

Covid-19 – PPE demand & supply perspectives

Final report – December 2020

Section III updated in March 2021



This programme is funded by UK aid from the UK Government; however, the views expressed do not necessarily reflect the UK government's official policies

Important notes

Covid-19 is, first and foremost, a humanitarian challenge. Thousands of healthcare professionals are heroically battling the virus, putting their own lives at risk. Governments and industry are working together to understand and address the challenge, support victims, their families and communities, and search for effective treatments and vaccines.

Solving the humanitarian challenge is the top priority. Much remains to be done globally to prepare, respond, and recover, from protecting populations at risk to supporting affected patients and their families and communities. To address this crisis, responses must be evidence-informed, and based on partnerships across multiple stakeholders and sectors. This includes but is not limited to the medical/pharmaceutical industry and regulatory/compliance agencies.

The content in this document is preliminary and non-exhaustive. It is being made available solely for information purposes in response to the urgent need for measures to address the Covid-19 crisis. It reflects general insights and may present potential options for consideration based on currently available information, which is inherently uncertain and subject to change. It does not contain all of the information needed to determine a future course of action. The insights and concepts included herein have not been validated nor independently verified. References to specific products or organizations are solely for illustration and do not constitute any endorsement or recommendation.

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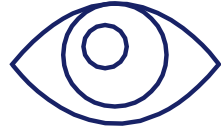
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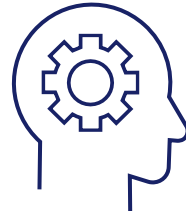
The full report has three main objectives

Key objectives



Provide a clear view of current market dynamics in global PPE supply and demand

Estimate global demand for PPE during 2021 to 2025 by geography and specific situation



Build an understanding of the main global dynamics and constraints of supply

Identify and describe the main global manufacturers



Disseminate this knowledge among other key stakeholders (e.g., health-related organizations, manufacturers) and at specific forums

What this report intends to do



Synthesize opinions about the recent and future dynamics of the global PPE market, based on interviews with industry experts and consolidation of publicly available data

Provide directional estimates of global PPE demand for 2020-2025 by volume, factoring in the impact of Covid-19 on various geographies, PPE usage and user segments

Help both current and prospective industry players make broad directional sense of these dynamics and thus understand the opportunities and threats they may represent across various time horizons

What this report does not intend to do



Provide an exhaustive list of current PPE manufacturers and their individual capacity increases in the wake of Covid-19

Provide an estimate of the global PPE market by value and/or forecast the evolution of market prices for various categories of PPE

Provide business plans for manufacturers or offer manufacturer-specific advice as to investment strategies or possible commercial or operational plays

Insights are based on interviews with 30+ global experts and analysis of 50+ international reports, databases and articles

SEE NEXT PAGES FOR DETAILS OF THE INTERVIEWEES



32 interviews with international experts

8 manufacturing experts
(employees of PPE and input manufacturers)

~10 members of international organizations
involved in supporting countries in the Covid-19 pandemic

~15 McKinsey experts in global public health and the PPE industry

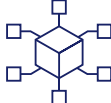


50+ international reports, databases and articles

Institutional reports on the PPE supply chain and the impact of Covid-19

Databases of PPE use and prices

Official communications by governments and manufacturers



Proprietary models

McKinsey epidemiological model used to design potential scenarios for Covid-19 case estimates in the short and medium term in turn informing demand modeling



List of interviewees (1/2)

Type	Organization	Name	Position
Manufacturing experts	3M (formerly)	Anonymous	Executive Director of Business Development
	3M (formerly)	Anonymous	General Manager (Life Safety Product)
	Kimberly-Clark (formerly)	Anonymous	National Account Manager Healthcare GPO
	Waterloo Filtration Institute	Anonymous	Director of Sales
	Ansell	Anonymous	Senior Director Marketing
	Grain Processing Corporation	Anonymous	VP - Alcohol Products
	Hayat Kimya	Anonymous	Production Chief
	MSA – The Safety Company	Anonymous	Former Regional Channels leader, ME/Africa/India
International organizations¹	Field Ready	Andrew Lamb	Innovation lead
	Field Ready	Cecilia Ho	Innovation manager
	World Bank	John Williams	Senior Procurement Specialist
	CHAI	Michael Curran	Program Manager
	UNICEF	Hani El-Jadaa	Contracts Manager
	UNICEF	Ehab Atia	Technical Officer

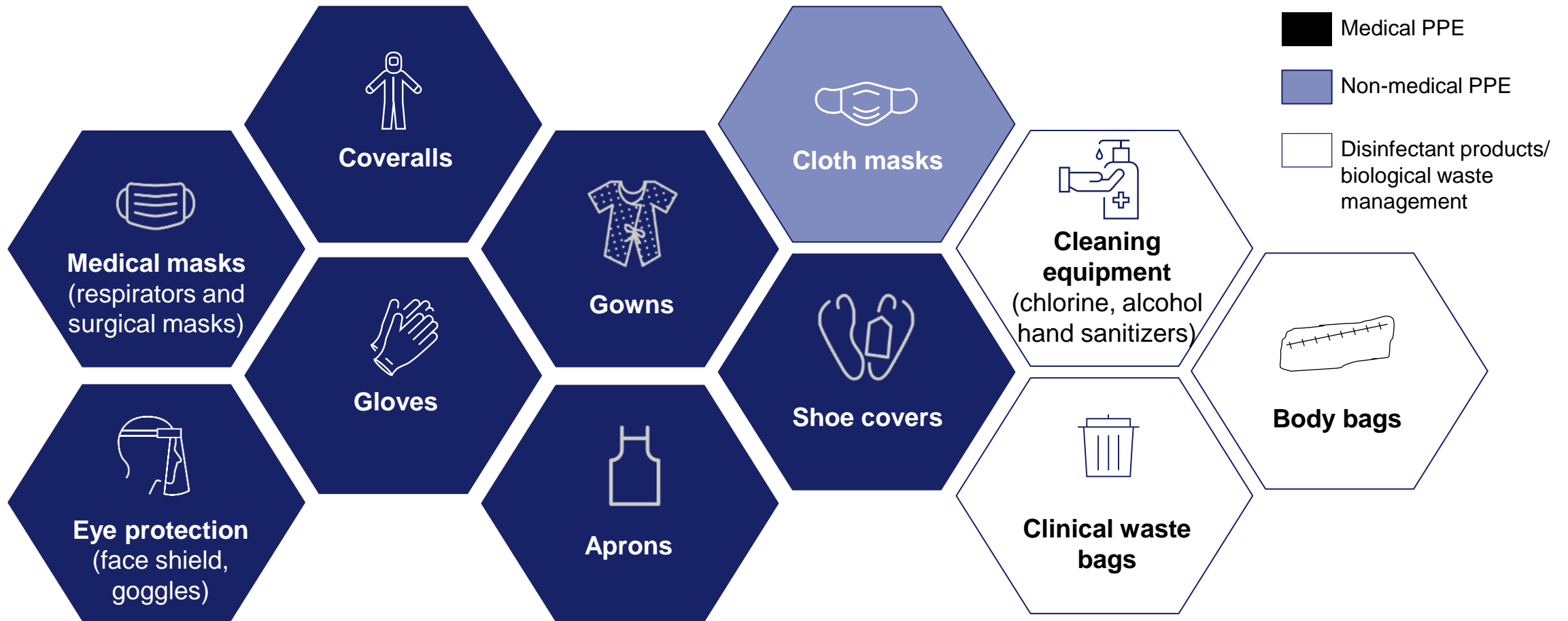
1. In addition to FCDO & the IFC

List of interviewees (2/2)

Type	Name	Position and expertise
McKinsey global experts	Mark Baptista	Partner – Manufacturing, PPE
	Mike Gordon	Senior Expert – Manufacturing, PPE
	Josh Rothenberg	Associate Partner – Manufacturing, PPE
	Adolf Makgatho	Associate Partner – Global Public Health, Africa
	Tania Holt ¹	Partner – Global Public Health, Africa
	Sunny Sun ¹	Partner – Global Public Health, Africa
	Bart Van de Vyver ¹	Partner – Global Public Health, Global
	Matt Craven ¹	Partner, MD – Global Public Health, Global
	Mengwei Xin ¹	Associate Partner – Global Public Health, China
	Marie-Renée B-Lajoie ¹	Engagement Manager, MD – Global Public Health, North and Latin America
	Chirag Adatia ¹	Partner, MD – Global Public Health, India
	Neeraja Nagarajan ¹	Associate, MD – Global Public Health, India and North America
	Sanjiv Baxi ¹	Associate Partner – Global Public Health, North America
	Jorge Torres ¹	Director of Client Development – Global Public Health, Latin America

1. Global public health experts contacted to validate the regional vaccine coverage and efficacy scenarios

This report looks at 3 types of products: medical PPE, non-medical PPE and disinfectant/waste management products



This report looks only at medical PPE used in (i) medical settings for « business as usual » activities and Covid-19-related activities and (ii) in other industry settings for usage related to Covid-19-induced sanitary measures.

PPE demand coming from « business as usual » of certain industries (e.g., construction, restauration) is not within the scope of this report.

What this report intends to do



Synthesize opinions on the recent and future dynamics of the global PPE market, based on interviews with industry experts and consolidation of publicly available data

Provide directional estimates of the global PPE demand for 2020-2025 in volume, factoring in impact of Covid-19 on various geographies, PPE usage, and user segments

Help industry players – current and prospective – understand directionally these dynamics and they opportunities and threats they may represent over various time horizons

What this report does not intend to do



Exhaustively list current PPE manufacturers and their individual capacity increase due to Covid-19

Provide estimate of the global PPE market in value and forecast evolution of market prices for various PPE categories

Develop business plans for manufacturers and provide manufacturers-specific advice on investments or commercial or operational plays

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I. Impact of Covid-19 on global PPE supply



In 2019 the medical PPE market amounted to ~\$8bn. It was consolidated and led by the US and Asia.

- China and the US accounted for ~60% of global production across most types of PPE – with the exception of gloves, which were mostly made in Malaysia and Thailand
- While leading global players accounted for ~40% of the entire market, distributing an exhaustive range of products and manufacturing in multiple geographies, local and specialty players had emerged in both direct sales and contract manufacturing channels

I. Impact of Covid-19 on global PPE supply



As a consequence of the Covid-19 pandemic, industry experts suggest that global production of medical PPE increased by at least 300% at the peak, principally driven by demand for masks.

This ramp-up started at the end of Q1/beginning of Q2 to compensate for a then global shortage and to satisfy forward-looking surge orders from governments and private entities.

- 50-60% of this supply increase was driven by existing global players expanding their production capacities (e.g., DuPont doubled its gowns output; 3M increased its face shield output ten-fold)
- 40-50% came from (i) a partial shift in production by adjacent industry manufacturers (e.g., in textiles) and (ii) entirely new but smaller-scale local players. Throughout Q1-Q3 2020, supply stress drove market prices up, enabling these new entrants to achieve good returns on their investments. Prices are now gradually returning to pre-crisis levels

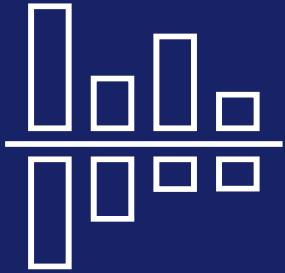
I. Impact of Covid-19 on global PPE supply



This increase in output put the entire PPE manufacturing value chain under significant pressure.

- There were raw materials shortages – for example of melt-blown nonwoven fabric for surgical masks and respirators
- Production was limited by manufacturing plant capacity – this was especially the case for gloves and other regulated products
- Trade was adversely impacted by, for example, export bans

II. 2020-25 global PPE demand forecast



Global volume demand for PPE increased by 300-400% between 2019 and 2020¹, driven by increased consumption by the general public and in non-healthcare work settings.

This peak demand is expected to continue throughout 2021 but is likely to decrease sharply in 2022 as consumption from both these groups is expected to shrink.

- In 2020 and 2021, consumer and non-healthcare workplace demand will account for ~60-70% of total demand, due to significant adoption and continued use of surgical masks
- In 2022, as surgical mask usage rates among the general public and in non-healthcare work settings are expected to drop, this Covid-19-induced peak in demand is expected to decrease considerably; as a result, global demand in 2022 may decline by 50% compared with 2021

1. Global demand for 2020-2025 in volume has been forecast across five main segments: non-Covid-19-related use, hospitals and clinics, immunization campaigns, workforce (non-healthcare) and general public use; each segment is estimated to use a differently weighted set of products. While demand from hospitals/clinics and immunization campaigns is modelled through 2022 and aligned with regional vaccination scenarios, demand from the general public & non-healthcare workforce is estimated through 2025 and depends on regional assumptions about return to work rates as well as those relating to adoption and frequency of use rates

II. 2020-25 global PPE demand forecast

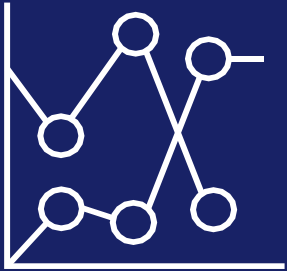


After 2021, global PPE demand is expected to return to close to its pre-crisis mix and keep rising at a CAGR of 6-9% between 2022 and 2025.

It will be underpinned by a combination of lagging effects of Covid-19 on PPE consumption as well as the underlying growth of the global healthcare sector.

- While the crisis has shifted the product demand mix significantly (e.g., with masks accounting for ~40% of global demand in 2021 vs. ~5% in 2019), this demand should gradually return to its pre-crisis mix: in 2025, masks are likely to account for a minor share of demand (~10%), while gloves will account for the majority of demand (~60% of the global market vs. ~70% in 2019)
- 2025 demand is estimated to reach ~185-235 bn units vs. ~105 bn in 2019 (i.e., approximately doubling since the year before the pandemic), driven by enduring PPE use among the general public and strong underlying fundamentals including an increasing global population and continuing improvements in sanitary systems

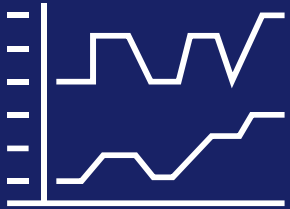
II. 2020-25 global PPE demand forecast – Update form March 2021



There is still some significant uncertainty as to the magnitude of the peak in 2021 as we witness a fast-evolving health situation (e.g. new variants) and developing scientific advice, leading to changes in public health and government policies as well as individual behaviors (i.e. mask wearing requirements and habits).

- Revised scenarios impact the general population (i.e. non-medical workplaces, individual use outside of work) and assume that:
 - Scenario 1: **the decrease in mask adoption rates starts later – when the at-risk population is immunized** – and a comparable return to pre-crisis adoption levels in the “new normal” phase
 - Scenario 2: **the decrease in mask adoption rates starts later still – when herd immunity is achieved** – and there is a higher adoption rate in the “new normal” phase
- These scenarios imply **higher demand for masks than the December 2020 scenario, especially in the short term (2021-22).**
- However, they also imply the **same overall shape in the demand curve over the period 2021-2025**, with the global market contracting sharply before resuming growth rates close to those observed pre-crisis

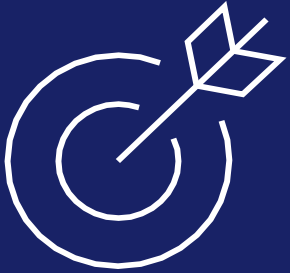
III. Emerging perspectives on short/medium term market dynamics



Market entry is less attractive than it was in 2020, with prices decreasing and global supply meeting demand for most PPE

- The Covid-19-induced demand peak included forward-looking bulk purchasing and drove a surge in global production in 2020, delivered both by established players scaling-up and new entrants
- As demand is expected to subside over the next 18 months and as there is evidence of oversupply in some countries, some of this additional capacity is already being scaled back
- Indeed, industry experts suggest that capacity is now sufficient to meet most of the Covid-19-related demand for PPE in almost every geography
- As prices return to pre-crisis levels, it will become harder for further new entrants to be as cost-competitive as they would have been in 2020, and to generate returns as high and as fast as last year
- Gloves and, to a lesser extent, high-end gowns remain exceptions to this picture. Limited new capacity was created in 2020 and persistent under-stocking or stock-outs are still reported across the globe

III. Emerging perspectives on short/medium term market dynamics



The outlook for the market nevertheless remains positive over the longer term

- Large, international incumbent players may adapt their production capacity to meet global demand and continue to capture the largest part of future growth thanks to the scale at which they can produce and their cost-competitiveness
- There may still be opportunity for smaller players already active in the PPE space to capture part of this growth in some geographies provided they can meet quality standards and stay relatively cost-competitive – especially if the declared ambition of many governments to diversify supply-chain and increase self-sufficiency in PPE, even if at a price premium, persists

III. Emerging perspectives on short/medium term market dynamics



In light of these dynamics, incumbents and new PPE manufacturers alike may wish to consider four strategic moves for the future – investment for the long term, distribution, diversification and innovation

- Invest in end product manufacturing capacity if local long-term prospects imply economic viability rather than – as did some in 2020 - seek short term returns
- Systematically explore and secure short- and medium-term offtake in geographies where they can be the most cost-competitive – including domestic markets, especially if government favors local production – using emerging channels such as online public tender platforms
- Diversify along the value chain – e.g., in the melt-blown non-woven industry, there may be opportunities to enter markets with a high volume, low cost strategy targeting small local players
- Focus on innovation and develop new products – e.g., more environmentally-friendly reusable products and self-disinfecting materials

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Important notes about the methodology used in this section

This section provides a high-level analysis of the current dynamics of global PPE supply, including a short overview of the market pre-Covid-19 and a review of the most significant trends arising as a consequence of Covid-19

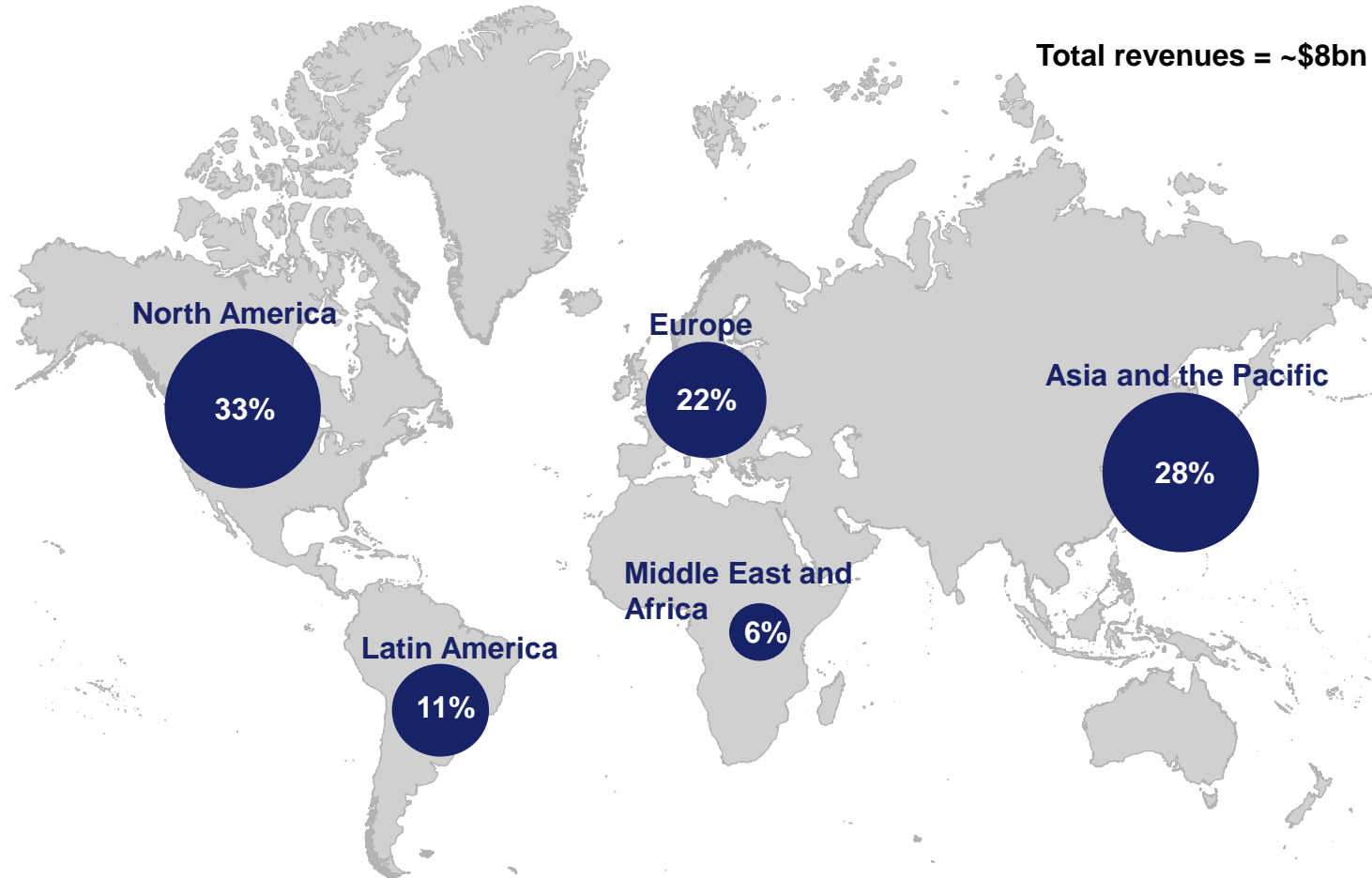
Methodology

- The pre-Covid-19 market analysis is based on multiple sources, including Mordor Intelligence, private company reports and interviews with industry players
- Covid-19-related trends comprise both quantitative and qualitative analyses. The quantitative elements are based on a non-exhaustive assessment of major country and player reactions to the crisis (e.g., increased production capacity) and not on any exhaustive and comprehensive modelling. Thus it has not been validated. In general, the data obtained were very fragmented, with no solid consensus across the industry. This is a fast-evolving situation with rapid redistribution of capacities. Sources include several interviews with key stakeholders (including industry leaders, national procurement agencies and international donors) as well as a review of official government statements and press reports

Before the crisis, the global PPE market accounted for ~\$8bn and was led by North America and Asia

MARKET ESTIMATES – ONLY MEDICAL PPE CONSIDERED

Medical PPE market share by region, 2019, %



Key messages

In **2019** the **medical PPE** market was estimated to amount to ~\$8bn, in turn accounting for **15% of total PPE¹ market size**

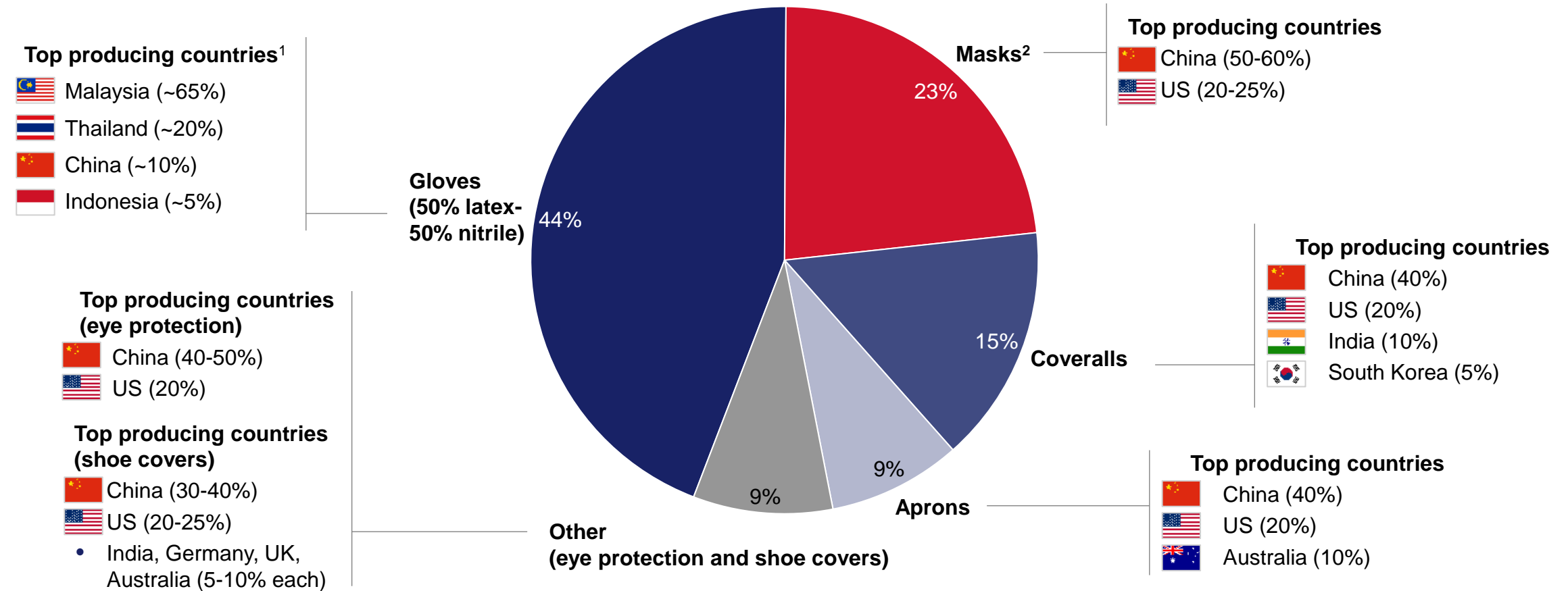
In 2019, the countries with the highest production were **China, US and Germany**, each with **different export dynamics**: while China was the biggest exporter worldwide, the US exported mainly across North and Latin America and Germany served almost exclusively European countries

1. The PPE market has several sub-industries, including healthcare, construction, chemicals, and industry

China and the US make the majority of every category except for gloves, which are mostly manufactured in Malaysia and Thailand

MARKET ESTIMATES – ONLY MEDICAL PPE CONSIDERED

Medical PPE market share by type of PPE, 2019, % of total market



1. Figures by the Malaysian Rubber Glove Manufacturers Association (MARGMA)

2. In 2019, respirators accounted for ~60% of the medical masks market and surgical masks accounted for ~40%, according to interviews with industry experts

Despite this relatively high level of concentration in global PPE production, there is significant interdependence of trade

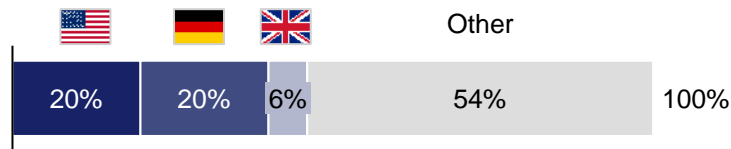
SELECTION OF MEDICAL PPE CONSIDERED – NON-EXHAUSTIVE

Top importing countries, 2019

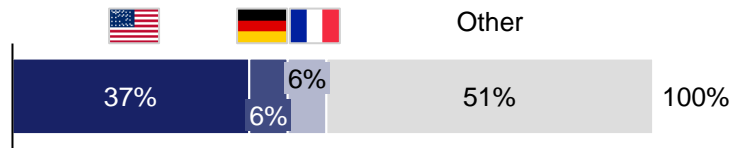
% of total imports



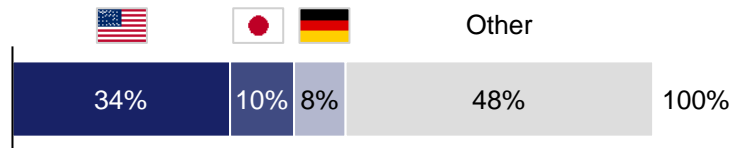
Gloves¹



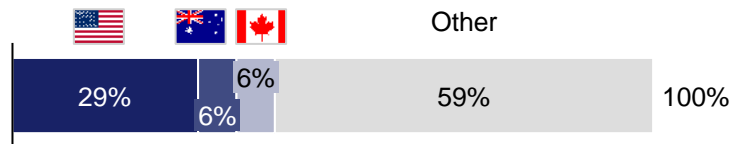
Coveralls, aprons, gowns²



Masks³

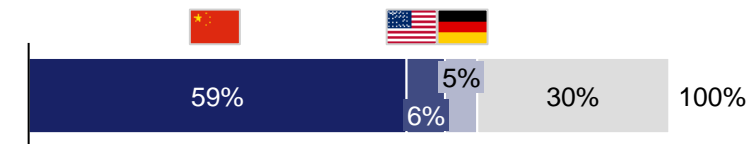
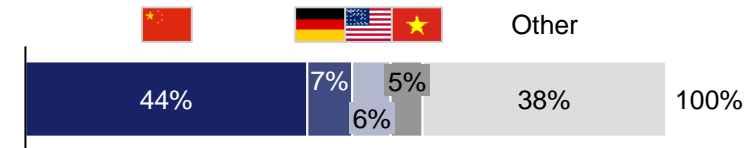
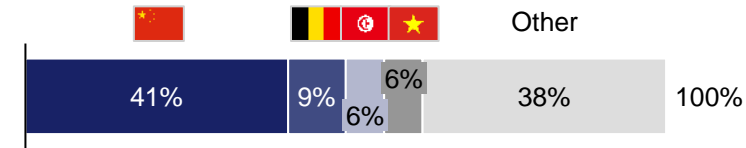
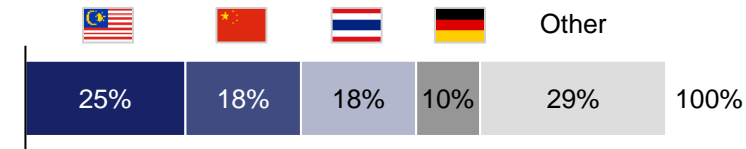


Eye protection⁴



Top exporting countries, 2019

% of total exports



Other

Key insights
















Despite global **PPE exports being concentrated** (the top 5 countries account for ~50% of exports), there is a **strong interdependence** of trade: every country depends on another for at least one PPE type

The biggest PPE exporters have **themselves been severely hit by Covid-19**, pushing governments to **impose export restrictions** impacting the entire world

1. The HS code used is 401511 (surgical gloves)
2. The HS code used is 621010 (garments made up of felt or non-wovens) and may not consider exclusively medical coveralls, aprons, and gowns
3. The HS code used is 630790 (made-up articles of textile materials) and considers broader categories of goods in which masks are included
4. The HS code used is 900490 (Spectacles, goggles and the like, corrective, protective, or other) and considers broader categories of goods in which face shield and medical goggles are included

While global leaders still account for ~40% of the market, local/specialty players have emerged in both direct sales and contract manufacturing

ONLY MEDICAL PPE CONSIDERED – NON-EXHAUSTIVE

Type of player		Description	Geographical footprint	Preferred distribution channel	Examples of players (non-exhaustive)
Manufacturing	Global leaders (~40% of the market)	Large players supplying a broad range of PPE (without necessarily manufacturing them all)	Manufacturing facilities across the world to support different requirements and standards across regions	Distribution through major and well-established distributors across the world	   
	Local players	Mid-sized players supplying a limited range of PPE and relying strongly on partnerships	Manufacturing facilities in usually just 1 country or region	Distribution through distributors or through large manufacturers (CM) ¹	 
	Specialty players	Mid-sized players supplying a single PPE type (e.g., gloves)	Manufacturing facilities in usually just 1 country or region	Distribution through retailers across the world or through large manufacturers (CM) ¹	   
Distribution ² (to end user)	Distributors (~60% of market)	Largest distribution channel – usually specialized in pharma and medical supplies			 
	E-commerce (~25% of market)	Growing distribution channel, allowing distributors to better serve customers			 
	Key accounts (~15% of market)	Major hospitals and companies who purchase PPE directly from manufacturers			

1. Contract manufacturing – local players and specialty players sometimes supply to large manufacturers who then brand with their own name

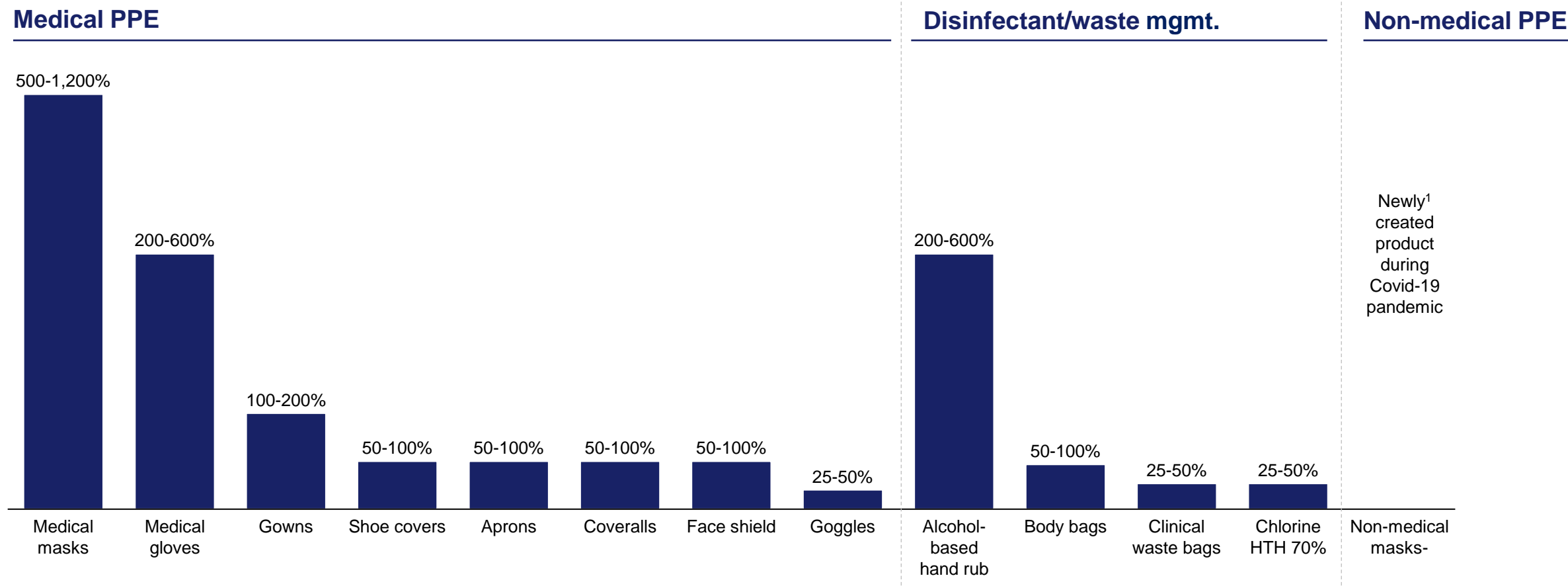
2. Governments managed very small distribution channels pre-crisis but grew rapidly during the pandemic

Source: interviews with experts (November 2020), press search

Covid-19 triggered a surge in global PPE production: medical mask manufacturing spiked by as much as 1,200%

NON-EXHAUSTIVE – DIRECTIONAL ESTIMATES BASED ON INTERVIEWS WITH INDUSTRY PLAYERS, AS OF MID-DECEMBER 2020

Estimated peak increases in global production during the Covid-19 crisis, %



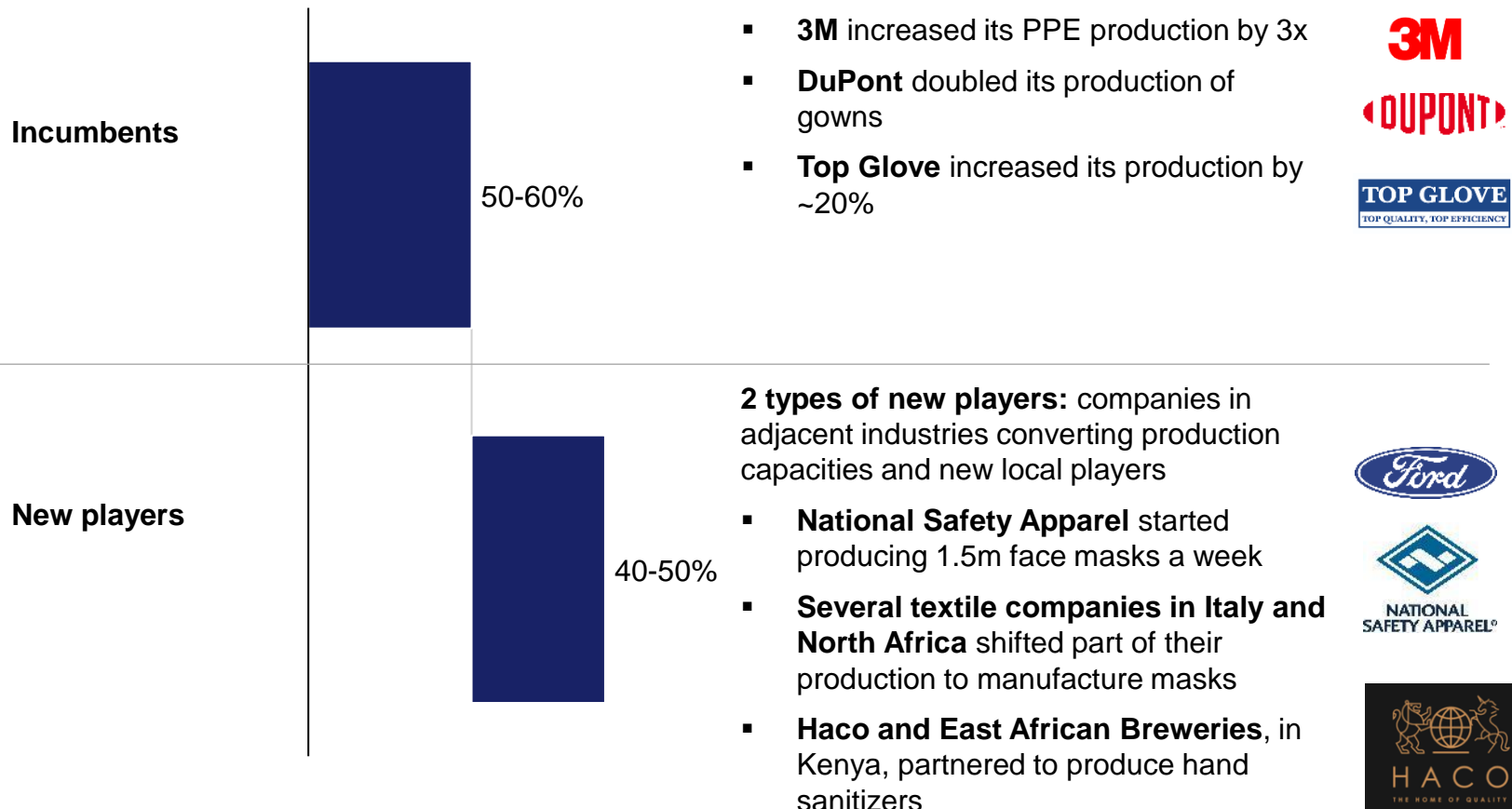
1. Production pre-Covid-19 was negligible compared to current production

Around half of this increased production was delivered by incumbents and the other half came from new market entrants

NON-EXHAUSTIVE AND ILLUSTRATIVE – ESTIMATES BASED ON INTERVIEWS WITH INDUSTRY PLAYERS, AS OF MID-DECEMBER 2020

Share of new production capacity added during Covid-19 pandemic, estimates

Examples (non-exhaustive)



Main insights from interviews



Most incumbents consider their capacity addition to be temporary as most have either increased utilization or deployed idle machine/production lines

New players have invested in machinery and equipment but only been able to generate acceptable returns on investment because of surges in market price

A significant part of this production surge has come from targeting new customer segments beyond health systems (e.g., consumers, workers in non-healthcare settings)



Before Covid-19, 90% of medical PPE was targeted at health system customers. Currently sales are running at closer to 50% to medical customers and 50% to non-medical customers

– former Life Safety Product Manager at leading PPE manufacturer

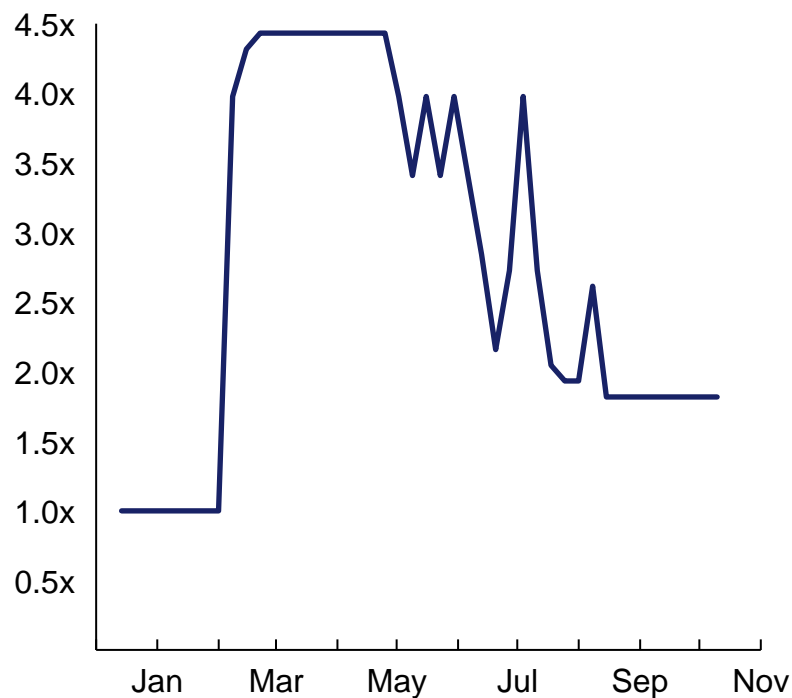
Increased PPE market prices allowed new entrants to generate significant returns on investment

NON-EXHAUSTIVE AND ILLUSTRATIVE – AS OF NOVEMBER 2020

Selected UK PPE unit prices

Type of PPE	2019 (Feb-Jul)	2020 (Feb-Jul)	Change
 Face masks	£0.11	£0.40	3.6x
 Respirators	£0.94	£2.51	2.7x
 Gowns and overalls	£0.33	£4.50	13.8x
 Gloves	£0.02	£0.12	6.2x
 Eye protection	£0.60	£1.82	3.0x
 Hand hygiene	£1.12	£6.14	5.5x

Price for face mask on Amazon.com (illustrative example, index January 2020)



Main insights



During the pandemic, PPE unit prices dramatically increased before dropping to a level which remains above pre-crisis (as of end-November 2020)

“ ”

[...] prices for PPE may remain high, up to 4x the costs for masks and gloves in January

– CFO of a US healthcare network, November 2020

“ ”

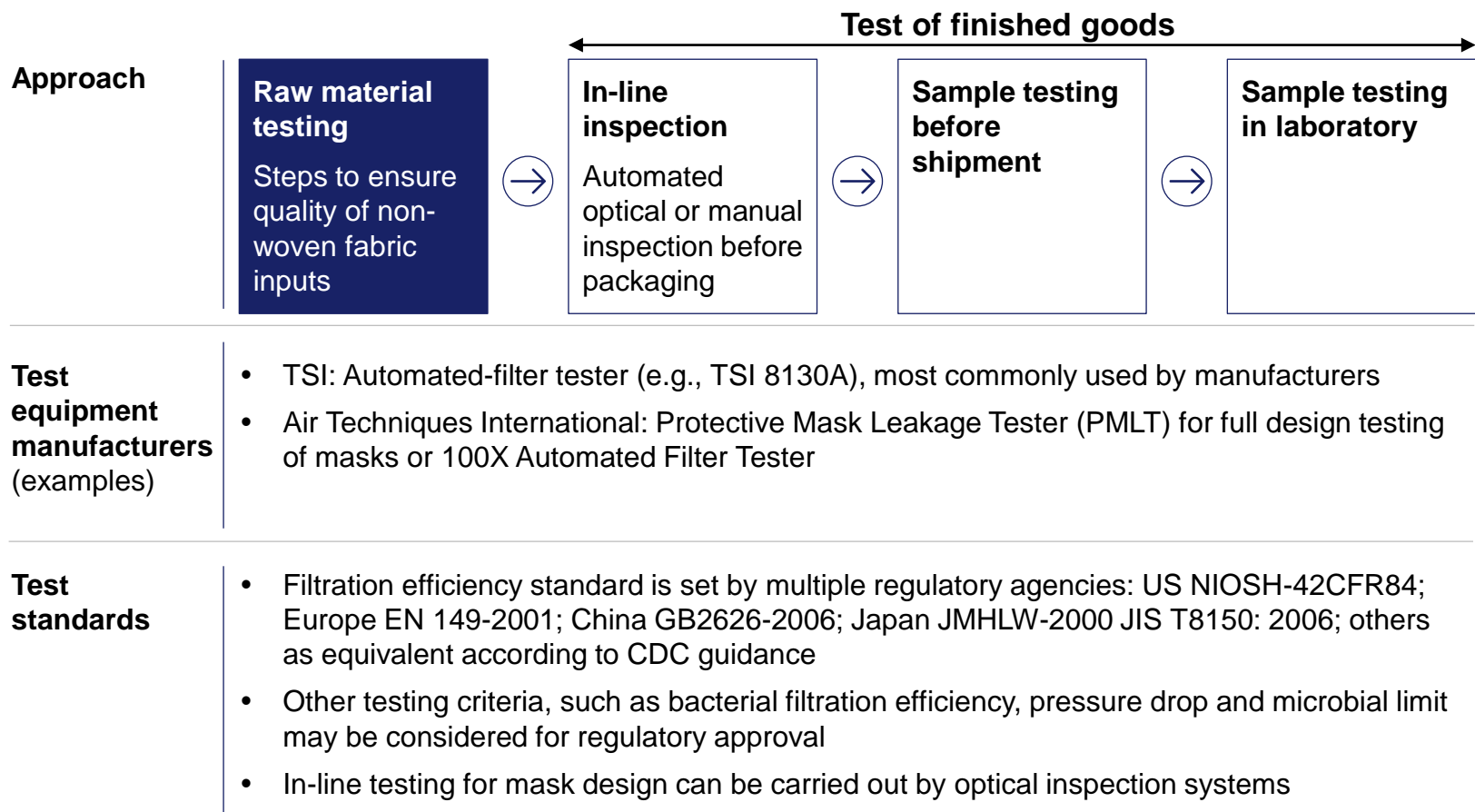
Due to high prices, new players who've invested in equipment and machinery are earning a high ROI and will probably take the money and get out of the market once the pandemic is gone

– PPE expert, November 2020

Conversely, quality issues arose against a backdrop of accelerated testing processes, limited testing capacity and fraud

NON-EXHAUSTIVE AND ILLUSTRATIVE

Representative testing approach and standards for N95 masks



Main insights from interviews



During the Covid-19 crisis, quality issues have arisen due to three main factors

- Compressed testing procedures to speed up delivery time, with some steps entirely skipped (e.g., sample testing)
- Limited testing capacity (TSI machines were a particular constraint) and use of less efficient alternative methods
- Fraudulent behaviors by manufacturers who labelled their products as finished despite not passing tests

“ Researchers at ECRI [...] found that 60-70% of imported N95 masks do not filter 95% of aerosol particulates, contrary to what their name suggests






– ECRI, 22 September 2020

“ Smaller new players usually achieve lower end quality and target less quality-sensitive PPE (e.g., shoe covers)

– former Life Safety Products Manager of leading PPE manufacturer

In order to enhance national autonomy, governments actively encouraged local manufacturers to increase capacity

NON-EXHAUSTIVE AND ILLUSTRATIVE – AS OF MID-DECEMBER 2020

Country/region	Examples of government interventions (non-exhaustive)
 India	In June 2020, the government relaxed manufacturing standards for PPE makers to enable more of them to be brought within the scope of the Bureau of Indian Standards (BIS) product certification scheme, which will in turn result in a greater quantity of BIS-certified PPE being made available to users
 China	The government has introduced measures to support production of face masks by helping with raw material purchasing and worker recruitment as well as offering tax breaks for manufacturers
 US	In July 2020, the US Department of Commerce's National Institute of Standards and Technology (NIST) awarded a total of \$50m in emergency funding to help manufacturers increase PPE production , reach new suppliers and recover from supply chain interruptions
 Morocco	The government has mobilized funds to support mask production, resulting in ~20 textile plants repurposing their production capacity
 European Union	The European Commission has temporarily waived customs duties and VAT on the import of medical devices and protective equipment from third party countries into member states



“ [...] a study by Ministry of Health and Family Welfare (MoHFW) undertaken in February-March for understanding the gaps in the existing infrastructure, resources, and overall for end-to-end production, testing and packaging of the PPE kits as per the WHO quality standards [...] MoHFW then focused on developing a PPE supply chain, getting special approvals [...], facilitating interstate logistics, streamlining international coordination and enabling round-the-clock support to the manufacturers on operational issues
– Press article (*The Economic Times*), October 2020



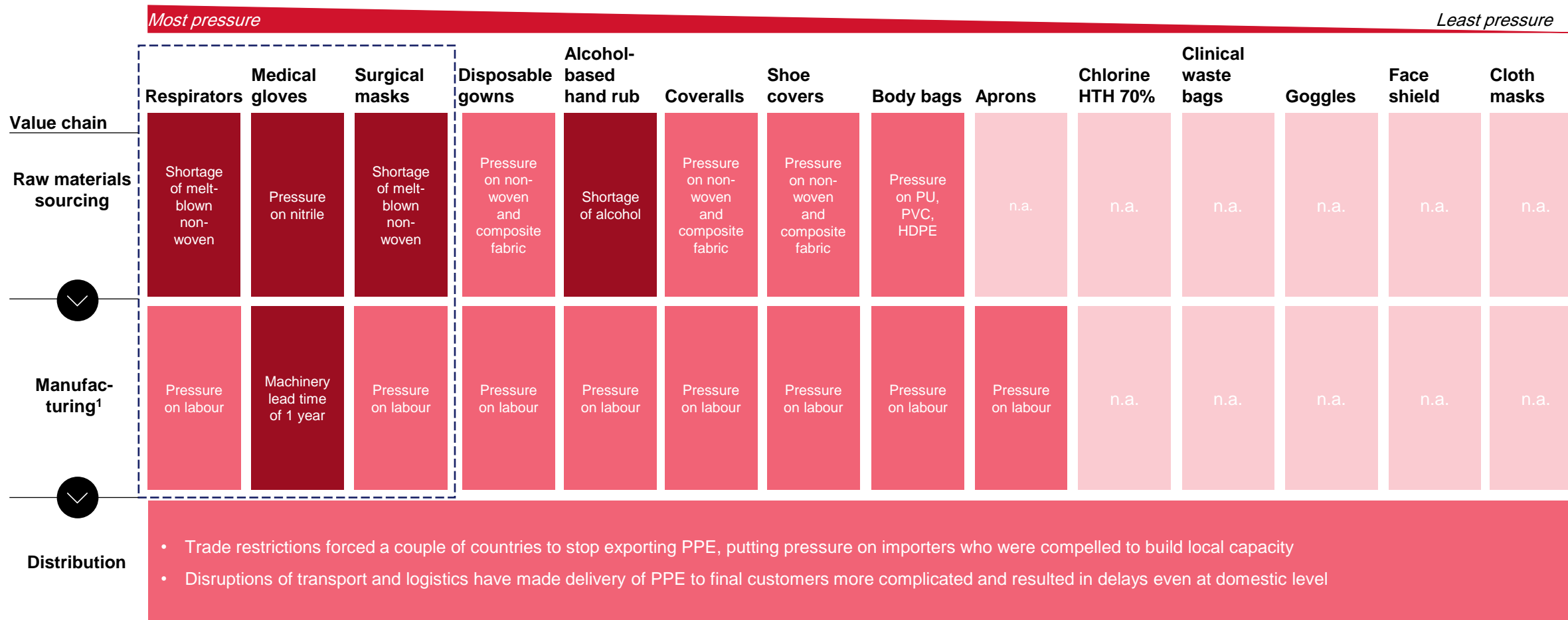
“ We have built robust and resilient supply chains from scratch and thanks to an absolutely phenomenal effort from UK businesses, almost three-quarters of demand for PPE will soon be met by UK manufacturers
– UK Health Minister (*Matt Hancock*) September 2020

Increasing manufacturing capacity has put the PPE supply chain under pressure, especially with regard to raw materials

NON-EXHAUSTIVE – BASED ON INTERVIEWS WITH INDUSTRY PLAYERS, AS OF MID-DECEMBER 2020

 Focus of next pages  High supply pressure  Medium supply pressure  Low supply pressure

Mapping of bottlenecks along the PPE value chain



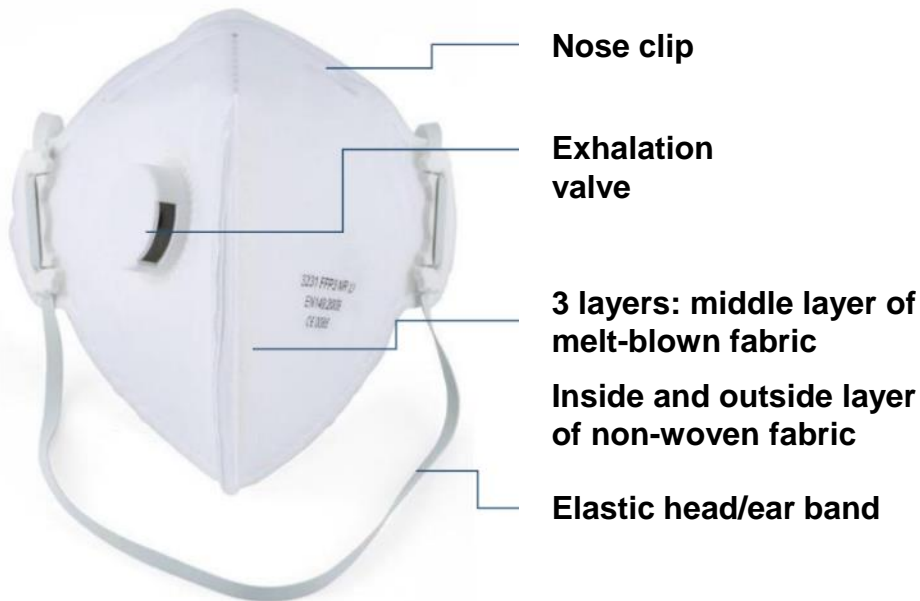
1. High pressure on manufacturing usually comes from technology solutions with machines manufactured by very few players over long lead times

For respirators, supply pressure arises mainly from shortages of melt-blown non-woven, a critical ingredient

NON-EXHAUSTIVE – BASED ON INTERVIEWS WITH INDUSTRY PLAYERS, AS OF MID-DECEMBER 2020
SEE APPENDIX FOR DETAILED DEEP-DIVE ON THE MELT-BLOWN MARKET

■ Highly supply pressure ■ Medium supply pressure ■ Low supply pressure

Respirators have 6 components with 3 layers of protection



Respirators and surgical masks have a similar production process, with 2 differences (enhanced filtering through high efficiency melt-blown and one of the layers passing through high temperature)

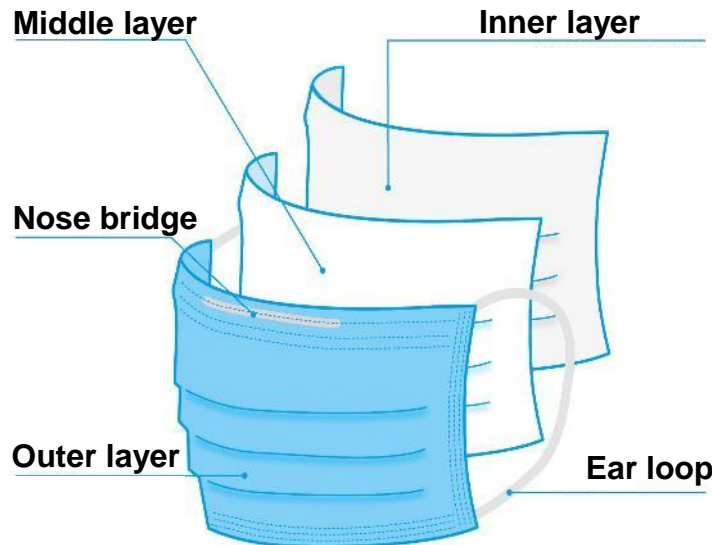
Value chain step	Description	Reasons for supply pressure (non-exhaustive)
Raw materials	2 main raw materials <ul style="list-style-type: none"> Spunbond non-woven fabric (for inner and outer layers) Melt-blown fabric (for the middle layer) 	High pressure on melt-blown non-woven fabric due to <ul style="list-style-type: none"> Limited number of players in the high quality melt-blown industry Limited access to polymer inputs Production capacity constraints
Manufacturing	3 steps in manufacturing <ul style="list-style-type: none"> Assembly Sterilization and testing Packaging 	<ul style="list-style-type: none"> Pressure on labour (reinforced by social distancing requirements in plants)
Distribution	4 major sales channels <ul style="list-style-type: none"> Distributors Government agencies Private hospitals Retail sales 	<ul style="list-style-type: none"> Establishment of temporary trade restrictions and export bans by some countries during pandemic Transport and logistics disruption

For surgical masks, supply pressure also arises mainly from shortages of melt-blown non-woven

NON-EXHAUSTIVE – BASED ON INTERVIEWS WITH INDUSTRY PLAYERS, AS OF MID-DECEMBER 2020
SEE APPENDIX FOR DETAILED DEEP-DIVE ON THE MELT-BLOWN MARKET

■ High supply pressure ■ Medium supply pressure ■ Low supply pressure

Medical masks have 5 components with 3 layers of protection



Value chain step	Description	Reasons for supply pressure
Raw materials	2 main raw materials <ul style="list-style-type: none"> Spunbond non-woven fabric (for inner and outer layers) Melt-blown fabric (for the middle layer) 	High pressure on melt-blown non-woven fabric due to <ul style="list-style-type: none"> Limited number of players in the high quality melt-blown industry Limited access to polymer inputs Production capacity constraints
Manufacturing	3 steps in manufacturing <ul style="list-style-type: none"> Assembly Sterilization and testing Packaging 	<ul style="list-style-type: none"> Pressure on labour (reinforced by social distancing requirements in plants)
Distribution	4 major sales channels <ul style="list-style-type: none"> Distributors Government agencies Private hospitals Retail sales 	<ul style="list-style-type: none"> Establishment of temporary trade restrictions and export bans by some countries during pandemic Transport and logistics disruption

For gloves, supply pressure is driven both by nitrile shortages and limited specialist manufacturing capacity

NON-EXHAUSTIVE – BASED ON INTERVIEWS WITH INDUSTRY PLAYERS, AS OF MID-DECEMBER 2020

■ High supply pressure
 ■ Medium supply pressure
 ■ Low supply pressure

Gloves can have different components



Value chain step

Description

Reasons for supply pressure



Latex or nitrile

Raw materials

2 main raw materials

- Latex
- Nitrile

Pressure on nitrile as the world is highly dependent on Malaysia, which handles the majority of nitrile production

Manufacturing

3 steps in manufacturing

- Production
- Quality control
- Packaging

Limited production capacity (highly automated and complex production line) due to

- High investment requirement
- Plant constraints (it takes up to 18 months to build a production line)
- Air-controlled environment required to meet quality standards of many countries

Distribution

4 major sales channels

- Distributors
- Government agencies
- Private hospitals
- Government agencies

- Establishment of temporary trade restrictions and export bans by some countries during pandemic
- Transport and logistics disruption

Contents

Report context and methodology

Executive summary

I. Impact of Covid-19 on global PPE supply

II. Modelling of global PPE demand for 2020-25

- **Overview of methodology and assumptions**

- Global forecast demand for PPE by volume – Overview
- Global forecast demand for PPE by volume – Regional deep-dives
- Global forecast demand for PPE – **March 2021 update**

III. Emerging perspectives on PPE market dynamics in the short to medium term

Country & regional deep-dives

Topical deep-dive

Appendix

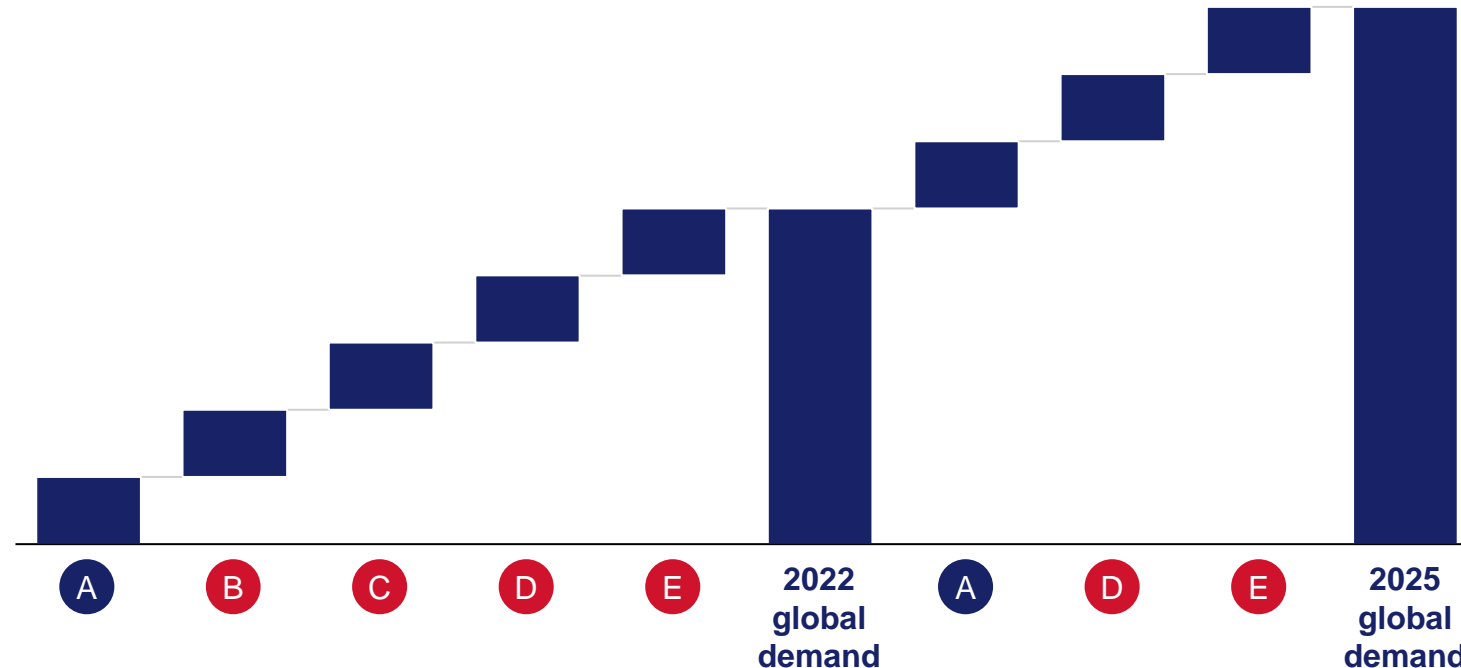
Five main segments of global PPE demand over the next five years are considered

Methodology used for global PPE demand modelling

CONCEPTUAL – DUMMY NUMBERS

X Non-Covid-19-related segment X Covid-19-related segment

Development of global demand for PPE and disinfectant/waste management products¹, 2019, 2022, and 2025, bn units



Global demand for PPE can be divided into five main segments


- A **Non-Covid-19-related usage:** baseline PPE demand pre-Covid-19, corresponding to the use of medical PPE in the health sector before the crisis ; based on historic 2019 market reports, and adjusted for impact of Covid-19 (e.g., cancellation of elective surgery)
- B **Hospitals and clinics:** demand driven by hospitalisations due to Covid-19
- C **Immunization:** demand driven by Covid-19 vaccination campaigns
- D **Workplaces:** demand from workers in non-healthcare settings returning to work, depending on activity type
- E **Consumers:** demand from the general public for daily activities


Out of these drivers, B and C are expected to last until Q4 2022, while A, D, and E may continue to grow until Q4 2025 due to (i) natural baseline growth and (ii) potential enduring habits in PPE use among workers in non-healthcare settings and the general public


1. PPE and disinfectant/waste management products refer to the following: surgical masks, respirators, aprons, gowns, coveralls, eye protectors, gloves, body bags, cleaning equipment, clinical waste bags, shoe covers and cloth masks














































Each demand segment includes different products

Methodology used for global PPE demand modelling: Product mapping by demand segment

 Non-Covid-19-related segment

 Covid-19-related segment

 Included in demand assessment

	Medical PPE								Non-med. PPE	Disinfectant products/biological waste management			
	 Surgical masks and respirators	 Gowns	 Aprons	 Coveralls	 Goggles	 Face shield	 Medical gloves	 Shoe covers	 Cloth mask	 Body bags	 Clinical waste bags	 Chlorine HTH 70%	 Hand sanitizers
A Non-Covid-19 usage													
B Hospitals and clinics													
C Immunization													
D Workplaces ¹													
E Consumers													

1. For non-healthcare workplaces, model estimates the incremental use of medical PPE related to Covid-19; modeling does not comprise non-medical PPE demand in other industries unrelated to Covid-19 (e.g., construction)

We have estimated each segment's demand with a separate methodology and have used of a wide range of sources

Methodologies used to model each demand driver

SEE NEXT PAGES FOR FURTHER DETAILS ON EACH SEGMENT'S METHODOLOGY AND ASSUMPTIONS



Non-Covid-19-related segment



Covid-19-related segment

Segment	Overall methodology	Most important independent variables	Sources	Impact timeline	
				2022	2025
A Non-Covid-19 usage	Use of historic market data to derive baseline demand Projection of 2019 figures at an adjusted growth rate compared with historic growth rate through to end-2025	Projected growth rate during 2020-25 – 2 scenarios <ul style="list-style-type: none"> Historic growth of -2% to account for the fact that the market has reached a critical size Historic growth of +1% to account for potential changes in usage habits 	Mordor Intelligence, Market report, November 2020 Interviews with experts (November-December 2020)		✓
B Hospitals and clinics	Projection of hospitalisation days due to Covid-19 in each region up to Q4 2022 Conversion of hospitalisation days into number of healthcare workers (regional data of HCW/bed) and then into PPE usage (global WHO norms)	Vaccine scenarios for each region – 2 main variables <ul style="list-style-type: none"> Efficacy: from 60% to 95%, i.e., range of modern technology (e.g., Pfizer) vs. older one (e.g., AZ) Coverage: from 30% to 70%, accounting for government's regulation, public reluctance, logistics difficulties and funding constraints 	McKinsey EPI model WHO and World Bank database Interviews with 15+ global public health experts Government and corporate public statements	✓	
C Immunization	Projection of immunized population per region up to Q4 2022 Conversion of immunized population into healthcare workers and PPE usage	Vaccine scenarios (see above)		✓	
D Workplaces	Segmentation of each region's workforce by type of job (physicality and level of interaction) Ramp-up of % of workers back to work from Q2 2020 to Q4 2022 By type of worker and for each PPE, assumptions about adoption rates (scale-down for each region from Q4 2020 to Q4 2022) and usage rate (assumed standard for all regions)	Adoption rates by archetype <ul style="list-style-type: none"> Current adoption rates from 1%-100% depending on region and PPE New normal adoption rates (from Q4 2022 onwards) assumed as 0%-10% 	ILO Interviews with experts		✓
E Consumers	Segmentation of each region's population by age group By age group and for each PPE, assumptions about adoption rates (scale-down for each region from Q4 2020 to Q4 2022) and usage rate (assumed standard for all regions)	Adoption rates by age group <ul style="list-style-type: none"> Current adoption rates from 1%-80% depending on region New normal adoption rates (from Q4 2022 onwards) assumed as 0%-10% 	YouGov Interviews with experts		✓













A| We have modelled baseline demand using historic market reports and adjusted for the impact of Covid-19

METHODOLOGY

SEE APPENDIX FOR DETAILED FIGURES

Unadjusted historic PPE demand

Adjustment for impact of Covid-19

Breakdown of baseline demand	Sources used	Country data ¹	Regional data	Global data
 Historic annual market in value	Mordor Intelligence			
 Pre-Covid-19 cost per item of PPE	UK National Audit Office analysis of Department of Health & Social Care data			
 Historic annual market in volume				
 % hospital visits requiring at least 1 surgical intervention	Scientific reviews			
 % elective surgery	Scientific reviews			
 % decrease in elective surgery	Duluth News Tribune 2020			
 2020 baseline demand				

For the purpose of this exercise, we used UK prices² as a proxy for global prices but price variations can be observed at country level

For the purpose of this exercise, we used US data³ as a standard but discrepancies can be observed at country level

1.The EPI model is built at country-level but for the purpose of this exercise, we aggregated at regional level; 2. Including cleaners, ambulance personnel and biomedical engineers

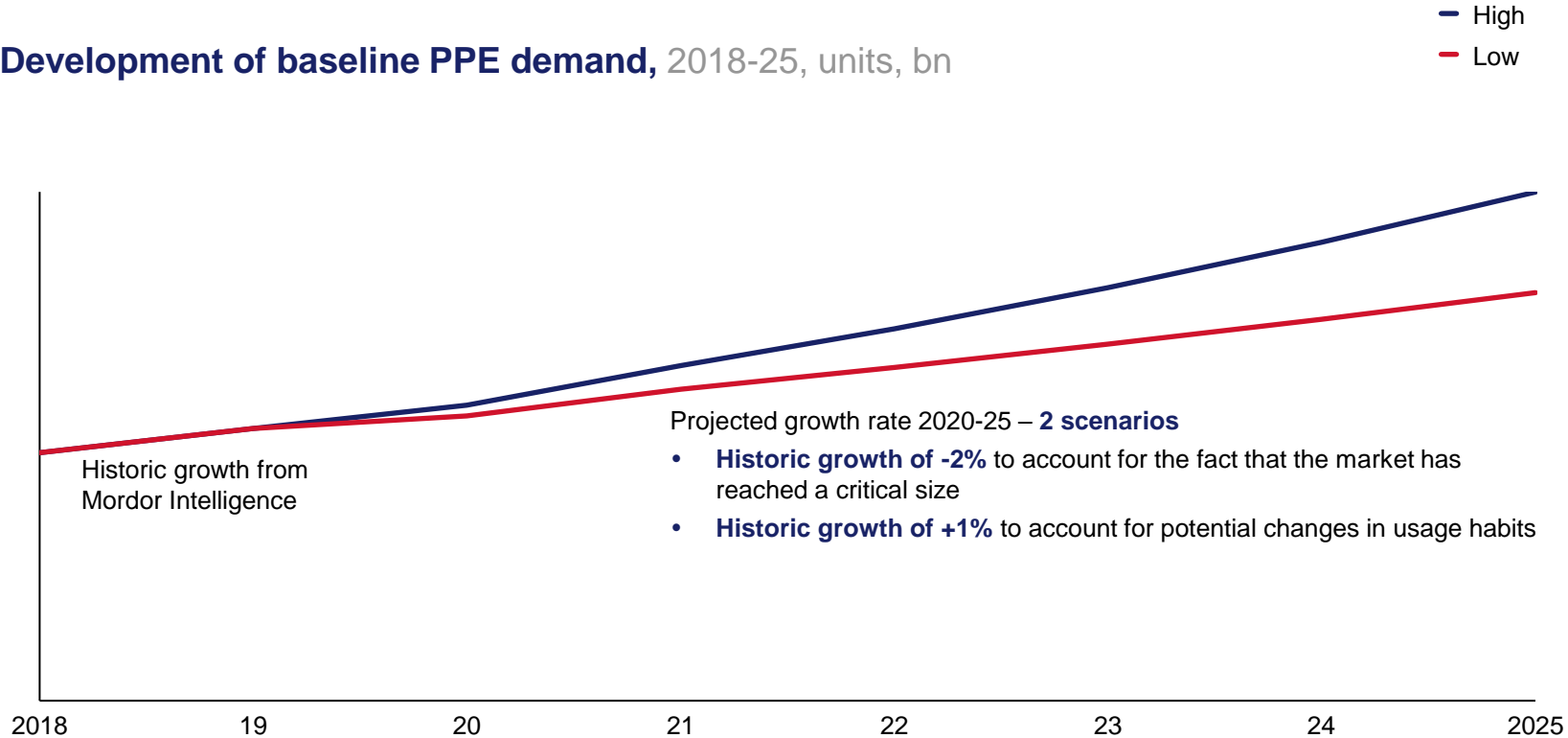
2.UK Department of Health & Social Care data for 2019 prices

3.Research paper on elective surgery based on US data (2014 and 2018)

A| The baseline projected growth rate has been indexed against the historic growth rate

CONCEPTUAL – DUMMY NUMBERS

Development of baseline PPE demand, 2018-25, units, bn




End user market and product mix ratios are assumed to be **consistent over time**








B| Health system PPE demand up to 2022 is modelled in terms of number of hospitalisations

METHODOLOGY

SEE APPENDIX FOR DETAILED ASSUMPTIONS ON NUMBER OF HEALTHCARE WORKERS AND OTHER STAFF BY BED AND THEIR DAILY PPE USAGE RATE

 Focus of the next page

Breakdown of clinic and hospital demand

	Source used	Country data ¹	Regional data	Global data
 Quarterly number of hospital days due to Covid-19	McKinsey EPI models			
 Healthcare workers and other staff² by bed	World Bank database			
 Usage rate per PPE per patient, healthcare workers and other staff²	Global WHO norms			
 Quarterly PPE usage by hospitals and clinics				

For the purposes of this exercise, we used global WHO norms but in a country-level exercise, these could be adjusted to reflect local clinical data/local observations



1. The EPI model is built at country-level but for the purposes of this exercise we aggregated at regional level

2. Including cleaners, ambulance personnel and biomedical engineers

B| Regional hospitalisation trajectories up to 2022 are driven by local variations in vaccination efficacy and coverage

METHODOLOGY

SEE NEXT PAGES FOR FURTHER DETAILS ABOUT PRELIMINARY KNOWLEDGE REGARDING VACCINE EFFICACY AND COVERAGE

Independent variables	Description	Major regional factors influencing the variables	Main sources used	Implications for the demand model
Vaccine efficacy 	<p>Efficacy is the performance of the vaccine under ideal and controlled circumstances (i.e., published results of clinical trials)</p> <p>In real-world conditions, achieved efficacy (i.e., effectiveness) can be lower</p>	<p>Access to different vaccine types (e.g., 95% for Pfizer-BioNTech and Moderna vs. 70% for AstraZeneca)</p>	<p>Results from Phase 3 Covid-19 vaccine trials</p> <p>Expert interviews</p>	<p>We built regional vaccination scenarios, adjusting both efficacy and coverage for the different regions, in turn depending on 2 main factors</p> <ul style="list-style-type: none"> • Access to the different vaccines, including potential financial difficulties in purchasing the most expensive vaccines • Logistic constraints (e.g., large populations, lack of or limited ultracold chain) <p>For each region, we triangulated the modelled demand in doses with national procurement commitments (bilateral agreements and COVAX) and global production capacity for each¹</p> <p>These scenarios also assumed the following technicalities</p> <ul style="list-style-type: none"> • 12-month ramp-up from regulatory approval to maximum coverage • Infinite vaccine-induced immunity duration • Equal vaccine distribution across age groups
Vaccine coverage 	<p>Coverage is the proportion of the total population who receive a Covid-19 vaccine</p>	<p>Government policies for enforcing vaccine usage</p> <p>Public reluctance to be immunized</p> <p>Existing supply contracts/ bilateral agreements to secure vaccine procurement</p> <p>Global production capacity</p>	<p>Duke University</p> <p>Ipsos global consumer survey</p> <p>Expert interviews</p>	




1. The production capacity of AstraZeneca, Pfizer and Moderna are estimated at ~5.3bn doses in 2021, which could cover ~2.6bn people

B| Preliminary studies from vaccine manufacturers suggest an efficacy range from 70% to 95%

Overview of available data on Phase III trials of select Covid-19 vaccine candidates

NON-EXHAUSTIVE – AS OF NOVEMBER 30, 2020



			
MoA	mRNA	mRNA	Viral vector
Dose schedule	2 doses, 4 weeks apart	2 doses, 3 weeks apart	2 doses, 1 month apart
Efficacy target	60%	60%	60%
Efficacy in clinical trial	94.5%	95%	70% ¹
Thermostability	-20°C shipped/stored for 6 months; 2-8°C for 30 days	-70°C shipped/stored for 6 months; 2-8°C for 5 days	2-8°C, normal cold chain
Announced manufacturing capacity	30m doses by end-2020 1bn doses in 2021	50m doses by end-2020 1.3bn doses in 2021	3bn doses in 2021
Pricing	~\$20 per dose	\$10-50 per dose	\$3-4 per dose

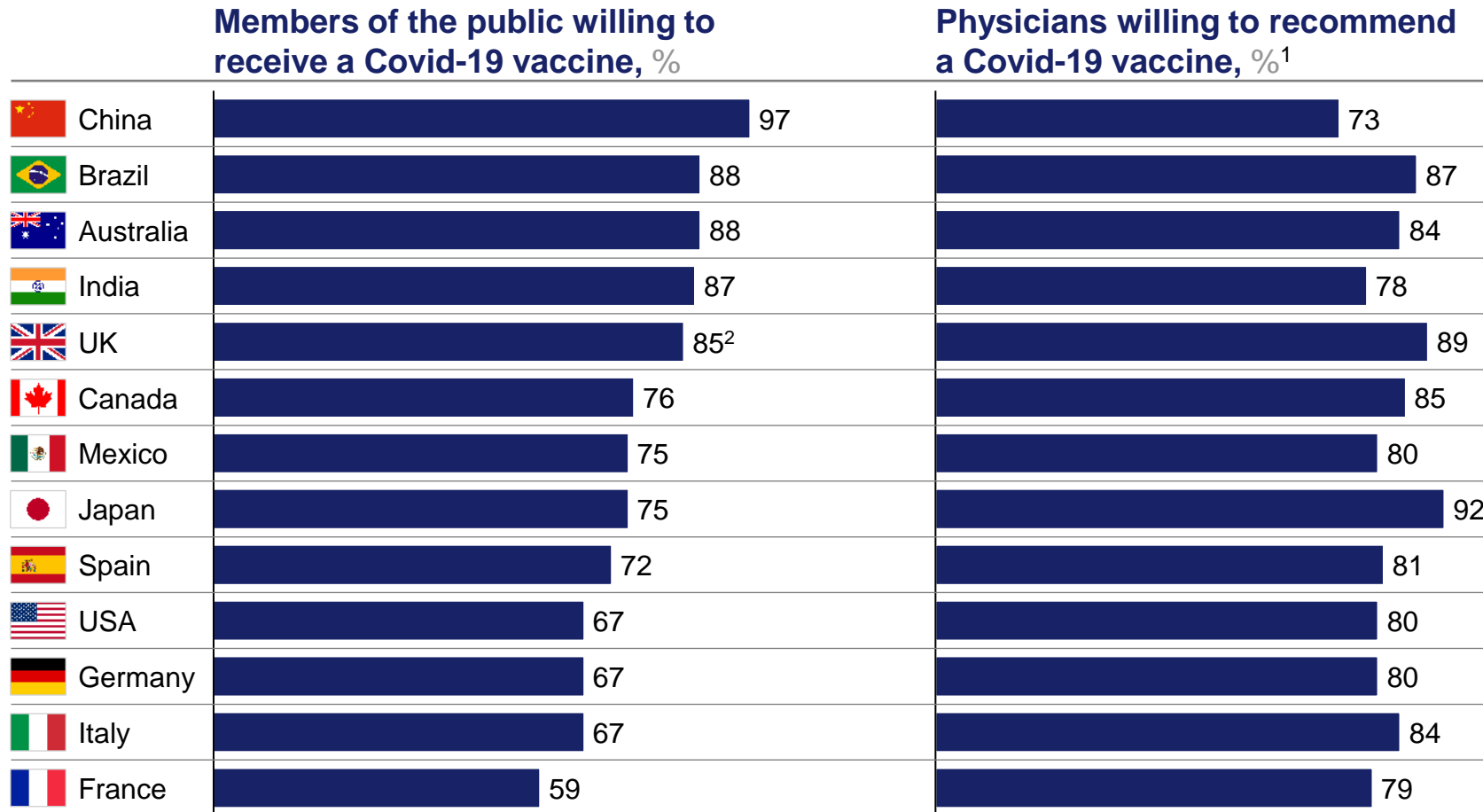
mRNA vaccines come with specific supply chain constraints:
-20°C to -70°C temperature requirements make their distribution challenging for some developing countries

AstraZeneca has pledged to provide the vaccine on a not-for-profit basis for the “duration of the pandemic” and in perpetuity to low- and middle-income countries

1. 3 efficacy levels reported from the trial – an overall efficacy of 70%, a lower one of 62% and a high of 90%

B| To achieve full vaccine coverage, some public resistance headwinds must be overcome...

NON-EXHAUSTIVE AND ILLUSTRATIVE – AS OF AUGUST 24, 2020



1. Based on a vaccine profile with 70% efficacy, moderate safety profile, 12 months duration of immunity, 2-dose regimen, novel platform technology (e.g., DNA/RNA vaccine), 9 months since first patient dosed in trials and established pharmaceutical manufacturer

Source: Ipsos global consumer survey, July-August 2020, Sermo Covid-19 global physician survey, August 2020 (includes GPs and specialists, n=1,837)

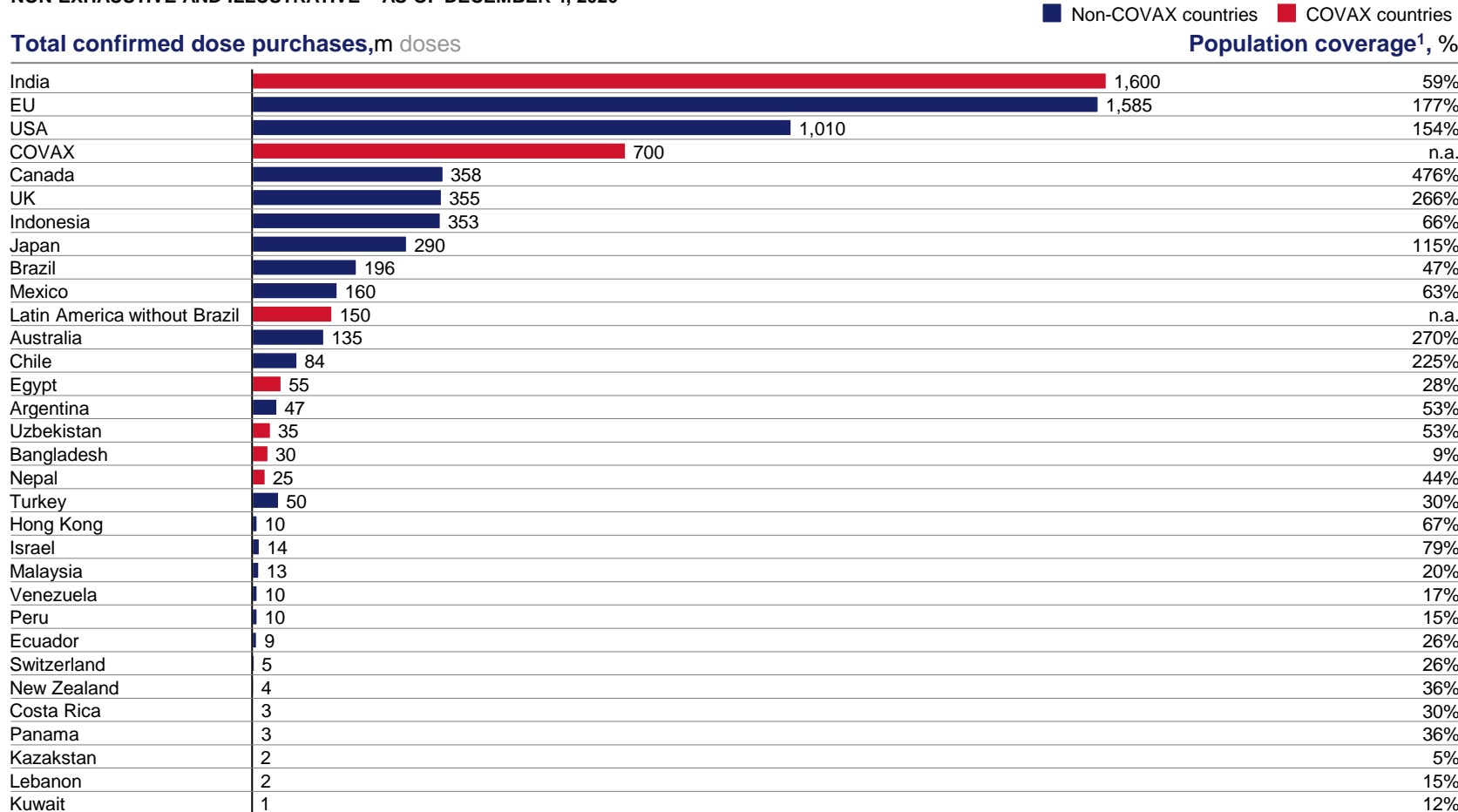
Public acceptance of Covid-19 vaccines varies by geography, though in the **majority of surveyed countries it is above 70%**

Physician willingness to recommend vaccination is generally 80% or higher, which is significant given their influential role

Due to these geographical differences, it is necessary to estimate **adoption rates based on local data**

B| ... along with limits determined by bilateral agreements and COVAX decisions

NON-EXHAUSTIVE AND ILLUSTRATIVE – AS OF DECEMBER 4, 2020



Total 7.3bn doses

1. Calculation based on a 2-dose vaccine

2. Depending on vaccines successfulness

3. COVAX aims to provide ~2Bn doses by the end of 2021 to protect high-risk populations around the world; in the longer term, the goal is to provide funded countries with enough doses to cover 20% of their population

Source: Duke Global Health Innovation Centre (Launch & Scale Speedometer), national press searches



Current models predict that there will be enough vaccines to **cover 30-50% of the world's population in 2021²**

However, **inequities in terms of global allocation** are to be expected

- High-income countries hold ~50% of confirmed dose purchases
- Countries with manufacturing capacity (e.g., India and Brazil) have negotiated large market commitments in advance with leading vaccine candidates as part of their manufacturing agreements
- Low-income countries will be mostly reliant on the 20% population coverage from COVAX³

B| For each region, we model 2 scenarios to show alternative hospitalisation trajectories through to the end of 2022

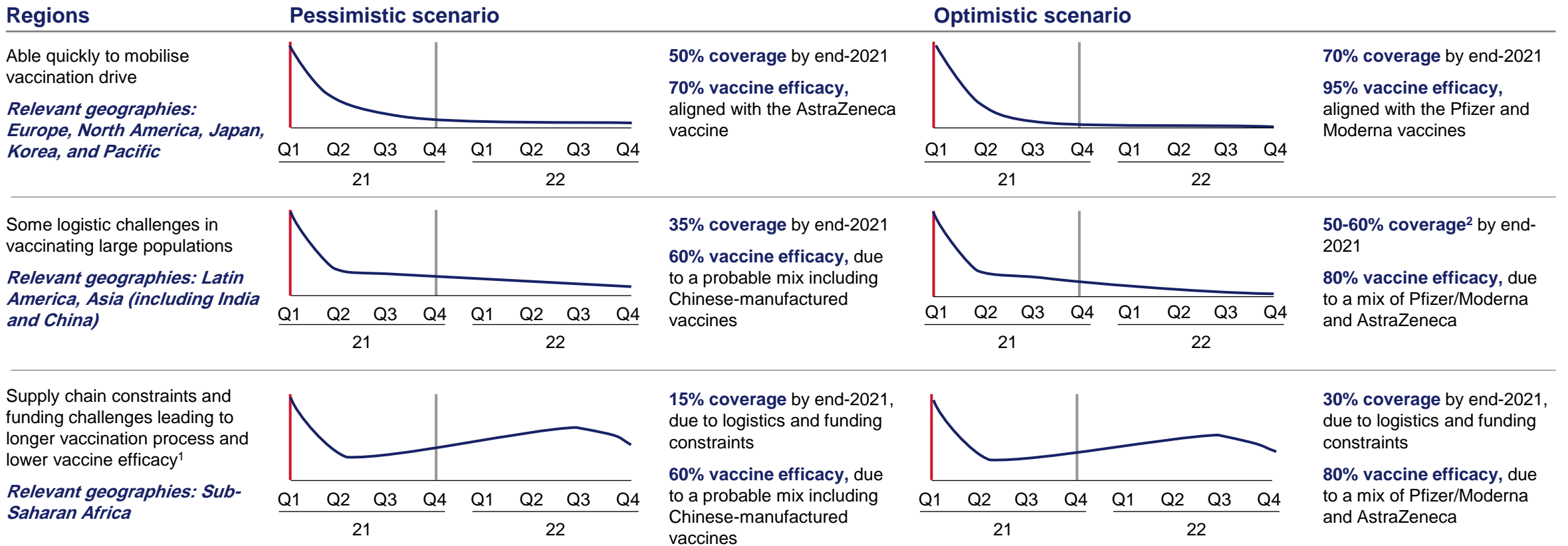
Overview of hospitalisation scenarios by region; pessimistic versus optimistic

DIRECTIONAL AND ILLUSTRATIVE

| Point when target coverage is achieved

| Point when vaccine distribution starts

hospitalisation trajectories (illustrative)



1. Sub-Saharan Africa may use more of the AstraZeneca vaccine as it is the cheapest (\$3-4 vs. \$20 for Pfizer and \$10-50 for Moderna) and does not require ultracold chain facilities as is the case for the Pfizer vaccine (which must be stored at -70°C)

2. Coverage is assumed to be higher in Latin America (60%) than in Asia/MENA (50%), reflecting the existing high rate of influenza vaccination (>80% among +60 year-old in Argentina, Brazil, Chile, and Peru)








C| Demand driven by immunization campaigns up to the end of 2022 is estimated by modelling the number of individuals being vaccinated

METHODOLOGY

SEE APPENDIX FOR DETAILED ASSUMPTIONS AS TO HOW MANY PEOPLE WILL BE VACCINATED

● Focus of the next page

Breakdown of the demand for clinics and hospitals

	Sources used	Country data ¹	Regional data	Global data
 Quarterly number of vaccinated population	McKinsey EPI models			
 Healthcare workers required for that number of vaccines administered	Expert interviews			
 PPE usage rate for each healthcare workers	Standard global WHO assumptions			
 Quarterly volume of PPE usage required for vaccination				

For the purposes of this exercise, we used global WHO norms but in a country-level exercise, these could be adjusted to reflect local clinical data/local observations

1. The EPI model is built at country-level but for the purposes of this exercise we aggregated at regional level

C| For each region, we model 2 scenarios to show alternative immunization trajectories through to the end of 2022

Overview of immunization scenarios by region; pessimistic versus optimistic

DIRECTIONAL AND ILLUSTRATIVE

Immunization trajectories – cumulative vaccinated individuals (illustrative)

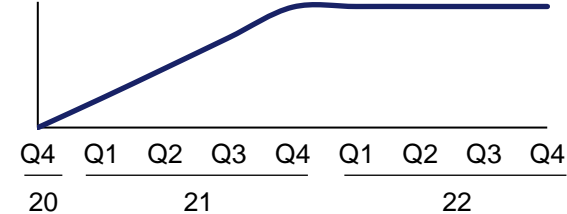
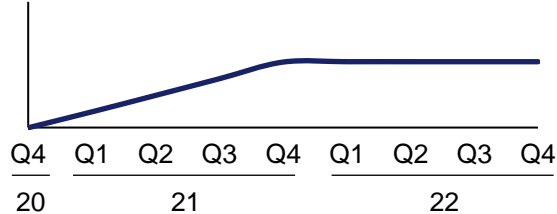
Region archetypes

Pessimistic scenario

Optimistic scenario

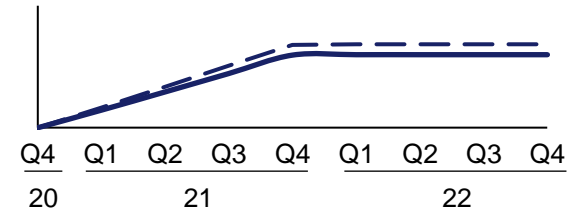
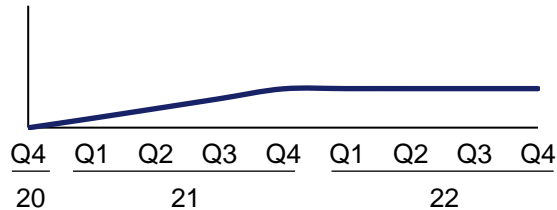
Able quickly to mobilise vaccination drive

Relevant geographies:
Europe, North America, Japan, Korea, and Pacific



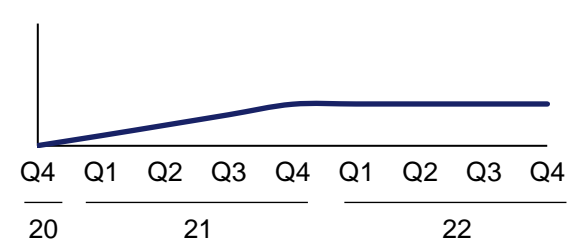
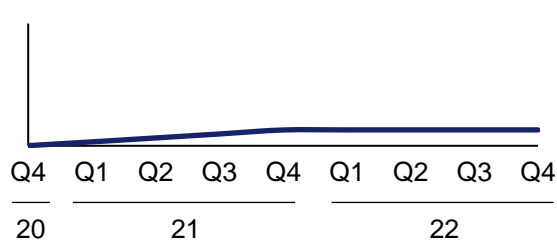
Some logistic challenges in vaccinating large populations

Relevant geographies: *Latin America, Asia (including India and China)*



Supply chain constraints and funding challenges leading to longer vaccination process and lower vaccine efficacy¹

Relevant geographies: *Sub-Saharan Africa*




1. Sub-Saharan Africa may use more of the AstraZeneca vaccine as it is the cheapest (\$3-4 vs. \$20 for Pfizer and \$10-50 for Moderna) and does not require ultracold chain facilities as is the case for the Pfizer vaccine (which must be stored at -70°C)

2. Coverage is assumed to be higher in Latin America (60%) than in Asia/MENA (50%), reflecting the existing high rate of influenza vaccination (>80% among +60 year-old in Argentina, Brazil, Chile, and Peru)




D| Non-healthcare workplace demand for PPE up until 2025 is driven by the level of social interaction and physicality of different jobs

Overview of methodology used to estimate the demand arising from non-health labour

SEE APPENDIX FOR DETAILED ASSUMPTIONS ON BACK-TO-WORK PROPORTION, ADOPTION RATES AND USAGE RATES






 Focus of the next page

The non-healthcare workforce can be segmented into 3 archetypes

	Description	Examples (non-exhaustive)
 Archetype 1	High social interaction and physicality (e.g., heavy lifting)	Waiters Physical trainers Construction
 Archetype 2	High social interaction but low physicality	Grocery Retail Education Transportation
 Archetype 3	Low social interaction and low physicality	Finance and other services jobs



For each archetype, PPE demand is estimated at regional level up to Q4 2025, based on 4 independent variables

Elements	Sources
 # workers by archetype	International Labour Organization
 % back to work	Interviews with experts ¹ Survey of working professionals ²
 Adoption rate by PPE element by archetype (i.e., proportion of workforce that will use that PPE)	
 Usage rate by PPE (i.e., number of units per day)	WHO recommendations YouGov Interviews with experts ¹
 Quarterly PPE usage for each non-healthcare worker	

1.November-December 2020

2.Survey held in the US, 28 May-3-June 2020; n=1,021

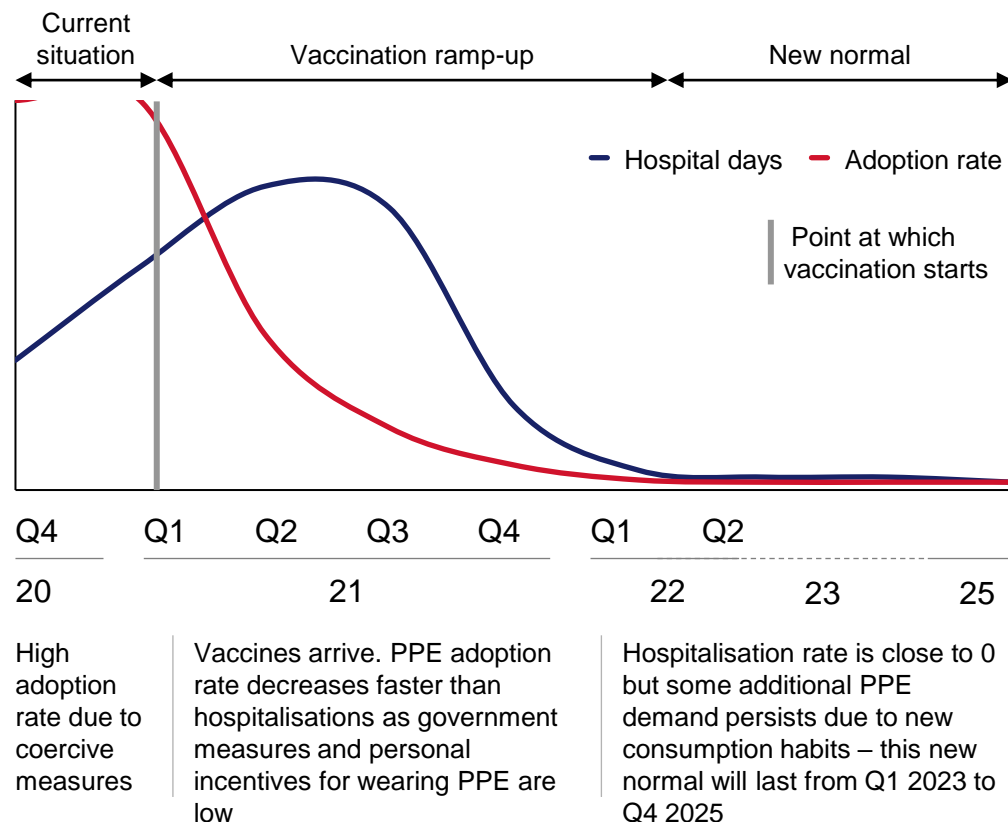
D| The adoption rate in non-healthcare workplaces is indexed to the EPI curve; usage rates will vary by type of worker

Overview of assumptions used to estimate adoption and usage rates for non-healthcare labour

DIRECTIONAL AND ILLUSTRATIVE




SEE APPENDIX FOR DETAILED ASSUMPTIONS ON BACK-TO-WORK PROPORTION, ADOPTION RATES AND USAGE RATES

Adoption rate will scale down once vaccination starts, with a different “new normal” defined for each region



Adoption and usage rates will vary depending on worker archetype and region


Degrees of surgical mask usage

Archetypes	Regional adoption rates (illustrative, non-exhaustive)			Usage rate
	North America	China	SSA	
 Archetype 1 High social interaction and physicality	Current: 60-70% New normal: 1-2%	Current: 60-70% New normal: 5-10%	Current: 10-15% New normal: 0%	1-4 Units/day
 Archetype 2 High social interaction but low physicality	Current: 60-70% New normal: 1-2%	Current: 60-70% New normal: 5-10%	Current: 10-15% New normal: 0%	1-2 Units/day
 Archetype 3 Low social interaction and low physicality	Current: 50-60% New normal: 1-2%	Current: 50-60% New normal: 5-10%	Current: 5-10% New normal: 0%	0.5-1 unit/day





E| Consumer demand for PPE through to 2025 will be driven by demographics

Overview of methodology used to estimate consumer demand

SEE APPENDIX FOR DETAILED ASSUMPTIONS ABOUT ADOPTION AND USAGE RATES








 Focus of the next page

The population can be segmented into 4 age segments

Behaviour		
	Under 15	No PPE usage
	15-19	High usage rate due to outdoor lifestyle and school usage
	20-65	Medium usage rate; PPE mainly used in the workplace
	Over 65	Low usage rate due to a more indoor lifestyle



For each age category, PPE demand can be estimated at the regional level up to Q4 2025, based on 3 independent variables

Elements	Sources
 # population by age range	UN Population Division
	
 Adoption rate by PPE by age range (i.e., proportion of the population that will use PPE)	YouGov Interviews with experts ¹ Survey of general public ²
	
 Usage rate by PPE (i.e., units per day)	WHO recommendation Interviews with experts ¹ Survey of general public ²
	
 Quarterly PPE usage for consumers	

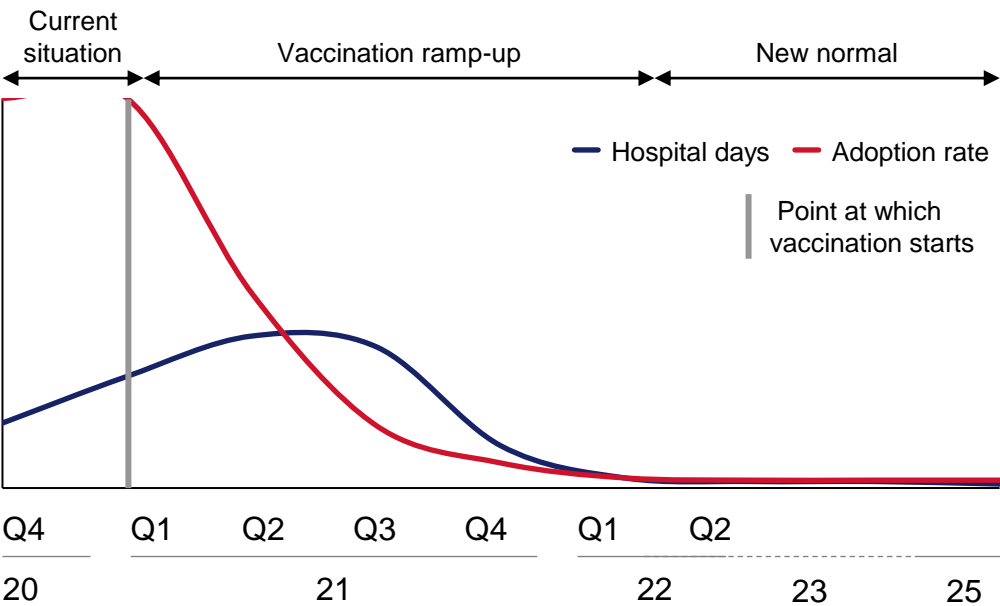
1.November-December 2020
2.Survey carried out in the US, 28 May-3 June 2020; n=1,021

E| Each age segment will exhibit different adoption and usage rates; adoption rates can be indexed to the EPI curve

Overview of assumptions used to estimate adoption and usage rates for the general public

DIRECTIONAL AND ILLUSTRATIVE SEE APPENDIX FOR DETAILED ASSUMPTIONS ON ADOPTION RATES AND USAGE RATES

Adoption rates will scale down once vaccination starts, with a different “new normal” defined for each region






High adoption rate due to coercive measures

Vaccines arrive. PPE adoption rate decreases faster than hospitalisations as government measures and personal incentives for wearing PPE are low

Hospitalisation rate is close to 0 but some additional PPE demand persists due to new consumption habits – this new normal will last from Q1 2023 to Q4 2025



Adoption and usage rates will vary by age segment and regions
Example of surgical mask usage

Age segment	Regional adoption rates (illustrative, non-exhaustive)			Usage rate
	North America	China	SSA	
 15-19	Current: 40-50% New normal: 1-2%	Current: 40-60% New normal: 4-5%	Current: 10-15% New normal: 0%	2-3 Units/week
 20-65	Current: 30-40% New normal: 1-2%	Current: 30-60% New normal: 3-4%	Current: 5-10% New normal: 0%	1-2 Units/week
 Over 65	Current: 25-40% New normal: 1-2%	Current: 25-50% New normal: 3-4%	Current: 5-10% New normal: 0%	1-2 Units/week

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- Global forecast demand for PPE by volume – Regional deep-dives
- Global forecast demand for PPE – **March 2021 update**

III. Emerging perspectives on PPE market dynamics in the short to medium term

Country & regional deep-dives

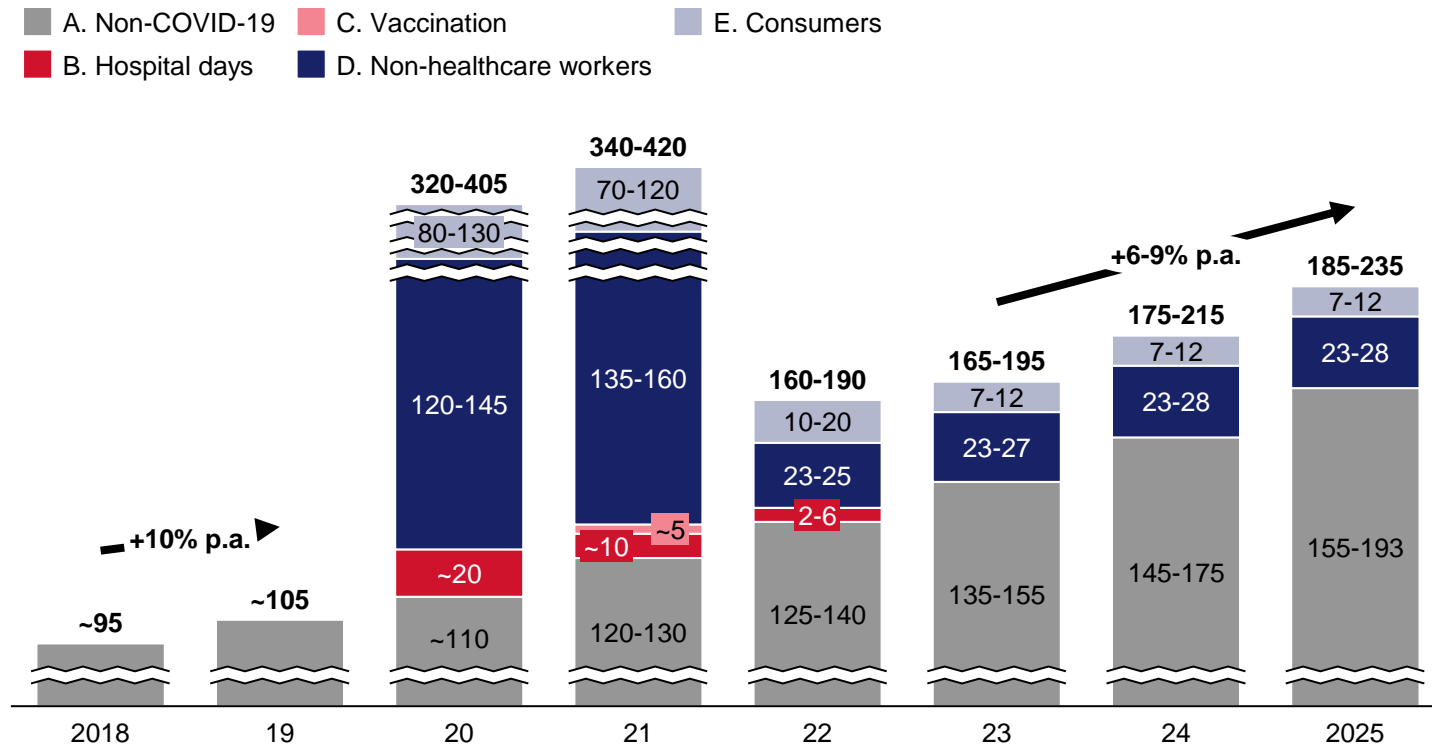
Topical deep-dive

Appendix

Consumers and non-healthcare workers will drive global PPE demand to peak at 340-420bn units in 2021 before it resumes its historic growth rate

ESTIMATES – AS OF 16 DECEMBER 2020

Total estimated¹ volume PPE demand, 2018-25, units, bn²



Key insights

Global PPE demand is expected to peak in 2020-21, driven by a surge in consumer and non-healthcare worker demand, which will account for ~60-70% of total demand

- Non-healthcare worker and consumer demand is critically dependent on surgical mask adoption rates (from 10-80%³ depending on geography)
- Demand increases are also driven by health system demand (5%), which in turn depends on vaccination scenarios

In 2022, PPE demand is expected to drop due to the sharp decline in consumer and non-healthcare worker demand

- Surgical masks adoption rates are expected to drop to 0-10% depending on geography
- Demand from health systems could fall alongside increased vaccine coverage

From 2023 onwards, global demand may well resume its historic growth rate

- Consumer and non-healthcare worker demand may stabilize at 30-40bn units a year, driven by a “legacy effect”
- Baseline demand is expected to grow by 7-11% p.a. throughout 2022-25, depending on which growth scenario is selected¹

1. Range reflects 2 scenarios (“high” vs. “low”): (i) non-Covid-19 baseline demand based on 2 growth scenarios (historic growth -2% to account for critical size of the market vs. historic growth +1% to account for potential changes in usage habits), (ii) hospital days and vaccination demands depend on vaccination scenario (“pessimistic” vs. “optimistic”), and (iii) workers in non-healthcare settings and consumer demand depend on adoption rate assumptions (“high” vs. “low”)

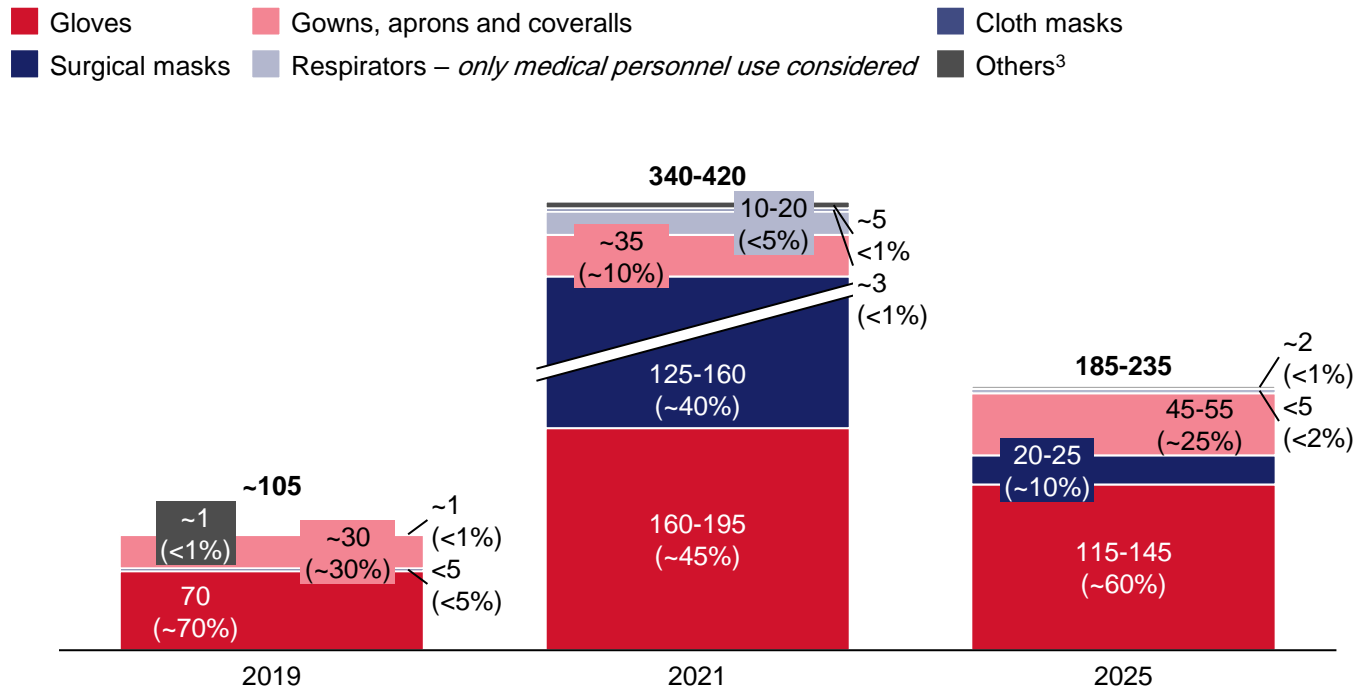
2. Unit is per item or per pair in case of gloves, hand sanitizer is per litre and chlorine is per kg

3. Surgical masks adoption rate is assumed to be 10% for consumers in Sub-Saharan Africa while 80% represents the adoption rate for workers in non-healthcare settings in China and North America

Consumers and non-healthcare workers will drive surgical mask demand to peak at 125-160bn units in 2021 before dropping by ~40% p.a. in 2021-25

ESTIMATES – AS OF 16 DECEMBER 2020

Total estimated PPE¹ demand by category

2019-25, units, bn² (% of total demand by volume)

Key insights

The crisis has **shifted category mix significantly**: masks will drive the demand surge in 2021, accounting for 40% of total demand in 2021 (vs. less than 5% in 2019)

- Surgical mask demand accounts for ~50% of non-healthcare worker and ~70-80% of consumer demand
- The surge in surgical mask demand vs. other products is explained by higher adoption rates among consumers (40-50%⁴ vs. 0% for medical gloves) and workers in non-healthcare settings (40-70% vs. 0-60%⁴ for medical gloves)

By 2025, category mix should return to a more typical distribution pattern with gloves constituting ~60% of demand

- With increased immunity, surgical mask demand is expected to decrease sharply, falling back to ~10% of total demand in 2025 reflecting declining adoption rates among consumers and workers in non-healthcare settings (0-10% depending on geography)

1. Range reflects 2 scenarios ("high" vs. "low"): (i) non-Covid-19 baseline demand based on 2 growth scenarios (historic growth -2% to account for critical size of the market vs. historic growth +1% to account for potential changes in usage habits), (ii) hospital days and vaccination demands depend on vaccination scenario ("pessimistic" vs. "optimistic"), and (iii) workers in non-healthcare settings and consumer demand depend on adoption rate assumptions ("high" vs. "low")

2. Unit is per item or per pair in case of gloves, hand sanitizer is per litre and chlorine is per kg ; bn = billion

3. Eye protection (face shields and goggles), shoe cover, and disinfectant products/biological waste management (i.e., hand sanitizer, chlorine, body bags and clinical waste bags)

4. Excluding Sub-Saharan Africa adoption rate, depending on geography, worker archetype and population age

Source: Mordor Intelligence (updated in November 2020), EPI model, WHO assumptions

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Topical deep-dive

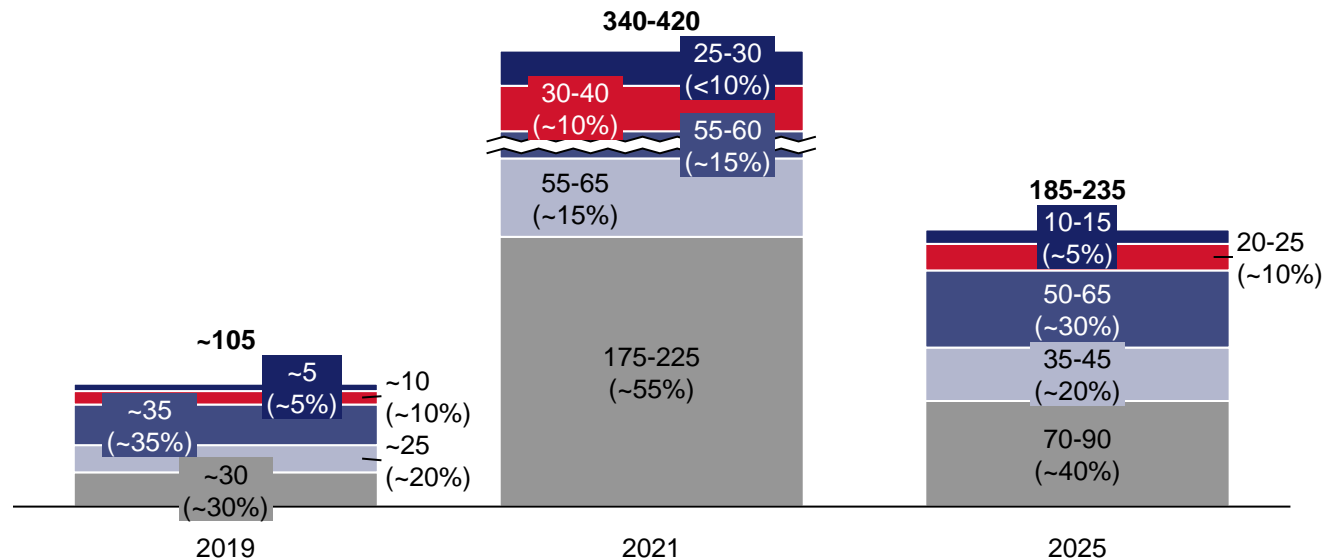
Appendix

We expect consumers and non-healthcare workers to drive a significant shift in the weight of global PPE demand away from North America and towards Asia

ESTIMATES - AS OF 16 DECEMBER 2020

Total estimated¹ PPE demand by region, 2019-25, units, bn² (% of total demand by volume)

■ Africa and Middle East ■ North America ■ Asia and Pacific⁴
■ Latin America ■ Europe³



Key insights

While **North America has been the largest historic source of demand** (~35% of global demand in 2019), by 2021, **Asia is expected to account for ~50%** of total PPE demand

- ~60% of consumer and non-healthcare worker demand is driven by Asian countries³ due to higher adoption rates for surgical masks in that region (~60-80%) and large populations

By 2025, **end-market mix may more closely resemble historic distribution patterns**, but with Asian markets still remaining the largest for PPE

- Asian leadership is driven by a stronger “legacy effect” of PPE use among consumers and workers in non-healthcare settings (~10% vs. <3% in other geographies)

1.Range reflects 2 scenarios (“high” vs. “low”): (i) non-Covid-19 baseline demand depends on 2 growth scenarios (historic growth of -2% to account for critical size of the market vs. historic growth of +1% to account for potential changes in usage habits), (ii) hospital days and vaccination demands depend on vaccination scenario (“pessimistic” vs. “optimistic”), and (iii) workers in non-healthcare settings and consumer demands depend on adoption rate assumptions (“high” vs. “low”)

2.Unit is per item or per pair in case of gloves, hand sanitizer is per liter, and chlorine is per kg

3.Including Russia and Central Asia

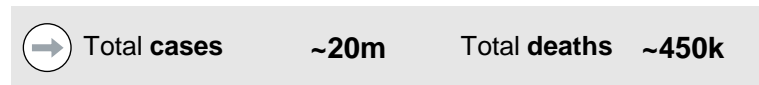
4.Including China and India

Source: Mordor Intelligence (updated in November 2020), EPI model, WHO assumptions

Europe

ESTIMATES SEE APPENDIX FOR DETAILS OF COUNTRIES INCLUDED

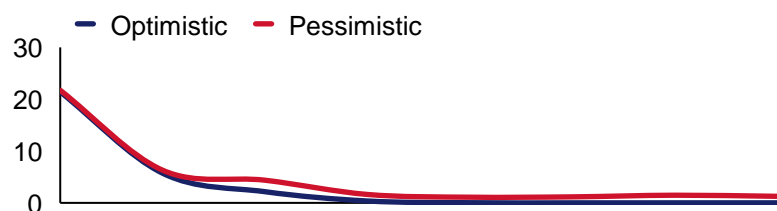
Epidemiological profile



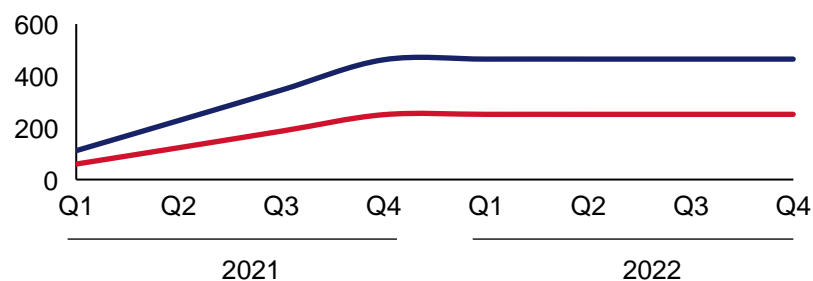
Vaccine scenario

- Optimistic: **70% coverage** by end-2021 and **95% efficacy**
- Pessimistic: **50% coverage** by end-2021 and **70% efficacy**

Hospitalisation days, days, m



Cumulative vaccinations (successful), people, m



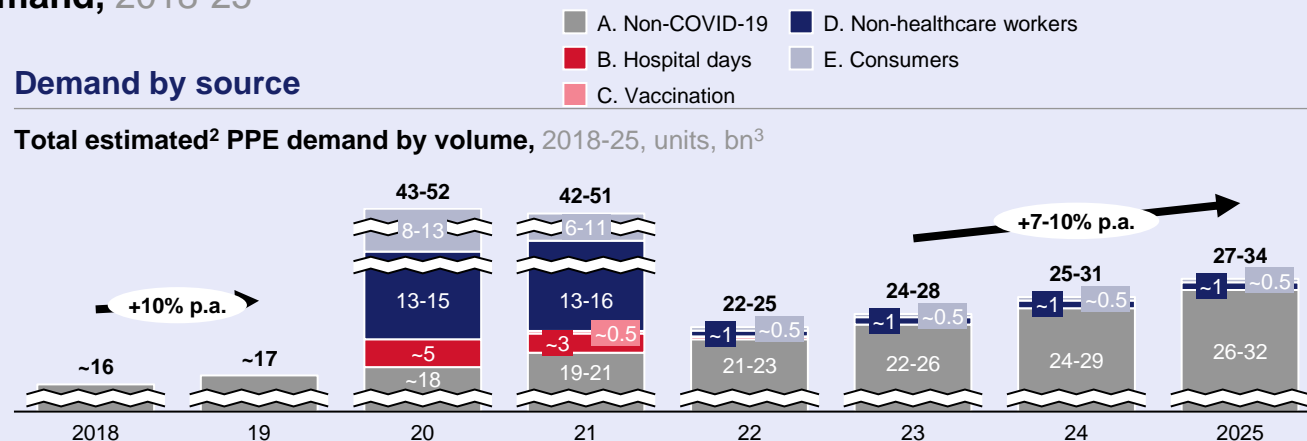
PPE demand, 2018-25

➔ Propagation trend¹



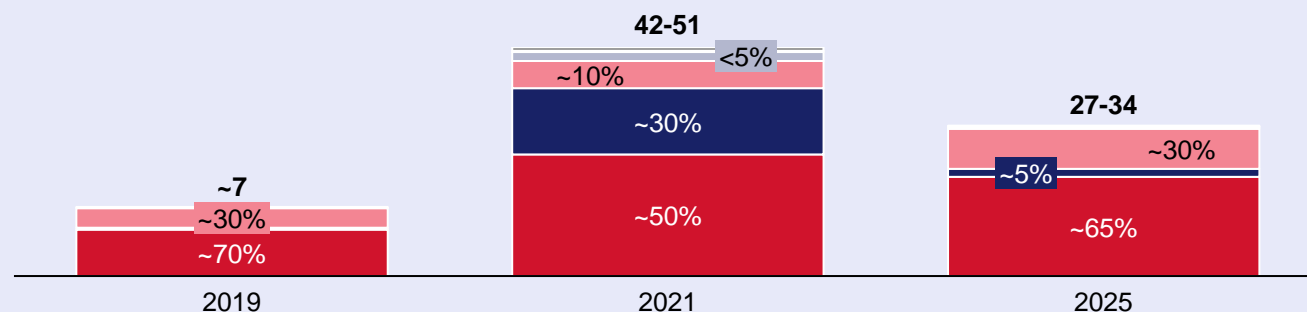
Demand by source

Total estimated² PPE demand by volume, 2018-25, units, bn³



Demand by PPE category

Total estimated² demand by type of PPE, 2019-25, % of total demand by volume



1. Increasing: > 10% increase in cumulative incremental cases over last 7 days, compared with incremental cases over last 8-14 days; stabilizing: ~ 10%; decreasing: < -10%

2. Range reflects 2 scenarios ("high" vs. "low"): non-Covid-19 baseline demand depends on 2 growth scenarios (historic growth of -2% to account for critical size of the market vs. historic growth of +1% to account for potential changes in usage habits) hospital days and vaccination scenarios depend on vaccination scenario ("pessimistic" vs. "optimistic"), and non-healthcare worker and consumer demand depend on adoption rate assumptions ("high" vs. "low")

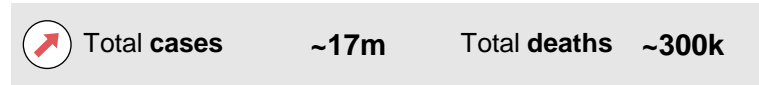
3. Unit is per item or per pair in case of gloves, hand sanitizer is per litre and chlorine is per kg

Source: Johns Hopkins, EPI model

North America

ESTIMATES SEE APPENDIX FOR DETAILS OF COUNTRIES INCLUDED

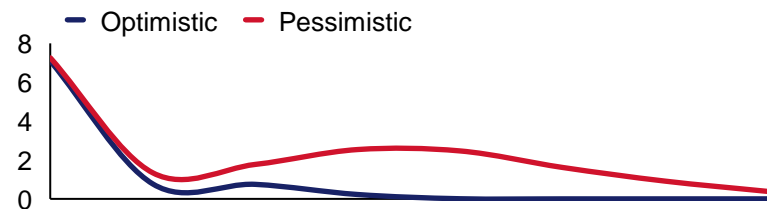
Epidemiological profile



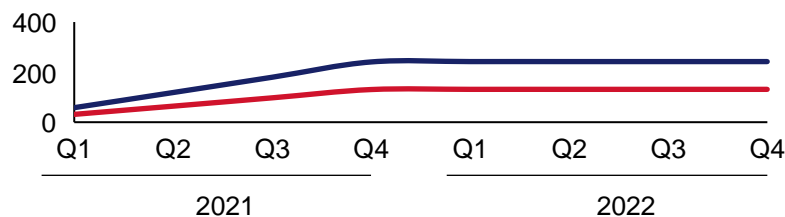
Vaccine scenario

- *Optimistic: 70% coverage by end-2021 and 95% efficacy*
- *Pessimistic: 50% coverage by end-2021 and 70% efficacy*

hospitalisation days, days, m



Cumulative vaccinations (successful), people, m



1.Increasing: > 10% increase in cumulative incremental cases over last 7 days, compared with incremental cases over last 8-14 days; stabilizing: ~ 10%; decreasing: < -10%

2.Range reflects 2 scenarios ("high" vs. "low"): non-Covid-19 baseline demand depends on 2 growth scenarios (historic growth of -2% to account for critical size of the market vs. historic growth of +1% to account for potential changes in usage habits) hospital days and vaccination scenarios depend on vaccination scenario ("pessimistic" vs. "optimistic"), and non-healthcare worker and consumer demand depend on adoption rate assumptions ("high" vs. "low")

3.Unit is per item or per pair in case of gloves, hand sanitizer is per litre and chlorine is per kg

Source: Johns Hopkins, EPI model

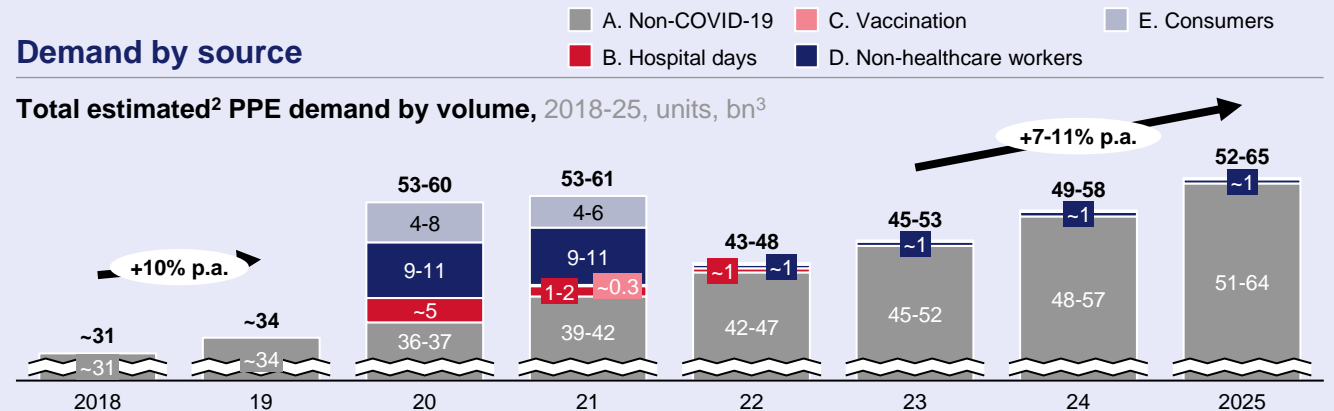
PPE demand, 2018-25

 Propagation trend¹



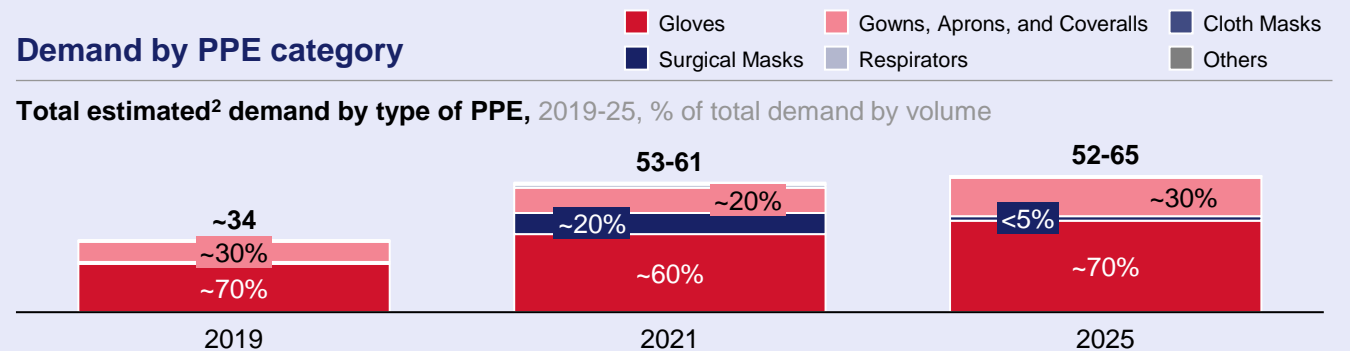
Demand by source

Total estimated² PPE demand by volume, 2018-25, units, bn³



Demand by PPE category

Total estimated² demand by type of PPE, 2019-25, % of total demand by volume

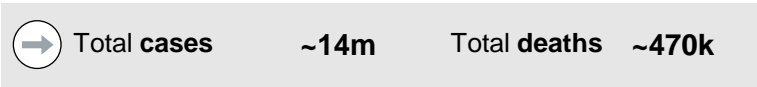


INTENDED TO PROVIDE INSIGHT BASED ON CURRENTLY AVAILABLE INFORMATION FOR CONSIDERATION AND NOT SPECIFIC ADVICE

Latin America and Caribbean

ESTIMATES SEE APPENDIX FOR DETAILS OF COUNTRIES INCLUDED

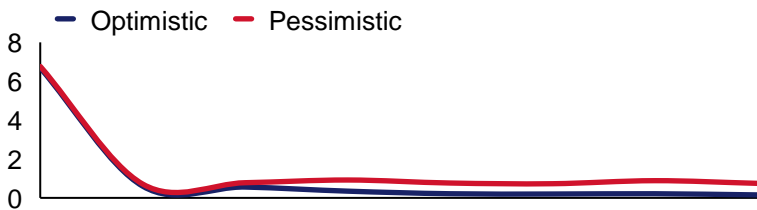
Epidemiological profile



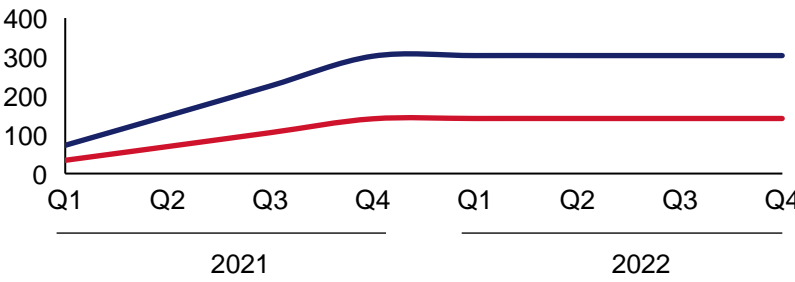
Vaccine scenario

- Optimistic: **60% coverage** by end-2021 and **80% efficacy**
- Pessimistic: **35% coverage** by end-2021 and **60% efficacy**

hospitalisation days, days, m



Cumulative vaccinations (successful), people, m



PPE demand, 2018-25

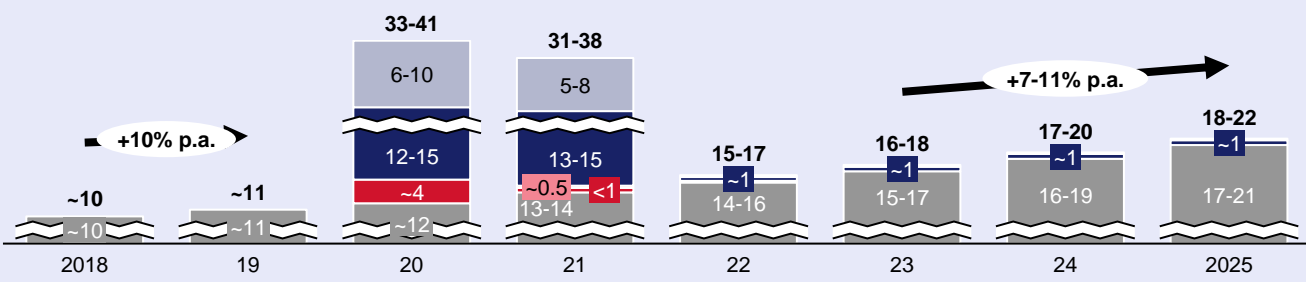
➔ Propagation trend¹



Demand by source

- A. Non-COVID-19
- B. Hospital days
- C. Vaccination
- D. Non-healthcare workers
- E. Consumers

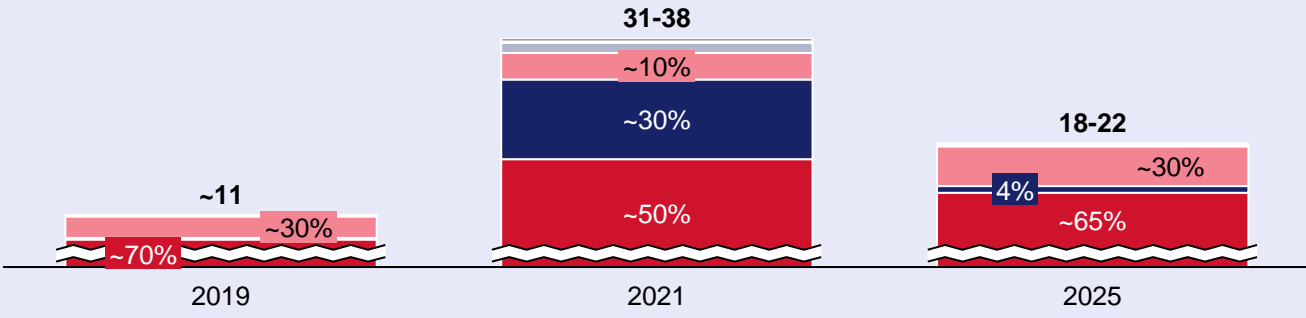
Total estimated² PPE demand by volume, 2018-25, units, bn³



Demand by PPE category

- Gloves
- Gowns, Aprons, and Coveralls
- Cloth Masks
- Surgical Masks
- Respirators
- Others

Total estimated² demand by type of PPE, 2019-25, % of total demand by volume



1. Increasing: > 10% increase in cumulative incremental cases over last 7 days, compared with incremental cases over last 8-14 days; stabilizing: ~ 10%; decreasing: < -10%

2. Range reflects 2 scenarios ("high" vs. "low"): non-Covid-19 baseline demand depends on 2 growth scenarios (historic growth of -2% to account for critical size of the market vs. historic growth of +1% to account for potential changes in usage habits) hospital days and vaccination scenarios depend on vaccination scenario ("pessimistic" vs. "optimistic"), and non-healthcare worker and consumer demand depend on adoption rate assumptions ("high" vs. "low")

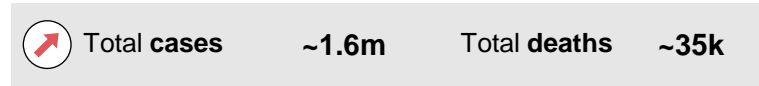
3. Unit is per item or per pair in case of gloves, hand sanitizer is per litre and chlorine is per kg

Source: Johns Hopkins, EPI model

Sub-Saharan Africa

ESTIMATES SEE APPENDIX FOR DETAILS OF COUNTRIES INCLUDED

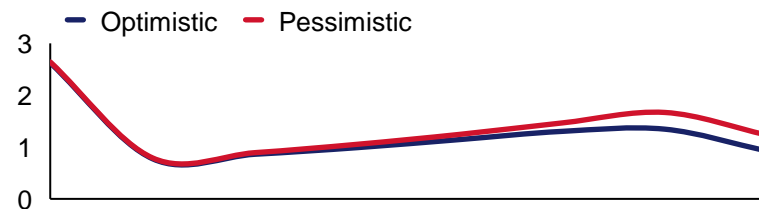
Epidemiological profile



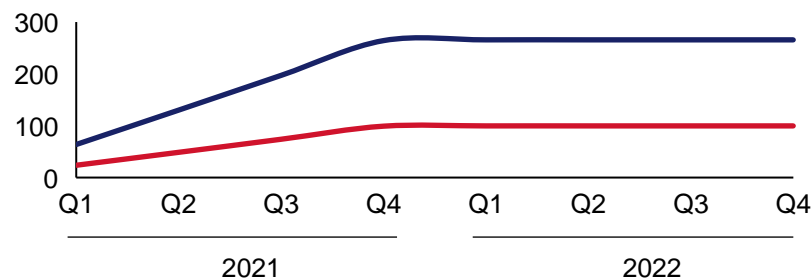
Vaccine scenario

- *Optimistic: 30% coverage by end-2021 and 80% efficacy*
- *Pessimistic: 15% coverage by end-2021 and 60% efficacy*

hospitalisation days, days, m



Cumulative vaccinations (successful), people, m



1. All African countries excluding North African countries (i.e., Morocco, Algeria, Tunisia, Libya, and Egypt)

2. Increasing: > 10% increase in cumulative incremental cases over last 7 days; compared with incremental cases over last 8-14 days; stabilizing: ~ 10%; decreasing: < -10%

3. Range reflects 2 scenarios ("high" vs. "low"): non-Covid-19 baseline demand depends on 2 growth scenarios (historic growth of -2% to account for critical size of the market vs. historic growth of +1% to account for potential changes in usage habits) hospital days and vaccination scenarios depend on vaccination scenario ("pessimistic" vs. "optimistic"), and non-healthcare worker and consumer demand depend on adoption rate assumptions ("high" vs. "low")

4. Unit is per item or per pair in case of gloves, hand sanitizer is per litre and chlorine is per kg

Source: Johns Hopkins, EPI model

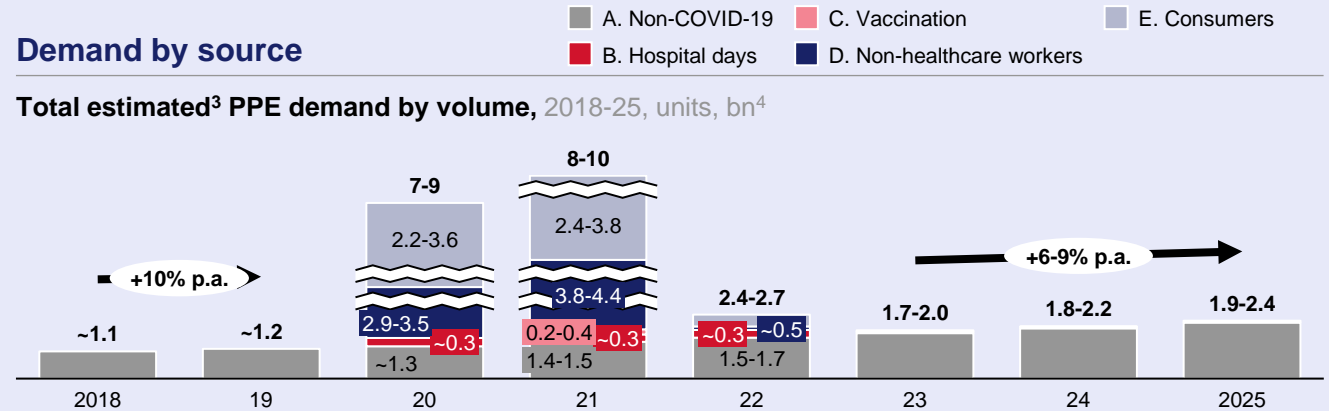
PPE demand, 2018-25

 Propagation trend²



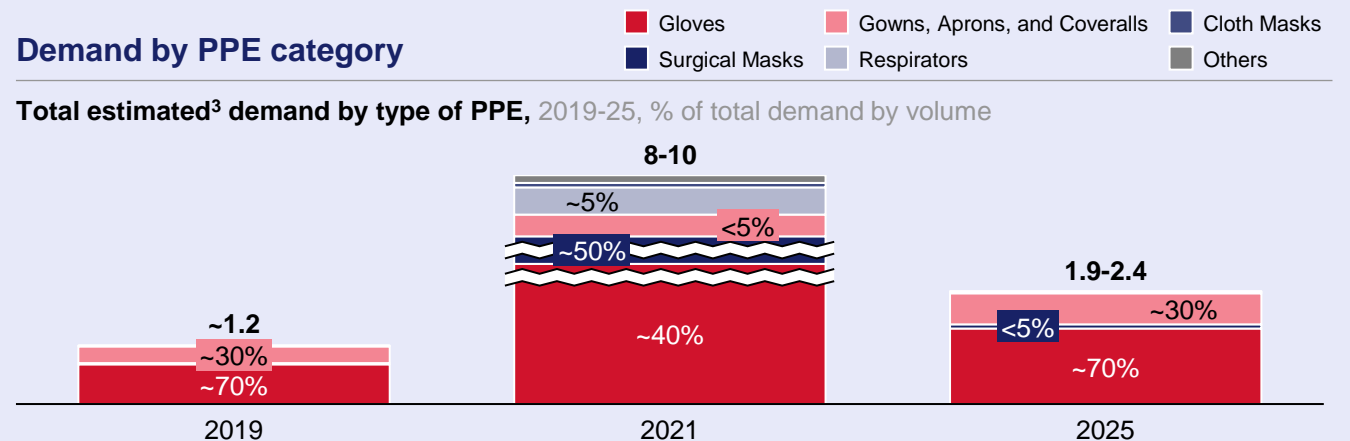
Demand by source

Total estimated³ PPE demand by volume, 2018-25, units, bn⁴



Demand by PPE category

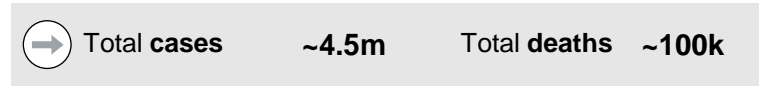
Total estimated³ demand by type of PPE, 2019-25, % of total demand by volume



Middle East and North Africa

ESTIMATES SEE APPENDIX FOR DETAILS OF COUNTRIES INCLUDED

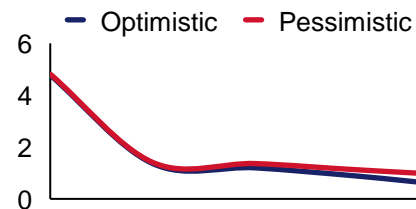
Epidemiological profile



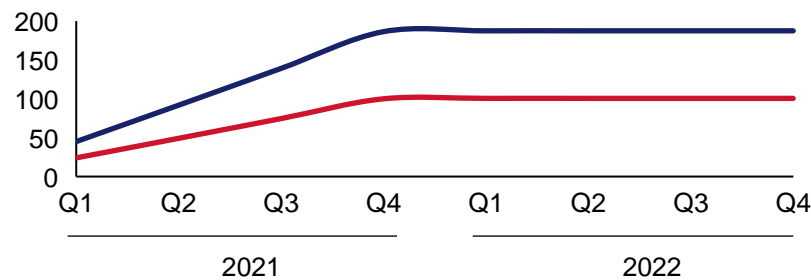
Vaccine scenario

- **Optimistic:** 50% coverage by end-2021 and 80% efficacy
- **Pessimistic:** 35% coverage by end-2021 and 60% efficacy

hospitalisation days, days, m



Cumulative vaccinations (successful), people, m



PPE demand, 2018-25

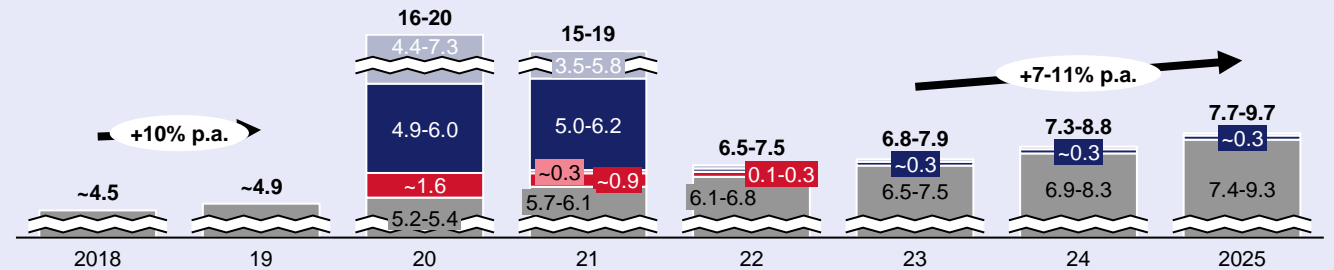
➔ Propagation trend¹



Demand by source

A. Non-COVID-19 B. Hospital days C. Vaccination D. Non-healthcare workers E. Consumers

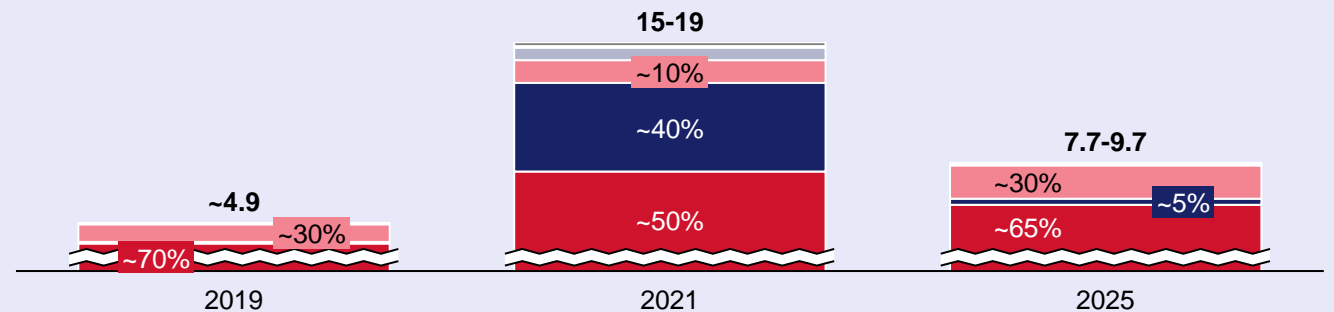
Total estimated² PPE demand by volume, 2018-25, units, bn³



Demand by PPE category

Gloves Gowns, Aprons, and Coveralls Cloth Masks
Surgical Masks Respirators Others

Total estimated² demand by type of PPE, 2019-25, % of total demand by volume



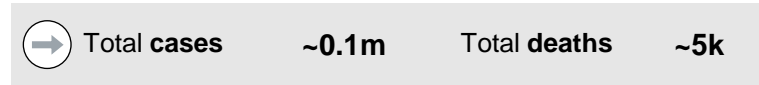
1. Increasing: > 10% increase in cumulative incremental cases over last 7 days, compared with incremental cases over last 8-14 days; stabilizing: ~ 10%; decreasing: < -10%
2. Range reflects 2 scenarios ("high" vs. "low"): non-Covid-19 baseline demand depends on 2 growth scenarios (historic growth of -2% to account for critical size of the market vs. historic growth of +1% to account for potential changes in usage habits) hospital days and vaccination scenarios depend on vaccination scenario ("pessimistic" vs. "optimistic"), and non-healthcare worker and consumer population demand depend on adoption rate assumptions ("high" vs. "low")
3. Unit is per item or per pair in case of gloves, hand sanitizer is per litre and chlorine is per kg

Source: Johns Hopkins, EPI model

China

ESTIMATES SEE APPENDIX FOR DETAILS OF COUNTRIES INCLUDED

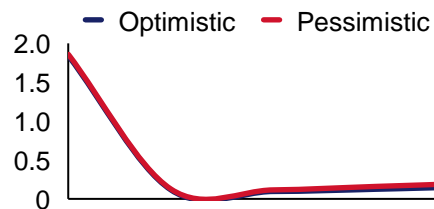
Epidemiological profile



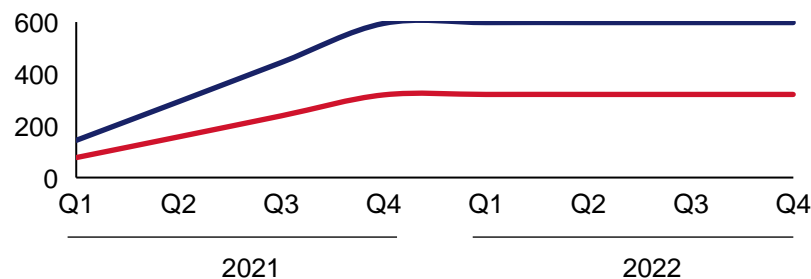
Vaccine scenario

- *Optimistic: 50% coverage by end-2021 and 80% efficacy*
- *Pessimistic: 35% coverage by end-2021 and 60% efficacy*

hospitalisation days, days, m



Cumulative vaccinations (successful), people, m



PPE demand, 2018-25

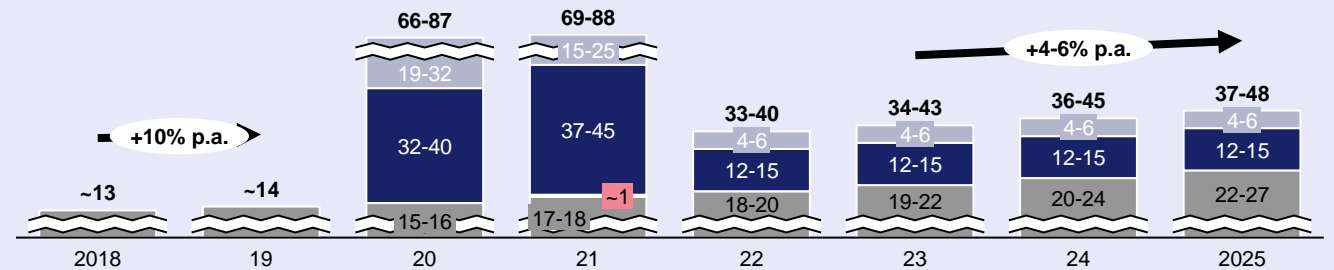
➔ Propagation trend¹



Demand by source

■ A. Non-COVID-19 ■ C. Vaccination ■ E. Consumers
■ B. Hospital days ■ D. Non-healthcare workers

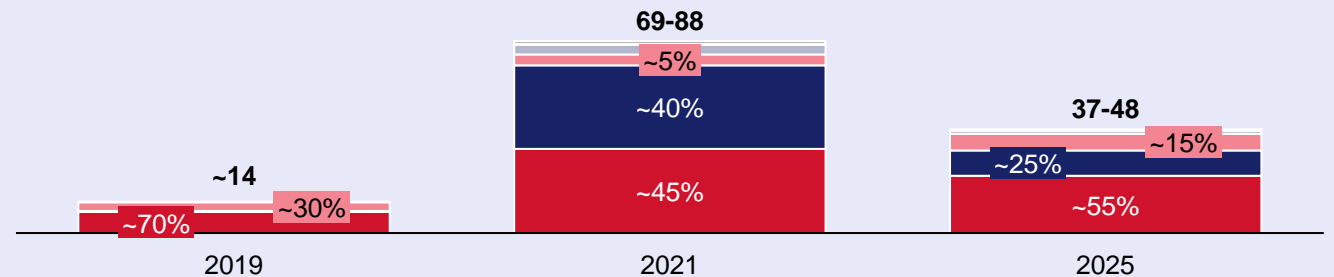
Total estimated² PPE demand by volume, 2018-25, units, bn³



Demand by PPE category

■ Gloves ■ Gowns, Aprons, and Coveralls ■ Cloth Masks
■ Surgical Masks ■ Respirators ■ Others

Total estimated² demand by type of PPE, 2019-25, % of total demand by volume



1. Increasing: > 10% increase in cumulative incremental cases over last 7 days, compared with incremental cases over last 8-14 days; stabilizing: ~ 10%; decreasing: < -10%
2. Range reflects 2 scenarios ("high" vs. "low"): non-Covid-19 baseline demand depends on 2 growth scenarios (historic growth of -2% to account for critical size of the market vs. historic growth of +1% to account for potential changes in usage habits) hospital days and vaccination scenarios depend on vaccination scenario ("pessimistic" vs. "optimistic"), and non-healthcare worker and consumer demand depend on adoption rate assumptions ("high" vs. "low")
3. Unit is per item or per pair in case of gloves, hand sanitizer is per litre and chlorine is per kg

Source: Johns Hopkins, EPI model

Indian subcontinent

ESTIMATES SEE APPENDIX FOR DETAILS OF COUNTRIES INCLUDED

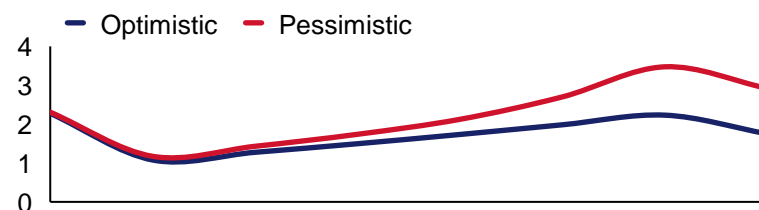
Epidemiological profile



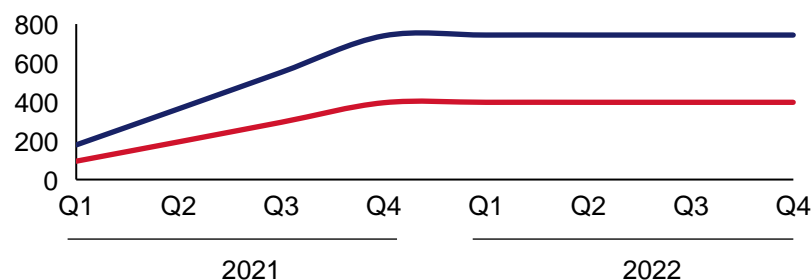
Vaccine scenario

- Optimistic: **50% coverage** by end-2021 and **80% efficacy**
- Pessimistic: **35% coverage** by end-2021 and **60% efficacy**


hospitalisation days, days, m



Cumulative vaccinations (successful), people, m



PPE demand, 2018-25

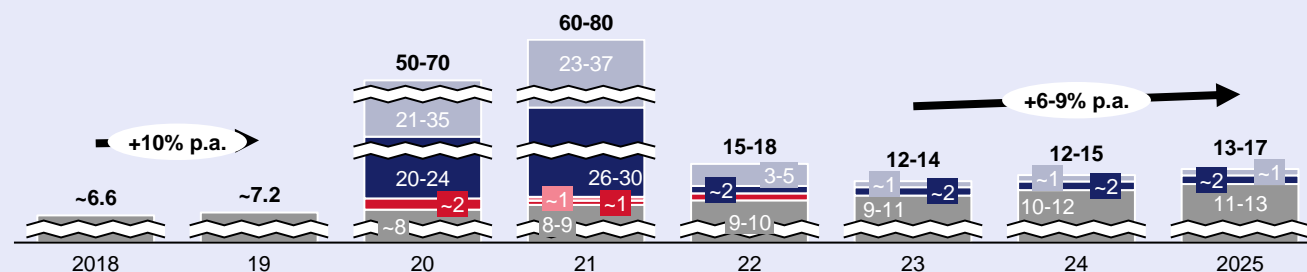
 Propagation trend¹



Demand by source

A. Non-COVID-19 C. Vaccination E. Consumers
B. Hospital days D. Non-healthcare workers

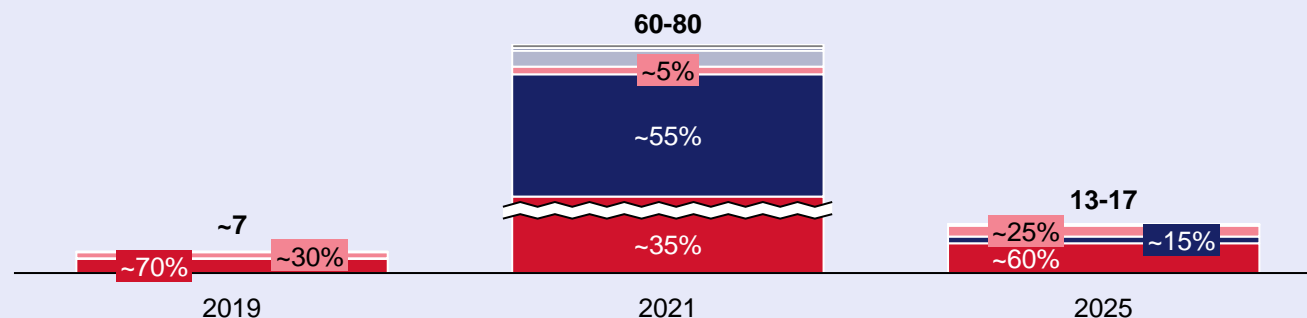
Total estimated² PPE demand by volume, 2018-25, units, bn³



Demand by PPE category

Gloves Gowns, Aprons, and Coveralls Cloth Masks
Surgical Masks Respirators Others

Total estimated² demand by type of PPE, 2019-25, % of total demand by volume



- Increasing: > 10% increase in cumulative incremental cases over last 7 days, compared with incremental cases over last 8-14 days; stabilizing: ~ 10%; decreasing: < -10%
- Range reflects 2 scenarios ("high" vs. "low"): non-Covid-19 baseline demand depends on 2 growth scenarios (historic growth of -2% to account for critical size of the market vs. historic growth of +1% to account for potential changes in usage habits) hospital days and vaccination scenarios depend on vaccination scenario ("pessimistic" vs. "optimistic"), and non-healthcare worker and consumer demand depend on adoption rate assumptions ("high" vs. "low")
- Unit is per item or per pair in case of gloves, hand sanitizer is per litre and chlorine is per kg

Source: Johns Hopkins, EPI model

Japan, Korea, and the Pacific

ESTIMATES SEE APPENDIX FOR DETAILS OF COUNTRIES INCLUDED

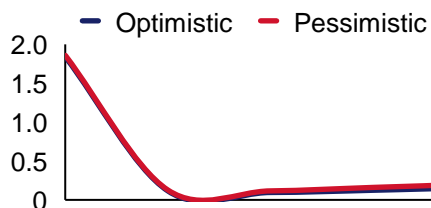
Epidemiological profile



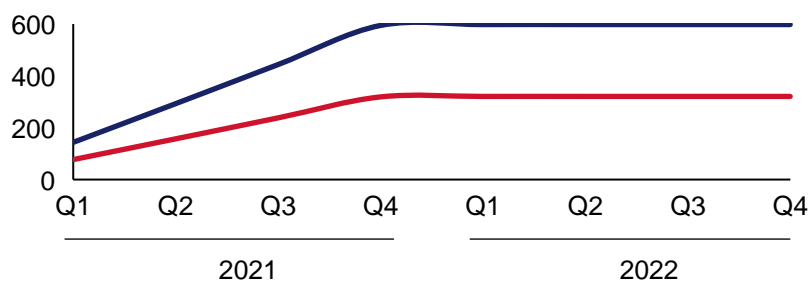
Vaccine scenario

- Optimistic: **70% coverage** by end-2021 and **95% efficacy**
- Pessimistic: **50% coverage** by end-2021 and **70% efficacy**

hospitalisation days, days, m



Cumulative vaccinations (successful), people, m



- Increasing: > 10% increase in cumulative incremental cases over last 7 days, compared with incremental cases over last 8-14 days; stabilizing: ~ 10%; decreasing: < -10%
 - Range reflects 2 scenarios ("high" vs. "low"): non-Covid-19 baseline demand depends on 2 growth scenarios (historic growth of -2% to account for critical size of the market vs. historic growth of +1% to account for potential changes in usage habits) hospital days and vaccination scenarios depend on vaccination scenario ("pessimistic" vs. "optimistic"), and non-healthcare worker and consumer demand depend on adoption rate assumptions ("high" vs. "low")
 - Unit is per item or per pair in case of gloves, hand sanitizer is per litre and chlorine is per kg
- Source: Johns Hopkins, EPI model

PPE demand, 2018-25

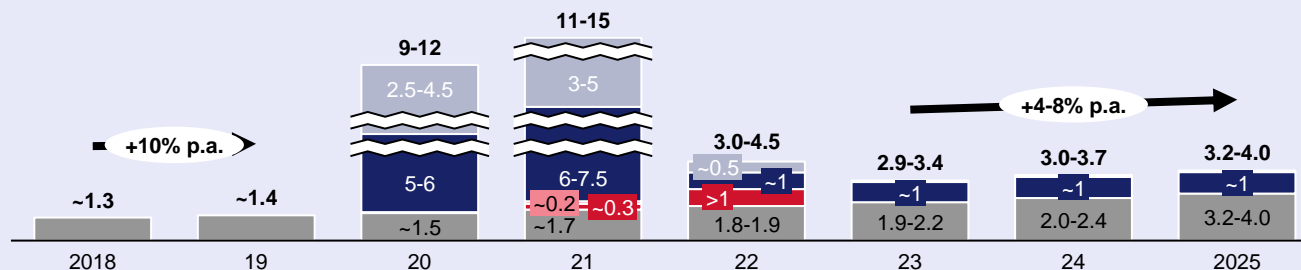
📈 Propagation trend¹



Demand by source

A. Non-COVID-19 C. Vaccination E. Consumers
B. Hospital days D. Non-healthcare workers

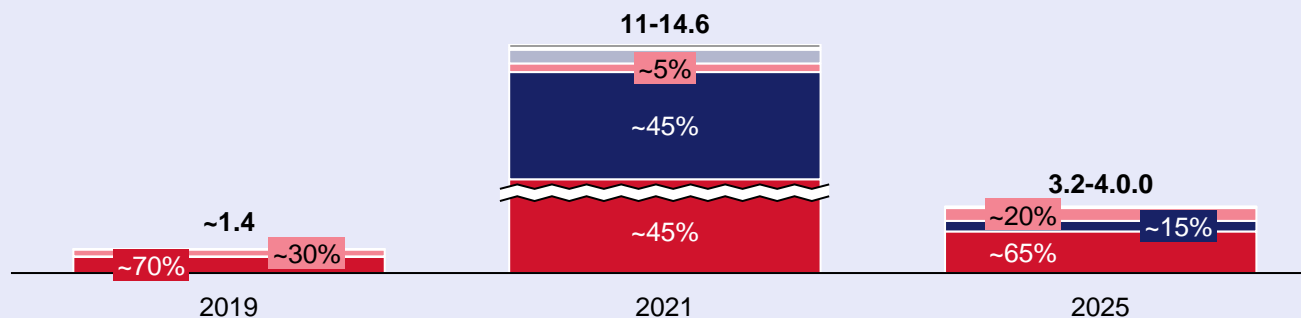
Total estimated² PPE demand by volume, 2018-25, units, bn³



Demand by PPE category

Gloves Gowns, Aprons, and Coveralls Cloth Masks
Surgical Masks Respirators Others

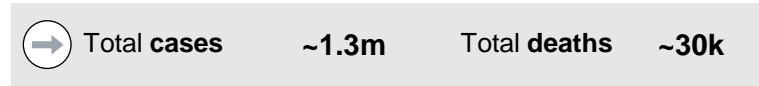
Total estimated² demand by type of PPE, 2019-25, % of total demand by volume



Rest of South East Asia

ESTIMATES SEE APPENDIX FOR DETAILS OF COUNTRIES INCLUDED

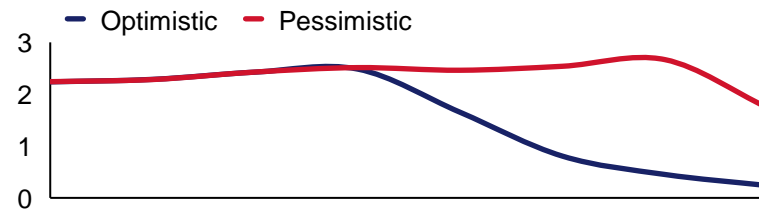
Epidemiological profile



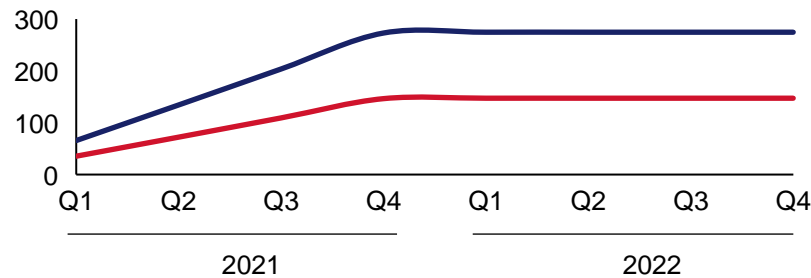
Vaccine scenario

- Optimistic: **50% coverage** by end-2021 and **80% efficacy**
- Pessimistic: **35% coverage** by end-2021 and **60% efficacy**

hospitalisation days, days, m



Cumulative vaccinations (successful), people, m



PPE demand, 2018-25

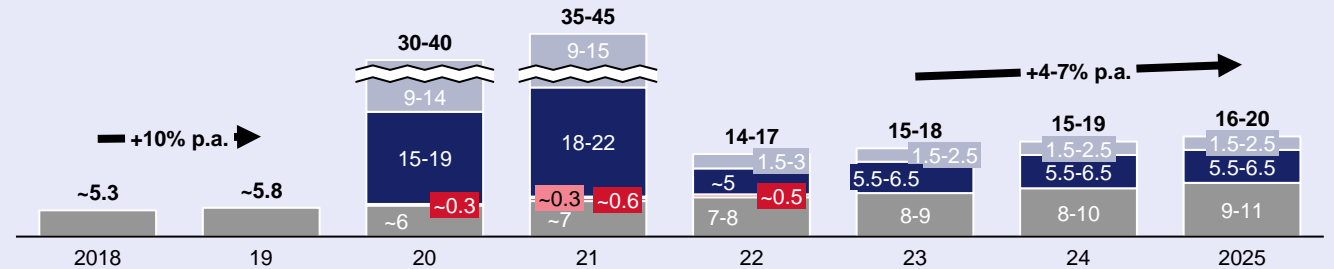
🔗 Propagation trend¹



Demand by source

■ A. Non-COVID-19 ■ C. Vaccination ■ E. Consumers
■ B. Hospital days ■ D. Non-healthcare workers

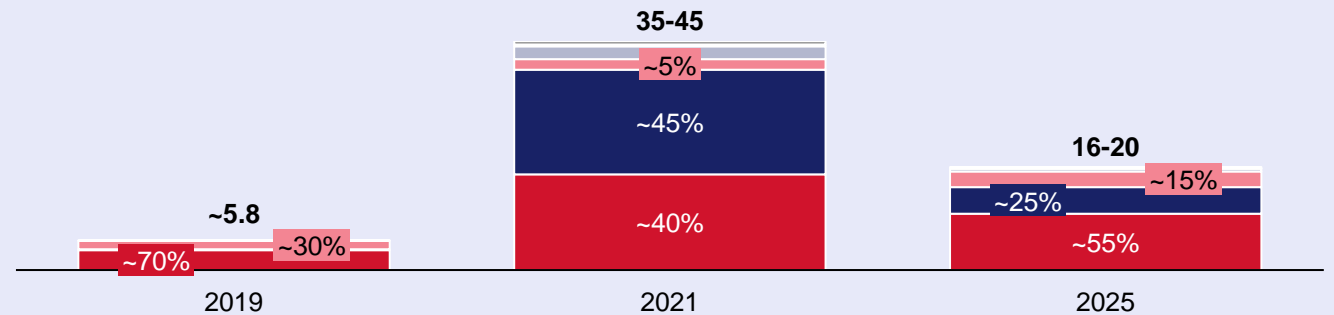
Total estimated² PPE demand by volume, 2018-25, units, bn³



Demand by PPE category

■ Gloves ■ Gowns, Aprons, and Coveralls ■ Cloth Masks
■ Surgical Masks ■ Respirators ■ Others

Total estimated² demand by type of PPE, 2019-25, % of total demand by volume



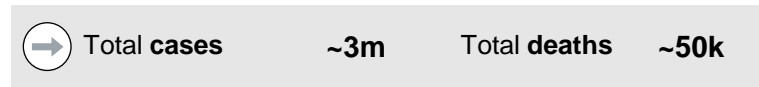
- Increasing: > 10% increase in cumulative incremental cases over last 7 days, compared with incremental cases over last 8-14 days; stabilizing: ~ 10%; decreasing: < -10%
- Range reflects 2 scenarios ("high" vs. "low"): non-Covid-19 baseline demand depends on 2 growth scenarios (historic growth of -2% to account for critical size of the market vs. historic growth of +1% to account for potential changes in usage habits) hospital days and vaccination scenarios depend on vaccination scenario ("pessimistic" vs. "optimistic"), and non-healthcare worker and consumer demand depend on adoption rate assumptions ("high" vs. "low")
- Unit is per item or per pair in case of gloves, hand sanitizer is per litre and chlorine is per kg

Source: Johns Hopkins, EPI model

Russia and Central Asia

ESTIMATES SEE APPENDIX FOR DETAILS OF COUNTRIES INCLUDED

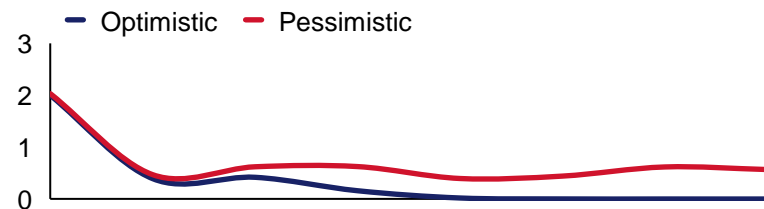
Epidemiological profile



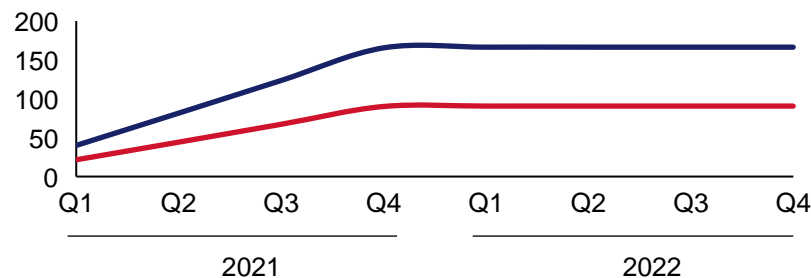
Vaccine scenario

- Optimistic: **70% coverage** by end-2021 and **95% efficacy**
- Pessimistic: **50% coverage** by end-2021 and **70% efficacy**

hospitalisation days, days, m



Cumulative vaccinations (successful), people, m



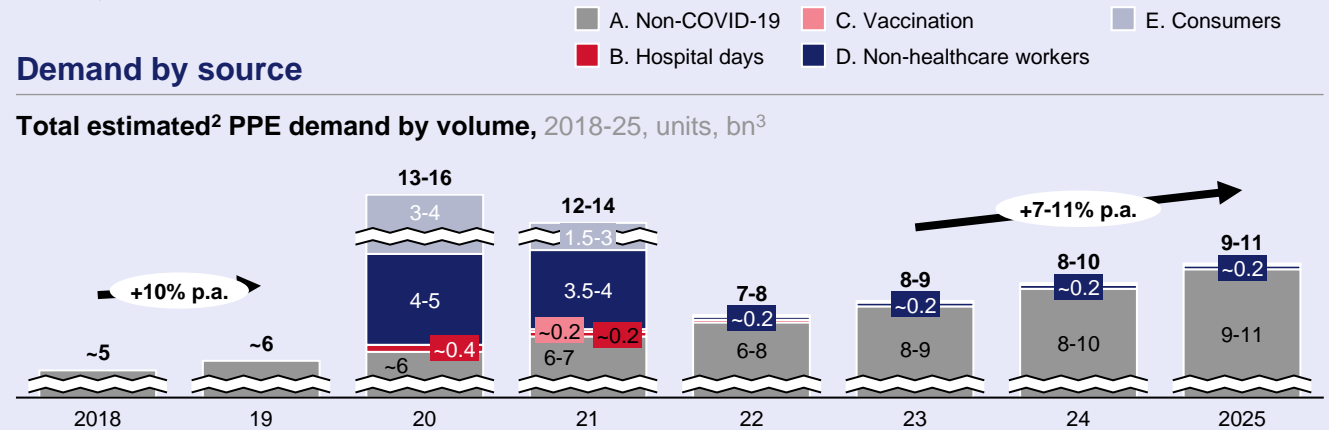
PPE demand, 2018-25

➔ Propagation trend¹



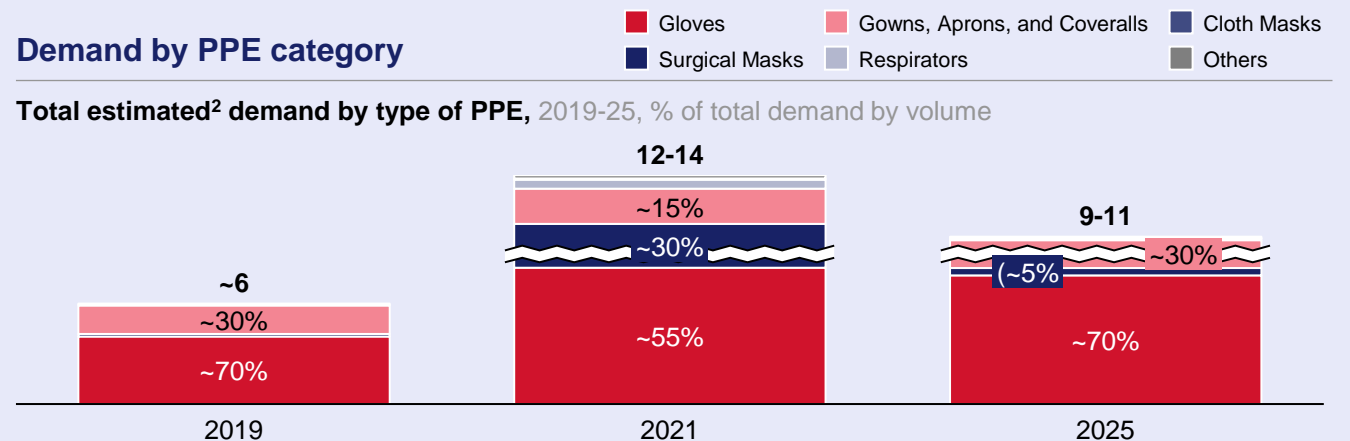
Demand by source

Total estimated² PPE demand by volume, 2018-25, units, bn³



Demand by PPE category

Total estimated² demand by type of PPE, 2019-25, % of total demand by volume



- Increasing: > 10% increase in cumulative incremental cases over last 7 days, compared with incremental cases over last 8-14 days; stabilizing: ~ 10%; decreasing: < -10%
- Range reflects 2 scenarios ("high" vs. "low"): non-Covid-19 baseline demand depends on 2 growth scenarios (historic growth of -2% to account for critical size of the market vs. historic growth of +1% to account for potential changes in usage habits) hospital days and vaccination scenarios depend on vaccination scenario ("pessimistic" vs. "optimistic"), and non-healthcare worker and consumer demand depend on adoption rate assumptions ("high" vs. "low")
- Unit is per item or per pair in case of gloves, hand sanitizer is per litre and chlorine is per kg

Source: Johns Hopkins, EPI model

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- Global forecast demand for PPE by volume – Overview
- Global forecast demand for PPE by volume – Regional deep-dives
- **Global forecast demand for PPE – March 2021 update**

III. Emerging perspectives on PPE market dynamics in the short to medium term

Country & regional deep-dives

Topical deep-dive

Appendix

Global forecast demand for PPE – March 2021 update

Key messages

- There is **continuing and high uncertainty** about the **impact of vaccines on virus transmission** and their **protection against new variants**
- This has recently pushed **several international institutions and national governments to update their public health guidelines** – these updates typically require **the general public to continue wearing masks** and practice social distancing
- For each geography, the original model assumed a gradual **decrease in mask adoption alongside the rollout of vaccination campaigns** and a **return to pre-crisis adoption levels in the “new normal” phase** as COVID-19 cases drop to relatively small levels
- Revised scenarios impact the general population (i.e. non-medical workplaces, individual use outside of work) and assume that:
 - Scenario 1: **the decrease in mask adoption rates starts later – when the at-risk population is immunized – and a comparable return to pre-crisis adoption levels** in the “new normal” phase
 - Scenario 2: **the decrease in mask adoption rates starts later still – when herd immunity is achieved – and there is a higher adoption rate in the “new normal” phase**
- These scenarios imply **higher demand for masks than the December 2020 scenario, especially in the short term (2021-22)**.
- However, they also imply the **same overall shape in the demand curve over the period 2021-2025**, with the global market contracting sharply before resuming growth rates close to those observed pre-crisis
- **In addition, Asia is expected to capture most of this additional demand**, driven by large populations and the highest adoption rates globally

As of March 2021, there are signs that masks adoption may be encouraged for longer than originally expected

NON-EXHAUSTIVE AND ILLUSTRATIVE – AS OF MARCH 18, 2021



“We’re still learning how vaccines will affect the spread of Covid-19. After you’ve been fully vaccinated against Covid-19, you should keep taking precautions in public places like wearing a mask, staying 6 feet apart from others, and avoiding crowds and poorly ventilated spaces until we know more.”

– CDC Guidelines “When you have been fully vaccinated”, *Updated March 9, 2021*



Will I have to wear a mask after getting the Covid vaccine? The science explained



“We now know the vaccines can protect, but what we haven’t had enough time to really understand is – does it protect from spreading?” – *Avery August, professor of immunology at Cornell University*

Think of mask-wearing and social distancing as a continuum of risk-mitigation strategies, which are in place while scientists conduct research, more and more people get vaccinated, and the prevalence of Covid-19 goes down.

– The Guardian, *Updated March 12, 2021*



Here’s Why Vaccinated People Still Need to Wear a Mask



“The Pfizer and Moderna trials tracked only how many vaccinated people became sick with Covid-19. That leaves open the possibility that some vaccinated people get infected without developing symptoms, and could then silently transmit the virus — especially if they come in close contact with others or stop wearing masks”

– The New York Times, *Updated March 9, 2021*



After you're vaccinated, it's critical to keep masking up in many places (for now). Here's why



““Americans will need to keep wearing masks until we reach herd immunity” – *CNN Medical Analyst Dr. Leana Wen, an emergency physician*

“About 70% to 85% of people must achieve immunity -- either by surviving Covid-19 or receiving a vaccine -- to reach herd immunity, the point at which enough people are protected against a disease that it cannot spread through the population.”

– CNN, *Updated March 16, 2021*



5 Reasons to Wear a Mask Even After You're Vaccinated



““The best hope for ending the pandemic isn’t to choose between masks, physical distancing and vaccines, Offit said, but to combine them. “The three approaches work best as a team,” he said.

“While covid vaccines clearly prevent illness, researchers need more time to figure out whether they prevent transmission [...] Until researchers can answer that question, Frieden said, wearing masks is the safest way for vaccinated people to protect those around them.

– GAVI, *January 20, 2021*

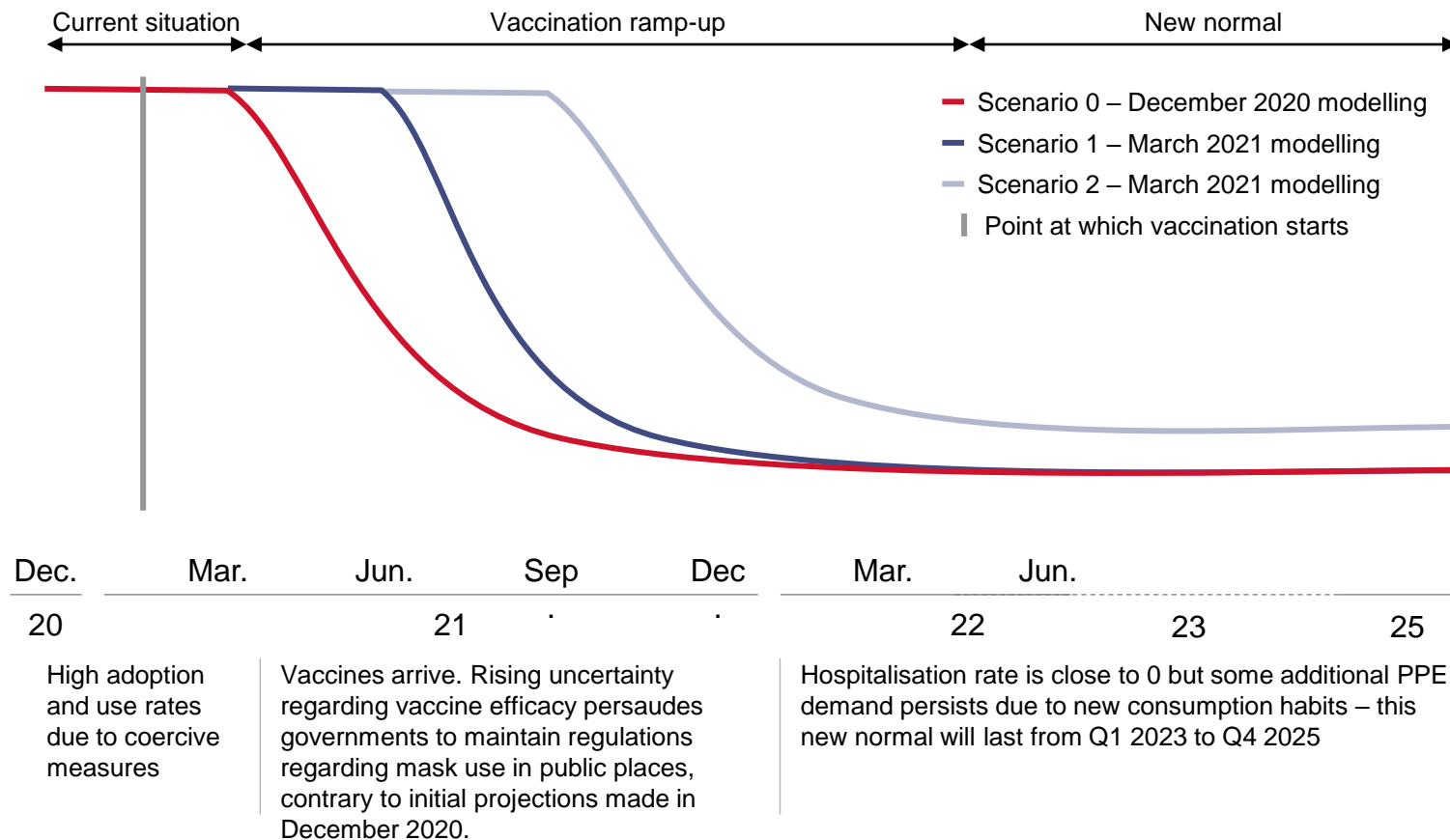
Continuing uncertainty about the impact of vaccines on virus transmission and their protection against variants have recently pushed several international institutions and national governments to revise their recommendations around sanitary measures.

In particular, from official statements by national authorities, mask wearing and social distancing are the 2 measures that may be the most consistently maintained by governments in the coming months.

2 new scenarios for mask adoption, driven by both regulations and sentiments

Mask adoption rate among general public, 2020-2025, US example (illustrative)

Note: in this example, the moment at which the adoption rate starts to decline is specific to the US context; in other geographies, it may occur later, depending on the progress of national vaccination campaigns.



Source: EPI model, WHO, YouGov, interviews with public health experts (November-December 2020), survey of working professionals (held in the US in May 28-June 3, 2020; n=100)

Scenario 1

- Official guidelines continue to require wearing masks in public places, in part due to uncertainty about incidence and transmission of variants
- As remaining at-risk populations are vaccinated, governments slowly lift regulations regarding masks wearing in public space
- Mask adoption declines as the vaccination continues, gradually reaching a "new normal" near the pre-COVID adoption rate

Scenario 2

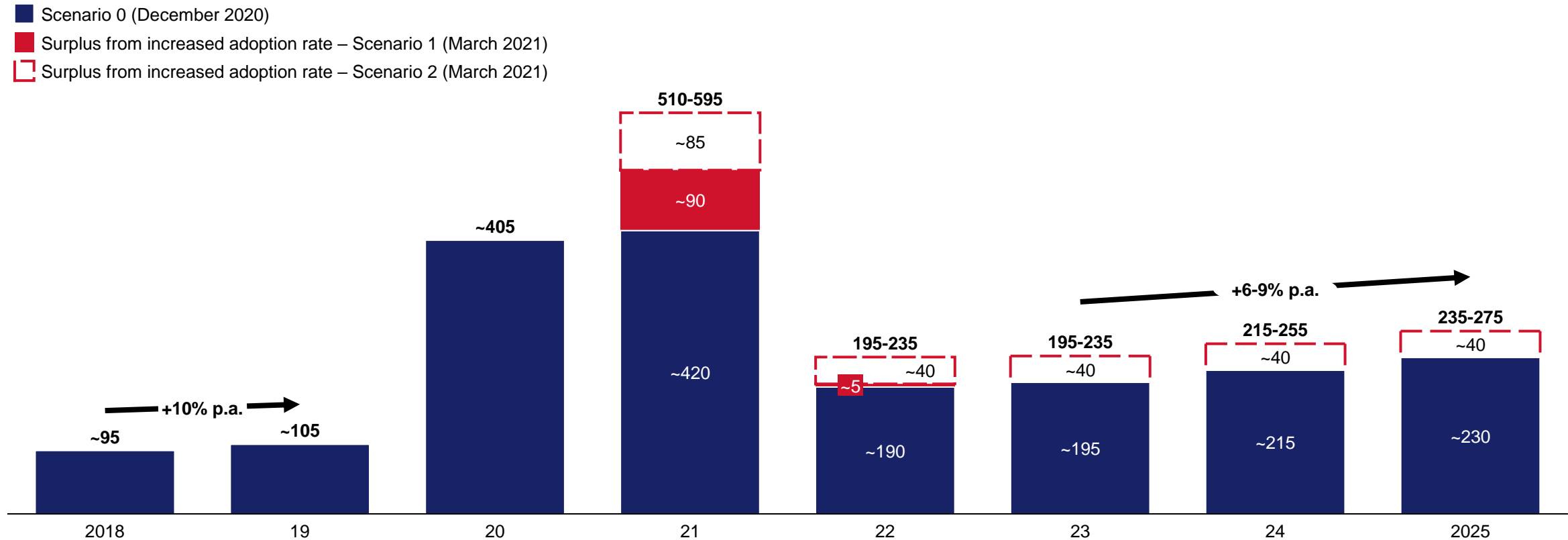
- Official guidelines continue to require wearing masks in public places until herd immunity is achieved
- Long-term adoption rate remains higher than pre-COVID crisis levels due to e.g. personal preferences

It is important to note that there is still a high level of uncertainty regarding the crisis future evolutions; therefore these might be more possible scenarios than these 2 ones.

With revised adoption rates, global PPE demand could peak in 2021 at 510-595bn units before falling back to 195-235bn units in 2022-23

ESTIMATES – NEW ADOPTION RATES AS OF MARCH 2021

Total estimated¹ volume PPE demand, 2018-25, units, bn²



1. For readability reasons, only the “high” scenario is presented

2. Unit is per item or per pair in case of gloves, hand sanitizer is per litre and chlorine is per kg

3. Surgical masks adoption rate is assumed to be 10% for consumers in Sub-Saharan Africa while 80% represents the adoption rate for workers in non-healthcare settings in China and North America

Source: Mordor Intelligence (updated in November 2020), EPI model, WHO assumptions

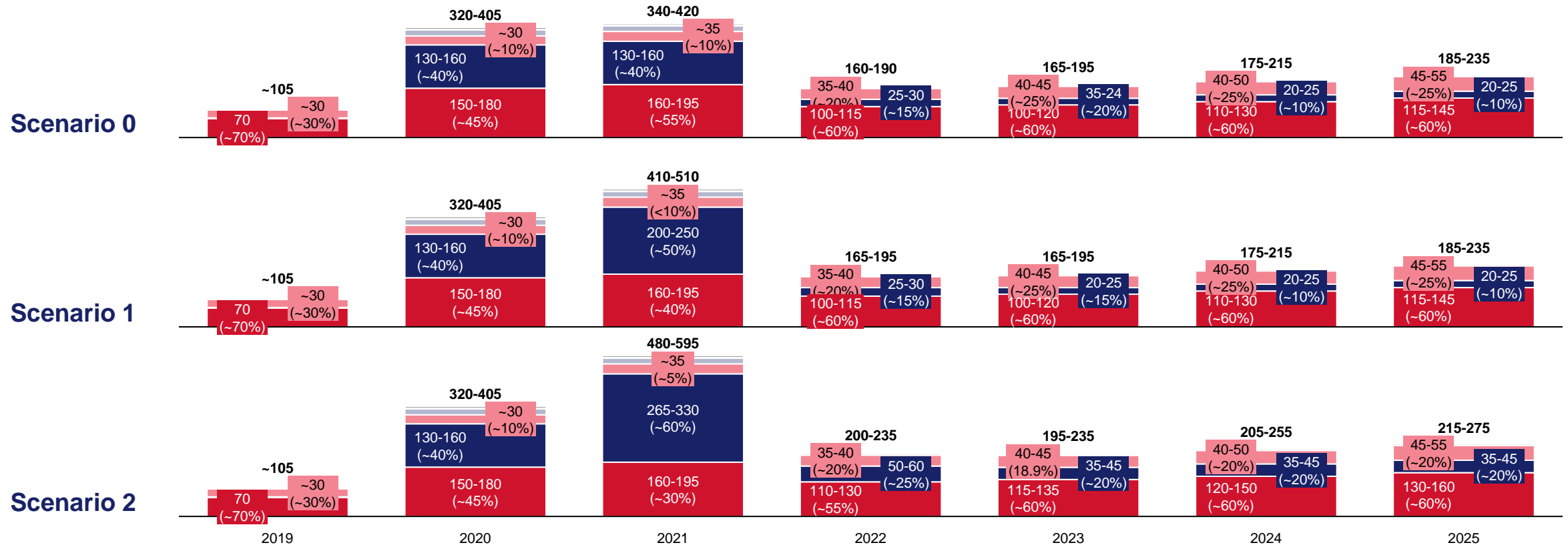
With revised adoption rates, mask demand could peak in 2021 at 250-330bn, instead of at 160bn as in the December model

SEE APPENDIX FOR DECEMBER 2020 PROJECTIONS

ESTIMATES – NEW ADOPTION RATES AS OF MARCH 2021

Total estimated PPE¹ demand by category,
2019-25, units, bn² (% of total demand by volume)

■ Gloves ■ Gowns, Aprons, and Coveralls ■ Cloth Masks
■ Surgical Masks ■ Respirators – *only medical personnel use considered* ■ Others³



1.Range reflects 2 scenarios ("high" vs. "low"): (i) non-Covid-19 baseline demand based on 2 growth scenarios (historic growth -2% to account for critical size of the market vs. historic growth +1% to account for potential changes in usage habits), (ii) hospital days and vaccination demands depend on vaccination scenario ("pessimistic" vs. "optimistic"), and (iii) workers in non-healthcare settings and consumer demand depend on adoption rate assumptions ("high" vs. "low")

2.Unit is per item or per pair in case of gloves, hand sanitizer is per litre and chlorine is per kg ; bn = billion

3.Eye protection (face shields and goggles), shoe cover, and disinfectant products/biological waste management (i.e., hand sanitizer, chlorine, body bags and clinical waste bags)

Asia-Pacific would capture most of the additional demand from revised adoption rates

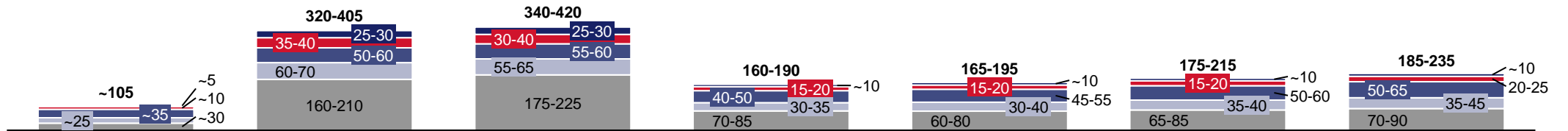
SEE APPENDIX FOR DECEMBER 2020 PROJECTIONS

ESTIMATES – NEW ADOPTION RATES AS OF MARCH 2021

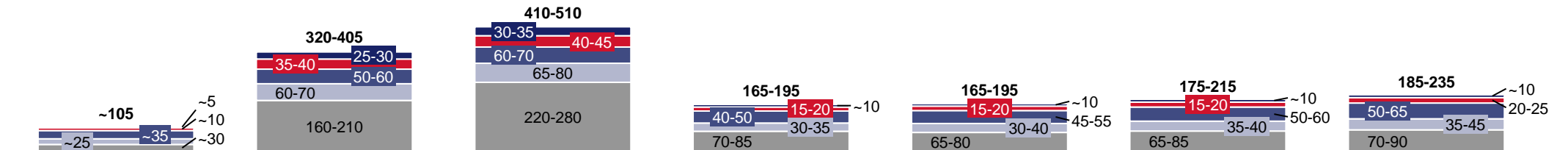
Total estimated PPE¹ demand by category,
2019-25, units, bn² (% of total demand by volume)

■ Africa and Middle East ■ Europe³
■ Latin America ■ Asia and Pacific⁴
■ North America

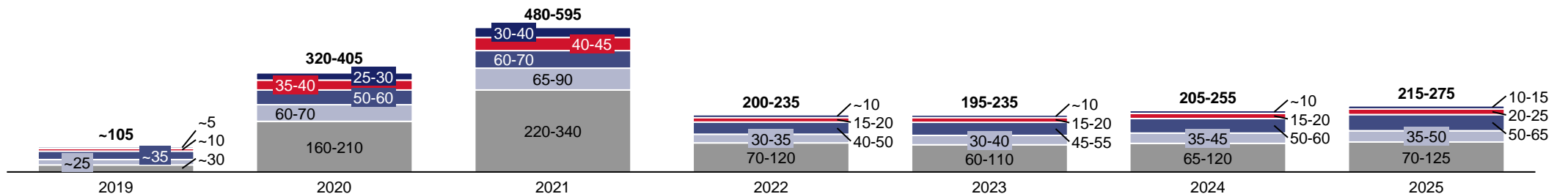
Scenario 0



Scenario 1



Scenario 2



1. Range reflects 2 scenarios ("high" vs. "low"): (i) non-Covid-19 baseline demand based on 2 growth scenarios (historic growth -2% to account for critical size of the market vs. historic growth +1% to account for potential changes in usage habits), (ii) hospital days and vaccination demands depend on vaccination scenario ("pessimistic" vs. "optimistic"), and (iii) workers in non-healthcare settings and consumer demand depend on adoption rate assumptions ("high" vs. "low")

2. Unit is per item or per pair in case of gloves, hand sanitizer is per litre and chlorine is per kg ; bn = billion

3. Including Russia and Central Asia

4. Including China and India

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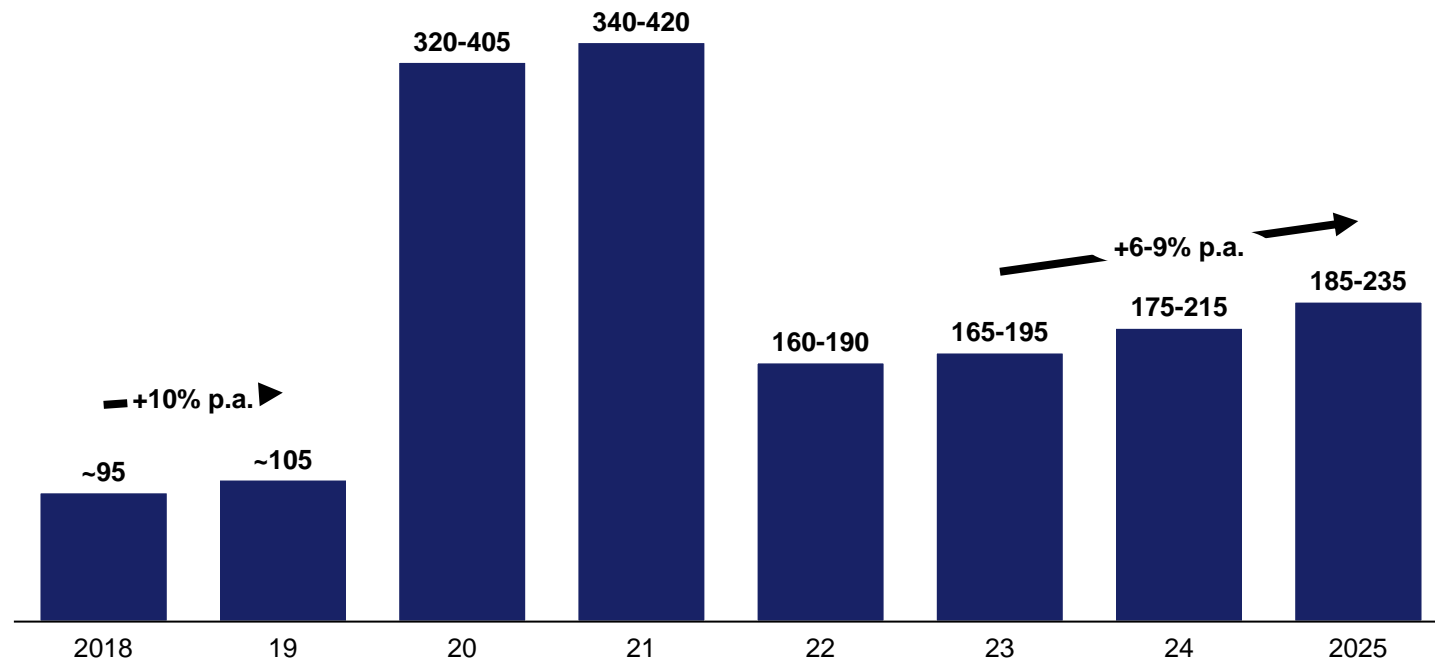
Topical deep-dive

Appendix

Although the 2020 demand peak triggered by Covid-19 might reduce after 2021, the outlook for the market remains positive over the longer term

ESTIMATES – ONLY MEDICAL PPE CONSIDERED – AS OF MID-DECEMBER 2020

Global estimated¹ PPE demand by volume, 2018-25, units, bn²



Key messages

In the short-term, although demand peak is to persist through 2021, market entry appears less attractive than it was in 2020, with prices decreasing and global supply meeting demand for most PPE

In the medium / long-term, despite the reduction of the Covid-19-induced peak after 2021, the outlook for the market remains positive over the longer term, with a 6-9% annual growth in 2023-2025

- Incumbents might continue to capture the lion's share of this growth as they are already cost-competitive, have been able to ramp up their production capacity during the crisis and already meet quality requirements
- New entrants may be able to capture a degree of this growth, provided that they can be cost-competitive, manage to meet quality standards, and receive government support (especially in guaranteeing offtake)

1.Range reflects 2 scenarios ("high" vs. "low"): (i) non-Covid-19 baseline demand depends on 2 growth scenarios (historic growth of -2% to account for critical size of the market vs. historic growth of +1% to account for potential changes in usage habits), (ii) hospital days and vaccination demands depend on vaccination scenario ("pessimistic" vs. "optimistic"), and (iii) non-healthcare worker and consumer demands depend on adoption rate assumptions ("high" vs. "low")

2.Unit is per item or per pair in case of gloves, hand sanitizer is per litre, and chlorine is per kg

Despite supply bottlenecks at the start of the crisis, several countries have now built stockpiles and are showing early signs of oversupply

NON-EXHAUSTIVE AND ILLUSTRATIVE – AS OF NOVEMBER 2020

Both France and the UK have accumulated large stocks of PPE



Before the crisis, France was producing 3 million masks a week [...] In June, 25 million masks were produced each week in France [...] 40 million masks did not find takers. [...] it is estimated that 10% of the companies involved in this production have stocks on their hands
– Press article (France Culture), June 2020

“Stocks of masks manufactured in France are largely sufficient to meet local demand [...] In the Auvergne-Rhône-Alpes region alone, we have a stock of 3 million masks and enough fabric to manufacture an additional 19 million”

– Regional general delegate (Pierric Chalvin), July 2020

Mask oversupply has succeeded the lack of supply in the French textile industry. [...] Some companies have actually had to lay off employees because of oversupply

– Press article (France Info), July 2020

Source: press search, interviews with industry experts (November-December 2020)



“The government is now in a position where it has sufficient contracted supplies to meet demand, and the total volume of offers it has is far greater than any foreseeable future requirement

It is therefore no longer accepting offers for PPE. It has also closed down all existing offers submitted that are surplus to requirements”

– Contractsfinder.service.gov.uk

Volume and value of PPE ordered in the UK has started to ramp down from June, given stock supply

– National Audit Office analysis of Department of Health & Social Care information

Interviews with industry experts suggest a potential oversupply risk



“ ” The UK is already facing an oversupply situation on surgical masks

– Procurement Director at a government agency, November 2020

“ ” We will find ourselves in an oversupply market once the pandemic is over. Australia alone can now supply all of Europe’s pre-Covid-19 needs

– PPE industry expert, November 2020

“ ” Since the second wave in Europe, there has been a slight increase in orders, but without comparison with last March and April. Countries have built up stocks and are now relying on them

– PPE industry expert, November 2020

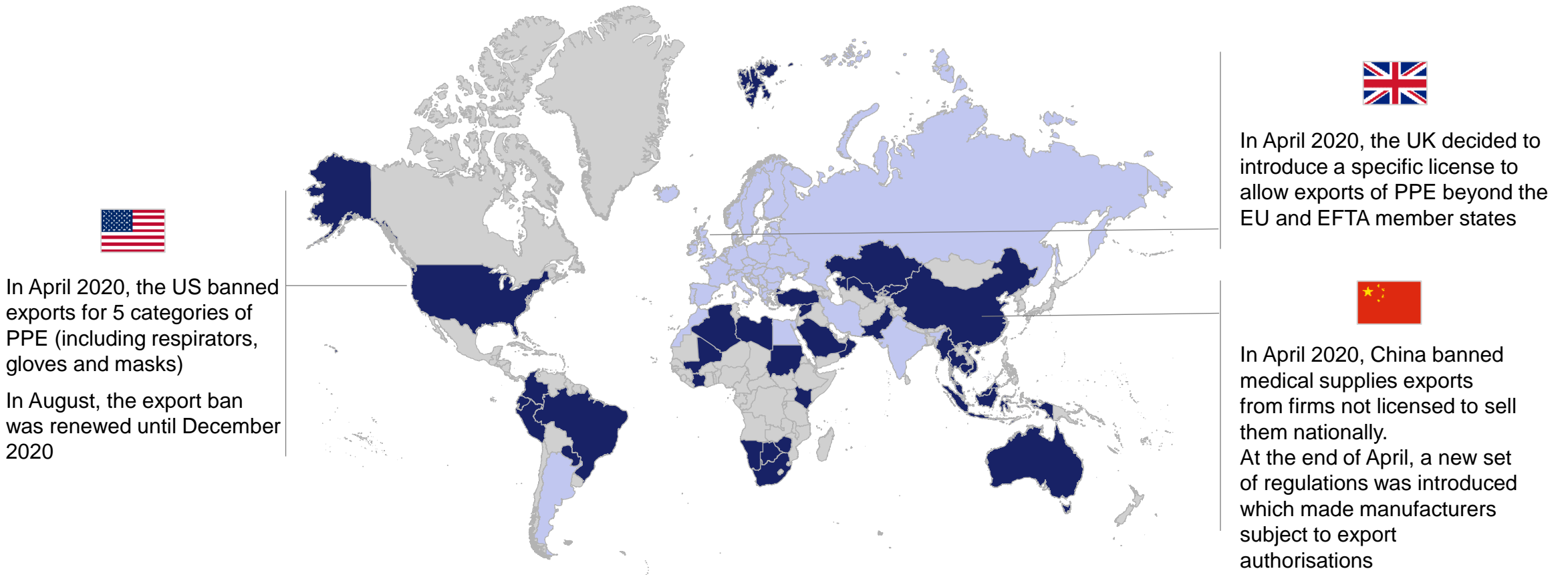
The progressive lifting of export restrictions imposed in March has eased supply pressure and rebalanced global supply and demand

NON-EXHAUSTIVE AND ILLUSTRATIVE – AS OF NOVEMBER 30, 2020

PPE export restrictions worldwide as of November 2020

 Countries with active export restrictions

 Countries with export restrictions which have been terminated
































PPE manufacturers can try to lock in short- and medium-term demand in those geographies where they are cost-competitive by systematic exploration of multiple channels

Demand	Typical channels	Description
Public healthcare provision and rest of government	International organizations' procurement arms	International organizations procuring from manufacturers on their own behalf to distribute to beneficiary governments (typically central/federal level), or on behalf of these individual governments
	Regional online tendering platform	Digital procurement platform allowing groups of governments (typically central/federal) to pool needs and jointly procure, or post individual procurement needs for medical supplies from manufacturers
	Distributors and/or GPOs supplying to public sector	Private distributors supplying to public entities (e.g., ministries, public hospitals, local governments/authorities, public GPOs) or private GPOs supplying to distributors or directly to these public entities, through competitive tendering/bidding
	Direct tendering from public sector	Direct procurement by public entities (e.g., ministries, public hospitals, local governments/authorities, public GPOs) through tenders open to manufacturers – typically through online national tendering/bidding platform
Private healthcare provision	Distributors and/or GPOs supplying to private sector	Private distributors supplying to private entities (e.g., private hospitals and pharmacy chains) through competitive tendering/bidding
	Direct tendering from private sector	Direct procurement by private entities (.g. private hospitals and pharmacy chains) through tenders open to manufacturers

Example – In Europe, distributor and GPO channels seem the most promising for manufacturers to supply both public and the private sectors going forward and may be the highest priority for exploration

NON EXHAUSTIVE AND ILLUSTRATIVE



 Limited →  High

Demand	Typical channels	Examples of organizations involved	Level of opportunity ¹
Public healthcare provision and rest of government	International organizations' procurement arms	n/a	 n/a to European countries overall
	Regional online tendering platform	 Ted	 Launch of pan-European med product procurement platform, few tenders open from local authorities and various public entities (e.g., schools)
	Distributors and/or GPOs supplying to public sector	Distributors:   GPOs:    	 Distributors and GPOs reported to be looking to enlarge their supplier list with cost-competitive options closer than Far East
	Direct tendering from public sector	   Regione Lombardia	 Few tenders open from local authorities and various public entities (e.g., schools) on national platforms,, sometimes directly accessible to manufacturers (vs. distributors/GPOs)
Private healthcare provision	Distributors and/or GPOs supplying to private sector	Distributors:   GPOs:    	 Distributors and GPOs reported to be looking to enlarge their supplier list with cost-competitive options closer than Far East
	Direct tendering from private sector	    	 Some opportunities flagged by private hospitals in UK on specific niche products (gloves, gowns) when NHS undersupplying; probably low volume

1. Qualitative assessment based on expert interviews - current as Nov-Dec 2020

Example – In Africa, 2 of the 6 typical channels seem to be the most promising for manufacturers and may be the highest priority for exploration

NON EXHAUSTIVE AND ILLUSTRATIVE

 Limited →  High

Demand	Typical channels	Examples of organizations involved	Level of opportunity ¹
Public healthcare provision and rest of government	International organizations' procurement arms	 	 UNICEF stating open to enriching its supplier catalogue in 2021 directly with manufacturers
	Regional online tendering platform	   	 African Medical Supply Platform (AMSP) launched in 2021 to pool volume from public sector across continent
	Distributors and/or GPOs supplying to public sector	Central pharmacies and public procurement authorities (public GPOs) from several African countries	 Several central state reported to be overall over-stocked with PPE at end of 2021 (e.g., French-speaking Africa); some exception also reported (e.g., Ethiopia)
	Direct tendering from public sector	Ministries of Health of several African countries	
Private healthcare provision	Distributors and/or GPOs supplying to private sector	   	 Inconsistencies in distributors reporting willingness to enlarge PPE supplier list
	Direct tendering from private sector	 	 Expected lower volume

1. Qualitative assessment based on expert interviews - current as Nov-Dec 2020

Global common procurement practices and channel/country-specific and emerging procurement practices


Procurement practices common across channels and geographies

- **Approach to customer comprising sharing of key information on manufacturer** (e.g. location, catalogue, certifications and product specifications, regular and surge production capacity, environmental and social audit results when existing) as well as **product sample**
- **Use of multi-year framework agreements by largest public and private consumers** (e.g., gov't, large GPO, large hospital chains) with **guaranteed off-take** (price, or volume, or both)
- **Risk on product integrity born by manufacturer** up to country port of entry, if not customer doorstep
- **Risk on volume born by distributors** – hence **need for manufacturer to use distributors** when trading outside of home country in many countries

Channel-specific, country-specific and emerging procurement practices

- **Minimum acceptable product specifications** – e.g., e.g. medical standards similar across Europe and NA but country-specific in Africa
- **Other required product certifications** – e.g., Certificate of Excellence (“CE”) mark expected across Europe, but not rest of the world
- **Offline supply-chain format and key stakeholder and their degree of centralization** – e.g. single GPO for public sector in the UK (NHS) vs. several ones in Germany and France
- **Relevance / maturity of emerging online supply chains** – e.g. B2C online marketplace mature in Europe, Asia and NA, but less elsewhere; regional / pooled B2G online marketplaces emerging Europe and Africa but not necessarily elsewhere

New businesses could target 3 potential diversification opportunities along the PPE value chain

 Focus next page

NON-EXHAUSTIVE – FROM EXPERT INTERVIEWS, AS OF MID-DECEMBER 2020
THOROUGH BUSINESS PLANNING REQUIRED TO ASSESS FURTHER THE 3 OPPORTUNITIES

Level of opportunity

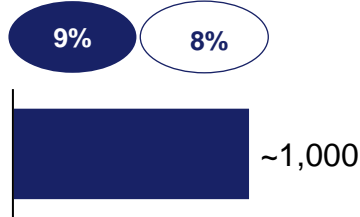

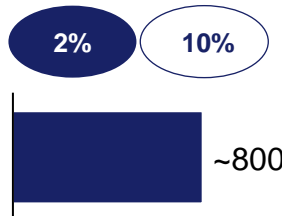

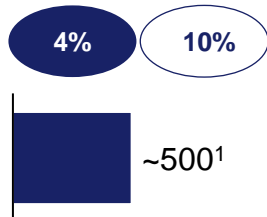



Limited



Significant

Historic CAGR
2017-19Forecast CAGR
2020-25

Opportunities	Market size 2019, Estimates, \$m	Market opportunity: high-level and directional assessment	Barriers to entry (non-exhaustive; see further details next pages)
i Melt-blown manufacturing		 <p>Potential to play a “volume” strategy and supply smaller mask manufacturers</p>	<ul style="list-style-type: none"> • Regulation • Raw material and machinery shortage • Consolidated market • Importance of scale
ii Gloves machinery manufacturing		 <p>Manufacturing semi-automated machines requiring less technical knowledge and expertise</p>	<ul style="list-style-type: none"> • Technical knowledge and expertise • Brand recognition needed • Highly fragmented market concentrated in China for semi-automated machines manufacturers
iii Alcohol manufacturing (for hand sanitizer)		 <p>Purchasing a low- quality alcohol factory (e.g., for gasoline end use) and upgrading it to a high-quality alcohol plant to supply hand sanitizer manufacturers</p>	<ul style="list-style-type: none"> • Importance of scale • High capex required • Brand recognition needed • Proximity to feedstocks required • Regulation

1. Global market size in volume is estimated at 200m gallons in 2019 and average price is estimated at \$2.50/gallon

i| Melt-blown manufacturing: to be successful, new entrants will need to achieve scale and secure raw materials and specialist machinery

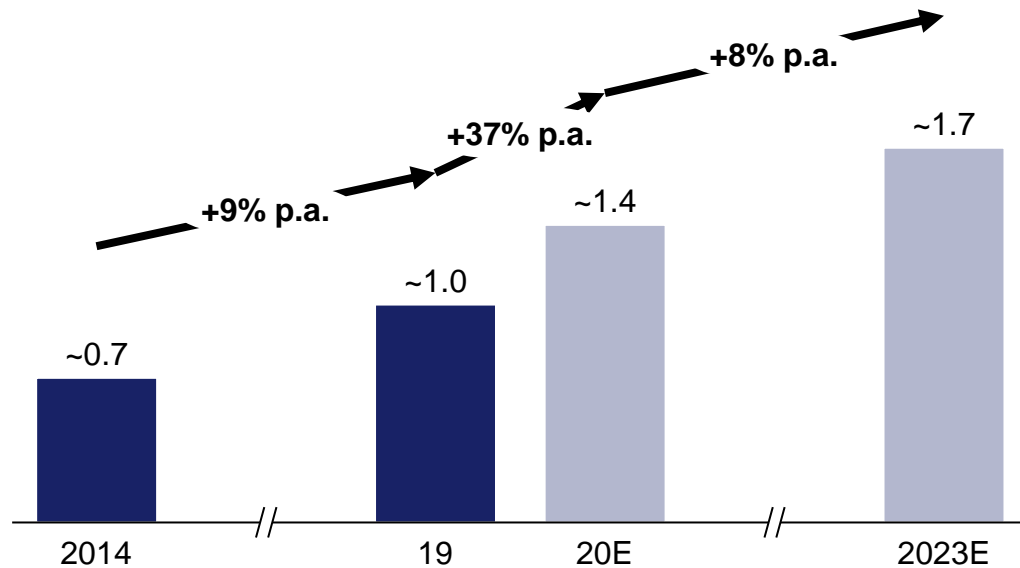
THOROUGH BUSINESS PLANNING REQUIRED TO ASSESS FURTHER THE OPPORTUNITY

NON-EXHAUSTIVE – FROM EXPERT INTERVIEWS, AS OF MID-DECEMBER 2020

SEE APPENDIX FOR DEEP-DIVE ON THE MELT-BLOWN SEGMENT

Market opportunity

Melt-blown non-woven market size, estimates, \$bn



Supplying small mask manufacturers who do not have access to large melt-blown producers

Could also target other end users as melt-blown non-woven is used in several industries: medical, electrical and electronics, insulation equipment, automotive and hygiene

Key success factors and barriers to entry (non-exhaustive)

Competitive industry with large players dominating the market

- The melt-blown competitive landscape is consolidated
- ~10-15 large players account for ~60% of the market, including 4-5 integrated players who manufacture finished PPE (e.g., 3M, DuPont)
 - ~80-90 small manufacturers operate in the US, China, and Europe, targeting small-scale local hygiene products manufacturers
 - In addition, +100 small manufacturers have supplied other industries (e.g., automotive) and shifted during the crisis to target mainly the medical segment

Changing regulations and brand strength

- Regulations have changed rapidly during the pandemic, with quality standards requirements becoming more stringent

Scale and volume

- Economies of scale and volume are critical to achieve competitiveness in this industry

Limited availability of machinery and raw materials

- Only 4-5 companies manufacture high-quality machine lines for the production of high-quality melt-blown and it takes ~6 months to produce 1 line
- Polymer is the main raw material used to manufacture melt-blown non-woven and has been in short supply during the pandemic

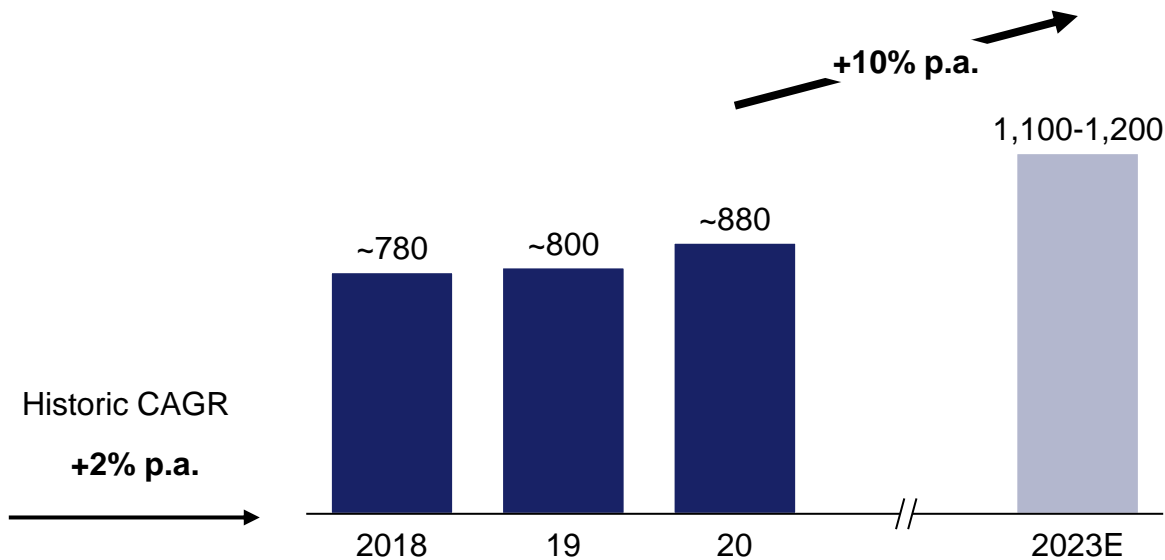
ii| Glove machinery manufacturing: to be successful, new entrants will need to acquire technical expertise and quickly build brand strength

THOROUGH BUSINESS PLANNING REQUIRED TO ASSESS FURTHER THE OPPORTUNITY

NON-EXHAUSTIVE – FROM EXPERT INTERVIEWS, AS OF MID-DECEMBER 2020

Market opportunity

Gloves machinery market size, estimates, \$m



Manufacturing semi-automated machines which require less technical expertise to operate and maintain (and use it to supply small- to medium-scale glove manufacturers)

Key success factors and barriers to entry (non-exhaustive)

Technical expertise and knowledge

- Technical knowledge and expertise are key, as gloves machinery is highly complex and automated (just programming the machines requires specific knowledge)
- Talent sourcing and IP protection is very important in this industry

Brand recognition

- Brand recognition is critical to build credibility in the market and prove efficiency and reliability of the machines
- Building a solid customers portfolio will be a challenge in the first years

High competition

- Highly competitive industry with a very fragmented market concentrated in China for semi-automated machines manufacturers (no clear leaders yet stand out)

iii| Hand sanitizer alcohol manufacturing: to be successful, new entrants will need quickly to build brand strength and thus justify cost-effective scale

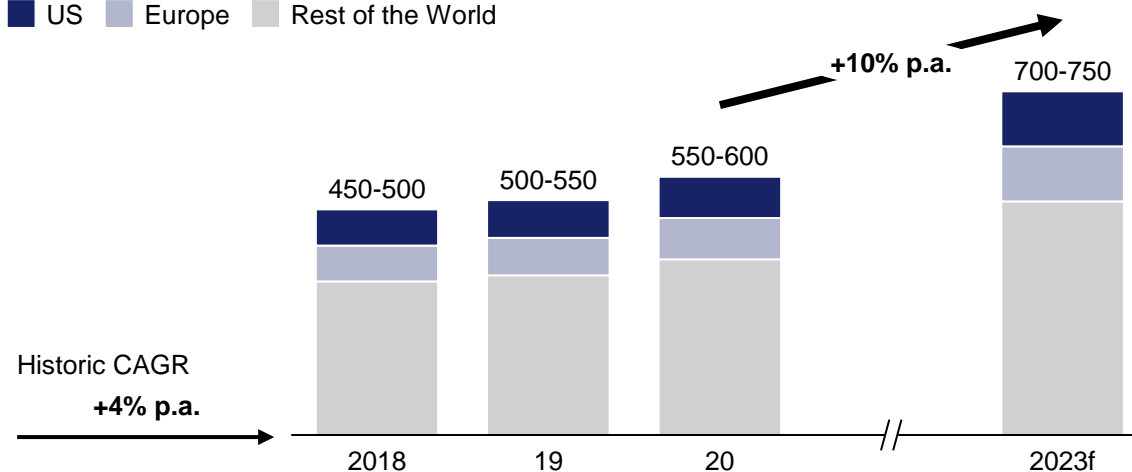
THOROUGH BUSINESS PLANNING REQUIRED TO ASSESS FURTHER THE OPPORTUNITY

NON-EXHAUSTIVE – FROM EXPERT INTERVIEWS, AS OF MID-DECEMBER 2020

Market opportunity

Alcohol used for hand sanitizer market size, \$m (estimates from experts)

■ US ■ Europe ■ Rest of the World



- Asia and Africa are net importers and would be the most attractive markets; US and European markets are crowded with adequate supply
- Need to diversify end users to achieve scale (as only 10-15% of high-quality ethyl alcohol is used for hand sanitizer/surface disinfectant)
- Rather than making a greenfield investment, new entrants could purchase existing low-quality alcohol production facilities (e.g., for gasoline end use) and upgrade it to a high-quality alcohol plant to supply hand sanitizer manufacturers

Source: Industry experts interviews (December 2020)

Key success factors and barriers to entry (non-exhaustive)

Scale and volume

- Economies of scale and volume are critical to survive in this industry (likely to achieve competitiveness 2-3 years after the purchase and upgrade of an existing low-quality alcohol plant)

Brand recognition

- Brand recognition is key to build credibility in the market (it takes ~3 years to get customer trust for a new brand on the market)

Feedstocks proximity

- Proximity of feedstocks (e.g., wheat, maize) is a critical factor for achieving cost competitiveness

Regulation

- Regulatory barriers: such a factory would be considered a pharma plant (and thus need to register with FDA or equivalent and guidelines to respect)

Capex

- Capex required: \$60m minimum for a plant of 50m gallons/year capacity (purchased and upgraded) vs. \$120m to set up a new plant from scratch

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- **United States**
- China
- Europe, including the EU and the UK
- Bangladesh, India, Sri Lanka and Vietnam

Topical deep-dive

Appendix



Overview of the US PPE market

1. Overview of the national market pre-Covid-19

Despite being a leading producer of several categories of PPE, the US is also heavily reliant on imports to meet domestic demand

- The US is a leading manufacturer of masks, coveralls and aprons, accounting for a 20-25% share of global production and is home to several top global players (e.g., 3M, Honeywell, Kimberly-Clark)
- However, the US still relies considerably on imports, being the largest¹ importer of masks and coveralls (imports of \$360m in 2019, mostly from China) and the second largest importer of gloves (imports of \$450m in 2019, mostly from Malaysia)

2. Perspectives on the Covid-19 supply/demand

The US has been one of the countries worst hit by the Covid-19 pandemic, with over 20m cases and 340k deaths (as of end-December 2020), which has driven booming demand for medical PPE

This increased demand, combined with export restrictions imposed by historic supply markets, has resulted in shortages, leading the US to scale up local PPE production (e.g., ~10x for masks, ~5x for face shields) to meet domestic needs

This increase in local manufacturing has been supported by several measures by the US government: (i) financial support for local supply chain operators through the DFC¹, (ii) use of the Defense Production Act to push manufacturers to increase production, and (iii) export bans on PPE (still active up to December 2020)

As of early December 2020, shortages still exist in some US states as the pandemic reaccelerates; conversely, early signs of oversupply of surgical masks have been observed during Q3 2020 when the pandemic slowed down temporarily (e.g., Fastenal announced it had a glut of masks, as it has built significant stockpiles)

3. Overview of the national distribution strategy

Pre-Covid-19, the PPE buyers landscape was dominated by distributors (accounting for ~60% of PPE transactions) who were selling directly to healthcare systems

Since the start of the Covid-19 crisis, this picture has changed considerably, notably because of new public sector entities:

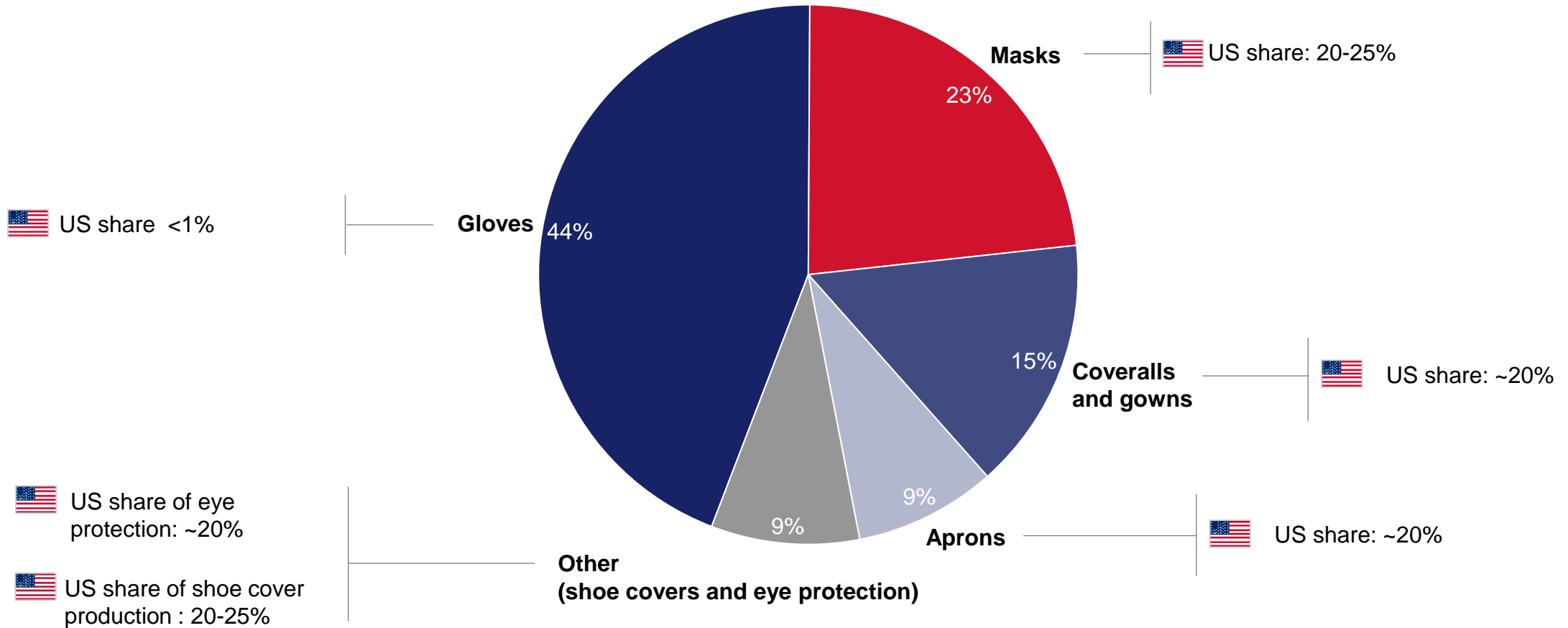
- Federal and state governments are now the largest PPE buyers in the country (~40% of PPE transactions vs. ~10% pre-crisis)
- E-commerce channels have grown (~15% of transactions vs. ~10% pre-crisis) driven by the surge in consumer PPE usage (especially masks)

1. US International Development Finance Corporation
Source: Mordor Intelligence (updated in November 2020), Press search, interviews with industry experts (November-December 2020), Johns Hopkins Coronavirus Resource Center (data for Covid-19 cases and deaths as of December 31, 2020)

1| The US is a major manufacturer, accounting for ~20% of the global production of every category apart from gloves

MARKET ESTIMATES – ONLY MEDICAL PPE CONSIDERED

Global market by medical PPE category and mapping of the United States share of production, 2019, % of total market




































1| The US is home to several top global players, including 3M, Honeywell, and Kimberly-Clark



PPE suppliers present in the US

NON-EXHAUSTIVE AND ILLUSTRATIVE

Suppliers (non-exhaustive)		Revenues 2019, \$m	PPE type (non-exhaustive)			
			 Surgical masks and respirators	 Medical gloves	 Gowns	 Face shield and goggles
	Cardinal Health, Inc.	137,000		✓	✓	
	Honeywell Safety Products	42,000		✓		
	Kimberly-Clark Professional	18,400		✓		✓
	Owens & Minor, Inc.	9,840		✓	✓	
	SVS, LLC	3,500		✓		
	Ansell Protective Products, Inc.	2,500		✓		✓
	Molnlycke Health Care US, LLC	1,500		✓		
	MSA Safety	375				✓
	Lakeland Industries, Inc. (NasdaqGM:LAKE)	105			✓	
	Prestige Ameritech, Ltd.	55			✓	
	Tronex	50		✓		
	Impact Products	35			✓	
	White Knight Engineered Products, Inc	17			✓	
	Precept Medical Products, Inc.	12			✓	
	3M Company (USA)	n.a.	✓			✓
	Alpha Pro Tech, Ltd. (AMEX:APT)	n.a.	✓			
	Amston Tool Company	n.a.	✓			
	Crosstex International	n.a.	✓			
	Fabric Sources International	n.a.	✓			
	Moldex-Metric, Inc (USA)	n.a.	✓			
	Oxco	n.a.	✓			
	Gateway Safety, Inc.	n.a.				✓
	Laser Engineering Inc	n.a.				✓
	Miller Electric Manufacturing Co.	n.a.				✓
	Oberon Company	n.a.				✓
	Pro-Tex	n.a.				✓
	Pyramex	n.a.				✓
	Sperian Eye & Face Protection, Inc.	n.a.				✓
	TIDI Products	n.a.				✓

Source: press search, calls with suppliers

1| Despite being a major PPE producer, the US relies heavily on imports to meet local demand

Exports/imports of the main PPE categories in 2019

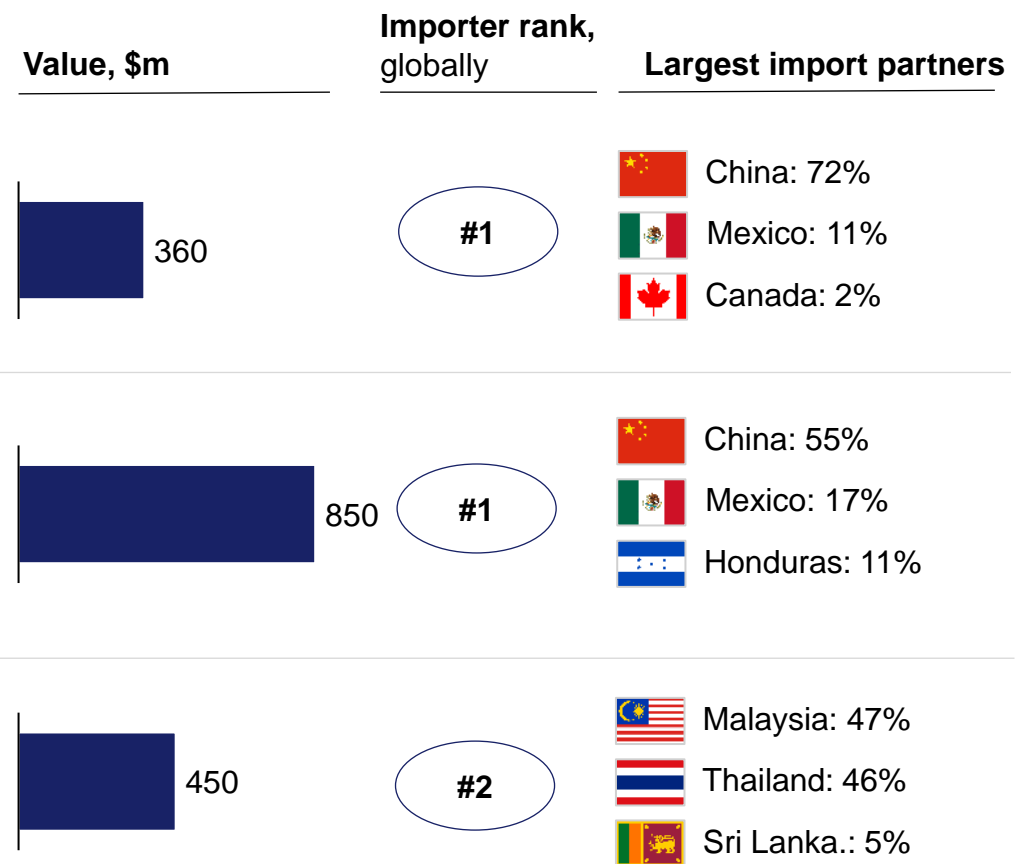
ONLY MEDICAL PPE CONSIDERED – NON EXHAUSTIVE



US exports 2019, selection of medical PPE (non-exhaustive)



US imports 2019, selection of medical PPE (non-exhaustive)



1. The HS code used is 630790 (made-up articles of textile materials) to which a % share of masks has been applied based on masks imports/exports figure between US and China (source: USA Today News)

2. The HS code used is 621010 (garments made up of felt or non-wovens) and may not consider exclusively medical coveralls, aprons, and gowns

3. The HS code used is 401511 (surgical gloves)

2| During 2020, US PPE production increased significantly as a consequence of Covid-19

Estimates of production increases for a selection of PPE categories during the Covid-19 crisis

NON-EXHAUSTIVE – DIRECTIONAL ESTIMATES FROM PRESS AND EXPERTS INTERVIEWS



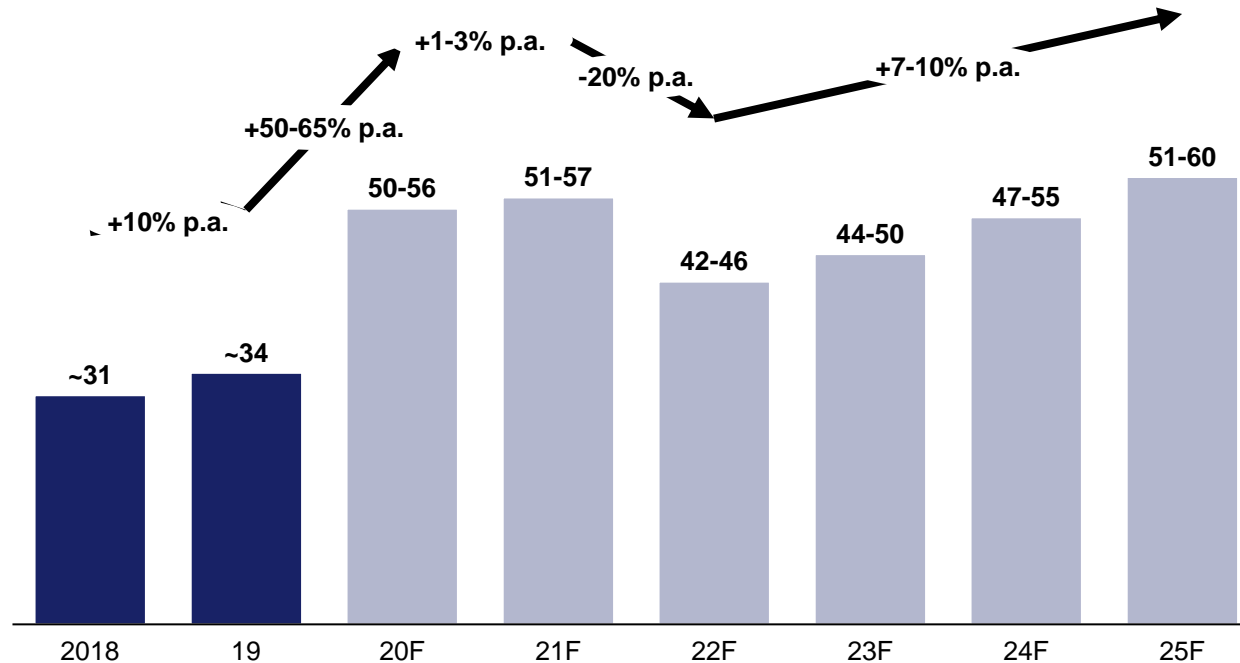
Selection of medical PPE (non-exhaustive)	Estimated peak production increase, %	Market insights from press search and experts interviews (as of December 2020)	
 Masks	 800-1200%	<p>“ Based on the investments made by the department, Cummings [principal Deputy Assistant Secretary of Defense] told the House panel, an increase in production of 450 million [N95] masks a year will be attained by October [knowing that production pre-Covid-19 was ~45 million N95 masks a year]</p> <p>– Press article (Dod news), June 2020</p>	<p>3M's monthly production of N95 respirators in the U.S. alone will have increased from 22 million in 2019 to 95 million by the end of 2020, a spokesperson said</p> <p>– Press article (CBS News), November 2020</p>
 Face shield	 400-600%	<p>“ Bullard [...] is now working around the clock to produce highly sought-after products like face shields for healthcare workers. The company has been manufacturing more than 5 times than they used to, and still trying to increase the capacity every day</p> <p>– US Chamber of Commerce</p>	<p>Bauer, a U.S.-based company that manufactures hockey gear, has shifted [...] started mass production of face shields. Bauer is set to produce 300,000 units and has received interest in more than 1 million medical shields</p> <p>– US Chamber of Commerce</p>
 Hand sanitizer	 200-500%	<p>“ Hand sanitizer sales have increased more than 300% in 1 week alone, and major retailers like Target, Kroger, Publix, and Stop & Shop have set limits on how much each shopper can buy</p> <p>– Press article (Today), March 2020</p>	<p>Dow Chemical is expanding its efforts [...] by shifting production at some of its plants around the world to making hand sanitizer. The company will use 5 facilities to produce more than 880,000 8-ounce bottles, which will be donated to health systems and governments</p> <p>– US Chamber of Commerce</p>

2| This 2020 demand peak will be sustained in 2021 but will drop in 2022 and return to historic ~10% p.a. growth during 2023-25

ESTIMATES FROM DEMAND MODEL, AS OF MID-DECEMBER 2020



Estimates¹ of US PPE demand by volume, 2018-19 historic and 2020-25 forecast, units, bn²



Market drivers

US demand surge in 2020 was mainly driven by

- Surgical masks (+700-800% vs. pre-crisis), which are expected to represent 10-15% of 2020 volume (vs. 2-4% in 2019)
- Gloves (+30-40% vs. pre-crisis), which are expected to represent 60-65% of 2020 volume (vs. 65-70% in 2019)

By 2025, the market is expected to return to historic growth rates (i.e., +10% p.a.) and category mix (60-65% of gloves, 25-30% of gowns/coveralls/aprons and 2-4% of surgical masks)

1. Range reflects 2 scenarios ("high" vs. "low"): (i) non-COVID baseline demand depends on 2 growth scenarios (historic growth -2% to account for critical size of the market vs. historic growth +1% to account for potential changes in usage habits), (ii) hospital days and vaccination demands depend on vaccination scenario ("pessimistic" vs. "optimistic"), and (iii) non-healthcare worker and consumer demands depend on adoption rate assumptions ("high" vs. "low")

2. Unit is per item or per pair in case of gloves, hand sanitizer is per litre, and chlorine is per kg

3| Over the past few months, Federal and state governments have become the largest buyers of PPE and e-commerce has grown (1/2)

High-level overview of the main PPE selling channels in the US

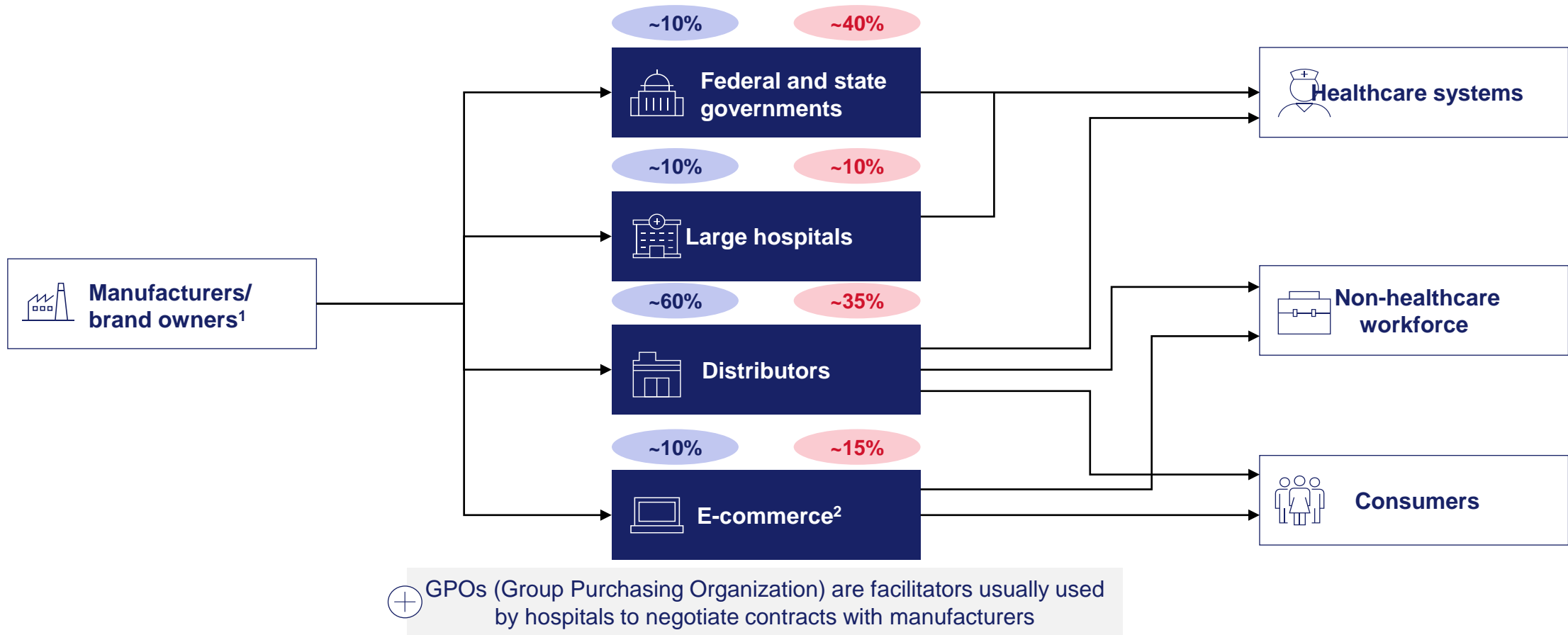
NON-EXHAUSTIVE – FROM EXPERTS INTERVIEWS, AS OF MID-DECEMBER 2020

 Volume share pre-Covid-19  Volume share during Covid-19 crisis

PPE suppliers (non-exhaustive)

PPE buyers/channels (non-exhaustive)

PPE end users (non-exhaustive)







1. Large PPE players are called brand owners when they purchase PPE products from manufacturers and put their brand on it
2. Most of the times, e-commerce platforms are only used as channels but do not purchase products

3| Over the past few months, Federal and state governments have become the largest buyers of PPE and e-commerce has grown (2/2)

High-level overview of the main PPE selling channels in the US

NON-EXHAUSTIVE – FROM EXPERTS INTERVIEWS, AS OF MID-DECEMBER 2020







PPE buyers/channels	High-level overview of Covid-19 impact	Procurement process (non-exhaustive)
 US government and US states	US Federal and state governments became the largest PPE buyers in the country as they started building stocks of PPE with the objective of avoiding future shortages	Procurement is defined by the IRP (Integrated Resource Planning) process where both manufacturers and distributors answer to government calls for tender with their available volume and prices States bid against each other and against the federal government in buying PPE
 Distributors	Private hospitals usually go through a distributor but they also typically engage a GPO (Group Purchasing Organization) to negotiate contracts with manufacturers	Distributors usually have a list of manufacturers/brand owners from whom they buy PPE (e.g., 3M usually contracts with ~10 large distributors) This supplier list is usually reviewed and updated annually. The process to become a distributor's supplier is strict, requires 2-3 months of work and culminates in the signing of a MSA ¹ , which lasts on average 3 years) Contracts are usually strict with no possibility for the manufacturer to compel the distributors to support any share of possible cost increases
 Large hospitals	Large hospitals have seen their volume share remain consistent during Covid-19	Only large hospitals can go directly to manufacturers/brand owners (average minimum annual purchase volume of \$800k) and are otherwise redirected to distributors Large hospitals usually deal with a dedicated key account manager at partner manufacturers
 E-commerce	E-commerce channels have emerged during the Covid-19 pandemic as private individual consumption surged dramatically (especially for masks)	E-commerce platforms (e.g., Amazon) are only used as distribution channels by manufacturers/brand owners (e-commerce platforms rarely purchase PPE on their own account)

1. Master Service Agreement

3| To secure offtakes with their largest buyers, PPE manufacturers need to comply with strict US standards



NON-EXHAUSTIVE – FROM PRESS SEARCH , AS OF MID-DECEMBER 2020

PPE type		US standard requirements
Surgical masks		ASTM F2100
Respirators		ASTM F3387 - 19 ¹
Surgical gloves		ASTM D3577 - 19 ²
Protective gloves		ASTM D5250-19 (for Polyvinyl chloride gloves) ASTM D5250-19 (for rubber examination gloves)
Protective eyewear and visors		ANSI/ISEA Z87.1 ³
Medical clothing		ASTM F2407-20 (for surgical gowns) ASTM F3352-19 (for isolation gowns)

1. Standard practice for respiratory protection
2. Standard practice for rubber surgical gloves
3. Standard practice for occupational and educational personal eye and face protection devices

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Topical deep-dive

Appendix



Overview of the Chinese PPE market

1. Overview of the national market pre-Covid-19

China is the largest PPE exporter worldwide for most items and relies very little on imports, making it self-sufficient for most PPE items:

- China is the largest global producer of masks, coveralls, aprons, shoe covers and eye protection, accounting for 40-60% of global production
- China is the largest global exporter of masks, coveralls, aprons and gowns worldwide, accounting for 40-45% of global exports in 2019

2. Perspectives on the Covid-19 supply/demand

China was the first country to be hit by the Covid-19 pandemic, but according to official statistics, China seems to have controlled the pandemic with fewer than 10k cases reported since March 2020

When the world was experiencing shortage of PPE kits in Q1-Q2 2020, China assumed the role of lead producer and dramatically scaled up its local production:

- +3,000 new players entered the PPE industry to join 4,000 existing manufacturers
- In total, local production increased by ~1,000% in masks and 300-500% for gloves at peak, according to local industry players

This increase in local manufacturing has been supported by several government measures such as (i) financial support for the purchase of raw materials and labour hiring, (ii) tax breaks for manufacturers and (iii) new manufacturing licenses

Following this production increase, signs of oversupply have been observed during summer 2020, especially for surgical masks

3. Overview of the national distribution strategy

Pre-Covid-19, the PPE kit buying landscape was dominated by distributors (accounting for ~65% of PPE transactions), with a solid e-commerce presence (~20% of PPE transactions)

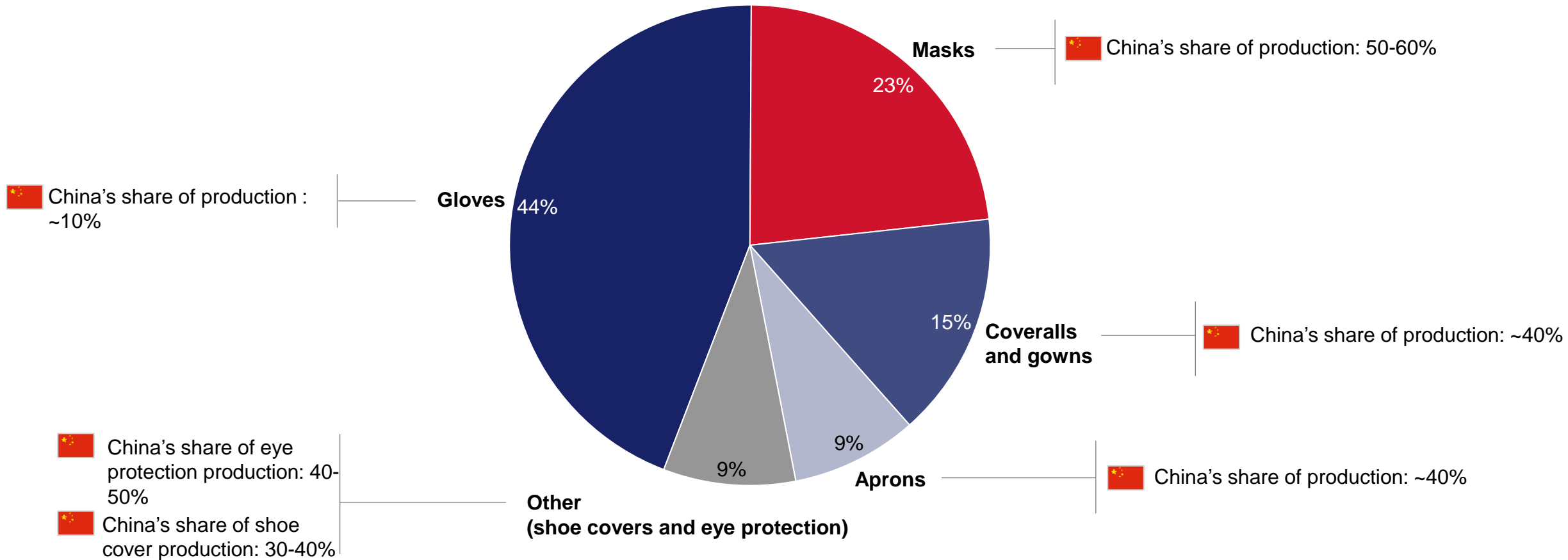
During the Covid-19 crisis, the Chinese buyer landscape has changed considerably, with a surge of state buyers:

- The Chinese government has become the largest buyer of PPE (~60% of transactions vs. ~5% pre-crisis), as it was building stocks
- Distributors and e-commerce shares have decreased, each of them accounting for ~15% of transactions, while large hospitals have retained their ~10% share of the market

1| China is the largest global manufacturer of PPE and accounts for 40-60% of the entire market

MARKET ESTIMATES – ONLY MEDICAL PPE CONSIDERED

Global market by medical PPE category and mapping of China's share of production, 2019, % of total market












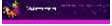


1| China is home to numerous PPE manufacturers across all product categories (1/2)

List of PPE suppliers present in China

NON-EXHAUSTIVE AND ILLUSTRATIVE














Suppliers (non-exhaustive)		Revenue 2019, \$m	Local manufacturing (non-exhaustive)			
			 Surgical masks and respirators	 Medical gloves	 Gowns	 Face shield and goggles
	Harbin Pharmaceutical Group Holding Co., Ltd	200			✓	
	Jiangxi Hongda Medical Equipment Group	173		✓		
	Jiangxi Zhonghong Pulin Medical Co., Ltd.	125		✓		
	Medtecs International Corporation Limited	68			✓	
	Huanghua Promisee Dental Co.,Ltd	43				✓
	Chongqing Shiji Changhe Industrial Co., Ltd.	38		✓		
	Shanghai Kebang Medical Latex Equipment Co., Ltd.	35		✓		
	Suzhou Colour-way New Material Co., Ltd	24		✓		
	Wuxi Yushou Medical Equipment Co.,Ltd.	19			✓	
	Dongguan Sailang Sports Articles Co., Ltd.	14				✓
	Tianrun (Zhuhai) health technology co.,Ltd.	14				✓
	Fitone Group	13		✓		
	Jiangxi Ideal Medical Co., Ltd.	8		✓		
	Beijing Xinduhui Technology Co., Ltd.	7				✓
	Shenzhen Rising Medical Co., Ltd.	7				✓
	Henan Joinkona Medical Products Co., Ltd	6			✓	
	Henan Yadu Industrial Co.,Ltd.	5			✓	
	Xinxiang Hongda Weicai Co.,Ltd.	4			✓	
	Jiangsu Raysun Medical Technology Co., Ltd.	4		✓		
	Xiantao Ruifeng Sanitary Products Co.,Ltd.	3			✓	
	Guilin HBM Health Protections Co., Ltd.	2		✓		
	Hubei Ruikang Medical Material Co.,Ltd.	2			✓	
BanBao	BanBao Co., Ltd.	1				✓
	Taihe Xiaoliang Protective Equipment Co., Ltd.	1				✓
	Shijiazhuang Yuhe Medical Supplies Co., Ltd.	1		✓		
HSSG	HSSG International Co., Ltd	1			✓	
	Hebei Sanxing Medical Latex Products Co., Ltd.	1		✓		
	Anqing Jida Labor Protection materials co. LTD	n.a.	✓			
	Baoji Gaosheng Medical Products Co., Ltd	n.a.	✓			

1| China is home to numerous PPE manufacturers across all product categories (2/2)

List of PPE suppliers present in the China

NON-EXHAUSTIVE AND ILLUSTRATIVE



Suppliers (non-exhaustive)		Revenue 2019,\$m	Local manufacturing (non-exhaustive)			
			 Surgical masks and respirators	 Medical gloves	 Gowns	 Face shield and goggles
	Chengdu Shennongtang Industrial	n.a.	✓			
	Gaomiyu Poly Labor Protection Products Co., Ltd	n.a.	✓			
	Hangzhou Chixiao Tec Co., Ltd.	n.a.	✓			
	Harbin Jiesheng Technology Development co., Ltd. Medical equipment branch	n.a.	✓			
	Henna Ruike Medical Instrument Co Ltd.	n.a.	✓			
	Hubei Mingerkang Sanitary Protective Equipment co., Ltd.	n.a.	✓			
	Innonix Tchnology (Shenzhen) Ltd.	n.a.	✓			
	Jiaozhou Naughty Baby Mask Factory	n.a.	✓			
	Jinzhou Fengguangrui Labor Protection Appliance Co., Ltd	n.a.	✓			
	Shandong Huazhan Labor Protection Appliance Co., Ltd	n.a.	✓			
	Sichuan Duochi Biotechnology Co. Ltd.	n.a.	✓			
	Tongcheng Jinlong Health Labor Protection Material Co., Ltd	n.a.	✓			
	Tongcheng Jinsong Labor Protection Articles Co., Ltd	n.a.	✓			
	Zhejiang Quzhou Nanhe Special Labor Protection Equipment Technology	n.a.	✓			
	Shenzhen Aurora Technology Limited	n.a.				✓
	Jinan Weiyang Medical Device Technology Co., Ltd.	n.a.				✓
	Ourlook (Zhangzhou) Optical Technology Co., Ltd.	n.a.				✓
	Shanghai Jheyewear Co., Ltd.	n.a.				✓
	Shenzhen Keygma Electrical Manufacturing Co., Ltd.	n.a.				✓
	Shenzhen Vivistar Technology Co., Ltd.	n.a.				✓
	ZheJiang Longmed Medical Technology Co., Ltd.	n.a.				✓

1| China is the top PPE exporter worldwide and relies very little on imports, making it self-sufficient for most components

Overview of exports/imports of main PPE categories in 2019



ONLY MEDICAL PPE CONSIDERED – NON EXHAUSTIVE

China exports 2019 , selection of medical PPE (non-exhaustive)

China imports 2019, selection of medical PPE (non-exhaustive)

	Value, \$m	Exporter rank, globally	Largest export partners	Value, \$m	Importer rank, globally	Largest import partners
 Coveralls, gowns, aprons¹	<div><div></div></div> 900	#1	<div><div> US: 40%</div><div> Germany: 7%</div><div> France: 6%</div></div>	3	#54	<div><div> Vietnam: 42%</div><div> Cambodia: 21%</div><div> Mexico.: 4%</div></div>
 Masks²	<div><div></div></div> 650	#1	<div><div> US: 39%</div><div> Japan: 10%</div><div> UK: 5%</div></div>	17	#14	<div><div> Vietnam: 11%</div><div> Japan: 11%</div><div> Mexico.: 5%</div></div>
 Gloves³	<div><div></div></div> 280	#2	<div><div> US: 45%</div><div> Canada: 5%</div><div> Japan: 4%</div></div>	15	#26	<div><div> Malaysia: 52%</div><div> US: 18%</div><div> Indonesia: 9%</div></div>

1.The HS code used is 621010 (garments made up of felt or non-wovens) and may not consider exclusively medical coveralls, aprons, and gowns

2.The HS code used is 630790 (made-up articles of textile materials) to which a % share of masks has been applied based on masks imports/exports figure between US and China (source: USA Today News)

3.The HS code used is 401511 (surgical gloves)

2| Chinese PPE production increased significantly during 2020 due to Covid-19, with medical masks up by ~1,200%



Estimation of production increases on a selection of PPE during the Covid-19 crisis

NON-EXHAUSTIVE AND DIRECTIONAL – ESTIMATES FROM PRESS AND EXPERTS INTERVIEWS, AS OF MID-DECEMBER 2020

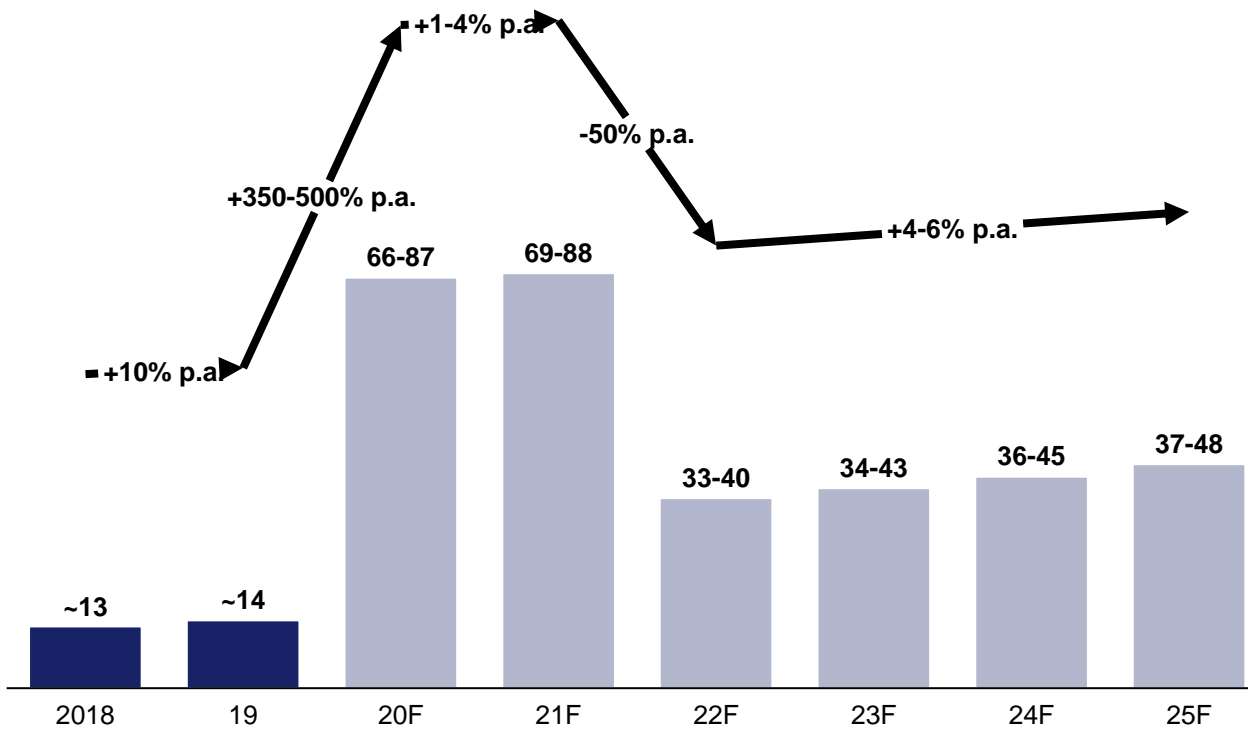
Selection of medical PPE (non-exhaustive)	Estimated peak production increase, %	Market insights from press search and expert interviews (AS OF MID-DECEMBER 2020)	
 Masks	 800-1,200%	<div></div> <p>China produces 200m face masks a day, more than ten times what it made at the start of February 2020. Local authorities have granted new licenses to allow more factories to produce masks, including high-grade ones used by healthcare professionals</p> <p>– Mordor intelligence, November 2020</p>	<p>[At the beginning of the pandemic] China boosted face masks production capacity by 450% in one month [in February] with 3,000 new entrants</p> <p>– Press article (South China Morning Post), March 2020</p>
 Gloves	 200-400%	<div></div> <p>Blue Sail Medical [a large Chinese glove manufacturer] announced its semi-annual revenue forecast, with an expected [...] 219.68% increase [in net profit] compared with the first half of 2019</p> <p>– Press article (Equal Ocean), July 2020</p>	<p>Blue Sail Medical intends to increase its production to 36.1bn pieces per annum by end-2023 from 4.3bn pieces as of end-2019. On the other hand, Intco plans to expand its nitrile glove capacity to 59.2bn pieces per annum by end-2023, from 5bn pieces at end-2019.</p> <p>– Press article (The Star), June 2020</p>

2| 2020 demand levels will be sustained in 2021 but will drop sharply in 2022 and growth will then fall to ~4-6% in 2022-25 – lower than pre-crisis

ESTIMATES FROM DEMAND MODEL, AS OF MID-DECEMBER 2020



China's estimated¹ PPE demand by volume, 2018-19 historic and 2020-25 forecast, units, bn²



Market drivers

China's demand surge in 2020 was mainly driven by:

- Surgical masks (+6,000-7,000% vs. pre-crisis) which are expected to represent 40-50% of the volume in 2020 (vs. 2-4% in 2019)
- Gloves (+150-200% vs. pre-crisis) which are expected to represent 40-45% of the volume in 2020 (vs. 65-70% in 2019)

After a 50% volume drop in 2021-22, the market is expected to grow again in 2022-25 at a 4-6% p.a. rate:

- Surgical mask demand is expected to remain high (20-25% of volume in 2025 vs. less than 2-4% in 2019) as consumer mask usage rates are predicted to remain high after the pandemic
- Glove share in the category mix may decrease vs. pre-crisis (60-65% of volume in 2025 vs. 65-70% in 2019)
- Gowns/aprons/coveralls share of category mix is expected to decrease to 15-20% of volume (vs. 25-30% in 2019)

1.Range reflects 2 scenarios ("high" vs. "low"): (i) non-COVID baseline demand depends on 2 growth scenarios (historic growth -2% to account for critical size of the market vs. historic growth +1% to account for potential changes in usage habits), (ii) hospital days and vaccination demands depend on vaccination scenario ("pessimistic" vs. "optimistic"), and (iii) non-healthcare worker and consumer demands depend on adoption rate assumptions ("high" vs. "low")

2.Unit is per item or per pair in case of gloves, hand sanitizer is per litre, and chlorine is per kg

Source: Mordor Intelligence (updated in November 2020), EPI model, WHO assumptions

3| During 2020, the Chinese government became the largest PPE buyer, accounting for ~60% of PPE transactions vs. ~5% pre-crisis (1/2)

High-level overview of the main PPE selling channels in China

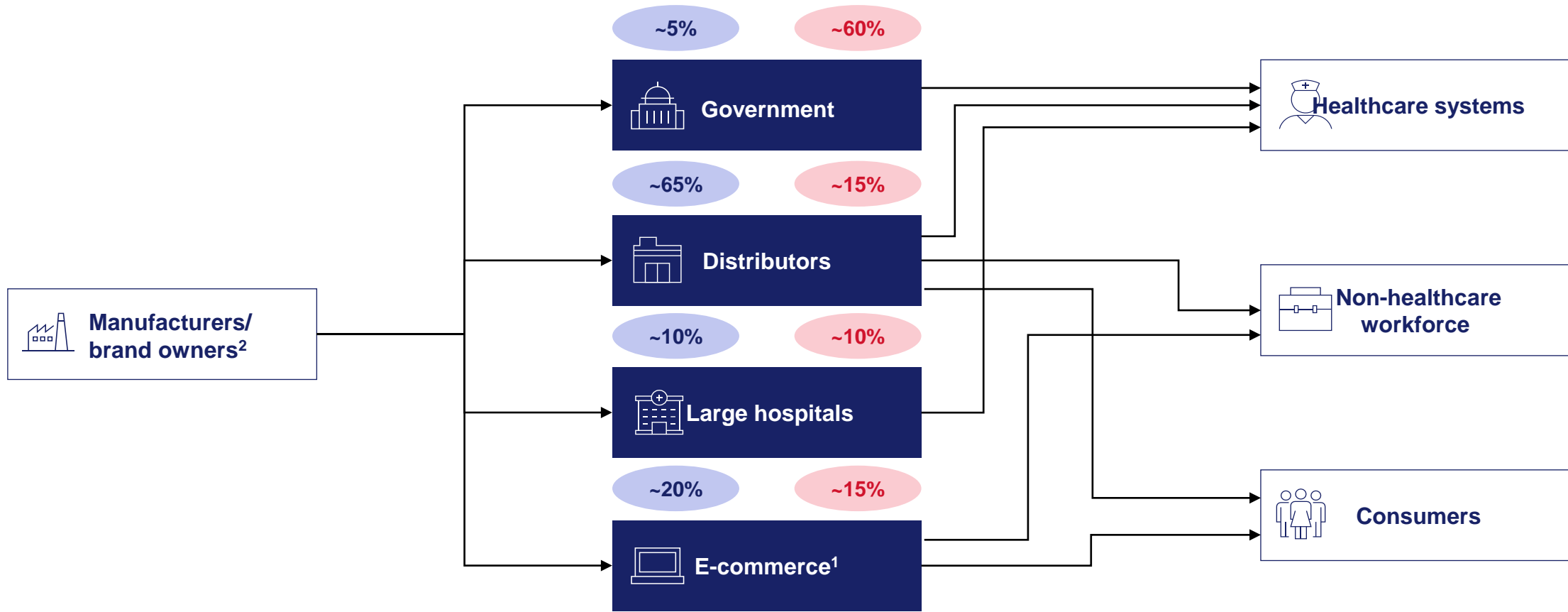
NON-EXHAUSTIVE – FROM EXPERTS INTERVIEWS, AS OF MID-DECEMBER 2020

x Volume share pre-Covid-19
 x Current volume share during Covid-19 crisis

PPE suppliers (non-exhaustive)

PPE buyers/channels (non-exhaustive)

PPE end users (non-exhaustive)







1. Most of the time e-commerce platform is only used as channel, but do not purchase products
2. Large PPE players are called brand owners when they purchase PPE products from manufacturers and put their brand on it

3| During 2020, the Chinese government became the largest PPE buyer, accounting for ~60% of PPE transactions vs. ~5% pre-crisis (2/2)

High-level overview of the main PPE selling channels in China

NON-EXHAUSTIVE – FROM EXPERTS INTERVIEWS, AS OF MID-DECEMBER 2020

PPE buyers/channels	High-level overview of Covid-19 impact	Procurement process (non-exhaustive)
 Government	<p>The government became the largest PPE buyer in China during the crisis as it started building PPE stocks</p> <p>It controlled ~70% of PPE transactions at the beginning of the crisis (~90% for masks) but that share is now decreasing as stocks are being built up and is estimated at ~60% AS OF MID-DECEMBER 2020</p>	<p>The Chinese government targets large players (e.g., 3M, Honeywell, Ansell), asks for an open book pricing and negotiates a supply agreement in line with national needs</p>
 Distributors	<p>Distributors have historically been the largest buyers of PPE in China (~70% of PPE volume) but they lost control of the market at the beginning of the crisis (down to less than 10% of volume) due to the government's concerted stockpiling efforts</p> <p>As the government is slowing down purchases, distributors are gradually regaining control (~15% AS OF MID-DECEMBER 2020)</p>	<p>Distributors usually have a list of manufacturers/brand owners from whom they buy PPE (e.g., 3M usually contracts with ~10 large distributors).</p> <p>This supplier list is usually reviewed and updated annually</p> <p>The process to become a distributor supplier is quicker compared with the US and Europe and only takes about 1 month but contracts are shorter (1-year on average)</p>
 Large hospitals	<p>Large hospitals have seen their volume share remain consistent during Covid-19, except for masks that have been overwhelmingly purchased by government</p>	<p>Only large hospitals can go directly to manufacturers/brand owners (minimum purchase: ~\$500k), otherwise they are redirected to distributors</p>
 E-commerce	<p>E-commerce was already a major channel pre-Covid-19 used by:</p> <ul style="list-style-type: none"> • Pharmacies and small retail stores • Consumers already using PPE for pollution and environmental purposes <p>E-commerce share dropped to 5% at the beginning of the crisis but has now recovered (~15% of volume AS OF MID-DECEMBER 2020)</p>	<p>E-commerce platforms (e.g., Alibaba) are only used as a distribution channel by manufacturers/brand owners</p>

3| To secure offtakes with these main buyers, PPE manufacturers need to comply with Chinese standards



NON-EXHAUSTIVE – FROM PRESS SEARCH, AS OF MID-DECEMBER 2020

PPE type (non-exhaustive)	Chinese standard requirements
Surgical masks	YY 0469-2011
Respirators	GB2626-2019 ¹
Surgical gloves	GB7543-2006 (for sterile rubber surgical gloves) GB24787-2009 (for non-sterile rubber surgical gloves)
Protective gloves	GB28881-2012 ² GB/T 12624-2009 ³
Protective eyewear and visors	N.a.
Medical clothing	GB19082-2009 ⁴

1. Standard for respiratory protection - non powered air purifying particle respirator
2. Standard for hand protection - protective gloves against chemicals and micro-organisms
3. Protective gloves - general requirements and test methods
4. Technical requirements for single-use protective clothing for medical use

Source: press search, GB China National Standards, Code of China

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- **Europe, including the EU and the UK**
- Bangladesh, India, Sri Lanka and Vietnam

Topical deep-dive

Appendix

Overview of the European (EU+UK) PPE market

1. Overview of the regional market pre-Covid-19

European PPE production is dominated by Germany, the UK and France and focuses mostly on high-quality PPE, with 2 implications:

- European manufacturers are limited competitively in global export markets and target mostly domestic and other European markets: 65-85% of PPE exports are within the EU+UK market (depending on the category)
- European countries still rely heavily on imports, especially from Asian countries, to meet domestic demand (e.g., 40-50% of masks via Chinese imports, 50-70% of gloves from Malaysia)

2. Perspectives on the Covid-19 supply/demand

Europe has been one of the regions worst-hit by Covid-19, with over 17m cases and 420k deaths (as of end-December 2020), which has led to a booming demand for medical PPE kits

This rising demand, combined with export restrictions imposed by traditional sourcing countries, has resulted in shortages, leading Europe to scale up local production of PPE kits (e.g., ~20x for masks) to meet domestic needs

This increase in local manufacturing has been supported by several government measures : (i) waivers of customs duties and VAT¹ on the import of PPE kits, (ii) export restrictions on PPE requiring a special authorization (restriction terminated end of May 2020), and (iii) large local orders of PPE by the different nation states to stimulate local production

As of late 2020, while pressure on some PPE still remains, early signs of oversupply have been observed in several countries, especially in masks (e.g., in the UK, PPE production started scaling down in June as NHS orders slowed and in France, it was estimated that 10% of mask manufacturers were struggling to sell their stocks by summer 2020)

3. Overview of the national distribution strategy

Pre-Covid-19, the PPE buyer landscape was dominated by distributors (accounting for ~70% of PPE transactions)

During the Covid-19 crisis, that picture has changed with a surge of public buyers:

- Governments saw their share increase by 3x (~15% of PPE transactions vs. ~5% pre-crisis), as they were building stocks
- Hospitals and e-commerce saw their share increase (respectively up to ~15% and up to ~20%), while distributors' share decreased to ~50% of PPE transactions (vs. ~70% pre-crisis); although distributors remain the largest buyers of PPE

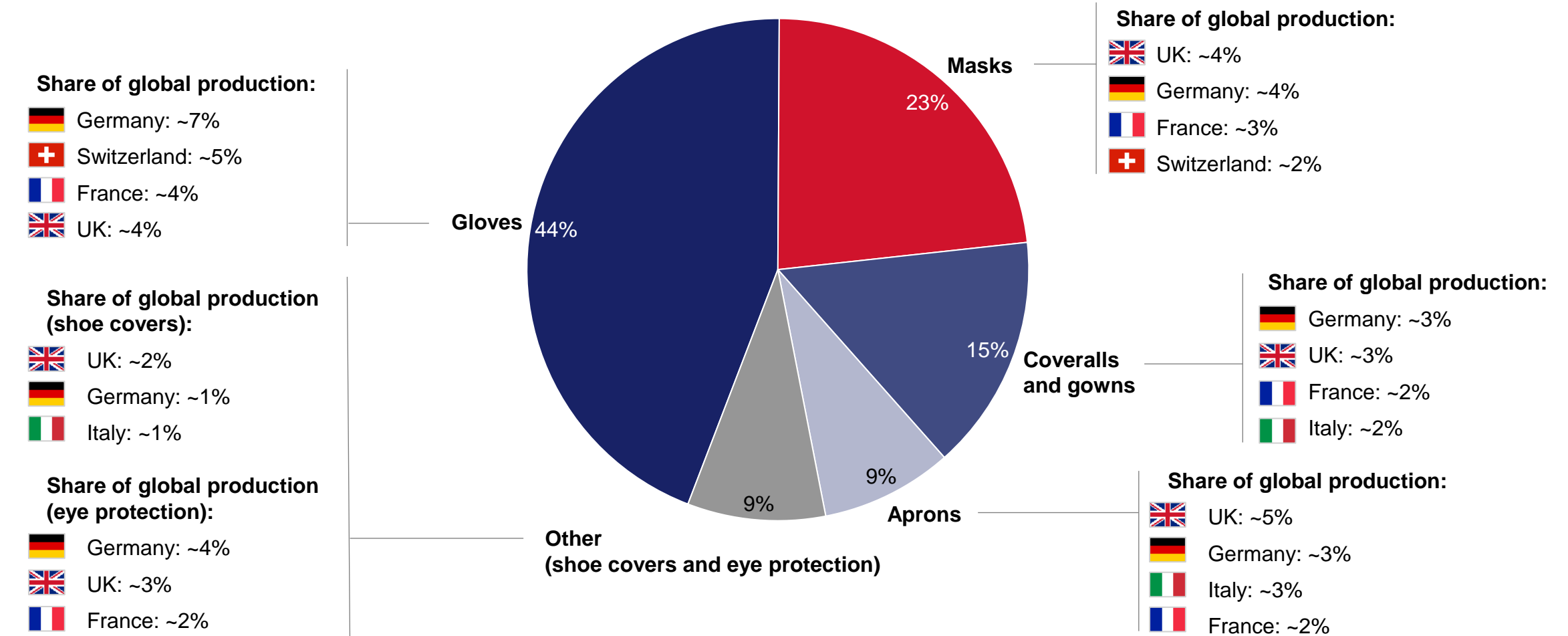
1. Value added tax

Source: Mordor Intelligence (updated in November 2020), Press search, interviews with industry experts (November-December 2020), European Centre for Disease Prevention and Control (data for Covid-19 cases & deaths as of 2020, week 52)

1| Germany, UK and France manufacture in multiple PPE categories, whereas Switzerland and Italy are present only in some

ESTIMATES – ONLY MEDICAL PPE CONSIDERED





































Global market by type of medical PPE and mapping of European countries' share of production, 2019, % of total market



1| Europe is home to some top global players, including Ansell, DuPont, and Kimberly-Clark

List of PPE suppliers present in Europe

NON-EXHAUSTIVE AND ILLUSTRATIVE

Suppliers (non-exhaustive)	Revenue 2019, \$m	Local manufacturing (non-exhaustive)			
		 Surgical masks and respirators	 Medical gloves	 Gowns	 Face shield and goggles
 DuPont de Nemours, Inc.	21,512		✓	✓	
 Kimberly-Clark	18,450			✓	
 Medline Europe Ltd.	11,700		✓		✓
 Drägerwerk	3,136			✓	
 Mölnlycke Health Care AB	1,666	✓	✓		
 Ansell	1,499	✓	✓	✓	
 MSA	1,402	✓			
 Semperit Aktiengesellschaft Holding	968		✓		
 Uvex	515		✓		
 Showa International	184		✓		
 Mercator Medical S.A. (WSE:MRC)	142			✓	
 Ejendals	133		✓		
 PIP	106			✓	
 LCH Medical Products	99			✓	
 Beeswift	64		✓	✓	✓
 Paul Boyé Technologies	60	✓		✓	
 Kolmi Hopen Medicom Group	52			✓	
 Etn Van Moer	49				
 UNISURGE International Limited	47			✓	
 Univet	25				
 Delta Med Spa	22		✓	✓	✓
 Rubberex	22		✓		
 ASID BONZ	21			✓	
 Unigloves	13		✓		
 Raguse	11			✓	
 DINA-HITEX	10			✓	
 Hase Safety Gloves	10		✓		
 Pluritex	3			✓	
 Van Oostveen Medical	3		✓		
 Cromptons Healthcare Limited	2			✓	
 JSP	0	✓			
 Portwest	0	✓			

Source: press search, calls with suppliers

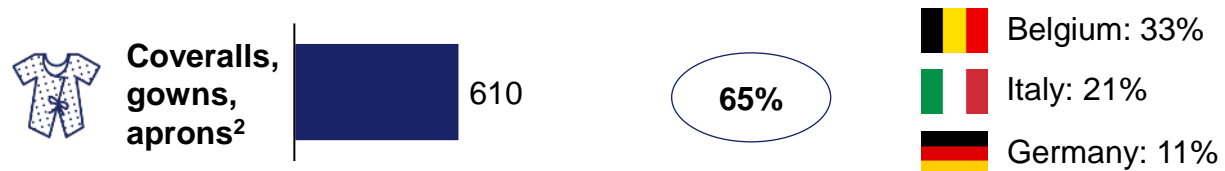
1| There is strong interdependence of trade in PPE, with 65-85% of exports remaining within Europe

Overview of exports/imports of main PPE categories in 2019

ONLY MEDICAL PPE CONSIDERED – NON EXHAUSTIVE

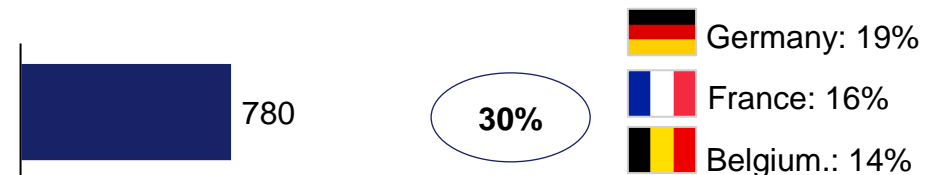
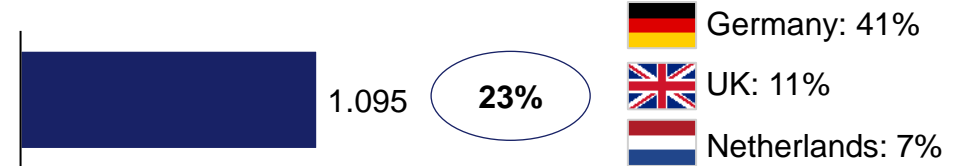
European exports 2019 , selection of medical PPE (non-exhaustive)

Value, \$m (internal trades included)	Share of exports to Europe	Top European exporting countries
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European imports 2019, selection of medical PPE (non-exhaustive)

Value,\$m (internal trades included)	Share of imports from Europe	Top European importing countries
---	---------------------------------	-------------------------------------



1. The HS code used is 401511 (surgical gloves)

2. The HS code used is 621010 (garments made up of felt or nonwovens) and may not consider exclusively medical coveralls, aprons and gowns


































3. The HS code used is 630790 (made-up articles of textile materials) to which a % share of masks has been applied based on masks imports/exports figure between US and China (source: USA Today News)

1| Germany's PPE trade balance is negative across all categories, relying heavily on Asian imports



Overview of exports/imports of main PPE categories in Germany in 2019

ONLY MEDICAL PPE CONSIDERED – NON EXHAUSTIVE

German exports 2019 , selection of medical PPE (non-exhaustive)				German imports 2019, selection of medical PPE (non-exhaustive)			
	Value,\$m	Exporter rank, globally	Largest export partners		Value,\$m	Importer rank, globally	Largest import partners
 Masks¹	 64	 #2	 France: 10%  Poland: 9%  Austria: 9%	 81	 #3	 China: 53%  Vietnam: 6%  UK: 5%	
 Gloves²	 154	 #4	 Austria: 19%  Italy: 9.4%  Poland: 8.8%	 448	 #1	 Malaysia: 70%  Thailand: 9%  Austria: 6%	
 Coveralls, gowns, aprons³	 69	 #9	 UK: 14%  France: 11%  Italy: 10%	 146	 #2	 China: 66%  Cambodia: 13%  Belgium: 3%	

1. The HS code used is 630790 (made-up articles of textile materials) to which a % share of masks has been applied based on masks imports/exports figure between US and China (source: USA Today News)

2. The HS code used is 401511 (surgical gloves)


































3. The HS code used is 621010 (garments made up of felt or nonwovens) and may not consider exclusively medical coveralls, aprons and gowns

1| The UK's trade balance is positive for coveralls and gowns, but negative for masks and gloves, again relying significantly on Asian imports



Overview of exports/imports of main PPE categories in the UK in 2019

ONLY MEDICAL PPE CONSIDERED – NON EXHAUSTIVE

UK exports 2019 , selection of medical PPE (non-exhaustive)				UK imports 2019, selection of medical PPE (non-exhaustive)			
	Value, \$m	Exporter rank, globally	Largest export partners	Value, \$m	Importer rank, globally	Largest import partners	
 Coveralls, gowns, aprons¹	 56	 #10	 Belgium: 33%  US: 13%  HK, China: 11%	 52	 #9	 China: 47%  Belgium: 15%  Germany: 14%	
 Masks²	 14	 #11	 Germany: 31%  Ireland: 11%  France: 9%	 31	 #5	 China: 50%  Germany: 11%  Vietnam: 5%	
 Gloves³	 4	 #21	 Ireland: 42%  France: 9%  Malaysia: 8%	 121	 #3	 Malaysia: 50%  Belgium: 24%  Netherlands: 5%	

1. The HS code used is 621010 (garments made up of felt or nonwovens) and may not consider exclusively medical coveralls, aprons and gowns

2. The HS code used is 630790 (made-up articles of textile materials) to which a % share of masks has been applied based on masks imports/exports figure between US and China (source: USA Today News)




























3. The HS code used is 401511 (surgical gloves)

1| France's PPE trade balance is negative across all PPE types, and the country also relies significantly on Asian imports

Overview of exports / imports of the main PPE in France in 2019



ONLY MEDICAL PPE CONSIDERED – NON EXHAUSTIVE

French exports 2019 , selection of medical PPE (non-exhaustive)				French imports 2019, selection of medical PPE (non-exhaustive)			
	Value, \$m	Exporter rank, globally	Largest export partners	Value, \$m	Importer rank, globally	Largest import partners	
 Masks¹	 18	#8	 Spain: 15%	 43	#4	 China: 41%	
			 Italy: 10%			 Tunisia: 13%	
			 Romania: 9%			 Germany: 6%	
 Gloves²	 11	#13	 Switzerland: 26%	 73	#6	 Malaysia: 46%	
			 Spain: 16%			 Thailand: 20%	
			 Italy: 14%			 Belgium: 12%	
 Coveralls, gowns, aprons³	 30	#13	 Switzerland: 23%	 126	#3	 China: 51%	
			 Italy: 16%			 Cambodia: 17%	
			 Spain: 15%			 Tunisia: 9%	

1. The HS code used is 630790 (made-up articles of textile materials) to which a % share of masks has been applied based on masks imports/exports figure between US and China (source: USA Today News)


2. The HS code used is 401511 (surgical gloves)

3. The HS code used is 621010 (garments made up of felt or nonwovens) and may not consider exclusively medical coveralls, aprons and gowns

2| Europe's PPE production increased significantly in 2020 due to Covid-19, with a 20-fold increase in the manufacture of medical masks

Estimation of production increases on a selection of PPE types during the Covid-19 crisis

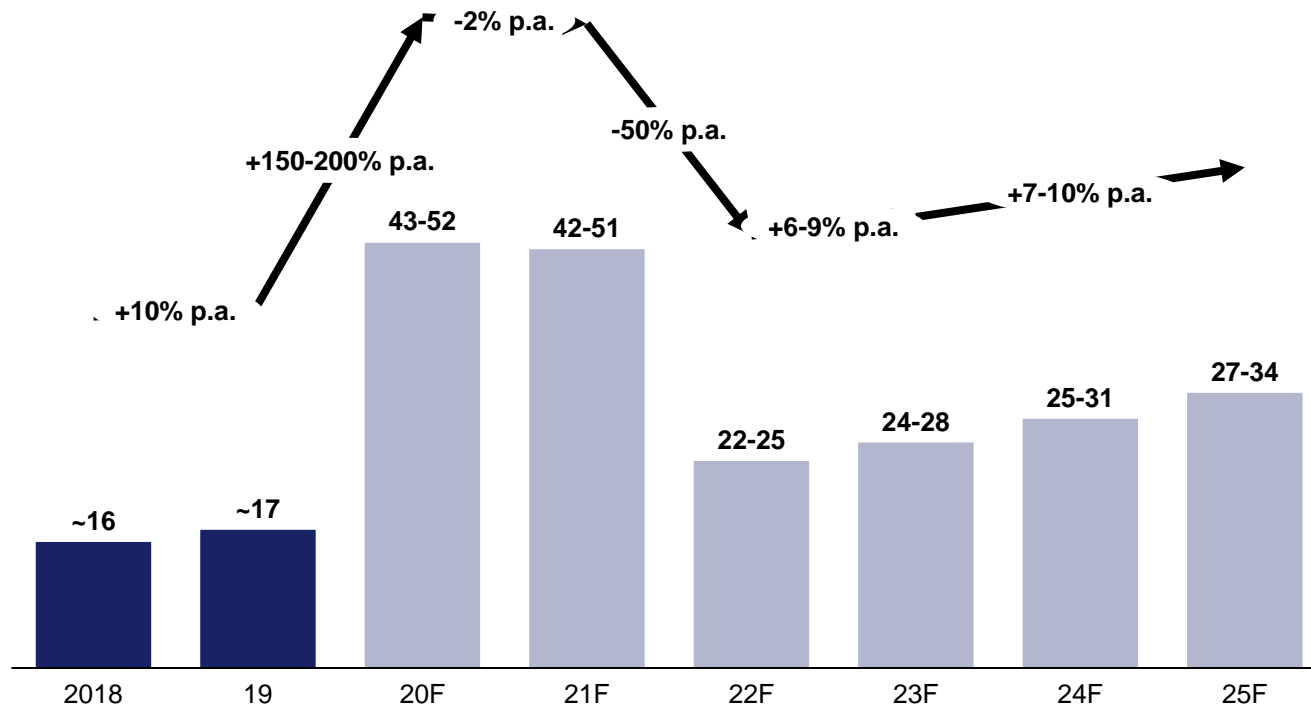
NON-EXHAUSTIVE AND DIRECTIONAL – ESTIMATES FROM PRESS AND EXPERTS INTERVIEWS, AS OF MID-DECEMBER 2020

Selection of medical PPE (non-exhaustive)	Estimated peak production increase, %	Market insights from press search (AS OF MID-DECEMBER 2020)	
 Masks	 1,500-2,000%	<p>“ EU production of face masks, essential for tackling the coronavirus crisis, is set to increase 20-fold by November this year compared with pre-crisis times. This means that EU-based producers will be able to make the equivalent of 1.5bn three-layer masks a month</p> <p>– Press article (Non woven industry), June 2020</p>	<p>“At the beginning of the crisis, mask demand was 10 times greater than local production. Since then, France has tripled its mask production.”</p> <p>– Vincent Moulin Wright (CEO of France Industrie), April 2020</p>
 Face shields	INFORMATION NOT AVAILABLE		<p>[In Germany] up to 1,500 face shields can now be produced at RWTH Aachen University per day. “This is rapid prototyping in perfection: Using 3D printing and similar processes, a prototype can be produced from a virtual 3D model, tested, and the design directly modified within a few hours,” explains RWTH professor Jan Borchers</p> <p>– Press article (DWIH New Delhi), May 2020</p>
 Hand sanitizer	INFORMATION NOT AVAILABLE	<p>“ Ineos [...] is planning to build two hand sanitizer factories in just 10 days as part of the effort to prevent the spread of coronavirus. [Ineos] aims to produce a million bottles of hand sanitizer a month when the plant is in operation.</p> <p>– Press article (The Guardian), March 2020</p>	<p>LVMH is to start producing hand sanitizer at three of its perfume and cosmetics factories for distribution to French hospitals fighting the country's coronavirus outbreak. Twelve tonnes will be produced as early as this week.</p> <p>– Press article (The Guardian), March 2020</p>

2| This 2020 demand peak will be sustained in 2021 but will drop in 2022 and return to historic ~7-10% p.a. growth during 2023-25

ESTIMATES FROM DEMAND MODEL, AS OF MID-DECEMBER 2020

European estimated¹ PPE demand by volume, 2018-19 historic and 2020-25 forecast, units, bn²



Market drivers

European demand surge in 2020 was mainly driven by:

- Surgical masks (+2,500-3,000% vs. pre-crisis), which are expected to represent 25-30% of the volume in 2020 (vs. 2-4% in 2019)
- Gloves (+30-35% vs. pre-crisis), which are expected to represent 60-65% of the volume in 2020 (vs. 65-70% in 2019)

After a sharp 50% volume drop in 2022, the market is expected to return to its 7-10% p.a. historic growth rate in 2022-25, with a similar product mix vs. pre-crisis:

- Gloves are estimated to represent 65-70% of European demand volume in 2025
- Gowns, coveralls, and aprons may represent 25-30% of total PPE demand
- Surgical masks may go back to less than 5% of the volume

1.Range reflects 2 scenarios ("high" vs. "low"): (i) non-COVID baseline demand depends on 2 growth scenarios (historic growth -2% to account for critical size of the market vs. historic growth +1% to account for potential changes in usage habits), (ii) hospital days and vaccination demands depend on vaccination scenario ("pessimistic" vs. "optimistic"), and (iii) non-healthcare worker and consumer demands depend on adoption rate assumptions ("high" vs. "low")

2.Unit is per item or per pair in case of gloves, hand sanitizer is per litre, and chlorine is per kg

3| Despite a 300% increase in government share of purchased PPE, distributors remain the top PPE buyers in most European countries

High-level overview of the main PPE selling channels in Europe

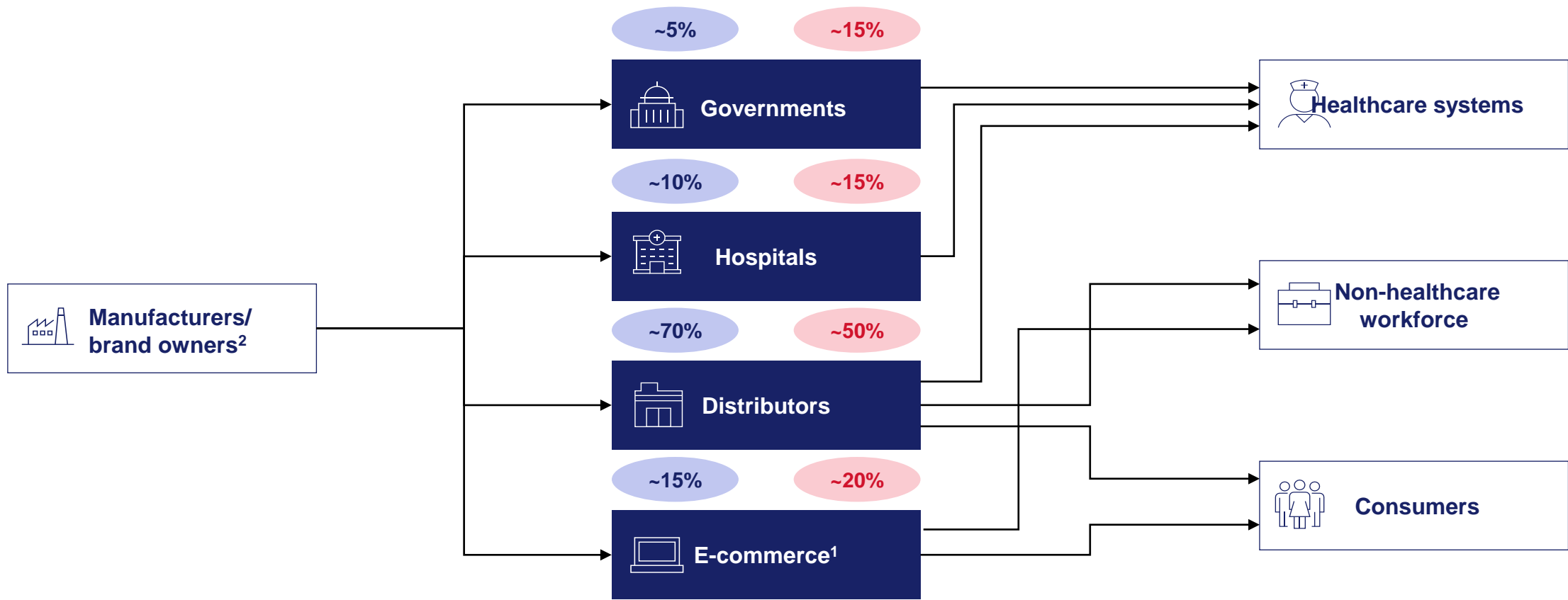
NON-EXHAUSTIVE – FROM EXPERTS INTERVIEWS, AS OF MID-DECEMBER 2020
UK AND GERMANY DEEP-DIVES ON NEXT PAGES

 Volume share pre-Covid-19  Current volume share during Covid-19 crisis

PPE suppliers (non-exhaustive)

PPE buyers/channels³ (non-exhaustive)

PPE end users (non-exhaustive)



1. Most of the time e-commerce platform is only used as channel, but do not purchase products
2. Large PPE players are called brand owners when they purchase PPE products from manufacturers and put their brand on it
3. Average figures across Europe; could vary from a European country to another

3| Deep-dive into buyers in Germany

High-level overview of the main PPE selling channels in Germany

NON-EXHAUSTIVE – FROM EXPERTS INTERVIEWS, AS OF MID-DECEMBER 2020



PPE buyers

Impact of Covid-19

Procurement process (non-exhaustive)



Government

PPE procurement was centralized by the Federal government in response to intense competition in the global PPE market. PPE has been procured via the procurement offices of the Ministries of Health, Interior, Defense, and Finance

The Federal government procured PPE through the following 2 channels:

- 1) BMG (Ministry of Health) which initiated a temporary open house procedure
- 2) Major German companies buying on behalf of the BMG for procurement on the Chinese market



GPOs (groups of hospitals)

Many hospitals and nursing homes are part of GPOs¹ (GPOs cover 80-90% of German healthcare and social care facilities), although during Covid-19 pandemic, PPE procurement was centralized by the Federal government

GPOs follow a regular 4-step procurement process through tenders to lower prices:

- 1) Start of nonbinding bidding process via an enquiry process
- 2) Offer collection for the defined contract period
- 3) Negotiation packages and evaluation of the offers
- 4) Contracting



Distributors

Distributors are historically the largest buyers of PPE in Germany. Despite the government's intervention in PPE purchasing, distributors remain the top buyers in the country.

Distributors usually have a list of manufacturers/brand owners from whom they buy PPE

A review/update of suppliers list is usually carried out annually and the process to become a distributor supplier is strict, requires two to three months of work and leads to the signing of a long-term contract (five years on average)



E-commerce

E-commerce channel emerged during the Covid-19 pandemic as private individual consumption surged (especially for masks)

E-commerce platforms (e.g., Amazon) are only used as a distribution channel by manufacturers/brand owners (e-commerce platforms rarely purchase PPE on their own account)




1. Group Purchasing Organizations

3| Deep-dive into buyers in the UK

High-level overview of the main PPE selling channels in the UK

NON-EXHAUSTIVE – FROM EXPERTS INTERVIEWS , AS OF MID-DECEMBER 2020



PPE buyers	Impact of Covid-19	Procurement process (non-exhaustive)
 Government	<p>Previously entirely absent from the market, the UK government became the major buyer in 2020 accounting for >90% of the demand</p> <p>The UK government has purchased directly from manufacturers as well as from distributors; and supplies principally to the NHS¹</p>	<p>The government uses the following 2 procurement processes:</p> <ol style="list-style-type: none"> 1) A single tender: establishes terms of 1 contract for 1 or many services and can be fulfilled by 1 supplier 2) A framework agreement: is specific for a type of PPE and can be fulfilled by 1 or many suppliers; typically lasts for 4 years
 Distributors	<p>Previously supplying NHS directly, distributors had to go through the government during the Covid-19 crisis in order to do business</p>	<p>Distributors usually have a list of manufacturers/brand owners from whom they buy their PPE</p> <p>An annual review/update of suppliers list is usually carried out and the process to become a distributor supplier is strict, requires two to three months of work and leads to the signing of a long-term contract (five years on average)</p>
 E-commerce	<p>E-commerce channel emerged during the Covid-19 pandemic as private individual consumption surged dramatically (especially for masks)</p>	<p>E-commerce platforms (e.g., Amazon) are only used as a distribution channel by manufacturers/brand owners (e-commerce platforms rarely purchase PPE on their own account)</p>

1. National Health Service

3| To secure offtakes by these principal buyers, PPE manufacturers need to comply with European standards

NON-EXHAUSTIVE – FROM PRESS SEARCH , AS OF MID-DECEMBER 2020

PPE type	European standard requirements
Surgical masks	EN 14683 :2019
Respirators	EN 149 +A1
Surgical gloves	EN 455
Protective gloves	EN 374 – Protection from chemical risks and micro-organisms
Protective eyewear and visors	EN 166
Medical clothing	EN 13795
Protective clothing	EN 14126 – protective clothing against infective agents EN 14605 – protective clothing against liquid chemicals

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Topical deep-dive

Appendix

Overview of the Indian, Sri Lankan, Bangladeshi and Vietnamese PPE markets

1. Limited PPE manufacturing capacity pre-Covid-19

PPE production capacity in India, Sri Lanka, Bangladesh and Vietnam was limited before the Covid-19 crisis and focused only on specific categories of PPE

- The four countries manufactured virtually no PPE kits until January 2020
- Sri Lanka accounted for ~5% of the global glove market (including examination, surgical and chemotherapy gloves) due to its privileged access to natural rubber

2. Increase in manufacturing capacity during the Covid-19 crisis

Since the Covid-19 outbreak, India has been the most proactive of the 4 countries in increasing PPE production capacity, driven by booming domestic demand and the global PPE shortage

- The country's PPE manufacturing capacity has surged, with a production increase of 56x in two to three months, making India the second largest PPE producer after China; this supply spike has been facilitated by ambitious support from the government
- Production increases in Bangladesh and Vietnam have been lower but are still highly significant (x10 for Bangladesh and x6 for Vietnam)

In these countries, most additional supply has arisen from textile manufacturers shifting their production in response to the health emergency and in order to mitigate losses caused by cancelled orders for garments, but they have struggled to meet global standards, resulting in significant quality issues

3. Key success factors and barriers to entry

The 2020 demand peak induced by Covid-19 is expected to persist in 2021, with some potential for new local manufacturers to capture market share

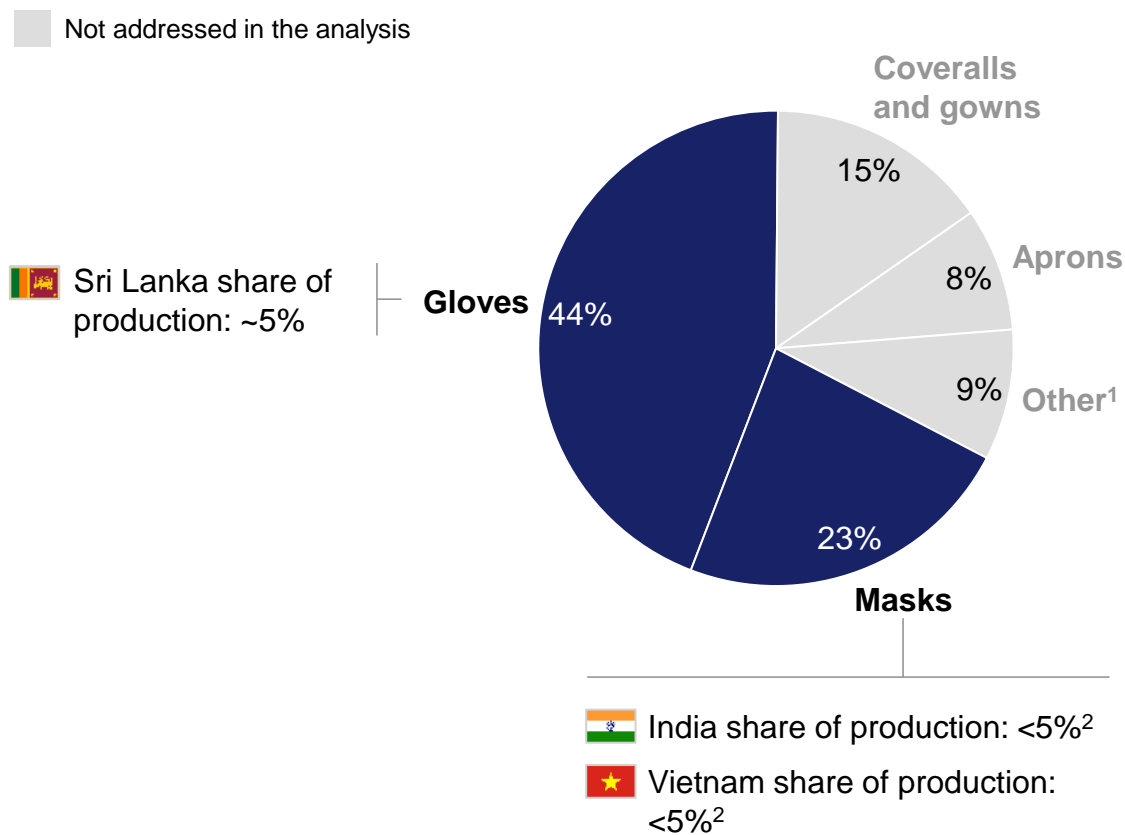
- All four countries have competitive advantages that could attract companies looking for alternatives to China (e.g., reliable partners, low labour costs, reduced geopolitical risk and significant domestic markets)
- To capture market share, new entrants would have to (i) meet international quality standards, (ii) secure large orders for the production of PPE and (iii) enforce best practice manufacturing processes to ensure quality output and price competitiveness

Thorough business plans will need to be constructed for each manufacturing project to prove long-term viability

1| In each of these four countries, PPE production was limited before the Covid-19 crisis and focused mostly on masks and gloves

ESTIMATES FROM PRESS AND EXPERTS INTERVIEWS – ONLY MEDICAL PPE CONSIDERED

Global medical PPE market by type of PPE, 2019, % of total market



1. Shoe covers and eye protection
2. Estimate based on exports value

Market insights from press search and experts interviews (as of mid-December, 2020)

- India had almost no production capacity for PPE kits until January 2020 and was only manufacturing a few products, like medical gowns and surgical gloves
– PPE industry expert, November 2020
- In March, when Bangladesh reported its first Covid-19 case, the country was completely relying on imports for PPE.
– Press article (The Business Standard), August 2020
- Sri Lanka is a leading manufacturer of protective gloves and medical gloves made with natural rubber latex and nitrile latex. The country's rubber gloves industry caters to nearly 5% of the global demand for household, industrial, and medical gloves
– Sri Lanka Export Development Board

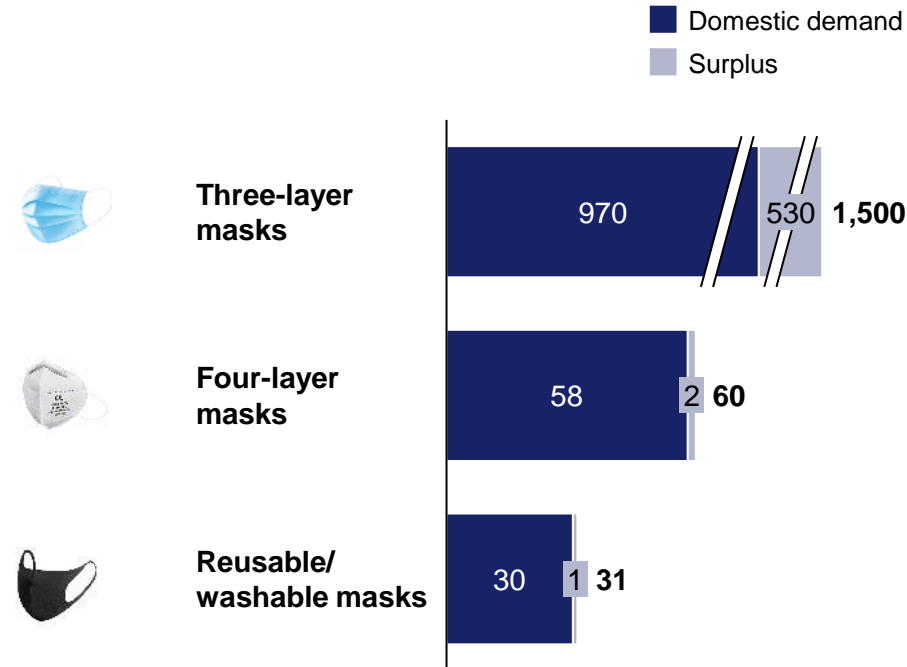
2| Since the Covid-19 outbreak, India has been the most proactive of the four countries in increasing its PPE production capacity

NON-EXHAUSTIVE – DIRECTIONAL ESTIMATES FROM PRESS AND EXPERTS INTERVIEWS

India has experienced a dramatic surge in domestic production of PPE, becoming the second largest PPE producer in the world

Selection of medical PPE (non-exhaustive)

Estimated production capacity, Units. m

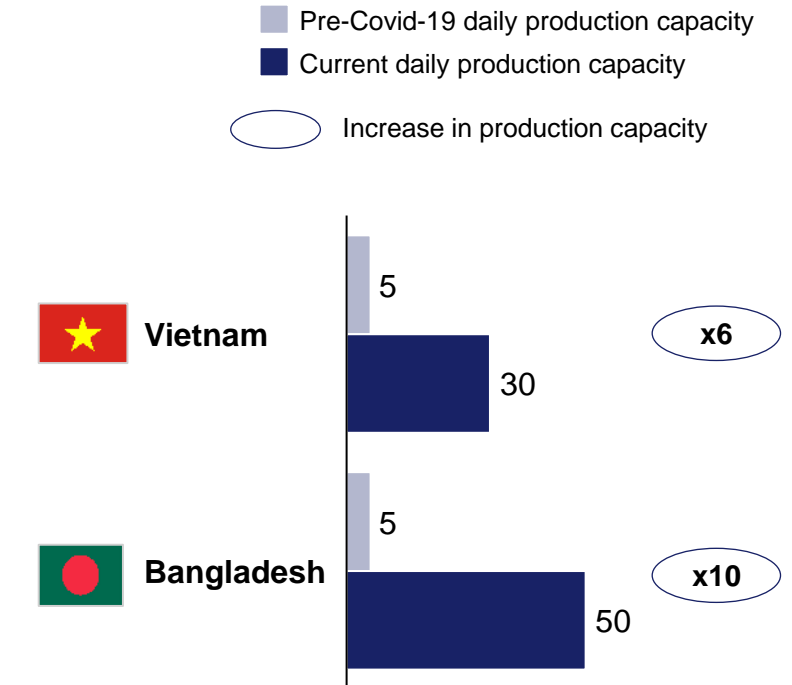


“” Beating all odds, India developed a domestic network of PPE fabric and garment manufacturers; in just 60 days, the PPE industry in India has witnessed a 56 times growth.
– PPE industry expert, December 2020

“” Now, we have numerous local manufacturers and PPE production capacity has increased so much that it has become a massive industry.
– Himanshu Baid, Chairman, Confederation of Indian Industry

Bangladesh and Vietnam have also increased their production¹









Pre-Covid-19 vs. current daily production capacity, K units/day



1. No reliable data found for Sri Lanka's production capacity











2| Most of this supply increase came from the textile industry, which shifted to PPE production to mitigate losses caused by cancelled orders

PRESS AND EXPERTS INTERVIEWS – AS OF MID-DECEMBER 2020

Country	Textile and clothing exports 2019, \$m (% of local exports)	Shift to PPE manufacturing	Market insights from press search and experts interviews (as of mid-December, 2020)
 India	 34	~10%	<p>+600 Indian companies are now lab-certified for PPE, including top garment and textile exporters Alok Industries, JCT Phagwara, Gokaldas Exports and Aditya Birla</p> <p>“” Garment demand had plummeted in past months [...]. We chose to switch to PPE kits as it was doable with the experienced hands we had and infrastructure. This helped us give employment to our workers. – Amit Jain, a garment manufacturer</p>
 Bangladesh	 35	~80%	<p>According to the Bangladesh Garment Manufacturers and Exporters Association (BGMEA), there are 33 companies who are making and preparing to export PPE to meet global demand.</p> <p>“” Beximco has proudly joined the fight against the global pandemic by moving swiftly to add manufacturing capabilities in PPE items such as gowns, masks, and coveralls – Syed Naved Husai, Beximco CEO</p>
 Sri Lanka	 6	~50%	<p>According to the Board of Investments (BOI), Sri Lanka's apparel industry has attracted +\$500m worth of PPE orders, and 33 factories are currently manufacturing these products</p> <p>“” Partnering with governments, doctors, healthcare authorities and internal teams, MAS+ is creating a collection of functional and comfortable PPE which includes masks and scrubs. [...] MAS+ hopes to bring new innovations to the medical apparel space – MAS official website</p>
 Vietnam	 40	~15%	<p>According to the Ministry of Trade, ~50 companies are producing surgical masks (e.g., TNG, supplier of Levi's, Tesco and Décathlon, exported millions of masks)</p> <p>“” We at DONY have long recognized the need to adapt to the pandemic [...] we're proud to have supported many countries' healthcare systems with our high-quality protective face masks and medical clothing. – Mr. Henry Pham, CEO of DONY Garment Company</p>

2| The four countries have benefited from three types of support from governments, albeit at different scale

NON-EXHAUSTIVE – PRESS AND EXPERTS INTERVIEWS – AS OF MID-DECEMBER 2020

Type of support	Examples of interventions from governments and international institutions (non-exhaustive)	
 Financial support and fiscal incentives		In April 2020, government announced a specialized incentive package to promote manufacture of PPE, including (i) a 30% capital subsidy , up to INR 20 crore (~\$3m) per individual entity for textiles and related products and (ii) a 2% interest subvention for loans for registered MSMEs
		In June, the government exempted PPE from VAT at the production and supplier level
 International norms enforcement		In July, Salman Rahman, adviser to the prime minister, pledged the government's support for the development of testing facilities so that local manufacturers could exploit the full export potential of PPE and masks
		The Ministry of Health, in collaboration with the Ministry of Science and Technology, will develop and promulgate standards and technical regulations for medical equipment , with the support of UNDP
		In June, USAID committed to initiate new activities to improve case management and strengthen regulatory and quality standards for local production of PPE
 Technical assistance		In July, USAID funded the organization of two webinars to support Sri Lankan apparel producers to export PPE to the US, including training on how to comply with the FDA regulations and access the US market (e.g., federal application, distribution chains, acquisition regulations)
		USAID LinkSME, in coordination with the Vietnamese government, is supporting the Vietnamese private sector to address gaps in the PPE supply chain , connecting Vietnam's PPE suppliers to distributors in the US

Among all four countries, India has benefited from the most **ambitious and proactive government's support** regarding PPE local production. The Indian government's plan has aimed at:

- Identifying 14 textile and latex companies which could rapidly scale up their production of PPE
- Providing them with an significant financial support, unequalled in any other country in the sub-region

3| Three main advantages could equip new local manufacturers to enter the PPE market

NON-EXHAUSTIVE – AS OF MID-DECEMBER 2020

Drivers

Description



Market opportunity

- Although PPE demand is expected to drop in 2022, it is expected to **resume its historic growth rate of ~6-9% p.a.** from 2023 onwards, resulting in a market of 185-235m units in 2025



Geographic diversification

- Many US, European, Japanese and South Korean companies are considering a significant restructuring of their global supply chains away from China in order to **mitigate supply-side risk**



Competitive advantages

- India, Bangladesh, Sri Lanka and Vietnam are well-known, reliable partners with **reduced geopolitical risk** compared with China
- The four countries are **cost competitive**, especially in terms of **labour costs** (e.g., monthly minimum wage in the garment industry of ~\$70 in Bangladesh, ~\$130 in India and ~\$140 in Vietnam vs. \$150-200 in China)
- Corporate tax rates** for new manufacturing companies are among the lowest in the world
- These countries benefit from **growing domestic markets** that may provide additional demand



Major PPE producers, such as DuPont, have chosen Vietnamese garment enterprises to produce protective items due to their textile know-how and value for money

– PPE industry expert, November 2020



We are aiming to diversify supply base and find alternatives to Chinese manufacturers [...] However, finding suitable manufacturers is challenging due to quality issues and export bans (especially in India)

– International donor, December 2020



In July 2020, the Japanese government announced that it would support the Japanese apparel maker Matsuoka Corp. to produce PPE in Vietnam, primarily to diversify supplies and reduce its dependence on China amid the novel coronavirus pandemic.

– Mordor Intelligence, November 2020

1. Bureau of Indian Standards

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Topical deep-dive

- **Melt-blown non-woven industry**

Appendix

Overview of the melt-blown industry

Main messages

1. Overview of the melt-blown industry pre-Covid-19

The melt-blown industry grew by ~9% p.a. during 2014-2019, reaching ~\$1bn in 2019. The largest part - at ~45% - was produced by Asia-Pacific with ~20% by the US and ~15% by Europe. The market is split into four types of players

- Large integrated players producing both melt-blown and end-products (e.g., 3M, Dupont, Honeywell), accounting for 35-50% of the market
- Small scale integrated players producing both melt-blown and end-products, accounting for 10-15% of the market
- Large non-integrated manufacturers (e.g., Toray, Mitsui), accounting for 20-30% of the market
- Small scale non-integrated manufacturers, accounting for 20-30% of the market

Most of the melt-blown players also produce spunbound and diversify their production by targeting different end uses in order to achieve scale (as of 2019, medical products only accounted for 10-20% of melt-blown consumption). It is also important to note that integrated players achieve a higher profit margin compared with non-integrated players (15-20% of EBITDA margin vs 10-15%)

2. Perspectives on the Covid-19 impact

Global melt-blown production has significantly increased during the Covid-19 pandemic (up to +100% increases in production in Asia-Pacific) driving the market up ~40% in 2020 (to ~\$1.4bn); this capacity surge came from three sources

- 30-50% from existing melt-blown players (e.g., Toray, Pegas, Mitsui, Kimberly-Clark)
- 35-45% from players in adjacent industries expanding into the melt-blown market (e.g., Winnebago, BYD, Sinopec)
- 10-30% from new players entering the market (~50% of whom were from Asia-Pacific); these are usually non-integrated players who may well disappear once the pandemic slows down

3. Overview of the industry key success factors

The melt-blown industry is expected to continue to grow at ~8% p.a. during 2020-2023, driven by (i) demographic growth, (ii) changes in mask usage habits and (iii) consumption growth in other end-usage segments, such as hygiene products

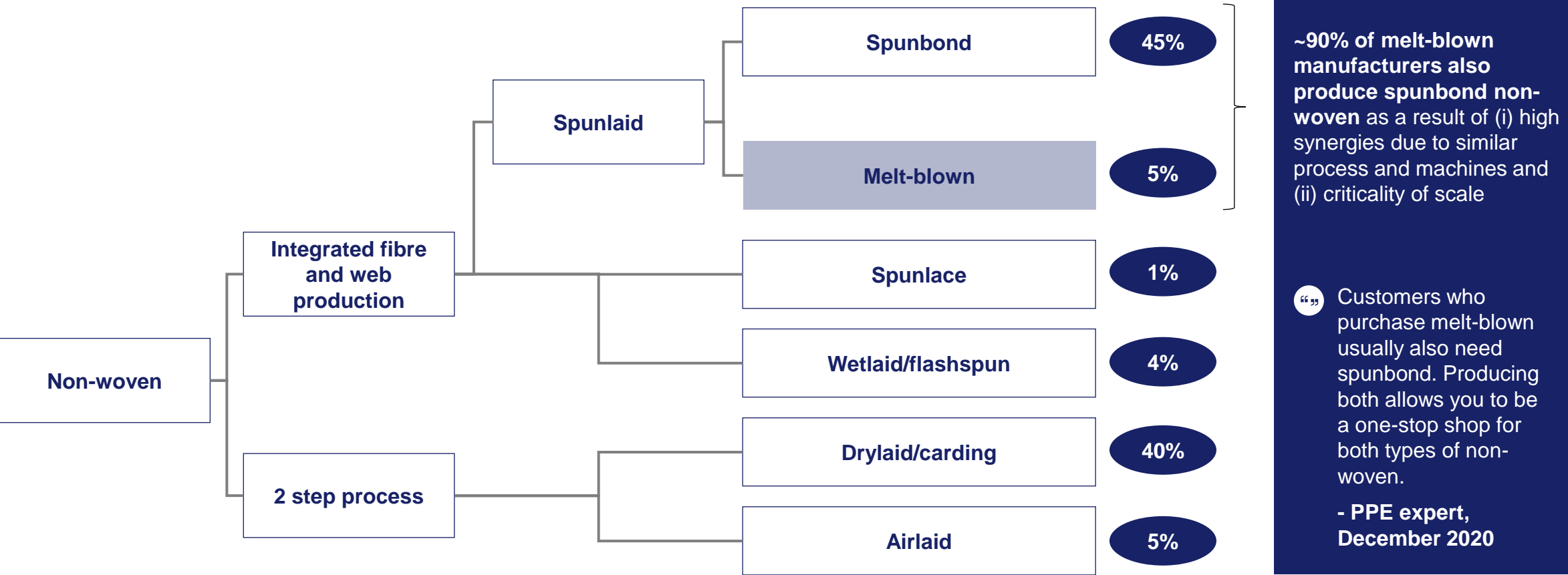
This growth may be captured either by new entrants, who could be positioned as cost leaders (focusing on high volume and low costs) or premium players (focusing on high quality and margin), or **by large end-product manufacturers willing to integrate the upstream part of the value chain**

Brand new players will need to overcome some major barriers to entry, including (i) achieving scale and volume in order to be cost-competitive, (ii) securing necessary raw materials and machinery and (iii) building solid brands

1| Melt-blown non-woven accounted for only ~5% of the total non-woven fabric market in 2019

x Share of total non-woven volume, 2019 ■ Focus of this section

Different technologies used for non-woven production

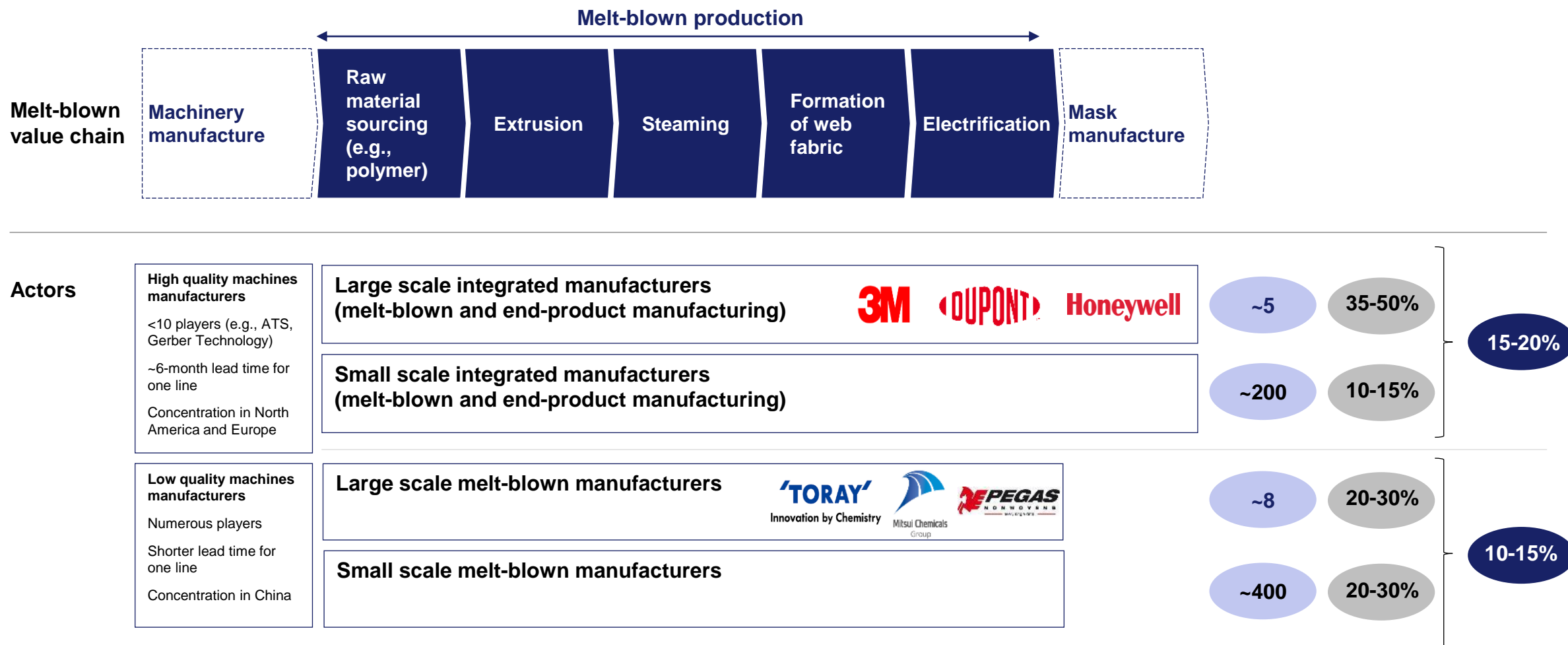


Source: Smithers Apex, interviews with industry experts (November-December 2020)

1| ~50% of the melt-blown market is provided by integrated players who also manufacture end-products

ESTIMATES – FROM EXPERTS INTERVIEWS, AS OF MID-DECEMBER 2020

xx Number of players
 xx Market share
 xx EBITDA margin¹



1. Pre-Covid-19 margins (EBITDA margins have increased during the pandemic as a result of price surge)

1| Historically, medical end-use only accounted for 10-20% of total melt-blown consumption compared with the 50-70% used in hygiene products

ESTIMATES – NON-EXHAUSTIVE, AS OF MID-DECEMBER 2020

x% Share of consumption, 2019  Durable  Disposable

Major spunlaid non-woven (including both melt-blown and spunbond) end uses¹

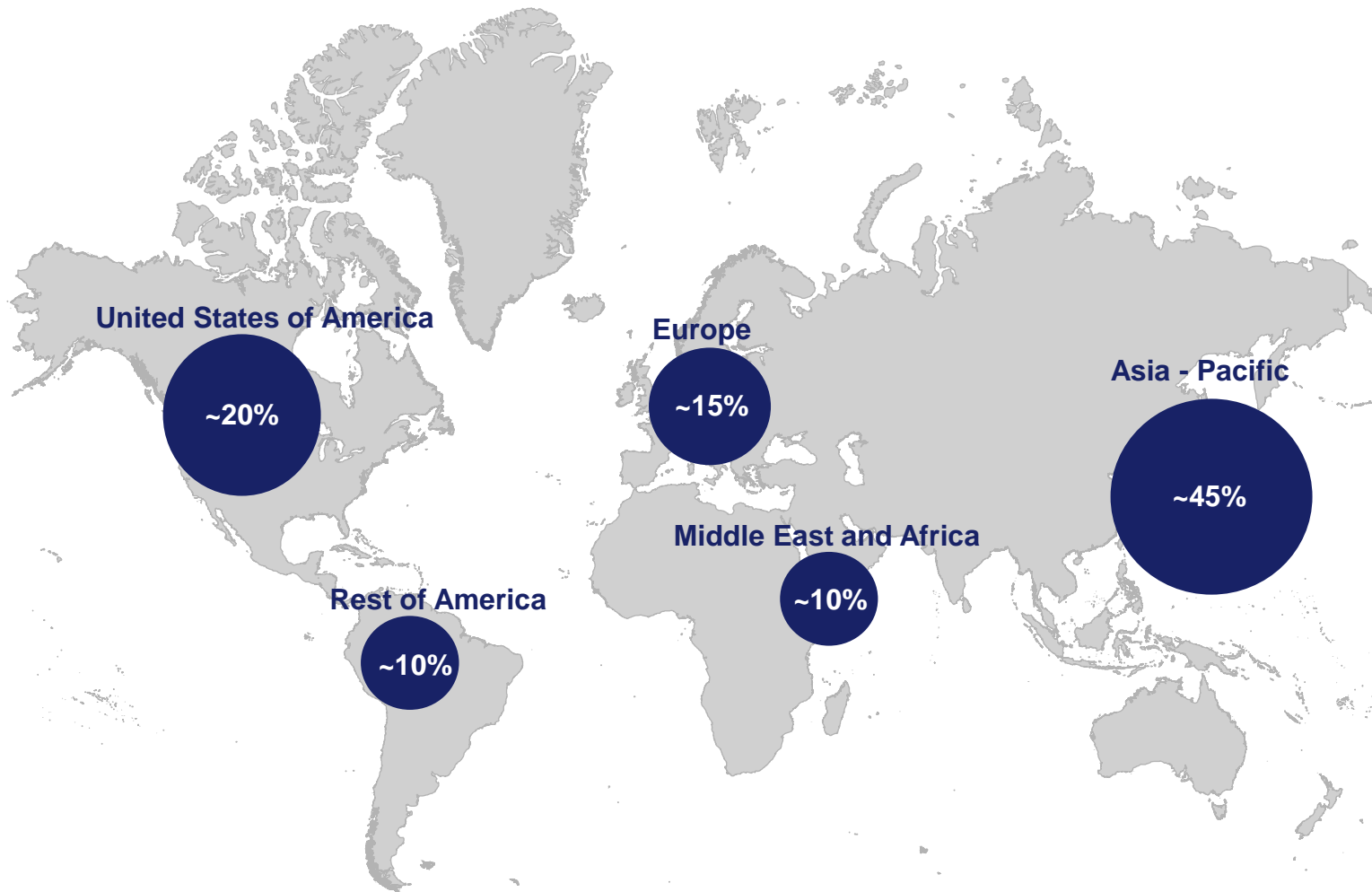


1. Other end uses exist (e.g., automotive, wipes, electronics)
Source: interviews with industry experts (November-December 2020), Smithers Apex

1| Asia-Pacific accounted for ~45% of melt-blown production in 2019, with differences in volume, quality and delivery time versus Europe and the US

ESTIMATES – FROM EXPERTS INTERVIEWS, AS OF MID-DECEMBER 2020

Melt-blown share of production by region, 2019, %



Key insights

Asian production is characterized by higher volume, lower quality and quicker delivery times compared with the US and Europe's manufacturers

The NA market is more consolidated than the European market (top 3 players hold ~50% of the NA market vs. ~20% in Europe)

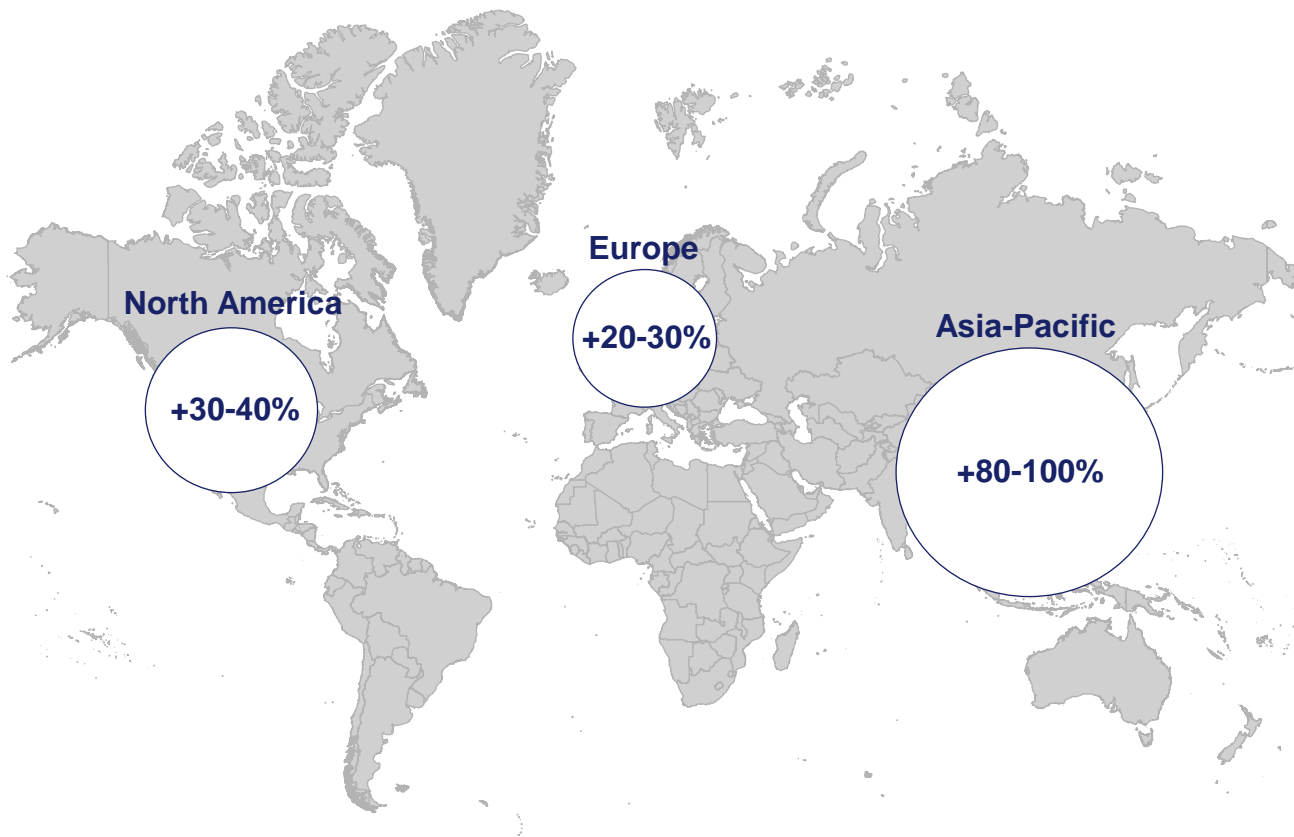
“ ” Asia production is dominated by China, India, Indonesia, Japan, South Korea and Taiwan. This region benefits from the lowest production costs worldwide and focuses on volume.

- Melt-blown expert, December 2020

2| Global melt-blown production increased significantly in 2020 due to Covid-19, with increases of +100% in Asia-Pacific

ESTIMATES – FROM EXPERTS INTERVIEWS, AS OF MID-DECEMBER 2020

Estimated increase in melt-blown production during the Covid-19 crisis, 2019-2020 change in production capacity, %



Key insights

The global melt-blown capacity increase in 2020 has been driven by:

- Existing melt-blown players increasing their production capacity: 30%-50% of the capacity increase
- Existing adjacent industries players (e.g., Sinopec, BYD, Winnebago) expanding into the melt-blown market: 35-45% of the capacity increase
- Entirely new players entering the market, representing 10-30% of the capacity increase



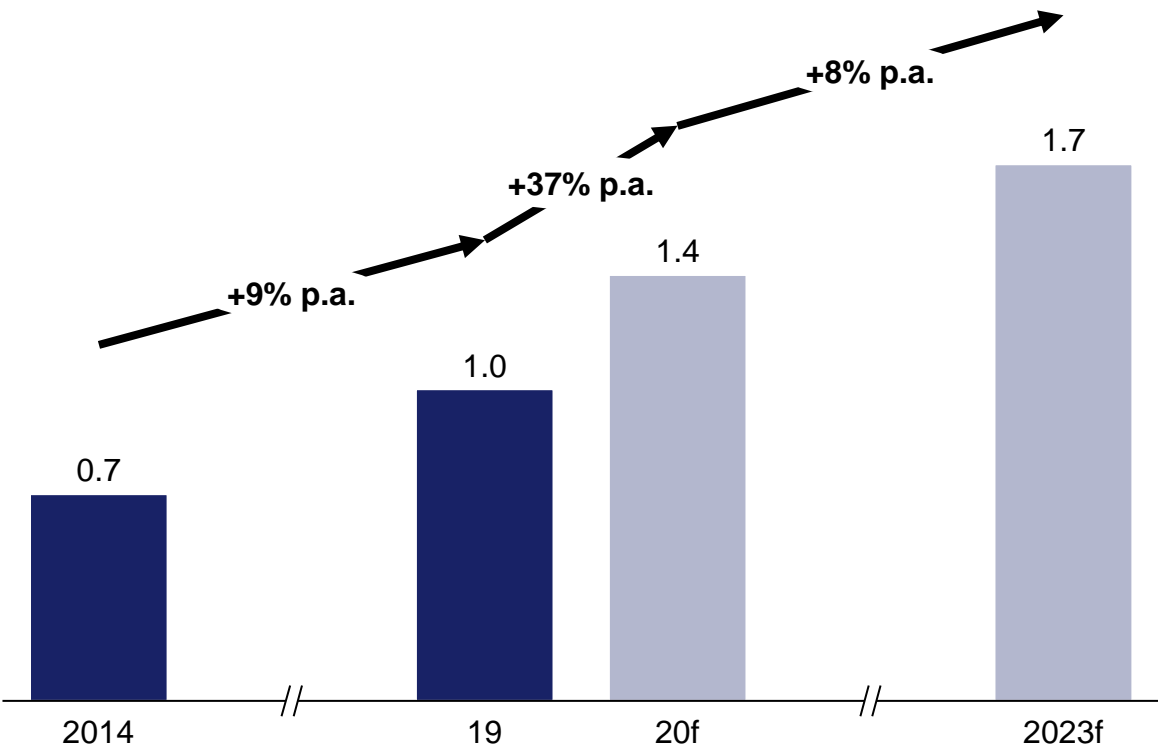
New small-scale players entering the market are usually non-integrated players as mask production would require higher capital, specific machines and a high number of workers; but those are likely to disappear once the pandemic slows down as a consequence of their full focus on supplying mask producers

- Melt-blown expert, December 2020

3| The melt-blown market is expected to continue to grow after the 2020 demand peak, maintaining a ~8% p.a. growth rate during 2020-2023

ESTIMATES – FROM EXPERTS INTERVIEWS, AS OF MID-DECEMBER 2020

Melt-blown market size¹,
2014-2019 historic & 2020-2023 forecast,\$bn



Key insights

The market is expected to continue to grow until 2023 driven by:

- Demographic growth, which is expected to increase by 1-1.5%² p.a. in 2020-2030
- Changes in consumer habits in wearing more masks after the crisis for environmental and sanitary purposes
- Growth in hygiene product consumption, especially in developing countries

After a price surge in melt-blown at the beginning of the crisis, prices are now progressively decreasing, as a result of supply increase

“” Melt-blown prices surged by 150% at the beginning of the crisis
- PPE expert, Dec 2020

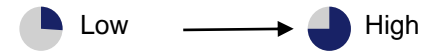
1. All melt-blown end uses have been considered in the market sizing
2. According to the United Nations

3| Focus on melt-blown market: potential opportunities for cost-advantaged new entrants and large end-product producers looking to integrate vertically

PROPOSITION - NON-EXHAUSTIVE

THOROUGH BUSINESS PLANNING REQUIRED TO FURTHER ASSESS THE STRATEGIC POSITIONING

Feasibility



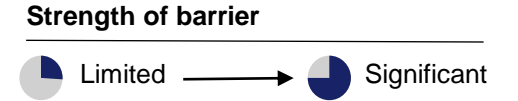
Type of player	Strategic positioning	Description	Key success factors	Feasibility
For a brand new player	Cost leader	Enter the melt-blown industry with a high volume and low cost strategy by using low cost raw materials and low quality machinery	<ul style="list-style-type: none"> Achieve economies of scale (would require producing spunbond as well as melt-blown and targeting multiple industries as customers) Locate near to raw material supply Locate in a low labour and utilities cost country Target small/medium and local players as customers 	
	Premium manufacturer	Enter the melt-blown industry with a high margin strategy by using high quality raw materials and machinery	<ul style="list-style-type: none"> Secure high quality raw materials and machinery (in short supply during the Covid-19 crisis) Target large players as customers (would involve inspections and quality control) Build solid brand and reputation (would require several years) 	
For an existing end-product manufacturer	Value chain integrator ¹	Build in-house melt-blown production capabilities for own use (only makes sense for large end-product manufacturers)	<ul style="list-style-type: none"> Sufficient internal demand to break-even; it would be hard for a small company to integrate upward due to capital intensity and technical barriers Secure high quality machinery and raw materials for premium products manufacturers/locate in low labour costs country with proximity to raw materials for lower quality products manufacture. 	









1. Some examples of hygiene end-product manufacturers with integrated melt-blown manufacturing: Cardinal Health, Kimberly-Clark, Halyard Health

Source: interviews with industry experts (November-December 2020)

3| New entrants to the melt-blown market must overcome four major entry barriers

NON-EXHAUSTIVE – FROM EXPERTS INTERVIEWS, AS OF MID-DECEMBER 2020
FOCUS ON REQUIREMENTS FOR BRAND NEW PLAYERS



Barrier	Description	Relevance/ strength	Expert quotes
 Competitive industry with large players dominating the market	<p>The melt-blown competitive landscape is consolidated:</p> <ul style="list-style-type: none"> ~10-15 large players account for ~60% of the market, incl. ~5 large integrated players who manufacture finished PPE (e.g., 3M, Dupont) In addition, + 500 smaller players are competing in this industry 		<p>“” The melt-blown market is dominated by large integrated and non-integrated manufacturers; in addition, hundreds of small players are producing melt-blown</p> <p>- PPE expert, November 2020</p>
 Changing regulations and importance of brand	<ul style="list-style-type: none"> Regulations have changed rapidly during the pandemic, with quality standards requirements becoming more stringent Building brand identity, trust and loyalty is key in this industry 		<p>“” The Covid-19 pandemic has led some governments to change regulations to limit low quality PPE on the market</p> <p>- Melt-blown expert, November 2020</p>
 Scale and volume	<p>Economies of scale and volume are critical to achieve competitiveness, suggesting manufacturers would have to expand beyond melt-blown for medical end use only:</p> <ul style="list-style-type: none"> Produce spunbond non-woven on top of melt-blown (spunbond market is 9x larger¹ than the melt-blown market) Target different types of customers (e.g., hygiene customers on top of medical ones) 		<p>“” A successful player would need quickly to scale and secure long-term contracts. The production of spunbond non-woven on top of melt-blown could be necessary to achieve scale.</p> <p>- PPE expert, November 2020</p>
 Limited availability of machinery and raw materials	<ul style="list-style-type: none"> Fewer than 10 companies manufacture high-quality machine lines which can produce high quality melt-blown and it takes ~6 months to produce a single line Polymer, the main raw material used to manufacture melt-blown, has been in short supply during the pandemic 		<p>“” A new entrant would need to secure its polymer inputs early to avoid another potential shortage in the future</p> <p>- Melt-blown expert, November 2020</p>

1. In volume

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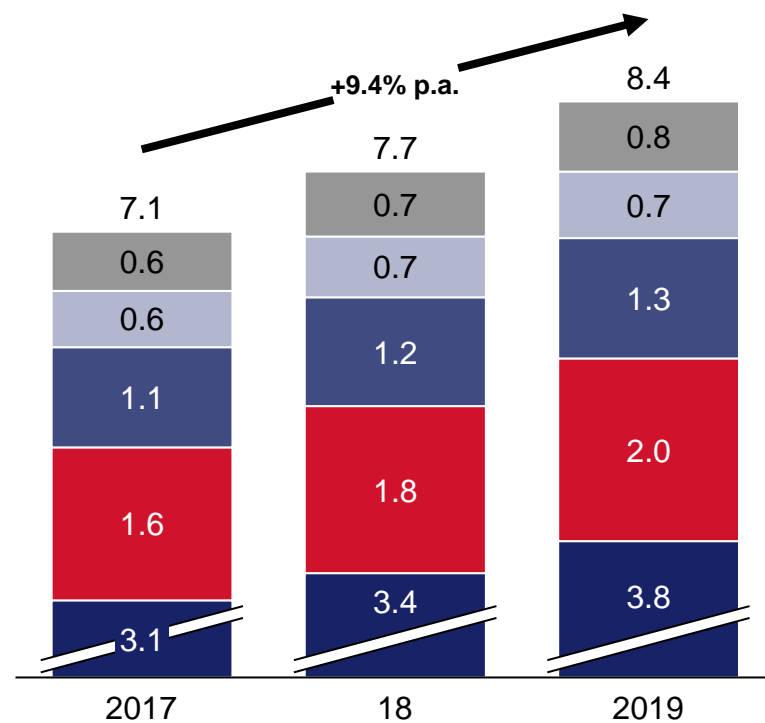
Appendix

- **Detailed assumptions used in the demand model**

A: Baseline modelled using historic annual market in value and average prices per PPE item by category post-Covid-19

ASSUMPTIONS

Historic annual market in value, \$bn



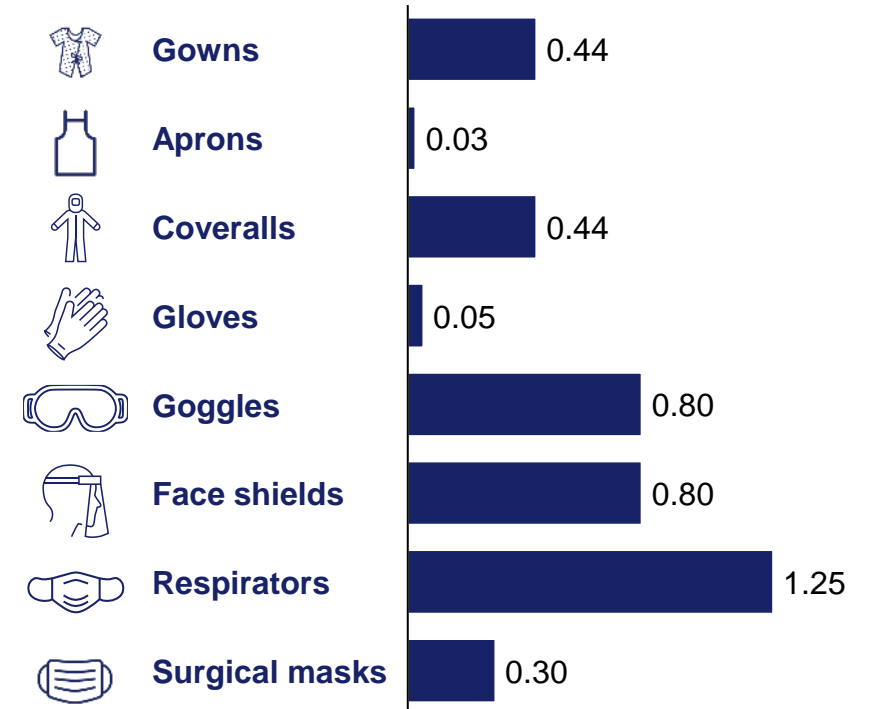
■ Other Products² ■ Masks
 ■ Aprons ■ Gloves
 ■ Suits or Coveralls

Global mask market; based on expert interviews we broke it down as follows:

- 60% respirators
- 40% surgical masks



Average prices per item in 2019, \$/unit¹




















1. Unit is per item or per pair in case of gloves
 2. Shoe cover and eye protection
 3. UK Department of Health & Social Care data on prices in 2019

For the purpose of this exercise, we used UK prices³ as an estimate of global prices but price variations can be observed at a country-level

B: Usage rates for different types of PPE estimated using WHO standards

Daily usage rate per item by healthcare workers and other staff

ASSUMPTIONS

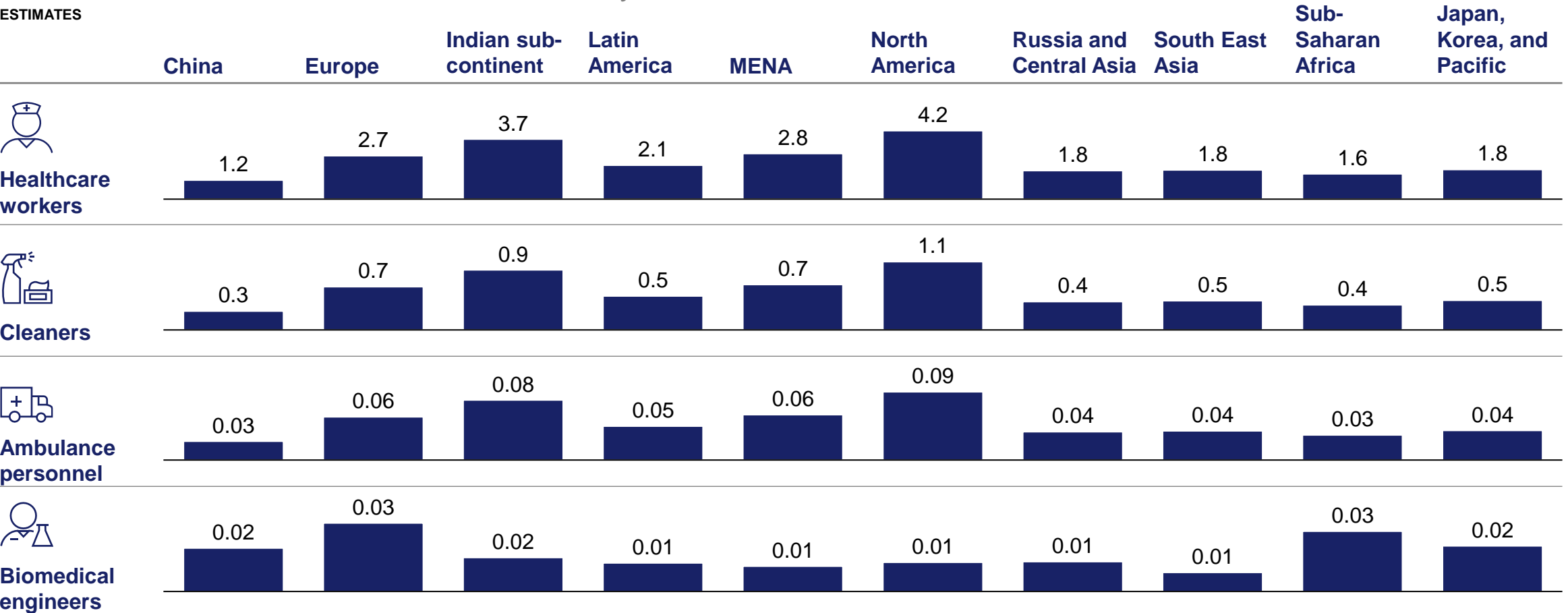
												
	Gowns	Aprons	Coveralls	Gloves	Goggles	Face shields	Respirators	Surgical masks	Chlorine HTH 70%	Hand sanitizer	Body bags	Clinical waste bags
 Healthcare workers	1.00	1.00	0	25.00	0.10	1.00	1.00	1.00	0	0.02	0	0.50
 Cleaners	1.00	0	0.05	0.10	0.10	1.00	0	4.00	0.03	0.02	0	0.50
 Ambulance personnel	1.00	0	0	4.00	0.10	0	0	4.00	0.03	0.02	0	0.50
 Biomedical engineers	1.00	0	0.05	4.00	0.10	0	0	4.00	0.03	0.02	0	0.50
 Patient	0	0	0	0	0	0	0	4.00	0	0	0.25	0

For the purpose of this exercise, we used global WHO standards but at a country-level exercise, these norms could be adjusted via local clinical data/local observations

B: Healthcare workers and other staff by bed and day reflect regional profiles

#Healthcare workers and other staff/bed/day

ESTIMATES



Methodology

- hospitalisation days are converted to number of healthcare workers using World Bank data on hospital beds and healthcare workers (HCW)by country
- Number of other workers is estimated based on WHO standards adjusted by a regional ratio $\frac{\text{WHO standards on \#HCW by bed}}{\text{Regional WB data on \#HCW by bed}}$

D: To model non-healthcare worker demand, different sources (each with limitations) have been used for each independent variable



High degree of uncertainty



Elements	Overall methodology	Main limitations	Sources
# workers by archetype	Segmentation of each region's workforce by type of job (physicality and level of social interaction)	Segmentation is based on overall economic activity but this data could be refined using country employment statistics	International Labour Organization
1 % back to work	Projection of return-to-work timeline indexed to the epidemiological curve	For the purpose of this exercise, we used a global percentage of workers physically back at work (across both geography and archetype)	Interviews with experts ¹ Survey of working professionals ²
2 Adoption rate by PPE by archetype (i.e., sections of the workforce that will use PPE)	Use of current US adoption rate to get an adoption rate baseline Conversion by region using a regional adjustment factor indexed to current surgical mask adoption rate Scale-down of adoption rate indexed to the epidemiological curve	For the purpose of this exercise, we used a regional assumption for the adoption rates but country-level adoption rates should be refined to fit local situation	
3 Usage rate by PPE (i.e., number of units per day)	Assumptions about usage rate by type of job	Usage rates are assumed to be standard for all regions but some discrepancies may exist between countries depending on usage habits	WHO recommendation Interviews with experts ¹ Survey of working professionals ²

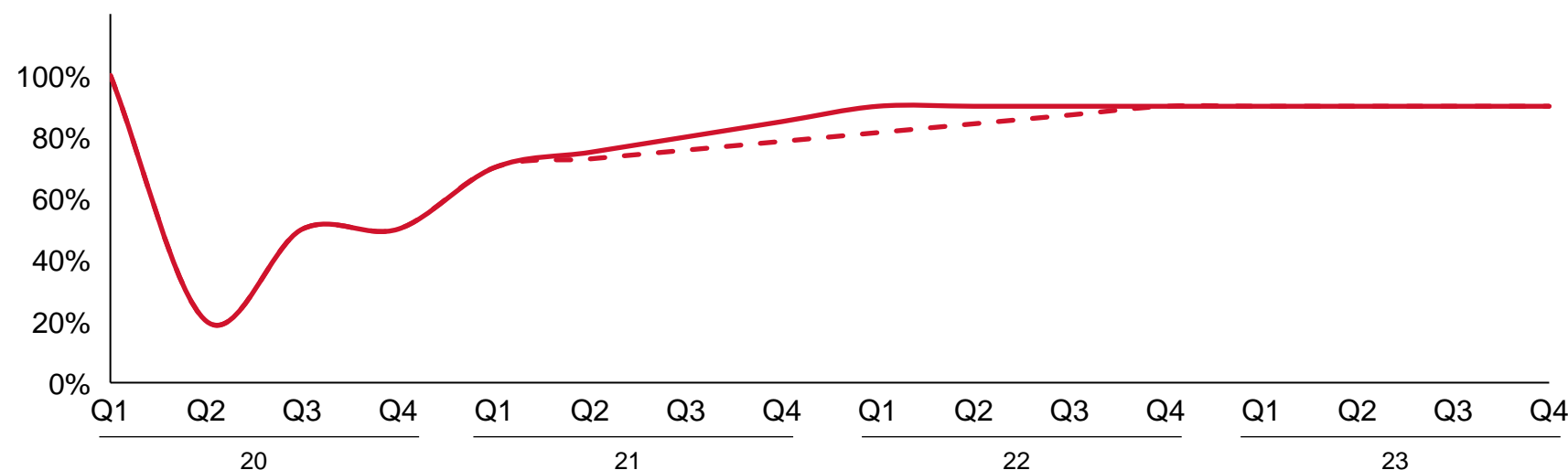
1.November-December 2020

2.Survey carried out in the US, 28 May – 3 June 2020; n=1,021

D1: The return-to-work timeline has been indexed to the epidemiological curve

ESTIMATES

Percentage of workers physically back at work



~20% of workers (i.e., essential workers) physically at work during Q2 2020 due to restrictive measures

Ramp-up of percentage of workers physically at work as Covid-19 immunity increases and hospitalisations decrease

Return to normal (90% of workers back at work) should vary depending by geographies driven by their vaccination timeline

Points to note




Percentage of workers physically back at work is assumed to be **consistent across all type of workers and geographies**

Return-to-work timeline is expected to vary **depending on the epidemiological curve**; 90% of workers should be physically back at work once herd immunity is achieved

D2: Adoption rates by archetype, PPE, and region (1/2)

Russia and Asia




ESTIMATES

		China			Indian subcontinent			Japan, Korea, and Pacific			Rest of South East Asia			Russia and Central Asia		
PPE category		Q2 2020	Current situation	New normal	Q2 2020	Current situation	New normal	Q2 2020	Current situation	New normal	Q2 2020	Current situation	New normal	Q2 2020	Current situation	New normal
 Archetype 1 High social interaction and high physicality	Respirators	4-6%	15-20%	~2%	4-5%	15-20%	0%	4-5%	14-19%	~1%	4-6%	15-20%	~2%	3-4%	13-18%	0%
	Surgical masks	14-17%	49-59%	5-6%	12-15%	50-60%	~1%	12-14%	48-57%	~3%	14-17%	50-60%	5-6%	11-13%	45-54%	~1%
	Gloves	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Hand sanitizer	14-17%	49-59%	5-6%	12-15%	50-60%	~1%	12-14%	48-57%	~3%	14-17%	50-60%	5-6%	11-13%	45-54%	~1%
	Face shields	26-28%	89-99%	9-10%	22-25%	90-100%	~2%	21-24%	86-95%	~5%	26-29%	91-101%	9-10%	20-22%	81-90%	~1%
 Archetype 2 High social interaction and low physicality	Respirators	3-4%	10-15%	1-2%	2-4%	10-15%	0%	2-4%	10-14%	~1%	3-4%	10-15%	1-2%	2-3%	9-13%	0%
	Surgical masks	0-1%	0-5%	0-1%	0-1%	0-5%	0%	0-1%	0-5%	0%	0-1%	0-5%	0-1%	0-1%	0-4%	0%
	Gloves	14-17%	49-59%	5-6%	12-15%	50-60%	~1%	12-14%	48-57%	~3%	14-17%	50-60%	5-6%	11-13%	45-54%	~1%
	Hand sanitizer	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Face shields	14-17%	49-59%	5-6%	12-15%	50-60%	~1%	12-14%	48-57%	~3%	14-17%	50-60%	5-6%	11-13%	45-54%	~1%
 Archetype 3 Low social interaction and low physicality	Respirators	26-28%	89-99%	9-10%	22-25%	90-100%	~2%	21-24%	86-95%	~5%	26-29%	91-101%	9-10%	20-22%	81-90%	~1%
	Surgical masks	1-3%	5-10%	~1%	1-2%	5-10%	0%	1-2%	5-10%	0-1%	1-3%	5-10%	~1%	1-2%	4-9%	0%
	Gloves	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Hand sanitizer	11-14%	39-49%	4-5%	10-12%	40-50%	~1%	10-12%	38-48%	2-3%	12-14%	40-50%	4-5%	9-11%	36-45%	0-1%
	Face shields	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

D2: Adoption rates by archetype, PPE, and region (2/2)

Europe, America, Africa, and Middle East

ESTIMATES

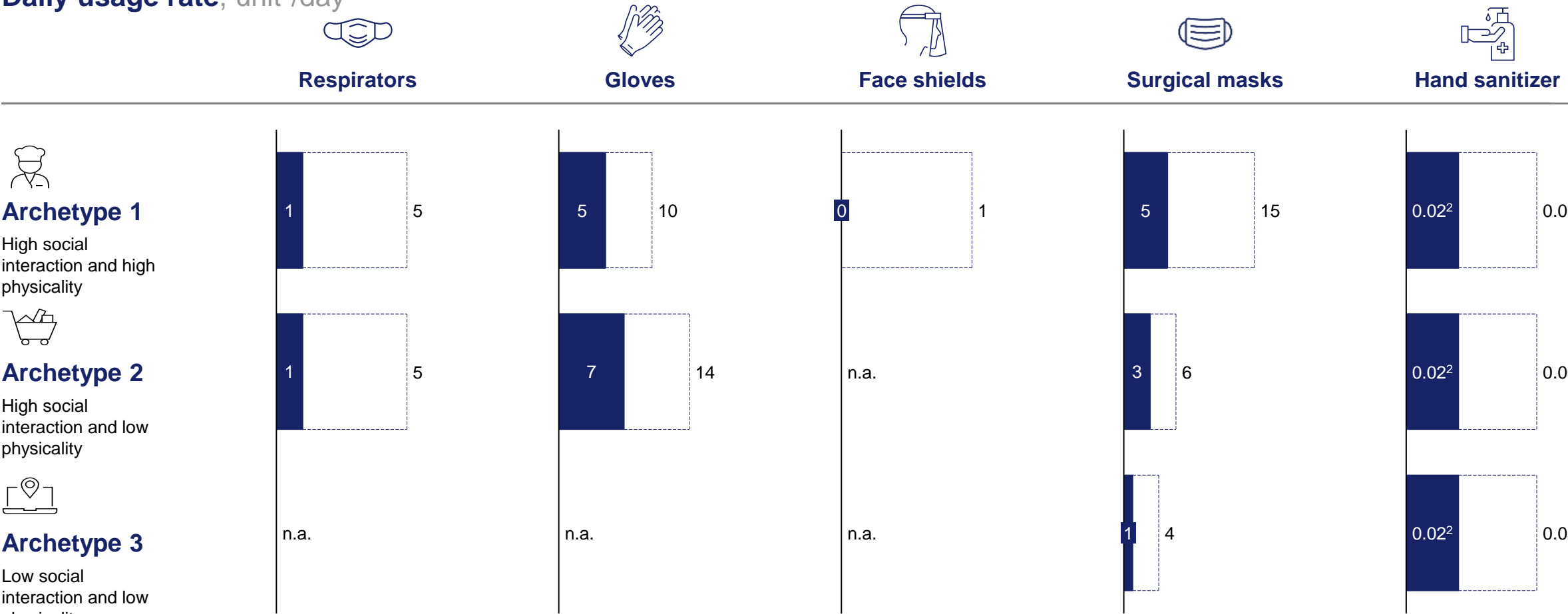
		Europe			North America			Latin America			Sub-Saharan Africa			Middle East and North Africa		
PPE category		Q2 2020	Current situation	New normal	Q2 2020	Current situation	New normal	Q2 2020	Current situation	New normal	Q2 2020	Current situation	New normal	Q2 2020	Current situation	New normal
 Archetype 1 High social interaction and high physicality	Respirators	3-4%	13-18%	0%	4-5%	15-20%	0%	3-4%	12-16%	0%	~1%	3-4%	0%	3-4%	13-17%	0%
	Surgical masks	11-13%	45-54%	~1%	13-15%	50-60%	~1%	10-12%	39-47%	~1%	~3%	10-12%	0%	11-13%	43-51%	~1%
	Gloves	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Hand sanitizer	11-13%	45-54%	~1%	13-15%	50-60%	~1%	10-12%	39-47%	~1%	~3%	10-12%	0%	11-13%	43-51%	~1%
	Face shields	20-22%	81-90%	~2%	23-25%	90-100%	~2%	18-20%	71-79%	~1%	~5%	18-20%	0%	19-21%	77-85%	~1%
 Archetype 2 High social interaction and low physicality	Respirators	2-3%	9-13%	0%	3-4%	10-15%	0%	2-3%	8-12%	0%	~1%	2-3%	0%	2-3%	9-13%	0%
	Surgical masks	0-1%	0-4%	0%	0-1%	0-5%	0%	0-1%	0-4%	0%	0%	0-1%	0%	0-1%	0-4%	0%
	Gloves	11-13%	45-54%	~1%	13-15%	50-60%	~1%	10-12%	39-47%	~1%	~3%	10-12%	0%	11-13%	43-51%	~1%
	Hand sanitizer	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Face shields	11-13%	45-54%	~1%	13-15%	50-60%	~1%	10-12%	39-47%	~1%	~3%	10-12%	0%	11-13%	43-51%	~1%
 Archetype 3 Low social interaction and low physicality	Respirators	20-22%	81-90%	~2%	23-25%	90-100%	~2%	18-20%	71-79%	~1%	~5%	18-20%	0%	19-21%	77-85%	~1%
	Surgical masks	1-2%	4-9%	0%	1-3%	5-10%	0%	1-2%	4-8%	0%	0-1%	1-2%	0%	1-2%	4-9%	0%
	Gloves	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Hand sanitizer	9-11%	36-45%	~1%	10-13%	40-50%	~1%	8-10%	31-39%	0-1%	2-3%	8-10%	0%	9-11%	34-43%	0-1%
	Face shields	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

D3: Usage rates by archetype and PPE category are assumed to be consistent across regions

ESTIMATES

Daily usage rate, unit¹/day

Low
High



1. Unit is per item or per pair in case of gloves, and is per liter for hand sanitizer
2. Corresponds to 2 frictions per day
3. Corresponds to 4 frictions per day

E: To model consumer demand, different sources (some with limitations) have been used for each independent variable



High degree of uncertainty



Elements	Overall methodology	Main limitations	Sources
1 # population by age range	Segmentation of each region's population by age group	n.a.	UN Population Division
2 Adoption rate of PPE by age range (i.e., proportion of the population that will use PPE)	Use of current US adoption rate to get an adoption rate baseline Conversion by region using a regional adjustment factor indexed on current surgical mask adoption rate Scale-down of adoption rate indexed on the epidemiological curve	For the purpose of this exercise, we used a regional assumption for the adoption rates but country-level adoption rates should be refined to fit local situation	YouGov Interviews with experts ¹ Survey of general public ²
3 Usage rate by PPE (i.e., number of units per day)	Assumption on usage rate by age group	Usage rate is assumed to be standard for all regions but some discrepancies may exist between countries depending on usage habits	WHO recommendation Interviews with experts ¹ Survey of general public ²

1.November-December 2020

2.Survey held in the US, 28 May-3 June 2020; n=1,021




E: Initial assumptions on adoption rates by age range, PPE and region

(1/2) – Updated March 2021 with 2 additional scenarios

Russia and Asia

ASSUMPTIONS AS OF DECEMBER 2020

ESTIMATES

		China				Indian Subcontinent				Japan, Korea, and Pacific				Rest of South East Asia				Russia and Central Asia			
PPE category		Q2 2020	Current situation	New normal – S0&S1	New normal – S2	Q2 2020	Current situation	New normal	New normal – S2	Q2 2020	Current situation	New normal	New normal – S2	Q2 2020	Current situation	New normal	New normal – S2	Q2 2020	Current situation	New normal	New normal – S2
 15-19	Respirators	0-1%	0-5%	0-1%	0-1%	0-1%	0-5%	0%	0%	0-1%	0-5%	0%	0-1%	0-1%	0-5%	0-1%	0-1%	0-1%	0-4%	0%	0%
	Surgical masks	11-14%	39-49%	4-5%	8-10%	10-12%	40-50%	~1%	~2%	10-12%	38-48%	2-3%	4-5%	12-14%	40-50%	4-5%	8-10%	9-11%	36-45%	0-1%	~1%
	Cloth masks	11-14%	39-49%	4-5%	8-10%	10-12%	40-50%	~1%	~2%	10-12%	38-48%	2-3%	4-5%	12-14%	40-50%	4-5%	8-10%	9-11%	36-45%	0-1%	~1%
	Gloves	0-1%	0-5%	0-1%	0-1%	0-1%	0-5%	0%	0%	0-1%	0-5%	0%	0-1%	0-1%	0-5%	0-1%	0-1%	0-1%	0-4%	0%	0%
	Hand sanitizer	17-23%	59-79%	6-8%	12-16%	15-20%	60-80%	1-2%	2-3%	14-19%	57-76%	3-4%	6-8%	17-23%	60-81%	6-8%	12-16%	13-18%	54-72%	~1%	1-2%
 20-65	Respirators	1-3%	5-10%	~1%	1-2%	1-2%	5-10%	0%	0%	1-2%	5-10%	0-1%	~1%	1-3%	5-10%	~1%	1-2%	1-2%	4-9%	0%	0%
	Surgical masks	9-11%	30-39%	3-4%	6-8%	7-10%	30-40%	~1%	1-2%	7-10%	29-38%	~2%	3-4%	9-12%	30-40%	3-4%	6-8%	7-9%	27-36%	0%	~1%
	Cloth masks	9-11%	30-39%	3-4%	6-8%	7-10%	30-40%	~1%	1-2%	7-10%	29-38%	~2%	3-4%	9-12%	30-40%	3-4%	6-8%	7-9%	27-36%	0%	~1%
	Gloves	0-3%	0-10%	0-1%	0-2%	0-2%	0-10%	0%	0%	0-2%	0-10%	0-1%	0-1%	0-3%	0-10%	0-1%	0-2%	0-2%	0-9%	0%	0%
	Hand sanitizer	10-14%	35-49%	4-5%	7-10%	9-12%	35-50%	~1%	1-2%	8-12%	33-48%	2-3%	4-5%	10-14%	35-50%	4-5%	7-10%	8-11%	31-45%	0-1%	~1%
 Over 65	Respirators	0-1%	0-5%	0-1%	0-1%	0-1%	0-5%	0%	0%	0-1%	0-5%	0%	0-1%	0-1%	0-5%	0-1%	0-1%	0-1%	0-4%	0%	0%
	Surgical masks	7-11%	25-39%	3-4%	5-8%	6-10%	25-40%	~1%	1-2%	6-10%	24-38%	1-2%	3-4%	7-12%	25-40%	3-4%	5-8%	6-9%	22-36%	0%	~1%
	Cloth masks	7-11%	25-39%	3-4%	5-8%	6-10%	25-40%	~1%	1-2%	6-10%	24-38%	1-2%	3-4%	7-12%	25-40%	3-4%	5-8%	6-9%	22-36%	0%	~1%
	Gloves	0-3%	0-10%	0-1%	0-2%	0-2%	0-10%	0%	0%	0-2%	0-10%	0-1%	0-1%	0-3%	0-10%	0-1%	0-2%	0-2%	0-9%	0%	0%
	Hand sanitizer	14-20%	49-69%	5-7%	10-14%	12-17%	50-70%	~1%	2-3%	12-17%	48-67%	3-4%	5-7%	14-20%	50-71%	5-7%	10-14%	11-16%	45-63%	~1%	~1%




E: Initial assumptions on adoption rates by age range, PPE and region

(2/2) – Updated March 2021 with 2 additional scenarios

Europe, America, Africa, and Middle East

ASSUMPTIONS AS OF DECEMBER 2020

ESTIMATES

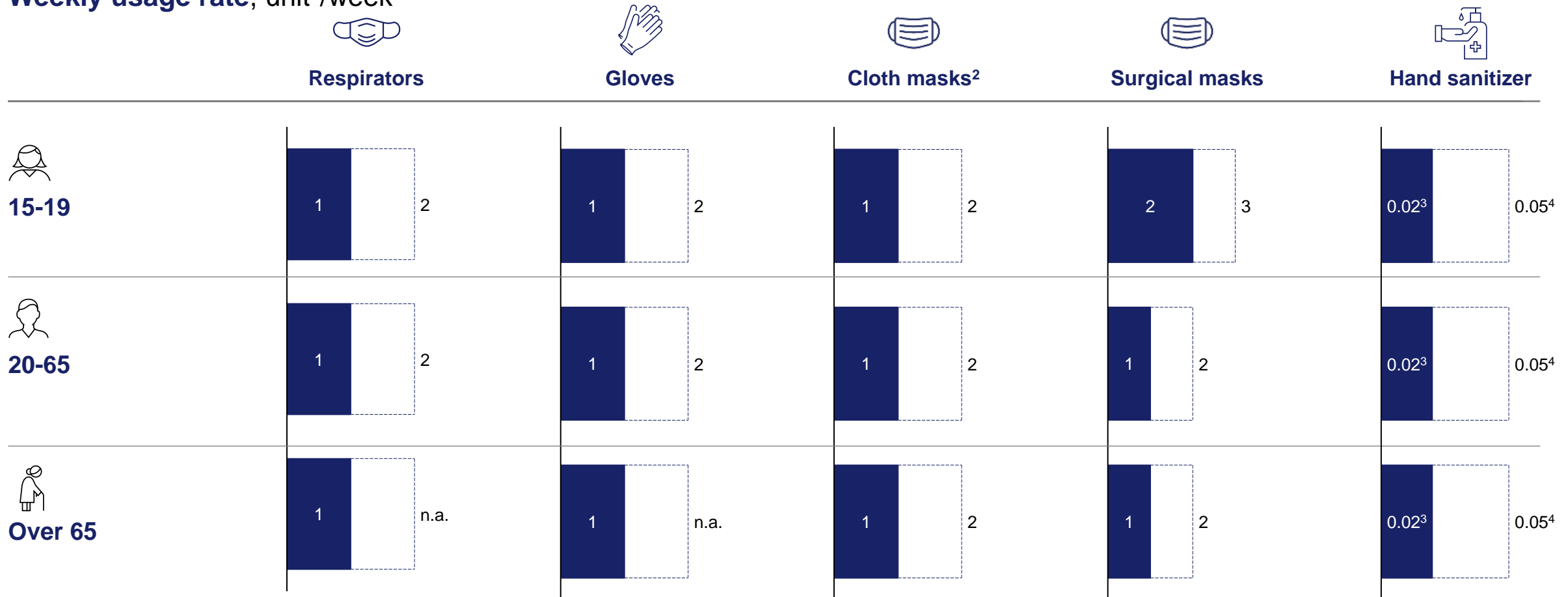
		Europe				North America				Latin America				Sub-Saharan Africa				Middle East and North Africa			
				New normal – S0&S1	New normal – S2			New normal	New normal – S2			New normal	New normal – S2			New normal	New normal – S2			New normal	New normal – S2
PPE category		Q2 2020	Current situation			Q2 2020	Current situation			Q2 2020	Current situation			Q2 2020	Current situation			Q2 2020	Current situation		
 15-19	Respirators	0-1%	0-4%	0%	0%	0-1%	0-5%	0%	0%	0-1%	0-4%	0%	0%	0-0%	0-1%	0%	0%	0-1%	0-4%	0%	0-1%
	Surgical masks	9-11%	36-45%	~1%	~2%	10-13%	40-50%	~1%	~2%	8-10%	31-39%	0-1%	~1%	2-3%	8-10%	0%	0%	9-11%	34-43%	~1%	8-10%
	Cloth masks	9-11%	36-45%	~1%	~2%	10-13%	40-50%	~1%	~2%	8-10%	31-39%	0-1%	~1%	2-3%	8-10%	0%	0%	9-11%	34-43%	~1%	8-10%
	Gloves	0-1%	0-4%	0%	0%	0-1%	0-5%	0%	0%	0-1%	0-4%	0%	0%	0-0%	0-1%	0%	0%	0-1%	0-4%	0%	0-1%
	Hand sanitizer	13-18%	54-72%	1-2%	2-3%	15-20%	60-80%	1-2%	2-3%	12-16%	47-63%	~1%	1-2%	3-4%	12-16%	0%	0%	13-17%	51-68%	1-2%	12-16%
 20-65	Respirators	1-2%	4-9%	0%	0%	1-3%	5-10%	0%	0%	1-2%	4-8%	0%	0%	0-1%	1-2%	0%	0%	1-2%	4-9%	0%	1-2%
	Surgical masks	7-9%	27-36%	~1%	1-2%	8-10%	30-40%	~1%	1-2%	6-8%	24-31%	0%	~1%	~2%	6-8%	0%	0%	6-9%	26-34%	~1%	6-8%
	Cloth masks	7-9%	27-36%	~1%	1-2%	8-10%	30-40%	~1%	1-2%	6-8%	24-31%	0%	~1%	~2%	6-8%	0%	0%	6-9%	26-34%	~1%	6-8%
	Gloves	0-2%	0-9%	0%	0%	0-3%	0-10%	0%	0%	0-2%	0-8%	0%	0%	0-1%	0-2%	0%	0%	0-2%	0-9%	0%	0-2%
	Hand sanitizer	8-11%	31-45%	~1%	1-2%	9-13%	35-50%	~1%	1-2%	7-10%	28-39%	0-1%	~1%	2-3%	7-10%	0%	0%	7-11%	30-43%	~1%	7-10%
 Over 65	Respirators	0-1%	0-4%	0%	0%	0-1%	0-5%	0%	0%	0-1%	0-4%	0%	0%	0-0%	0-1%	0%	0%	0-1%	0-4%	0%	0-1%
	Surgical masks	6-9%	22-36%	~1%	1-2%	6-10%	25-40%	~1%	1-2%	5-8%	20-31%	0%	~1%	1-2%	5-8%	0%	0%	5-9%	21-34%	~1%	5-8%
	Cloth masks	6-9%	22-36%	~1%	1-2%	6-10%	25-40%	~1%	1-2%	5-8%	20-31%	0%	~1%	1-2%	5-8%	0%	0%	5-9%	21-34%	~1%	5-8%
	Gloves	0-2%	0-9%	0%	0%	0-3%	0-10%	0%	0%	0-2%	0-8%	0%	0%	0-1%	0-2%	0%	0%	0-2%	0-9%	0%	0-2%
	Hand sanitizer	11-16%	45-63%	~1%	2-3%	13-18%	50-70%	~1%	2-3%	10-14%	39-55%	~1%	~1%	3-4%	10-14%	0%	0%	11-15%	43-60%	~1%	10-14%

E: Usage rates by age group and PPE category are assumed to be consistent across regions

ESTIMATES

Weekly usage rate, unit¹/week

■ Low
□ High



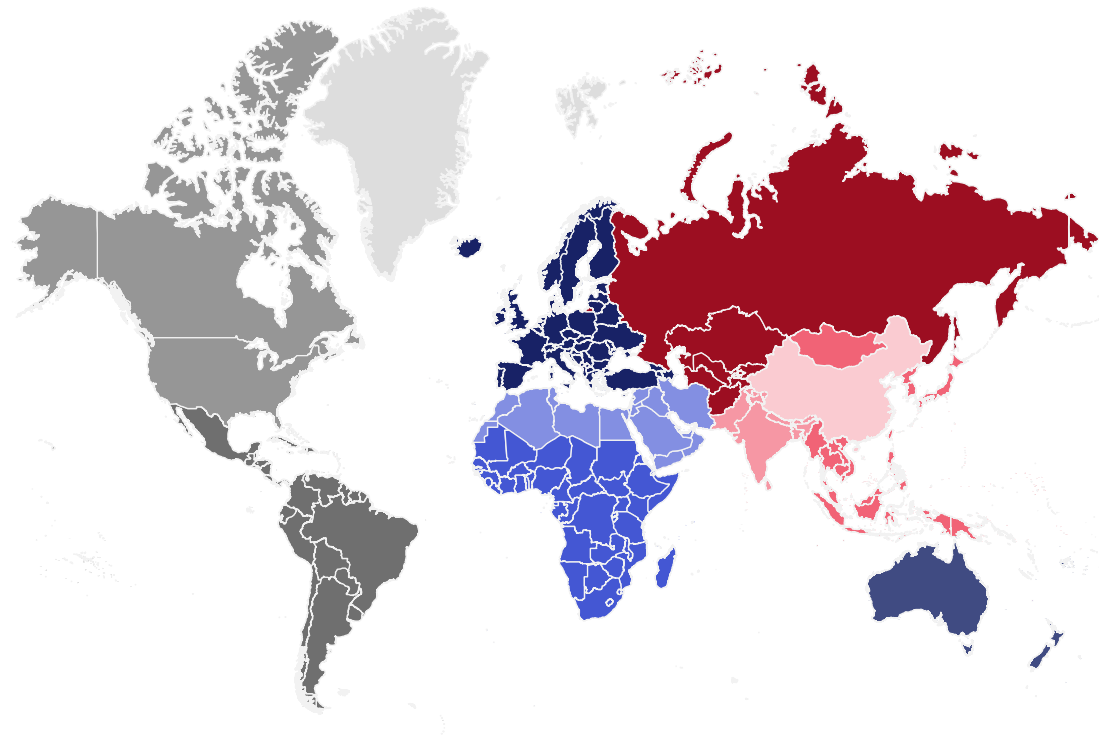
1. Unit is per item or per pair in case of gloves, and is per liter for hand sanitizer

2. Usage rate per month

3. Corresponds to 2 frictions per day

4. Corresponds to 4 frictions per day

Geographical scope



Europe

Albania
Andorra
Armenia
Austria
Azerbaijan
Belarus
Belgium
Bosnia and Herzegovina
Bulgaria
Channel Islands
Croatia
Cyprus
Czech Republic
Denmark
Estonia
Faroe Islands
Finland
France
Georgia
Germany
Gibraltar
Greece
Greenland
Hungary
Iceland
Ireland
Isle of Man
Italy
Kosovo
Latvia
Liechtenstein
Lithuania
Luxembourg
Malta
Moldova
Monaco
Montenegro
Netherlands
North Macedonia
Norway
Poland
Portugal
Romania
San Marino
Serbia
Slovak Republic
Slovenia
Spain
Sweden
Switzerland
Turkey
Ukraine
United Kingdom

China

China
Hong Kong SAR, China
Macao SAR, China

Indian sub-continent

Bangladesh
Bhutan
India
Maldives
Nepal
Pakistan
Sri Lanka

South East & Far East Asia

Brunei Darussalam
Cambodia
Indonesia
Korea, Dem. People's Rep.
Lao PDR
Malaysia
Mongolia
Myanmar
Philippines
Singapore
Thailand
Timor-Leste
Vietnam

Russia & Central Asia

Afghanistan
Kazakhstan
Kyrgyz Republic
Russian Federation
Tajikistan
Turkmenistan
Uzbekistan

North America

Bermuda
Canada
United States

Latin America & Caribbean

Antigua and Barbuda
Argentina
Aruba
Bahamas, The
Barbados
Belize
Bolivia
Brazil
British Virgin Islands
Cayman Islands
Chile
Colombia
Costa Rica
Cuba
Curacao
Dominica
Dominican Republic
Ecuador
El Salvador
Grenada
Guatemala
Guyana
Haiti
Honduras
Jamaica
Mexico
Nicaragua
Panama
Paraguay
Peru
Puerto Rico
Sint Maarten (Dutch part)
St. Kitts and Nevis
St. Lucia
St. Martin (French part)
St. Vincent and the Grenadines
Suriname
Trinidad and Tobago
Turks and Caicos Islands
Uruguay
Venezuela, RB
Virgin Island (U.S.)

Sub-Saharan Africa

Angola
Burundi
Benin
Burkina Faso
Botswana
Central African Republic
Cote d'Ivoire
Cameroon
Congo, Dem. Rep.
Congo, Rep.
Comoros
Cabo Verde
Eritrea
Ethiopia
Gabon
Ghana
Guinea
Gambia, The
Guinea-Bissau
Equatorial Guinea
Kenya
Liberia
Lesotho
Madagascar
Mali
Mozambique
Mauritania
Mauritius
Malawi
Namibia
Niger
Nigeria
Rwanda
Sudan
Senegal
Sierra Leone
Somalia
South Sudan
Sao Tome and Principe
Eswatini
Seychelles
Chad
Togo
Tanzania
Uganda
South Africa
Zambia
Zimbabwe

Middle East & North Africa

Algeria
Bahrain
Djibouti
Egypt, Arab Rep.
Iran, Islamic Rep.
Iraq
Israel
Jordan
Kuwait
Lebanon
Libya
Morocco
Oman
Qatar
Saudi Arabia
Syrian Arab Republic
Tunisia
United Arab Emirates
West Bank and Gaza

Japan, Korea, and the Pacific

American Samoa
Australia
Fiji
French Polynesia
Japan
Guam
Kiribati
Korea, Rep.
Marshall Islands
Micronesia
Nauru
New Caledonia
New Zealand
Northern Mariana Islands
Palau
Papua New Guinea
Samoa
Solomon Islands
Tonga
Tuvalu
Vanuatu

