S22 [redacted]

s22 [redacted]

s22 [redacted]

- A **vaccine trial by US company Moderna has found neutralising antibodies** in the first eight people who took part. The next phase is for larger trials to be conducted. (BBC)

S22 [redacted]

S22

- **The US** is supporting one of the fastest-moving experimental solution to the COVID-19 pandemic, pledging as much as US$1.2 billion to AstraZeneca Plc to help make the University of Oxford's COVID-19 vaccine. The US has backed other projects at Johnson & Johnson, Moderna Inc and France's Sanofi, fuelling concerns that other parts of the world could fall behind. (Bloomberg)

S22

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- **US** – An experimental vaccine developed by the National Institutes of Health and Moderna Inc will start a 30,000-person study to prove if the vaccine is strong enough to protect against COVID-19. The study will commence 27 July. The US government is reportedly hoping to have results end of 2020. (ABC)

S22

S22

- **US equity markets rose on 15 July** on the back of positive vaccine news from Moderna and strong quarterly earnings reported by Goldman Sachs. The S&P increased by 29 points or 0.9 per cent, and the Dow Jones increased 228 points or 0.9 per cent. (Reuters)

S22

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- **The UK's Ministry of Business** announced it has entered agreements with French group Valneva and Pfizer Inc and BioNTech to secure a potential 90 million doses of possible vaccines. The deal with Pfizer and BioNTech will reportedly provide Britain with 30 million doses, and the other 60 million will be provided by Valneva, with an option of 40 million more doses if it is proven to be safe, effective and suitable. (ABC)

S22

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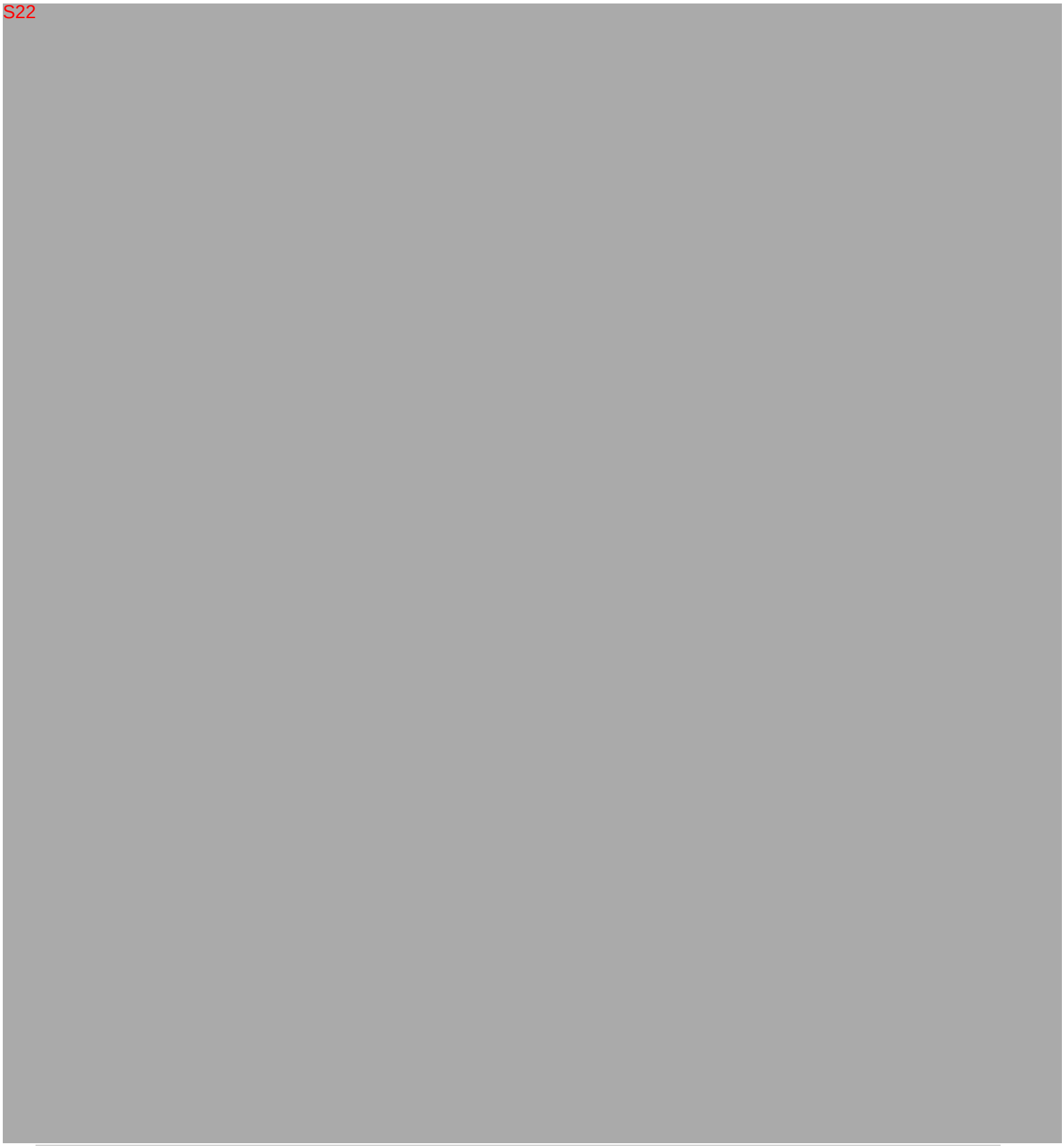


- The **US** has agreed to pay **Pfizer Inc. and BioNTech SE nearly US$2 billion to secure 100 million doses of their experimental COVID-19 vaccine** to provide to Americans free of charge, the latest sign the government is readying plans to make vaccines available if proved to work safely. Under the US$1.95 billion agreement, the US Department of Health and Human Services and the Defense Department will receive 100 million doses of the vaccine should it be cleared by regulators, and can also acquire an additional 500 million doses. The vaccine, which has shown promising preliminary results in small groups of patients, is set to enter late-stage testing this month. (WSJ)

S22

- US company Moderna Inc. said the study of its **experimental COVID-19 vaccine** began on 27 July. Researchers plan to enroll 30,000 people across the US in the last-stage, or phase three, trial of the Moderna vaccine candidate. Results, which government health officials said could come by November, will determine whether two doses protect against symptomatic COVID-19, and whether it should be cleared for widespread use. (WSJ)

S22

- **Israel** has formally submitted an expression of interest to join the COVAX global access facility, and has signed a number of bilateral agreements on COVID-19 R&D collaboration. Israel is also working with Moderna and AstraZeneca to secure potential vaccine supplies. Israel has also announced a number of bilateral programs to progress COVID-19 scientific collaboration, including a partnership with the UAE (announced on 25 June). S47E(d)

S22

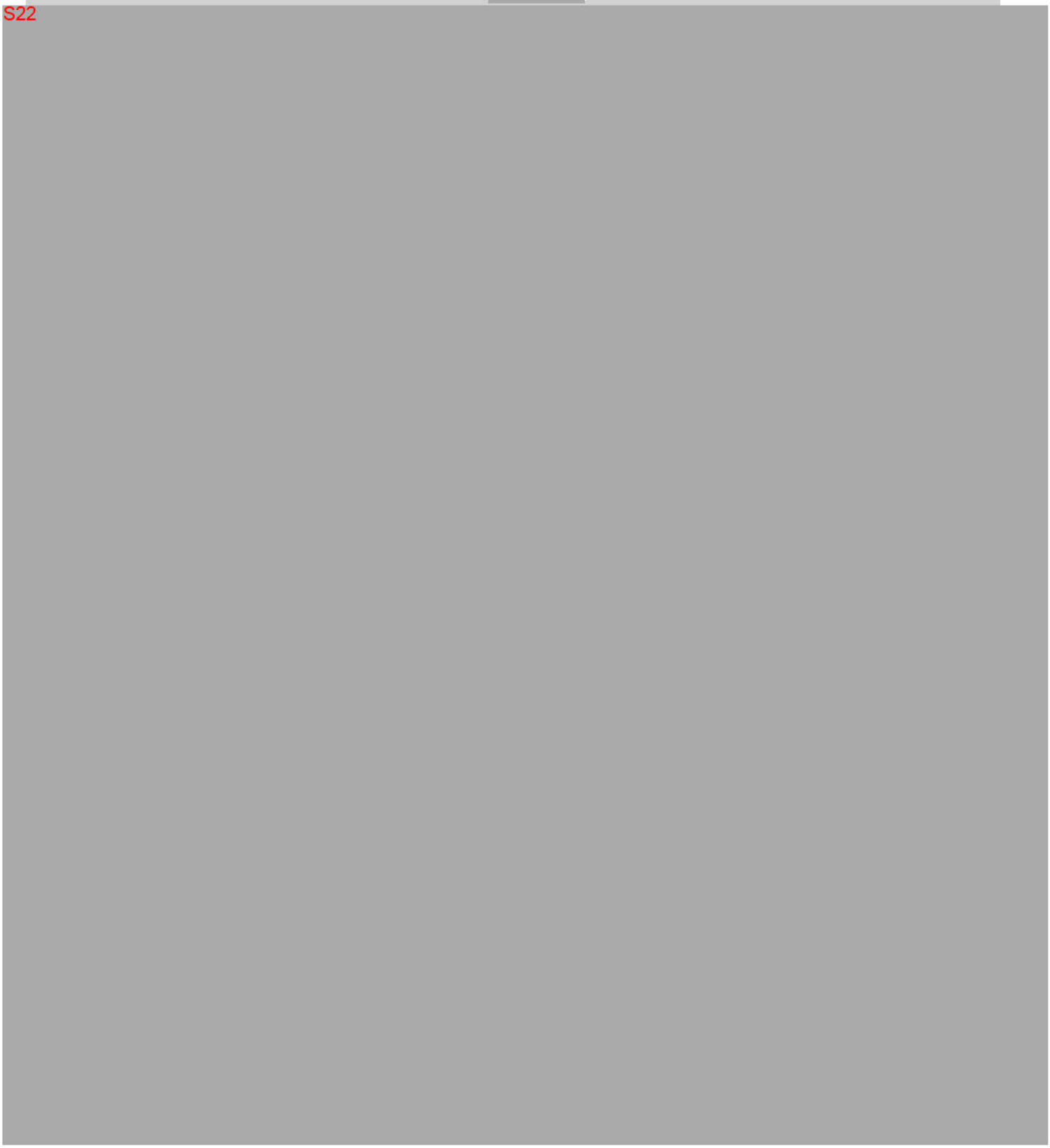
S22 [redacted]

- Media reports that the **Japanese** government has procured 120 million doses of Pfizer and Germany's BioNTech experimental COVID-19 vaccine by the end of June 2021. (FT)

S22 [redacted]

- German media reports that **German biotechnology company BioNTech** and US drug company Pfizer have received approval to proceed with phase 2 and 3 clinical trials of their BNT162b2 vaccine on 30,000 participants around the world. The BioNTech website states that by the end of the trial, the Phase 2/3 study is expected to be active at approximately 120 clinical investigation sites globally. S47E(d)

S22



ATTACHMENT B

COVID-19 Vaccines and Treatments: State of Play – Week ending 24 July 2020

Headline updates

- There are currently over **160** vaccine candidates in pre-clinical and clinical trials, including **25** undergoing clinical trials in humans (according to the WHO COVID-19 vaccine candidate landscape).
- The University of Oxford vaccine candidate - peer-reviewed Phase 1/2 clinical trial results were published in The Lancet on 20 July 2020. The candidate showed an acceptable safety profile and generated an immune response. The candidate will next move to large scale evaluation in a Phase 3 trial to be conducted in the United Kingdom and Brazil.
- The CanSino Biologics Inc. / Beijing Institute of Biotechnology candidate - peer-reviewed Phase 2 clinical trial results were published in The Lancet on 20 July 2020. The candidate showed an acceptable safety profile and generated an immune response. The candidate will next move to Phase 3 trials.
- On 18 July 2020 the Courier Mail reported that the Queensland Government had secured 100 million doses of the University of Queensland vaccine candidate. CSL published a response to these reports, clarifying that that they do not have a specific agreement with the Queensland Government.

Status of vaccines outlined in this update:

	Evaluation Phase				CEPI / Warp Speed portfolio	
Vaccine candidate	**Pre-clinical**	**Phase 1**	**Phase 2**	**Phase 3**	**CEPI**	**Warp Speed**
University of Oxford					X	X
Cansino Biologics						
Moderna					X	X
Inovio					X	X
BioNtech/Pfizer					X	X
Novavax						
Johnson & Johnson						
Clover Biopharmaceutical					X	
University of Queensland					X	
Vaxine						

CureVac					X	

Table key

Phase completed				
Phase underway				

Clinical trials being conducted in Australia

- The **University of Queensland (UQ)** protein vaccine (UQ-1-SARS-CoV-2-Sclamp) from Australia (*CEPI*)
    - Licenced to manufacture by CSL (Australia). Anticipated scalability: 100 million doses/year.
    - Funding: $5m from Medical Research Future Fund (MRFF), $10 million from the QLD Government and $3.5 million from the Paul Ramsay Foundation.
    - Phase 1 clinical trials are being conducted on 120 adults in Brisbane and began on Monday 13 July 2020. If clinical trials are successful, the vaccine is expected to be available from mid-late 2021.
- **Flinders University (SA) / Vaxine** recombinant protein-based vaccine (COVAX-19) from Australia
    - The Phase 1 clinical trial began on 2 July and will test safety and immunogenicity of the vaccine in 40 healthy candidates. Results are expected in September 2020.
    - Vaxine announced a partnership with Sypharma (Australia) and Medytox Inc. (South Korea) to progress vaccine development and commercialisation.
- The **Novavax** protein vaccine (NVX CoV2373) from the United States (*Operation Warp Speed & CEPI*)
    - Phase 1 trials are being conducted in 130 healthy volunteers at Brisbane and Melbourne sites with results expected by the end of July 2020. Phase 2 trials are to be conducted in multiple countries, including the USA, with results expected by the end of 2020.
    - Pre-clinical data is positive (the vaccine induced an antibody response), but the resulting publication is at the pre-print stage and has not yet been peer reviewed.
    - On 7 July 2020 the US Department of Defense announced an agreement to demonstrate commercial scale manufacturing.
    - On 27 May 2020 Novavax announced the acquisition of a biologics manufacturing facility in Czech Republic.
- The **Clover Biopharmaceuticals** protein vaccine (S-Trimer) from China (*CEPI*)
    - A Phase 1 trial is being conducted by Linear Clinical Research using 150 Perth-based volunteers. The trial began on 19 June and preliminary results are expected in August 2020.

- Clover Biopharmaceuticals has partnered with Dynavax and GSK to trial its vaccine with adjuvants CpG 1018 and AS03 respectively.

Other vaccine candidates being monitored:

- The **University of Oxford** viral vector vaccine (AZD1222) from the United Kingdom (funded by *Operation Warp Speed & CEPI*)
  - Licenced to manufacture by AstraZeneca (US, Europe) which have agreed to supply 400 million doses to Europe's Vaccines Alliance with deliveries starting by the end of 2020.
  - AstraZeneca has also reached agreements with the UK, US, CEPI and Gavi, and has agreed to a licence with the Serum Institute of India to supply 1 billion doses for low and middle income countries.
  - Preliminary results of the Phase 1/2 trial were peer reviewed and published in the Lancet on 20 July 2020:
    - Methods: 1,077 participants aged 18-55 years with no history of laboratory confirmed SARS-CoV-2 infection or of COVID-19-like symptoms were randomly assigned to receive ChAdOx1 nCoV-19 at a dose of 5×10^{10} viral particles or MenACWY (the trial comparator) as a single intramuscular injection. Safety was assessed over 28 days after vaccination with initial reports on the preliminary findings on safety, reactogenicity, and cellular and humoral immune responses. The study is ongoing.
    - Results:
      - Immune response: The vaccine induced strong antibody and T cell immune responses up to day 56 of the ongoing trial. These responses may be even greater after a second dose, according to a sub-group study of 10 participants.
      - Adverse events: The vaccine was found to have an acceptable safety profile and there were no serious adverse events. Fatigue and headache were the most commonly reported side-effects, reduced by taking paracetamol. The vaccine did not produced any serious adverse events.
    - Future plans: Further clinical studies, including in older adults, are being conducted with this vaccine. The current results focus on the immune response measured in the laboratory, and further testing is needed to confirm whether the vaccine effectively protects against infection.
- The **Moderna** mRNA vaccine (mRNA-1273) from the United States (*Operation Warp Speed & CEPI*)
  - Moderna has partnered with Lonza with the aim of utilising the worldwide manufacturing facilities of both companies to produce one billion doses annually.
  - Moderna has also reached agreement with Catalent for vaccine fill-and-finish, with the company preparing to provide 100 million doses of the finished

product to the US beginning in the third quarter of 2020 (assuming the vaccine is effective).

- Published preliminary results of Phase 1 trial in the New England Journal of Medicine:
  - 45 healthy adults (15 in three different dose groups) received two vaccinations, 28 days apart.
  - The candidate induced immune responses in all participants.
  - Adverse events that occurred in more than half of the participants included fatigue, chills, headache, myalgia and pain at the injection site. Three participants in the highest dose group reported one or more severe adverse events. No trial-limiting safety concerns were identified.
- A Phase 2 trial in 600 healthy adults is ongoing and a large phase 3 efficacy trial is anticipated to begin within the next month.

- **Inovio Pharmaceuticals** DNA vaccine (INO-4800) from the US (*Operation Warp Speed & CEPI*)
  - Interim data from 40 participants of a Phase 1 clinical trial to test the safety and immunogenicity indicated the vaccine was well tolerated and generated appropriate immune responses. The data is not yet peer reviewed or published.
  - Inovio conducted pre-clinical trials in several animal models with Public Health England and the CSIRO.
  - Inovio has reportedly signed an agreement with German manufacturer Richter-Helm BioLogics for large-scale production.
- The **Johnson & Johnson** viral vector vaccine (AdVac® adenoviral vector) from the US (*BARDA*)
  - Pre-clinical trials are underway, with researchers testing an adenovirus called Ad26 in monkeys. Phase 1/2 trials are anticipated to begin in late July.
  - On 6 July it was announced that Emergent Biosolutions, a Maryland-based drug manufacturer, will help Johnson & Johnson produce its candidate at scale over the next five years.
- The **BioNTech/Pfizer** mRNA vaccine (BNT162) from Germany and the US (supported by Fosun Pharma)
  - The expected manufacturing scalability is up to 100 million doses by the end of 2020 and 1.2 billion doses by the end of 2021.
  - The United Kingdom Ministry of Business announced it has agreements with the BioNTech/Pfizer alliance to provide Britain with 30 million doses.
  - A phase 1/2 clinical trial aiming to determine the efficacy, safety and immunogenicity is underway using 7,600 healthy participants.
  - On 1 July Pfizer and BioNTech announced early positive data from the clinical trial. Data from this study was published on pre-print server and is not yet peer reviewed.

- 45 healthy adults (12 in each dose group) received one vaccination or two, 21 days apart.
- All participants who received two vaccinations expressed elevated antibodies to the SARS-CoV-2 receptor binding domain (RBD).
- The most commonly reported adverse reactions were low grade fever and injection site pain. Pain was mild to moderate in low dose participants and higher for higher dose participants. Because of this, higher dose participants did not receive a second vaccination.

  - Further data from the ongoing clinical trial will enable the selection of lead dose levels for a Phase 2b/3 safety and efficacy study, potentially starting in July 2020.

- The **CanSino Biological Inc. / Beijing Institute of Biotechnology** viral vector vaccine from China
  - Preliminary results of the Phase 2 trial were peer reviewed and published in The Lancet on 20 July 2020:
    - Methods: 508 participants aged 18-83 years received low dose (5×10^{10} viral particles), high dose (1×10^{11} viral particles), or placebo as a single intramuscular injection. The study is ongoing.
    - Results:
      - Immune response: SARS-CoV-2 specific antibody responses were detected from Day 14 onwards and peaked at Day 28. Age and pre-existing immunity to the viral vector may affect the vaccine's safety and immunogenicity.
      - Adverse events: The low dose vaccine had a better safety profile and comparable immunogenicity to high dose. There were no serious adverse events from the vaccine.
  - Future plans: A Phase 2b trial will gather more evidence on immunogenicity and feasibility of additional dose immunisation in the older population.
- The **CureVac** mRNA vaccine (CVnCoV) from Germany (*CEP*I)
  - A Phase I trial began on 18 June 2020, with 168 adults recruited in Germany and Belgium. The next clinical phase will begin in September pending the Phase I data.

<u>Treatments:</u>

- Synairgen in the UK is trialling its drug, **Synairgen SNG001**, as a potential treatment for COVID-19. It works by using aerosols to send high concentrations of a naturally occurring antiviral protein to restore the lung's defence against the virus.
  - Between March and May this year, Synairgen sponsored a clinical trial at University Hospital Southampton to test SNG001 for COVID-19 patients. Those eligible for the trial only needed to have mild symptoms of COVID-19. In total, 101 patients in a hospital setting were enrolled in the trial and were given the drug daily for 14 days. Compared with a placebo, those given SNG001 had a 79% lower

risk of developing severe disease, were twice as likely to recover from their infection and were discharged earlier from hospital than those given the placebo.

- While the results of the SNG001 trial are very promising, further trials are required and independent consideration of its benefits against the potential risks. Side effects of SNG001 include inducing depression and worsening seizure disorders or heart failures.

- CSL Behring is part of the **CoVIg-19 Plasma Alliance**, an unprecedented industry partnership to develop CoVIg-19, a potential plasma-derived therapy for treating COVID-19. The CoVIg-19 Plasma Alliance will work toward developing the unbranded anti-SARS-CoV-2 polyclonal hyperimmune immunoglobulin medicine with the potential to treat individuals with serious complications from COVID-19, and to support national governments in their efforts to fight the current pandemic.
  - CSL Behring Australia is developing an anti-SARS-CoV-2 plasma product for the Australian market with the potential to treat people with serious complications of COVID-19, particularly those whose illness is progressing towards the need for ventilation. The investigational product, to be known as COVID-19 Immunoglobulin, is under development at the company's advanced manufacturing facility located in Broadmeadows, Victoria.

- As at 24 July, 1,410 randomised control trials relating to COVID-19 have been registered with the World Health Organisation's (WHO) International Clinical Trials Registry Platform. Some treatments being monitored include:
  - **Remdesivir**
    - The Therapeutic Goods Administration (TGA) granted provisional approval to remdesivir ("Veklury", Gilead Sciences Pty Ltd) on 10 July as the first treatment option for COVID-19. It has received provisional approval for use in adults and adolescent patients with severe COVID-19 symptoms who have been hospitalised.
    - Remdesivir is the most promising treatment option so far to reduce hospitalisation time for those suffering from severe coronavirus infections.
    - Remdesivir will not be available to Australians unless they are severely unwell, requiring oxygen or high level support to breathe, and in hospital care.
  - **Dexamethasone**
    - On 16 June the Chief Investigators released a statement regarding results for 2,104 patients that were randomised to receive 6mg dexamethasone daily for 10 days compared with 4,321 controls. The preliminary results indicate that the drug reduced mortality in critically ill COVID-19 patients:
      - In ventilated patients mortality was reduced by one-third;
      - In patients receiving oxygen mortality was reduced by one-fifth; and
      - There was no benefit in patients with mild disease.

- The Australian National COVID-19 Clinical Evidence Taskforce has released a statement that once the peer-reviewed data from the study are available, the Taskforce will incorporate evidence into the clinical guidelines.

- **Chloroquine or Hydroxychloroquine**
    - Preprint results of the RECOVERY trial on 15 July concluded that hydroxychloroquine was not associated with reductions in 28-day mortality in patients hospitalised with COVID-19, but was associated with an increased length of hospital stay and increased risk of progressing to invasive mechanical ventilation or death.
    - The RECOVERY trial stated on 5 June that no clinical benefit from using hydroxychloroquine in hospitalised patients with COVID-19 was found.
    - On 4 July WHO announced the hydroxychloroquine treatment arm of the Solidarity Trial had been discontinued with immediate effect.
- **Lopinavir/Ritonavir**
    - The Australian National COVID-19 Clinical Evidence Taskforce notes the release of the press statement from the chief investigators of the RECOVERY trial on 29 June that found no clinical benefit from using lopinavir-ritonavir in hospitalised patients with COVID-19.
    - On 4 July WHO announced the lopinavir-ritonavir treatment arm of the Solidarity Trial had been discontinued with immediate effect. The Taskforce is awaiting publication of the results of both trials.