
Consumer and Investment Management Division

Latest Developments on Covid-19 Therapies and Vaccines (Eighth in a Series)

April 14, 2020

Investment Strategy Group

Overview of Today's Call

- **Update on Covid-19**

- **Potential Therapies**



Esther Krofah, Executive Director, FasterCures, Milken Institute

- Served as the Director of Public policy at GlaxoSmithKline
- Previously was Deputy Director of HHS' Office of Health Reform
- Served as a program director at the National Governors Association

- **Potential Vaccines**



Richard Hatchett, MD, CEO of the Coalition for Epidemic Preparedness Innovations

- Served as acting Director of the Biomedical Advanced Research and Development Authority (BARDA)
- Previously was BARDA's Chief Medical Officer and Deputy Director
- Led the development of vaccines, therapeutics, and diagnostics for a number of emerging viruses
- Served at the White House under Presidents Bush and Obama



Paul Stoffels, MD, Chief Scientific Officer at Johnson & Johnson

- Served as Worldwide Chairman, Pharmaceuticals
- Led the transformation of the pharmaceutical R&D pipeline for Janssen
- Previously held various R&D leadership roles within the pharmaceutical sector of Johnson & Johnson

Forward-Looking Statements

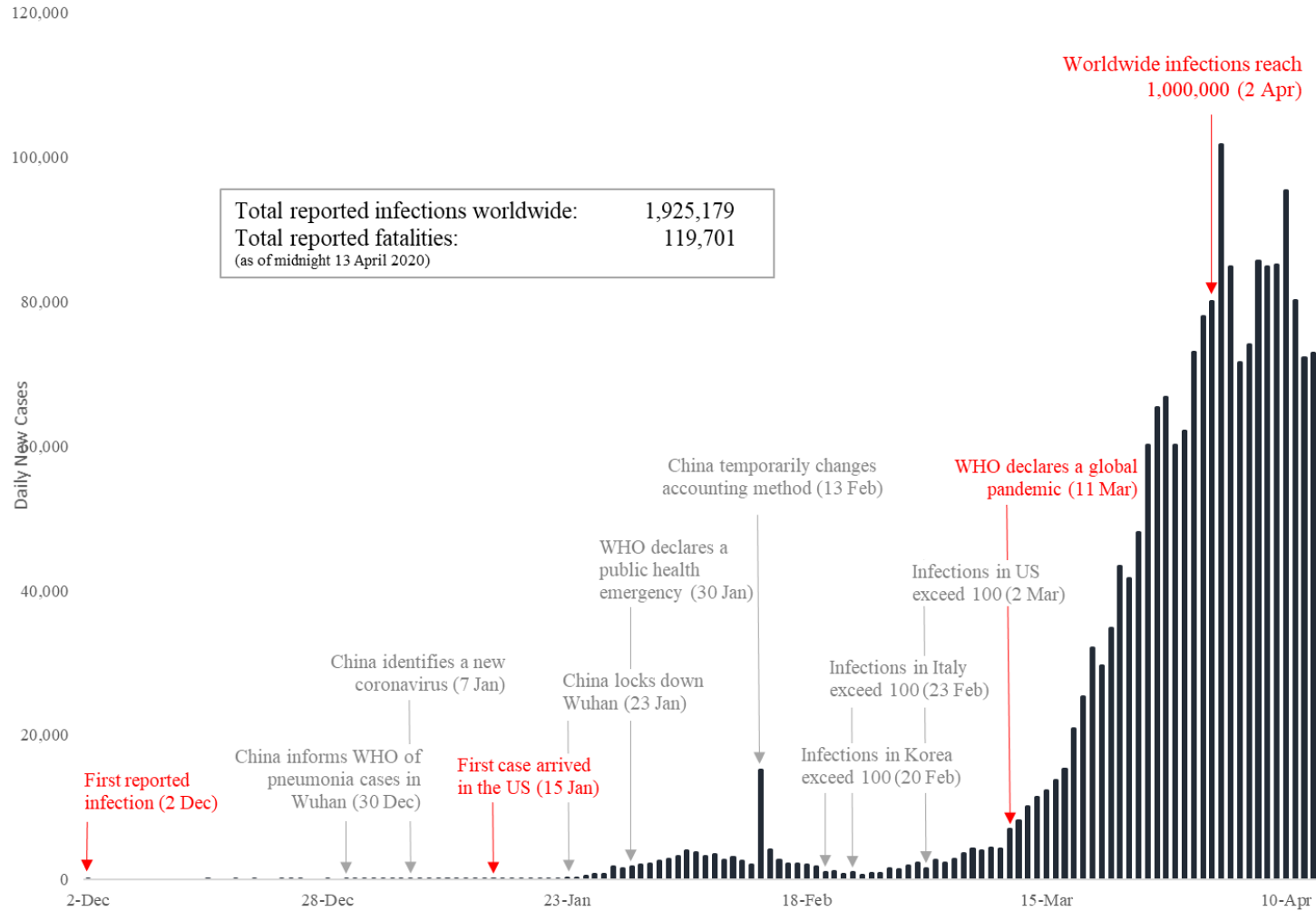
Today's presentations include forward-looking statements. These statements are not historical facts, but instead represent only the Firms' presenting beliefs regarding future events, many of which, by their nature, are inherently uncertain and outside of the Firms' control. Forward-looking statements include statements about the potential efficacy of diagnostic kits, therapies, vaccines and their potential impact on the global outbreak of a novel strain of coronavirus (COVID-19). Any impact of these measures on the results of the companies presenting or on financial markets or national economies more broadly is uncertain. As at the time of these presentations, the COVID-19 outbreak is resulting in widespread disruption to financial markets and normal patterns of business activity across the world and has led to significant market volatility and accommodative monetary policies by global central banks and companies around the world activating business continuity planning (BCP) strategies to safeguard the well-being of employees, the continued operation of critical functions and the support of clients. The extent of the impact of these measure on the COVID-19 outbreak and on the companies' operational and financial performance, and on the markets and national economies more generally, will depend on future developments including the efficacy of these measures and the duration and continued spread of the outbreak.

The statements in the presentations are current only as of their date, April 14, 2020. For a discussion of some of the risks and important factors that could affect the Firms' future results and financial condition, please refer to their quarterly reports filed on Form 10-Q and their Annual Reports filed on Form 10-K along with their other public reporting, including in particular the "Risk Factors" included therein.

We have expressed views from various sources including experts in the medical and pharmaceutical community. These views may be different than other views in the medical and/or pharmaceutical community.

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SARS-CoV-2 Pandemic Timeline

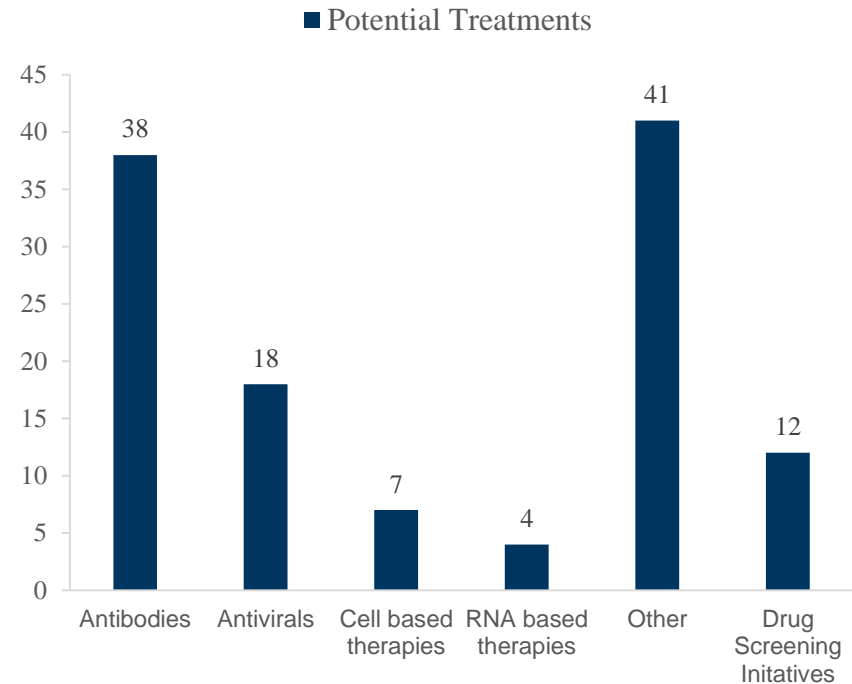


* As of April 13, 2020

Source: Investment Strategy Group, WHO, CDC, National Health Commission of People's Republic of China, John Hopkins University, Worldometers.

FasterCures – Treatments in the Pipeline

- Treatments are being developed to provide tools to impact the trajectory of the condition while a vaccine is developed.
- Some treatments are being studied to see if they can prevent infection. In addition, many currently used medicines are being studied to see if they can be repurposed to fight COVID-19.
- FasterCures/Milken Institute is currently tracking **120** potential treatments, including following **12** drug screening initiatives.*



- ~50 Treatment candidates currently in clinical trials or being used in hospitals/compassionate use
 - Including... Avastin, AiRuiKa, Kevzara, Actemra, Sylvant, Soliris, Gamifant, Convalescent plasma, Favipiravir, Kaletra, remdesivir, Prezcofix, Arbidol, Mesenchymal stem cells, corticosteroids, hydroxychloroquine, Jakafi, Rebif, losartan
- ~15 Treatment candidates expected to enter human trials by the end of the summer
 - Including... Antibodies from Takeda, Regeneron, Vir Biotech, AstraZeneca, and Emergent Biosolutions; galidesivir, Celularity's natural killer cell therapy, fenretinide

Remdesivir Compassionate Use Study

- Glimmers of hope, but more testing needed
- New England Journal of Medicine, April 10:
 - “In this cohort of patients hospitalized for severe Covid-19 who were treated with compassionate-use remdesivir, clinical improvement was observed in 36 of 53 patients (68%). Measurement of efficacy will require ongoing randomized, placebo-controlled trials of remdesivir therapy.”
 - Study was funded by Gilead Sciences, developer of remdesivir



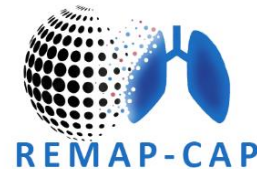
Solidarity Study - Remdesivir; Lopinavir/Ritonavir; Lopinavir/Ritonavir with Interferon beta-1a; and Chloroquine or Hydroxychloroquine



Adaptive COVID-19 Treatment Trial (ACTT) - Remdesivir



RECOVERY Trial- lopinavir-ritonavir; low-dose dexamethasone, hydroxychloroquine, azithromycin



REMAP-CAP - lopinavir-ritonavir; hydroxychloroquine, lopinavir-ritonavir + hydroxychloroquine; Interferon-beta-1a; Anakinra; tocilizumab; sarilumab

Antibody Studies

- Antibody studies are showing promise.
- From NIH on serosurvey:
 - Researchers will collect and analyze blood samples from as many as 10,000 volunteers. The results will help illuminate the extent to which the novel coronavirus has spread undetected in the United States and provide insights into which communities and populations are most affected.
 - Investigators will test participants' blood samples for the presence of SARS-CoV-2 antibodies, proteins the immune system produces to fight a specific infectious agent. A positive test result indicates previous infection....While cotton swab-based tests rapidly and effectively identify active infection, they do not determine whether a person was previously infected with SARS-CoV-2 and recovered.

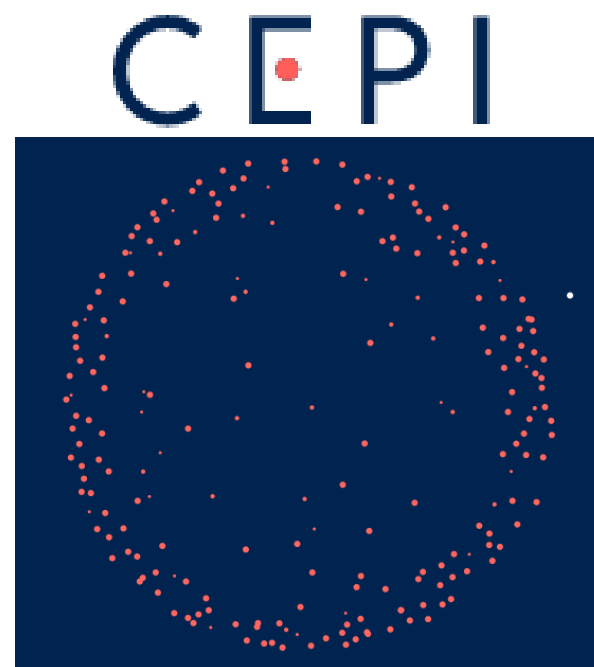


"Actually at the last task force meeting the individuals responsible for both developing, validating and getting the tests out, are saying, and I'm certain that's gonna happen, that within a period of a week or so, we're gonna have a rather large number of tests that are available."

*Dr. Anthony Fauci
Director, National Institute of Allergy and Infectious Diseases
10 April 2020*



- Launched in Davos in 2017 to develop vaccines to stop future epidemics.
- Founded by Governments of Norway and India, Bill & Melinda Gates Foundation, the Wellcome Trust, and the World Economic Forum.
- Backed by the Governments of Norway, UK, Germany, Japan, Canada, Ethiopia, Australia, Belgium, Denmark, Finland, the Bill & Melinda Gates Foundation, the Wellcome Trust, and the European Commission.
- Funds technologies with potential to accelerate the development and manufacturing of vaccines.



Partnerships with Vaccine Developers (1 of 2)

- On Jan 23, CEPI announced the initiation of three programs to develop vaccines against COVID-19 with:

1. Inovio

- An initial grant of up to \$9 million to support preclinical and clinical development through Phase 1 human testing of INO-4800 vaccine.
- Inovio's collaborators in this vaccine development include the Wistar Institute, VGXI, a fully owned subsidiary of GeneOne Life Science, Twist Bioscience, University of Pennsylvania, and Center for Pharmaceutical Research (MO).
- INOvio Initiated Phase 1 Clinical Trial on 6 April.



2. The University of Queensland

- Builds on previous \$14.7 millions partnership.
- Leverage a “molecular clamp” vaccine platform, a transformative technology that enables targeted and rapid vaccine production against multiple viral pathogens.



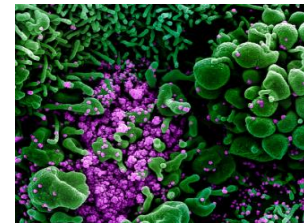
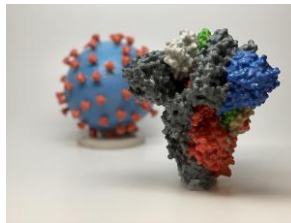
3. Moderna and US National Institute of Allergy and Infectious Diseases

- Under the terms of the partnership, CEPI funds Moderna’s manufacturing of an mRNA vaccine against COVID-19.
- The Vaccine Research Center of the National Institute of Allergy and Infectious Diseases (NIAID) collaborated with Moderna to design the vaccine.
- Clinical trial started on 16 March at Kaiser Permanente Washington Health Research Institute in Seattle.



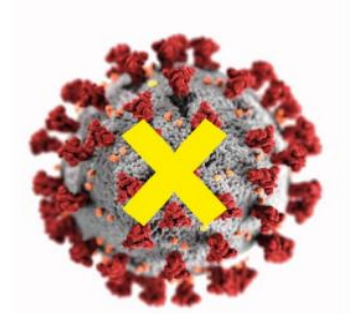
Partnerships with Vaccine Developers (2 of 2)

- CEPI has concluded 5 additional partnerships to develop COVID-19 vaccine with:
 - Curevac
 - Novavax
 - The University of Oxford
 - University of Hong Kong
 - Institut Pasteur



Resources Required to Develop a COVID-19 Vaccine

- CEPI has moved urgently to coordinate with global health authorities and partners to rapidly develop vaccine candidates against the disease.
- CEPI estimates that it will cost \$2 billion to develop a vaccine within the next 12-18 months. So far CEPI has raised over \$690 million towards this goal.
- CEPI is also a partner in the new COVID-Zero initiative, which aims to help raise at least \$8 billion by the end of April to cover a global funding shortfall for vaccines, treatments and testing for coronavirus.
- In comparison, a study by Bloomberg Economics has found that the pandemic could cost businesses a total of \$2.7 trillion in lost output – equivalent to the entire GDP of the U.K.



Johnson & Johnson – Fact Sheet

Overview

- Launched in 1886 with 14 employees
- \$82bn in total revenue in 2019
- Market cap of \$380bn; Largest pharmaceutical company in the world by market cap
- 1.61% of S&P500

Segments

- Pharmaceuticals
 - \$42bn in revenue. 11 products with \$1bn+ in annual revenue
 - Key franchises: Oncology, immunology, neuroscience, pulmonary hypertension, cardiovascular, and infectious diseases
 - Each area generated at least \$2.5bn in revenue in 2019
 - Immunology is the largest, generating ~\$14bn in revenue in 2019
- Medical Devices
 - \$26bn in revenue. 2nd largest medical device company
 - Key franchises: Cardiovascular, neurovascular, orthopedic surgery, general surgery, contact lenses, biosurgery, and wound closure
- Consumer
 - \$14bn in revenue
 - Key products include Tylenol, Band-Aid, Neutrogena, Listerine, Aveeno, Johnson's baby products



The Johnson & Johnson Vaccine Development

- Research teams at Janssen, in collaboration with the team of Dr. Dan Barouch at Beth Israel Deaconess Medical Center, part of Harvard Medical School, constructed and tested multiple vaccine candidates using the Janssen AdVac® technology.



Vaccine Timeline



- **AdVac® technology**
 - A technology based on the development and production of adenovirus vectors (gene carriers).
 - It can be used together with PER.C6® technology to develop recombinant vaccines against life-threatening infectious diseases.
- **PER.C6® technology**
 - Provides a cost-effective manufacturing system for high-yield, faster and large-scale production of vaccines and monoclonal antibodies.
 - Particularly useful for vaccine manufacturing that requires the production of hard-to-grow viruses and could enable making such vaccines affordable for the whole world.
- **Partnership with Biomedical Advanced Research and Development Authority**
 - Committing more than \$1 billion of investment to co-fund vaccine research, development, and clinical testing.

Expanded Antiviral Research

- Janssen's ongoing work in screening compound libraries from other pharmaceutical companies
- Screening Janssen's library of anti-viral molecules



FasterCures' Approach to COVID-19

- **Tracking:** What is the state-of-play for the development of treatments and vaccines?
- **Accelerating medicines:** What can be done to move as quickly as possible from research and development to the market?
- ➔ • **Developing Policy Solutions:** Where are there gaps? What are the policy needs for a comprehensive, long-term response?
- ➔ • **Surveillance:** How can data and technology create an “early warning system” for future pandemics?

Key Takeaways: Warp Speed

- Healthcare:
 - Testing
 - Medical Supplies (ventilators, PPE, ICU beds)
 - Therapies research and approvals
 - Vaccines research and approvals

Consumer and Investment Management Division

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Period	Gross Return	Net Return	Differential
1 year	6.17%	4.61%	1.56%
2 years	12.72%	9.43%	3.29%
10 years	81.94%	56.89%	25.05%

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