sme-tracker-120070601229_1.html)
- <sup>14</sup> <https://www.idma-assn.org/pdf/idma-bulletin-21-may-2020.pdf>
- <sup>15</sup> <https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/what-ails-indias-pharmaceutical-sector/articleshow/73339737.cms>
- <sup>16</sup> <https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/coronavirus-pandemic-threatens-to-cut-pharmaceutical-industrys-lifeline/articleshow/73753415.cms>
- <sup>17</sup> <https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/coronavirus-pandemic-threatens-to-cut-pharmaceutical-industrys-lifeline/articleshow/73753415.cms>
- <sup>18</sup> <https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/coronavirus-pandemic-threatens-to-cut-pharmaceutical-industrys-lifeline/articleshow/73753415.cms>
- <sup>19</sup> <http://www.pharmabiz.com/NewsDetails.aspx?aid=129007&sid=1>
- <sup>20</sup> <https://economictimes.indiatimes.com/news/economy/foreign-trade/govt-frees-exports-of-all-apis-formulations-except-paracetamol/articleshow/75017469.cms>
- <sup>21</sup> [https://economictimes.indiatimes.com/markets/stocks/news/icra-revises-domestic-pharma-industry-outlook-to-negative-due-to-coronavirus-outbreak/articleshow/74225750.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](https://economictimes.indiatimes.com/markets/stocks/news/icra-revises-domestic-pharma-industry-outlook-to-negative-due-to-coronavirus-outbreak/articleshow/74225750.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)
- <sup>22</sup> <https://pib.gov.in/PressReleasePage.aspx?PRID=1606367>
- <sup>23</sup> <https://www.theguardian.com/world/2020/mar/04/india-limits-medicine-exports-coronavirus-paracetamol-antibiotics>
- <sup>24</sup> <https://www.idma-assn.org/pdf/idma-bulletin-21-april-2020.pdf>
- <sup>25</sup> [https://economictimes.indiatimes.com/news/economy/foreign-trade/govt-frees-exports-of-all-apis-formulations-except-paracetamol/articleshow/75017469.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](https://economictimes.indiatimes.com/news/economy/foreign-trade/govt-frees-exports-of-all-apis-formulations-except-paracetamol/articleshow/75017469.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)
- <sup>26</sup> <https://economictimes.indiatimes.com/markets/expert-view/post-covid-innovative-and-agile-pharma-cos-will-become-stronger-gv-prasad/articleshow/75534453.cms>

- 
- 27 <https://economictimes.indiatimes.com/markets/stocks/news/drug-makers-manage-to-up-mfg-capacity-to-50-60/articleshow/75802335.cms>
- 28 <https://docs.google.com/document/d/1g6QxAamidqSX1Jg8Yb1YSpF86MnuZJMqno4XBjsY4ucM/edit>
- 29 <https://economictimes.indiatimes.com/markets/stocks/news/icra-downgrades-indian-pharma-on-china-lockdown/articleshow/74235993.cms>
- 30 <https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/covid-19-restrictions-affected-sales-created-liquidity-crunch-lyka-labs/articleshow/76212241.cms>
- 31 <https://economictimes.indiatimes.com/news/economy/foreign-trade/boycott-china-checks-on-imports-to-hit-drug-devices-supply/articleshow/76681615.cms>
- 32 [https://www.business-standard.com/article/companies/relief-for-pharma-firms-as-govt-starts-clearing-api-imports-from-china-120070100060\\_1.html](https://www.business-standard.com/article/companies/relief-for-pharma-firms-as-govt-starts-clearing-api-imports-from-china-120070100060_1.html)
- 33 <https://www.fiercepharma.com/manufacturing/india-pharma-manufacturing-hub-back-up-and-running-after-covid-19-lockdown-report>
- 34 [http://ficci.in/spdocument/23233/FICCI-Report\\_COVID-19-Impact%20on%20Regional-Industry-Economy.pdf](http://ficci.in/spdocument/23233/FICCI-Report_COVID-19-Impact%20on%20Regional-Industry-Economy.pdf)
- 35 [http://ficci.in/spdocument/23233/FICCI-Report\\_COVID-19-Impact%20on%20Regional-Industry-Economy.pdf](http://ficci.in/spdocument/23233/FICCI-Report_COVID-19-Impact%20on%20Regional-Industry-Economy.pdf)
- 36 [https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/some-drugs-more-essential-govt-moves-to-ensure-supply/articleshow/75339240.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/some-drugs-more-essential-govt-moves-to-ensure-supply/articleshow/75339240.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)
- 37 <https://www.fiercepharma.com/manufacturing/lupin-shuts-down-indian-plant-after-18-workers-test-positive-for-covid-19-report>
- 38 [https://www.business-standard.com/article/companies/this-pharma-hub-gets-back-on-its-feet-after-relief-in-locked-down-india-120042600948\\_1.html](https://www.business-standard.com/article/companies/this-pharma-hub-gets-back-on-its-feet-after-relief-in-locked-down-india-120042600948_1.html)
- 39 <https://health.economictimes.indiatimes.com/news/pharma/lockdown-hits-production-by-telanganas-bulk-drug-manufacturers/75627223>
- 40 <https://health.economictimes.indiatimes.com/news/pharma/lockdown-hits-production-by-telanganas-bulk-drug-manufacturers/75627223>
- 41 [https://www.business-standard.com/article/companies/lockdown-3-0-pharma-hubs-take-extra-precaution-to-tame-covid-19-outbreak-120050900004\\_1.html](https://www.business-standard.com/article/companies/lockdown-3-0-pharma-hubs-take-extra-precaution-to-tame-covid-19-outbreak-120050900004_1.html)
- 42 <https://www.thehindubusinessline.com/news/12-employees-test-positive-for-covid-at-lupins-ankleshwar-facility/article32076604.ece>
- 43 <https://health.economictimes.indiatimes.com/news/pharma/lupin-shuts-manufacturing-drug-plant-after-17-employees-test-positive-for-covid-19/76969702>
- 44 <https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/covid-19-restrictions-affected-sales-created-liquidity-crunch-lyka-labs/articleshow/76212241.cms>
- 45 <https://www.thehindubusinessline.com/news/12-employees-test-positive-for-covid-at-lupins-ankleshwar-facility/article32076604.ece>
- 46 [https://timesofindia.indiatimes.com/business/india-business/key-covid-19-drugs-to-be-hit-by-customs-checks-at-ports/articleshow/76700469.cms?utm\\_source=twitter.com&utm\\_medium=social&utm\\_campaign=TOIMobile](https://timesofindia.indiatimes.com/business/india-business/key-covid-19-drugs-to-be-hit-by-customs-checks-at-ports/articleshow/76700469.cms?utm_source=twitter.com&utm_medium=social&utm_campaign=TOIMobile)
- 47 <https://economictimes.indiatimes.com/markets/stocks/news/coronavirus-impact-on-indias-pharma-sector/articleshow/75136862.cms>
- 48 <https://www.mycii.in/KmResourceApplication/65793.IndianAPIIndustryReachingthefullpotentialKPMGCIITheughtLeadershipreport2020.pdf>
- 49 [https://www.business-standard.com/article/companies/relief-for-pharma-firms-as-govt-starts-clearing-api-imports-from-china-120070100060\\_1.html](https://www.business-standard.com/article/companies/relief-for-pharma-firms-as-govt-starts-clearing-api-imports-from-china-120070100060_1.html)
- 50 <https://www.mycii.in/KmResourceApplication/65793.IndianAPIIndustryReachingthefullpotentialKPMGCIITheughtLeadershipreport2020.pdf>
- 51 <https://www.idma-assn.org/pdf/idma-bulletin-14-july-2020.pdf>
- 52 <https://health.economictimes.indiatimes.com/news/pharma/post-relaxation-in-lockdown-the-immediate-focus-for-pharma-would-be-to-ramp-up-production-levels-ramkumar-sv/75420164>
- 53 [https://economictimes.indiatimes.com/news/company/corporate-trends/coronavirus-concerns-india-inc-in-a-cold-sweat-as-lockdown-in-china-continues/articleshow/73973114.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](https://economictimes.indiatimes.com/news/company/corporate-trends/coronavirus-concerns-india-inc-in-a-cold-sweat-as-lockdown-in-china-continues/articleshow/73973114.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)



- 
- <sup>54</sup> <https://www.theweek.in/news/health/2020/02/11/drug-shortages-due-to-coronavirus-india-has-api-stocks-for-two-three-months.html>
- <sup>55</sup> [https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/covid-19-impact-pharma-companies-feel-the-pain-as-prices-of-key-inputs-shoot-up/articleshow/74144044.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/covid-19-impact-pharma-companies-feel-the-pain-as-prices-of-key-inputs-shoot-up/articleshow/74144044.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)
- <sup>56</sup> [https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/covid-19-impact-government-panel-lists-essential-drugs-that-can-run-out/articleshow/74449944.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/covid-19-impact-government-panel-lists-essential-drugs-that-can-run-out/articleshow/74449944.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)
- <sup>57</sup> [https://www.business-standard.com/article/sme/pharma-smes-will-overcome-short-term-disruptions-crisil-sme-tracker-120070601229\\_1.html](https://www.business-standard.com/article/sme/pharma-smes-will-overcome-short-term-disruptions-crisil-sme-tracker-120070601229_1.html)
- <sup>58</sup> <https://www.ft.com/content/ef9735fa-55e8-11ea-a528-dd0f971febbc>
- <sup>59</sup> <https://www.businesstoday.in/current/corporate/chinese-pharma-suppliers-raise-prices-by-20/story/407011.html>
- <sup>60</sup> <https://www.idma-assn.org/pdf/idma-bulletin-21-april-2020.pdf>
- <sup>61</sup> <https://www.idma-assn.org/pdf/idma-bulletin-30-april-2020.pdf>
- <sup>62</sup> <http://www.pharmabiz.com/NewsDetails.aspx?aid=129007&sid=1>
- <sup>63</sup> <http://www.pharmabiz.com/NewsDetails.aspx?aid=129007&sid=1>
- <sup>64</sup> [https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/covid-19-impact-pharma-companies-feel-the-pain-as-prices-of-key-inputs-shoot-up/articleshow/74144044.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/covid-19-impact-pharma-companies-feel-the-pain-as-prices-of-key-inputs-shoot-up/articleshow/74144044.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)
- <sup>65</sup> [https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/covid-19-impact-pharma-companies-feel-the-pain-as-prices-of-key-inputs-shoot-up/articleshow/74144044.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/covid-19-impact-pharma-companies-feel-the-pain-as-prices-of-key-inputs-shoot-up/articleshow/74144044.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)
- <sup>66</sup> <https://www.beroeinc.com/blog/category-scan-drug-shortages-and-export-restrictions/>
- <sup>67</sup> <https://theprint.in/india/prices-of-some-medicines-could-go-up-as-cost-of-chinese-bulk-drugs-import-surges/459421/>
- <sup>68</sup> [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(20\)30459-1/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30459-1/fulltext)
- <sup>69</sup> <https://health.economictimes.indiatimes.com/news/pharma/inventory-buffer-to-keep-pharma-healthy-for-now/74109041>
- <sup>70</sup> <https://www.idma-assn.org/pdf/idma-bulletin-21-april-2020.pdf>
- <sup>71</sup> <http://www.pharmabiz.com/NewsDetails.aspx?aid=129007&sid=1>
- <sup>72</sup> <https://www.businesstoday.in/sectors/pharma/atma-nirbhar-bharat-here-are-53-drugs-on-which-india-will-test-self-reliance/story/405758.html>
- <sup>73</sup> <https://www.idma-assn.org/pdf/idma-bulletin-07-june-2020.pdf>
- <sup>74</sup> [https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/some-drugs-more-essential-govt-moves-to-ensure-supply/articleshow/75339240.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/some-drugs-more-essential-govt-moves-to-ensure-supply/articleshow/75339240.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)
- <sup>75</sup> <https://economictimes.indiatimes.com/industry/healthcare/biotech/pharmaceuticals/indian-drug-firms-cheer-dexamethasone-efficacy-on-severe-covid-19-patients/articleshow/76437755.cms?from=mdr>
- <sup>76</sup> <https://www.deccanherald.com/national/pharma-sector-reels-as-coronavirus-rages-in-china-806025.html>
- <sup>77</sup> <https://www.expresspharma.in/covid19-updates/cdco-observes-lower-supply-of-15-drugs-used-for-covid-19-treatment/>
- <sup>78</sup> <https://asiatimes.com/2020/02/covid-19-indian-pharma-catches-a-cold/>
- <sup>79</sup> [https://www.business-standard.com/article/companies/hindustan-antibiotics-seeks-redemption-begins-manufacturing-of-bulk-drugs-120062701309\\_1.html](https://www.business-standard.com/article/companies/hindustan-antibiotics-seeks-redemption-begins-manufacturing-of-bulk-drugs-120062701309_1.html)
- <sup>80</sup> <https://www.fsrh.org/blogs/what-covid-19-means-for-the-global-provision-of-srh/>
- <sup>81</sup> <https://asiatimes.com/2020/02/covid-19-indian-pharma-catches-a-cold/>
- <sup>82</sup> <https://www.expresspharma.in/covid19-updates/cdco-observes-lower-supply-of-15-drugs-used-for-covid-19-treatment/>
- <sup>83</sup> <https://www.idma-assn.org/pdf/idma-bulletin-21-april-2020.pdf>