

COVID-19 BCG Perspectives Series

Facts, scenarios, and actions for leaders

Vaccines & Therapeutics Outlook Part I: Timelines and Success Factors

26 August 2020

COVID-19 BCG Perspectives

Objectives of this document

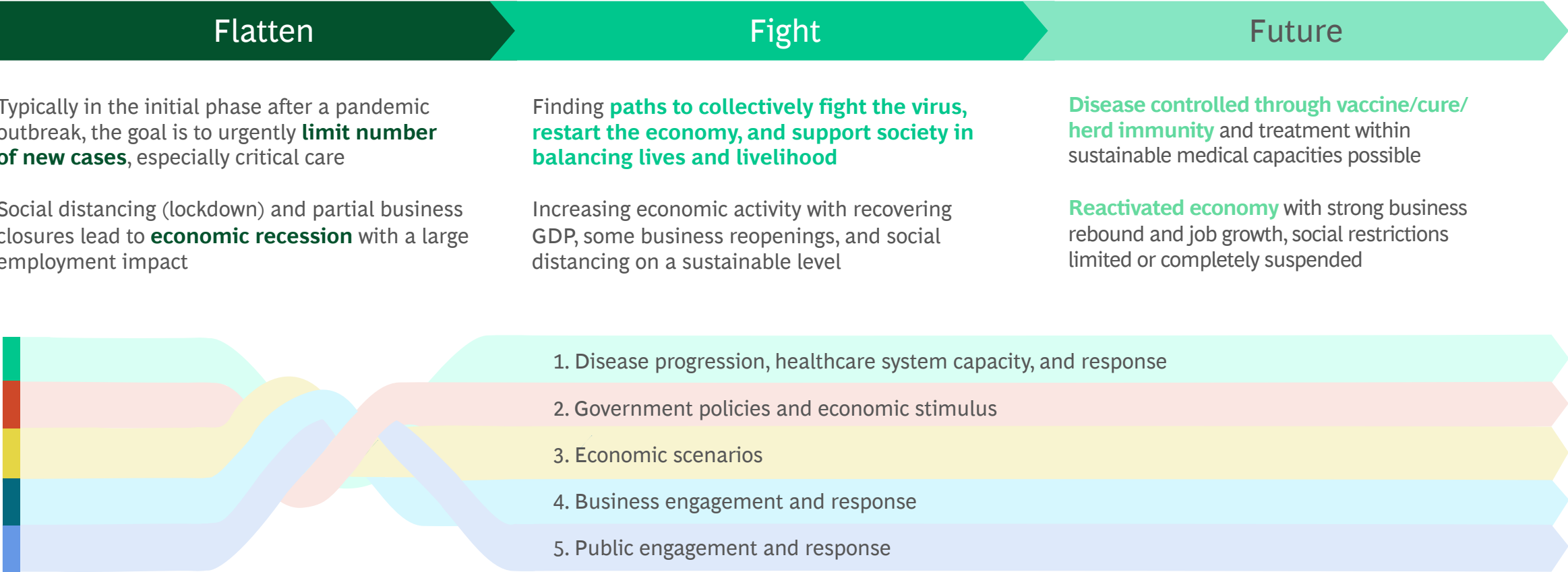
COVID-19 is a global societal crisis

We at BCG believe that the COVID-19 outbreak is first and foremost a societal crisis, threatening lives and the well-being of our global community. Society now, more than ever, needs to collaborate to protect people's lives and health, manage mid-term implications, and search for lasting solutions.

Leaders need to drive an integrated response to navigate the crisis

It is the duty of health, political, societal, and business leaders to navigate through this crisis. A complex interplay of epidemic progression, medical response, government action, sector impact, and company action is playing out. This document intends to help leaders find answers and shape opinions to navigate the crisis in their own environments. It encourages thinking across the multiple time horizons over which we see the crisis manifesting itself.

The COVID-19 recovery will be driven by disease progression, de-averaged economic impact, government policies, and business and public responses



All of the above five factors result in specific economic and social outcomes in each phase

Summary snapshot | Restart progression at a glance

As of 21 August 2020

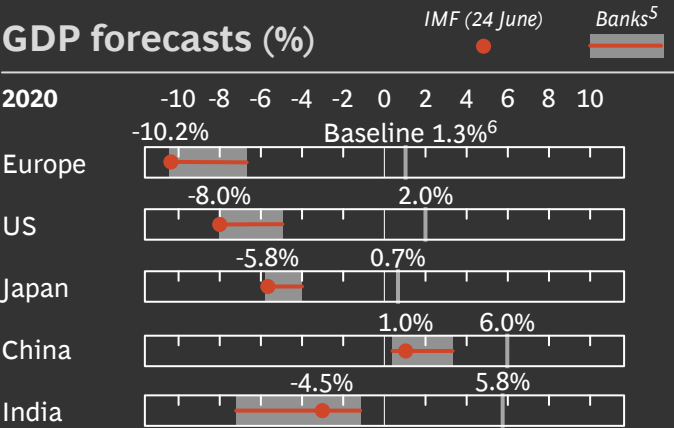
Epidemic Progression

Global epidemic snapshot

23.0M		255K		7.4M		799K	
# of cases		# of daily cases ¹		# of active cases		# of fatalities	
			May	June	July	Aug ⁴	
Month-on-month growth of new cases ²	Americas		1.4x	1.6x	1.7x	1.0x	
	Europe		0.7x	0.8x	1.0x	1.5x	
	Asia ³		1.7x	2.0x	1.7x	1.4x	

Economic Impact

GDP forecasts (%)



Consumer Activity

Mobility

		May	June	July
Mobility ⁷ (month vs. Jan '20)	US	-27%	-19%	-19%
	Europe	-42%	-25%	-17%
	Japan	-26%	-13%	-13%
Domestic air travel tickets booking ⁸ (YoY)	US	-82%	-69%	-76%
	UK	-92%	-88%	-86%
	China	-37%	-45%	-26%

Sales

Retail goods sales ⁹ (excl. auto & fuel, YoY)	US	3%	8%	9%
	UK	-11%	1%	N/A
	China	-1%	2%	-2%
Passenger vehicle sales ¹⁰ (YoY)	US	-40%	-38%	-19%
	Europe	-59%	-25%	-19%
	China	7%	2%	9%
Hotel occupancy ¹¹ (YoY)	US	-52%	-43%	-36%
	Europe	-82%	-73%	-66%
	China	-34%	N/A	-19%

Business Impact

Stock market performance

Month end vs. 02 Jan '20	May	June	July
S&P500	-7%	-5%	0%
FTSE100	-20%	-19%	-22%
CHN SSE	-8%	-3%	7%
Volatility Index (S&P500) ¹²	2.2x	2.4x	2.0x

International trade

Trade value ¹³ (YoY)	US	-28%	-20%	N/A
	UK	-25%	-14%	N/A
	China	-9%	1%	3%

Industrial production

Purchasing Manager's index ¹⁴ (base = 50)	US	40	50	51
	EU	40	48	52
	China	51	51	51
Steel production (YoY) ¹⁵		-9%	-7%	N/A

1. Calculated as seven day rolling average; 2. Calculated as monthly average of daily cases as compared to previous month; 3. Includes Middle East and Oceania; 4. As of 21 August 2020; 5. For India, forecast is for financial year; for others, it is for calendar year; YoY forecasts; range from forecasts (where available) of World Bank, International Monetary Fund, JP Morgan Chase; Goldman Sachs; Morgan Stanley; Bank of America; Fitch Solutions; Credit Suisse; Danske Bank; ING Group; HSBC; As of reports dated 12 April 2020 to 20 Aug 2020; 6. IMF Jan 2020 forecast; 7. Mobility values are calculated as the average of mean monthly mobilities in workplace, public transit and retail & recreation and compared to a baseline from 03 Jan – 06 Feb 2020; Europe mobility values are calculated as the average of Germany, France, UK, Spain, and Italy; 8. Calculated as change in last 14 days rolling average value as compared to same period last year; 9. Retail goods sales includes online & offline sales and comprise food & beverages, apparel, cosmetics & personal care, home appliances, general merchandise, building material; does not include auto, fuel & food services; 10. Figures represent passenger vehicle (cars including sedan, hatchback, SUV, MPV, van and pickup) sales data for 2020 over same month in 2019; Europe value calculated as cumulative sales in Germany, France, UK, Spain, and Italy; 11. Calculated as average occupancy rates compared to same month of previous year; 12. Underlying data is from Chicago Board Options Exchange Volatility Index (VIX); Volatility Index is a real-time market index that represents the market's expectation of 30-day forward-looking volatility and provides a measure of market risk and investors' sentiments; 13. Calculated as sum of imports and exports, measured in USD and compared to previous year period; 14. PMI (Purchasing Manager's Index) is a diffusion index that summarizes whether market conditions, as viewed by purchasing managers, are expanding (>50), staying the same (50), or contracting (<50); 15. Data corresponds to G-20 countries (minus Indonesia). Sources: JHU CSSE; Our World in Data; WHO; World Bank; IMF; Bloomberg; Google Mobility; US Census Bureau; Eurostat; PRC National Bureau of Statistics; ACEA actuals; Wards Automotive; just auto; Marklines; China Assoc. of Automobile Manufact. (CAAM); ARC ticketing data; STR; Statista; CBOE; OECD; BCG

Executive Summary | COVID-19 BCG Perspectives

Vaccines and therapeutics are key to containing the virus; unprecedented response globally on scale and speed of R&D efforts

- Early signs of slowing global case growth visible in August 2020; however some countries experiencing substantial resurgence
- Current developments for a COVID-19 vaccine moving at turbo-charged pace; 12-18 month timeline¹ unprecedented when compared to traditional paradigms
- 6 vaccine candidates already in Phase III; some may start getting emergency use authorizations starting in Q4 2020², however subject to safety/efficacy profiles
- Current best case scenario points to start of broad distribution in Q2 2021, but subject to pre-conditions like regulatory approvals, manufacturing & distr. scale-up
- 4 key therapeutic candidates already under emergency authorization in select countries³; however safety, efficacy and broad clinical trials key to further approvals
- Multiple scenarios possible based on vaccine/therapeutic characteristics, supply chains and societal response; leaders need to prepare requisite action agenda

Severe global economic downturn expected for 2020; some green shoots on recovery visible

- Economic forecasts indicate a rebound to 2019 GDP levels only by end of 2021 for most leading economies
- Unemployment numbers for top economies declining or flattening out; in US, temporary jobs coming back, permanent job losses flattening
- Retail and recreation mobility recovered fastest; lower recovery rate of workplace mobility indicates continued adoption of work from home
- Business activity across many sectors has recovered to previous year levels; transportation & logistics, and energy among the few that continue to be hit
- 5 (out of 24) sectors⁴ are currently above pre-crisis TSR⁵ levels; 6 sectors have a significant share⁵ of companies with >15% default risk

We believe during this crisis leaders need to think along two dimensions:

Taking an integrated perspective on health/medical progression, governmental responses, societal reactions, and economic implications to understand business/sector impacts

Thinking multi-timescale in a Flatten-Fight-Future logic

1. From exploratory / pre-clinical trials to phased approvals, and assumes no significant R&D challenges; 2. Initial data observed in the early stages of phase 3 trials may lead to restricted approvals starting in Q4 2020; 3. EUA for Remdesivir in the US, Japan, Australia (non-exhaustive), Convalescent plasma therapy in the US (non-exhaustive); Dexamethasone in UK, Japan (non-exhaustive); Favipiravir in India, Russia, China (non-exhaustive); 4. Semiconductors, Retailing, Pharma, Foods/ staples retail and Household products; 4. TSR: Total Shareholder Return; 5. Retailing, Auto, Transport, Hospitality, Real estate and Energy are sectors with > 10% of companies with probability of default > 15%

Questions on every public and business leader's mind right now

Non-exhaustive

1 When and what will a safe and effective COVID-19 vaccine/ therapeutic look like?

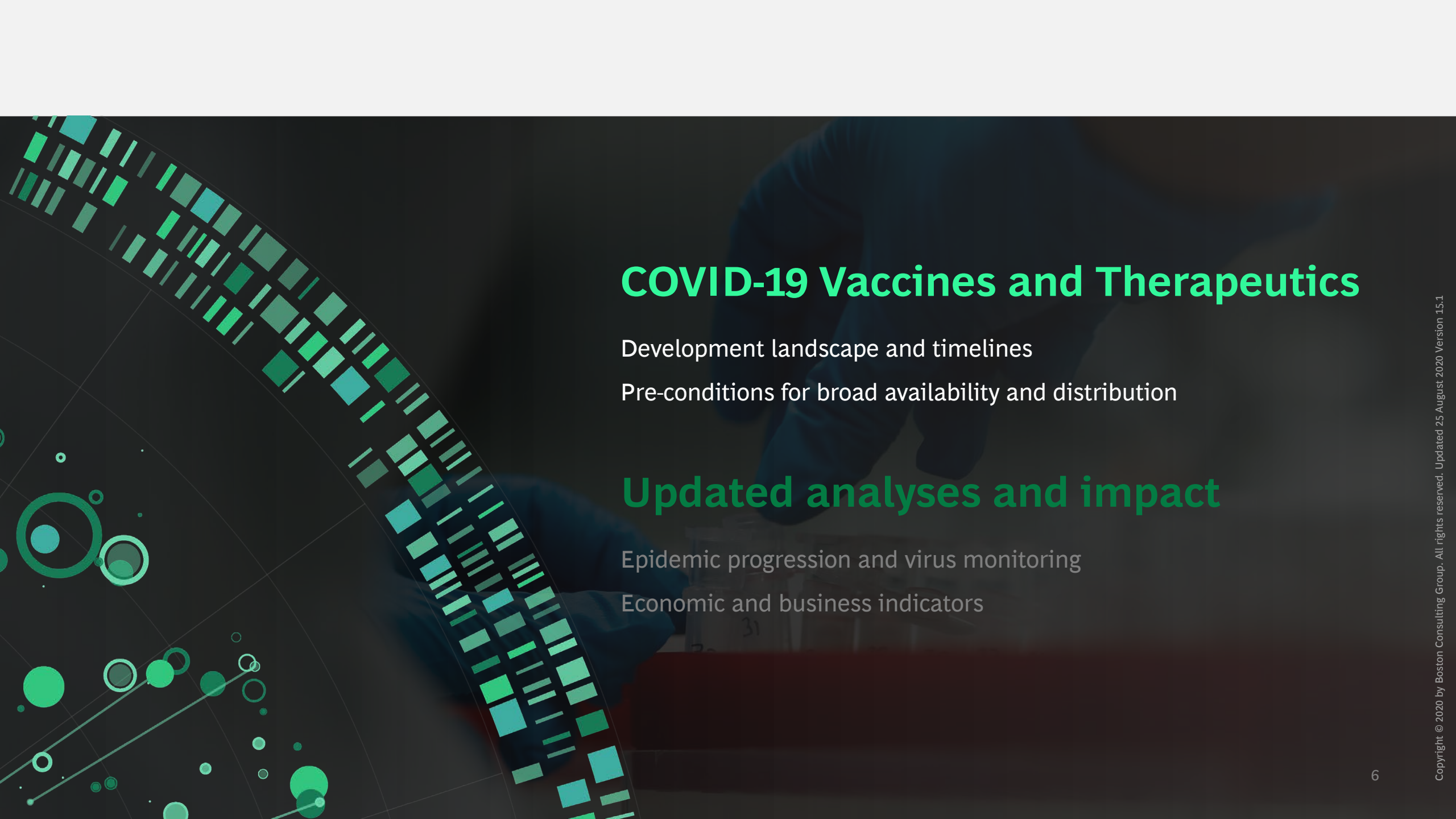
- What is the current development landscape across leading COVID-19 pharmaceutical countermeasures (vaccines & therapeutics)?
- What factors will drive early authorizations and subsequent approvals?
- When will a vaccine likely be widely available?
- Will vaccine efficacy and safety outcomes impact vaccine adoption patterns and healthcare response priorities?
- What are the pre-conditions to ensure broad availability & distribution?

Focus for the current edition

2 What choices and implications emerge for public and business leaders?

- What are the likely scenarios that emerge across vaccine characteristics and adoption behaviors?
- What are the choices (and implications) individuals will have to make given considerations around safety, efficacy and duration of immunity of vaccines and therapeutics?
- How should public leaders think about communication strategies and ensuring equitable access across scenarios?
- How should business leaders think about safeguarding their employees and planning for a potentially tumultuous 2021?

Focus for the next edition



COVID-19 Vaccines and Therapeutics

Development landscape and timelines

Pre-conditions for broad availability and distribution

Updated analyses and impact

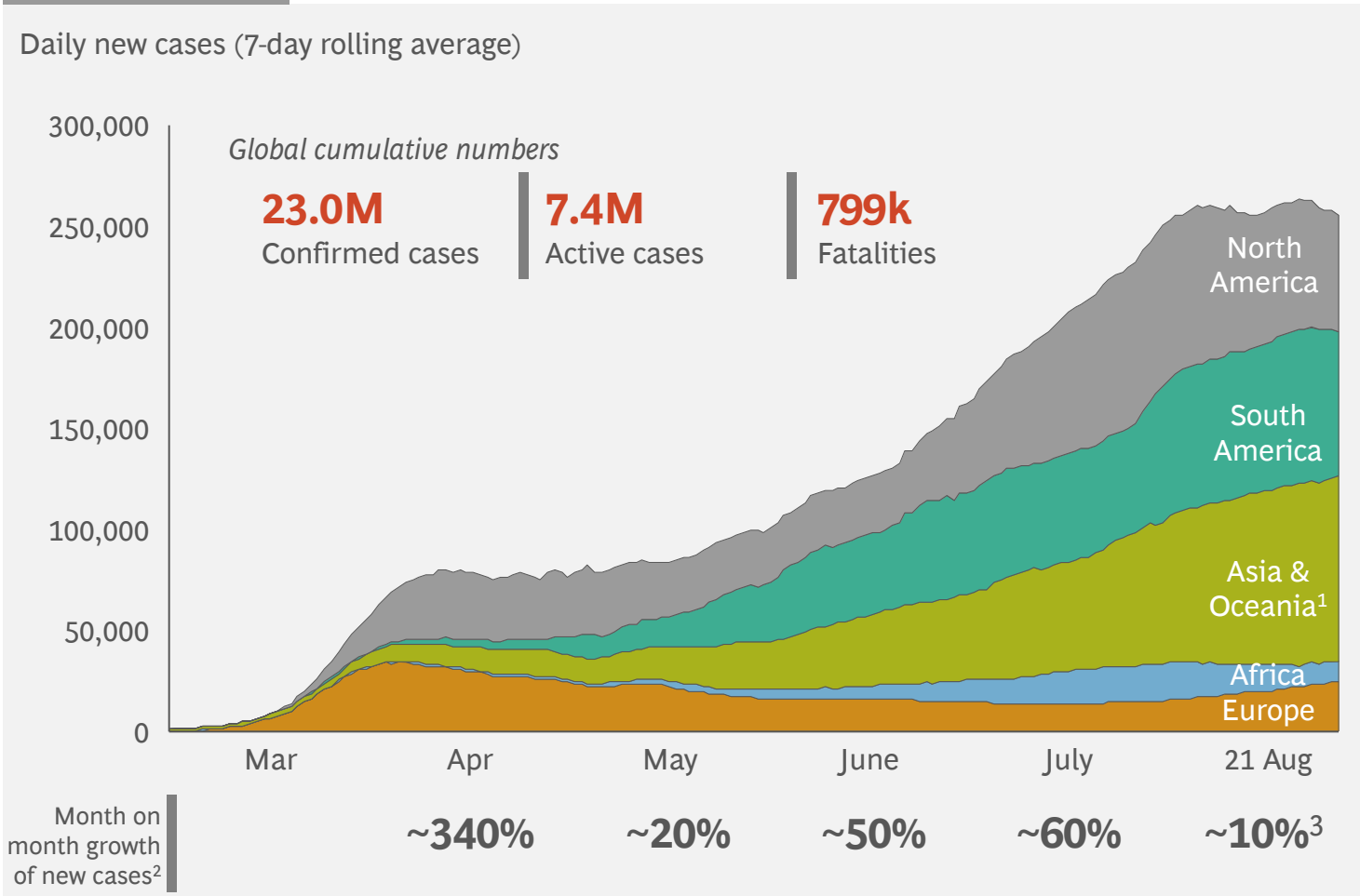
Epidemic progression and virus monitoring

Economic and business indicators

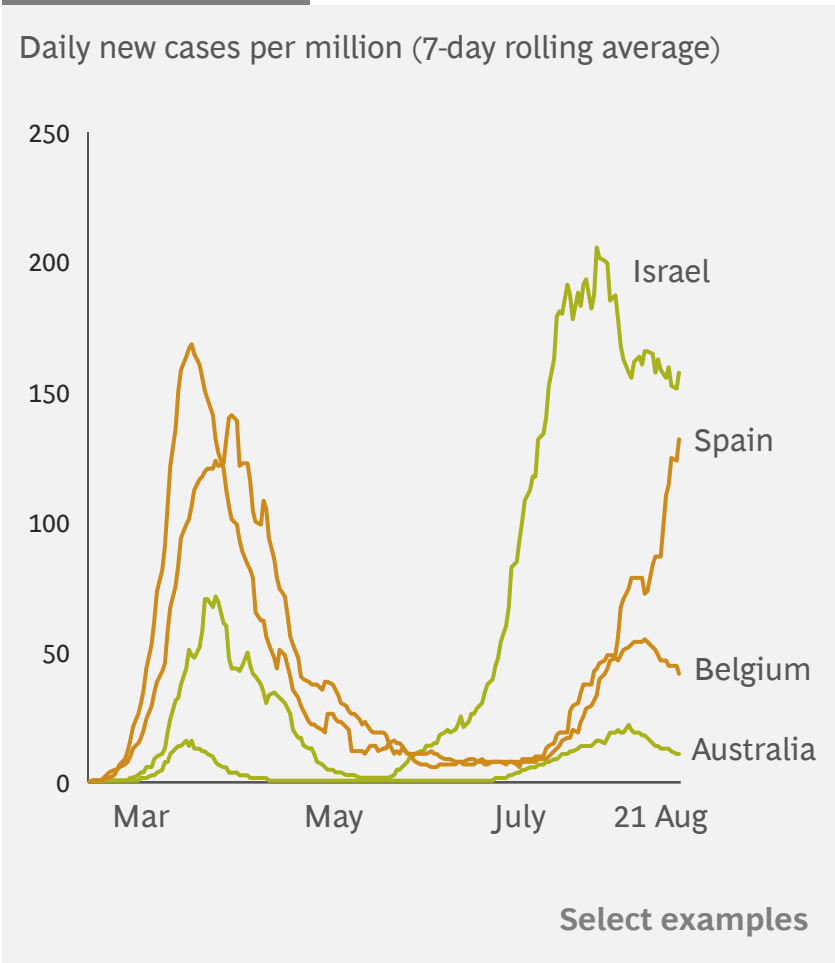
Epidemic progression | Early signs of slowing global case growth in August; however, some countries experiencing resurgence

As of 21 August 2020

Daily case growth continues, albeit at a lower pace in August



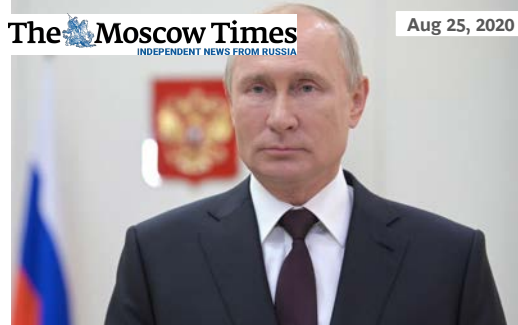
Signs of resurgence observed across geos.



1. Oceania includes Australia, New Zealand, Papua New Guinea and surrounding island nations of the Pacific ocean; 2. Calculated as growth in monthly average of daily cases as compared to previous month; 3. Calculated as an average until 21 August; Source: Johns Hopkins CSSE; Our World in Data; BCG

Vaccines & therapeutics are key to containing the virus; multiple candidates from different countries

As of 25 August 2020



Russia registers world's first COVID-19 vaccine; phase 3 trials set to begin soon



FDA grants Emergency Use Authorization for expanded use of plasma to treat COVID-19



172 countries considering engaging with global vaccine alliance COVAX – goal to procure 2B doses by 2021 end



Dr. Fauci expects enough vaccine shots for all Americans by end of 2021 – tens of millions of doses by start of 2021



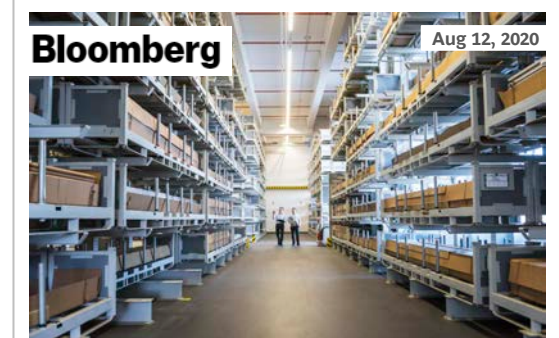
The race to find a COVID-19 vaccine has intensified – 30 candidates are now in clinical trials



Remdesivir, already approved in EU & Japan, now seeks US FDA approval



EU reserves 300M doses of vaccine in pharma deal, says in touch with companies about promising vaccines



Drug-makers race to build vaccine supply chains – building plants & expanding manufacturing capacities

Vaccines & Therapeutics | Summary snapshot

Best-case timelines as of 21 August 2020

Vaccines

30

candidates currently in clinical trials

6

candidates currently in Phase III;
in race for EUA^{1,2} starting Q4'20,
contingent on safety and efficacy profiles

Q2'21

expected start of broader distribution
(beyond targeted population segments)³
in the best-case scenario⁴

Therapeutics

202

candidates currently in clinical trials

4

key candidates currently under EUA^{1,5} in select
countries; ensuring broad clinical trials, safety
and efficacy key for further approvals

Q4'20

expected broader availability⁶

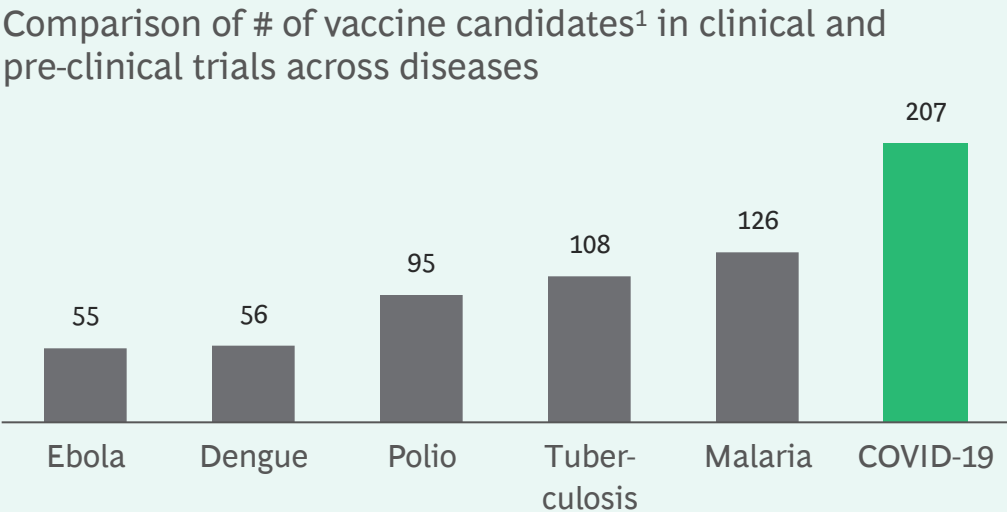
1. Emergency Use Authorization; nomenclature may differ across different geographies.; 2. EUA for BioNTech/Pfizer, Moderna est. by Q4 '20, University of Oxford/AstraZeneca est. between Q4 '20 and Q1 '21; Sinovac, Sinopharm/BIPB, Sinopharm/WIPB est. by Q1 '21; 3. Anyone who wants a vaccine can get a prescription; 4. Estimated for the US; will be subject to a set of preconditions including phase 3 results, manufacturing & distribution setup and scale-up, etc.; 5. EUA for Remdesivir in the US, Japan, Australia (non-exhaustive), Convalescent plasma therapy in the US (non-exhaustive); Dexamethasone in UK, Japan (non-exhaustive); Favipiravir in India, Russia, China (non-exhaustive); 6. First few million doses; Remdesivir & Gilead to ramp up availability to 2M by Dec 2020; the US has secured 500k already and pre-booked 90% of next 2 months capacity; Additionally, availability basis prescription has started in select countries like India, Japan, European Union, etc; Gilead has also signed non-exclusive voluntary licensing agreements with generic pharmaceutical manufacturers based in Egypt, India and Pakistan; Dexamethasone widely available but used generally in severe patients requiring supplemented oxygen support. Source: FDA, WHO, Milken Institute; Company websites, BCG

COVID-19 vaccine | An unprecedented response globally on scale and speed of R&D efforts

As of 21 August 2020

Non-exhaustive

Large number of candidates in trials



Large funding commitments by governments & global institutions toward vaccine development:

➤ US (\$5.8B), Germany (\$1.0B), UK (\$0.5B), etc. *(select examples)*

(EvaluatePharma, WHO, Milken Institute, Policy Cures Research, Press Search)

Multi-technology approaches being pursued

Key vaccine technologies for COVID-19

Traditional technologies

Protein sub-unit *(Immune-stimulating component of the virus)*

80+ candidates in trials

Prior vaccines: Malaria, Hepatitis B, etc.

Whole virus *(Inactivated form of the whole virus)*

10+ candidates in trials

Prior vaccines: Dengue, Polio, TB, etc.

Novel technologies

Viral vector *(Replicating and non-replicating approaches)*

40+ candidates in trials

Prior vaccines: Ebola

Nucleic acid *(Genetic info. for cells to make "safe" viral proteins)*

40+ candidates in trials

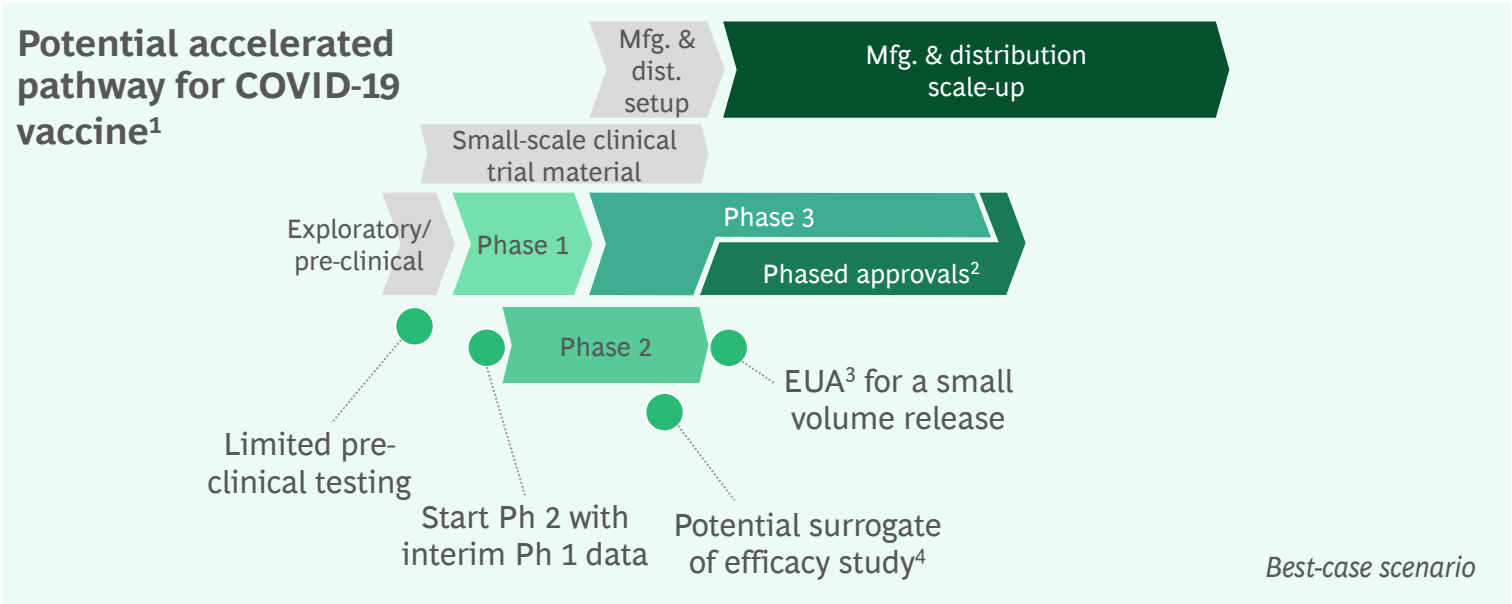
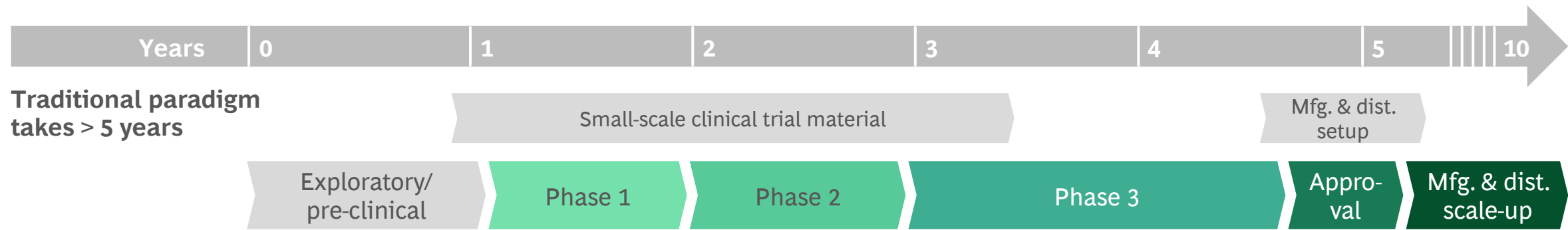
Prior vaccines: None²

(Milken Institute, NIAID³, NCBI⁴, Press search)

1. For COVID-19, the numbers are expected to increase with time; 2. No vaccines yet approved for humans, however vaccines exist for animal diseases: West Nile virus for horses, Avian flu for poultry, etc.; 3. National Institute of Allergy and Infectious Diseases; 4. National Center for Biotechnology Information
Source: EvaluatePharma, WHO, Milken Institute, Research Professional News, Bloomberg, Press search, BCG

Vaccine development life cycle | Current development moving at turbo-charged pace; 12-18 month timeline unprecedented

As of 21 August 2020



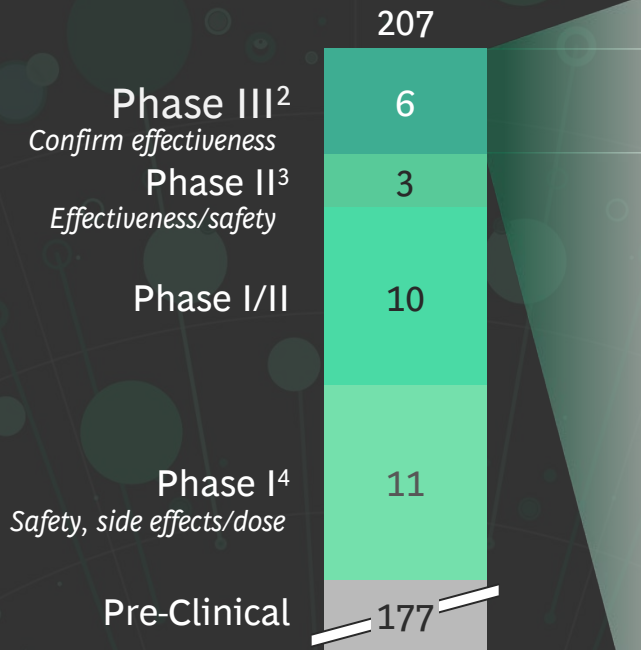
Current outlook points to a **12-18 month timeline from exploratory to start of phased approvals** & assumes no significant R&D challenges

For early availability and access, **manufacturing has been kick-started** even before granting of EUAs³

1. Estimated best-case scenario, with stages developed simultaneously; 2. Phased approvals are sequential approvals for specific segments of population based on Phase 3 results; 3. Emergency Use Authorization; 4. There are no clear markers associated with long term protection against COVID-19; to support a surrogate endpoint, these markers would have to be defined; Source: FDA, CDC, Press search, BCG

Vaccine fast movers | 6 vaccine candidates already in Phase III; in the US, two candidates currently in race for EUA¹ in Q4 2020

Vaccine candidates across development phases



Russia has registered the world's first vaccine, Sputnik V; validation from global health agencies⁵ pending on safety and efficacy data

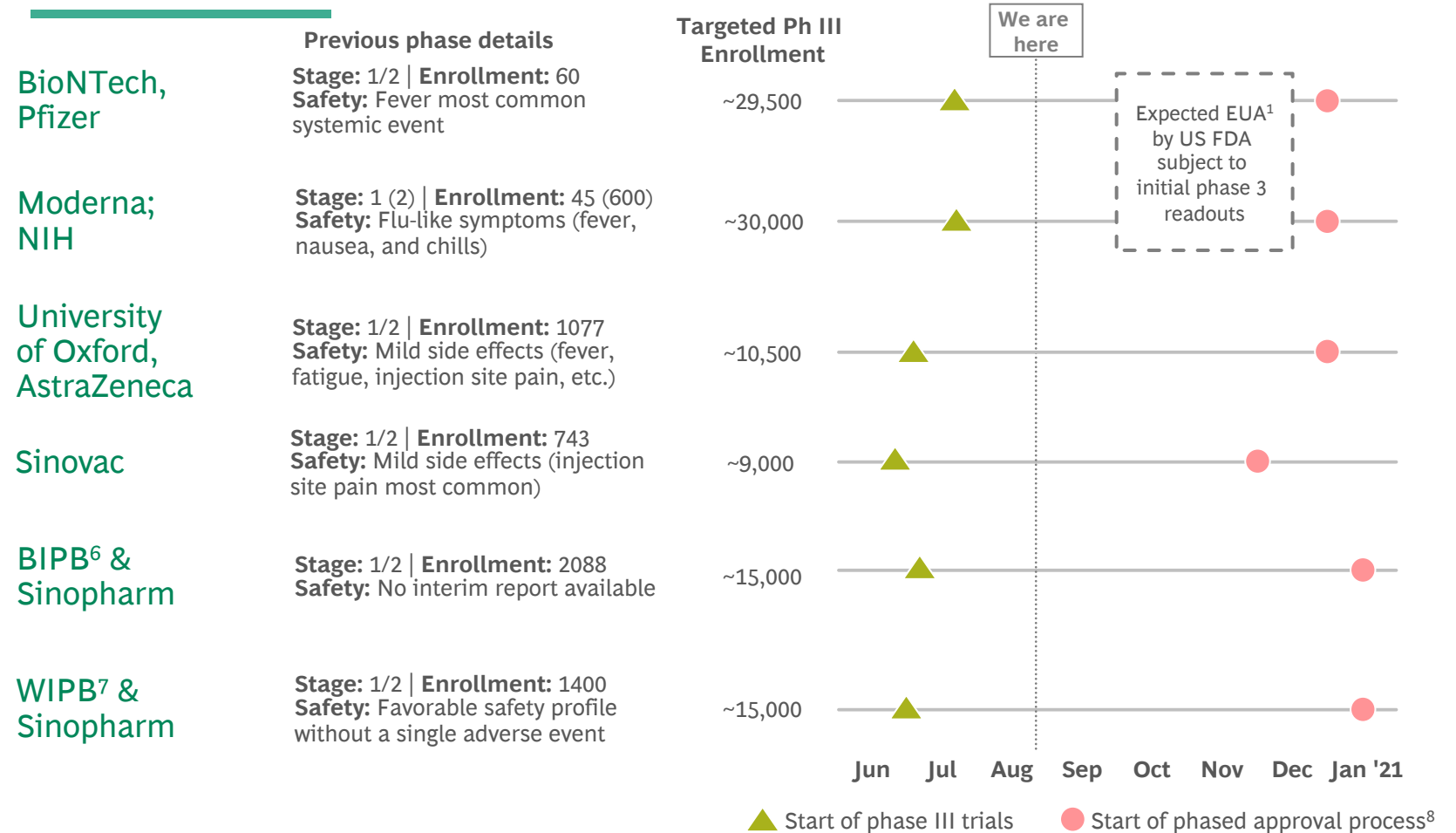
Johnson & Johnson plans to start Phase III trials in early September targeting ~60k enrollments

(WHO, Milken Institute)

As of 21 Aug 2020

Potential timelines for candidates currently in Phase III

WHO Phase III classification

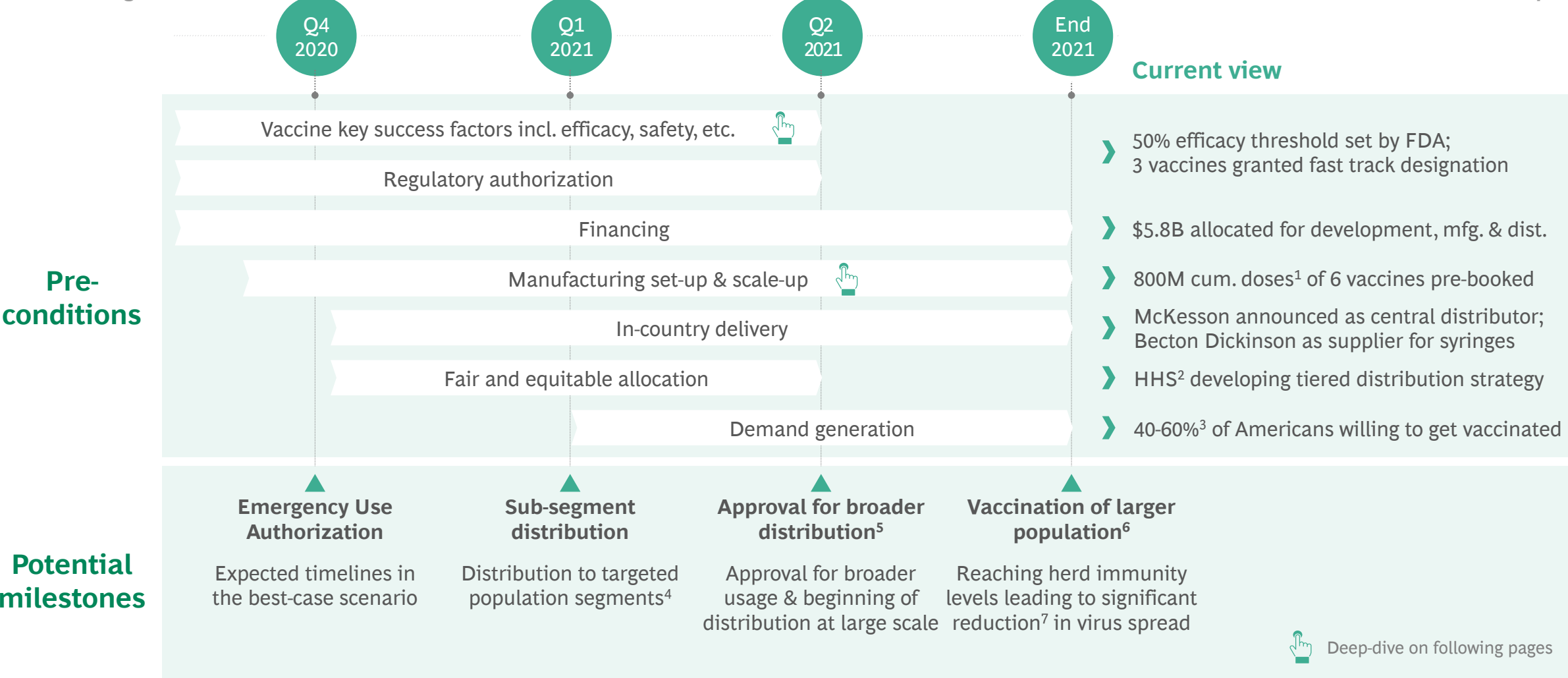


1. Emergency Use Authorization conditional to safety & efficacy profiles; 2. Ph III trials involve a much larger population to test efficacy & safety of vaccine; 3. Phase II studies involve larger number of subjects & are intended to provide preliminary information about a vaccine's ability to produce its desired effect; 4. Phase I clinical studies involve initial testing in small numbers (e.g., 20) to test the properties of a vaccine; 5. WHO, Association of Clinical Trials Organizations, etc.; 6. Beijing Institute of Biological Products; 7. Wuhan Institute of Biological Products; 8. Trials are expected to continue till end of 2021 & 2022 for different candidates, as per WHO, clinicaltrials.gov. However, companies are expected to start applications with initial phase 3 results; Source: Guggenheim, Wells Fargo, Bloomberg, NYT, RBC, SVB, Milken Institute, Morgan Stanley, NIH, JPMorgan Chase, WHO (21 Aug), Press Search, BCG

Broad distribution timelines | Current best-case scenario for US points to start of broad distribution in Q2 2021, subject to a set of pre-conditions

As of 21 August 2020

US example



Note: The timeline represented is highly dependent on Phase III vaccine results and hence, subject to change; 1. US has currently pre-booked 300M of Oxford Univ. (Ph 3), 100M each of Sanofi (pre-clinical), Novavax (Ph 1/2), BioNtech (Ph 3), Moderna (Ph 3), J&J (Ph 1/2) and can buy additional doses if required; Actual cumulative quantity will depend upon vaccine approval; 2. United States Department of Health and Human Services; 3. As per survey conducted by Yahoo News & YouGov; as per US 50 state COVID survey conducted with 19,058 individuals from 10-26 July; 4. Population subsegments like frontline workers, segments most impacted, certain age groups etc. or as defined by the approval; 5. Approval & distribution may be phased depending upon phase 3 results; broad distribution implies that anyone who wants vaccine can get a prescription; 6. 60-80% of the population, which is also the threshold for herd immunity; 7. Depends on the rigor of other interventions such as wearing mask, social distancing; Source: FDA, HHS, Press search, BCG

Vaccine key success factors | Approval authorization and broader distribution driven by three key factors

As of 21 August 2020

Efficacy¹

Validation data currently limited; WHO target profile suggests a **preferred² efficacy of 70%+**; FDA recommends 50%+ for approval

Efficacy data for population sub-groups like children, pregnant women, elderly, etc. may be limited and will have an impact on adoption

While target efficacy levels seem low, they are **comparable to influenza vaccine efficacies** of 40-60%

Safety

Limited data available including that across population sub-groups³; initial reports suggest **acceptable safety profile** (may induce short term discomfort in some cases)

Few trials have displayed **grade 3 adverse reactions⁴ at higher doses**; data from large enrollment trials (Phase 3) awaited

Traditional paradigm takes 5-10+ years from start of pre-clinical trials to gaining regulatory approval

Duration of immunity

Limited data available; 3 months of immunity observed in recovered patients

WHO target profile suggests a **preferred⁵ duration of 1 year**; current claims for leading vaccines lie between 1 and 2 years⁶

Recent studies show evidence of a **positive t-cell immune response** that could be long-lived

1. The potential of a drug/vaccine to protect from a disease in controlled clinical trials; 2. WHO target profile minimum efficacy expectation is 50%+; 3. Sub-groups like children, pregnant women, elderly, etc; 4. Severe or medically significant but not immediately life-threatening; 5. WHO target profile minimum duration expectation is 6 months; 6. Russia's recently registered vaccine, Sputnik V, claims to provide immunity for up to 2 years; Source: WHO, BBC, Science Magazine, Bloomberg, Livemint, FiercePharma, BCG

Vaccine efficacy expected to impact demand dynamics & healthcare response priorities

"...if you had 70, 80 percent efficacy and enough of the population is vaccinated with it, COVID-19 will have nowhere to go, and it will just go away. That's what happened for smallpox. It's what happened for measles, with the exception of the occasional times we've had re-importation."

Dr. Peter Marks, Director FDA CBER¹

Immediate priorities that emerge basis vaccine efficacy outcomes

Vaccine with lower efficacy (50%-80%)

Non-exhaustive

- 1 Ensuring consistent communication for adoption & **continued implementation of non-pharmaceutical interventions (NPIs)** like masks, social distancing, etc.
- 2 Continued impetus for **development of alternative (higher efficacy) vaccines and therapeutics**, and rapid testing technologies
- 3 Sustaining **demand generation in appropriate population segments**; and investing to maximize public health benefit

Vaccine with higher efficacy (>80%)

- 1 Maintaining **sufficient supply and resources for broad administration** to meet initial surge in demand
- 2 Building a tiered distribution strategy to **prioritize vulnerable and impacted populations** in a supply constrained scenario
- 3 Continued consistent communication to ensure **adoption across population segments and keeping skeptics at bay**

1. FDA CBER: FDA Center for Biologics Evaluation and Research. Source: FDA, BCG

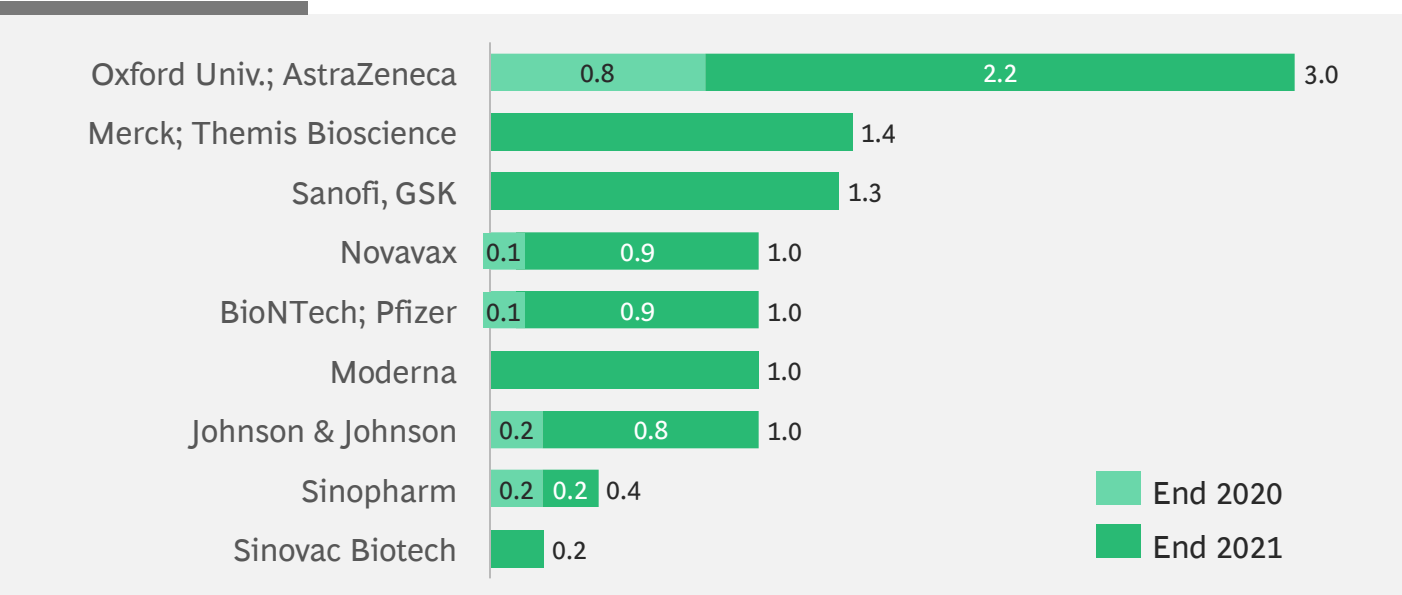
Manufacturing set-up & scale-up | Developers rapidly augmenting capacity; several governments putting mechanisms for early access

As of 21 August 2020

Non-exhaustive

Estimated vaccine production capacity (B doses)

Cumulative production capacity subject to vaccine approval



Key considerations

Country-specific tiered distribution strategies and deployment prioritizing vulnerable and impacted populations

Specific transportation & storage requirements (e.g., cold storage that goes as low as -80°C⁴)

Resources⁵ required for administration and follow-ups (e.g., booster shots) to broad population

Global collaboration to ensure equitable distribution to low and middle income countries

Several countries and global organizations pre-booking capacities to ensure early access (select examples)¹

EU Commission: 1.1B cum. of 5 vaccines^{1,2} for EU members

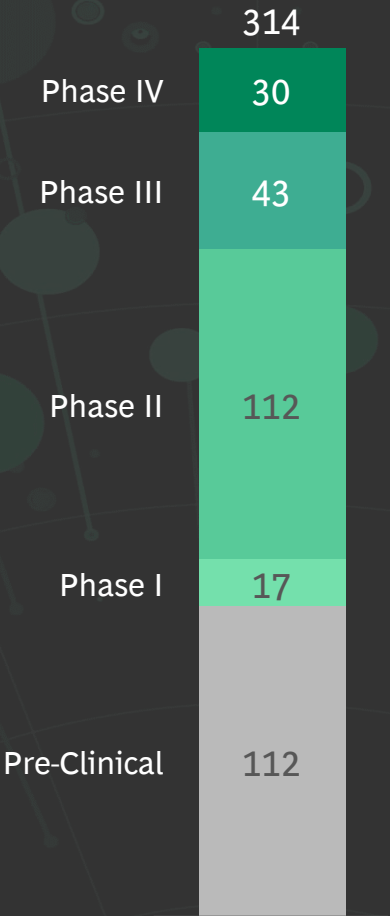
US govt.: 800M cum. of 6 vaccines^{1,2} under "Operation Warp Speed"

COVAX facility: 1B+ cum. of 2 vaccines^{1,3} for low & middle income countries

Note: Actual production will depend upon the vaccine approval timelines. Some developers have already started manufacturing to be ready with supply after approval; 1. Numbers represented are cumulative; actual number of doses will depend upon approval; 2. Option to purchase additional vaccines if required; 3. Target is to provide 2B doses of the approved vaccines by 2021; 4. For Moderna, Pfizer vaccine; 5. Manpower, logistics & funds; Source: European Commission, Press search, BCG

Therapeutics | Effective therapeutic treatments could reduce the strain on healthcare systems; two candidates currently under EUA¹ in the US

300+ treatments
undergoing trials



As of 23 Aug 2020

US Example: 4 therapeutic candidates for potential COVID-19 treatment

	1 Remdesivir	2 Plasma Therapy	3 Dexamethasone	4 Favipiravir
Interim report view	~30% drop in recovery time >50% patients discharged in 2 weeks	8.7% mortality rate ² for patients transfused within 3 days of diagnosis versus 11.9% in patients transfused after 3 days	Mortality risk reduction in <u>severe patients</u> ³ Reduced 28 day mortality rate by 17%	Normalization of clinical signs ⁴ is 40% faster Longer median time to first use of oxygen
Exp. start of broad availability ⁵	Q4 '20	TBC ⁶	Widely available ⁷	Q4 '20
Authorization Status	EUA ¹ based on rigorous clinical trials	EUA ¹ ; rigorous randomized clinical trials underway	N/a	Granted clearance for expanded phase 2 trials ⁸

Challenges to accelerated approvals

Establishing proof of efficacy with manageable systemic events

E.g. EUA¹ issued for HCQ⁹ was revoked both in the US and EU given lack of drug efficacy

Ensuring broad clinical trials with randomly assigned participants

E.g. EUA¹ issued for plasma therapy; might limit enrollment for a placebo trial as per experts¹⁰

Non exhaustive

1. Emergency Use Authorization; 2. 7-day mortality rate; 3. Patients requiring supplemental oxygen support; 4. Clinical signs include temperature, oxygen saturation, cough, which are compared with control arm; 5. First few million doses; not limited to restricted segments; 6. U.S. government launched nationwide program to collect & provide convalescent plasma to patients in need, led by Mayo Clinic; 7. As anti-inflammatory medication; 8. Expanded phase 2 clinical trials to evaluate the safety & efficacy of the antiviral for the control of COVID-19 outbreaks in long-term care facilities; 9. Hydroxychloroquine; 10. Art Caplan, NYU School of Medicine; Source: ClinicalTrials.gov, Milken Institute, WHO, NEJM, RAPS, CNN, The New York Times, Company Websites, BCG

Multiple scenarios need to be considered as leaders think about their agenda

Several factors and their interplay to drive potential scenarios for the new reality

Non-exhaustive

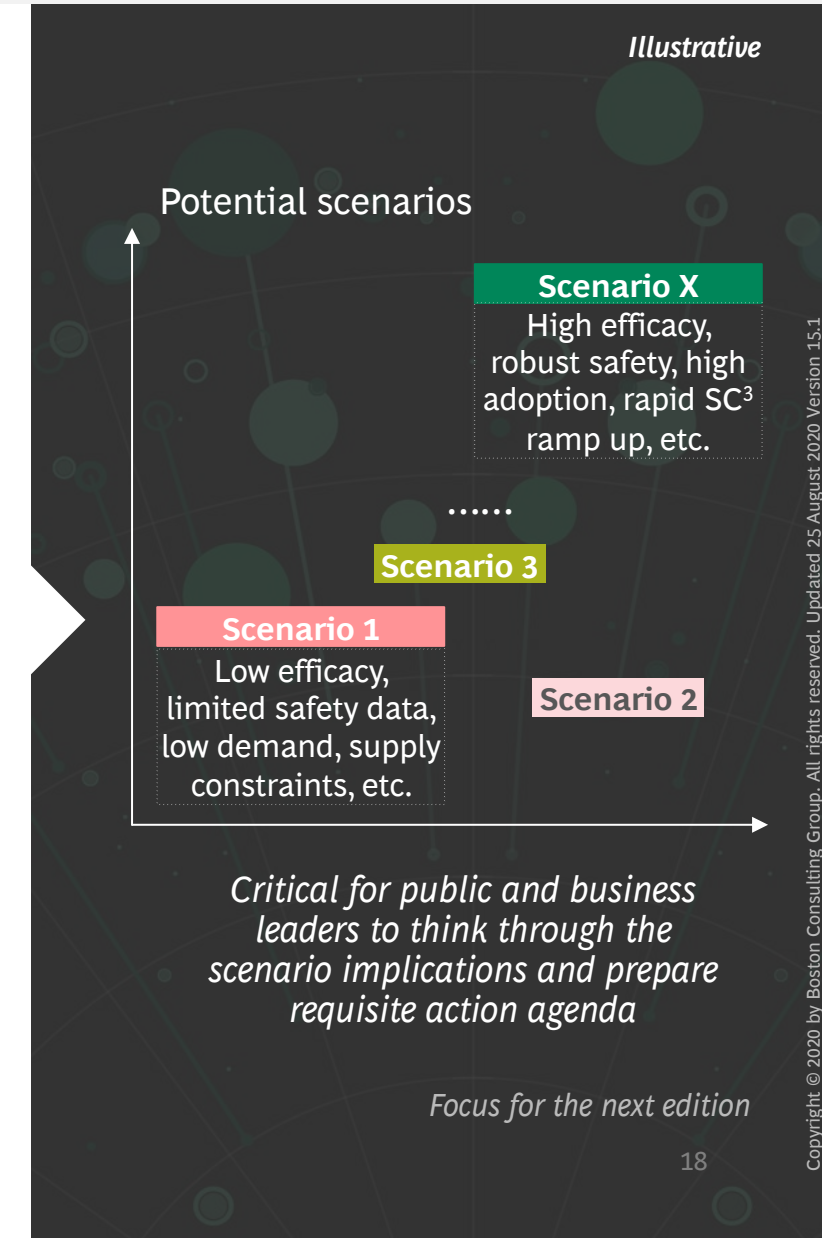
Vaccine / therapeutic characteristics	Safety performance: As trials move to larger/broader populations, do any safety signals emerge (at all or in any subgroups) Efficacy: Observed efficacy rates (e.g., 50% vs 90+%); consistency across vaccines Duration of immunity: Duration of natural immunity; duration of immunity from vaccine Vaccine & therapeutic interplay: Approval timelines & effectiveness of therapeutics could potentially shift the need of vaccine
Supply chain readiness	Manufacturing & distribution: Scale-up of required infrastructure¹ and resources for timely manufacturing & widespread distribution
Societal response	NPI² adoption rates: Ongoing adherence to social distancing, mask wearing, social gathering restrictions, etc. Consumer uptake: Adoption rates; adherence levels to government messages/ mandates

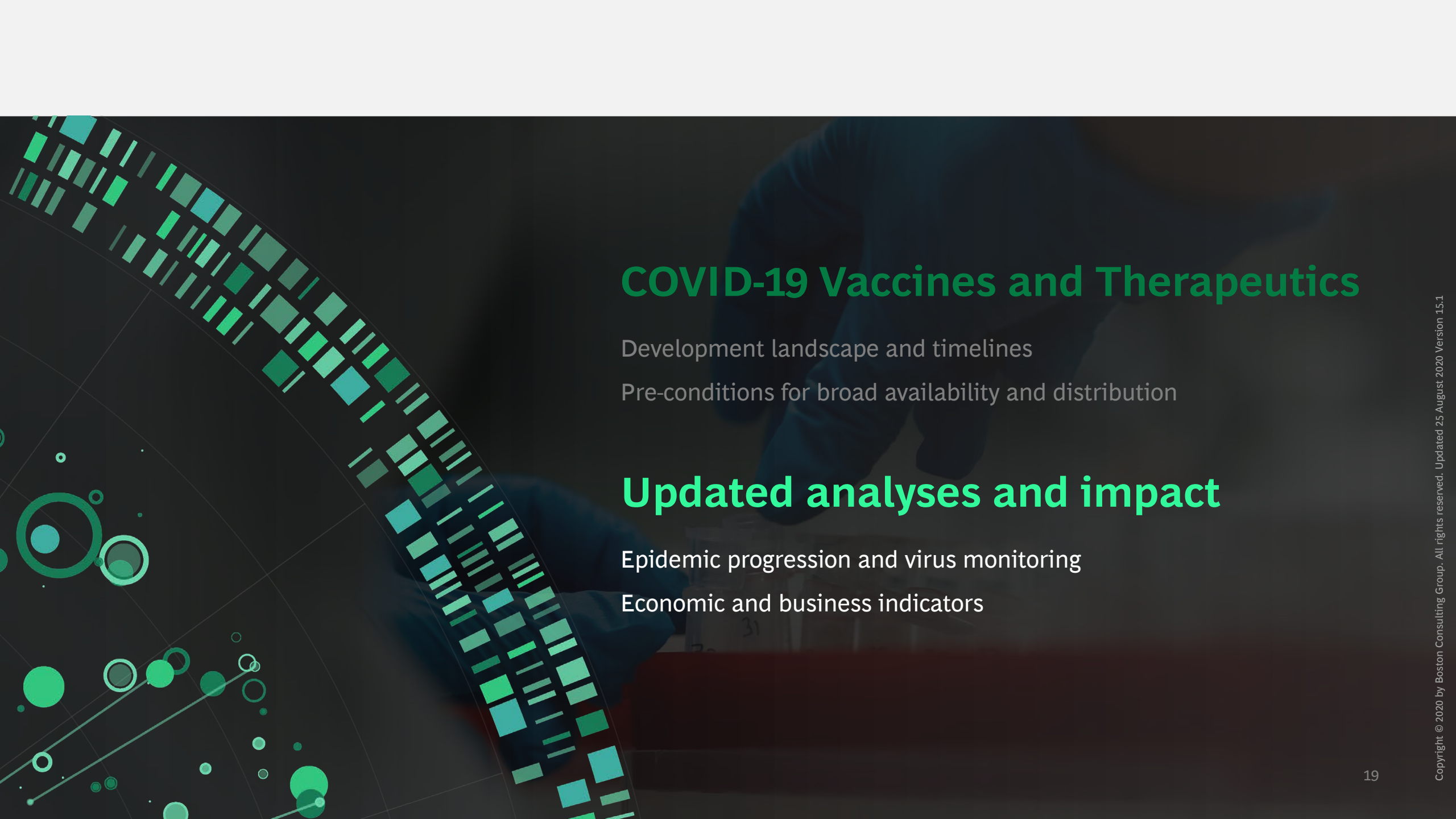
1. Manufacturing capacity and supply chains, transportation, cold storage, in-country delivery, etc;

2. NPI: Non-Pharmaceutical Interventions; 3 SC: Supply Chain

Source: BCG

Illustrative





COVID-19 Vaccines and Therapeutics

Development landscape and timelines

Pre-conditions for broad availability and distribution

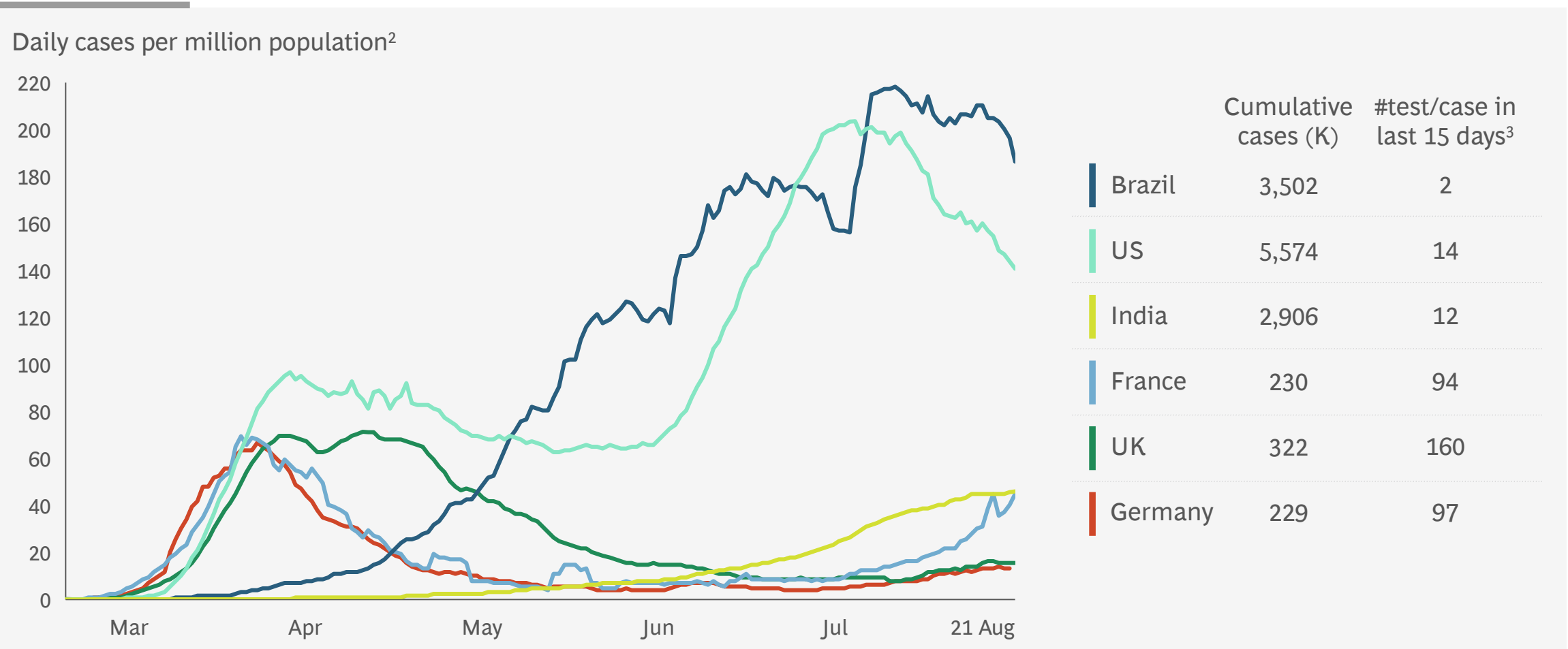
Updated analyses and impact

Epidemic progression and virus monitoring

Economic and business indicators

De-averaged view | Brazil & US continue to have highest daily cases per million population among top economies

As of 21 August 2020
Data shown only for top 10 economies by GDP (with >10 daily cases/M)¹

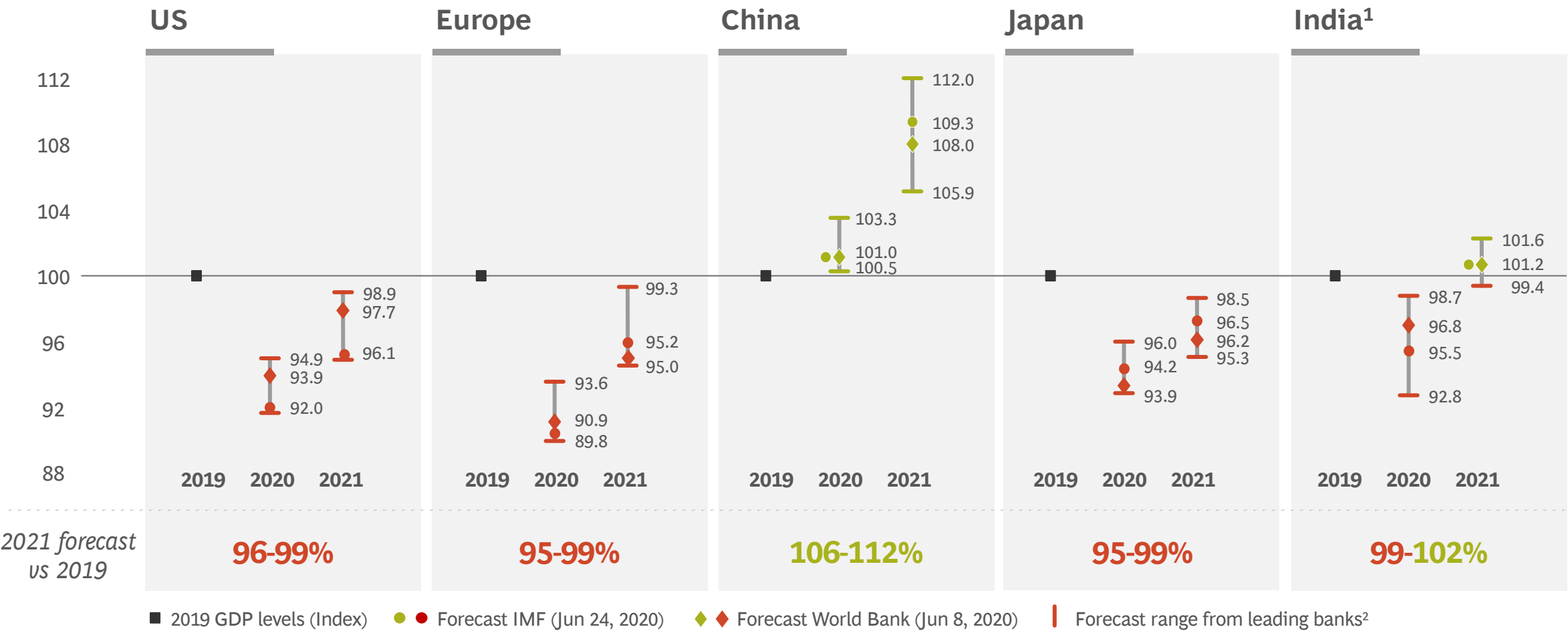


1. Excludes China, Japan, Italy & Canada as these countries' daily cases/M are less than 10; 2. Calculated as a 7-day rolling average; 3. Change in number of tests/change in number of cases in last 15 days; testing data is not updated daily for some countries, data represented is within last 1 week; Source: Johns Hopkins CSSE; Our World in Data; BCG

Economic forecasts point toward a severe downturn in 2020; most countries expected to rebound to 2019 GDP only by end of 2021

As of 21 August 2020

GDP forecast levels indexed to 2019 value (Base: 100)

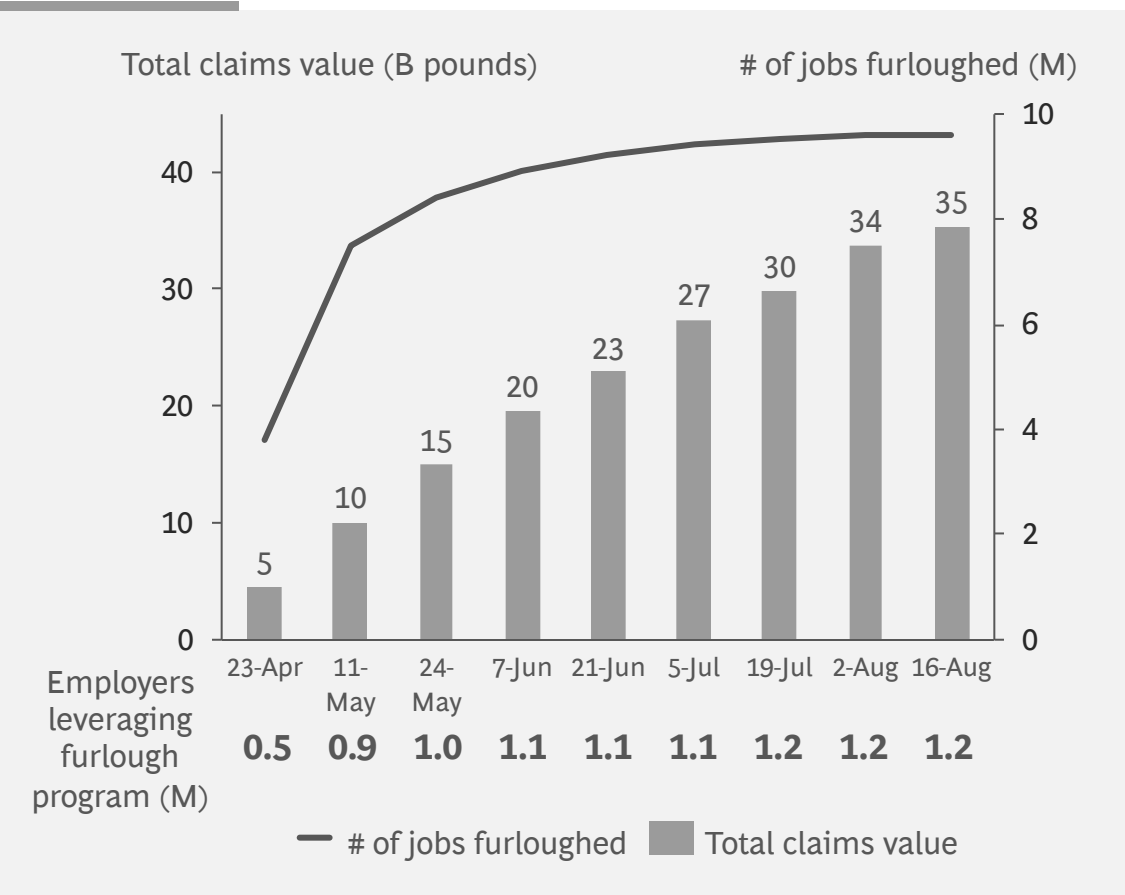


Note: As of reports dated 31 March 2020 to 21 August 2020, YoY forecasts; 1. For India, forecast is for financial year; for other countries, the forecast is for calendar year; 2. Range from forecasts (where available) of JPMorgan Chase; Morgan Stanley; Bank of America; Fitch Solutions; Credit Suisse; Danske Bank; ING Group; HSBC; Source: Bloomberg; World Bank; IMF; BCG

Unemployment numbers declining or flattening out; in the US, temporary job starting to come back

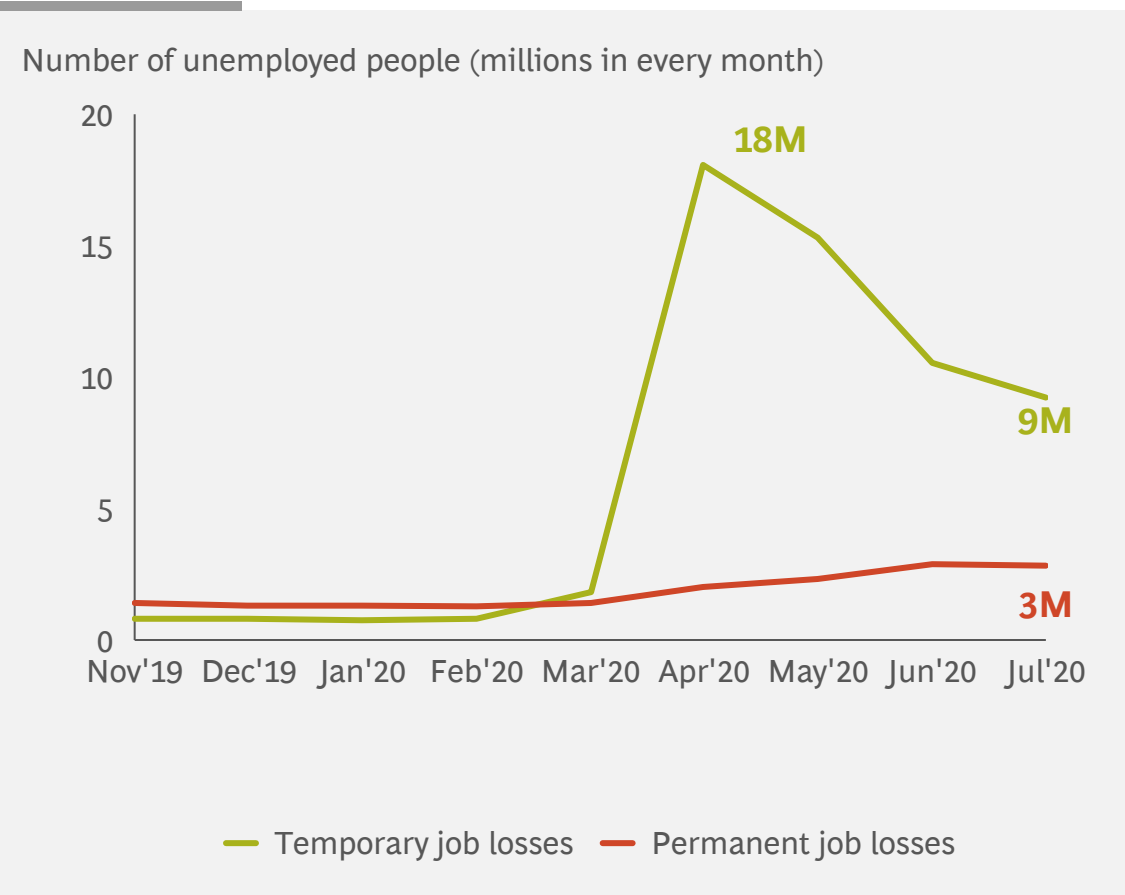
As of 16 August 2020 | UK Example

In the UK, number of jobs furloughed is flattening out



As of 31 July 2020 | US Example

In the US, temporary job losses continue to decline; permanent job losses are now flattening out

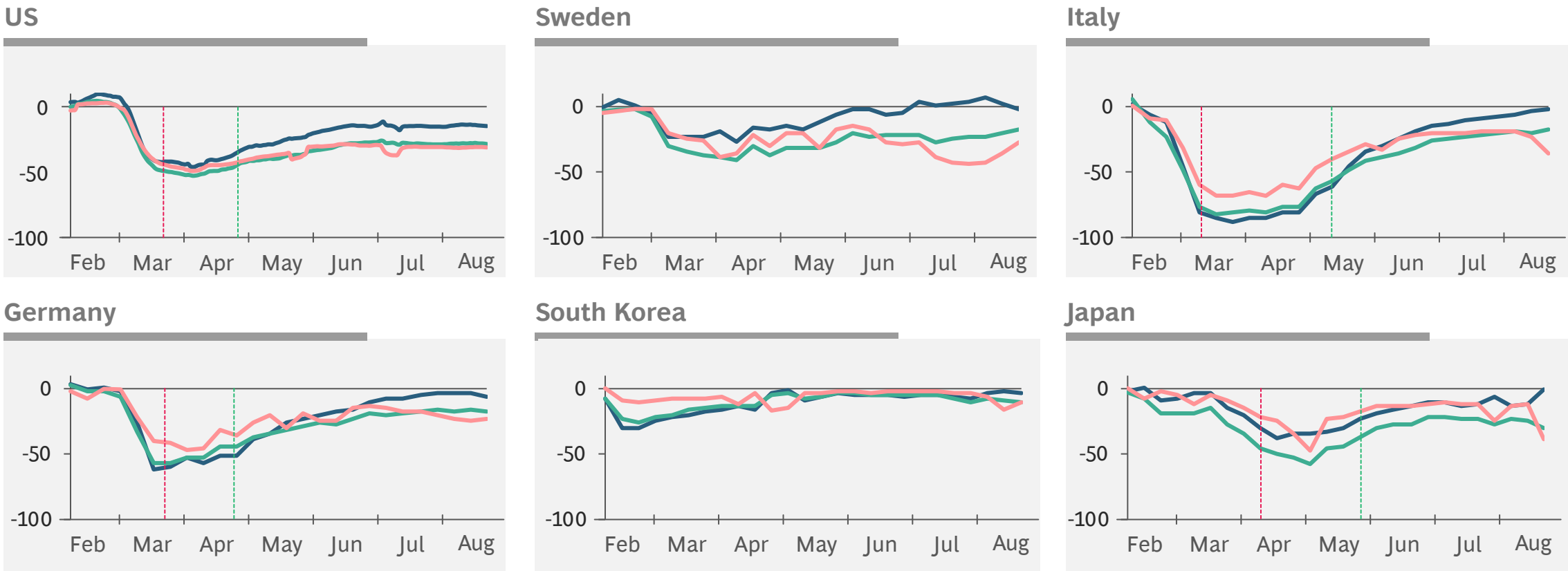


Retail and recreation mobility recovered fastest; lower recovery of workplace mobility indicates continued adoption of work from home

As of 16 August 2020

Non-exhaustive

Workplace¹, public transit² and retail & recreation³ mobility compared to baseline of January to mid-February 2020



Lockdown started⁴ Lockdown easing⁴ Workplace mobility Public transit mobility Retail & recreation

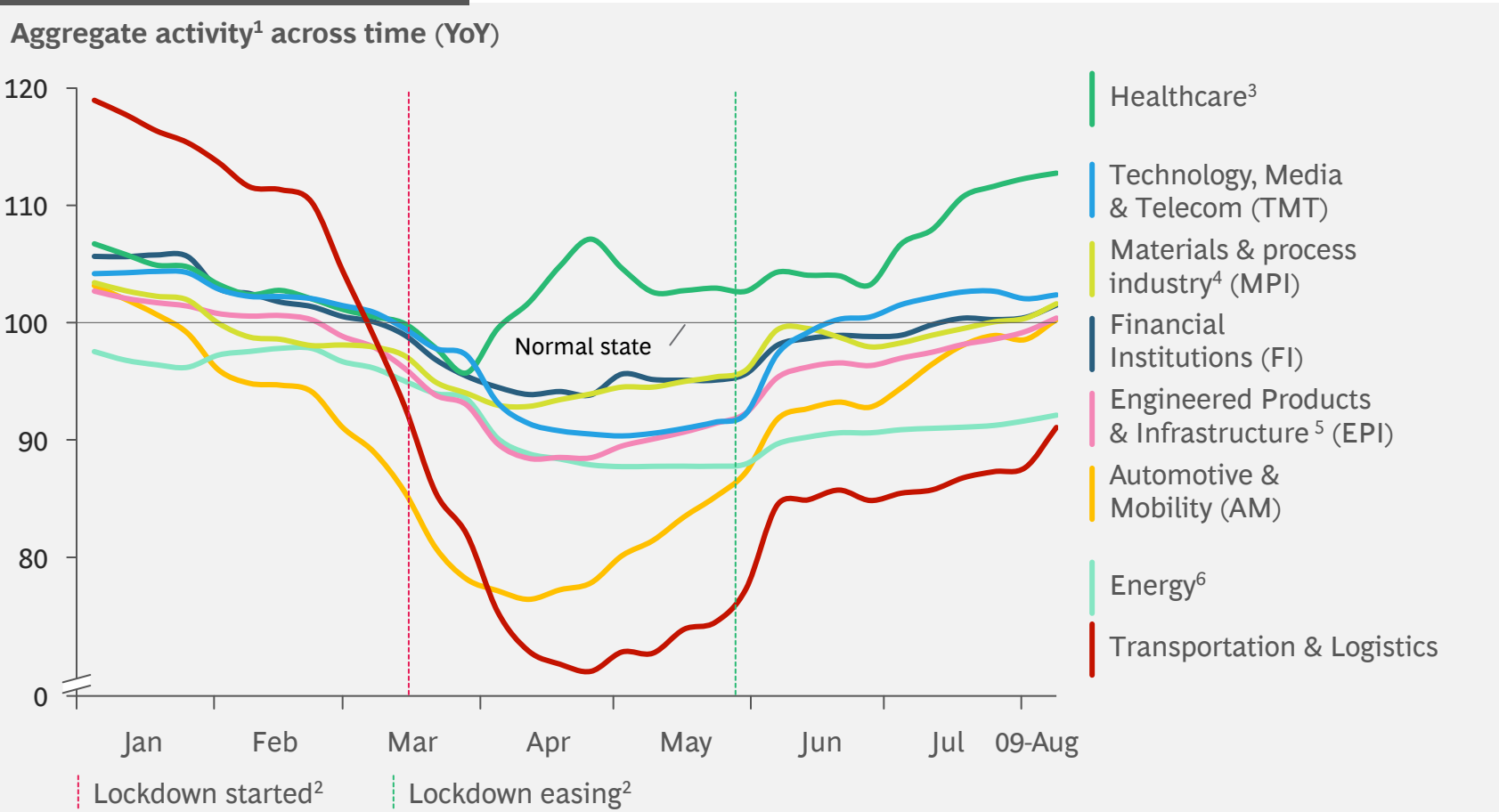
1. Tracked as changes in visits to workplaces; 2. Tracked as changes in visits to public transport hubs, such as underground, bus and train stations; 3. Tracked as changes for restaurants, cafés, shopping centers, theme parks, museums, libraries and cinemas; 4. Refers to average lockdown start and easing dates; Note: Data taken as weekly average compared with baseline (average of all daily values of respective weeks during Feb 15–Aug 16 2020); Source: Google LLC "Google COVID-19 Community Mobility Reports". <https://www.google.com/covid19/mobility/> Accessed: 21 Aug 2020; Press search; BCG

Business activity¹ across many sectors has currently rebounded to previous year levels

As of 09 August 2020 Aggregated for GER, FR, UK, ITA, SPA, US, BR, CN, JP

Non-exhaustive

BCG Economic Recovery Pulse Check (ERPC)



Healthcare witnessed stronger rebound due to increased demand during current crisis

TMT, MPI, FI, EPI & AM saw moderate recovery; currently above previous year levels

Energy, Transportation & Logistics continue to remain below pre-crisis levels; early signs of rebound seen in Transportation & Logistics but still far from recovery

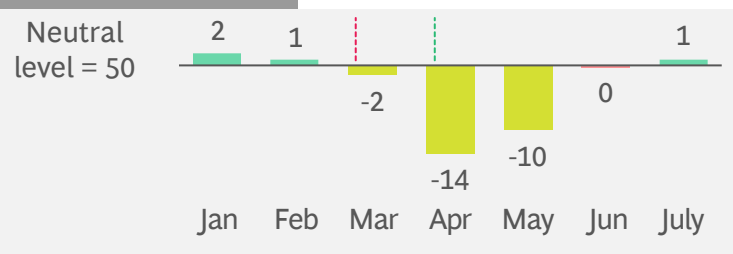
Note: ERPC tracks industries in EU5 (GER, FR, UK, ITA, SPA), US, Brazil, China and Japan. Index value of 100 indicates a normal activity compared to previous year's period; 1.Sector level activity based on 100+ data sources, e.g. financial index, macro economic data, employment, sector confidence, specific data source by sector etc.; 2. Refers to average lockdown start and easing dates across countries except China; China first went into lockdown starting 23rd Jan until April; 3. Medical Tech, Biopharma, Consumer Health (excluding Hospitals); 4. Chemicals, Metals and Mining, Building Materials, Forest Products, Paper and Packaging; 5. Aerospace & Defense, Infrastructure, Machinery & Industrial Automation; 6. Oil & Gas, Energy & Utilities; Source: BCG

Manufacturing PMI recovery globally indicates positive momentum

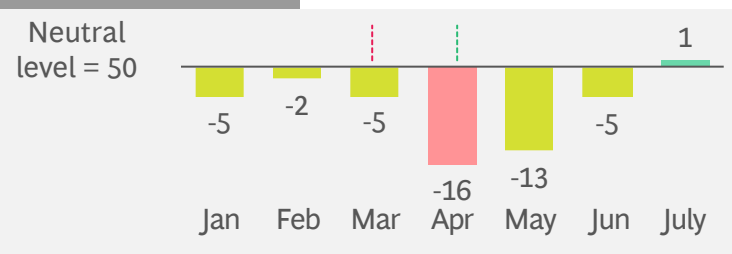
As of 21 August 2020

Manufacturing PMI before, during, and after the crisis

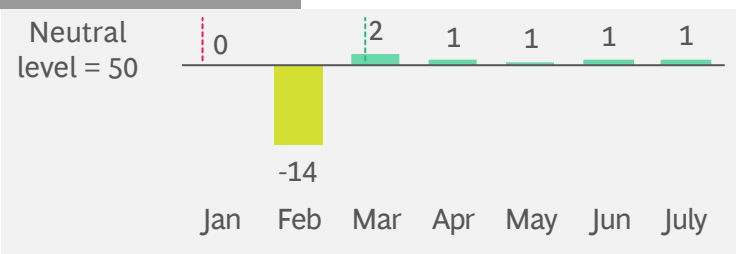
US



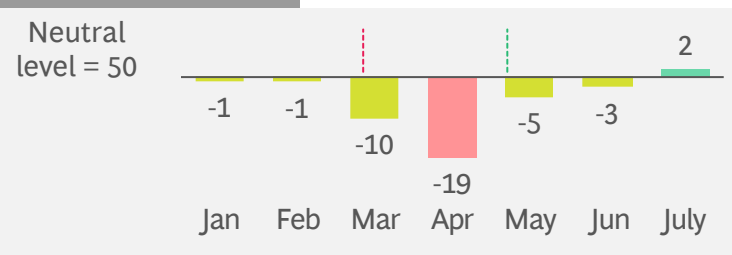
Germany



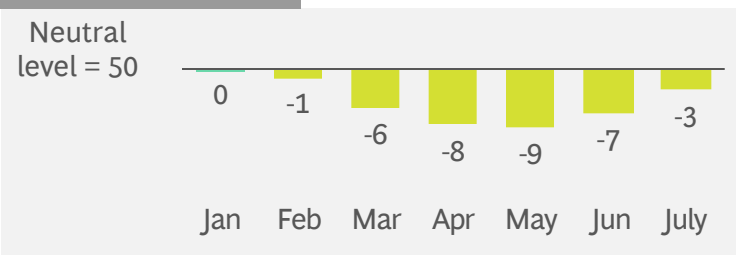
China¹



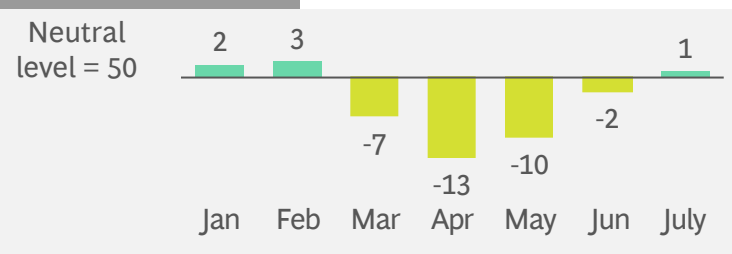
Italy



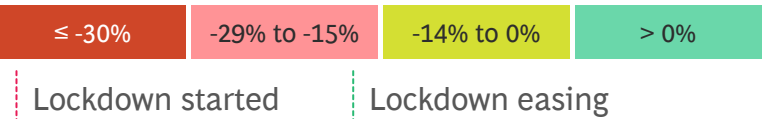
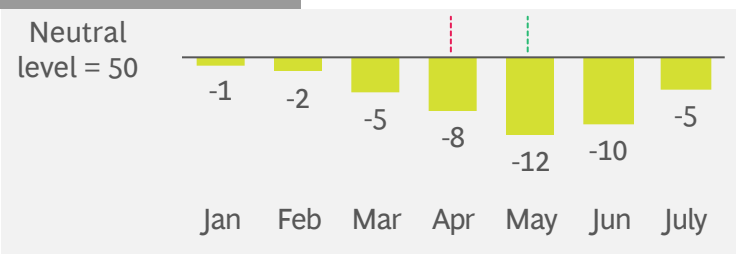
South Korea



Sweden



Japan



Note: PMI (Purchasing Manager's Index) is a diffusion index that summarizes whether market conditions, as viewed by purchasing managers, are expanding, staying the same, or contracting. 50 is neutral, >50 is considered to be positive sentiment and <50 is considered to be negative sentiment.

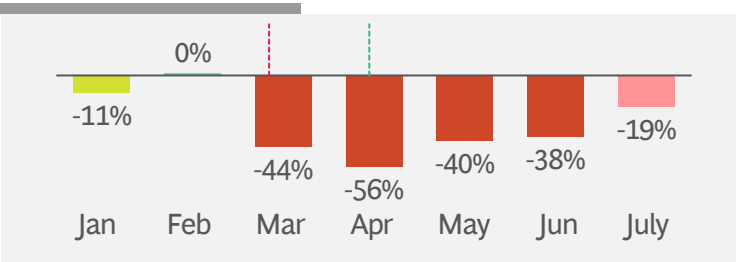
1. Lockdown dates are only pertaining to Hubei province; Source: Markit South Korea Manufacturing PMI SA; Jibun Bank Japan Manufacturing PMI SA; China Manufacturing PMI SA; Swedbank Sweden PMI SA; Markit/BME Germany Manufacturing PMI SA; Markit Italy Manufacturing PMI SA; Markit Spain Manufacturing PMI SA; Markit/CIPS UK Manufacturing PMI SA; Markit US Manufacturing PMI SA; Bloomberg

Passenger vehicle sales sees limited rebound, except for China and South Korea due to local market dynamics

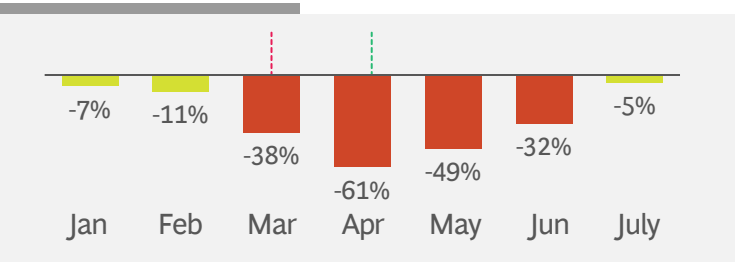
As of 21 August 2020

Monthly passenger vehicle¹ sales, YOY % change vs 2019

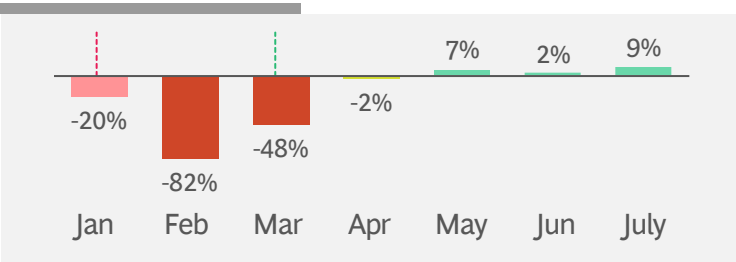
US¹



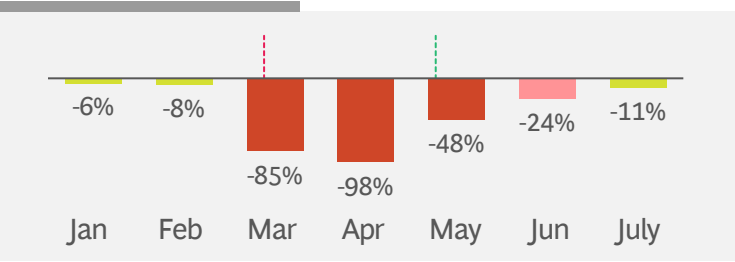
Germany



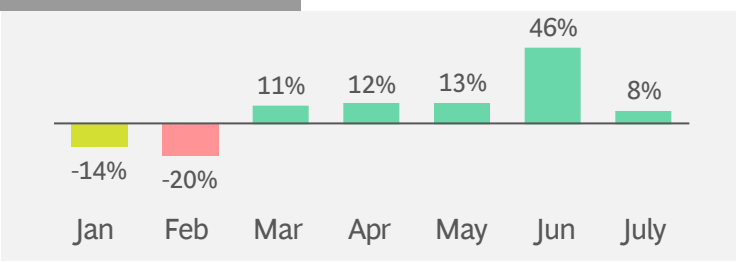
China²



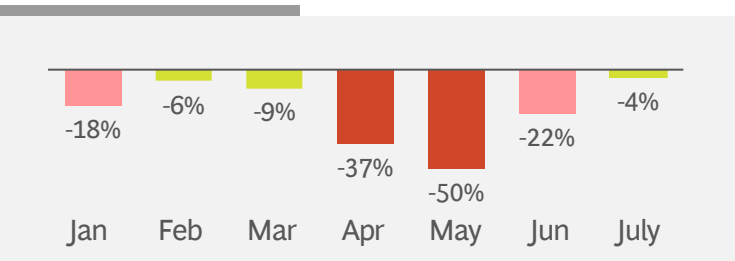
Italy



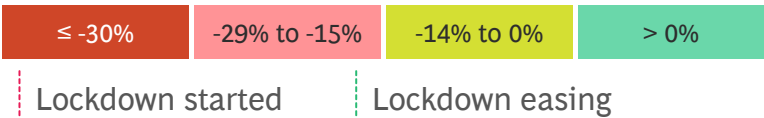
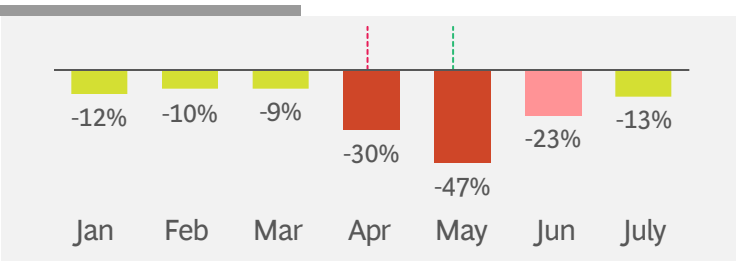
South Korea³



Sweden



Japan



1. Passenger vehicle sales includes data on, where available, hatchback, MPV, pickup, sedan, SUV, and vans; 2. Stimulus policies: Launched subsidies for car purchases in 10 cities, lessened purchase restriction in high tier cities and extended NEV subsidies; 3. South Korea's growth in auto sales from Mar through June 2020 is supported by recent tax cuts for individual consumption goods (e.g., cars), several carmakers (e.g. Audi, VW) launching new models and the increased appreciation by the Koreans of cars as a safe mode of transport and as a travel alternative for camping during COVID-19, supported by recently passed legislation to allow a variety of different cars to be modified into 'camping cars'. Source: Marklines, BCG

Retail goods sales (excl. auto and fuel) have rebounded to pre-COVID-19 levels across most of the countries

As of 21 August 2020

Growth of total retail goods sales (excl. auto & fuel)¹, YOY % change vs 2019

Retail goods sales include online & offline sales and comprise food & beverages, apparel, cosmetics & personal care, home appliances, general merchandise, building material; do not include auto, fuel & food services

	Jan	Feb	Mar	Apr	May	June	July
China ²	-16%		-12%	-6%	-1%	2%	-2%
Japan	0%	2%	1%	-6%	-1%	10%	
US	3%	4%	7%	-6%	3%	8%	8%
UK	1%	0%	-4%	-19%	-11%	1%	
Italy	1%	2%	-18%	-27%	-11%	-2%	
Sweden	4%	4%	1%	-1%	2%	4%	

Retail goods sales have currently **rebounded** to pre-COVID-19 levels in **US, China, Japan & UK**

Italy has shown **signs of recovery**, but is still **slightly behind** last year's sales

Sweden hasn't shown a significant impact of COVID-19 on retail goods sales

≤ -30%

-29% to -15%

-14% to 0%

> 0%

1. Retail goods sales categorization may be different across countries; seasonally adjusted values taken; 2. For China, combined value of Jan & Feb is available;
Source: US Census Bureau; PRC National Bureau of Statistics; Eurostat; Ministry of Economy Japan

Further reading

Reigniting Retail Demand

De-averaged view | Retail store sales in China have rebounded across categories; apparel sales continue to be impacted

As of 21 August 2020

Retail store sales' breakdown by category, YoY % change vs 2019

Food & beverage stores

	Feb	Mar	Apr	May	June	Jul
China ¹	10%	19%	18%	11%	11%	7%
Japan	4%	-1%	0%	2%	3%	
US	4%	29%	12%	15%	12%	11%
UK	1%	10%	5%	5%	5%	
Italy	3%	4%	0%	1%	-1%	
Sweden	2%	5%	-2%	0%	2%	

Personal care & cosmetics stores

	Feb	Mar	Apr	May	June	Jul
China ¹	-14%	-12%	4%	13%	21%	9%
Japan	9%	2%	3%	-3%	3%	
US	0%	6%	-10%	-9%	-1%	3%
UK	-9%	0%	-38%	-35%	-1%	
Italy	1%	-13%	-13%	-14%	-10%	
Sweden	5%	20%	-3%	-5%	3%	

Apparel stores²

	Feb	Mar	Apr	May	June	Jul
China ¹	-31%	-35%	-19%	-1%	0%	-3%
Japan	-4%	-23%	-54%	-34%	-6%	
US	1%	-49%	-86%	-62%	-25%	-21%
UK	0%	-35%	-67%	-60%	-34%	
Italy	0%	-64%	-88%	-43%	-16%	
Sweden	-2%	-34%	-37%	-30%	-22%	

Home appliance stores³

	Feb	Mar	Apr	May	June	Jul
China ¹	-30%	-30%	-9%	4%	10%	-2%
Japan	5%	-10%	-9%	9%	26%	
US	0%	-18%	-53%	-37%	-20%	-3%
UK	0%	-11%	-50%	-31%	0%	
Italy	2%	-43%	-55%	-15%	2%	
Sweden	8%	1%	9%	16%	17%	

China's sales have almost rebounded to year-ago run rates

Retail store sales **recovery driven by F&B** across all countries

Personal care & cosmetics category sales have rebounded to last year levels except in Italy

Apparels category saw the largest decline; **far from recovery** across countries except China & Japan

Home appliances sales showing signs of rebound; continue to be higher than last year in Sweden

≤ -30%

-29% to -15%

-14% to 0%

> 0%

Note: For US, share in retail store sales in Q4 2019: F&B ~25%, personal care & cosmetics ~12%, apparel ~6%, home appliances ~3%, general merchandising ~25% and building material & gardening equip ~13%. Sector classification & mix may be different across countries; 1. For China, Feb data includes both Jan & Feb, Food & beverages category only includes food & grains; 2. Includes clothing accessories, shoes, etc.; 3. Includes Audio video & home appliances stores; Source: US Census Bureau; PRC National Bureau of Statistics; Eurostat; Ministry of Economy Japan

5 sectors currently above pre-crisis TSR levels; 6 sectors with significant share¹ of companies with >15% default risk

ECONOMIC &
BUSINESS IMPACT

As of 21 August 2020

Categories based on TSR and net debt/enterprise value²

Based on top S&P
Global 1200 companies

		TSR performance ³			Companies with probability of default >15% ⁴		
		21 Feb 2020 - 20 Mar 2020	21 Feb 2020 - 21 August 2020	7 August 2020 - 21 August 2020	21 Feb 2020	21 August 2020	7 August 2020 - 21 August 2020
Healthier sectors	Semiconductors	-30%	12%	→	0%	0%	→
	Retailing	-40%	6%	↗	0%	35%	→
	Pharma	-20%	3%	→	0%	5%	↘
	Food/staples Retail	-10%	2%	→	0%	0%	→
	Household Products	-16%	2%	↗	0%	0%	→
Pressured sectors	Tech Hardware	-26%	-1%	→	0%	0%	→
	Software	-30%	-2%	→	9%	0%	→
	Materials	-32%	-2%	→	4%	9%	→
	Health Equipment	-31%	-2%	→	0%	0%	→
	Media	-36%	-4%	→	0%	0%	→
	Prof. Services	-30%	-6%	→	0%	0%	→
	Capital Goods	-35%	-6%	↗	2%	4%	→
	Food & Beverage	-23%	-9%	→	0%	0%	→
	Telecom	-17%	-10%	→	0%	4%	↗
	Financials	-35%	-11%	→	0%	0%	→
Vulnerable sectors	Auto	-41%	-12%	↗	0%	14%	→
	Durable Goods	-39%	-14%	↗	0%	0%	→
	Utilities	-30%	-14%	↘	0%	0%	→
	Transport	-34%	-15%	↗	0%	32%	→
	Insurance	-39%	-22%	→	0%	0%	→
	Hospitality	-44%	-25%	↗	7%	36%	→
	Banks	-39%	-28%	→	0%	4%	→
	Real Estate	-39%	-30%	→	0%	13%	↗
	Energy	-52%	-34%	↘	0%	15%	↘

Note: Based on top S&P Global 1200 companies; Sectors are based on GICS definitions; 1. Retailing, Auto, Transport, Hospitality, Real estate and Energy are sectors with > 10% of companies with probability of default > 15%; 2. Net debt & enterprise value from latest available balance sheet; Categories defined based on comparison with S&P Global 1200 median: healthy = TSR & debt/EV > median, pressured = TSR or debt/EV < median, vulnerable = TSR & debt/EV < median; 3. Performance is tracked for two periods, first from 21 February 2020 (before international acceleration of outbreak) to 20 March 2020 (trough of the market) and from 21 February 2020 through 21 Aug 2020 based on median; 4. Implied by 5-year credit default swap based on median
Source: S&P Capital IQ; BCG ValueScience Center; BCG

↗ Pos. trend ≥ 2%
→ No sig. change
↘ Neg. trend ≥ 2%

Additional perspectives on COVID-19



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[US: Current Dynamics and How to Win the Fight](#)



Edition #13

[Global Restart: Key Dynamics](#)



Edition #12

[Ensuring an Inclusive Recovery](#)



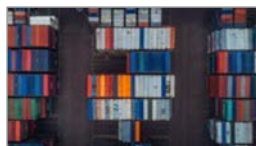
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Edition #3

[Emerging Stronger from the Crisis](#)

Glossary of terms

Clinical Trial	A systematic study of new tests and treatments to evaluates their effects on human health outcomes	Phase IV	Studies performed after medical intervention ¹ has been approved & marketed for sale; conducted to identify adverse effects that may not have been apparent in prior trials
Emergency Use Authorization	Authority granted to facilitate availability of an unapproved product, or an unapproved use of an approved product, during a state of emergency	Placebo Controlled Trial	Clinical trials involving two groups – one group gets the active treatment, the other gets the placebo (inactive drug with no effect)
Herd Immunity	Resistance to spread of contagious disease within a population that results if high proportion is immune, especially through vaccination	Pre-Clinical Study	Testing of drug/vaccine in test tube and animals to see if it triggers an immune response
Nucleic Acid Vaccine	Direct introduction of naked plasmid DNA/RNA (i.e. without any associated lipid, protein or carbohydrate) to elicit an immune response	Repurposed Drug	Usage of existing/known drugs and compounds to treat new disease
Phase I	First human trials of a medical intervention ¹ in a small group of people to evaluate a safe dosage range and identify side effects	Subunit Vaccine	A vaccine made from components (typically surface protein) of viruses or bacteria instead of the whole organism
Phase II	Assessment of short-term safety of medical intervention ¹ in patients; given to hundreds of people	Efficacy	The potential of a drug/vaccine to protect from a disease in controlled clinical trials; expressed as %
Phase III	Trials in large (thousands) and possibly varied patient groups to determine short & long-term safety-efficacy	Viral Vector Vaccine	Viral vector vaccine use live viruses to carry DNA into human cells
		Whole Virus vaccine	A vaccine made from viruses and bacteria that have been killed through heat, chemical or radiation

1. Experimental drug, vaccine, etc.; Source: CDC, WHO, NCBI, Oxford

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