RESPONDING TO COVID-19
Primer, Scenarios, and Implications

March 25, 2020 UPDATE
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INTRODUCTION: COVID-19 PRIMER

Context and purpose

The novel coronavirus has infected hundreds of thousands of people globally and is taking a severe toll on individuals, families, and economies as productivity drops and stock markets reflect increased global uncertainty.

This document provides some baseline facts and guidance for business leaders as to critical questions to address in the immediate and near-term to ensure the continuity of their business and the safety, health, and wellbeing of their workforce and customers.

What is it?

COVID-19 is the name for the illness caused by the novel coronavirus that originated in Wuhan, China in December 2019.

It is from the same family of viruses that cause some common colds, as well as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS).

It is considered similar to other respiratory infections such as influenzas; symptoms range from fever, cough, shortness of breath to more severe cases of pneumonia and organ failure.
# CURRENT UNDERSTANDING OF COVID-19 FACTS

Current pace of spread and understanding of the disease suggest that we must aggressive action

<table>
<thead>
<tr>
<th>Key facts</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contagion</strong></td>
<td>COVID-19 is twice as contagious as the seasonal flu</td>
</tr>
<tr>
<td>• R0 for COVID-19 is currently estimated at between 2 and 3 (with edge of range estimates closer to 1.4 and 3.6), which means <strong>each person infects 2-3 others</strong>; R0 for the seasonal flu is around 1.3</td>
<td></td>
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</tbody>
</table>

| **Current human immunity** | Social distancing (quarantines, WFH, school closures) is the only “brake” to slow the spread |
| • No herd immunity exists yet as **the virus is novel in humans** | |

| **Incubation period** | People are contagious for longer periods than the flu or other illnesses, requiring longer bouts of quarantine to truly suppress spread |
| • The infectious period is a median of 5.5 days (up to 14 days), while the annual flu is commonly a 3-day period; data suggests that viral shedding continues beyond symptom resolution | |

| **Fatality** | Fatality is orders of magnitude higher than typical influenzas |
| • Case fatality rates are trending at 4.9% globally (vs. 0.1% for the flu) | |

| **Portion of cases asymptomatic but contagious** | People who feel “fine” are capable of -- and are -- transmitting COVID-19 to others |
| • COVID-19 can be **spread asymptotically** | |
| • Diamond Princess testing estimated asymptomatic rate of 17.9%; emerging sources in Asia suggest rates potentially higher rates | |

| **Portion of cases reaching “critical” / “severe” infection** | Hospital systems risk being overtaxed (ICU beds, ventilators, PPE) meaning case fatality rates could rise further |
| • Approximately **19% of confirmed cases are considered “severe” or “critical”, requiring hospitalization**, and 1/4th of those need ICU beds | |

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COVID-19 SPREAD GLOBALLY

- First reported in Wuhan, China, on December 31, 2019
- Declared a global pandemic by the World Health Organization on March 11, 2020
- As of March 23rd, 2020
  - >375K cases reported in 168 countries and territories
  - ~16.4K reported deaths

1. Countries included: All Countries in "European Region" Sub-region in WHO Situation Report
   Source: Map from CDC (link), Numbers from John Hopkins University & Medicine (link)

Information as of 3/23/20
COVID-19 TRENDS AND SPREAD OF THE DISEASE
The number of new cases in China has slowed – likely due to significant containment measures – as the outbreak spreads to other countries

**Confirmed Cases of COVID-19**
Cumulative Number of Cases as of March 23

**New Cases Per Day of COVID-19**
New Cases Per Day as of March 23

Source: John Hopkins University & Medicine Coronavirus Resource Centre

1. Until February 17, the WHO situation reports included only laboratory confirmed cases causing a spike in total cases. Some sources include this update as of February 13. The jump due to inclusion of non lab confirmed cases is not included in the new cases data in WHO situation reports.
2. Includes countries categorized under “European region” based off latest WHO Situation Reports.
COVID-19 TRENDS AND SPREAD OF THE DISEASE

Daily death rates indicate that suppression, aggressive testing, and active tracing / isolation strategies (as seen in countries like South Korea) can effectively ease the burden on the healthcare system, leading to lower death rates.

Number of daily COVID-19 deaths by country

Day 0 is the day each country reached 100 cases. Day 0 for China – 1/22/2020 based on data availability.
HOW DOES COVID-19 COMPARE TO OTHER DISEASE OUTBREAKS? (1 OF 2)

COVID-19 is currently more deadly than the Flu, but the science on transmission and mortality continues to evolve.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Infected</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bird Flu</td>
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<td>Ebola</td>
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<td>Smallpox</td>
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<td>MERS</td>
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<td>1918 Spanish Flu</td>
<td>~500 MM</td>
<td>~50 MM</td>
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<tr>
<td>COVID-19</td>
<td>~375K</td>
<td>~16K</td>
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<tr>
<td>H1N1 Swine Flu</td>
<td>700 MM–1.4 BN</td>
<td>284 deaths</td>
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<tr>
<td>Seasonal Flu</td>
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<td>Common cold</td>
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<td>Chickenpox</td>
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<tr>
<td>Measles</td>
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<tr>
<td>SARS</td>
<td>8,096</td>
<td>774</td>
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<tr>
<td>MERS</td>
<td>2,494</td>
<td>858</td>
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<tr>
<td>1918 Spanish Flu</td>
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<td>COVID-19</td>
<td>As of Mar 23:</td>
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<td>~375K</td>
<td>~16K</td>
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</tbody>
</table>

**Legend and key statistics**
- ▲ SARS
  - 8,096 infected | 774 deaths
- ▲ MERS
  - 2,494 infected | 858 deaths
- 1918 Spanish Flu
  - ~500 MM infected | ~50 MM deaths
- ▲ COVID-19
  - As of Mar 23:
    - ~375K infected | ~16K deaths
- ▲ H1N1 Swine Flu
  - 700 MM–1.4 BN infected | 284 deaths

**Additional details**

- R-naught (R0) represents the number of cases an infected person will cause. R0 for COVID-19 is currently estimated at between 2 and 3 (with edge of range estimates closer to 1.4 and 3.6), which means each person infects 2-3 others; R0 for the seasonal flu is around 1.3.

- The global case fatality rate for confirmed COVID-19 cases is currently 4.9% according to WHO’s reported statistics versus 0.1% for the seasonal flu; the rate varies significantly by country (e.g., Italy – 10.28%, South Korea – 1.24%).

- We expect case fatality rates to fluctuate as testing expands identifying more cases and as existing cases are resolved.

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1. New York Times (link) for fatality and R-naught comparisons, CDC timelines for case numbers (selected link: CDC SARS timeline); 2. Updated CDC estimates (link); 3. The R0 for the coronavirus was estimated by the WHO to be between 1.4 - 2.5 (end of January estimate) (link), other organizations have estimated an R0 ranging between 2-3 or higher (link); 4. CDC Paper (link); 5. Calculated as Number of Deaths / Total Confirmed Cases as reported by John Hopkins University as of 03/23/2020.

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The infectious cycle of COVID-19 is unlike that of any other outbreak we have seen before.

### Incubation Timeline (Days)*, 1

<table>
<thead>
<tr>
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<th>1</th>
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</tbody>
</table>

*All but SARS have the potential for asymptomatic transmission
**Symptoms most commonly appear on Days 10-14
***The median incubation period for COVID-19 is 5.5 days, but symptoms can develop as late as 14 days post exposure

### Why does this matter?
- The combination of a longer incubation period with asymptomatic transmission means that there is a longer window of time during which infected individuals are unaware that they are contagious.

### Why is quarantine 14 days?
- While the median incubation period is 5.5 days, symptoms have been documented to occur over a longer time frame; 14 days should capture 99% of all cases²

### What do we still not know?
- We still do not accurately understand the full infectious period for COVID-19

### What we know about the infectious cycle?
- Multiple sources confirm asymptomatic transmission, but the exact timing of when an exposed individual becomes contagious is not known ³, ⁴, ⁵
- Viral loads build rapidly and continue to shed until 6-12 days after symptoms have cleared⁶

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1. CDC 2. Annals of Internal Medicine (link) 3. JAMA (link) 4. NEJM (link) 5. Science (link) 6. medRxiv (link)

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CASE FATALITY RATE (CFR) BY COUNTRY

While the global CFR is a useful metric to understand COVID-19, country-specific CFRs range by an order of magnitude.

**CFR by country**

What is driving the variation?

- **Position along the trajectory of the outbreak:** For many countries (e.g., Europe, US), the vast majority of cases have not yet resolved and the CFR is changing rapidly.

- **Breadth of testing:** Broader testing leads to a larger confirmed base of patients, decreasing CFR.

- **Distribution of key risk factors within the population:** Age, gender and pre-existing conditions have a significant influence on mortality (see next page); countries with higher CFRs have a population skewed towards these risk factors (e.g., Italy has the second oldest population on earth).

- **Health system threshold:** Every country has a health system capacity, that when exceeded, will result in the inability to provide sufficient support to all patients thereby resulting in a higher CFR.

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1. Calculated as Number of Deaths / Total Confirmed Cases as reported by Johns Hopkins University as of 3/21/2020. 2. Calculated as Number of Active Cases / Total Confirmed Cases as reported by Johns Hopkins University as of 3/23/2020.

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CASE FATALITY RATE (CFR) BY PATIENT CHARACTERISTIC

Significantly higher death rates occur among the elderly and those with underlying conditions

Case Fatality Rate by Specific Patient Characteristics
All confirmed cases in China as of February 11, 2020

Notes: Data includes 44,672 confirmed cases reported through February 11, 2020, which is the latest data available as of 3/23/20.
HOW CAN MITIGATION MEASURES LOWER THE BURDEN OF THE PANDEMIC?

Proactive and swift suppression measures (e.g., lockdowns, social distancing) are critical to control the spread and reduce the overall burden on the healthcare system, as ~15–20% of confirmed cases require hospitalization.

Illustrative COVID-19 transmission with and without suppression measures

Timing and width of peaks may vary between countries.

Proactive suppression efforts reduce the intensity of the spread, easing burden on health systems; use the time to prepare for more aggressive testing and system capacity.

Continued monitoring of social distancing measures (minimize large gatherings, keep travel restrictions) to keep transmission low.

Given asymptomatic spread of COVID-19, “flattening” of the curve is dependent on social distancing by all individuals, not just those displaying symptoms.

# of cases

Time (illustrative)

Uncontrolled transmission

Today

TBD – pending success and severity of suppression efforts

1. Assuming case-based isolation only
EARLY OBSERVATIONS ON CONTAINMENT MEASURES

• To arrest the growth of the confirmed cases, we have observed a number of **best practices**:
  – Moving quickly with a seemingly small number of cases to implement **tracing and suppression actions**
  – Deploying **extensive testing across a population to identify cases**, particularly in light of asymptomatic transmission of the virus
  – Implementing **aggressive containment measures** (e.g., closing bars, schools, restaurants, gyms, churches to maintain social distancing, restricting non-essential travel, quarantining all infected patients including asymptomatic ones)

• Experience to date in Europe and the United States points to a much lower level of containment than seen in China
  – Response has been **fragmented**: from “wait-and-see” approaches and “partial” solutions (i.e., limiting gatherings or travel in a city or region), to **total lockdown** of a country
  – Compliance with recommendations and declarations has been mixed (e.g., beach goers in CA post declaration of lockdown)
OPPORTUNITY FOR PHARMACEUTICAL INTERVENTIONS

While researchers are exploring potential existing therapeutics and new vaccines which could relieve the COVID-19 disease burden, the path is not short as clinical trials and subsequent manufacturing ramp-up will take months.

<table>
<thead>
<tr>
<th>Therapeutics</th>
<th>Vaccines</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description &amp; Status</strong></td>
<td><strong>Vaccines</strong></td>
</tr>
<tr>
<td>• No existing therapeutics are currently FDA approved to treat COVID-19, though studies and trials are underway to test efficacy of existing drugs for COVID-19</td>
<td>• Several vaccine types could be considered for COVID-19: 1) traditional protein-based (longer development, manufacturing timeframe but proven approach), 2) mRNA-based (quick to design but less proven technology and efficacy), 3) DNA-based (quick to design but less proven technology)</td>
</tr>
<tr>
<td>• Three general classes of therapeutics which act differently could be tested/approved: 1) Antiviral – slow virus spreading, 2) Symptom relief, 3) Immune system enhancement</td>
<td>• At the outset of the pandemic, multiple biotechs have moved to create a COVID-19 vaccine – the first out of the gate are mRNA varietals</td>
</tr>
<tr>
<td>• Front-line physicians are using some therapies off-label, which are approved for other indications</td>
<td>– <strong>Moderna</strong>, a biotech, is the first to have launched clinical testing of an mRNA vaccine in humans on 3/16/20 – but has not yet partnered with a larger, scaled PharmaCo</td>
</tr>
<tr>
<td>• Several clinical trials are underway with the CDC:</td>
<td>– <strong>Pfizer and BioNTech</strong> have partnered to test another mRNA vaccine starting in late April 2020</td>
</tr>
<tr>
<td>– Remdesivir (antiviral) – Gilead – originally for Ebola, but low efficacy – highly limited supply</td>
<td></td>
</tr>
<tr>
<td>– Hydroxychloroquine (antiviral) – generic – used to treat Malaria – limited supply</td>
<td></td>
</tr>
<tr>
<td><strong>Key hurdles</strong></td>
<td><strong>Key hurdles</strong></td>
</tr>
<tr>
<td>• Even if off-label efficacy was confirmed, significant manufacturing and distribution capacity would be needed to ramp up production of existing therapeutics; current global stores insufficient</td>
<td>• Large-scale manufacturing capacity would be needed and is not readily available/scalable (GSK Shingrix example demonstrates multi-year lag between vaccine approval and production scale)</td>
</tr>
<tr>
<td></td>
<td>• Timelines to produce required safety and efficacy clinical trial results estimated to take 12-18 months, even if ‘fast tracked’</td>
</tr>
</tbody>
</table>

Source: Credit Suisse Equity Research.

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Q1: Will public health measures suppress the outbreak and maintain suppression?
China has demonstrated suppression is feasible, but can suppression be maintained as suppression measures are eased? As importantly, will other countries be able to replicate suppression within their borders before their health systems are overwhelmed?

Key items to watch
- New case rates as China lifts restrictions: some new cases (a ‘bump’) are to be expected, but a spike could be concerning
- Case growth rates in the US and Europe: Multiple EU countries and the US have sustained near-exponential growth over the last few weeks and are enacting various degrees of containment measures now; the next few weeks are critical to see whether the tide can be stemmed

SCENARIO 1
Serial outbreaks lasting 4-6 months

SCENARIO 2
6–12 months to rein in pandemic

SCENARIO 3
12+ months; ongoing epidemic

Q2: Will a mitigating factor emerge to help dampen the effects of the virus?
If public health measures are insufficient, will the trajectory of the pandemic be influenced by an external factor such as a mutation that renders the virus less virulent, seasonality or a significantly improved clinical protocol?

Key items to watch
- Signs of seasonality: We will not know definitively if the virus is seasonal for 9-12 months, but diminishing outbreaks in the Northern Hemisphere as temperatures rise, and limited outbreaks in the Southern Hemisphere could be indicative
- Data on mutations and their impact: Very limited data is available on the impact of identified mutations of the virus on prevalence, transmission, or severity of disease
- Direct treatment and vaccine development efforts; clinical trials

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OUR SCENARIO FORECAST GENERATOR HELPS TO QUANTIFY POTENTIAL SCENARIOS

The model paints the picture of the “book-end” scenarios and a range of trajectories in between and is now incorporated into our hospital supply and demand model.

Oliver Wyman created a model to forecast the number of confirmed cases in a region or area based on the starting number of cases, daily case growth rates, the speed with which officials move to enact containment measures, and the effectiveness of those measures.

The model has been applied to forecast scenarios for hospital capacity in US geographies.

Link to the model can be found at https://oliverwymangroup.wufoo.com/forms/s12hwj5h0qqcx1/
**Scenario 1: Outbreak suppression in 4-6 months**

**What you’d have to believe**

- New case rates spike with initial outbreak in a region and increased testing, but level off within ~8 weeks
- Public health officials enact early and aggressive suppression measures to contain localized outbreaks (e.g., Norway, India, Czech Republic), learning from the “playbook” set by China, Singapore and refined by the next regions to experience outbreak
- Population largely complies with public health directives, slowing human-to-human transmission (R0<1); health systems are not overwhelmed, CFR does not rise
- Cases in China do not increase after broad public health measures (e.g., school closures, travel restrictions) are lifted
- China is then able to maintain suppression through testing, contact tracing and selective quarantine (particularly for international travelers)

**What we know so far**

- Aggressive suppression measures in China (100 MM under quarantine in February 2020, 59 MM remain so as of early March) contained spread within 8 weeks of identification
- New case rates in China have declined; similar compliance would be necessary in rest of world to contain
- China has not yet returned to “normal” (e.g., schools are still closed with staggered re-opening planned for Mar-May, Wuhan scheduled to re-open on April 8)

**Anticipated business impacts**

- Supply chain shocks in some sectors; Chinese manufacturing shutdown in part tempered by inventories stockpiled in advance of Lunar New Year
- Corporate and government-mandated travel restrictions lead to drop-off in demand in airlines and hotels and impact some retail supply and demand
- Earnings dented for 1-2 quarters post outbreak with gradual recovery and rebounding consumer confidence allowing companies to return to normal 2-3 quarters later
- Small local businesses (e.g., restaurants, gyms, salons) struggle to tread water during suppression measures, some do not reopen
- Central bank intervention and government stimulus implemented
- As international travel restrictions and quarantines are lifted, recovery in travel and hospitality begins

**Oliver Wyman COVID-19 Scenario Generator insights**

- Containment measures can take a few days to two weeks to demonstrate steady decay in the growth of confirmed cases (flattening of the curve) driven by a lag in case identification and variation in testing breadth
- High levels of containment (suppression) in a country with 100 starting cases and a growth rate of 50% per day, can contain the problem to 10,000 cases over an 8 week period (a ~100X difference compared to delayed, and minimal, containment measures)
Scenario 2: 6–12 months to rein in pandemic

What you’d have to believe

- While some countries move rapidly to replicate aggressive suppression measures, others either do not or are unable to drive compliance.
- Countries with slower, less aggressive response and/or poor compliance are not able to suppress the virus with case rates continuing to increase beyond expected 8 week window; in some places overwhelming healthcare systems.
- Some countries with initial containment see spike of cases after lifting containment measures.
- Insufficient public health measures are offset by an external factor (e.g., viral mutation affecting virulence, early identification and improved treatment, seasonality) that either decreases CFR or helps contain spread.

What we know so far

- Multiple other countries have thus far been unable (e.g., lack of resources to rapidly erect hospitals, lack of infrastructure and surveillance capabilities to track and isolate cases) or unwilling to mount the same public health response as China.
- Compliance with public health recommendations is more difficult to enforce in many countries (e.g., packed beaches in California post “shelter in place” order).
- Virulence-lowering viral mutations have been observed previously (e.g., SARS) and there is emerging evidence of at least two strains of COVID-19, one less virulent than the other.
- While ~50% of coronavirus family have proved to be seasonal, no direct evidence yet indicates COVID-19 is seasonal.
- Aggressive testing and documentation of effective treatment protocols has contributed to a dramatically reduced CFR in South Korea (1.24% as of 3/23) compared to that of other regions.
- There is a pipeline of pharmaceutical products in various stages of development.

Anticipated business impacts

- Employers reluctant to relax travel and WFH mandates without guidance from public health officials.
- Vulnerable industries experience a continued drop in demand driven by suppressive measures and shaken consumer confidence; take measures to stabilize balance sheets and ensure liquidity.
- Supply chain shocks play out over a six+ month period, after which momentum could begin to stabilize and recover.
- Moderate to potentially severe recession in impacted countries; larger, more diversified economies with less dependence on international trade and/or foreign income prove better able to weather slowing growth.
- Significant central bank intervention and government support programs (e.g., extended unemployment insurance, credit support for SMEs) are implemented.
- Some governments may choose to remove suppression measures to resuscitate economy, leading to restart of once dormant economic sectors, but re-emergence of COVID cases suggests more suppression measures may be needed.
**HOW LONG COULD THIS LAST? HOW MIGHT THIS PLAY OUT?**

**Scenario 3: 12+ months; ongoing pandemic**

<table>
<thead>
<tr>
<th>What you’d have to believe</th>
<th>What we know so far</th>
<th>Anticipated business impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Virus proves to either not be seasonal, or seasonal and endemic (rising, falling and returning seasonally by Hemisphere)</td>
<td>• Insufficient data to support scenario as of yet</td>
<td>• Severe recession on the order of Global Financial Crisis in 2020, possibly into 2021</td>
</tr>
<tr>
<td>• Regions are unable or unwilling for economic reasons to contain outbreaks; virus spreads widely, affecting ~20–60%(^1) of adult population in next 2 years</td>
<td>• Multiple vaccines under development but at least 1 year out</td>
<td>• Dramatic drop in demand (consumer confidence, access to supply, part-time/gig economy workers with less discretionary income) results in severe contraction in Q2 and Q3 with uncertain recovery in Q4</td>
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<tr>
<td>• Mortality rates do not decline, placing significant strain on or overwhelming health systems and further increasing fatality rates for other clinical conditions</td>
<td>• Unless “spike” of cases in a region can be smoothed over a longer period of time, health systems become overtaxed and cannot adequately meet all patients’ needs (e.g., Wuhan, Italy)</td>
<td>• Companies in particularly vulnerable industries (travel, energy, hospitality) require additional liquidity, and may trigger complications for related industries</td>
</tr>
<tr>
<td>• Vaccine or immunity after natural infection is required to halt progress of disease</td>
<td>• As health systems become overwhelmed, transmission and case fatality increases</td>
<td>• Massive central bank intervention plus government stimulus injected to protect vulnerable workers and businesses on a scale exceeding TARP</td>
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</tbody>
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**Oliver Wyman COVID-19 Scenario Generator insights**

- If daily growth rate is 50%, a totally passive approach to managing the outbreak leads to a growth trajectory just shy of a truly exponential curve
- 100 cases become almost 1,000,000 over an 8-week period
## WHAT SHOULD COMPANIES BE THINKING ABOUT RIGHT NOW?

| Confirm Business Resiliency | All companies should be implementing business continuity plans to reassure employees and ensure readiness for **supply chain constraints, demand shocks, and impacts to business partners**, prioritizing critical business activities and creating contingency plans for disruption |
| Model Financial scenarios | Companies should be **evaluating their financial outlook, modelling supply and demand** across a number of scenarios, identifying potential interventions and contingency plans for subsequent impacts and/or sustained challenges (e.g. *strategies for managing variable costs, cash flow, liquidity*) |
| Reassure Customers | Consumer concerns need to be understood, mapped, and incorporated into the business continuity plan such that consumer needs are addressed and trust is maintained |
| Move to Digitization Rapidly | Some industries are likely to see a **massive acceleration in the use of digital channels**. Retail, Financial Services, and Healthcare companies have experienced 100–900% growth in key digital channels in China during the outbreak. Customers with positive digital experiences are unlikely to return to analog channels |
| Prepare for Long Haul | Pandemic business continuity plans will get companies through the next 2–4 weeks, but strategies may be required to get through 6–12 months (or more) of disruption if subsequent demand shocks exist. Companies should consider the nature and required timing associated with more structural changes to their operations |
| Convene Industry | Companies should consider which industry and government collaborations are necessary to address safety concerns, share best practices, stimulate demand, and rebuild consumer trust |
READ OUR LATEST INSIGHTS ABOUT COVID-19 AND ITS GLOBAL IMPACT ONLINE

Oliver Wyman and our parent company Marsh & McLennan (MMC) have been monitoring the latest events and are putting forth our perspectives to support our clients and the industries they serve around the world. Our dedicated COVID-19 digital destination will be updated daily as the situation evolves.

Visit our dedicated COVID-19 website
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