From lab to clinic

Vaccines typically require many years of research and testing before reaching the clinic. But scientists are now racing to produce a safe and effective Covid-19 vaccine by next year, within a highly compressed timeframe. The process began in January this year with the deciphering of the Sars-CoV-2 genome.

**PROCESS**

1. **Discovery**
   Scientists devise an experimental vaccine from the disease-causing pathogen. (With the coronavirus, the usual time span of 2 to 5 years was shortened to months.)

2. **Pre-clinical testing**
   Scientists test a new vaccine on cells and then give it to animals such as mice or monkeys to see if it produces an immune response.

3. **Phase 1 (safety trials)**
   Scientists give the vaccine to a small number of people — 20 to 100 — to test safety and dosage as well as to confirm that it stimulates the immune system.

4. **Phase 2 (expanded trials)**
   Scientists give the vaccine to hundreds of people split into groups, such as children and the elderly, to see if the vaccine acts differently in them. These trials further test the vaccine's safety and ability to stimulate the immune system.

5. **Phase 3 (efficacy trials)**
   Scientists give the vaccine to thousands of people and wait to see how many become infected, compared with those who received a placebo. These trials can determine if the vaccine protects against the coronavirus.

6. **Early or limited approval**
   China and Russia have approved vaccines without waiting for the results of phase 3 trials. Experts say the rushed process has serious risks.

7. **Approval**
   Regulators in each country review the trial results and decide whether to approve the vaccine or not. During a pandemic, a vaccine may receive emergency use authorisation before getting formal approval. Once a vaccine is licensed, researchers continue to monitor people who receive it to make sure it is safe and effective.

8. **Manufacturing**
   Mass quantities of vaccine are produced and distributed.

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**Combined phases**

One way to accelerate vaccine development is to combine phases. Some coronavirus vaccines are now in phase 1/2 trials, for example, in which they are tested for the first time on hundreds of people.

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**Number of vaccines at this stage**

- **Phase 1:**
  - Discover: 1
  - Pre-clinical: 0
  - Phase 1: 0
  - Combined phases: 0

- **Phase 2:**
  - Discover: 0
  - Pre-clinical: 0
  - Phase 1: 0
  - Combined phases: 0

- **Phase 3:**
  - Discover: 0
  - Pre-clinical: 0
  - Phase 1: 0
  - Combined phases: 0

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*As of Sept 17, 2020

Sources: WORLD HEALTH ORGANISATION, NYTIMES, BLOOMBERG STRAITS TIMES GRAPHICS