at the outset of the pandemic were heightened by initial systems failures, including a lack of evidence-based guidelines, shortages of PPE, sudden lockdowns that disrupted normal operations, and an overwhelming sense that facilities were unprepared.[d]

The agility with which countries were able to manage **surge health workforce** demands has been a key difference between successful and struggling responses. The health systems that managed the COVID-19 response better quickly mobilized, trained and reallocated their health workforce with a combination of hiring new staff, using volunteers and medical trainees and mobilizing retirees. They took proactive steps to increase system capacity — in some cases with the rapid construction of makeshift hospitals in places where COVID-19 was out of control, but also by extending telemedicine, postponing elective medical procedures and supporting primary care.

Rapid research and development: while much of the early response to COVID-19 involves missed opportunities and failure to act, there are some areas in which early action was taken to good effect, most notably in **research and development** (R&D) and, in particular, vaccine product development.

The COVID-19 response benefited from years of effort to expand capacities for R&D to address potential pandemics. Expertise and technology from decades of work — especially on HIV, Ebola and cancer vaccine research and immunology — were available and ready to apply to the new virus.

In the wake of the Ebola epidemic in 2016, a new model for R&D response to emerging pathogens likely to cause severe outbreaks in the future was developed under WHO's R&D Blueprint[43, 44]. It identified bottlenecks in international collaboration, encouraged agreement on basic data-sharing principles, and sought more efficient ways to conduct clinical trials in times of distress[45]. The Coalition for Epidemic Preparedness Innovations (CEPI) was launched in 2017 as a non-profit organization funding basic research and early clinical trials for a list of epidemic-prone infectious diseases.

This infrastructure was deployed almost as soon as the COVID-19 alert was sounded. CEPI sought out and sponsored some of the first vaccine candidates (Moderna and Oxford University) as early as 20 January 2020, when there were fewer than 600 cases around the world. A number of adaptive clinical trials were launched which provided evidence quickly, for example the UK's Recovery trial by June 2020 had shown the effectiveness of dexamethasone, and the lack of clinical benefit of the use of hydroxychloroquine in COVID-19 disease[46]. The R&D Blueprint encouraged adaptive clinical trials and launched the Solidarity trial in mid-April 2020, which exemplified an efficient and robust way to generate randomized evidence using simple large trials.

d Source: Focus group discussions conducted for the Independent Panel Secretariat with a sample of health workers from different disciplines and regions.