PACIFIC JOURNAL OF MEDICAL SCIENCES

{Formerly: Medical Sciences Bulletin}

ISSN: 2072 – 1625

Pac. J. Med. Sci. (PJMS)

www.pacjmedsci.com. Email: managingeditorpjms1625@gmail.com.

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TIMELINE OF COVID-19 PANDEMIC: FROM DECEMBER 2019 TO DECEMBER 2022

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The impact of the COVID-19 pandemic across the world cannot be overemphasized. It affected the day-to-day life in multiple ways, causing lockdowns to reduce the rapid spread of the virus. The emerging variants of the virus (nCoV-2) rendered the drugs and vaccines, that had been designed for the management of the disease, ineffective. The prolonged lockdowns affected the mental health of people, causing serious psychological disturbances, such as depression, anxiety, and inability to tackle negative emotions [1, 2]. The authorities in countries around the world responded in a variety of ways and with different timelines to the pandemic after it was declared by the World Health Organization (WHO).

The major objective of this paper is to highlight the timeline of the most important events which took place during the COVID-19 pandemic, using open access publications by the Center for Disease Control (CDC) [3], WHO [4] and Papua New Guinea Joint Agency Task Force National Control Centre for COVID-19 [5] as major sources of information.

On December 12, 2019, a cluster of patients in China's Hubei Province, in the city of Wuhan, begin to experience the symptoms of an atypical pneumonia-like illness that does not respond well to standard treatments [3].

On December 31, 2019, the WHO Country Office in China was informed of several cases of a pneumonia of unknown cause with symptoms including shortness of breath and fever occurring in Wuhan, China. All initial cases seem connected to the Huanan Seafood Wholesale Market [3]. At the same time the Wuhan Municipal Health Commission, China, reported a cluster of cases of pneumonia in Wuhan, Hubei Province. A novel coronavirus was eventually identified [4, 6].

On the 1st and 2nd January 2020, the Huanan Seafood Wholesale Market in Wuhan was closed amid worries in China of a reprise of the 2002–2004 SARS (Severe Acute Respiratory

Syndrome Coronavirus or SARS-CoV-1) outbreak [3]. WHO had set up the Incident Management Support Team (IMST) across the three levels of the organization: headquarters, regional headquarters and country level, putting the organization on an emergency footing for dealing with the outbreak [3, 4].

On January 3, 2020, China informs WHO that they have identified over 40 cases of pneumonia of unknown cause [3]. On 4 January 2020, on social media the WHO reported that there was a cluster of pneumonia cases – with no deaths – in Wuhan, Hubei province [4].

On January 5, 2020, the CDC National Center for Immunization and Respiratory Diseases (NCIRD) activates a center-level response to investigate this novel pneumonia of unknown cause. The genetic sequence for the atypical pneumonia virus, Wuhan-Hu-1, was submitted to the Department of Zoonoses, National Institute of Communicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention, in Beijing, China by Yong-Zhen Zhang of Fudan University, Shanghai. The complete genetic sequence of the virus remains unavailable to the rest of the world as the virus spreads [3]. On the same day (5 January 2020), WHO published the first Disease Outbreak News on the new virus. This was a flagship technical publication to the scientific and public health community as well as global media. It contained a risk assessment and advice, and reported on what China had told the organization about the status of patients and the public health response on the cluster of pneumonia cases in Wuhan [6].

On January 7, 2020, public health officials in China identify a novel coronavirus as the causative agent of the outbreak. CDC establishes an incident management structure to guide their response to the novel coronavirus by following the preparedness plan for developing tests and managing cases made for Middle East Respiratory Syndrome Coronavirus (MERS-CoV) [3].

On January 10, 2020, WHO started using the phrase “2019 Novel Coronavirus” or “2019-nCoV” to refer to disease causing the outbreak in Wuhan, China. CDC publishes information about the 2019 Novel Coronavirus (2019-nCoV) outbreak caused by the SARS CoV-2 virus on its website. Edward C. Holmes of the University of Sydney, Australia posts online that the viral genome sequence of the unknown pneumonia causing the outbreak in Wuhan has been uploaded to GenBank as “Wuhan-Hu-1” (MN908947) and will be released shortly. He does so on behalf of Yong-Zhen Zhang of Fudan University, Shanghai in collaboration with the Shanghai School of Public Health, the Central Hospital of Wuhan, Huazhong University of Science and Technology, the Wuhan Center for Disease Control and Prevention, the National Institute for Communicable Disease Control and

Prevention, Chinese Center for Disease Control, and the University of Sydney. Hours later, Holmes and Zhang publish the sequence [3].

On the same day, 10 January 2020, WHO issued a comprehensive package of technical guidance online with advice to all countries on how to detect, test and manage potential cases, based on what was known about the virus at the time. This guidance was shared with WHO's regional emergency directors to share with WHO representatives in countries. Based on experience with SARS and MERS and known modes of transmission of respiratory viruses, infection and prevention control guidance were published to protect health workers recommending droplet and contact precautions when caring for patients, and airborne precautions for aerosol generating procedures conducted by health workers [4].

On January 11, 2020, WHO tweets that it has received the genetic sequences of the novel coronavirus from China and expects that the information will shortly become publicly available. CDC updates its Travel Health Notice (THN) system for persons traveling to Wuhan, China to Level 1 or “practice usual precautions.” China reports the first death from the novel coronavirus and publishes a draft genome of the newly discovered coronavirus suspected of causing the outbreak. By January 12, 2020, four other genomes have been uploaded to the viral sequence database curated by the Global Initiative on Sharing All Influenza Data (GISAID) [3].

On 12 January 2020, China shared publicly the genetic sequence of COVID-19 [7].

On January 13, 2020, the Thailand Ministry of Public Health confirms the first laboratory-confirmed case of the SARS-CoV-2 virus outside of China [3, 8].

On January 14, 2020, WHO finds evidence of possible human-to-human transmission of the SARS-CoV-2 virus, but WHO scientists say that human-to-human transmission is not surprising given our knowledge of respiratory pathogens [3]. On the same day 14 January 2020, the WHO technical lead for the response noted in a press briefing there may have been limited human-to-human transmission of the coronavirus (in the 41 confirmed cases), mainly through family members, and that there was a risk of a possible wider outbreak. The lead also said that human-to-human transmission would not be surprising given our experience with SARS, MERS and other respiratory pathogens [4].

On January 15, 2020, the Japanese Ministry of Health, Labor and Welfare reports an additional laboratory-confirmed case of the SARS-CoV-2 virus outside of China [3].

On January 19, 2020 Worldwide, 282 laboratory-confirmed cases of the 2019 Novel

Coronavirus have been reported in four countries: China (278 cases), Thailand (2 cases), Japan (1 case) and the Republic of Korea (1 case) [3].

On January 20, 2020, CDC reported the first laboratory-confirmed case of the 2019 Novel Coronavirus in the U.S. from samples taken on January 18 in Washington state and on the same day activates its Emergency Operations Center (EOC) to respond to the emerging outbreak [3].

On January 21, 2020, Chinese government officials confirm that human-to-human transmission is driving the spread of the SARS-CoV-2 virus in China [3].

Between January 20 – 21 2020, the WHO experts from its China and Western Pacific regional offices conducted a brief field visit to Wuhan [4].

On January 22, 2020, the WHO International Health Regulation Emergency Committee decided not to declare the 2019 Novel Coronavirus a Public Health Emergency of International Concern (PHEIC). Instead, the committee decides to monitor the situation and reconvene in 10 days to re-evaluate [3]. On the same day, 22 January 2020, WHO mission to China issued a statement saying that there was evidence of human-to-human transmission in Wuhan but more investigation was needed to understand the full extent of transmission [9].

On 22- 23 January 2020, the WHO Director-General convened an Emergency Committee (EC) under the International Health Regulations (IHR 2005) to assess whether the outbreak constituted a public health emergency of international concern. The independent members from around the world could not reach a consensus based on the evidence available at the time. They asked to be reconvened within 10 days after receiving more information [10].

On January 23, 2020, in Wuhan, China— a city of 11 million people, was placed under lockdown due to the 2019 Novel Coronavirus outbreak [3].

On January 28, 2020, CDC issues a Level 3 Travel Health Notice— advising travellers to avoid all non-essential travel to China due to the 2019 Novel Coronavirus outbreak. The U.S. government relocates U.S. citizens from Wuhan, China back to the U.S. due to the 2019 Novel Coronavirus (2019-nCoV) [3]. On the same day 28 January 2020, a senior WHO delegation led by the Director-General travelled to Beijing to meet China's leadership, learn more about China's response, and to offer any technical assistance. While in Beijing, Dr. Tedros agreed with Chinese government leaders that an international team of leading scientists would travel to China on a mission to better understand

the context, the overall response, and exchange information and experience [11].

On January 30, 2020, CDC confirms that the SARS-CoV-2 virus has now spread between two people in Illinois with no history of recent travel. This is the first recorded instance of person-to-person spread of the 2019 Novel Coronavirus in the U.S and brings the total number of cases up to seven [3]. On the same day, 30 January 2020, the WHO Director-General reconvened the Emergency Committee (EC). This was earlier than the 10-day period and only two days after the first reports of limited human-to-human transmission were reported outside China. This time, the EC reached consensus and advised the Director-General that the outbreak constituted a Public Health Emergency of International Concern (PHEIC). The Director-General accepted the recommendation and declared the novel coronavirus outbreak (2019-nCoV) a PHEIC. This is the 6th time WHO has declared a PHEIC since the International Health Regulations (IHR) came into force in 2005 [12]. The situation report of the WHO for 30 January reported 7818 total confirmed cases worldwide, with the majority of these in China, and 82 cases reported in 18 countries outside China. WHO gave a risk assessment of very high for China, and high at the global level [13].

On January 31, 2020, WHO's International Health Regulation Emergency Committee reconvenes early to declare the 2019 Novel Coronavirus outbreak a Public Health Emergency of International Concern (PHEIC). The Secretary of the Department of Health and Human Services (HHS), Alex Azar, declares the 2019 Novel Coronavirus (2019-nCoV) outbreak a public health emergency [3].

On February 3, 2020, the Department of Homeland Security (DHS) directs all flights from China and all passengers who have travelled to China within the last 14 days to be routed through one of eleven airports in the U.S. for enhanced screening procedures and possible quarantine. U.S. citizens who have been in Hubei province within 14 days of their return are subject to up to 14 days of mandatory quarantine; U.S. citizens who have been in other areas of mainland China within 14 days of their return are subject to 14 days of self-quarantine with health monitoring; and foreign nationals (other than immediate family of U.S. citizens, permanent residents, and flight crew) who have travelled in China (excluding Hong Kong and Macau) within 14 days of their arrival, will be denied entry into the U.S. CDC submits an emergency use authorization (EUA) to FDA to expedite approval for a CDC developed SARS-CoV-2 diagnostic test [3].

On the 3 February 2020, WHO releases the international community's Strategic Preparedness and Response Plan to help protect states with weaker health systems [14].

On February 4, 2020, FDA approves the EUA for the CDC developed SARS-CoV-2 diagnostic test kit [3].

On February 5, 2020, CDC begins shipping its laboratory test kit to detect SARS-CoV-2 virus, "CDC 2019-nCoV Real Time RT-PCR," to select domestic and international laboratories [3].

On February 11, 2020, WHO announces the official name for the disease that is causing the 2019 Novel Coronavirus outbreak: "COVID-19." The new name of this disease is an abbreviated version of "Coronavirus Disease 2019" [3].

Between 11 - 12 February 2020, WHO convened a Research and Innovation Forum on COVID-19, attended by more than 400 experts and funders from around the world, which included presentations by George Gao, Director General of China CDC, and Zunyou Wu, China CDC's chief epidemiologist [15].

Between 16 - 24 February 2020, the WHO-China Joint mission, which included experts from Canada, Germany, Japan, Nigeria, Republic of Korea, Russia, Singapore, and the US (CDC, NIH) spent time in Beijing and travelled to Wuhan and two other cities. They spoke with health officials, scientists, and health workers in health facilities (maintaining physical distancing) [16, 17].

On March 11, 2020, after more than 118,000 cases in 114 countries and 4,291 deaths, the WHO declares COVID-19 a pandemic [3]. On the same day, 11 March 2020, deeply concerned both by the alarming levels of spread and severity, and by the alarming levels of inaction, WHO made assessment that COVID-19 can be characterized as a pandemic [4].

On 13 March 2020, the COVID-19 Solidarity Response Fund was launched to receive donations from private individuals, corporations, and institutions [18].

On March 15, 2020, in the USA, States begin to implement shutdowns to prevent the spread of COVID-19. The New York City public school system— the largest school system in the U.S., with 1.1 million students— shuts down, while Ohio calls for restaurants and bars to close [3].

On March 17, 2020, Moderna Therapeutics begin the first human trials of a vaccine to protect against COVID-19 at a research facility in Seattle, Washington. The University of Minnesota launches a clinical trial testing hydroxychloroquine, an FDA-approved drug for the prevention and treatment of malaria, for the treatment of COVID-19 [3].

On 18 March 2020, WHO and partners launch the Solidarity Trial, which is an international clinical trial that aims to generate robust data

from around the world to find the most effective treatments for COVID-19 [19].

On 20 March 2020, the Prime Minister of Papua New Guinea announced the first positive COVID-19 case in the country [5]

On 22 March 2020, a "State of Emergency" (SOE) for 14 days was declared. The entire country was put on a 14-day lockdown. PNG government established the National Emergency Operation Centre (NEOC) which is a multi-ministerial and inter-agency coordination body, to coordinate all the strategic planning and operations on all the health and non-health aspects [5]

On March 31, 2020, the Journal of the American Medical Association Ophthalmology reports that COVID-19 can be transmitted through the eye. One of the first warnings of the emergence of the SARS-CoV-2 virus came late in 2019 from a Chinese ophthalmologist treating patients in Wuhan, Li Wenliang, MD, who died at age 34 from COVID-19 [3].

On April 22, 2020, after two pet cats in separate areas of New York state test positive for the SARS-CoV-2 virus, CDC recommends that people restrict their pets' interactions with other people or animals outside their household to prevent the spread of COVID-19 [3].

On April 26, 2020, Clinicians in the U.S. and U.K. report clusters of children and adolescents requiring admission to intensive care units (ICUs) with a multisystem inflammatory condition that can lead to multiorgan failure—like Kawasaki disease and toxic shock syndrome. This condition became known as Multisystem Inflammatory Syndrome in Children (MIS-C), a serious inflammatory condition that affects children with current or recent COVID-19 infections [3].

On April 30, 2020, USA administration launches Operation Warp Speed, an initiative to produce a vaccine against the SARS-CoV-2 virus as quickly as possible. The operation funds the development of six promising vaccine candidates while they are still in the clinical trial phase, including the Pfizer-BioNTech and Moderna mRNA vaccines [3].

On May 1, 2020, the FDA issues an emergency use authorization (EUA) for the use of the antiviral drug Remdesivir for the treatment of suspected or confirmed COVID-19 in people who are hospitalized with severe disease [3]. CDC launches the SARS-CoV-2 Sequencing for Public Health Emergency Response, Epidemiology and Surveillance (SPHERES), a national network to provide real-time genomic sequencing data to public health response teams investigating COVID-19 cases, allowing them to track the SARS-CoV-2 virus as it evolves [3]. On the same day (May 1 2020), the

WHO convenes the International Health Regulation Emergency Committee for a third time and declares that the global COVID-19 pandemic remains a Public Health Emergency of International Concern (PHEIC) [3].

On May 8, 2020, FDA authorizes the first COVID-19 test with the option of using home-collected saliva samples [3].

On May 15, 2020, CDC distributes a warning for clinicians through the Health Alert Network describing Multisystem Inflammatory Syndrome in Children (MIS-C), a serious inflammatory condition that affects children with current or recent COVID-19 infections [3].

On May 21, 2020, AstraZeneca receives more than $1 billion from the U.S. government in funding for the development of the AstraZeneca/Oxford University COVID-19 vaccine, with the first doses due to arrive in September 2020 [3].

On July 6, 2020, more than 200 scientists sign an open letter asking WHO to update its COVID-19 guidelines to include warnings about airborne transmission [3].

On July 9, 2020, WHO announces that the SARS-CoV-2 virus that causes COVID-19 can be transmitted through the air and is likely being spread by asymptomatic individuals [3].

On August 11, 2020, Sputnik V was granted full permanent approval in Russia. It becoming the world's first vaccine against COVID-19 to be granted emergency use authorization. Sputnik V has been authorized in 71 countries with a total population of over 4 billion people. Its one-component version, Sputnik Light, is authorized in over 30 countries, both as a standalone vaccine and a universal booster to other vaccines [20].

On August 14, 2020, CDC releases data indicating that most COVID-19 positive people are infectious to others for up to 10 days after symptoms first appear, but that individuals with severe illness or who are immunocompromised may be infectious for up to 20 days [3].

On August 22, 2020, a study published by the Journal of the American Medical Association calls into question the clinical benefits of the anti-viral drug Remdesivir being used to treat patients hospitalized with COVID-19 [3].

On August 23, 2020, FDA issues an EUA for use of convalescent plasma (the liquid component of blood that, when taken from someone who has recently recovered from an infection, can contain antibodies to that illness) to treat people hospitalized with severe COVID-19 [3].

On August 24, 2020, the first documented case of COVID-19 reinfection was confirmed by the University of Hong Kong [3].

On September 1, 2020, the U.S. and China decline to join the COVID-19 Vaccine Global Access Facility, or COVAX, a global program spearheaded by WHO that aims to develop and distribute COVID-19 vaccines worldwide— more than 170 other nations sign on [3].

On September 3, 2020, the Journal of the American Medical Association and WHO now recommend the use of steroids for the treatment of severe COVID-19 disease after multiple studies find that steroids like dexamethasone, hydrocortisone, and methylprednisolone— a group of cheap and widely available drugs that reduce inflammation and immune response— can reduce mortality in severe cases of COVID-19 by up to 36% [3].

On September 14, 2020, Pfizer BioNTech expands phase 3 clinical trials of its COVID-19 vaccine to 44,000 participants— increasing the trial population diversity to include adolescents as young as 16 years and people with chronic, stable HIV, hepatitis C, or hepatitis B infections. The Pfizer/BioNTech vaccine is a 2-shot series given 3 weeks apart and must be stored at a temperature of –70 degrees Celsius (or –94 degrees Fahrenheit) [3].

On September 21, 2020, Johnson & Johnson begins phase 3 clinical trials of its COVID-19 vaccine with 60,000 participants. The J&J vaccine does not need to be frozen and may require just one shot [3].

On November 9, 2020, FDA issues an EUA for Eli Lilly's drug Bamlanivimab, a monoclonal antibody treatment that mimics the immune system's response to infection with SARS-CoV-2 and appears to protect patients at increased risk from a COVID-19 infection progressing to more severe forms of disease [3].

On November 17, 2020, Dr. Anthony Fauci discusses the need to understand the "long COVID" symptoms like persistent fatigue, shortness of breath, muscle aches, sporadic fevers, and concentration issues, that as many as one-third of patients experience for weeks or months after contracting COVID-19 [3].

On December 11, 2020, FDA issues an EUA for the Pfizer-BioNTech COVID-19 vaccine. ACIP recommends the Pfizer-BioNTech COVID-19 vaccine for all people ages 16 years or older for the prevention of COVID-19 [3].

On December 14, 2020, the U.K. announces the detection of a new and more contagious COVID-19 variant, B.1.1.7 [3].

On December 18, 2020, FDA issues an EUA for the Moderna COVID-19 vaccine [3].

On December 19, 2020, ACIP recommends the Moderna COVID-19 vaccine in persons ages 18 years or older for prevention of COVID-19 [3].

On December 30, 2020, the Oxford University / AstraZeneca COVID-19 vaccine is authorized for emergency use in the U.K. Within a week, 530,000 doses are available for care-home residents, adults ages 80 years and older, and healthcare workers [3].

December 31, 2020, One year anniversary of the first reported case of COVID-19 to WHO [3].

On January 25, 2021, the first case of the COVID-19 P.1 / "Gamma" variant, first identified by scientists in Brazil, is detected in Minnesota USA [3].

On January 28, 2021, the first case of the COVID-19 B 1.351 / "Beta" variant, first identified by scientists in South Africa, is detected in South Carolina [3].

On February 27, 2021, FDA approves an emergency use authorization (EUA) for Johnson & Johnson's one-shot COVID-19 vaccine for all people ages 18 years and older [3].

On February 28, 2021, ACIP recommends Johnson & Johnson's COVID-19 vaccine for all people ages 18 years and older [3].

On Tuesday 9 March 2021, PNG Medical and Scientific Advisory Committee (MESAC), after studying the various COVID-19 vaccines developed, recommended that PNG source the AstraZeneca vaccine that was developed through the COVID-19 Vaccine Global Access (COVAX) facility and approved by WHO [5, 21].

On March 11, 2021, first anniversary of WHO declaring COVID-19 a global pandemic [3, 22].

On March 14, 2021, Ireland, Iceland, Denmark, and Norway suspend distribution of AstraZeneca's COVID-19 vaccine as the European Union (EU) investigates if the shot may be linked to reports of blood clots [3].

On March 18, 2021, after 13 European countries halt distribution of the AstraZeneca COVID-19 vaccine pending review, the European Medicines Agency (EMA) announces that they did not find any evidence that the vaccine causes blood clots, and while they were unable to definitively rule out a link between rare blood clots events and the vaccine, the AstraZeneca COVID-19 vaccine is still considered safe, is effective, and the benefits of this vaccine still outweigh its risks [3].

On March 29, 2021, CDC study finds that mRNA COVID-19 vaccines, Pfizer-BioNTech and Moderna, are highly effective at preventing infection with the SARS-CoV-2 virus in real-world conditions among healthcare personnel,

first responders, and other essential workers (groups that are more likely than the general population to be exposed to the virus because of their occupations), reducing their risk of infection by 90% [3].

On April 13, 2021, CDC and FDA issue a joint statement recommending pausing the use of the Johnson & Johnson's COVID-19 vaccine while six cases of a rare and serious blood clot in people who received the J&J COVID-19 vaccine are investigated [3].

On April 21, 2021, ACIP and FDA recommend the continued use of Johnson & Johnson's COVID-19 vaccine for all people ages 18 years and older in the U.S., following a thorough safety review after the use of the vaccine was paused when 6 cases of rare and severe type of blood clots were reported [3].

On May 10, 2021, FDA expands the emergency use authorization (EUA) for the Pfizer-BioNTech COVID-19 vaccine to include all adolescents ages 12–15 years [3].

On May 12, 2021, ACIP recommends the Pfizer-BioNTech COVID-19 vaccine for all adolescents ages 12–15 years [3].

On June 1, 2021, the COVID-19 B.1.617.2 / "Delta" variant, first identified in India, becomes the dominant variant in U.S. The variant begins a third wave of infections during the summer of 2021 [3, 23].

On Thursday 3, June 2021 the "Direction No.2" authorizing AstraZeneca vaccination to be administered in the vaccination roll-out program in PNG was issued [5].

On July 9, 2021, CDC and FDA release a joint statement assuring the public that Americans who have been fully vaccinated do not need a booster shot at this time [3].

On July 20, 2021, the Lancet reports that more than 1.5 million children worldwide have lost their primary or secondary caregiver due to the COVID-19 pandemic [3].

On August 11, 2021, CDC releases a statement assuring the public that COVID-19 vaccination is safe for pregnant and breastfeeding people. CDC studies have found that an infection with COVID-19 during pregnancy increases the risk of developing severe illness from COVID-19 and that there is no evidence that any vaccines, including the COVID-19 vaccines, cause fertility problems in women or men [3, 24].

On August 13, 2021, ACIP recommends an additional dose of COVID-19 vaccine after the two-dose vaccine series for all people with moderately to severely compromised immune systems [3].

On August 18, 2021, HHS, CDC, and FDA release a statement concluding that booster shots of the Pfizer-BioNTech, Moderna, and Johnson & Johnson COVID-19 vaccines will be needed to protect against severe disease, hospitalization, and death in coming months [3].

On August 23, 2021, FDA fully approves the Pfizer-BioNTech COVID-19 vaccine for all people ages 18 years and older. Full FDA approval further reinforces that the Pfizer-BioNTech COVID-19 vaccine has been shown to meet the agency's high standards for safety, effectiveness, and consistent quality in manufacturing [3].

On August 30, 2021, ACIP recommends Pfizer-BioNTech's COVID-19 vaccine for all people ages 16 years and older [3].

On September 24, 2021, ACIP recommends Pfizer-BioNTech's COVID-19 vaccine boosters for all people ages 65 years and older, residents of long-term care settings, people age 50–64 years with underlying medical conditions, and people ages 18–49 years with underlying medical conditions and / or who live or work in high-risk settings to be given at least 6 months after their primary vaccination series [3].

On September 29, 2021, CDC issues an urgent health advisory to increase COVID-19 vaccination rates among people who are pregnant, breastfeeding, or who are trying to become pregnant. More than 22,000 pregnant people have been hospitalized with COVID-19 and 161 have died. COVID-19 in pregnant people carries a two-fold risk of admission to intensive care, a 70% increased risk of death, and adverse pregnancy outcomes that can include preterm birth, stillbirth, and the admission of a newborn into the ICU with COVID-19 [3].

On October 6, 2021, WHO publishes a clinical case definition of "post COVID-19 condition" or long COVID. The symptoms of long COVID include, but are not limited to, fatigue, shortness of breath, and / or cognitive dysfunction that persists for at least two months and impacts everyday life, three months from the onset of an initial COVID-19 infection [3, 25].

On October 21, 2021, ACIP recommends Moderna or Pfizer-BioNTech's COVID-19 vaccine boosters for all people ages 65 years and older and all people ages 18 years and older who are residents of long-term care settings, have underlying medical conditions, and who live or work high-risk settings to be given least 6 months after their primary vaccination series. ACIP also recommends booster shots for everyone who received Johnson & Johnson's COVID-19 vaccine more than 2 months ago [3]. On November 2, 2021, ACIP recommends the Pfizer-BioNTech pediatric COVID-19 vaccine for all children ages 5–11 years [3].

On November 10, 2021, CDC and WHO report that more than 22 million infants missed their first dose of the measles vaccine in 2020. This is the largest global increase of unvaccinated children in two decades and is due in-part to the disruptions the COVID-19 pandemic has had on health care and immunization [3, 26].

On November 19, 2021, amid worries of an upcoming Omicron surge, CDC strengthens its recommendation urging that everyone ages 18 years and older who received a Johnson & Johnson, Pfizer-BioNTech, or Moderna COVID-19 vaccine should receive a booster after they are fully vaccinated [3].

On November 26, 2021, WHO designates the COVID-19 "Omicron" variant, first identified by scientists in South Africa, as a "variant of concern." Changes in the spike protein of the Omicron variant of the SARS-CoV-2 virus, concern scientists around the world due to the potential for increased transmissibility and decreased vaccine protection [3, 27].

On November 29, 2021, CDC recommends that everyone ages 18 years and older who received a Johnson & Johnson COVID-19 vaccine should receive a booster shot 2 months after their initial J&J vaccine [3].

On December 1, 2021, the first case of the Omicron variant in the U.S. was detected by the California and San Francisco Departments of Public Health [3].

On December 9, 2021, CDC and FDA expand COVID-19 booster recommendations to include everyone ages 16 years and older [3].

On December 20, 2021, CDC releases data estimating that the Omicron variant is around 1.6 times more transmissible than Delta variant [3].

On December 23, 2021, FDA authorizes Merck's anti-viral pill Molnupiravir to treat COVID-19 under an EUA for all adults and children ages 18 years and older who test positive and are at high risk for progression to severe disease. It is the second treatment for COVID-19 that is taken orally and can be used at home but, despite supply concerns, Paxlovid remains the preferred oral anti-viral treatment for COVID-19 [3].

On January 3, 2022, FDA amends the emergency use authorization (EUA) for the Pfizer-BioNTech COVID-19 vaccine to allow a single booster dose for all individuals ages 12–15 years; shortens the time-period between the completion of primary vaccination series of the Pfizer-BioNTech COVID-19 vaccine and a booster dose to at least 5 months; and allows for a third primary series dose for certain immunocompromised children in the 5–11 years age group [3].

The WHO Emergency Use Listing (EUL) process determines whether a product can be recommended for use based on all the available data on safety and efficacy and on its suitability in low- and middle-income countries. As of 12 January 2022, the following vaccines have obtained the WHO EUL [29, 30]:

- The Pfizer/BioNTech COMIRNATY vaccine, 31 December 2020.
- The SII/COVISHIELD and AstraZeneca/AZD1222 vaccines, 16 February 2021.
- The Janssen/Ad26.COV 2.S vaccine developed by Johnson & Johnson, 12 March 2021.
- The Moderna COVID-19 vaccine (mRNA 1273), 30 April 2021.
- The Sinopharm COVID-19 vaccine, 7 May 2021.
- The Sinovac-CoronaVac vaccine, 1 June 2021.
- The Bharat Biotech BBV152 COVAXIN vaccine, 3 November 2021.
- The Covovax (NVX-CoV2373) vaccine, 17 December 2021.
- The Nuvaxovid (NVX-CoV2373) vaccine, 20 December 2021

On January 13, 2022, the Papua New Guinea authorities fully approved the administration of booster dose or second dose of the COVID-19 vaccine. The approved vaccines were AstraZeneca, J & J and Sinopharm [31].

On January 31, 2022, FDA fully approves the Moderna COVID-19 vaccine for all people ages 18 years and older. Full FDA approval further reinforces that the Moderna COVID-19 vaccine has been shown to meet the agency's high standards for safety, effectiveness, and consistent quality in manufacturing [3].

On February 4, 2022, ACIP recommends the use of Moderna's vaccine for all people ages 18 years and older [3].

On February 11, 2022, CDC releases data showing that COVID-19 vaccine boosters remain safe and were highly effective against severe disease during the Omicron and Delta variant surges for everyone ages 5 years and older [3].

On March 2, 2022, WHO releases data showing that COVID-19 pandemic triggered a 25% increase in anxiety and depression worldwide, with young people and women at highest risk [3].

March 11, 2022 was the second-year anniversary of WHO declaring COVID-19 a global pandemic [3].

On March 16, 2022, at the World Trade Organization (WTO) meeting the U.S., the European Union, India, and South Africa forge a preliminary agreement on a COVID-19 vaccine

intellectual property (IP) waiver, hoping to expand access to vaccines around the world [3].

On March 29, 2022, CDC, and FDA both recommend a second mRNA COVID-19 vaccine booster for immunocompromised individuals and all adults ages 50 and older 4 months after their last booster dose [3]. On the same day, CDC recommends that all adults who received a primary vaccine series and booster dose of Johnson & Johnson's COVID-19 vaccine receive a second booster dose with an mRNA COVID-19 vaccine. In addition, CDC recommends that all adults who received a primary vaccine series and booster dose of Johnson & Johnson's COVID-19 vaccine receive a second booster dose with an mRNA COVID-19 vaccine [3].

On May 5, 2022, WHO estimates that there have been approximately 15 million direct or indirect deaths (also called "excess mortality") globally from January 2020 – December 2021 that were caused by the COVID-19 pandemic. South-East Asia, Europe, and the Americas accounted for 84% of the excess deaths [3, 31].

On May 19, 2022, ACIP recommends Pfizer-BioNTech's COVID-19 vaccine boosters for everyone ages 5–11 years to be given at least 5 months after their primary vaccination series. ACIP also recommends everyone ages 12 years and older who is immunocompromised and those ages 50 years and older should receive a second booster dose at least 4 months after their first to prevent severe disease, hospitalization, and death [3].

On June 18, 2022, ACIP recommends Moderna and Pfizer-BioNTech's COVID-19 vaccines for everyone ages 6 months – 5 years, expanding vaccine eligibility to over 20 million additional children in the U.S. All people ages 6 months and older are now eligible for COVID-19 vaccination in the U.S [3].

On June 24, 2022, ACIP recommends Moderna's COVID-19 vaccine for everyone ages 6–17 years [3].

On July 8, 2022, FDA fully approves Pfizer-BioNTech's COVID-19 vaccine for everyone ages 12–15 years. Full FDA approval further reinforces that Pfizer-BioNTech's COVID-19 vaccine has been shown to meet the agency's high standards for safety, effectiveness, and consistent quality in manufacturing.

On July 13, 2022, ACIP interim recommendation for use of Novavax COVID-19 vaccine in adults 18 years and older [32].

On August 5, 2022, FDA issues EUA for Novavax (Novavax, Inc), COVID-19 vaccine adjuvanted to provide a two-dose primary series to individuals 18 years of age and older [32].

On August 19, 2022, FDA expands age indication of Novavax COVID-19 vaccine, adjuvanted EUA to include use in individuals 12 years of age and older [32].

On August 22, 2022: CDC recommends Novavax COVID-19 vaccine for use in adolescents 12 years through 17 years as a primary series option [32].

On August 31, 2022, FDA amended EUAs of Moderna and Pfizer-BioNTech COVID-19 vaccines to authorize bivalent formulations for use as a single booster dose at least 2 months following primary or booster vaccination [32].

On October 12, 2022, CDC recommends expanding the use of updated (bivalent) COVID-19 vaccines (Pfizer-BioNTech for children ages 5 through 11 years, Moderna for children and adolescents ages 6 through 11 years) to children ages 5 through 11 years [32].

On December 8, 2022, FDA authorizes updated (bivalent) COVID-19 vaccines for children down to 6 months of age [32].

WHO continues to provide Coronavirus disease (COVID-19) weekly epidemiological updates and monthly operational updates [33, 34].

CONCLUSION:

The timeline presented here is not exhaustive because of the complexities of the coronavirus pandemic effects and impact in different countries around the world. It briefly highlights the tremendous efforts by the CDC, WHO and other relevant agencies to track and record some of the events related to the pandemic over the last 3 years.

REFERENCES:

1. Chakraborty, I., and Maity, P. (2020). Covid-19 Outbreak: Migration, Effects on Society, Global Environment and Prevention. Sci. Total Environ. 728, 138882. doi: 10.1016/j.scitotenv.2020.138882.
2. Saladino, V., Algeri, D., and Auriemma, V. (2020). The Psychological and Social Impact Of Covid-19: New Perspectives Of Well-Being. Front. Psychol. 11, 2550. doi: 10.3389/fpsyg.2020.577684
3. David J. Sencer CDC Museum: In Association with the Smithsonian Institution. https://www.cdc.gov/museum/timeline/covid19.html
4. Archived: WHO Timeline - COVID-19. https://www.who.int/news/item/27-04-2020-who-timeline---covid-19.
5. PNG Joint Agency Task Force National Control Centre for COVID-19: https://covid19.info.gov.pg/
6. Pneumonia of unknown cause – China. https://www.who.int/emergencies/disease-outbreak-news/item/2020-DON229
7. Genetic sequence of COVID-19 – China. https://www.who.int/csr/don/12-january-2020-novel-coronavirus-china/en/
8. WHO statement on novel coronavirus in Thailand. https://www.who.int/news/item/13-01-2020-who-statement-on-novel-coronavirus-in-thailand.
9. Mission summary: WHO Field Visit to Wuhan, China 20-21 January 2020.

https://www.who.int/china/news/detail/22-01-2020-field-visit-wuhan-china-jan-2020.
10. Statement on the first meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV) https://www.who.int/news/item/23-01-2020-statement-on-the-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov).
11. WHO, China leaders discuss next steps in battle against coronavirus outbreak. https://www.who.int/news/item/28-01-2020-who-china-leaders-discuss-next-steps-in-battle-against-coronavirus-outbreak.
12. Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV). https://www.who.int/news/item/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov).
13. Novel Coronavirus(2019-nCoV) Situation Report–10. www.who.int/docs/default-source/coronaviruse/situation-reports/20200130-sitrep-10-ncov.pdf?sfvrsn=d0b2e480_2.
14. 2019 Novel Coronavirus (2019-nCoV): Strategic preparedness and response plan. https://www.who.int/publications/i/item/strategic-preparedness-and-response-plan-for-the-new-coronavirus.
15. World experts and funders set priorities for COVID-19 research. https://www.who.int/news/item/12-02-2020-world-experts-and-funders-set-priorities-for-covid-19-research
16. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19) https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf?sfvrsn=fce87f4e_2;
17. WHO joint mission. https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf
18. COVID-19 Solidarity Response Fund: Help WHO fight COVID-19. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/donate.
19. WHO COVID-19 Solidarity Therapeutics Trial. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/global-research-on-novel-coronavirus-2019-ncov/solidarity-clinical-trial-for-covid-19-treatments.
20. Sputnik V Vaccine Granted Full Permanent Approval in Russia. https://sputnikvaccine.com/newsroom/pressreleases/sputnik-v-vaccine-granted-full-permanent-approval-in-russia/
21. PNG government looks at AstraZeneca COVID-19 vaccine: https://covid19.info.gov.pg/government-looks-at-astrazeneca-covid-19-vaccine/
22. COVID-19: One year later – WHO Director-General's new year message https://www.who.int/news/item/30-12-2020-covid-19-anniversary-and-looking-forward-to-2021.
23. Deltavariant:www.who.int/emergencies/diseases/novel-coronavirus-2019/media-resources/science-in-5/episode-45---delta-variant?gclid=EAIaIQobChMItdyquMuc_gIVkrCWCh0scABtEAAYAiAAEgIFaPD_Bw
24. Vaccines, pregnancy, menstruation, lactation and fertility https://www.who.int/emergencies/diseases/novel-coronavirus-2019/media-resources/science-in-5/episode-41---vaccines-pregnancy-menstruation-lactation-and-fertility
25. WHO Post COVID condition: Long COVID www.who.int/emergencies/diseases/novel-coronavirus-2019/media-resources/science-in-5/episode-47---post-covid-19 condition?gclid=EAIaIQobChMI2J6B_syc_

gIV67-WCh2uXAE5EAAYASAAEgLvBfD_BwE
26. Nearly 40 million children are dangerously susceptible to growing measles threat. https://www.who.int/news/item/23-11-2022-nearly-40-million-children-are-dangerously-susceptible-to-growing-measles-threat.
27. WHO about Omicron variant. www.who.int/emergencies/diseases/novel-coronavirus-2019/media-resources/science-in-5/episode-63---omicron-variant?gclid=EAIaIQobChMI1J-Dxsc_gIVjKqWCh2zcAmKEAAYASAAEgLOy_D_BwE
28. Global excess deaths associated with COVID-19, January 2020 - December 2021. A comprehensive view of global deaths directly and indirectly associated with the COVID-19 pandemic. https://www.who.int/data/stories/global-excess-deaths-associated-with-covid-19-january-2020-december-2021.
29. Coronavirus disease (COVID-19): Vaccines with WHO EUL. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-(covid-19)-vaccines?adgroupsurvey={adgroupsurvey}&gclid=EAIaIQobChMI1PTx4JGg_gIVDoeWCh01Lw9XEAAYASAAEgL4B_D_BwE.
30. COVID-19 Vaccines with WHO EUL. https://covid19.trackvaccines.org/agency/who/
31. Direction – Booster Vaccination. PNG Joint Agency Task Force, National Control Centre for COVID-19. https://covid19.info.gov.pg/
32. Vaccine Timeline: Historic Dates and Events Related to Vaccines and Immunization. https://www.immunize.org/timeline/
33. Coronavirus disease (COVID-19) Weekly Epidemiological Updates and Monthly Operational Updates. https://www.who.int/publications/m/item/weekly-epidemiological-update-on-covid-19---1-march-2023
34. Coronavirus disease (COVID-19) Weekly Epidemiological Updates and Monthly Operational Updates. https://www.who.int/publications/m/item/weekly-epidemiological-update-on-covid-19---30-march-2023.