

Meeting global demand for medical supplies induced by the coronavirus pandemic

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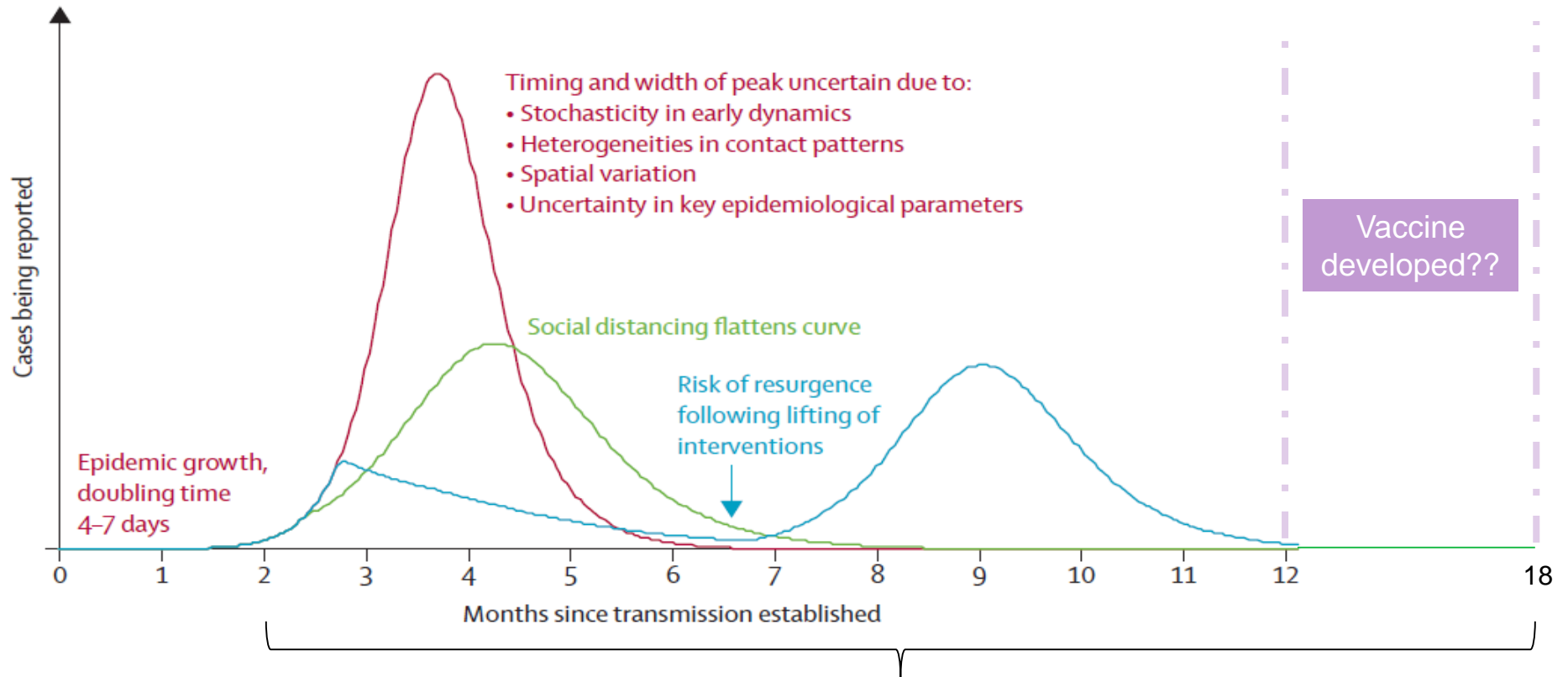
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Executive Summary

- The Covid-19 pandemic has increased demand for medical supplies, specifically personal protection equipment (PPE) for health workers, ventilators and testing kits. Shortages have been observed and will persist in the near term. Vaccines for 7.8 billion people will eventually be required
- This document provides rules of thumb for assessing national needs and a rough estimate of global demand
 - Low and lower middle income countries will demand approximately 0.5-3 ventilators per 10,000 people as well as 0.5-2 respirator masks per capita in the next 12 months. Per capita demand will be higher in high income countries, given they have more health workers and critical care beds per capita
 - Widespread (antibody) testing could cover at least 1 in 10 people in each country in the next 12 months. Once a vaccine is developed, 2-20 units per 100 people will be required to provide urgent vaccination to the vulnerable population over 65 years of age, before inoculating the entire population
- Medical supply production capabilities are concentrated in only a few countries. Some but not all governments have requisitioned exports to satisfy local demand, limited exports, or banned them outright
 - Many countries have no domestic production capabilities at all. If export restrictions persist, these countries will be unable to treat the sick, creating a risk that the virus returns to rich countries after it is initially brought under control, because poorer countries lack the supplies to suppress it effectively
- **Policy Recommendation: The World Bank Group and partners should enter the market immediately to broker and/or purchase supplies for and at the request of client countries and those without production capacity**
 - WBG and each partner to concentrate on their established comparative advantages and track record in this exercise
 - Countries with no domestic production capability will require approximately 4.5 billion respirator masks, 133 thousand ventilators, 307 million testing kits and eventually 163 million vaccinations for the elderly. Preliminary estimates of demand for 25 individual countries with WB fast-track emergency operations is provided in Annex A

The need for medical supplies to fight COVID-19 is urgent and will persist for at least 12-18 months



Time to Build Production and Distribution Capacity

- Personal protection equipment (PPE) and ventilators needed urgently to treat infections
- 7.8 billion units of the vaccine will be needed to inoculate the world population

How to forecast demand for medical supplies induced by Covid-19

PRELIMINARY

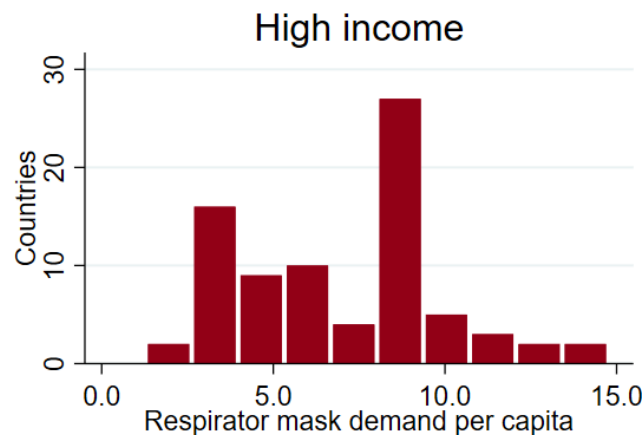
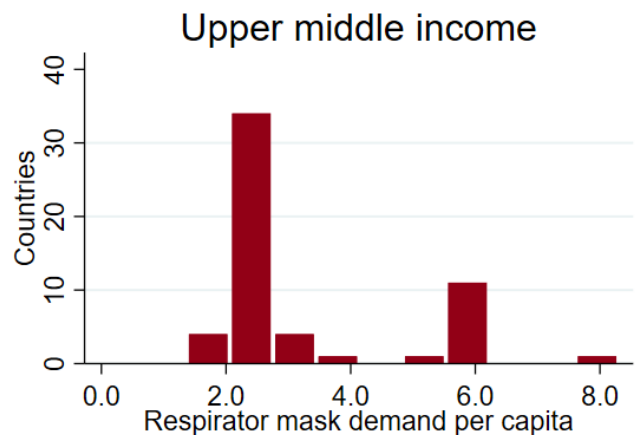
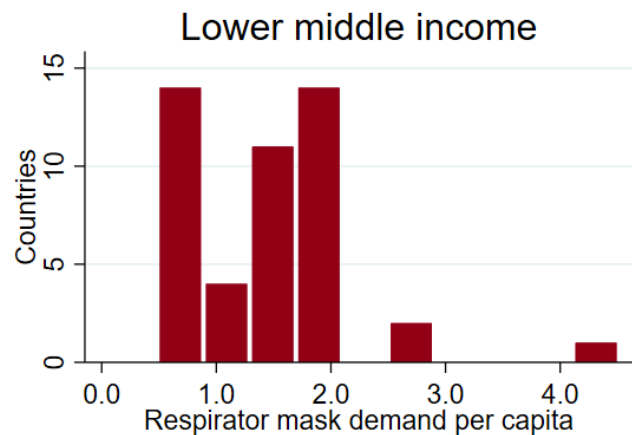
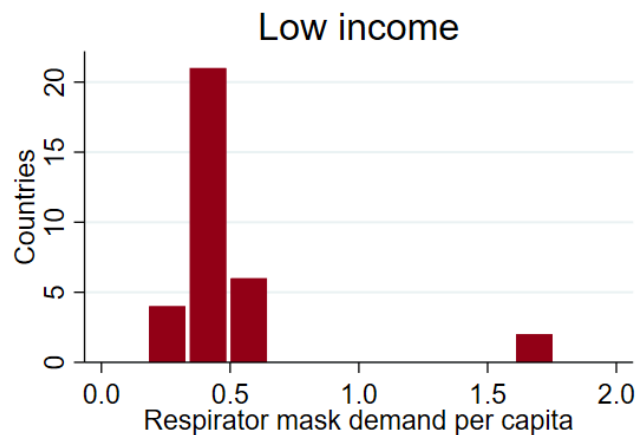
1 For treatment supplies, demand is a function of health system capacity

- Respirator masks demanded = # of health care workers*1.05*365*(6/7)*2
 - Assume 5% surge in capacity
 - Workers work six days per week for the next 12 months
 - Two masks per worker per day
- Ventilators demanded = # of critical care beds*1.05
 - Assume 5% surge in capacity
 - Critical care beds, or the sum of intensive care unit (ICU) beds and intermediate care unit (IMCU) beds, proxies for availability of health care providers with skills to operate ventilators

2 For prevention supplies, demand is a function of population size

- Urgent vaccines demanded = Population over 65 years of age
 - Elderly population prioritized for early ``urgent'' vaccination
- COVID-19 tests demanded = Population*10%
 - South Korea has tested cumulatively 9 people per 1,000. If this grows at 1% daily (less than current rate), it will be 174 per 1,000 by the end of the year, or 17% of the population

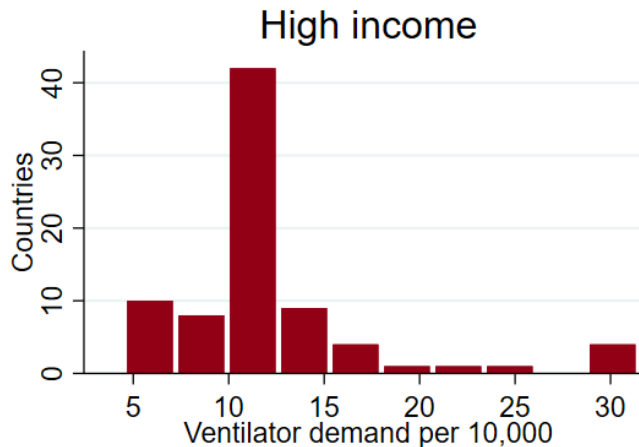
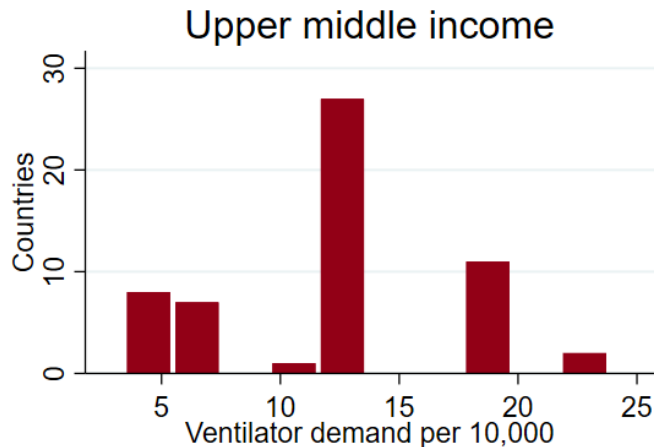
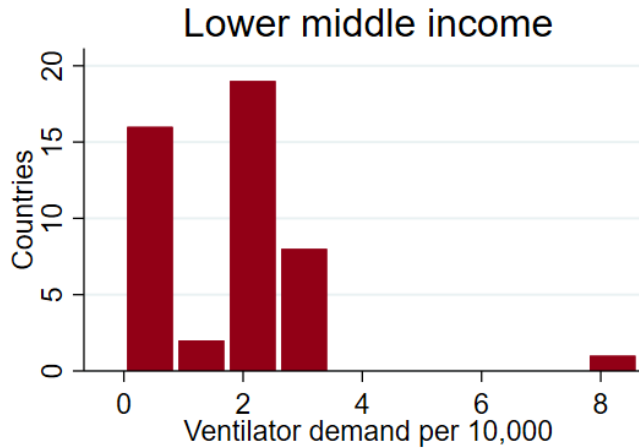
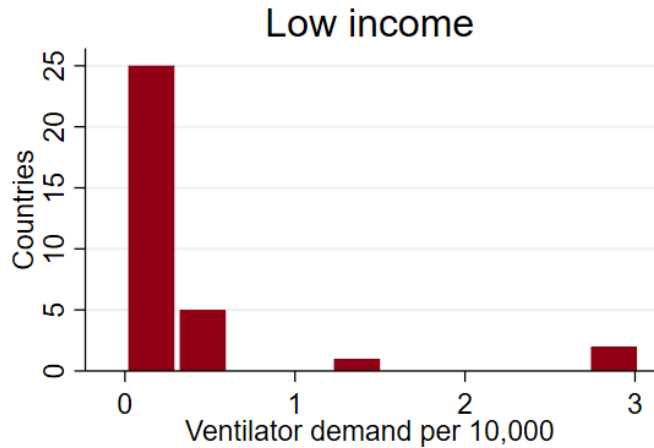
Respirator mask demand is expected to be approximately 0.5-2 units per capita in low and middle income countries



- Ranges in these charts suggest rules of thumb for estimating national respirator mask demand:
 - Low income countries need about 0.5 masks per capita
 - Lower middle income countries need about 1-2 masks per capita
 - High income country demand is much larger, at about 5-10 masks per capita
- Demand for other PPE articles (e.g., gloves, gowns) will be similar
- Estimates do not account for consumer demand, only needs of health workers

SOURCE: Number of health care workers is the sum of physicians, midwives and nurses reported in the World Development Indicators for 2016. Number of workers is assumed to grow at population growth rate for to achieve a 2020 value Missing values for remaining countries set equal to the average for the income group within the region. If this average is not available due to missing data, missing values replaced with the average for the income group globally

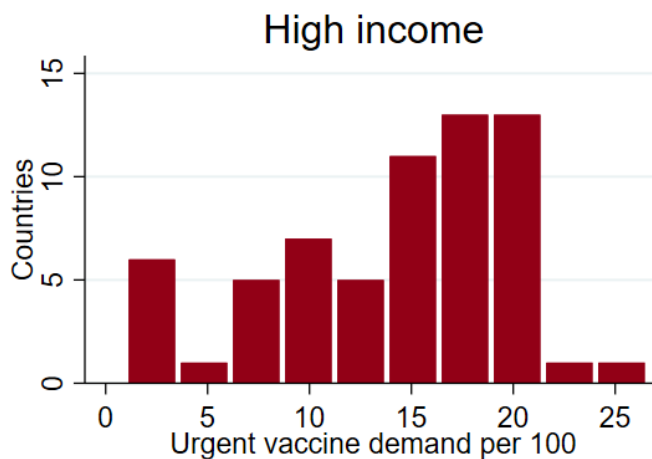
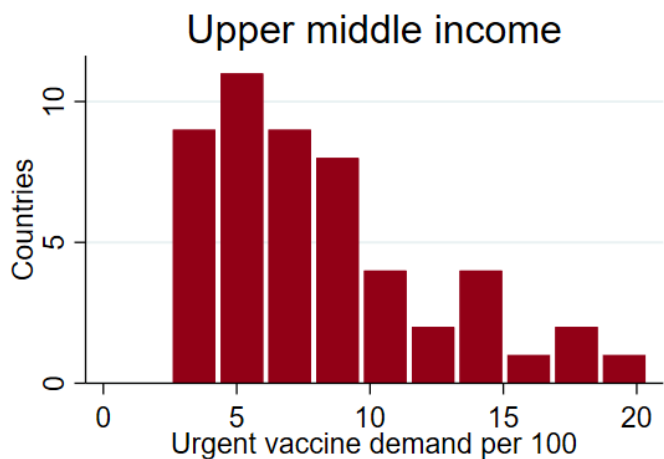
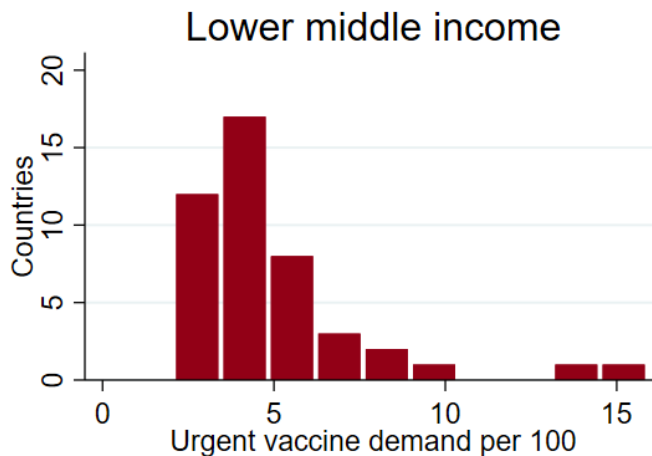
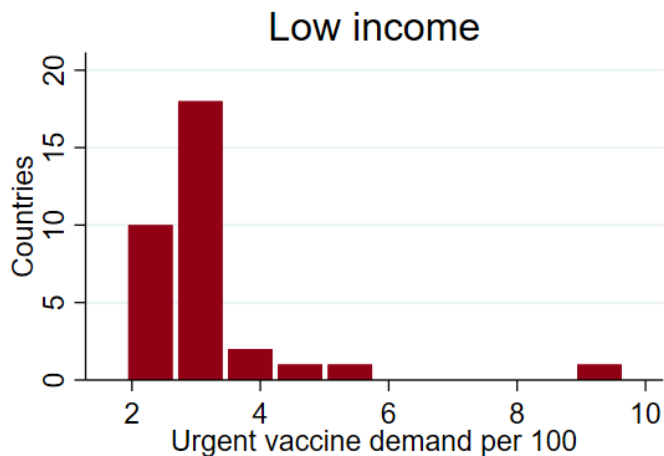
Ventilator demand is expected to be approximately 0.5-15 units per 10,000 people, depending on income



- Ranges in these charts suggest rules of thumb for estimating national ventilator demand:
 - Low income countries need about 0.5 ventilator units per 10,000 people
 - Lower middle income countries need about 0.5-3 ventilator units per 10,000 people
- No time to move used ventilators across countries
 - Peak demand roughly contemporaneous, since virus arrived in all countries within the same 1-3 months

SOURCE: The number of critical care beds in 64 countries is reported by Phua, Faruq, Kulkarni (2020); Murthy, Leligdowicz, Adhikari (2015) and Rhodes, Ferdinande, Flaatten, Guidet, Metnitz and Moreno (2012). Capacity assumed to grow at population growth rate from year of study to 2020. Missing values for remaining countries set equal to the average for the income group within the region. If this average is not available due to missing data, missing values replaced with the average for the income group globally

Urgent vaccination demand is expected to be 2-20 units per 100 people, once vaccine is developed

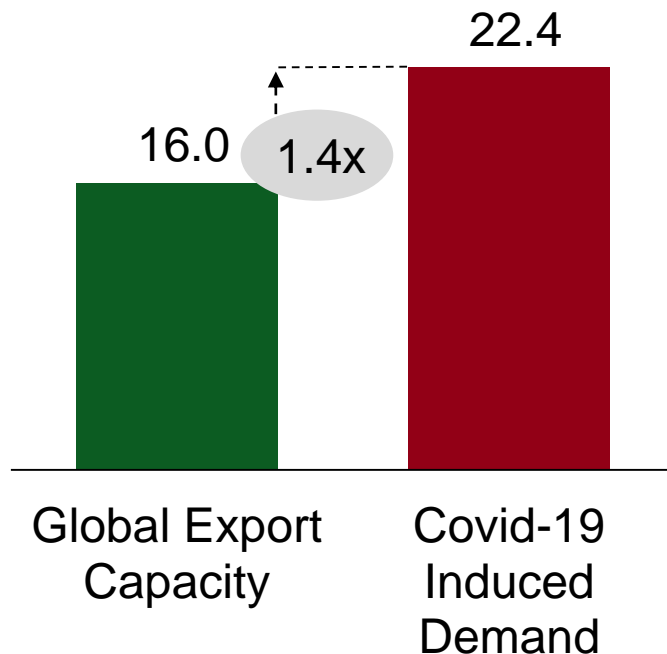


- Urgent vaccinations go to those over 65 years of age
 - Ranges in these charts suggest rules of thumb for estimating national urgent vaccination demand
- Higher income countries are older on average, and so will demand more urgent vaccinations per capita

Meeting demand will require increases in global production capacity

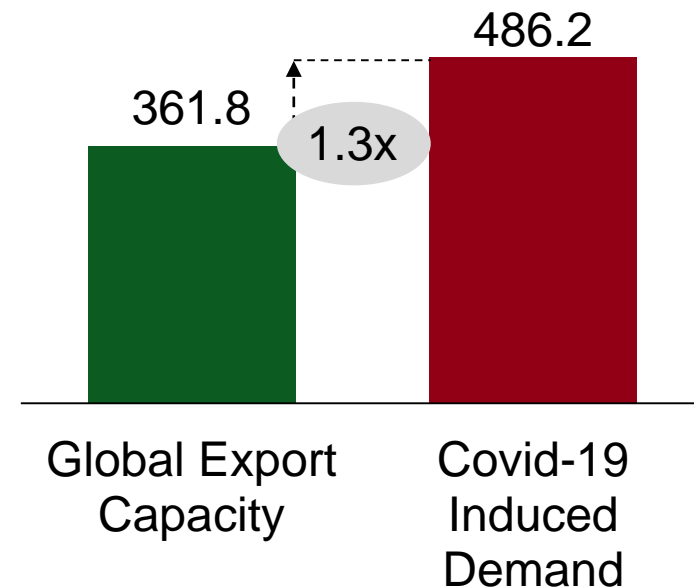
Respirator Masks

Billions of units



Ventilators

Thousands of units



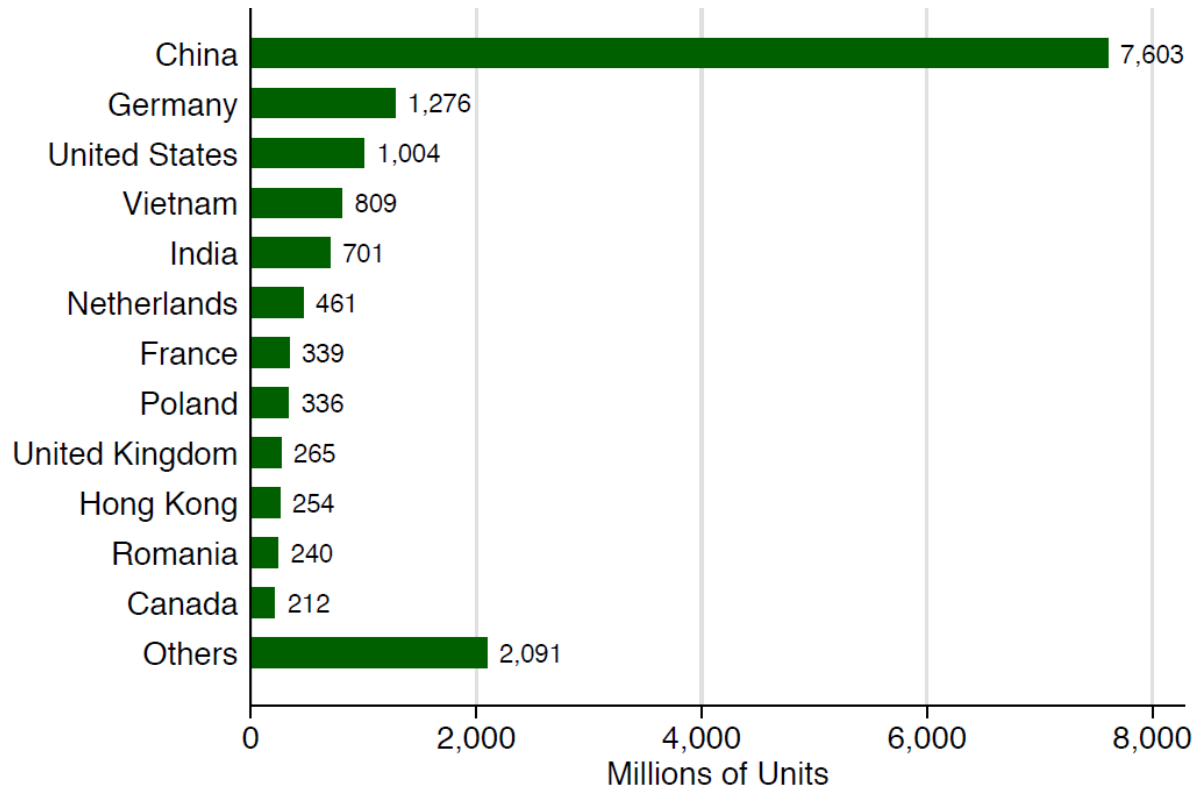
- Global export capacity estimated by dividing 2018 export values by typical unit prices

Some firms are scaling capacity by 1.5x–7x to meet demand for ventilators and respirator masks

Ventilators				
Firm	Factory Locations	Production Capacity Before Outbreak	Planned Capacity	Scaling Factor
AdvaMed	US	600-700 per week	3000-4000 per week	4.3x – 6.7x
Hamilton Medical	Switzerland	220 per week	330 -500 per week	1.5x – 2x
Tecme SA/Medical Equipments	Argentina	130 per week	200 per week	1.5x
Respirator Masks				
Firm	Factory Locations	Production Capacity Before Outbreak	Planned Capacity	Scaling Factor
3M	US, China, Canada, and 35 others	50 million per month	100 million per month (35 million inside the US)	2x
Medicom	Canada, China, South Korea, Japan, France, Australia, Malaysia	14 million per month	40 million per month	2.9x
CNTUS-Sungjin Co. Ltd.	South Korea, China, Vietnam	2.5 million per month	9.5 million per month	3.8x

But production capabilities are concentrated in a few countries that are restricting exports

Respirator Mask Export Capacity (2018)



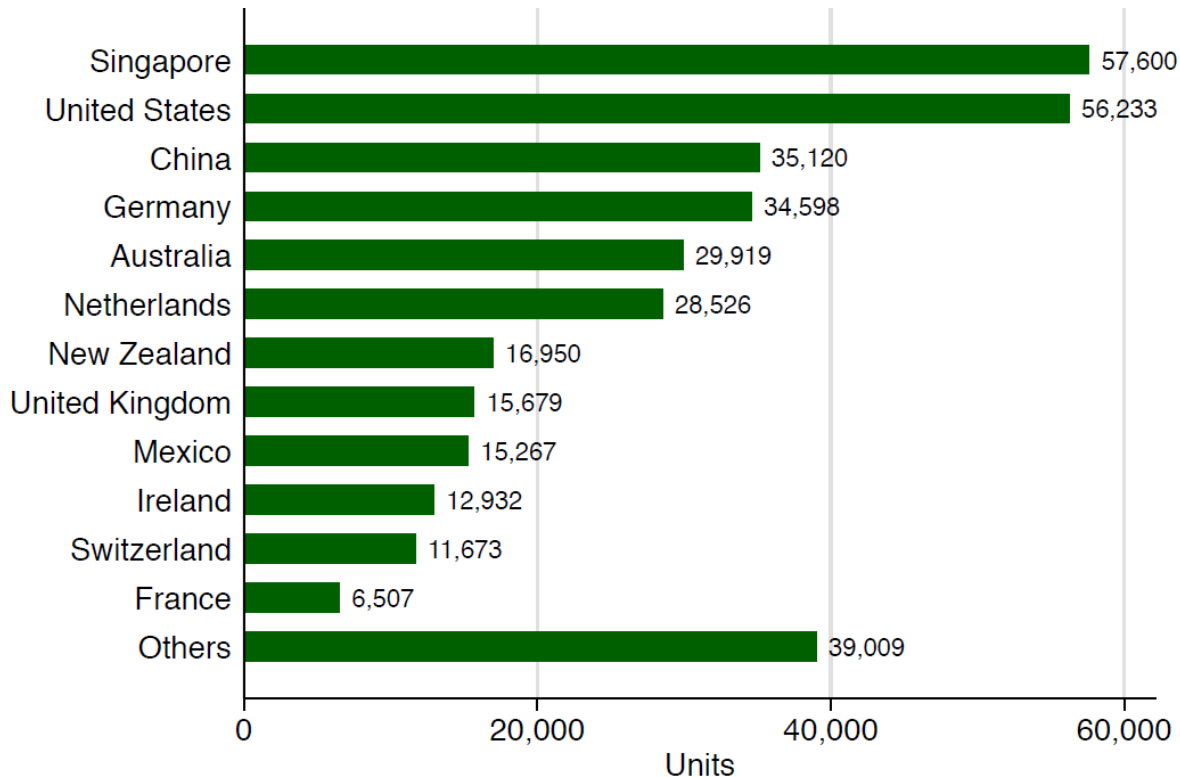
- Assumption: Export capacity is equal to 2018 export value¹ divided by \$0.675
 - N95 mask price is between \$0.75-\$1.00
 - Surgical mask price is \$0.10-\$0.65

- Major producers have imposed export restrictions
 - **China** requisitioned production to meet domestic demand in Jan and Feb, though it is now exporting again
 - **European Union** requires special authorization for exports
 - **United States** orders 3M to divert overseas production to United States

1. HS code 630790. "Textiles; made up articles (including dress patterns), n.e.c. in chapter 63, n.e.c. in heading no. 6307," which includes textile face-masks, without a replaceable filter or mechanical parts, including surgical masks and disposable face-masks made of non-woven textiles

Some major producers of ventilators, however, have not restricted trade

Ventilator Export Capacity (2018)



- Assumption: Export capacity is equal to 2018 export value¹ divided by \$20,000, the approximate cost of a 74kg bed-side ventilator

- **Canada, Australia, New Zealand and Singapore** have committed to keeping supply chains open and dropping any existing restrictions on trade in medical supplies

1. HS code 901920 ``Ventilators, oxygen mask and nebulizer, nasal cannula and CPAP machines''

Many countries have no production capability at all

Countries with no respirator mask production capability¹



- It will be impossible to manufacture supplies without existing domestic production capabilities, given specialized technology required for quality control
 - Exporters have responsibility to meet **import demand** of developing countries
- **Reserving supplies for developing countries is not zero-sum**
 - Abiy Ahmed (PM, Ethiopia): If we do not treat COVID19 in Africa, it will return to Europe and the United States

1. Name size is proportional to expected number of infections in Imperial College London late suppression scenario. Country has production capability if in at least one year between 2016-2018, it had more than \$5 million in respirator mask exports (HS Code 630790), and also more than \$5 million in exports of three key inputs: polyester (HS code 3907), polyurethane (390950), and propylene (390210)

The WBG and development partners should purchase supplies for developing countries immediately

- The World Bank Group and partners (e.g., Gates Foundation, Clinton Health Access Initiative, WHO, UNICEF, UNOPS) can help satisfy demand in developing countries through three steps:
 1. Assist countries to forecast demand, using transparent formulas and local data
 - Time phased procurement plans may be used to stagger orders over time, adjusting for limited storage or distribution capacity (e.g., warehousing and trucking)
 2. Immediately purchase supplies directly from manufacturers, for resale to client countries
 - Clients may struggle to secure purchases on their own, given demand from rich countries and export restrictions. Aggregating their demand will increase bargaining power
 - Potential role for IFC as purchaser. Substantial dry powder (cash) already available
 - Client countries reimburse IFC once orders are delivered, with reimbursements funded by IDA/IBRD loans or grants
 3. Track and publicize commitments of manufacturing firms, in order to document the gap between expected demand and supply commitments
 - Publication will bring visibility to how much capacity still needs to expand
 - Countries can be recognized for committing to export, helping to build a movement against protectionism that may last beyond the pandemic

Medical supply demand induced by Covid-19

PRELIMINARY

Product	Total global demand	Imports needed by countries without domestic production capability ¹	Imports needed by countries with WB fast-track COVID-19 operations (ex-India) ²
• Respirator masks for every health worker (proxy for each article of PPE, e.g., gowns, gloves)	22.4 billion	4.5 billion	0.822 billion
• Ventilators for every critical care bed	486.2 thousand	133.3 thousand	14.2 thousand
• Testing kits sufficient to test 1 in 10 people	775.0 million	307.1 million	73.8 million
• Urgent vaccination for the population over 65	642.0 million	163.3 million	31.5 million

1. Country has ventilator and respirator mask production capability if it had >\$5 million in exports of product and key inputs between 2016-2018. Country has vaccine and testing production capability if it had >\$5 million exports of vaccines between 2016-2018

2. Afghanistan, Argentina, Cabo Verde, Cambodia, Democratic Republic of the Congo, Djibouti, Ecuador, Ethiopia, Ghana, Haiti, Kenya, Kyrgyz Republic, Maldives, Mauritania, Mongolia, Pakistan, Paraguay, São Tomé and Príncipe, Senegal Sierra Leone, Sri Lanka, Tajikistan, The Gambia, Yemen

Illustrative options for procurement support by development partners

	For countries with weak procurement capacity	For countries with strong procurement capacity
Immediate response to pandemic	<ul style="list-style-type: none">• WBG-financed procurement through UN agencies (e.g., UNOPS), potentially purchasing in advance for later resale to countries• WBG (via IFC?) serves as procurement agent	<ul style="list-style-type: none">• Country procures directly from suppliers/ manufacturers• Country participates in pooled procurement brokered by UN agencies like UNOPS
Post-pandemic recovery and development	<ul style="list-style-type: none">• WBG-financed procurement through UN agencies (e.g., UNOPS)• Country participates in pooled procurement brokered by UN agencies like UNOPS	<ul style="list-style-type: none">• Country procures directly from suppliers/ manufacturers

Annex A: Expected medical supply demand in 25 countries, assuming 5% scaling of existing capacity

Data Used for Demand Estimation				Estimated Demand				
Country	Population	Share of Physicians, population over 65	nurses and midwives	Existing critical care beds	Ventilators	Respirator masks for health workers	Testing kits for 1 in 10 people	Urgent vaccines for population over 65
Afghanistan	39,482,280	2.5%	30,084	1,139	1,195	19,765,018	3,948,228	994,923
Argentina	45,463,124	10.9%	229,301	5,255	5,518	150,650,656	4,546,313	4,937,285
Congo, Dem. Rep.	89,656,176	3.0%	46,818	4	4	30,759,726	8,965,618	2,708,010
Cabo Verde	557,386	4.5%	742	-	-	487,306	55,739	25,044
Djibouti	991,602	4.4%	3,025	19	20	1,987,511	99,160	43,514
Ecuador	17,646,206	6.8%	57,350	1,955	2,053	37,679,064	1,764,621	1,193,555
Ethiopia	115,290,448	3.5%	60,205	34	36	39,554,472	11,529,045	4,004,013
Ghana	31,128,998	3.0%	52,222	11	11	34,309,860	3,112,900	943,425
Gambia, The	2,417,805	2.6%	1,263	4	4	829,514	241,780	63,807
Haiti	11,433,372	4.7%	8,712	47	49	5,723,601	1,143,337	540,762
India	1,383,202,688	5.8%	3,952,225	29,997	31,497	2,596,611,840	138,320,272	80,133,152
Kenya	53,977,456	2.2%	71,828	34	36	47,190,868	5,397,746	1,174,738
Kyrgyz Republic	6,590,258	4.4%	16,680	126	132	10,958,587	659,026	287,239
Cambodia	16,776,825	4.3%	49,219	13	14	32,336,558	1,677,683	714,298
Sri Lanka	22,155,806	9.8%	70,307	519	545	46,191,716	2,215,581	2,164,283
Maldives	565,505	3.9%	2,821	63	66	1,853,336	56,550	21,822
Mongolia	3,297,061	3.9%	22,655	271	285	14,884,181	329,706	129,272
Mauritania	4,659,964	3.1%	6,201	2	2	4,074,066	465,996	145,536
Pakistan	221,142,464	4.3%	473,168	3,142	3,299	310,871,040	22,114,246	9,543,393
Paraguay	7,143,929	6.1%	23,293	791	831	15,303,262	714,393	432,698
Rwanda	12,931,717	2.8%	6,753	21	22	4,436,684	1,293,172	357,666
Senegal	16,749,455	3.1%	6,400	27	28	4,204,778	1,674,946	513,408
Sierra Leone	7,984,251	3.0%	4,169	13	14	2,739,280	798,425	238,720
Sao Tome and Principe	218,989	2.9%	291	-	-	191,456	21,899	6,336
Tajikistan	9,543,762	3.0%	7,272	39	41	4,777,653	954,376	282,410

Data from publicly available statistics. Countries should confirm values using local data, and account for plans to expand capacity (i.e., scaling number of beds and health care workers by more than 5%)