PHARMACOVIGILANCE PLAN FOR

BIOLOGIC LICENSE APPLICATION #125742

OF

COMIRNATY® (PFIZER-BIONTECH COVID-19 VACCINE, mRNA, BNT162b2, PF-07302048)

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LIST OF ABBREVIATIONS

Abbreviation	Definition of Term
AE	adverse event
AESI	adverse event of special interest
A:G	albumin:globulin
ALC-0315	((4-hydroxybutyl)azanediyl)bis(hexane-6,1-diyl)bis(2-hexyldecanoate)
ALC-0159	2-[(polyethylene glycol)-2000]-N,N-ditetradecylacetamide
ARDS	acute respiratory distress syndrome
BALB/c	bagg albino
BC	Brighton Collaboration
BEST	biologics effectiveness and safety
BLA	biologics license application
BMI	body mass index
BP	blood pressure
CD4, CD8	cluster of differentiation-4, 8
CDC	Centers for Disease Control and Prevention
CI	confidence interval
COPD	chronic obstructive pulmonary disease
COVID-19	coronavirus disease 2019
CSR	clinical study report
CT	clinical trial
DART	developmental and reproductive toxicology
DCA	data capture aid
DLP	data-lock point
DoD	Department of Defense
DSPC	1,2-distearoyl-sn-glycero-3-phosphocholine
ECDC	European Center for Disease Control
EEA	European Economic Area
eGFR	estimated glomerular filtration rate
EU	European Union
EUA	emergency use authorization
FDA	(US) Food and Drug Administration
GLP	good laboratory practice
HbA1c	glycated hemoglobin
HBV	hepatitis b virus
HCV	hepatitis c virus
HIV	human immunodeficiency virus
IA	interim analysis
ICU	intensive care unit
IFN	Interferon
IL-4	interleukin-4
IM	intramuscular(ly)

Abbreviation	Definition of Term
IMD	index of multiple deprivation
IND	investigational new drug
LNP	lipid nanoparticle
LOE	lack of efficacy
MAH	marketing authorization holder
MedDRA	Medical Dictionary for Regulatory Activities
MERS-CoV	Middle East respiratory syndrome–coronavirus
MHS	Military Health System
MIS-C	multisystem inflammatory syndrome in children
MOA	mechanism of action
modRNA	nucleoside-modified messenger ribonucleic acid
mRNA	messenger ribonucleic acid
NCMD	National child mortality database
NDA	new drug application
NDS	new drug submission
NHP	nonhuman primate
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
OCS	oral corticosteroids
OTIS	Organization of Teratology Information Specialists
PHN	Pediatric Heart Network
PK	pharmacokinetic
PRAC	pharmacovigilance risk assessment committee
PT	Preferred Term
PVP	pharmacovigilance plan
RBC	red blood cell
RMP	Risk Management Plan
RNA	ribonucleic acid
RR	relative risk
RSV	respiratory syncytial virus
SAE	serious adverse event
SARS	severe acute respiratory syndrome
SARS-CoV-1	severe acute respiratory syndrome coronavirus 1
SARS-CoV-2	severe acute respiratory syndrome coronavirus 2
siRNA	small-interfering RNA
SMSR	summary monthly safety report
Tdap	tetanus, diphtheria, and acellular pertussis
TESSy	The European Surveillance System
Th1	T helper cell type 1
Th2	T helper cell type 2
UK	United Kingdom
US	United States
USP	United States pharmacopeia
V8	variant 8

Abbreviation	Definition of Term
V9	variant 9
VAED	vaccine-associated enhanced disease
VAERD	vaccine-associated enhanced respiratory disease
WBC	white blood cells
WHO	World Health Organization
WOCBP	women of childbearing potential

1. INTRODUCTION

1.1. Product Details

Table 1. Product Details[a]

Product	COVID-19 Vaccine, mRNA, herein after referred to as BNT162b2 is a nucleoside-modified messenger RNA (modRNA) encoding the viral spike (S) glycoprotein of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).
Brief description of the product	Chemical class: modRNA formulated in lipid particles. Mechanism of Action: The modRNA in the BNT162b2 is formulated in lipid particles, which enable delivery of the mRNA into host cells to allow expression of the SARS-CoV-2 S antigen. The vaccine elicits an immune response to the S antigen, which protects against COVID-19. Important information about its composition: 1. PBS Sucrose Formulation with *purple cap* The BNT162b2 is a sterile suspension for injection. The BNT162b2 is supplied as a frozen suspension in multiple dose vials. Each vial must be diluted with 1.8 mL of sterile 0.9% Sodium Chloride Injection, USP prior to use to form the vaccine. Each dose of the BNT162b2 contains 30 mcg of a nucleoside-modified messenger RNA (modRNA) encoding the viral spike (S) glycoprotein of SARS-CoV-2. Each 0.3 mL dose of the BNT162b2 also includes the following ingredients: lipids (0.43 mg ((4-hydroxybutyl)azanediyl)bis(hexane-6,1-diyl)bis(2-hexyldecanoate), 0.05 mg 2-(polyethylene glycol 2000)-N,N-ditetradecylacetamide, 0.09 mg 1,2-distearoyl-sn-glycero-3-phosphocholine, and 0.2 mg cholesterol), 0.01 mg potassium chloride, 0.01 mg monobasic potassium phosphate, 0.36 mg sodium chloride, 0.07 mg dibasic sodium phosphate dihydrate, and 6 mg sucrose. The diluent (0.9% Sodium Chloride Injection, USP) contributes an additional 2.16 mg sodium chloride per dose. The BNT162b2 does not contain preservative. The vial stoppers are not made with natural rubber latex. 2. Tris Sucrose Formulation with *gray cap* The drug product formulation is based on the current approved vaccine except that the formulation buffer has been changed from phosphate buffered saline to Tris buffer without sodium chloride and potassium chloride while maintaining the same target pH. Excipients for 30 micrograms (mcg)/dose dispersion for injection: ALC-0315, ALC-0159, DSPC, cholesterol, trometamol, trometamol hydrochloride, and sucrose. The label for Tris/Sucrose – 30 mcg (for ages 12 years and older) states "Do Not Dilute" in prominent placement, as well as having a wide gray border, in contrast to the purple PBS/Sucrose border.

Table 1. Product Details[a]

Indication	Current: Active immunization to prevent COVID-19 caused by SARS-CoV-2 in individuals 16 years of age and older. Proposed: Active immunization to prevent COVID-19 caused by SARS-CoV-2 in individuals 12 years of age and older.
Dosage and route of administration	Current: BNT162b2 is administered intramuscularly as a series of two doses (0.3 mL each) 3 weeks apart. There are no data available on the interchangeability of BNT162b2 with other COVID-19 vaccines to complete the vaccination series. Individuals who have received 1 dose of BNT162b2 should receive a second dose of BNT162b2 to complete the vaccination series.

a. COVID-19 Vaccine, mRNA US Prescribing Information

Data Lock Point / Data cut-off:	16 years and older	13 March 2021 (Pfizer Clinical Database)
		23 October 2020 (BioNTech Clinical Database)
		18 June 2021 (Pfizer Safety Database)
	12 to 15 years older	02 September 2021 (Pfizer Clinical Database)
		30 September 2021 (Pfizer Safety Database)

2. SAFETY SPECIFICATION

2.1. Elements of the Safety Specification

2.1.1. Non-Clinical

Nonclinical evaluation of BNT162b2 included pharmacology (mouse immunogenicity and NHP immunogenicity and challenge studies), pharmacokinetic (series of biodistribution, metabolism and pharmacokinetic studies), and toxicity (2 GLP rat repeat-dose toxicity and a GLP DART) studies in vitro and in vivo. No additional toxicity studies are planned for BNT162b2.

Nonclinical studies in mice and NHP for BNT162b2 demonstrated both a strong neutralizing antibody response and a Th1-type $CD4^+$ and an $IFN\gamma^+$ $CD8^+$ T-cell response. The Th1 profile is characterized by a strong IFNγ, but not IL-4, response indicating the absence of a potentially deleterious Th2 immune response and is a pattern favored for vaccine safety and efficacy.[1] Rhesus macaques (Study VR-VRT-10671) that had received two IM immunizations with 100 µg BNT162b2 or saline 21 days apart were challenged with 1.05×10^6 plaque forming units of SARS-CoV-2 (strain USA-WA1/2020), split equally between the intranasal and intratracheal routes.[2] BNT162b2 provided complete protection from the presence of detectable viral RNA in the lungs compared to the saline control with no clinical, radiological or histopathological evidence of vaccine-elicited disease enhancement.

An intravenous rat PK study, using an LNP with the identical lipid composition as BNT162b2, demonstrated that the novel lipid excipients in the LNP formulation, ALC-0315 and ALC-0159, distribute from the plasma to the liver. While there was no detectable excretion of either lipid in the urine, the percent of dose excreted unchanged in feces was ~1% for ALC-0315 and ~50% for ALC-0159. Further studies indicated metabolism played a role in the elimination of ALC-0315. Biodistribution was assessed using luciferase expression as a surrogate reporter formulated like BNT162b2, with the identical lipid composition. After IM injection of the LNP-formulated RNA encoding luciferase in BALB/c mice, luciferase protein expression was demonstrated at the site of injection 6 hours post dose and expression decreased over time to almost reach background levels after 9 days. Luciferase was detected to a lesser extent in the liver; expression was present at 6 hours after injection and was not detected by 48 hours after injection. After IM administration of a radiolabeled LNP-mRNA formulation containing ALC-0315 and ALC-0159 to rats, the percent of administered dose was also greatest at the injection site. Outside of the injection site, total recovery of radioactivity was greatest in the liver and much lower in the spleen, with very little recovery in the adrenal glands and ovaries. The metabolism of ALC-0315 and ALC-0159 was evaluated in blood, liver microsomes, S9 fractions, and hepatocytes from mice, rats, monkeys, and humans. The in vivo metabolism was examined in rat plasma, urine, feces, and liver samples from the PK study. ALC-0315 and ALC-0159 are metabolized by hydrolytic metabolism of the ester and amide functionalities, respectively, and this hydrolytic metabolism is observed across the species evaluated.

In GLP toxicity studies, two variants of the BNT162b2 candidate were tested, designated "variant 8" and "variant 9" (V8 and V9, respectively). The variants differ only in their codon optimization sequences which are designed to improve antigen expression, otherwise the

amino acid sequences of the encoded antigens are identical. BNT162b2 (V9) was evaluated clinically and submitted for application. Two GLP-compliant repeat-dose toxicity studies were performed in Wistar Han rats; one with each variant. Both studies were 17 days in duration with a 3-week recovery period. A GLP-compliant DART study in Wistar Han rats has also been completed. Safety pharmacology, genotoxicity and carcinogenicity studies have not been conducted, in accordance with the 2005 WHO vaccine guideline.[3]

The IM route of exposure was selected for nonclinical investigations as it is the clinical route of administration. Rats were selected as the toxicology test species as they demonstrated an antigen-specific immune response to the vaccine and are routinely used for regulatory toxicity studies with an extensive historical safety database.

Administration of up to 100 µg BNT162b2 by IM injection to male and female Wistar Han rats once every week, for a total of 3 doses, was tolerated without evidence of systemic toxicity. Expected inflammatory responses to the vaccine were evident such as edema and erythema at the injection sites, transient elevation in body temperature, elevations in WBC count and acute phase reactants, and lower A:G ratios. Injection site reactions were common in all vaccine-administered animals and were greater after boost immunizations. Changes secondary to inflammation included slight and transient reduction in body weights and transient reduction in reticulocytes, platelets and RBC mass parameters. Decreased reticulocytes were reported in rats treated with the licensed LNP-siRNA pharmaceutical Onpattro™ (NDA # 210922) but have not been observed in humans treated with this biotherapeutic[4] suggesting this is a species-specific effect. Decreased platelet counts were noted after repeat administration, but were small in magnitude of change, likely related to inflammation-related platelet activation and consumption, and unassociated with other alterations in hemostasis. Elevated levels of gamma-glutamyl transferase were observed in the first repeat-dose toxicity study with BNT162b2 (V8) without evidence of cholestasis or hepatobiliary injury but was not recapitulated in the second repeat dose-toxicity study with BNT162b2 (V9), the final clinical candidate. All changes in clinical pathology parameters and acute phase proteins were reversed at the end of the recovery phase for BNT162b2, with the exception of low magnitude higher red cell distribution width (consistent with a regenerative erythroid response) and lower A:G ratios (resulting from acute phase response) in animals administered BNT162b2. Macroscopic pathology and organ weight changes were also consistent with immune activation and inflammatory response and included increased size and/or weight of draining iliac lymph nodes and spleen. Vaccine-related microscopic findings at the end of the dosing phase consisted of edema and inflammation in injection sites and surrounding tissues, increased cellularity in the draining iliac lymph nodes, bone marrow and spleen and hepatocyte vacuolation in the liver. Vacuolation of periportal hepatocytes, the only test article-related liver microscopic finding, was not associated with any microscopic evidence of hepatic injury or hepatic functional effects (i.e., liver functional enzymes were not elevated) and may be associated with hepatocyte uptake of the LNP lipids.[5] Microscopic findings at the end of the dosing phase were partially or completely recovered in all animals at the end of the 3-week recovery period for BNT162b2. A robust immune response was elicited to the BNT162b2 antigen.

Administration of BNT162b2 to female rats twice before the start of mating and twice during gestation at the human clinical dose (30 µg) was associated with non-adverse effects (body

weight, food consumption and effects localized to the injection site) after each dose administration. However, there were no effects of BNT162b2 administration on mating performance, fertility, or any ovarian or uterine parameters in the F0 female rats nor on embryo-fetal or postnatal survival, growth, or development in the F1 offspring. An immune response was confirmed in F0 female rats following administration of each vaccine candidate and these responses were also detectable in the F1 offspring (fetuses and pups).

In summary, the nonclinical safety findings related to BNT162b2 administration primarily represent an expected immune reaction to vaccine administration and are clinically manageable or acceptable risks in the intended population. The key safety findings regarding BNT162b2 from nonclinical studies and their relevance to human usage are presented in Table 2. There was no evidence of vaccine-elicited disease enhancement.

Table 2. Key Safety Findings and Relevance to Human Usage

Key Safety findings from Nonclinical Studies[a]	Relevance to Human Usage
Pharmacology	
NHP Challenge Model • No evidence of vaccine-elicited disease enhancement.	• Suggests low risk of vaccine-enhanced disease in humans; being investigated in CTs.
Toxicity	
Injection site reactions: • Injection site reactions were common and reversible or showed signs of reversibility at the end of the 3-week recovery period in nonclinical studies.	• In common with other vaccines, BNT162b2 administration has the potential to generate injection site reactions such as edema and erythema at the injection sites.
Inflammation and immune activation: • Evidence of inflammation or immune activation was common, reversible, and included transiently higher body temperature, higher circulating WBCs, and higher acute phase reactants. Secondarily, transiently lower body weights, reticulocytes, platelets, and RBC mass parameters were observed.	• In common with all vaccines, BNT162b2 administration has the potential to generate inflammation which can lead to increased body temperature, higher circulating WBCs and higher acute phase proteins. • Decreased reticulocytes have not been observed in humans treated with the LNP-siRNA pharmaceutical Onpattro[4], suggesting this finding in rats is a species-specific effect. • BNT162b2 administration has the potential to transiently decrease platelets and RBC mass parameters. These slight decreases are not likely to be clinically meaningful due to their small magnitude.
Developmental and Reproductive Toxicity • No vaccine-related effects on female fertility or the development of fetuses or offspring were observed in a DART study of BNT162b2 in rats.	• No effects are anticipated in WOCBP, pregnant women or their offspring.

a. Safety pharmacology, genotoxicity, and carcinogenicity studies were not conducted, in accordance with 2005 WHO vaccine guideline, as they are generally not considered necessary to support development and licensure of vaccines for infectious diseases.[3] In addition, the components of the vaccine construct are lipids and RNA and are not expected to have carcinogenic or genotoxic potential.

2.1.2. Clinical

2.1.2.a. Limitations of the Human Safety Database

The pivotal study was initially planned to enroll approximately 30,000 participants, which would have a probability of 78% of detecting an AE with a frequency of 0.01% (1/1000) and a probability of 95% of detecting an AE with a frequency of 0.02% (1/500). The protocol was amended to enroll approximately 46,000 participants, which would slightly enhance the ability to detect AEs. However, rarer events might not be detected.

Participants in the pivotal study were initially planned to be followed for up to 24 months in order to assess the potential for late-occurring adverse reactions, such as the theoretical risk of VAED. After completing the final efficacy analysis with vaccine efficacy shown to be 95%, and obtaining regulatory authorization to vaccinate in many countries, Pfizer-BioNTech started to unblind all participants to determine those randomized to placebo so that they could be offered vaccine in accordance with local authorization. To date, most placebo subjects have been unblinded to receive active vaccine at or prior to 6 months after the second dose, therefore, a placebo group for comparison of safety data is only available for up to 6 months post Dose 2.

2.1.2.a.1. Clinical Trial Exposure

Brief Overview of Development

Study BNT162-01

BioNTech is conducting a first-in-human dose level–finding Phase 1/2 study in Germany to gather safety and immunogenicity data to enable evaluation of 4 vaccines candidates individually to inform the overall clinical development of a BNT162b2.

BNT162-01 is not conducted under the US IND application but is being conducted under a German Clinical Trial Application.

Four vaccine candidates were evaluated in Study BNT162-01. Based on safety and immunogenicity results from this study, 2 vaccine candidates, BNT162b1 and BNT162b2, were selected for evaluation in Study C4591001, which is a Phase 1/2/3 randomized, placebo-controlled, observer-blind, dose-finding, vaccine candidate-selection, and efficacy study in healthy adults (conducted under IND 019736).

Study C4591001

- Phase 1: comprised dose-level–finding evaluations of the 2 selected vaccine candidates; multiple dose levels (some corresponding to those evaluated in Study BNT162-01) were evaluated. Study vaccine was administered using the same 2-dose schedule as in Study BNT162-01 (21 days apart). Dose levels were administered first to an 18- to 55-year age cohort, then to a 65- to 85-year age cohort.

Both vaccine candidate constructs were safe and well tolerated. BNT162b2 at the 30-µg dose level was selected and advanced to the Phase 2/3 expanded cohort and efficacy evaluation primarily because:

- the reactogenicity profile for BNT162b2 was more favorable than BNT162b1 in both younger and older adults with similar immunogenicity results;
- in the NHP challenge study (VR-VTR-10671, see Section 2.1.1), a trend toward earlier clearance of BNT162b2 was observed in the nose.

- Phase 2 (enrollment has completed) comprised the evaluation of safety and immunogenicity data for the first 360 participants (180 from the active vaccine group and 180 from the placebo group, with each group divided between the younger and older age cohorts) entering the study after completion of Phase 1.

- Phase 3 part of the study (which is ongoing) evaluates the efficacy and safety in all participants (including the first 360 participants from Phase 2). Phase 3 introduced:
  - enrollment of participants 16 to 17 years of age to be evaluated with the 18- to 55-year-old cohort,
  - enrollment of a 12- to 15-year-old cohort,
  - immunogenicity data from the 12- to 15-year-old cohort (Table 3, Table 5, Table 11, Table 13, Table 15, and Table 17), anticipated to bridge to the 16- to 25-year-old cohort.

Participants in the pivotal study were initially planned to be followed for up to 24 months in order to assess the potential for late-occurring adverse reactions, such as the theoretical risk of VAED including VAERD. After completing the final efficacy analysis with vaccine efficacy shown to be 95% and obtaining regulatory authorization to vaccinate in many countries, Pfizer-BioNTech started to unblind all participants to determine those participants randomised to placebo so that they could be offered vaccine in accordance with local authorization. To date, most placebo subjects have been unblinded to receive active vaccine at or prior to 6 months after the second dose, therefore, a placebo group for comparison of safety data is only available for up to 6 months post Dose 2.

The initial efficacy analysis on the 16 years and older population was event-driven, with prespecified interim analyses after accrual of at least 62, 92, and 120 cases and a final analysis at 164 cases.

A further efficacy analysis has been conducted on 12- to ≤15-year-old cohort participants and on 16 years and older participants cohort participants reported by 13 March 2021.

Other ongoing[1] BNT162b2 interventional studies at the cut-off of the clinical database (02 September 2021) also include:

- C4591005: *A phase 1/2 study, placebo-controlled, randomized, and observer-blind study to evaluate the safety, tolerability, and immunogenicity of a SARS-CoV-2 RNA vaccine candidate against COVID-19 in healthy Japanese adults.*
  One hundred sixty participants were randomly assigned in a 3:1 ratio to study intervention (candidate vaccine: 120, placebo: 40).

- PASS: C4591015: *A phase 2/3 study, placebo-controlled, randomized, observer-blind study to evaluate the safety, tolerability, and immunogenicity of SARS-CoV-2 RNA vaccine candidate (BNT162b2) against COVID-19 in healthy pregnant women 18 years of age and older.*

- C4591007: *A phase 1, open-label dose-finding study to evaluate safety, tolerability, and immunogenicity and phase 2/3 placebo-controlled, observer-blinded safety, tolerability, and immunogenicity study of a SARS-CoV-2 RNA vaccine candidate against COVID-19 in healthy children <12 years of age*.
  Phase 1 is an open-label dose-finding study that consists of up to 3 different dose levels in each age group, with 16 participants per dose level (total of 144 participants). Phase 2/3 will evaluate the safety, tolerability, and immunogenicity of the selected dose level in each age group from Phase 1, with a total of approximately 4500 participants. Participants will be randomized in a 2:1 ratio to receive active vaccine or placebo.

- C4591020: *A phase 3, randomized, observer-blind study to evaluate the safety, tolerability, and immunogenicity of multiple formulations of the vaccine candidate BNT-162B2 against COVID-19 in healthy adults 18 through 55 years of age*.

- C4591031 *A phase 3 master protocol to evaluate additional dose(s) of BNT162B2 in healthy individuals previously vaccinated with BNT162B2*.

- BNT162-01 *A multi-site, phase I/II, 2-Part, dose-escalation trial investigating the safety and immunogenicity of four prophylactic SARS-CoV-2 RNA vaccines against COVID-19 using different dosing regimens in healthy and immunocompromised adults.*

- BNT162-03[2] *Safety and immunogenicity of SARS-CoV-2 mRNA vaccine (BNT162b1) in Chinese healthy subjects: A phase I, randomized, placebo- controlled, observer-blind study*.

[1] Study C4591017 was completed and therefore is removed from this list.

[2] This study is conducted by Shanghai Fosun Pharmaceutical Development, Inc. and sponsored by BioNTech SE.

- BNT162-04 *A multi-site, phase I/II, 2-part, dose escalation trial investigating the safety and immunogenicity of a prophylactic SARS-CoV-2 RNA vaccine (BNT162b3) against COVID-19 using different dosing regimens in healthy adults*.

- BNT162-06[2] *Safety and immunogenicity of SARS-CoV-2 mRNA vaccine (BNT162b2) in Chinese healthy population: A phase II, randomized, placebo-controlled, observer-blind study*

- BNT162-14 *A Phase II, open-label, rollover trial to evaluate the safety and immunogenicity of one or two boosting doses of Comirnaty or one dose of BNT162b2s01 in BNT162-01 trial subjects, or two boosting doses of Comirnaty in BNT162-04 trial subjects*

- BNT162-17 A Phase II trial to evaluate the safety and immunogenicity of a SARS-CoV-2 multivalent RNA vaccine in healthy subjects.

Clinical Trial Exposure

Population for analysis of CTs data in this US Pharmacovigilance Plan includes the following 2 studies:

C4591001: *Phase 1/2/3, placebo-controlled, randomized, observer-blind, dose finding, study to evaluate the safety, tolerability, immunogenicity, and efficacy of SARS-CoV-2 RNA vaccine candidates against COVID-19 in healthy individuals*.

BNT162-01: *A multi-site, phase I/II, 2-part, dose-escalation trial investigating the safety and immunogenicity of four prophylactic SARS-CoV-2 RNA vaccines against COVID-19 using different dosing regimens in healthy adults.*

Participants 16 years of age and older

At the cut-off date of 13 March 2021, a total of 46,505 participants were vaccinated in the BNT162b2 clinical development program:

- 21,745 participants received 2 doses and 360 received 1 dose of BNT162b2 during the blinded follow-up period; 96 participants from study BNT162-01 received 2 doses of the vaccine.

- 19,647 participants, who originally received placebo, then received 1 dose of BNT162b2 in the Open-Label Follow-up period after unblinding. (none from study BNT162-01).

Exposure to BNT162b2 for participants aged 16 years and older in the 2 ongoing studies by number of doses, and demographic characteristics is shown in Table 3 through Table 21.

In addition, exposure in clinical studies in special populations is provided in Table 22 and Table 23.

Participants 12 to 15 years of age

- At the cut-off date of 13 March 2021, a total of 2260 participants 12 to 15 years of age were vaccinated in the BNT162b2 clinical development program (study C4591001).

- At the cut-off date of 02 September 2021, updated clinical study exposure data for the 12- to 15 years of age are provided for the ongoing study C4591001:

    - One thousand one hundred twenty-four (1124) participants received 2 doses and 7 received 1 dose of BNT162b2 in the Blinded-Placebo Controlled Follow-up period.

    - One thousand and ten (1010) participants who originally received placebo, then received 1 dose of BNT162b2 (18) or 2 doses (992) in the Open-Label Follow-up period after unblinding.

Exposure to BNT162b2 for participants aged 12- to 15 years of age by number of doses and demographic characteristics is shown in Table 3,Table 5, Table 11, Table 13, Table 15, Table 17 (at the cut-off date of 13 March 2021) and in Table 24, Table 25, Table 26, Table 27, Table 28, and Table 29 (at the cut-off date of 02 September 2021). In addition, exposure in clinical studies in special populations is provided in Table 22 and Table 23, Table 30 and Table 31.

Exposure in participants 12 years of age and older (Studies C4591001 – Cut-off date 13 March 2021 and BNT162-01 – Cut off date 23 October 2020)

Table 3. Exposure to BNT162b2 by Age Group and Dose (C4591001) – Blinded Placebo-Controlled Follow-up Period

Age Group Dose Exposure (Number of Doses Received)	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
≥12 years to ≤15 years		
Vaccine 30 µg		
1 Dose	7	7
2 Doses	1124	2248
Total	1131	2255
≥16 years to ≤17 years		
Vaccine 30 µg		
1 Dose	4	4
2 Doses	374	748
Total	378	752
≥18 years to ≤55 years		
Vaccine 10 µg		
2 Doses	12	24
Total	12	24
Vaccine 20 µg		
2 Doses	12	24
Total	12	24
Vaccine 30 µg		
1 Dose	267	267
2 Doses	12438	24876
Total	12705	25143
>55 years to ≤64 years		
Vaccine 30 µg		
1 Dose	67	67
2 Doses	4341	8682
Total	4408	8749
≥65 years to ≤74 years		
Vaccine 10 µg		
2 Doses	12	24
Total	12	24
Vaccine 20 µg		
2 Doses	9	18
Total	9	18
Vaccine 30 µg		
1 Dose	17	17

Table 3. Exposure to BNT162b2 by Age Group and Dose (C4591001) – Blinded Placebo-Controlled Follow-up Period

Age Group Dose Exposure (Number of Doses Received)	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
2 Doses	3624	7248
Total	3641	7265
≥75 years to ≤84 years		
Vaccine 20 µg		
2 Doses	3	6
Total	3	6
Vaccine 30 µg		
1 Dose	3	3
2 Doses	899	1798
Total	902	1801
≥85 years		
Vaccine 30 µg		
1 Dose	2	2
2 Doses	21	42
Total	23	44

Note: 30 µg includes data from phase 1 and phase 2/3.
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(Cutoff Date: 13MAR2021, Snapshot Date: 25MAR2021) Output File: ./nda2_unblinded/C4591001_PVP_BLA/adsl_s912

Table 4. Exposure to BNT162b2 by Age Group and Dose (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received BNT162b2

Age Group Dose Exposure (Number of Doses Received)	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
≥16 years to ≤17 years		
Vaccine 30 µg		
1 Dose	3	3
≥18 years to ≤55 years		
Vaccine 30 µg		
1 Dose	58	58
>55 years to ≤64 years		
Vaccine 30 µg		
1 Dose	17	17

Table 4. Exposure to BNT162b2 by Age Group and Dose (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received BNT162b2

Age Group Dose Exposure (Number of Doses Received)	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
≥65 years to ≤74 years		
Vaccine 30 µg		
1 Dose	8	8
≥75 years to ≤84 years		
Vaccine 30 µg		
1 Dose	1	1
≥85 years		
Vaccine 30 µg		
1 Dose	2	2

Note: 30 µg includes data from phase 1 and phase 2/3.
Note: Subjects who received 2nd Dose of BNT162b2 after unblinding.
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(Cutoff Date: 13MAR2021, Snapshot Date: 25MAR2021) Output File: ./nda2_unblinded/C4591001_PVP_BLA/adsl_s9123

Table 5. Exposure to BNT162b2 by Age Group and Dose (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Age Group Dose Exposure (Number of Doses Received)	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
≥12 years to ≤15 years[a]		
Vaccine 30 µg		
1 Dose	30	30
2 Doses	19	38
Total	49	68
≥16 years to ≤17 years		
Vaccine 30 µg		
1 Dose	107	107
2 Doses	186	372
Total	293	479
≥18 years to ≤55 years		
Vaccine 30 µg		
1 Dose	2713	2713
2 Doses	8419	16838
Total	11132	19551
>55 years to ≤64 years		

Table 5. Exposure to BNT162b2 by Age Group and Dose (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Age Group Dose Exposure (Number of Doses Received)	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Vaccine 30 µg		
1 Dose	655	655
2 Doses	3330	6660
Total	3985	7315
≥65 years to ≤74 years		
Vaccine 30 µg		
1 Dose	128	128
2 Doses	3286	6572
Total	3414	6700
≥75 years to ≤84 years		
Vaccine 30 µg		
1 Dose	23	23
2 Doses	783	1566
Total	806	1589
≥85 years		
Vaccine 30 µg		
1 Dose	1	1
2 Doses	16	32
Total	17	33

Note: 30 µg includes data from phase 1 and phase 2/3.
a. Includes subjects who became eligible for unblinding at 16 years of age, confirmed to have received placebo originally and then received BNT162b2 post unblinding.
PFIZER CONFIDENTIAL SDTM Creation: 25MAR2021 (23:24) Source Data: adsl Table Generation: 27MAR2021 (12:46)
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Table 6. Exposure to BNT162b2 by Age Group and Dose (BNT162-01)

Age Group Dose Exposure (Number of Doses Received)	No. of Subjects Exposed to BNT162b2	Total No. of Vaccine Doses
≥18 years to ≤64 years		
Vaccine 1 µg		
1 Dose	1	1
2 Doses	11	22
Total	12	23

Table 6. Exposure to BNT162b2 by Age Group and Dose (BNT162-01)

Age Group Dose Exposure (Number of Doses Received)	No. of Subjects Exposed to BNT162b2	Total No. of Vaccine Doses
Vaccine 3 µg		
1 Dose	0	0
2 Doses	12	24
Total	12	24
Vaccine 10 µg		
1 Dose	1	1
2 Doses	11	22
Total	12	23
Vaccine 20 µg		
1 Dose	0	0
2 Doses	17	34
Total	17	34
Vaccine 30 µg		
1 Dose	0	0
2 Doses	18	36
Total	18	36
≥65 years to ≤74 years		
Vaccine 1 µg		
1 Dose	0	0
2 Doses	0	0
Total	0	0
Vaccine 3 µg		
1 Dose	0	0
2 Doses	0	0
Total	0	0
Vaccine 10 µg		
1 Dose	0	0

Table 6. Exposure to BNT162b2 by Age Group and Dose (BNT162-01)

Age Group Dose Exposure (Number of Doses Received)	No. of Subjects Exposed to BNT162b2	Total No. of Vaccine Doses
2 Doses	5	10
Total	5	10
Vaccine 20 µg		
1 Dose	0	0
2 Doses	6	12
Total	6	12
Vaccine 30 µg		
1 Dose	0	0
2 Doses	6	12
Total	6	12
≥75 years to ≤84 years		
Vaccine 1 µg		
1 Dose	0	0
2 Doses	0	0
Total	0	0
Vaccine 3 µg		
1 Dose	0	0
2 Doses	0	0
Total	0	0
Vaccine 10 µg		
1 Dose	0	0
2 Doses	1	2
Total	1	2
Vaccine 20 µg		
1 Dose	0	0
2 Doses	1	2
Total	1	2
Vaccine 30 µg		
1 Dose	0	0
2 Doses	0	0
Total	0	0

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Output File: ex_b2_age_dose2.rtf

Table 7. Exposure to BNT162b2 by Dose (Totals) (C4591001) – Blinded Placebo-Controlled Follow-up Period

Dose Exposure (Number of Doses Received)	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Vaccine 10 µg		
2 Doses	24	48
Total	24	48
Vaccine 20 µg		
2 Doses	24	48
Total	24	48
Vaccine 30 µg		
1 Dose	367	367
2 Doses	22821	45642
Total	23188	46009

Note: 30 µg includes data from phase 1 and phase 2/3.
PFIZER CONFIDENTIAL SDTM Creation: 25MAR2021 (23:24) Source Data: adsl Table Generation: 27MAR2021 (12:46)
(Cutoff Date: 13MAR2021, Snapshot Date: 25MAR2021) Output File: ./nda2_unblinded/C4591001_PVP_BLA/adsl_s922

Table 8. Exposure to BNT162b2 by Dose (Totals) (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received BNT162b2

Dose Exposure (Number of Doses Received)	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Vaccine 30 µg		
1 Dose	89	89

Note: 30 µg includes data from phase 1 and phase 2/3.
Note: Subjects who received 2nd Dose of BNT162b2 after unblinding.
PFIZER CONFIDENTIAL SDTM Creation: 25MAR2021 (23:24) Source Data: adsl Table Generation: 27MAR2021 (12:46)
(Cutoff Date: 13MAR2021, Snapshot Date: 25MAR2021) Output File: ./nda2_unblinded/C4591001_PVP_BLA/adsl_s9223

Table 9. Exposure to BNT162b2 by Dose (Totals) (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Dose Exposure (Number of Doses Received)	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Vaccine 30 µg		
1 Dose	3657	3657
2 Doses	16039	32078

Table 9. Exposure to BNT162b2 by Dose (Totals) (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Dose Exposure (Number of Doses Received)	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Total	19696	35735

Note: 30 µg includes data from phase 1 and phase 2/3.
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Table 10. Exposure to BNT162b2 by Dose (Totals) (BNT162-01)

Dose Exposure (Number of Doses Received)	No. of Subjects Exposed to BNT162b2	Total No. of Vaccine Doses
Vaccine 1 µg		
1 Dose	1	1
2 Doses	11	22
Total	12	23
Vaccine 3 µg		
1 Dose	0	0
2 Doses	12	24
Total	12	24
Vaccine 10 µg		
1 Dose	1	1
2 Doses	23	46
Total	24	47
Vaccine 20 µg		
1 Dose	0	0
2 Doses	24	48
Total	24	48
Vaccine 30 µg		
1 Dose	0	0
2 Doses	24	48
Total	24	48

Table 10. Exposure to BNT162b2 by Dose (Totals) (BNT162-01)

Dose Exposure (Number of Doses Received)	No. of Subjects Exposed to BNT162b2	Total No. of Vaccine Doses

PFIZER CONFIDENTIAL SDTM Creation: 24NOV2020 (15:06) Source Data: adsl Table Generation: 10MAR2021 (11:49) (Cutoff date:23OCT2020, Snapshot Date: 23OCT2020)
Output File: ex_b2_dose rtf

Table 11. Exposure to BNT162b2 by Dose, Age Group, and Gender (C4591001) – Blinded Placebo-Controlled Follow-up Period

	Number of Subjects Exposed to BNT162b2		Total Number of Vaccine Doses	
Dose Age Group	Male	Female	Male	Female
Vaccine 10 µg				
≥18 years to ≤55 years	5	7	10	14
≥65 years to ≤74 years	2	10	4	20
Total	7	17	14	34
Vaccine 20 µg				
≥18 years to ≤55 years	6	6	12	12
≥65 years to ≤74 years	4	5	8	10
≥75 years to ≤84 years	1	2	2	4
Total	11	13	22	26
Vaccine 30 µg				
≥12 years to ≤15 years	567	564	1128	1127
≥16 years to ≤17 years	187	191	373	379
≥18 years to ≤55 years	6456	6249	12770	12373
>55 years to ≤64 years	2231	2177	4421	4328
≥65 years to ≤74 years	1934	1707	3858	3407
≥75 years to ≤84 years	511	391	1020	781
≥85 years	12	11	23	21
Total	11898	11290	23593	22416

Note: 30 µg includes data from phase 1 and phase 2/3.
PFIZER CONFIDENTIAL SDTM Creation: 25MAR2021 (23:24) Source Data: adsl Table Generation: 27MAR2021 (12:46)
(Cutoff Date: 13MAR2021, Snapshot Date: 25MAR2021) Output File: ./nda2_unblinded/C4591001_PVP_BLA/adsl_s932

Table 12. Exposure to BNT162b2 by Dose, Age Group, and Gender (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received BNT162b2

	Number of Subjects Exposed to BNT162b2		Total Number of Vaccine Doses	
Dose Age Group	**Male**	**Female**	**Male**	**Female**
Vaccine 30 µg				
≥16 years to ≤17 years	0	3	0	3
≥18 years to ≤55 years	24	34	24	34
>55 years to ≤64 years	12	5	12	5
≥65 years to ≤74 years	4	4	4	4
≥75 years to ≤84 years	0	1	0	1
≥85 years	1	1	1	1
Total	41	48	41	48

Note: 30 µg includes data from phase 1 and phase 2/3.
Note: Subjects who received 2nd Dose of BNT162b2 after unblinding.
PFIZER CONFIDENTIAL SDTM Creation: 25MAR2021 (23:24) Source Data: adsl Table Generation: 27MAR2021 (12:46)
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Table 13. Exposure to BNT162b2 by Dose, Age Group, and Gender (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

	Number of Subjects Exposed to BNT162b2		Total Number of Vaccine Doses	
Dose Age Group	**Male**	**Female**	**Male**	**Female**
Vaccine 30 µg				
≥12 years to ≤15 years[a]	26	23	36	32
≥16 years to ≤17 years	152	141	250	229
≥18 years to ≤55 years	5424	5708	9450	10101
>55 years to ≤64 years	1973	2012	3602	3713
≥65 years to ≤74 years	1801	1613	3530	3170
≥75 years to ≤84 years	495	311	976	613
≥85 years	13	4	25	8
Total	9884	9812	17869	17866

Note: 30 µg includes data from phase 1 and phase 2/3.
a. Includes subjects who became eligible for unblinding at 16 years of age, confirmed to have received placebo originally and then received BNT162b2 post unblinding.
PFIZER CONFIDENTIAL SDTM Creation: 25MAR2021 (23:24) Source Data: adsl Table Generation: 27MAR2021 (12:46)

Table 13. Exposure to BNT162b2 by Dose, Age Group, and Gender (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Dose Age Group	Number of Subjects Exposed to BNT162b2 Male	 Female	Total Number of Vaccine Doses Male	 Female
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Table 14. Exposure to BNT162b2 by Dose, Age Group, and Gender (BNT162-01)

	No. of Subjects Exposed to BNT162b2		Total No. of Vaccine Doses	
Dose Age Group	**Male**	**Female**	**Male**	**Female**
Vaccine 1 µg				
≥18 years to ≤64 years	7	5	14	9
≥65 years to ≤74 years	0	0	0	0
≥75 years to ≤84 years	0	0	0	0
Total	7	5	14	9
Vaccine 3 µg				
≥18 years to ≤64 years	5	7	10	14
≥65 years to ≤74 years	0	0	0	0
≥75 years to ≤84 years	0	0	0	0
Total	5	7	10	14
Vaccine 10 µg				
≥18 years to ≤64 years	8	10	16	19
≥65 years to ≤74 years	3	2	6	4
≥75 years to ≤84 years	1	0	2	0
Total	12	12	24	23
Vaccine 20 µg				
≥18 years to ≤64 years	7	10	14	20
≥65 years to ≤74 years	1	5	2	10
≥75 years to ≤84 years	0	1	0	2
Total	8	16	16	32
Vaccine 30 µg				
≥18 years to ≤64 years	10	8	20	16
≥65 years to ≤74 years	2	4	4	8
≥75 years to ≤84 years	0	0	0	0

Table 14. Exposure to BNT162b2 by Dose, Age Group, and Gender (BNT162-01)

	No. of Subjects Exposed to BNT162b2		Total No. of Vaccine Doses	
Dose Age Group	**Male**	**Female**	**Male**	**Female**
Total	12	12	24	24

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Output File: ex_b2_age_dose_sex.rtf

Table 15. Exposure to BNT162b2 by Age Group, Dose, and Race/Ethnic Origin (C4591001) – Blinded Placebo-Controlled Follow-up Period

Age Group Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
≥12 years to ≤15 years		
Vaccine 30 µg		
Racial origin		
White	971	1937
Black or African American	52	103
Asian	72	143
American Indian or Alaska Native	4	8
Native Hawaiian or other Pacific Islander	3	6
Multiracial	23	46
Not reported	6	12
Total	1131	2255
Ethnic origin		
Hispanic/Latino	132	263
Non-Hispanic/non-Latino	997	1988
Not reported	2	4
Total	1131	2255
≥16 years to ≤17 years		
Vaccine 30 µg		
Racial origin		
White	309	614
Black or African American	30	60
Asian	22	44
American Indian or Alaska Native	4	8
Native Hawaiian or other Pacific Islander	3	6
Multiracial	10	20
Total	378	752
Ethnic origin		
Hispanic/Latino	49	98

Table 15. Exposure to BNT162b2 by Age Group, Dose, and Race/Ethnic Origin (C4591001) – Blinded Placebo-Controlled Follow-up Period

Age Group Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Non-Hispanic/non-Latino	329	654
Total	378	752
≥18 years to ≤55 years		
Vaccine 10 µg		
Racial origin		
White	11	22
Asian	1	2
Total	12	24
Ethnic origin		
Hispanic/Latino	1	2
Non-Hispanic/non-Latino	11	22
Total	12	24
Vaccine 20 µg		
Racial origin		
White	10	20
Black or African American	2	4
Total	12	24
Ethnic origin		
Hispanic/Latino	1	2
Non-Hispanic/non-Latino	11	22
Total	12	24
Vaccine 30 µg		
Racial origin		
White	9923	19637
Black or African American	1400	2764
Asian	683	1358
American Indian or Alaska Native	161	311
Native Hawaiian or other Pacific Islander	40	80
Multiracial	427	851
Not reported	71	142
Total	12705	25143
Ethnic origin		
Hispanic/Latino	4000	7874
Non-Hispanic/non-Latino	8650	17160
Not reported	55	109
Total	12705	25143
>55 years to ≤64 years		
Vaccine 30 µg		
Racial origin		

Table 15. Exposure to BNT162b2 by Age Group, Dose, and Race/Ethnic Origin (C4591001) – Blinded Placebo-Controlled Follow-up Period

Age Group Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
White	3719	7388
Black or African American	430	849
Asian	135	267
American Indian or Alaska Native	30	58
Native Hawaiian or other Pacific Islander	8	15
Multiracial	76	152
Not reported	10	20
Total	4408	8749
Ethnic origin		
Hispanic/Latino	965	1903
Non-Hispanic/non-Latino	3413	6786
Not reported	30	60
Total	4408	8749
≥65 years to ≤74 years		
Vaccine 10 µg		
Racial origin		
White	12	24
Total	12	24
Ethnic origin		
Non-Hispanic/non-Latino	12	24
Total	12	24
Vaccine 20 µg		
Racial origin		
White	9	18
Total	9	18
Ethnic origin		
Non-Hispanic/non-Latino	9	18
Total	9	18
Vaccine 30 µg		
Racial origin		
White	3272	6528
Black or African American	219	437
Asian	82	164
American Indian or Alaska Native	22	44
Native Hawaiian or other Pacific Islander	6	12
Multiracial	30	60
Not reported	10	20
Total	3641	7265
Ethnic origin		

Table 15. Exposure to BNT162b2 by Age Group, Dose, and Race/Ethnic Origin (C4591001) – Blinded Placebo-Controlled Follow-up Period

Age Group Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Hispanic/Latino	583	1158
Non-Hispanic/non-Latino	3038	6067
Not reported	20	40
Total	3641	7265
≥75 years to ≤84 years		
Vaccine 20 µg		
Racial origin		
White	3	6
Total	3	6
Ethnic origin		
Non-Hispanic/non-Latino	3	6
Total	3	6
Vaccine 30 µg		
Racial origin		
White	838	1673
Black or African American	22	44
Asian	31	62
American Indian or Alaska Native	3	6
Native Hawaiian or other Pacific Islander	1	2
Multiracial	7	14
Total	902	1801
Ethnic origin		
Hispanic/Latino	107	213
Non-Hispanic/non-Latino	789	1576
Not reported	6	12
Total	902	1801
≥85 years		
Vaccine 30 µg		
Racial origin		
White	20	38
Asian	1	2
American Indian or Alaska Native	1	2
Multiracial	1	2
Total	23	44
Ethnic origin		
Hispanic/Latino	2	4
Non-Hispanic/non-Latino	21	40
Total	23	44

Table 15. Exposure to BNT162b2 by Age Group, Dose, and Race/Ethnic Origin (C4591001) – Blinded Placebo-Controlled Follow-up Period

Age Group Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses

Note: 30 µg includes data from phase 1 and phase 2/3.
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Table 16. Exposure to BNT162b2 by Age Group, Dose, and Race/Ethnic Origin (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received BNT162b2

Age Group Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
≥16 years to ≤17 years		
Vaccine 30 µg		
Racial origin		
White	3	3
Total	3	3
Ethnic origin		
Non-Hispanic/non-Latino	3	3
Total	3	3
≥18 years to ≤55 years		
Vaccine 30 µg		
Racial origin		
White	46	46
Black or African American	2	2
Asian	2	2
American Indian or Alaska Native	8	8
Total	58	58
Ethnic origin		
Hispanic/Latino	31	31
Non-Hispanic/non-Latino	27	27
Total	58	58
>55 years to ≤64 years		
Vaccine 30 µg		
Racial origin		
White	14	14
Asian	1	1
American Indian or Alaska Native	2	2
Total	17	17

Table 16. Exposure to BNT162b2 by Age Group, Dose, and Race/Ethnic Origin (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received BNT162b2

Age Group Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Ethnic origin		
Hispanic/Latino	10	10
Non-Hispanic/non-Latino	7	7
Total	17	17
≥65 years to ≤74 years		
Vaccine 30 µg		
Racial origin		
White	8	8
Total	8	8
Ethnic origin		
Hispanic/Latino	5	5
Non-Hispanic/non-Latino	3	3
Total	8	8
≥75 years to ≤84 years		
Vaccine 30 µg		
Racial origin		
White	1	1
Total	1	1
Ethnic origin		
Non-Hispanic/non-Latino	1	1
Total	1	1
≥85 years		
Vaccine 30 µg		
Racial origin		
White	2	2
Total	2	2
Ethnic origin		
Non-Hispanic/non-Latino	2	2
Total	2	2

Note: 30 µg includes data from phase 1 and phase 2/3.
Note: Subjects who received 2nd Dose of BNT162b2 after unblinding.
PFIZER CONFIDENTIAL SDTM Creation: 25MAR2021 (23:24) Source Data: adsl Table Generation: 27MAR2021 (12:46)
(Cutoff Date: 13MAR2021, Snapshot Date: 25MAR2021) Output File: ./nda2_unblinded/C4591001_PVP_BLA/adsl_s9423

Table 17. Exposure to BNT162b2 by Age Group, Dose, and Race/Ethnic Origin (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Age Group Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
≥12 years to ≤15 years[a]		
Vaccine 30 µg		
Racial origin		
White	45	62
Asian	3	5
Multiracial	1	1
Total	49	68
Ethnic origin		
Hispanic/Latino	2	4
Non-Hispanic/non-Latino	47	64
Total	49	68
≥16 years to ≤17 years		
Vaccine 30 µg		
Racial origin		
White	251	410
Black or African American	11	19
Asian	14	25
American Indian or Alaska Native	2	4
Native Hawaiian or other Pacific Islander	1	2
Multiracial	12	16
Not reported	2	3
Total	293	479
Ethnic origin		
Hispanic/Latino	26	43
Non-Hispanic/non-Latino	266	434
Not reported	1	2
Total	293	479
≥18 years to ≤55 years		
Vaccine 30 µg		
Racial origin		
White	8806	15340
Black or African American	1087	1899
Asian	619	1136
American Indian or Alaska Native	128	236
Native Hawaiian or other Pacific Islander	17	32
Multiracial	405	781
Not reported	70	127
Total	11132	19551
Ethnic origin		

Table 17. Exposure to BNT162b2 by Age Group, Dose, and Race/Ethnic Origin (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Age Group Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Hispanic/Latino	3441	5300
Non-Hispanic/non-Latino	7635	14157
Not reported	56	94
Total	11132	19551
>55 years to ≤64 years		
Vaccine 30 µg		
Racial origin		
White	3416	6271
Black or African American	331	592
Asian	120	227
American Indian or Alaska Native	35	67
Native Hawaiian or other Pacific Islander	4	7
Multiracial	63	120
Not reported	16	31
Total	3985	7315
Ethnic origin		
Hispanic/Latino	901	1560
Non-Hispanic/non-Latino	3067	5724
Not reported	17	31
Total	3985	7315
≥65 years to ≤74 years		
Vaccine 30 µg		
Racial origin		
White	3093	6076
Black or African American	187	360
Asian	78	154
American Indian or Alaska Native	20	39
Native Hawaiian or other Pacific Islander	6	12
Multiracial	22	43
Not reported	8	16
Total	3414	6700
Ethnic origin		
Hispanic/Latino	547	1060
Non-Hispanic/non-Latino	2842	5590
Not reported	25	50
Total	3414	6700
≥75 years to ≤84 years		
Vaccine 30 µg		

Table 17. Exposure to BNT162b2 by Age Group, Dose, and Race/Ethnic Origin (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Age Group Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Racial origin		
White	752	1483
Black or African American	22	42
Asian	17	34
American Indian or Alaska Native	4	8
Multiracial	6	12
Not reported	5	10
Total	806	1589
Ethnic origin		
Hispanic/Latino	89	174
Non-Hispanic/non-Latino	706	1393
Not reported	11	22
Total	806	1589
≥85 years		
Vaccine 30 µg		
Racial origin		
White	15	29
Asian	1	2
Multiracial	1	2
Total	17	33
Ethnic origin		
Non-Hispanic/non-Latino	17	33
Total	17	33

Note: 30 µg includes data from phase 1 and phase 2/3.
a. Includes subjects who became eligible for unblinding at 16 years of age, confirmed to have received placebo originally and then received BNT162b2 post unblinding.
PFIZER CONFIDENTIAL SDTM Creation: 25MAR2021 (23:24) Source Data: adsl Table Generation: 27MAR2021 (12:46)
(Cutoff Date: 13MAR2021, Snapshot Date: 25MAR2021) Output File: ./nda2_unblinded/C4591001_PVP_BLA/adsl_s942_open

Table 18. Exposure to BNT162b2 by Dose and Race/Ethnic Origin (C4591001) – Blinded Placebo-Controlled Follow-up Period

Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Vaccine 10 µg		
Racial origin		
White	23	46

Table 18. Exposure to BNT162b2 by Dose and Race/Ethnic Origin (C4591001) – Blinded Placebo-Controlled Follow-up Period

Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Asian	1	2
Total	24	48
Ethnic origin		
Hispanic/Latino	1	2
Non-Hispanic/non-Latino	23	46
Total	24	48
Vaccine 20 µg		
Racial origin		
White	22	44
Black or African American	2	4
Total	24	48
Ethnic origin		
Hispanic/Latino	1	2
Non-Hispanic/non-Latino	23	46
Total	24	48
Vaccine 30 µg		
Racial origin		
White	19052	37815
Black or African American	2153	4257
Asian	1026	2040
American Indian or Alaska Native	225	437
Native Hawaiian or other Pacific Islander	61	121
Multiracial	574	1145
Not reported	97	194
Total	23188	46009
Ethnic origin		
Hispanic/Latino	5838	11513
Non-Hispanic/non-Latino	17237	34271
Not reported	113	225
Total	23188	46009

Note: 30 µg includes data from phase 1 and phase 2/3.
PFIZER CONFIDENTIAL SDTM Creation: 25MAR2021 (23:24) Source Data: adsl Table Generation: 27MAR2021 (12:47)
(Cutoff Date: 13MAR2021, Snapshot Date: 25MAR2021) Output File: ./nda2_unblinded/C4591001_PVP_BLA/adsl_s952

Table 19. Exposure to BNT162b2 by Dose and Race/Ethnic Origin (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received BNT162b2

Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Vaccine 30 µg		
Racial origin		
White	74	74
Black or African American	2	2
Asian	3	3
American Indian or Alaska Native	10	10
Total	89	89
Ethnic origin		
Hispanic/Latino	46	46
Non-Hispanic/non-Latino	43	43
Total	89	89

Note: 30 µg includes data from phase 1 and phase 2/3.
Note: Subjects who received 2nd Dose of BNT162b2 after unblinding.
PFIZER CONFIDENTIAL SDTM Creation: 25MAR2021 (23:24) Source Data: adsl Table Generation: 27MAR2021 (12:47)
(Cutoff Date: 13MAR2021, Snapshot Date: 25MAR2021) Output File: ./nda2_unblinded/C4591001_PVP_BLA/adsl_s9523

Table 20. Exposure to BNT162b2 by Dose and Race/Ethnic Origin (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Vaccine 30 µg		
Racial origin		
White	16378	29671
Black or African American	1638	2912
Asian	852	1583
American Indian or Alaska Native	189	354
Native Hawaiian or other Pacific Islander	28	53
Multiracial	510	975
Not reported	101	187
Total	19696	35735
Ethnic origin		
Hispanic/Latino	5006	8141
Non-Hispanic/non-Latino	14580	27395
Not reported	110	199
Total	19696	35735

Table 20. Exposure to BNT162b2 by Dose and Race/Ethnic Origin (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses

Note: 30 µg includes data from phase 1 and phase 2/3.
PFIZER CONFIDENTIAL SDTM Creation: 25MAR2021 (23:24) Source Data: adsl Table Generation: 27MAR2021 (12:47)
(Cutoff Date: 13MAR2021, Snapshot Date: 25MAR2021) Output File: ./nda2_unblinded/C4591001_PVP_BLA/adsl_s952_open

Table 21. Exposure to BNT162b2 by Dose and Race/Ethnic Origin (BNT162-01)

Dose Race/Ethnic Origin	No. of Subjects Exposed to BNT162b2	Total No. of Vaccine Doses
Vaccine 1 µg		
Racial Origin		
White	12	23
Total	12	23
Ethnic Origin		
Non-Hispanic/non-Latino	12	23
Total	12	23
Vaccine 3 µg		
Racial Origin		
White	12	24
Total	12	24
Ethnic Origin		
Non-Hispanic/non-Latino	12	24
Total	12	24
Vaccine 10 µg		
Racial Origin		
White	24	47
Total	24	47
Ethnic Origin		
Non-Hispanic/non-Latino	24	47
Total	24	47
Vaccine 20 µg		
Racial Origin		
White	24	48
Total	24	48
Ethnic Origin		

Table 21. Exposure to BNT162b2 by Dose and Race/Ethnic Origin (BNT162-01)

Dose Race/Ethnic Origin	No. of Subjects Exposed to BNT162b2	Total No. of Vaccine Doses
Non-Hispanic/non-Latino	24	48
Total	24	48
Vaccine 30 µg		
Racial Origin		
White	24	48
Total	24	48
Ethnic Origin		
Non-Hispanic/non-Latino	24	48
Total	24	48

Only race, ethnic origins collected on the case report form with a count of at least one in either column are displayed.
PFIZER CONFIDENTIAL SDTM Creation: 24NOV2020 (15:06) Source Data: adsl Table Generation: 10MAR2021 (12:27) (Cutoff date:23OCT2020, Snapshot Date: 23OCT2020)
Output File: ex_b2_dose_race.rtf

Table 22. Exposure to BNT162b2 (30 µg) by Special Population (C4591001) – Blinded Placebo-Controlled Follow-up Period

Population	Number of Subjects Exposed to BNT162b2 (30 µg) (N[a]=23188) n[b]	Total Number of Vaccine Doses
Subjects with any baseline comorbidity	10371	26487
AIDS/HIV	100	196
Any Malignancy + Metastatic Solid Tumor + Leukemia + Lymphoma	852	1696
Chronic Pulmonary Disease	1901	3774
Renal Disease	140	279
Rheumatic Disease	75	147
Mild Liver Disease + Moderate or Severe Liver Disease	154	302
Cerebrovascular Disease + Peripheral Vascular Disease + Myocardial Infarction + Congestive Heart Failure	651	1298
Dementia	7	14
Diabetes With/Without Chronic Complication	1706	3385
Hemiplegia or Paraplegia	4	8
Peptic Ulcer Disease	63	126
Obese	7689	15262

Note: Comorbidity is based on Charlson Comorbidity Index categories. Participants identified as belonging to these categories were identified by medical history data collected during the study.
Note: 30 µg includes data from phase 1 and phase 2/3.
Note: Hemiplegia or Paraplegia only includes preferred terms Hemiplegia and Paraplegia.
a. N = number of subjects in the specified group.

Table 22. Exposure to BNT162b2 (30 µg) by Special Population (C4591001) – Blinded Placebo-Controlled Follow-up Period

Population	Number of Subjects Exposed to BNT162b2 (30 µg) (N[a]=23188) n[b]	Total Number of Vaccine Doses

b. n = Number of subjects reporting at least 1 occurrence of any comorbidity or obese (BMI ≥30 kg/m^2 [≥16 Years of age] or BMI ≥95th percentile [12-15 Years of age]).
PFIZER CONFIDENTIAL SDTM Creation: 25MAR2021 (19:25) Source Data: admh Table Generation: 27MAR2021 (12:47)
(Cutoff Date: 13MAR2021, Snapshot Date: 25MAR2021) Output File: ./nda2_unblinded/C4591001_PVP_BLA/admh_s953

Table 23. Exposure to BNT162b2 (30 µg) by Special Population (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Population	Number of Subjects Exposed to BNT162b2 (30 µg) (N[a]=19696) n[b]	Total Number of Vaccine Doses
Subjects with any baseline comorbidity	8981	21590
AIDS/HIV	86	161
Any Malignancy + Metastatic Solid Tumor + Leukemia + Lymphoma	734	1406
Chronic Pulmonary Disease	1590	2953
Renal Disease	139	262
Rheumatic Disease	66	122
Mild Liver Disease + Moderate or Severe Liver Disease	102	193
Cerebrovascular Disease + Peripheral Vascular Disease + Myocardial Infarction + Congestive Heart Failure	567	1075
Dementia	9	17
Diabetes With/Without Chronic Complication	1555	2928
Hemiplegia or Paraplegia	4	8
Peptic Ulcer Disease	76	145
Obese	6760	12320

Note: Comorbidity is based on Charlson Comorbidity Index categories. Participants identified as belonging to these categories were identified by medical history data collected during the study.
Note: 30 µg includes data from phase 1 and phase 2/3.
Note: Hemiplegia or Paraplegia only includes preferred terms Hemiplegia and Paraplegia.
a. N = number of subjects in the specified group.
b. n = Number of subjects reporting at least 1 occurrence of any comorbidity or obese (BMI ≥30 kg/m^2 [≥16 Years of age] or BMI ≥95th percentile [12-15 Years of age]).
PFIZER CONFIDENTIAL SDTM Creation: 25MAR2021 (19:25) Source Data: admh Table Generation: 27MAR2021 (12:47)

Table 23. Exposure to BNT162b2 (30 µg) by Special Population (C4591001) – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Population	Number of Subjects Exposed to BNT162b2 (30 µg) (N[a]=19696) n[b]	Total Number of Vaccine Doses

(Cutoff Date: 13MAR2021, Snapshot Date: 25MAR2021) Output File: ./nda2_unblinded/C4591001_PVP_BLA/admh_s953_open

Exposure in participants 12-15 years of age – (Study C4591001-6-month follow-up period – Cut-off date 02 September 2021)

Table 24. Exposure to BNT162b2 by Dose (Totals) (C4591001) – 12-15 Years – Blinded Placebo-Controlled Follow-up Period

Dose Exposure (Number of Doses Received)	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Vaccine 30 µg		
1 Dose	7	7
2 Doses	1124	2248
Total	1131	2255

PFIZER CONFIDENTIAL SDTM Creation: 30SEP2021 (11:35) Source Data: adsl Table Generation: 04NOV2021 (12:52)
(Data Cutoff Date: 02SEP2021, Database Snapshot Date: 27SEP2021) Output File: ./nda2_unblinded/C4591001_PVP_adl6mpd2/adsl_s922

Table 25. Exposure to BNT162b2 by Dose (Totals) (C4591001) – 12-15 Years – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Dose Exposure (Number of Doses Received)	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
Vaccine 30 µg		
1 Dose	18	18
2 Doses	992	1984
Total	1010	2002

Note: Includes subjects who became eligible for unblinding at 16 years of age, confirmed to have received placebo originally and then received BNT162b2 post unblinding.
PFIZER CONFIDENTIAL SDTM Creation: 30SEP2021 (11:35) Source Data: adsl Table Generation:

Table 25. Exposure to BNT162b2 by Dose (Totals) (C4591001) – 12-15 Years – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Dose Exposure (Number of Doses Received)	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses

04NOV2021 (12:52)
(Data Cutoff Date: 02SEP2021, Database Snapshot Date: 27SEP2021) Output File: ./nda2_unblinded/C4591001_PVP_adl6mpd2/adsl_s9222

Table 26. Exposure to BNT162b2 by Gender (C4591001) – 12-15 Years – Blinded Placebo-Controlled Follow-up Period

	Number of Subjects Exposed to BNT162b2		Total Number of Vaccine Doses	
Dose Age Group[a]	Male	Female	Male	Female
Vaccine 30 µg ≥12 years to ≤15 years	567	564	1128	1127

a. Based on age at vaccination.
PFIZER CONFIDENTIAL SDTM Creation: 30SEP2021 (11:35) Source Data: adsl Table Generation: 04NOV2021 (12:52)
(Data Cutoff Date: 02SEP2021, Database Snapshot Date: 27SEP2021) Output File: ./nda2_unblinded/C4591001_PVP_adl6mpd2/adsl_1215_s932_blind

Table 27. Exposure to BNT162b2 by Gender (C4591001) – 12-15 Years – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

	Number of Subjects Exposed to BNT162b2		Total Number of Vaccine Doses	
Dose Age Group[a]	Male	Female	Male	Female
Vaccine 30 µg ≥12 years to ≤15 years	518	492	1027	975

a. Based on age at vaccination. Includes subjects who became eligible for unblinding at 16 years of age, confirmed to have received placebo originally and then received BNT162b2 post unblinding.
PFIZER CONFIDENTIAL SDTM Creation: 30SEP2021 (11:35) Source Data: adsl Table Generation: 04NOV2021 (12:52)

Table 27. Exposure to BNT162b2 by Gender (C4591001) – 12-15 Years – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

	Number of Subjects Exposed to BNT162b2		Total Number of Vaccine Doses	
Dose Age Group[a]	Male	Female	Male	Female

(Data Cutoff Date: 02SEP2021, Database Snapshot Date: 27SEP2021) Output File: ./nda2_unblinded/C4591001_PVP_adl6mpd2/adsl_1215_s932_plac

Table 28. Exposure to BNT162b2 by Race/Ethnic Origin (C4591001) – 12-15 Years – Blinded Placebo-Controlled Follow-up Period

Age Group[a] Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
≥12 years to ≤15 years		
Vaccine 30 µg		
Racial origin		
White	970	1935
Black or African American	52	103
Asian	72	143
American Indian or Alaska Native	4	8
Native Hawaiian or other Pacific Islander	3	6
Multiracial	24	48
Not reported	6	12
Total	1131	2255
Ethnic origin		
Hispanic/Latino	132	263
Non-Hispanic/non-Latino	997	1988
Not reported	2	4
Total	1131	2255

Table 28. Exposure to BNT162b2 by Race/Ethnic Origin (C4591001) – 12-15 Years – Blinded Placebo-Controlled Follow-up Period

Age Group[a] Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses

a. Based on age at vaccination.
PFIZER CONFIDENTIAL SDTM Creation: 30SEP2021 (11:35) Source Data: adsl Table Generation: 04NOV2021 (12:52)
(Data Cutoff Date: 02SEP2021, Database Snapshot Date: 27SEP2021) Output File: ./nda2_unblinded/C4591001_PVP_adl6mpd2/adsl_1215_s942_blind

Table 29. Exposure to BNT162b2 by Race/Ethnic Origin (C4591001) – 12-15 Years – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Age Group[a] Dose Race/Ethnic Origin	Number of Subjects Exposed to BNT162b2	Total Number of Vaccine Doses
≥12 years to ≤15 years		
Vaccine 30 µg		
Racial origin		
White	866	1718
Black or African American	48	96
Asian	62	123
American Indian or Alaska Native	2	3
Multiracial	26	52
Not reported	6	10
Total	1010	2002
Ethnic origin		
Hispanic/Latino	115	222
Non-Hispanic/non-Latino	892	1774
Not reported	3	6
Total	1010	2002

a. Based on age at vaccination. Includes subjects who became eligible for unblinding at 16 years of age, confirmed to have received placebo originally and then received BNT162b2 post unblinding.
PFIZER CONFIDENTIAL SDTM Creation: 30SEP2021 (11:35) Source Data: adsl Table Generation: 04NOV2021 (12:52)
(Data Cutoff Date: 02SEP2021, Database Snapshot Date: 27SEP2021) Output File: ./nda2_unblinded/C4591001_PVP_adl6mpd2/adsl_1215_s942_plac

Table 30. Exposure to BNT162b2 (30 µg) by Special Population (C4591001) – 12-15 Years – Blinded Placebo-Controlled Follow-up Period

Population	Number of Subjects Exposed to BNT162b2 (30 µg) (N[a]=1131) n[b]	Total Number of Vaccine Doses
Subjects with any baseline comorbidity	249	494
Chronic Pulmonary Disease	119	235
Mild Liver Disease + Moderate or Severe Liver Disease	2	4
Diabetes With/Without Chronic Complication	2	4
Obese	143	284

Note: Includes subjects who became eligible for unblinding at 16 years of age.
Note: Comorbidity is based on Charlson Comorbidity Index categories. Participants identified as belonging to these categories were identified by medical history data collected during the study.
Note: Hemiplegia or Paraplegia only includes preferred terms Hemiplegia and Paraplegia. No participants were identified.
a. N = number of subjects in the specified group.
b. n = Number of subjects reporting at least 1 occurrence of any comorbidity or obese (BMI ≥95th percentile [12-15 Years of age]).
PFIZER CONFIDENTIAL SDTM Creation: 05OCT2021 (18:33) Source Data: admh Table Generation: 04NOV2021 (12:52)
(Data Cutoff Date: 02SEP2021, Database Snapshot Date: 27SEP2021) Output File: ./nda2_unblinded/C4591001_PVP_adl6mpd2/admh_1215_s953_blind

Table 31. Exposure to BNT162b2 (30 µg) by Special Population (C4591001) – 12-15 Years – Open-Label Follow-up Period – Subjects Who Originally Received Placebo and Then Received BNT162b2 After Unblinding

Population	Number of Subjects Exposed to BNT162b2 (30 µg) (N[a]=1010) n[b]	Total Number of Vaccine Doses
Subjects with any baseline comorbidity	214	425
Chronic Pulmonary Disease	114	226
Rheumatic Disease	2	4
Diabetes With/Without Chronic Complication	2	4
Obese	116	229

Note: Includes subjects who became eligible for unblinding at 16 years of age.
Note: Includes subjects confirmed to have received placebo originally and then received BNT162b2 post unblinding.
Note: Comorbidity is based on Charlson Comorbidity Index categories. Participants identified as belonging to these categories were identified by medical history data collected during the study.
Note: Hemiplegia or Paraplegia only includes preferred terms Hemiplegia and Paraplegia. No participants were identified.
a. N = number of subjects in the specified group.
b. n = Number of subjects reporting at least 1 occurrence of any comorbidity or obese (BMI ≥95th percentile [12-15 Years of age]).
PFIZER CONFIDENTIAL SDTM Creation: 05OCT2021 (18:33) Source Data: admh Table Generation: 04NOV2021 (12:52)
(Data Cutoff Date: 02SEP2021, Database Snapshot Date: 27SEP2021) Output File: ./nda2_unblinded/C4591001_PVP_adl6mpd2/admh_1215_s953_plac

2.1.2.a.2. Inclusion and Exclusion Criteria

Detailed descriptions of all inclusion and exclusion criteria for clinical studies are provided in the individual CSRs which were filed to IND 019736.

Inclusion criteria

- Healthy participants who are determined by medical history, physical examination (if required), and clinical judgment of the investigator to be eligible for inclusion in the study.

- Healthy participants with pre-existing stable disease, defined as disease not requiring significant change in therapy or hospitalization for worsening disease during the 6 weeks before enrollment, can be included. In order for the overall Phase 3 study population to be as representative and diverse as possible, the inclusion of participants with known chronic stable infection with HIV, HCV, or HBV was permitted as the study progressed. Specific criteria for these Phase 3 participants can be found in the C4591001 protocol, Section 10.8.

- Phase 2/3 only: Participants who, in the judgment of the investigator, are at higher risk for acquiring COVID-19 (including, but not limited to, use of mass transportation, relevant demographics, front-line essential workers, and others).

- The participants enrolled were 12 years of age and older; the 12- to 15-year-old cohort was included in the protocol in October 2020.

Exclusion criteria

Phase 1 exclusion criteria were stricter than criteria in Phases 2 and 3 of the study. Participants were excluded from the studies according to the general criteria listed below:

- **Previous vaccination with any coronavirus vaccine**

  Reason for exclusion: To avoid confounding the assessment of serological or clinical immune response in the study population.

  Is it considered to be included as missing information? No.

  Rationale: Minimal potential clinical impact on the target population.

- **Previous clinical or microbiological diagnosis of COVID-19**

  Reason for exclusion: Phase 1 excluded participants with a previous clinical or microbiological diagnosis of COVID-19 because these participants may have some degree of protection from subsequent infection by SARS-CoV-2 and therefore would confound the pivotal efficacy endpoint. During Phase 2/3, participants with prior undiagnosed infection were allowed to be enrolled. Screening for SARS-CoV-2 with nucleic acid amplification test by nasal swab or antibodies to non-vaccine SARS-CoV-2

antigen by serology was not conducted before vaccine administration in Phase 2/3, but samples were taken to run these assays after vaccination, thus identifying participants with unidentified prior infection. This group will be assessed to identify whether prior infection affects safety.

Is it considered to be included as missing information? No.

Rationale: Safety in study participants with prior infection will be assessed in the pivotal study.

- **Immunocompromised individuals with known or suspected immunodeficiency, as determined by history and/or laboratory/physical examination.**

  Reason for exclusion: Immunocompromised participants may have impaired immune responses to vaccines and would therefore limit the ability to demonstrate efficacy, which is the primary pivotal endpoint.

  Is it considered to be included as missing information? No.

  Rationale: Participants with potential immunodeficient status were not specifically included in the study population. However, since the study population is intended to be as representative as possible of the vulnerable population to COVID-19 illness, sub-analyses of immunogenicity data in future studies may provide further understanding of immune responses in this population.

- **Receipt of blood/plasma products or immunoglobulin, from 60 days before study intervention administration or planned receipt throughout the study**

  Reason for exclusion: To avoid confounding the assessment of serological or clinical immune response in the study population.

  Is it considered to be included as missing information? No.

  Rationale: No impact on the safety of the target population.

- **Women who are pregnant or breastfeeding**

  Reason for exclusion: To avoid use in a vulnerable population.

  Is it considered to be included as missing information? Yes.

  Rationale: Maternal vaccination with COVID-19 mRNA vaccine is being studies in C4591015 to explore unexpected negative consequences to the embryo or foetus.

- **Other medical or psychiatric condition including recent (within the past year) or active suicidal ideation/behavior or laboratory abnormality that may increase the risk of study participation or, in the investigator's judgment, make the participant inappropriate for the study**

  Reason for exclusion: To avoid misleading results deriving from non-compliance to study procedures.

  Is it considered to be included as missing information? No.

  Rationale: Safety profile of BNT162b2 is not expected to differ in these subjects when properly administered.

2.1.2.a.2.1. Non-Study Post-Authorization Exposure

Cumulatively, through 30 September 2021, approximately 1,709,812,866 doses of BNT162b2 were shipped worldwide, corresponding to approximately 1,402,241,841 estimated administered doses.

The worldwide number of shipped doses may serve as a reasonable indicator of subject exposure, considering that approximately 82% of the shipped doses were administered.

The estimated cumulative number of shipped and administered doses of BNT162b2 by region based on data provided in the shipment tracker (Order Book),[3] from the receipt of the first temporary authorization for emergency supply on 01 December 2020 through 30 September 2021, are summarized in Table 32.

Table 32. Cumulative Estimated Shipped/Administered Doses of BNT162b2 by Region Worldwide

Region/Country/Other	% of Doses	Total Number of Shipped Doses	Total Number of Administered Doses
Europe	**41.1%**	**703267110**	**571473911**
European Union[a] (27)	30.0%	513505785	415939686
Additional EEA Countries[a] (3)	0.4%	7006155	5674986
Switzerland[a]	0.3%	4500990	3690812
UK[b]	3.6%	61213230	50194849
Other Countries[c]	6.3%	107217045	87917977
Commonwealth of Independent States[d]	0.6%	9823905	8055602
North America[e]	**18.5%**	**316093695**	**264597240**
US	15.8%	270020505	226817224
Canada	2.7%	46073190	37780016
Central and South America[f]	**12.5%**	**213085680**	**174730258**

[3] The Order Book is the most accurate tracker of shipment used as data source for all the Regions and Countries; US shipment data not available in the Order Book were taken from the Order Management Dashboard and data for Fosun License Partner territories, Hong Kong and Macau, were provided by BioNTech.

Table 32. Cumulative Estimated Shipped/Administered Doses of BNT162b2 by Region Worldwide

Region/Country/Other	% of Doses	Total Number of Shipped Doses	Total Number of Administered Doses
Asia	**23.6%**	**404077581**	**331343616**
Japan[a]	10.7%	183498120	150468458
Other Countries[g]	12.9%	220579461	180875158
Oceania	**1.4%**	**23158980**	**18990364**
Australia/New Zealand[a]	1.4%	23158980	18990364
Other Countries	0.0%	0	0
Africa[h]	**2.9%**	**50129820**	**41106452**
Total	**100.0%**	**1709812866**	**1402241841**

a. In this Region BNT162b2 was conditionally approved;
b. In the UK, both the authorization for emergency supply under regulation 174 and the conditional marketing authorization approval are currently active for BNT162b2.
c. Includes Albania, Kosovo and North Macedonia where BNT162b2 was conditionally approved, Serbia where it received authorization for emergency supply, Bosnia where it was shipped for COVAX, Turkey where it was shipped according to a pharmacovigilance agreement in place by the MAH and the Turkish government;
d. Includes Georgia and Ukraine where BNT162b2 received authorization for emergency supply and Moldova where it was conditionally approved; in Azerbaijan BNT162b2 was shipped for COVAX, and Tajikistan and Uzbekistan are part of US government donations;
e. In this Region BNT162b2 initially received authorization for emergency supply; in the US, a full approval (BLA) was also granted on 23 August 2021 and in Canada a full approval (NDS) replacing the pre-existing authorization for emergency supply was granted during the current reporting period on 16 September 2021;
f. Includes Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Honduras, Mexico, Panama, Paraguay and Uruguay where BNT162b2 received authorization for emergency supply, Argentina, Brazil and Peru where BNT162b2 was conditionally approved; Bolivia and Guatemala where BNT162b2 was shipped for COVAX and Antigua&Barbuda, Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, St Kitts&Nevis, St. Lucia, StVin&Grenadine, Suriname and Trinidad&Tobago that are part of US Government donations;
g. Includes Bahrain, Bhutan, Indonesia, Iraq, Israel, Jordan, Kuwait, Lebanon, Macau, Maldives, Mongolia, Oman, Pakistan, Palestine, Philippines, Qatar, Saudi Arabia, Singapore, Sri Lanka, United Arab Emirates and Vietnam where BNT162b2 received authorization for emergency supply; Hong Kong, Malaysia, South Korea and Thailand where BNT162b2 was conditionally approved and Bangladesh, Laos and West Bank & Gaza where BNT162b2 was shipped for COVAX;
h. Includes Angola, Cape Verde, Chad, Ivory Coast, Lybia and Togo where BNT162b2 was shipped for COVAX; Benin, Congo, Gabon, Namibia, Seychelles, Sierra Leone and Uganda that are parts of US Government donations; Botswana, Egypt, Eswatini, Kenya, Mauritius, Morocco, Rwanda, South Africa and Tunisia where BNT162b2 received authorization for emergency supply.

Method Used to Calculate Exposure

Not applicable.

Exposure

Not applicable.

2.1.2.a.3. Regulatory Actions Related to Safety

There were no withdrawals for safety reasons up to 30 September 2021.

2.1.2.b. Populations Not Studied in the Pre-Approval Phase

There has been limited exposure to BNT162b2 in some special populations and no epidemiologic studies have been conducted in pregnant/lactating women, pediatric participants (<12 years of age), and specific subpopulations that were initially excluded from the BNT162b2 program.

Table 33. Exposure of Special Populations Included or not in Clinical Trial Development Programs

Type of special population	Exposure
Pregnant women	Available data on BNT162b2 administered to pregnant women are insufficient to inform on vaccine-associated risks in pregnancy. In a reproductive and developmental toxicity study, no vaccine-related adverse effects on female fertility, fetal development, or postnatal development were reported. **Participants 16 years of age and older** Through the cut-off date of 13 March 2021, there were 50 cases (52 events) originating from Study C4591001 in participant 16 years of age and older, and all were unique pregnancies. **Participants 12-15 years of age** Through the cut-off date of 02 September 2021, there were no CT cases of pregnancies from study C4591001 in participants 12-15 years of age.
Breastfeeding women	Breastfeeding women were not initially included in the BNT162b2 clinical development program. Data are not available to assess the effects of BNT162b2 on the breastfed infant or on milk production/excretion. The developmental and health benefits of breastfeeding should be considered along with the mother's clinical need for BNT162b2 and any potential adverse effects on the breastfed child from BNT162b2 or from the underlying maternal condition. For preventive vaccines, the underlying maternal condition is susceptible to disease prevented by the vaccine. **Participants 16 years of age and older** Through the cut-off date of 13 March 2021, there were no CT cases indicative of exposure during breastfeeding from study C4591001 in participants 16 years of age and older. **Participants 12-15 years of age** Through the cut-off date of 02 September 2021, there were no CT cases indicative of exposure during breastfeeding from study C4591001 in participants 12-15 years of age.

Table 33. Exposure of Special Populations Included or not in Clinical Trial Development Programs

Type of special population	Exposure
Participants with relevant comorbidities: • Participants with hepatic impairment • Participants with renal impairment • Participants with cardiovascular disease • Immunocompromised participants • Participants with a disease severity different from inclusion criteria in CTs	Healthy participants with pre-existing stable disease, defined as disease not requiring significant change in therapy or hospitalization for worsening disease during the 6 weeks before enrollment, were included. This allowed enrollment of a proportion of participants with common comorbidities such as cardiovascular diseases including hypertension, chronic pulmonary diseases, asthma, chronic liver disease, BMI >30 kg/m^2, participants with stage 3 or worse chronic kidney disease, and participants with varying disease severity. Participants with potential immunodeficient status were not specifically included in the study population. Please refer to Table 22, Table 23, Table 30 and Table 31 for the exposure of special populations.
Participants of different racial and/or ethnic origin	Please refer to Table 15, Table 16, Table 17, Table 18, Table 19, Table 20, Table 21, Table 28 and Table 29 for exposure information by ethnic origin from the studies.
Subpopulations carrying known and relevant polymorphisms	No data available.
Pediatric participants	The safety and effectiveness of BNT162b2 in individuals younger than 5 years of age have not been established. **Participants 16 to 17 years of age** A total of 671 pediatric participants 16 to 17 years of age received BNT162b2 through the DLP of 13 March 2021: • 378 participants in the blinded-placebo controlled follow-up period (Table 3). • 293 participants in the open-label follow-up period after the unblinding (Table 5). **Participants 12 to 15 years of age** One thousand one hundred thirty-one (1131) pediatric participants 12 to 15 years of age received in the blinded controlled follow-up period; 1010 participants, who originally received placebo, then received BNT162b2 in the Open-Label Follow-up period after unblinding through the cut-off date of 02 September 2021 (Table 24 and Table 25).
Elderly (≥65 years old)	The safety and effectiveness of BNT162b2 in elderly participants was consistent with that seen in younger adult participants. Clinical studies of BNT162b2 included a total of 8846 participants 65 years of age and over; of these, 8827 were from study C4591001, through the cut-off date of 13 March 2021: • 4590 participants in the blinded-placebo controlled follow-up period (Table 3) • 4237 participants in the open-label follow-up period after unblinding (Table 5). Nineteen (19) participants 65 years of age and over were from study BNT162-01 study through the cut-off date of 23 October 2020 (Table 6).

Table 33. Exposure of Special Populations Included or not in Clinical Trial Development Programs

Type of special population	Exposure

Abbreviations: EUA = emergency use authorization; BMI = body mass index; COVID-19 = coronavirus disease 2019; CT = clinical trial

2.1.2.c. Adverse Events / Adverse Reactions

2.1.2.c.1. Identification of Safety Concern in the Initial PVP Submission

2.1.2.c.1.1. Risks not Considered Important for Inclusion in the List of Safety Concerns in the PVP

Not all potential or identified risks for the vaccine are considered to meet the level of importance necessitating inclusion in the list of safety concerns in the PVP:

- Risks with minimal and temporary clinical impact on patients (in relation to the severity of the disease prevented).
- The following reactogenicity events are identified risks not included in the list of safety concerns in the PVP: Injection site pain, Fever, Chills, Fatigue, Headache, Muscle pain, and Joint pain.
- Very rare potential risks for any medicinal treatment, including vaccines, which are well known to healthcare professionals are not included in the list of safety concerns.

2.1.2.c.2. Important Identified and Potential Risks and Missing Information

2.1.2.c.2.1. Presentation of Important Identified Risks and Important Potential Risks

Important Identified Risks

Table 34. Myocarditis and Pericarditis

Potential mechanisms, evidence source and strength of evidence	A mechanism of action (MOA) by which the vaccine could cause myocarditis and pericarditis has not been established. Nonclinical studies, protein sequence analyses and animal studies in rats and non-human primates have not identified a MOA. Hypotheses for MOA include an immune stimulated response (including the possibility of molecular mimicry), a general systemic inflammatory response from vaccination or a hypersensitivity response.
Characterisation of the risk	***Participants 16 years of age and older*** Data from the CT dataset[a] (cut-off date: 18 June 2021) Two cases were retrieved with the myocarditis and pericarditis search strategy[b] in the clinical trial dataset through the cut-off date of 18 June 2021. These cases originated from Phase 3 clinical study C4591001 and are summarized below: Myocarditis: There were no cases reporting myocarditis as SAE.

Table 34. Myocarditis and Pericarditis

Pericarditis (2 cases):

Two (2) serious adverse events [PT Pericarditis] were reported, both deemed not related to study treatment by the Investigator.

Data from the safety database (cut-off date: 18 June 2021):

Since the first temporary authorization for emergency supply under Regulation 174 in the UK (01 December 2020) and through 18 June 2021, 823 potentially relevant cases (0.3% of the total post-authorization dataset) were retrieved from the Myocarditis and Pericarditis search strategy:[b] 490 cases reported events related to myocarditis and 371 cases reported events related to pericarditis (in 38 of these 823 cases, the subjects developed both myocarditis and pericarditis related events).

Myocarditis (490 cases):

These 490 cases were individually reviewed and assessed according to Brighton Collaboration (BC) Myocarditis Case Definition and Level of Certainty Classification (version 1.4.2, 30 May 2021), as shown in the Table below:

Brighton Collaboration Level	Number of cases
BC 1	41
BC 2	44
BC 3	42
BC 4	337
BC 5	26
Total	490

Level 1 indicates a definitive case with the highest level of diagnostic certainty of myocarditis, level 2 indicates a probable case, and level 3 indicates a possible case. Level 4 is defined as "reported event of myocarditis with insufficient evidence to meet the case definition" and Level 5 as not a case of myocarditis.

There were 464 cases meeting BC Level 1 to 4, which are presented below:

Country of incidence: Israel (135), US (78), Germany (76), UK (55), France (21), Italy, Japan (13 each), Austria (10), Greece, Spain (8 each), Sweden (7), Canada, Norway (6 each), Ireland (5); the remaining 23 cases originated from 17 different countries.

Gender: Females (133), Males (325), Unknown (6).

Age (n=443) ranged from 16 to 97 years (mean = 37.2 years, median = 32.0 years).

Reported relevant PTs: Myocarditis (463) and Autoimmune myocarditis (1).

Overall event seriousness and outcome of these 464 cases are summarized below.

	Total Events N = 464 (%)
Serious events	459 (98.9)
Events with Criterion of Hospitalization	337 (72.6)
Distribution of events by Outcome	
Outcome: Death	14 (3.0)
Outcome: Resolved/Resolving	149 (32.1)
Outcome: Not resolved	106 (22.8)

Table 34. Myocarditis and Pericarditis

Outcome: Resolved with sequelae	10 (2.2)
Outcome: Unknown/No data	185 (39.9)

Pericarditis (371 cases)

Country of incidence: US (68), France (62), Israel (50), UK (38), Italy (33), Norway, Spain (24 each), Canada (10), Australia (9), Greece (7), Germany (6), Belgium, Denmark, Netherlands, Switzerland (5 each); the remaining 20 cases originated from 11 different countries.
Gender: Females (185), Males (181), Unknown (5).
Age (n=335) ranged from 16 to 92 years (mean = 51.5 years, median = 51.0 years).
Reported relevant PTs: Pericarditis (360) and Pleuropericarditis (12).

Overall event seriousness and outcome of these 371 cases are summarized below.

	Total Events N = 372 (%)
Serious events	370 (99.5)
Events with Criterion of Hospitalization	206 (55.4)
Distribution of events by Outcome	
Outcome: Death	3 (0.8)
Outcome: Resolved/Resolving	213 (57.3)
Outcome: Not resolved	63 (16.9)
Outcome: Resolved with sequelae	7 (1.9)
Outcome: Unknown/No data	86 (23.1)

Participants 12 to 15 years of age

Data from the CT database (cut-off date 02 September 2021):
One (1) case was retrieved with the Myocarditis and Pericarditis search strategy[b] in the CT database through the cut-off date of 02 September 2021. This case originated from the clinical study C4591001.

Myocarditis (1 case):
One (1) SAE (PT Myocarditis) was reported 3 days after the administration of the second dose of BNT162b2; the participant recovered the following day. The SAE was deemed not related to study treatment by the investigator.

Pericarditis:
There were no cases reporting pericarditis as SAE.

Data from the safety database (cut-off date 30 September 2021):
Through 30 September 2021, 180 potentially relevant cases (0.03% of the total post-authorization dataset) were retrieved from the Myocarditis and Pericarditis search strategy:[b] 154 cases reported myocarditis and 61 cases reported pericarditis (in 35 of these 180 cases, the subjects developed both myocarditis and pericarditis).

Myocarditis (154 cases)

Table 34. Myocarditis and Pericarditis

These 154 cases were individually reviewed and assessed according to Brighton Collaboration (BC) Myocarditis Case Definition and Level of Certainty Classification, as shown in the Table below:

Brighton Collaboration Level	Number of cases
BC 1	14
BC 2	9
BC 3	0
BC 4	130
BC 5	1
Total	*154*

Level 1 indicates a definitive case with the highest level of diagnostic certainty of myocarditis, level 2 indicates a probable case, and level 3 indicates a possible case. Level 4 is defined as "reported event of myocarditis with insufficient evidence to meet the case definition" and Level 5 as not a case of myocarditis.

The details of 153 cases (excluding 1 Level 5 case) are presented below:
Country of incidence: Hong Kong (39), US (25), Germany (18), France (17), Italy (8), Israel (7), Austria and Spain (6 each), Denmark and Japan (5 cases); the remaining 17 cases originated from 13 different countries.
Gender: Females (20), Males (130), and not reported (3).
Age (n=153) ranged from 12 to 15 years (mean = 13.9 years, median = 14.0 years).
Reported relevant PT: Myocarditis (153).

Overall event seriousness and outcome of these 153 cases are summarized below.

	Total Events N = 153 (%)
Serious events	153* (100.0)
Events with Criterion of Hospitalization	110 (71.9)
Distribution of events by Outcome	
Outcome: Death	0
Outcome: Resolved/Resolving	79 (51.6)
Outcome: Not resolved	17 (11.1)
Outcome: Resolved with sequelae	0
Outcome: Unknown/No data	57 (37.3)

*Includes 1 case where myocarditis was captured as non-serious and upgraded to serious after the DLP.

Pericarditis (61 cases)
These 61 cases were individually reviewed and assessed according to Brighton Colloboration (BC) Pericarditis Case Definition and Level of Certainty Classification, as shown in the Table below

Brighton Collaboration Level	Number of cases
BC 1	1
BC 2	4
BC 3	0
BC 4	56

Table 34. Myocarditis and Pericarditis

BC 5	0
Total	*61*

Level 1 indicates a definitive case with the highest level of diagnostic certainty of pericarditis, level 2 indicates a probable case, and level 3 indicates a possible case. Level 4 is defined as "reported event of pericarditis with insufficient evidence to meet the case definition" and Level 5 as not a case of pericarditis.

The details of 61 cases are presented below:

Country of incidence: Hong Kong (29), Italy (7), France (6), US (4), Canada (3), Australia, Belgium, Germany, and Japan (2 each); the remaining 4 cases originated from 4 different countries.

Gender: Males (48) and Females (13).

Age (n=61) ranged from 12 to 15 years (mean = 14.0 years, median = 14.0 years).

Reported relevant PT: Pericarditis (61).

Overall event seriousness and outcome of these 61 cases are summarized below.

	Total Events N = 61 (%)
Serious events	61 (100.0)
Events with Criterion of Hospitalization	17 (27.9)
Distribution of events by Outcome	
Outcome: Death	0
Outcome: Resolved/Resolving	18 (29.5)
Outcome: Not resolved	9 (14.8)
Outcome: Resolved with sequelae	1 (1.6)
Outcome: Unknown/No data	33 (54.1)

Risk factors and risk groups	Post-authorization reports have been received for more males than females, over a wide age range and following dose 1 and dose 2 of the vaccine. Evaluation by the US CDC has found reports to be most frequent in adolescent and young adult male patients following the second dose of vaccine.
Preventability	Due to an unknown MOA, preventative measures are not clear for individuals with or without a personal history of myocarditis or pericarditis.
Impact on the risk-benefit balance of the biologic product	The vaccine continues to have a favorable risk benefit balance
Public health impact	Considering the low rates of myocarditis and pericarditis reported following vaccination, balanced with the risk of death and illness (including myocarditis) caused by SARS-CoV-2, the public health impact of post-vaccination myocarditis and pericarditis is minimal.

a. Please note that CT dataset from the safety database includes only cases reporting SAEs.
b. Search criteria: the following PTs were used to retrieve cases of Myocarditis and Pericarditis: Autoimmune myocarditis; Eosinophilic myocarditis; Giant cell myocarditis; Hypersensitivity myocarditis; Immune-mediated myocarditis; Myocarditis; Autoimmune pericarditis, Pericarditis; Pericarditis adhesive; Pericarditis constrictive; Pleuropericarditis.

Table 35. Anaphylaxis

Potential mechanisms, evidence source and strength of evidence	Interaction of an allergen with IgE on basophils and mast cells triggers release of histamine, leukotrienes and other mediators that cause diffuse smooth muscle contraction and vasodilation with plasma leakage. This can manifest clinically with dyspnea, hypotension, swelling (sometimes leading to airway compromise), and rash (including hives).
Characterisation of the risk	***Participants 16 years of age and older*** Data from the CT dataset[a] (cut-off date 18 June 2021) Through 18 June 2021,[b] there was 1 case from the CT dataset (from Phase 3 clinical study C4591001) of serious Anaphylactoid reaction in a 17-year-old participant reported as resolved and deemed related to study treatment by the Investigator: Data from the safety database (cut-off date 18 June 2021): Through 18 June 2021,[b] there were 3822 cases (1.2% of the total post authorization dataset) reporting a total of 3914 events in individuals 16 years and older including: Anaphylactic reaction (3414) Anaphylactic shock (420) Anaphylactoid rection (75) Anaphylactoid shock (5) Overall event seriousness and outcome are summarized below:

	Total Events N = 3914 (%)
Serious events	3868 (98.8)
Events with Criterion of Hospitalization	1231 (31.5)
Distribution of events by Outcome*	
Outcome: Death	28 (0.7)
Outcome: Resolved/Resolving	2958 (75.6)
Outcome: Not resolved	171 (4.4)
Outcome: Resolved with sequelae	56 (1.4)
Outcome: Unknown	704 (18)

*For the outcome count, the multiple Lowest Level Terms that code to the same PT within a case are counted and presented individually. Therefore, for selected PTs the total count of the event outcome may exceed the total number of events.

Participants 12 to 15 years of age

Data from the CT database (cut-off date 02 September 2021)

Through 02 September 2021, there were no cases[b] reporting Anaphylactic reaction/shock, Anaphylactoid reaction/shock as SAEs from the CT database.

Data from the safety database (cut-off date 30 September 2021):

Through 30 September 2021, there were 43 cases[b] (41 Anaphylactic reaction, 4 Anaphylactic shock, and 1 Anaphylactoid reaction) in individuals 12 to 15 years of

Table 35. Anaphylaxis

<table>
<tr><td></td><td>age (0.01% of total post-authorization dataset); overall event seriousness and outcome are summarized below:

<table><tr><th></th><th>Total Events
N = 46 (%)</th></tr><tr><td>Serious events</td><td>46 (100)</td></tr><tr><td>Events with Criterion of Hospitalization</td><td>15 (32.6)</td></tr><tr><td colspan="2">Distribution of events by Outcome</td></tr><tr><td>Outcome: Death</td><td>0</td></tr><tr><td>Outcome: Resolved/Resolving</td><td>32 (69.6)</td></tr><tr><td>Outcome: Resolved with sequelae</td><td>0</td></tr><tr><td>Outcome: Not resolved</td><td>2 (4.3)</td></tr><tr><td>Outcome: Unknown</td><td>12 (26.1)</td></tr></table>
Conclusion: Evaluation of Anaphylactic reaction/shock, Anaphylactoid reaction/shock cases through 30 September 2021 did not reveal any significant new safety information. Anaphylaxis is appropriately described in the product labeling as are non-anaphylactic hypersensitivity events. Surveillance will continue.</td></tr>
<tr><td>Risk factors and risk groups</td><td>Known hypersensitivity to any components of the vaccine.</td></tr>
<tr><td>Preventability</td><td>Prevention of anaphylaxis may not be possible, particularly with the 1st dose of a vaccine; therefore, healthcare professionals administering the vaccine must be vigilant for early signs and symptoms.</td></tr>
<tr><td>Impact on the risk-benefit balance of the biologic product</td><td>Anaphylactic reaction in an individual can be impactful (medically important) because it is a potentially life-threatening event requiring medical intervention.</td></tr>
<tr><td>Public health impact</td><td>Minimal due to rarity of the event. Although the potential clinical consequences of an anaphylactic reaction are severe, this is a known risk of vaccines to healthcare professionals with negligible public health impact.</td></tr>
</table>

a. Please note that CT dataset from the safety database includes only cases reporting SAEs.
b. Updated search criteria starting from the 6th SMSR (see 5th Monthly Safety Update preliminary PRAC Assessment Report; EMEA/H/C/005735/MEA/002.4): PTs Anaphylactic reaction, Anaphylactic shock, Anaphylactoid reaction, Anaphylactoid shock, without Brighton Collaboration criteria applied.

Important Potential Risks

Table 36. Vaccine-Associated Enhanced Disease (VAED), including Vaccine-Associated Enhanced Respiratory Disease (VAERD)

Potential mechanisms, evidence source and strength of evidence	This potential risk is theoretical because it has not been described in association with the BNT162b2 or it has not been reported from any other late phase clinical trial of other human vaccine. Animal models of SARS-CoV-2 infection have not shown evidence of VAED after immunization, whereas cellular immunopathology has been demonstrated after viral challenge in some animal models administered SARS-CoV-1 (murine, ferret and non-human primate models) or MERS-CoV (mice model) vaccines.[1,6] This potential risk has been included based on these animal data with these related betacoronaviruses. Historically, disease enhancement in vaccinated children following infection with natural virus has been observed with an inactivated respiratory syncytial virus vaccine.[7]

Table 36. Vaccine-Associated Enhanced Disease (VAED), including Vaccine-Associated Enhanced Respiratory Disease (VAERD)

<table>
<tr><td></td><td>Potential mechanisms of enhanced disease may include both T cell-mediated [an immunopathological response favoring T helper cell type 2 (T_H2) over T helper cell type 1 (T_H1)] and antibody-mediated activity (antibody responses with insufficient neutralizing activity leading to formation of immune complexes and activation of complement or allowing for Fc-mediated increase in viral entry to cells).[8]</td></tr>
<tr><td>Characterization of the risk</td><td><u>Participant 16 years and older</u>
<u>Data from the CT database (cut-off date 13 March 2021)</u>
Confirmed Case of Postvaccination Severe COVID-19 – Blinded Placebo-Controlled Follow-up Period - Safety Population (C4591001)
<table><tr><th></th><th colspan="2">BNT162b2 (30 µg) (N[a]=23164)</th><th colspan="2">Placebo (N[a]=23155)</th></tr><tr><th>Timing</th><th>n[b] (%)</th><th>(95% CI[c])</th><th>n[b] (%)</th><th>(95% CI[c])</th></tr><tr><td>PD1 Before Dose 2</td><td>0</td><td>(0.0, 0.0)</td><td>6 (0.0)</td><td>(0.0, 0.1)</td></tr><tr><td>Within 7 days PD1</td><td>0</td><td>(0.0, 0.0)</td><td>0</td><td>(0.0, 0.0)</td></tr><tr><td>PD2</td><td>1 (0.0)</td><td>(0.0, 0.0)</td><td>25 (0.1)</td><td>(0.1, 0.2)</td></tr><tr><td>Within 7 days PD2</td><td>0</td><td>(0.0, 0.0)</td><td>2 (0.0)</td><td>(0.0, 0.0)</td></tr><tr><td>Total[d]</td><td>1 (0.0)</td><td>(0.0, 0.0)</td><td>31 (0.1)</td><td>(0.1, 0.2)</td></tr></table>
Note: This table includes subjects from Phase 2/3 only.
Abbreviations: PD1 = post-dose 1; PD2 = post-dose 2.
a. N = number of subjects in the specified group. This value is the denominator for the percentage calculations.
b. n = Number of subjects reporting at least 1 occurrence of the specified event.
c. Exact 2-sided CI based on the Clopper and Pearson method.
d. Total is the sum of PD1 and PD2.
PFIZER CONFIDENTIAL SDTM Creation: 25MAR2021 (23:24) Source Data: adc19ef Table Generation: 27MAR2021 (12:47) (Cutoff date: 13MAR2021, Snapshot Date: 25MAR2021)
Output File: /nda2 unblinded/C4591001 PVP BLA/adeff s901

If VAED/VAERD were to occur in vaccinated individuals, it may manifest as a modified and/or more severe clinical presentation of SARS-CoV-2 viral infection upon subsequent natural infection. This may result in individuals assumed to be at lower risk for severe COVID-19 having more severe disease, for individuals at known risk for severe COVID-19 (e.g. older or immunocompromised) having higher rates of fatal outcomes, or for observation of an unfavorable imbalance in severe COVID-19 cases in vaccinated individuals when compared to those not vaccinated. It is challenging to assess for VAED/VAERD on an individual case basis, given the lack of specific clinical or laboratory markers at this time, rather surveillance for this theoretical risk is best performed at a population level,[9] as noted above. The table above shows a favorable balance of severe COVID-19 cases in participants receiving BNT162b2 versus those receiving placebo, providing reassurance against the potential risk of VAED/VAERD at this time.

Data from the CT dataset[a] (cut-off date 18 June 2021):
There were no cases indicative of VAED/VAERD as SAEs in the CT dataset through the DLP of 18 June 2021.</td></tr>
</table>

Table 36. Vaccine-Associated Enhanced Disease (VAED), including Vaccine-Associated Enhanced Respiratory Disease (VAERD)

Data from the safety database (cut-off date 18 June 2021)

No post-authorized AE reports have been identified as cases of VAED/VAERD, therefore, there is no observed data at this time. An expected rate of VAED is difficult to establish so a meaningful observed/expected analysis cannot be conducted at this point based on available data. The feasibility of conducting such an analysis will be re-evaluated on an ongoing basis as data on the virus grows and the vaccine safety data continues to accrue.

The search criteria utilised to identify potential cases of VAED for this report includes PTs indicating a lack of effect of the vaccine and PTs potentially indicative of severe or atypical COVID-19.

Since the first temporary authorization for emergency supply under Regulation 174 in the UK (01 December 2020) and through the DLP 18 June 2021, there were 584 cases (0.2% of the total post-authorization dataset), reporting 1427 potentially relevant events.

Seriousness criteria for the total 584 cases: Medically significant (452, of which 10 also serious for disability), Hospitalization required (non-fatal/non-life threatening) (115, of which 3 also serious for disability), Life threatening (34, of which 22 were also serious for hospitalization), Death (160).

Gender: Females (298), Males (268), Unknown (18);

Age (n=553) ranged from 17 to 103 years (mean = 70.3 years, median = 77.0);

Overall event seriousness and outcome are summarized below:

	Total Events N = 1427 (%)
Serious events	1261 (88.4)
Events with Criterion of Hospitalization	612 (42.9)
Distribution of events by Outcome*	
Outcome: Death	311 (21.8)
Outcome: Resolved/Resolving	375 (26.3)
Outcome: Not resolved	246 (17.2)
Outcome: Resolved with sequelae	14 (1.0)
Outcome: Unknown/No data	484 (33.9)

* For the outcome count, the multiple Lowest Level Terms that code to the same PT within a case are counted and presented individually. Therefore, for selected PTs the total count of the event outcome may exceed the total number of events.

The most frequently reported relevant PTs (≥2%) were: Drug ineffective (390), Vaccination failure (194), Dyspnoea (180), COVID-19 pneumonia (179), Diarrhoea (111), Respiratory failure (52), Vomiting (50), Pulmonary embolism (33).

Conclusion: VAED may present as severe or unusual clinical manifestations of COVID-19. Overall, there were 425 subjects with confirmed COVID 19 following one or both doses of the vaccine; 288 of the 425 cases were severe, resulting in

Table 36. Vaccine-Associated Enhanced Disease (VAED), including Vaccine-Associated Enhanced Respiratory Disease (VAERD)

<table>
<tr><td></td><td>hospitalization, disability, life threatening consequences or death. None of the 288 cases could be definitively considered as VAED/VAERD.

In this review of subjects with COVID-19 following vaccination, based on the current evidence, VAED/VAERVAED remains a theoretical risk for the vaccine. Surveillance will continue.

<u>Participants 12 to 15 years of age</u>

<u>Data from the CT database (cut-off date 02 September 2021):</u>

There were no cases reporting VAED/VAERD as SAEs in the CT database through the DLP of 02 September 2021.

<u>Data from the safety database[b] (cut-off date 30 September 2021):</u>

Through the DLP 30 September 2021, there were 2 cases (reporting 6 potentially relevant events) indicative of VAED or VAERD in the safety database involving individuals 12 to 15 years of age.

Seriousness criteria for the 2 cases: Life threatening (1 also serious for hospitalization) and Hospitalization required (non-fatal/non-life threatening) (1).

Gender: Males (2);

Age (n=2): 12 years and 15 years (1 case each);

Overall event seriousness and outcome are summarized below:

<table>
<tr><th></th><th>Total Events
N = 6</th></tr>
<tr><td>Serious events</td><td>6</td></tr>
<tr><td>Events with Criterion of Hospitalization</td><td>6</td></tr>
<tr><td>Distribution of events by Outcome</td><td></td></tr>
<tr><td>Outcome: Death</td><td>0</td></tr>
<tr><td>Outcome: Resolved/Resolving</td><td>4</td></tr>
<tr><td>Outcome: Unknown/No data</td><td>2</td></tr>
</table>

The relevant PTs reported in these 2 cases were: Diarrhoea, Drug ineffective, Multisystem inflammatory syndrome in children, Seizure, Vaccination failure, and Vomiting (1 each).

Conclusion: VAED may present as severe or unusual clinical manifestations of COVID-19. In both cases, the subjects had confirmed COVID-19 following 2 doses of the vaccine. Upon review, these 2 cases unlikely represent VAED as the clinical course was not descriptive of an unusual clinical manifestation of COVID-19 infection.

In this review of subjects with COVID-19 following vaccination, based on the current evidence, VAED/VAERD remains a theoretical risk for the vaccine. Surveillance will continue.</td></tr>
<tr><td>Risk factors and risk groups</td><td>It is postulated that the potential risk may be increased in individuals producing lower neutralizing antibody titers or in those demonstrating waning immunity.[8,9]</td></tr>
<tr><td>Preventability</td><td>An effective vaccine against COVID-19 that produces high neutralizing titers and a T_H1 predominant $CD4^+$ T cell response and strong $CD8^+$ T cell response, is expected</td></tr>
</table>

Table 36. Vaccine-Associated Enhanced Disease (VAED), including Vaccine-Associated Enhanced Respiratory Disease (VAERD)

	to mitigate the risk of VAED/VAERD;[1,8] that immune profile is elicited by BNT162b2 in clinical and preclinical studies.[10,11]
Impact on the risk-benefit balance of the biologic product	If there were an unfavorable balance in COVID-19 cases, including severe cases, in the pivotal clinical study between the vaccine and placebo groups, that may signal VAED/VAERD.
Public health impact	The potential risk of VAED/VAERD could have a public health impact if large populations of individuals are affected.

a. Please note that CT dataset from the safety database includes only cases reporting SAEs.
b. Search criteria updated to include new PTs introduced in the MedDRA version 24.0. The updated search criteria is: PTs Vaccine associated enhanced disease OR Vaccine associated enhanced respiratory disease OR Standard Decreased Therapeutic Response Search AND at least 1 of the following PTs Dyspnoea; Tachypnoea; Hypoxia; COVID 19 pneumonia; Respiratory Failure; Acute Respiratory Distress Syndrome; Cardiac Failure; Cardiogenic shock; Acute myocardial infarction; Arrhythmia; Myocarditis; Vomiting; Diarrhoea; Abdominal pain; Jaundice; Acute hepatic failure; Deep vein thrombosis; Pulmonary embolism; Peripheral Ischaemia; Vasculitis; Shock; Acute kidney injury; Renal failure; Altered state of consciousness; Seizure; Encephalopathy; Meningitis; Cerebrovascular accident; Thrombocytopenia; Disseminated intravascular coagulation; Chillblains; Erythema multiforme; Multiple organ dysfunction syndrome; Multisystem inflammatory syndrome in children. Note: the "Standard Decreased Therapeutic Response" search includes the Lack of efficacy PTs (Drug ineffective/Vaccination failure).

2.1.2.c.2.2. Presentation of Missing Information

Table 37. Use in Pregnancy and Lactation

Evidence source:
The safety profile of the vaccine is not known in pregnant or lactating women due to their exclusion from the pivotal clinical study. There may be pregnant women who choose to be vaccinated despite the lack of safety data. It will be important to follow these women for pregnancy and birth outcomes. The timing of vaccination in a pregnant woman and the subsequent immune response may have varying favorable or unfavorable impacts on the embryo/fetus. The clinical consequences of SARS-CoV-2 infection to the woman and fetus during pregnancy is not yet fully understood and the pregnant woman's baseline health status may affect both the clinical course of her pregnancy and the severity of COVID-19 disease. These factors and the extent to which the pregnant woman may be at risk of exposure to SARS-CoV-2 will influence the benefit risk considerations for use of the vaccine.

Population in need of further characterization:
The lack of data is communicated in product labeling; one clinical study of the safety and immunogenicity of the BNT162b2 in pregnant and lactating women is ongoing (C4591015); 2 non-interventional studies (C4591009 and C4591011) are planned and 2 non-interventional studies (C4591021, and C4591022) are ongoing to assess use of BNT162b2 in pregnancy (see 3.1.3 – *Action plan for safety issues*).

Data from the Safety Database[a] (Cut-off date 18 June 2021)
Since the first temporary authorization for emergency supply under Regulation 174 in the UK (01 December 2020) and through 18 June 2021, there were 2636 cases (0.8 % of the total Post-authorization dataset) reporting use during pregnancy or lactation.

Overall event seriousness and outcome are summarized below:

Table 37. Use in Pregnancy and Lactation

	Total Events N = 6215 (%)
Serious events	2464 (39.6)
Events with Criterion of Hospitalization	314 (5.1)
Distribution of events by Outcome*	
Outcome: Death	61 (1)
Outcome: Resolved/Resolving	1657 (26.7)
Outcome: Not resolved	602 (9.7)
Outcome: Resolved with sequelae	65 (1)
Outcome: Unknown/No data	3864 (62.2)

* For the outcome count, the multiple Lowest Level Terms that code to the same PT within a case are counted and presented individually. Therefore, for selected PTs the total count of the event outcome may exceed the total number of events.

The most frequently reported relevant PTs (≥2%) were: Maternal exposure during pregnancy (867), Exposure via breast milk (791), Exposure during pregnancy (402), Off label use (296), Abortion spontaneous, Product use issue (277 each), Headache (184), Maternal exposure during breast feeding (161), Fatigue (155), Pyrexia (134), Pain in extremity (119), Vaccination site pain (91), Myalgia (79), Chills (75), Maternal exposure timing unspecified (73), Nausea, Pain (72 each), and Dizziness (56).

Participants 12 to 15 years of age

Data from the safety database: (Cut-off date 30 September 2021)

Through 30 September 2021, there was 1 case reporting use of BNT162b2 during pregnancy in the safety database. The serious case involved a 12-year-old female who received first dose of BNT162b2 during pregnancy (trimester of exposure unknown) and had miscarriage after 2 weeks of vaccine administration (PTs Maternal exposure during pregnancy, Fatigue, and Abortion spontaneous). Patient outcome was reported as recovered with sequelae. Through 30 September 2021, there were no cases reporting use of BNT162b2 during lactation.

a. Cumulative RMP tables on Missing information are provided as per previous FDA's request to include a cumulative analysis, from post-authorization experience, of the Important Missing Information identified in the Pharmacovigilance Plan.

Table 38. Vaccine Effectiveness

Evidence source:

Although vaccine efficacy in a controlled clinical study is the objective of the pivotal study, real-world vaccine effectiveness when the BNT162b2 is used in a large and more diverse population is unknown.

Anticipated risk/consequence of missing information:

Efficacy information obtained from clinical study data is communicated in the product labeling. Four post-authorization effectiveness studies in real-world use are ongoing: 1 interventional study (BNT162-01 cohort 13), 1 non-interventional study (C4591014) and 2 low-interventional studies (WI235284 and WI255886) to determine the effectiveness of BNT162b2 when administered outside of the clinical setting (see 3.1.3 – *Action plan for safety issues*).

Data from the Safety Database[a] (Cut-off date: 18 June 2021)

Since the first temporary authorization for emergency supply under Regulation 174 in the UK (01 December 2020) and through 18 June 2021, there were 6373 cases (1.9% of the total Post-authorization dataset) reporting lack of efficacy.

Overall event seriousness and outcome are summarized below:

	Total Events N = 6373 (%)
Serious events	6373 (100)*
Events with Criterion of Hospitalization	616 (9.7)
Distribution of events by Outcome	
Outcome: Death	334 (5.2)
Outcome: Resolved/Resolving	1253 (19.7)
Outcome: Not resolved	721 (11.3)
Outcome: Resolved with sequelae	21 (0.3)
Outcome: Unknown/No data	4044 (63.5)

*Includes 26 cases where LOE was captured as non-serious and upgraded to serious after the DLP.

The PT Drug ineffective was reported in 4765 cases, Vaccination failure was reported in 1608 cases; the most frequently co-reported PTs (≥2%) were: COVID-19 (5022), Asymptomatic COVID-19 (502), Pyrexia (412), Suspected COVID-19 (379), SARS-CoV-2 test positive (359), Headache (327), Fatigue (262), Cough (227), Dyspnoea (180), COVID-19 pneumonia (179), Myalgia (162), Asthenia (156), Malaise (152), and Chills (133).

Participants 12 to 15 years of age

Data from the safety database: (Cut-off date 30 September 2021)

Through 30 September 2021, there were 29 cases retrieved reporting lack of efficacy. Upon review, 1 case was not considered to be true lack of efficacy because the subject developed SARS-CoV-2 infection during the early days from the first dose (days 1-13); the development of a vaccine preventable disease during this time is not considered a lack of effect of the vaccine. Therefore, there were 28 relevant cases reporting lack of efficacy in individuals 12 to 15 years of age; overall event seriousness and outcome are summarized below:

Table 38. Vaccine Effectiveness

	Total Events N = 28 (%)
Serious events	28 (100)
Events with Criterion of Hospitalization	2 (7.1)
Distribution of events by Outcome	
Outcome: Death	0
Outcome: Resolved/Resolving	4 (14.3)
Outcome: Not resolved	1 (3.6)
Outcome: Unknown/No data	23 (82.1)

The PTs Drug ineffective and Vaccination failure were reported in 19 and 9 cases, respectively; the co-reported events reported more than once were coded to the PTs: COVID-19 (24), Pyrexia (5), Headache (4), Suspected COVID-19 (3), and Fatigue (2).

a. Cumulative RMP tables on Missing information are provided as per previous FDA's request to include a cumulative analysis, from post-authorization experience, of the Important Missing Information identified in the Pharmacovigilance Plan.

Table 39. Use in Paediatric Individuals <5 Years of Age§

Evidence source:
Paediatric individuals may display different reactogenicity and safety profiles compared to adults, due to lower body mass and differently matured immunological responses.

Population in need of further characterization:
The are no data in individuals less than 5 years of age; in the pediatric population:

- 3 clinical studies [C4591001 (≥12 to ≤15 years of age), C4591007 (<12 years of age) and C4591007 substudy - Troponin group (5 to <12 years of age and 12 to <16 years of age) are ongoing;
- 1 clinical study [C4591023 (<6 months; ≥5 to <12 years of age) is planned;
- 2 non-interventional studies [C4591009 (< 12 years of age) and C4591038 (former C4591021 substudy) (<12 years of age)] are planned;
- 1 low interventional study is planned [C4591036 (<21 years of age, including <12 years of age)]

For details on these studies, see 3.1.3 – *Action plan for safety issues*.

Data from the Safety Database[a] (cut-off date 30 September 2021)
Since the first temporary authorization for emergency supply under Regulation 174 in the UK (01 December 2020) and through 30 September 2021, there were 56 cases[b] (0.01% of the total Post-authorization dataset) involving individuals below 5 years of age.
Overall event seriousness and outcome are summarized below:

	Total Events N = 172 (%)
Serious events	30 (17.4)
Events with Criterion of Hospitalization	3 (1.7)
Distribution of events by Outcome	
Outcome: Death	2 (1.2)
Outcome: Resolved/Resolving	61 (35.5)
Outcome: Not resolved	46 (26.7)
Outcome: Resolved with sequelae	0
Outcome: Unknown/No data	63 (36.6)

The most frequently reported PTs (>3 occurrences) were: Product administered to patient of inappropriate age (21), Off label use (17), Product use issue (15), Pyrexia (11), Fatigue, Headache, Myalgia, and Nausea (4 each).

§ Missing information has been reworded to reflect the current state.
a. Cumulative RMP tables on Missing information are provided as per previous FDA's request to include a cumulative analysis, from post-authorization experience, of the Important Missing Information identified in the Pharmacovigilance Plan.
b. Please note that at the DLP of 18 June 2021 there were 29 additional pediatric cases under 5 years of age; at the DLP of 30 September 2021, follow-up information was received for these cases and they were identified to refer to adult subjects, rather than to pediatric subjects under 5 years of age.

2.1.2.d. Identified and Potential Interactions, Including Food-Biologic Product and Drug-Biologic Product Interactions

As noted in the WHO Guidelines on Nonclinical Evaluation of Vaccines,[3] pharmacokinetics testing is not required for final formulation. No interaction linked to metabolism is expected with vaccines. The only potential for interaction is with other vaccines administered concomitantly and with immunosuppressive drugs.

Co-administration studies with BNT162b2 have not been done, therefore there is not sufficient data to understand the effect on vaccine effectiveness of BNT162b2 or co-administered vaccines. A co-administration study with seasonal influenza vaccine is planned. If BNT162b2 is given at the same time as other injectable vaccine(s), the vaccine(s) should be administered at different injection sites.

2.1.2.e. Epidemiology of Indication and Target Population

Indication

Active immunization to prevent COVID-19 caused by SARS-CoV-2 virus, in individuals 12 years and older.

Incidence:

The COVID-19 is caused by a novel coronavirus labeled as SARS-CoV-2. The disease first emerged in December 2019, when a cluster of patients with pneumonia of unknown cause was recognized in Wuhan City, Hubei Province, China.[12] The number of infected cases rapidly increased and spread beyond China throughout the world. On 30 January 2020, the WHO declared COVID-19 a Public Health Emergency of International Concern and thus a pandemic.[13]

Estimates of SARS-CoV-2 incidence change rapidly. The MAH obtained incidence and prevalence estimates using data from Worldometer, a trusted independent organization that collects COVID-19 data from official reports and publishes current global and country-specific statistics online.[14]

As of 15 August 2021, the overall number of people who had been infected with SARS-CoV-2 was over 207 million worldwide,[15] an increase of 92 million in the 5 months since 03 March 2021.[16] Table 40 shows the incidence and prevalence as of 15 August 2021 for the US, UK, and EU-27 countries. In the EU and the UK, by 15 August 2021 the total number of confirmed cases had accumulated to 41 million people, or 8,074 per 100,000 people (from 27 million, or 5,226 per 100,000 by 03 March 2021). Across countries in the EU, the number of confirmed cases ranged from 2,118 to 15,620 cases per 100,000 people. Finland and Germany reported the lowest incidence rates while Czech Republic, Slovenia, and Luxembourg reported the highest. [15]

In the US, the number of confirmed cases had reached over 37 million cases (11,236 per 100,000 people) by 15 August 2021. [15] This is an increase from 29 million (8,864 per 100,000) by 03 March 2021. [16]

Table 40. Incidence, Prevalence, and Mortality of COVID-19 as of 15 August 2021[15]

	Total Cases	Incidence: Total Cases/ 100,000	Active Cases	Prevalence: Active Cases/ 100,000	Total Deaths	Mortality: Deaths / 100,000	Population
Global	207,731,370	2,665	17,141,537	220	4,371,692	56	7,794,798,124
EU-27	35,243,565	7,910	2,000,178	449	747,450	168	445,541,383
UK	6,241,011	9,140	1,313,343	1,923	130,894	192	68,284,715
EU-27 + UK	41,484,576	8,074	3,313,521	645	878,344	171	513,826,098
US	37,435,835	11,236	6,653,787	1,997	637,439	191	333,172,543
EU-27 Countries							
Austria	668,732	7,378	8,559	94	10,756	119	9,063,848
Belgium	1,149,869	9,873	52,835	454	25,287	217	11,646,025
Bulgaria	432,962	6,284	14,645	213	18,339	266	6,889,852
Croatia	367,022	9,002	1,903	47	8,283	203	4,076,913
Cyprus	108,707	8,931	17,496	1,437	456	38	1,217,182
Czech Republic	1,676,222	15,620	2,441	23	30,373	283	10,731,206
Denmark	330,777	5,688	12,854	221	2,560	44	5,815,014
Estonia	136,992	10,319	5,131	387	1,279	96	1,327,533
Finland	117,531	2,118	70,536	1,271	995	18	5,550,349
France	6,449,863	9,857	455,926	697	112,612	172	65,435,079
Germany	3,825,039	4,549	53,169	63	92,370	110	84,083,573
Greece	535,237	5,163	37,611	363	13,174	127	10,366,043
Hungary	810,316	8,412	14,326	149	30,038	312	9,632,892
Ireland	322,989	6,461	42,205	844	5,059	101	4,999,386
Italy	4,435,008	7,347	126,466	210	128,413	213	60,362,319
Latvia	140,122	7,522	1,218	65	2,561	138	1,862,827
Lithuania	289,810	10,815	12,355	461	4,451	166	2,679,705
Luxembourg	74,595	11,704	705	111	828	130	637,340
Malta	35,337	7,979	1,043	236	430	97	442,858
Netherlands	1,901,900	11,072	124,498	725	17,909	104	17,177,282
Poland	2,885,333	7,633	154,721	409	75,299	199	37,800,220
Portugal	1,003,335	9,872	45,367	446	17,562	173	10,163,426
Romania	1,087,223	5,694	2,982	16	34,348	180	19,093,951
Slovakia	393,529	7,204	825	15	12,544	230	5,462,601
Slovenia	261,428	12,573	2,150	103	4,433	213	2,079,258
Spain	4,693,540	10,034	722,353	1,544	82,470	176	46,775,041

Table 40. Incidence, Prevalence, and Mortality of COVID-19 as of 15 August 2021[15]

	Total Cases	Incidence: Total Cases/ 100,000	Active Cases	Prevalence: Active Cases/ 100,000	Total Deaths	Mortality: Deaths / 100,000	Population
Sweden	1,110,147	10,916	15,858	156	14,621	144	10,169,660

The reported numbers refer to cases that have been tested and confirmed to be carrying the virus and sometimes, depending upon the country, also presumptive, suspect, or probable cases of detected infection. There are large geographic variations in the proportion of the population tested as well as in the quality of reporting across countries. People who carry the virus but remain asymptomatic are less likely to be tested and therefore mild cases are likely underreported. The numbers should therefore be interpreted with caution. [17]

Prevalence:

The prevalence of SARS-CoV-2 infection is defined as active cases per 100,000 people including confirmed cases in people who have not recovered or died. On 15 August 2021, the overall prevalence estimates for the EU and UK were 449 and 1,923 active cases per 100,000, respectively[15] compared to approximately 1,500 per 100,000 for both the EU and UK on 03 March 2021.[16] The range of reported prevalence was 15 to 1,544 per 100,000: Slovakia, Romania, and Czech Republic reported the lowest prevalence while Spain, Cyprus, and Finland reported the highest (Table 40).

In the US, the prevalence on 15 August 2021 was similar to the UK, with 1,997 active cases per 100,000.[15] This is a decrease of approximately 700 per 100,000 since 03 March 2021, when the prevalence was 2,685 per 100,000.[16]

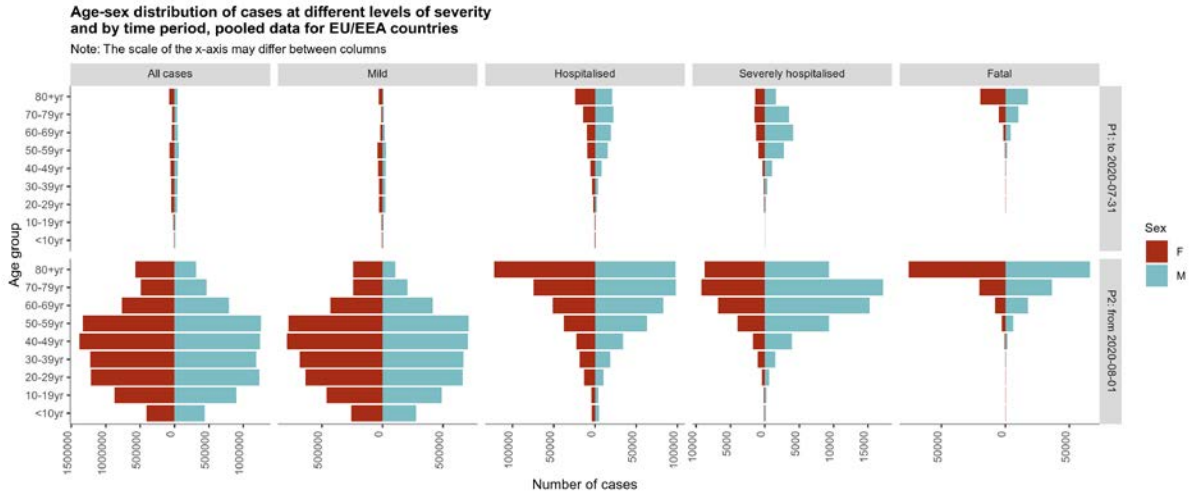
Demographics of the population in the proposed indication and risk factors for the disease:

Since the beginning of the pandemic, the ECDC has continuously collected COVID-19 information from all countries who are members of the EU/EEA. In the ECDC's TESSy database, COVID-19 case-based data, including age and gender, are available for over 80% of the official number of cases reported by ECDC epidemic intelligence,[18] enabling estimates of age and gender distribution representative of the European population. TESSy data on age and sex distributions by severity of symptoms as posted on 12 August 2021 are shown in Figure 1.[19]

The top half of the figure represents data ending on 31 July 2020 and the bottom half presents data from 01 August 2020 to 08 August 2021 (Figure 1). In general, the age-sex patterns before 01 August 2020 have remained the same since then. The gender distribution of persons testing positive for SARS-CoV-2 in the European population is similar for most age groups. Cases reported in TESSy have been older than the general population throughout the pandemic, with few cases observed in people aged younger than 20 years.

This likely reflects the age distribution of people who met the requirements for being tested and is unlikely to reflect the actual distribution of infections in the population. Those with severe outcomes (hospitalized, severely hospitalized [admitted to intensive care and/or required respiratory support], or fatal) have been disproportionately older and male compared to COVID-19 cases overall. While age-sex patterns have remained consistent throughout the pandemic, a notable difference between the periods before and since 01 August 2020 is that the absolute numbers of cases have increased dramatically in the latter period compared to the earlier one.

Figure 1. Age-Sex distribution of COVID-19 Cases as Different Levels of Severity, Pooled Data for EU/EEA Countries. Case-based Data from TESSy produced on 12 August 2021[a]



Note: "mild" = a case that has not been reported as hospitalized or a case that resulted in death.

a. Data from ECDC. COVID-19 Surveillance report. Week 31, 2021. 12 August 2021. "2.2 Age-sex pyramids" Accessed 15 August 2021[19]

US distributions of COVID cases and deaths by age, sex, and race, as well as the cross-tabulation of age and sex, are shown in Table 41 as of 14 August 2021.[20] At that time, the CDC reported that the US had recorded a total of 36,556,516 cases of COVID and 618,591 deaths attributable to the disease. However, because demographic data were not available for all US COVID cases and deaths, the numbers in Table 41 and Table 42 are drawn, respectively, from 29,346,352 cases and 513,204 deaths. Those under age 50 account for roughly 67% of cases but approximately 5% of deaths. For ages 18-74, males account for less than half of cases but over 60% of deaths. Among the pediatric population, there is close to a 50-50 case distribution between males and females across ages 0-17. However, the pediatric mortality distribution is highly irregular between the sexes, with males being 51.5% of COVID deaths among 0-4 year olds, 55.9% among 5-11 year olds, 46.7% among 12-15 year olds, and 68.7% among 16-17 year olds.

Table 41. Distribution of Cases (n=29,346,352) by Age, Sex, Race, and Cross-Tabulated Age and Sex -- United States as of 14 August 2021[a] [20]

Event	Age Group	Age %	Sex	Sex %	Race[b]	Race %	Age Group	Males %	Females %
Cases	**0-4**	2.2	**Males**	47.7	**H/L**	28.3	**0-4**	51.7	48.3
	5-11	4.2	**Females**	52.3	**AI/AN**	1	**5-11**	50.8	49.1
	12-15	3.8			**Asian**	3.2	**12-15**	49.6	50.4
	16-17	2.6			**Black**	11.6	**16-17**	48.3	51.7
	18-29	22.7			**NH/PI**	0.3	**18-29**	46.9	53.1
	30-39	16.6			**White**	50.3	**30-39**	47.9	52.1
	40-49	14.8			**M/O**	5.3	**40-49**	47.7	52.3
	50-64	20					**50-64**	48.6	51.4
	65-74	7.3					**65-74**	48.7	51.3
	75-84	3.7					**75-84**	45.7	54.3
	85+	2.1					**85+**	34.4	65.6

a. Percentage of missing demographic data varied by types of event and demographic.
b. Except for Hispanics/Latinos, all categories refer to non-Hispanics
Abbreviations: AI/AN=American Indian/Alaska Native, H/L=Hispanic/Latino, M/O=Multiple/Other, NH/PI=Native Hawaiian/Other Pacific Islander

Table 42. Distribution of Deaths (n=513,204) by Age, Sex, Race, and Cross-Tabulated Age and Sex -- United States as of 14 August 2021[a] [20]

Event	Age Group	Age %	Sex	Sex %	Race[b]	Race %	Age Group	Males %	Females %
Deaths	**0-4**	<0.1	**Males**	54.2	**H/L**	18.5	**0-4**	51.5	48.5
	5-11	<0.1	**Females**	45.8	**AI/AN**	1.2	**5-11**	55.9	44.1
	12-15	<0.1			**Asian**	3.8	**12-15**	46.7	53.3
	16-17	<0.1			**Black**	13.8	**16-17**	68.7	31.3
	18-29	0.6			**NH/PI**	0.2	**18-29**	64	36
	30-39	1.3			**White**	58.7	**30-39**	65.1	34.9
	40-49	3.1			**M/O**	3.8	**40-49**	65.3	34.7
	50-64	15.4					**50-64**	64	36
	65-74	21.6					**65-74**	60.6	39.4
	75-84	27.3					**75-84**	55.5	44.5
	85+	30.7					**85+**	41.8	58.2

a. Percentage of missing demographic data varied by types of event and demographic.
b. Except for Hispanics/Latinos, all categories refer to non-Hispanics
Abbreviations: AI/AN=American Indian/Alaska Native, H/L=Hispanic/Latino, M/O=Multiple/Other, NH/PI=Native Hawaiian/Other Pacific Islander

In general, disease has been much less severe among ages 0-24 compared to ages ≥25 years, with 2.5% hospitalized, 0.8% admitted to an intensive care unit, and <0.1% dying among ages 0-24, versus 16.6% hospitalized, 8.6% intensive care, and 5% dying among ages ≥25 years.[21] Among hospitalized cases with COVID-19 in the US, approximately 90% are over 40 years old, and between 58% to 66% are at least 60 years old.[22] The majority (approximately 60%) of COVID-19 patients admitted to hospitals in the US have been male.[22,23,24,25,26]

African American COVID-19 patients have been reported to have an increased risk of hospitalization[23,27] and mortality,[28] compared to white patients in the United States. A CDC report examined demographic trends among US COVID-19 deaths from May to August of 2020.[29] During the observation period, the percentage of US COVID-19 deaths that were Hispanic increased from 16.3% in May to 26.4% in August, the only racial or ethnic group among whom the percentage of deaths increased during that time. In terms of setting, 64.3% of deaths occurred in inpatient hospitals and 21.5% in nursing homes or long-term care facilities.

The most recent CDC estimate of the total number of excess deaths (as opposed to overall deaths in the preceding paragraph) across the US from 26 January 2020 to 27 February 2021 from all causes (COVID-19 and otherwise) ranged from 545,600-660,200, with an estimated 75-88% of excess deaths being associated with COVID-19.[30] An earlier CDC report on excess deaths covering 26 January 2020 through 3 October 2020 broke down excess deaths by demographics[30]: by age during that period, the largest increase in deaths compared to average expected deaths occurred among adults aged 25-44 (26.5% increase). By race, increases in deaths compared to expectation were largest among Hispanics (53.6% increase), Asian Americans (36.6% increase), African Americans (32.9% increase), and Native Americans and Native Alaskans (28.9% increase), all compared to an excess 11.9% deaths among non-Hispanic whites.

While research earlier in the pandemic tended to focus on adults, more recent data have given greater attention to children and adolescents. For the period January 1-March 31 2021 across 14 states (the most recently available data), the CDC's COVID-NET database recorded 204 adolescents aged 12-17 who were hospitalized for likely primarily COVID-19-related reasons.[31] The 204 adolescents were 47.5% male—consistent with the COVID case sex distribution across all ages—and disproportionately from minorities, with 31.4% Hispanic and 35.8% non-Hispanic African Americans.[31]

Another recent CDC report described demographic trends in US COVID-19 incidence among 15,068 cases aged 0-24 years across 16 jurisdictions during the period 01 January 2020 through 31 December 2020.[32] The report broke down incidence by age groups and 2020 sub-periods that are presented in Table 43. The table shows that early in 2020, 5-9 year olds were experiencing less COVID-19 than 0-4 year olds, but by the end of the year this pattern had reversed. Compared to 5-9 year olds, the age categories 10-14, 15-19, and 20-24 years old showed progressively greater incidence rates, a pattern that held throughout 2020.

Table 43. COVID-19 incidence and rate ratios, by age group among persons aged <25 years across three periods of 2020 in 16 U.S. jurisdictions[32]

2020 Sub-Period	Age Group (years)	Number of Cases	Cases per 100,000 population (95% CI)	Rate Ratio (95% CI)
Jan 1-Apr 30	0-4	956	21 (20-23)	1.28 (1.17-1.41)
	5-9	772	17 (16-18)	Reference[a]
	10-14	1,184	25 (23-26)	1.49 (1.36-1.63)
	15-19	3,267	67 (65-70)	4.03 (3.72-4.36)
	20-24	8,889	175 (171-178)	10.47 (9.72-11.26)
May 1-Aug 31	0-4	14,017	314 (309-319)	1.01 (0.98–1.03)
	5-9	14,406	312 (307-317)	Reference[a]
	10-14	20,490	430 (424-436)	1.38 (1.35–1.41)
	15-19	50,210	1,034 (1,025-1,043)	3.32 (3.26–3.38)
	20-24	78,655	1,547 (1,536-1,557)	4.96 (4.88–5.05)
Sep 1-Dec 31	0-4	33,595	752 (744–760)	0.71 (0.70–0.72)
	5-9	48,824	1,056 (1,047–1,066)	Reference[a]
	10-14	76,922	1,615 (1,604–1,627)	1.53 (1.51–1.55)
	15-19	149,660	3,083 (3,067–3,098)	2.92 (2.89–2.95)
	20-24	187,825	3,693 (3,677–3,710)	3.50 (3.46–3.53)

a. Reference to imply that incidence rate in 5-9 year-old age group is used as comparison to calculate rate ratios for other age groups

Other US pediatric data are generally consistent with the CDC findings. Table 44 summarizes demographic results for a retrospective cohort of 135,794 individuals under the age of 25 who were tested for COVID-19 by 08 September 2020 within the PEDSnet network of US pediatric health systems.[33] The Table 44 shows that, among the pediatric population, children age 12-17 were more frequently infected than those under age 12. African Americans and Hispanics had elevated frequencies of testing positive relative to their proportion of the cohort.

A study of 1,945,831 individuals aged 0-18 recorded in the Premier Healthcare Database between March and October 2020 included 20,714 pediatric cases of COVID-19; the authors reported similar patterns to what is shown in Table 43, with the additional observation that

COVID-19 cases aged 0-1 and 12-18 years were more likely to develop serious illness than those aged 2-11.[34]

Table 44. Demographics of 135,794 US individuals under age 25 tested for COVID-19 by 08 September 2020[33]

Characteristic	Patients, n (%)		
	COVID-19 negative (n=130,420)	COVID-19 positive, Asymptomatic or mild illness (n=5,015)	COVID-19 positive, Severe illness (n=359)
Age, years			
<1	17,431 (13)	494 (10)	72 (20)
1-4	32,619 (25)	808 (16)	40 (11)
5-11	35,617 (27)	1,029 (21)	72 (20)
12-17	32,362 (25)	1,521 (30)	117 (33)
18-24	12,391 (10)	1,163 (23)	58 (16)
Sex			
Female	61,637 (47)	2,527 (50)	172 (48)
Male	68,701 (53)	2,485 (50)	187 (52)
Other or Unknown	82 (0.06)	3 (0.06)	0
Race/ethnicity			
Hispanic	14,156 (11)	918 (18)	108 (30)
API	4,471 (3)	151 (3)	9 (3)
Black or AA	18,646 (14)	1,424 (28)	119 (33)
White	77,540 (60)	1,988 (40)	97 (27)
Multiple	3,883 (3)	126 (3)	5 (1)
Other or Unknown	11,724 (9)	408 (8)	21 (6)

AA=African American, API=Asian or Pacific Islander

Risk Factors

While anyone can become infected with SARS-CoV-2, COVID-19 disease can range from very mild (or no symptoms) to severe or fatal. A person's risk of initial infection increases through spending time in close physical proximity to others, especially in indoor spaces with poor ventilation.[35] People living in long-term care facilities or high-density apartment homes, or working in occupations with close proximity to others (e.g. healthcare, transportation), have a higher risk of infection.[35,36] Among children, the primary source of infection is an infected adult living in the same household.[37] According to the CDC, some ethnic minority groups have a higher risk of infection, but age is not associated with risk of initial infection among people aged 5 and older (Table 45).[38, 39]

Table 45. Risk for COVID-19 infection, Hospitalisation, and Death by Age Group and by Race/Ethnicity[39]

Age Group (years)	Rate ratios[a]		
	Cases[c]	Hospitalisation[d]	Death[e]
0-4	<1	<1	<1
5-17	1	<1	<1
18-29[b]	1	1	1
30-39	1	2	4
40-49	1	2	10
50-64	1	4	35
65-74	1	6	95
75-84	1	9	230
85+	1	15	600
Race/Ethnicity			
Non-Hispanic White[f]	1	1	1
American Indian or Alaska Native, non-Hispanic	1.7	3.4	2.4
Asian, non-Hispanic	0.7	1.0	1.0
Black or African American, non-Hispanic	1.1	2.8	2.0
Hispanic or Latino	1.9	2.8	2.3

a. Rates are expressed as whole numbers, with values less than 10 rounded to the nearest integer, two-digit numbers rounded to nearest multiple of five, and numbers greater than 100 rounded to two significant digits.
b. Rate ratios for each age group are relative to the 18-29-year age category. This group was selected as the reference group because it has accounted for the largest cumulative number of COVID-19 cases compared to other age groups.
c. Includes all cases reported by state and territorial jurisdictions (accessed on July 12, 2021). The denominators used to calculate rates were based on the 2019 Vintage population (https://www.census.gov/newsroom/press-releases/2019/popest-nation html).
d. Includes all hospitalizations reported through COVID-NET (from March 1, 2020 through July 3, 2021, accessed on July 12, 2021). Rates were standardized to the 2020 US standard COVID-NET catchment population (https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covid-net/purpose-methods.html).
e. Includes all deaths in National Center for Health Statistics (NCHS) provisional death counts (accessed on July 12, 2021). The denominators used to calculate rates were based on the 2019 Vintage population (https://data.cdc.gov/NCHS/Provisional-COVID-19-Deaths-by-Sex-and-Age/9bhg-hcku).
f. Rate ratios for each race/ethnicity group are relative to the Non-Hispanic White category.

Risk for severe or fatal COVID-19 disease has been shown to increase with older age, male sex, or ethnic minority status. [38,39, 40 41, 42,43] Children aged 5-17 typically experience a milder disease course and have lower risk of hospitalization or death.[38,44,45] Among adults, these risks increase for every 10-year age group above age 39 (Table 42).[38, 46] Table 45 also gives estimated rate ratios for COVID-19 hospitalisation and death by race/ethnicity relative to white, non-Hispanic persons in the US. The highest risks of hospitalisation and death were observed among American Indian or Alaska native persons (RR = 3.4 for hospitalisation and 2.4 for death) and Hispanic or Latino persons (RR = 2.8 for hospitalisation and 2.3 for death). These differences in risk among ethnic groups may be attributed to differences in underlying factors that are correlated with race/ethnicity including socioeconomic status, access to health care, and occupation-related virus exposure.[39]

Risk of severe or fatal COVID-19 disease is higher among persons who are current or former smokers, have lower socioeconomic status, have no or public insurance, or live in neighborhoods with higher rates of limited English proficiency.[40,42,46] The CDC has also recognized other socio-demographic groups who may need to take extra precautions against COVID-19 due to increased risk for severe illness: pregnant women; breastfeeding mothers; people with disabilities; people with developmental, behavioural, or substance abuse disorders; and newly resettled refugee populations.[47]

Among adults, risk for severe or fatal COVID-19 disease increases with the presence of chronic medical conditions, including obesity, chronic lung diseases (e.g., COPD or asthma), cardiovascular disease, diabetes, cancer, liver disease, neurological diseases (e.g., stroke or dementia), chronic kidney disease, sickle cell disease, immunosuppression, HIV, higher scores on the WHO Clinical Progression Scale and Charlson Comorbidity Index.[41, 46, 48, 40, 42]. Table 46 shows the estimated hazard ratios of COVID-19 mortality associated with these chronic conditions and socio-demographics from a cohort study of 17 million adults (with 17,000 COVID-19-related deaths) in England.[46]

The presence of one or more underlying medical conditions also increases risk of severe or fatal disease among children aged 5-17.[49,50,51, 52] In particular, childhood obesity has been consistently associated with two to three times the risk of severe disease or hospitalization.[49, 52, 53, 54,]. For many other individual comorbid conditions, pediatric sample sizes are very small and different studies produce conflicting results, so it is difficult to estimate precise risk ratios based on current literature.[37, 51]

Table 46. Hazard Ratios and 95% Confidence Intervals for COVID-19-related Death[46]

Characteristic	Category	COVID-19 death Hazard Ratio	
		Adjusted for age, sex, and NHS administrative region	Fully adjusted
Age	18-39	0.05 (0.04-0.06)	0.06 (0.04-0.07)
	40-49	0.32 (0.28-0.38)	0.34 (0.29-0.39)
	50-59	1.00 (ref)	1.00 (ref)
	60-69	2.93 (2.69-3.20)	2.57 (2.35-2.80)
	70-79	9.17 (8.48-9.93)	6.74 (6.21-7.31)
	80+	43.16 (40.03-46.53)	24.10 (22.23-26.13)
Sex	Female	1.00 (ref)	1.00 (ref)
	Male	1.73 (1.68-1.78)	1.55 (1.50-1.60)
BMI (kg/m^2)	Not obese	1.00 (ref)	1.00 (ref)
	30-34.9 (obese class I)	1.23 (1.18-1.28)	1.07 (1.03-1.12)
	35-39.9 (obese class II)	1.79 (1.68-1.90)	1.44 (1.36-1.54)
	40+ (obese class III)	2.76 (2.54-3.00)	2.11 (1.93-2.29)
Smoking	Never	1.00 (ref)	1.00 (ref)
	Former	1.44 (1.40-1.49)	1.26 (1.22-1.30)
	Current	1.17 (1.10-1.25)	0.97 (0.91-1.04)
Ethnicity	White	1.00 (ref)	1.00 (ref)
	Mixed	1.59 (1.28-1.97)	1.43 (1.15-1.78)
	South Asian	1.97 (1.82-2.14)	1.70 (1.55-1.85)
	Black	1.82 (1.61-2.05)	1.44 (1.27-1.63)

Table 46. Hazard Ratios and 95% Confidence Intervals for COVID-19-related Death[46]

Characteristic	Category	COVID-19 death Hazard Ratio	
		Adjusted for age, sex, and NHS administrative region	Fully adjusted
	Other	1.38 (1.17-1.63)	1.38 (1.16-1.63)
IMD quintile[a]	1 (least deprived)	1.00 (ref)	1.00 (ref)
	2	1.17 (1.11-1.23)	1.13 (1.07-1.19)
	3	1.37 (1.30-1.44)	1.25 (1.19-1.32)
	4	1.77 (1.68-1.86)	1.53 (1.46-1.61)
	5 (most deprived)	2.11 (2.01-2.22)	1.71 (1.62-1.80)
Blood pressure	Normal	1.00 (ref)	1.00 (ref)
	High BP or diagnosed hypertension	1.09 (1.06-1.13)	0.90 (0.87-0.94)
Respiratory disease excluding asthma		1.95 (1.86–2.04)	1.66 (1.59-1.73)
Asthma (vs. none)	With no recent OCS use	1.15 (1.10-1.21)	1.00 (0.95-1.05)
	With recent OCS use	1.61 (1.47-1.75)	1.15 (1.05-1.26)
Chronic heart disease		1.57 (1.51–1.64)	
Diabetes[b] (vs. none)	With HbA1c < 58 mmol/mol	1.53 (1.47-1.59)	1.20 (1.16-1.25)
	With HbA1c ≥ 58 mmol/mol	2.57 (2.45-2.70)	1.83 (1.74-1.93)
	With no recent HbA1c measure	2.19 (2.02-2.37)	1.71 (1.58-1.86)
Cancer (non-hematological, vs. none)	Diagnosed <1 year ago	1.47 (1.31-1.65)	1.44 (1.28-1.62)
	Diagnosed 1-4.9 years ago	1.13 (1.04-1.22)	1.11 (1.03-1.20)
	Diagnosed ≥ 5 years ago	0.99 (0.95-1.04)	2.41 (1.86-3.13)
Hematological malignancy (vs. none)	Diagnosed <1 year ago	2.54 (1.96-3.29)	2.80 (2.08–3.78)
	Diagnosed 1-4.9 years ago	2.28 (1.95-2.66)	2.25 (1.92-2.62)
	Diagnosed ≥ 5 years ago	1.71 (1.51-1.93)	1.65 (1.46-1.87)
Reduced kidney function[c] (vs. none)	eGFR 30-60	1.50 (1.45-1.55)	1.30 (1.25-1.35)
	eGFR 15-<30	2.74 (2.56-2.93)	2.52 (2.33–2.72)
	eGFR <15 or dialysis	6.40 (5.75-7.12)	4.42 (3.93-4.98)
Liver disease		2.27 (2.01-2.57)	1.75 (1.54-1.98)
Dementia		4.59 (4.33-4.87)	3.62 (3.41-3.84)
Stroke		2.03 (1.95-2.12)	1.53 (1.46-1.59)
Other neurological disease		3.15 (2.96-3.36)	2.72 (2.55-2.90)
Organ transplant		5.54 (4.51-6.81)	1.61 (1.28-2.02)
Asplenia		1.50 (1.16-1.95)	1.26 (0.97-1.64)
Rheumatoid arthritis, lupus, or psoriasis		1.30 (1.21–1.38)	1.23 (1.17-1.30)
Other immunosuppressive condition		2.75 (2.10–3.62)	2.00 (1.57-2.54)

a. Classification by HbA1c is based on the most recent measurement within 15 months of baseline.
b. eGFR is measured in mL min^{-1} per 1.73 m^2 and derived from the most recent serum creatinine measurement.
c. Index of Multiple Deprivation (derived from the patient's postcode)
Models were adjusted for age using a four-knot cubic spline for age, except for estimation of age-group hazard ratios.
Ref, reference group; 95% CI, 95% confidence interval.

The main existing treatment options:

Through 30 September 2021, other COVID-19 vaccines were authorized and recommended for use in the United States including vaccines from Moderna (NCT04470427), and Johnson & Johnson/Janssen (NCT04505722). Others may subsequently be approved.

Natural history of the indicated condition in the untreated population, including mortality and morbidity:

Symptoms of COVID-19

The clinical manifestations of COVID-19 vary widely, from asymptomatic infection in 17-45% across age groups, [55, 56 57, 58] to critical illness and death. The rate of asymptomatic infection decreases with increasing age and long-term care facilities are associated with a lower rate of asymptomatic infection when compared to household transmission or other healthcare facilities.[58] A recent meta-analysis has estimated that 46.7% of infections in children are asymptomatic.[58] The most common symptoms of COVID-19 are fever, cough, and shortness of breath for both children and adults (Table 47).[59, 60] .

Table 47. Signs and symptoms among 291 pediatric (age <18 years) and 10,944 adult (age 18–64 years) patients[a] with laboratory confirmed COVID-19 — United States, 12 February– 2April 2020 [59]

	No. (%) with sign/symptom	
Sign/Symptom	**Pediatric**	**Adult**
Fever, cough, or shortness of breath[b]	213 (73)	10,167 (93)
Fever[d]	163 (56)	7,794 (71)
Cough	158 (54)	8,775 (80)
Shortness of breath	39 (13)	4,674 (43)
Myalgia	66 (23)	6,713 (61)
Runny nose[c]	21 (7.2)	757 (6.9)
Sore throat	71 (24)	3,795 (35)
Headache	81 (28)	6,335 (58)
Nausea/Vomiting	31 (11)	1,746 (16)
Abdominal pain[c]	17 (5.8)	1,329 (12)
Diarrhea	37 (13)	3,353 (31)

a. Cases were included in the denominator if they had a known symptom status for fever, cough, shortness of breath, nausea/vomiting, and diarrhea. Total number of patients by age group: <18 years (N = 2,572), 18–64 years (N = 113,985).
b. Includes all cases with one or more of these symptoms.
c. Runny nose and abdominal pain were less frequently completed than other symptoms; therefore, percentages with these symptoms are likely underestimates.
d. Patients were included if they had information for either measured or subjective fever variables and were considered to have a fever if "yes" was indicated for either variable.

Progression and Timeline of Mild to Moderate Disease

Mild to moderate disease is defined as the absence of viral pneumonia and hypoxia. For those who develop symptoms, the incubation period is usually 4 to 5 days, with 97.5% experiencing symptoms within 11 days of exposure.[61,62] Those with mild COVID-19 recover

at home with supportive care and guidance to self-isolate. Those with moderate disease are monitored at home and are sometimes recommended to be hospitalized if conditions worsen. [62] Data on rates of re-infection are limited but variants that are not neutralized by immune antisera, such as the recent beta (South African) variant, may lead to increased risk of re-infection in the future. [61]

Progression and Timeline of Severe Disease Requiring Hospitalization

Those with severe disease will require hospitalization to manage their illness. Based on data that have been systematically collected for the US by the CDC between 01 August 2020 and 05 September 2021, there were 2,816,280 new hospital admissions for patients with confirmed COVID-19 in the US.[63] For the week ending 22 August 2021, 3.5 patients per 100,000 population were hospitalised due to COVID-19 in 21 countries of the EU/EEA with available data.[64] Based on data from 23 states and New York City, as of August 19, 2021, 1.6%-3.6% of children with COVID-19 have been hospitalised and 0.0-0.03% of children with COVID-19 have died.[65]

The most common symptoms in patients are fever (42-80%), shortness of breath (35-71%), fatigue (33-62%), cough (77-84%), chills (63%), myalgias (63%), headache (59%), and diarrhea (33%).[66,67,68,69] COVID-19 patients also commonly experience gustatory disorders (44%) and olfactory disorders (53%).[70] Among unhospitalised children < 18 years of age, 89% experienced one or more typical symptoms of COVID, including fever, cough, shortness of breath, and 22% experienced all three. [67]Approximately 17% to 40% of those hospitalised with COVID-19 experience severe symptoms necessitating intensive care,[22,27,66] with 31% of children hospitalised experiencing severe COVID-19 that necessitates intensive care or invasive ventilation or ends in death. Risk factors for severe COVID-19 in hospitalised children include presence of a comorbid condition, younger age, and male sex.[34] More than 75% of patients hospitalised with COVID-19 require supplemental oxygen.[71]

Studies early in the pandemic demonstrated that time from onset of illness to ARDS was 8-12 days and time from onset of illness to ICU admission was 9.5–12 days. [61] In 17 countries of the EU/EEA with available data, 1.8 patients per 100,000 population were in the ICU due to COVID-19 for the week ending 28 February 2021.[72] A recent meta-analysis found that, of patients <19 years of age, 11% went to the ICU, non-invasive ventilation was administered among 12%, and 4% required mechanical ventilation. [56]

Mortality

As of 17 August 2021, there were 620,493 deaths reported in the US for all age groups among 36,951,181 cases (1.7% of cases).[73] As of 17 August 2021 there were 746,566 deaths reported for all age groups in the EU/EEA among 35,381,520 cases (2.1% of cases).[74] As of 17 August 2021, the UK has seen 131,466 deaths from COVID-19 in all age groups among 6,352,224 cases (2.1% of cases).[75] According to a recent meta-analysis of paediatric studies published through October 2020, the mortality for paediatric patients is 0.1-2%.[56,21] In a study from January through June 2020 using the National Child Mortality Database (NCMD) in England, 5.7% of 437 children 0-17 years of age who died were SARS-CoV-2

PCR-positive and those who died of COVID-19 were older and were more likely to be non-White ethnicity.[76]

Mortality data are also presented from Worldometer, an independent organisation that publishes current, reliable COVID-19 statistics online.[14] The mortality of SARS-CoV-2 infection is defined as the cumulative number of deaths among detected cases.

As of 15 August 2021, the overall SARS-CoV-2 mortality for the EU + UK was 878,344 deaths, or 171 per 100,000 people. Reported mortality among EU countries and the UK ranged from 18 to 312 deaths per 100,000 (Table 40). Finland and Cyprus reported the lowest mortality; Hungary, Czech Republic, and Bulgaria reported the highest.[15]

In the US, as of 15 August 2021, the mortality was 637,439 deaths (191 per 100,000 people). Mortality in the US was very similar to that of the UK (192 per 100,000).[15]

Overall reported mortality among hospitalised COVID-19 patients varies from 12.8% to 26% in the EU, UK, and US.[27,29,77,78]. Mortality rates are declining over time, presumably due to an improved understanding of COVID-19 and its management.[79]

Complications of COVID-19 and Long-COVID

Complications of COVID-19 include impaired function of the heart, brain, lung, liver, kidney, and coagulation system.[22,25,80] Based on a meta-analysis of 42 studies, the risk of thromboembolism was 21% overall and 31% in the ICU, with the pooled odds of mortality being 74% higher among those who experienced thromboembolism compared to those who did not.[81]

COVID-19 symptoms can persist weeks or months beyond the acute infection.[82,83] The NICE guideline scope published on 30 October 2020 defined "Long COVID" signs and symptoms that continue or develop after acute COVID-19. It includes both ongoing symptomatic COVID-19 (from 4 to 12 weeks) and post-COVID-19 syndrome (12 weeks or more and for which signs and symptoms are not explained by an alternative diagnosis).[84]

A meta analysis of 31 studies among patients between 18 to 49 years of age found that COVID-19 symptoms were experienced for 14 days to 3 months post-infection, including persistent fatigue (39–73%), breathlessness (39–74%), decrease in quality of life (44–69%), impaired pulmonary function, abnormal CT findings including pulmonary fibrosis (39–83%), evidence of peri-/perimyo-/myocarditis (3–26%), changes in microstructural and functional brain integrity with persistent neurological symptoms (55%), increased incidence of psychiatric diagnoses (5.8% versus 2.5–3.4% in controls), and incomplete recovery of olfactory and gustatory dysfunction (33–36%).[85] Post-acute COVID symptoms in children with asymptomatic or mild disease appear to be less severe than in adults, with the most common symptoms being a post-viral cough (4%), fatigue (2%), or both symptoms (1%) with the duration of symptoms lasting 3 to 8 weeks.[86]

Children who are infected with COVID-19 are at risk of subsequent multisystem inflammatory syndrome (MIS-C) and often develop a rash following resolution of COVID-19.[56,87,88] As of August 19, 2021 there were 4,403 cases of MIS-C reported to health

departments in the US. [89] Additional symptoms of MIS-C include abdominal pain, bloodshot eyes, chest tightness or pain, diarrhea, lethargy, headache, low blood pressure, neck pain, and vomiting. [90]

Important co-morbidities:

Important comorbidities in hospitalized COVID-19 patients include hypertension, diabetes, obesity, cardiovascular disease, chronic pulmonary disease or asthma, chronic kidney disease, cancer, and chronic liver disease. [23, 24, 25, 66, 69] Prevalence of these conditions have been reported to be lower in mild cases and higher among fatal cases, as shown as for EU/EEA countries in Table 48 below using TESSy data posted on 12 August 2021.[91]

Table 48. Preconditions among COVID-19 Patients in EU/EEA, by Severity of Disease. Case-based Data from TESSy Reported 12 August 2021[91]

	EU/EEA, reported on 12 August 2021			
	Mild	Hospitalised	Severe	Fatal
TotalN	1,948,252	356,472	52,365	109,878
Asplenia (%)	0	0	0	0
Asthma (%)	0.6	1.2	1.3	1.2
Cancer, malignancy (%)	3.1	9.1	10	11.1
Cardiac disorder, excluding hypertension (%)	9.1	23.7	22.8	29.4
Chronic lung disease, excluding asthma (%)	1.8	3.6	4.4	3.6
Current smoking (%)	0.9	0.1	0.2	0
Diabetes (%)	5	17.1	20.5	19.2
Haematological disorders (%)	0	0.2	0.1	0.1
HIV/other immune deficiency (%)	0.2	0.7	0.7	0.5
Hypertension (%)	0.8	2.9	3.2	3.8
Kidney-related condition, renal disease (%)	0.3	1.8	1.9	2.7
Liver-related condition, liver disease (%)	0.3	0.7	0.7	0.6
Neuromuscular disorder, chronic neurological (%)	0.7	1.8	1.4	2.4
Obesity (%)	0.1	0.2	0.5	0.2
Other endocrine disorder, excluding diabetes (%)	0.3	0.2	0.1	0.1
Rheumatic diseases including arthritis (%)	0	0	0	0
Tuberculosis (%)	0	0	0	0
None (%)	76.7	36.7	32.3	25

Table 49 below summarizes comorbidities among US COVID-19 patients in a retrospective cohort study conducted among 629,953 individuals tested for COVID-19 in a large health system in the US Northwest between 01 March and 31 December 2020.[40] The most common comorbidities were similar in the full cohort and among those who tested positive: obesity, hypertension, diabetes, and asthma. Among those hospitalized for COVID-19, a large number of comorbidities had elevated prevalence compared to the full cohort and those who tested positive: obesity, hypertension, diabetes, kidney disease, congestive heart failure, coronary artery disease, and chronic obstructive pulmonary disease.

Table 49. Comorbidities in individuals tested for COVID-19 in the Providence St. Joseph Health System – States of California, Oregon, and Washington, 01 March–31 December 2020 [40]

Comorbidity	Tested (N= 629,953) %	Positive (N= 54,645) %	Hospitalized (N= 8,536) %
Hypertension	23.3	19.8	40.2
Diabetes	9.4	10.9	28.3
Weight			
Underweight	2.1	1.7	3.1
Normal	29.0	23.9	24.3
Overweight	31.7	32.6	30.3
Class 1 Obesity	19.8	22.3	21.2
Class 2 Obesity	9.6	11.1	10.9
Class 3 Obesity	7.7	8.6	10.3
Asthma	6.5	5.3	6.7
Chronic Obstructive Pulmonary Disease	4.0	2.6	8.3
Coronary Artery Disease	5.5	3.6	9.7
Myocardial Infarction	2.2	1.6	5.5
Congestive Heart Failure	5.3	3.9	13.2
Kidney Disease	5.6	5.3	17.2
Liver Disease	3.1	2.5	4.0
Cancer	6.1	3.0	6.3

In a retrospective cohort of 135,794 individuals under the age of 25 who were tested for COVID-19 by 08 September 2020 within the PEDSnet network of US pediatric health systems, the proportion of obese individuals was similar among those who tested negative (18%) and among mild or asymptomatic COVID-19 cases (19%), but clearly elevated among severe COVID-19 cases (37%).[33] Those with severe cases of COVID-19 more commonly had chronic conditions in at least two body systems, with 25% of COVID-19 negative individuals, 17% mild or asymptomatic cases, and 38% of severe cases having multiple chronic conditions.

More recent data provide insight into comorbidities among the pediatric population. For the period January 1-March 31 2021 across 14 states, the CDC's COVID-NET database recorded 204 adolescents aged 12-17 who were hospitalized for likely primarily COVID-related reasons.[31] Among the 204 adolescents, 70.6% had at least one major underlying medical condition, the most common conditions being obesity (35.8%), chronic lung diseases including asthma (30.9%), and neurologic disorders (14.2%).[31]

2.1.2.f. Pharmacological Class Effects

There are 2 vaccines (including BNT162b2) with a mRNA platform authorized for emergency use in multiple US jurisdictions since 11 December 2020. Theoretical concerns in mRNA vaccines have included the risk of the presence of naked extracellular RNA in the body which may lead to edema or coagulation and concerns about aberrant immune responses to the RNA or lipid particles. The immunogenicity and efficacy data from study C4591001 are indicative of the vaccine delivery system's success in transfecting the RNA

into the appropriate target cells to stimulate an immune response. The RNA itself cannot integrate into the DNA genome.[92,93] The probability of any sequences from the vaccine RNA being integrated into the human genome by a reverse transcription mediated mechanism is considered remote, no higher than the probability of host RNA sequences being re-inserted into the genome, especially given the small quantity of RNA in the vaccine, the barriers to transfected RNA reaching the nucleus, the non-replicating nature of the vaccine RNA, the limited stability of RNA in a cellular context, and the expected targeting of transfected cells for elimination by T cells elicited by the vaccine antigen expressed from the RNA.

3. PHARMACOVIGILANCE PLAN

3.1. Structure of the Pharmacovigilance Plan

3.1.1. Summary of Ongoing Safety Concerns

Table 50. Ongoing Safety Concerns

Important Identified Risks	Anaphylaxis
	Myocarditis and Pericarditis
Important Potential Risks	Vaccine-associated enhanced disease (VAED) including Vaccine-associated enhanced respiratory disease (VAERD)
Missing Information	Use in pregnancy and lactation
	Vaccine effectiveness
	Use in pediatric individuals <5 years of age§

§ Missing information has been reworded to reflect the current state.

3.1.2. Routine Pharmacovigilance Practices

- Routine pharmacovigilance activities are a critical component of activities relating to the detection, assessment, understanding and prevention of risks. The objective of routine pharmacovigilance is to have processes in place to assure the ongoing and timely collection, processing, follow-up, and analysis of individual AE reports globally, following global safety Standard Operating Procedures and regulatory guidance.

- Pfizer, on behalf of the marketing authorization holder(MAH), monitors the safety profile of its products, evaluates issues potentially impacting product benefit-risk profiles in a timely manner, and ensures that appropriate communication of relevant information is conveyed in a timely manner to regulatory authorities and other interested parties as appropriate and in accordance with international principles and prevailing regulations.

- Pfizer, on behalf of the MAH, conducts scientific data gathering activities for the detection and evaluation of AEs to ensure safety monitoring, which is commensurate with product characteristics.

- Signal detection activities include periodic literature review for the life cycle of the product. This includes reviewing the medical literature for individual case reports that

should be entered into the safety database as well as periodic aggregate literature review for broader signal detection.

- Safety signal evaluation requires the collection, analysis, and assessment of information to evaluate whether there is a potential causal association between an event and the administration of the product and includes subsequent qualitative or quantitative characterization of the relevant safety risk to determine appropriate pharmacovigilance and risk mitigation actions.

- Routine pharmacovigilance activities will include the use of DCAs. They are intended to facilitate the capture of clinical details about:

  – the nature and severity of COVID-19 illness in individuals who have received the COVID-19 vaccine and is anticipated to provide insight into potential cases of vaccine lack of effect or VAED.

  – potential anaphylactic reactions in individuals who have received the COVID-19 vaccine.

- A web-based AE reporting portal will be available for vaccine providers and recipients, to assist with anticipated high volume of reports (based on expected large target population). The portal will capture key adverse event data in the initial interaction and will provide automated intake into the Pfizer safety database via E2B for safety review.

- At the country level, the Drug Safety Unit performs routine pharmacovigilance activities including the collection of AEs from various sources and the reporting of AEs to the regulatory authority as per local regulatory guidelines.

Vial Differentiation

All vials have specific color flip off plastic cap and label differentiation factors – see table below.

Table 51. Vaccine Presentation Characteristics

Age group	12 years and older	
Name	12 years of age and older, DILUTE BEFORE USE, Purple Cap	12 years of age and older, DO NOT DILUTE, Gray Cap
Dose	30 mcg (with dilution)	30 mcg (no dilution)
Vial cap color and Label with Color Border	Purple	Gray
Dose Volume	0.3 mL	0.3 mL
Amount of Diluent Needed per Vial	1.8 mL	NO DILUTION
Fill Volume	0.45 mL	2.25 mL
Doses per vial	6 doses per vial (after dilution)	6 doses per vial
Formulation	PBS sucrose	Tris sucrose

Table 51. Vaccine Presentation Characteristics

Age group	12 years and older	
Name	12 years of age and older, DILUTE BEFORE USE, Purple Cap	12 years of age and older, DO NOT DILUTE, Gray Cap
Dose	30 mcg (with dilution)	30 mcg (no dilution)

PBS = Phosphate Buffered Saline; Tris = Tromethamine Buffer or $(HOCH_2)_3CNH$

Potential medication errors are mitigated through the information in the label and available educational materials for healthcare providers.

30 mcg/dose – 12 years of age and older, Dilute before use– Purple cap:

If 1.8 mL sodium chloride solution is not added to the 30 mcg/dose concentrate for dispersion for injection vial (purple cap), the user would only be able to extract approximately 1 dose instead of 6 doses as the filled volume is 0.45 mL.

30 mcg/dose – 12 years of age and older, Do not dilute– Gray cap:

If attempted to further dilute the 30 mcg/ dose dispersion for injection vial (gray cap), a user would immediately experience resistance to addition of any further volume, as the filled volume is 2.25 mL and therefore, there is little remaining physical space to add additional diluent to the vial.

Various educational resources to inform HCPs on the proper preparation and differentiation will be available.

3.1.3. Action Plan for Safety Issues

Action Plan for Important Identified Risks

Table 52. Action Plan for Important Identified Risk "Myocarditis and Pericarditis"

Actions proposed	• Communication of this important identified risk via label (Section 5.2 - *Myocarditis and Pericarditis,* Section 6.2 - *Post Marketing Experience*). • C4591009: A non-interventional post-approval safety study of the Pfizer-BioNTech COVID-19 vaccine in the United States. • C4591011: Active safety surveillance of the Pfizer-BioNTech COVID-19 vaccine in the US Department of Defense population following Emergency Use Authorization. • C4591012: Post-emergency use authorization active safety surveillance study among individuals in the Veteran's Affairs Health System receiving Pfizer-BioNTech Coronavirus Disease 2019 (COVID-19) vaccine. • C4591021: Post Conditional approval active surveillance study among individuals in Europe receiving the Pfizer BioNTech Coronavirus Disease 2019 (COVID-19) vaccine. • C4591038 (former, C4591021 substudy: Post Conditional approval active surveillance study among individuals in Europe receiving the Pfizer BioNTech Coronavirus Disease 2019 (COVID-19) vaccine. Substudy to investigate natural history of post-vaccination myocarditis and pericarditis. • C4591036 - Pediatric Heart Network Study: Low interventional cohort study of myocarditis/pericarditis associated with Comirnaty in persons less than 21 years of age. • C4591031 substudy B: A randomized, placebo-controlled, observer-blind, cross-over substudy to evaluate the safety and tolerability of a booster (third) dose of BNT162b2. Participants ≥12 years of age to ≤30 years of age who have completed a 2-dose primary series of BNT162b2 (30 µg doses) at least 6 months (≥12 months for those 12-17 years of age) prior to randomization will be enrolled. • C4591007 substudy – Troponin group: A Phase 3 substudy of 750 participants 5 to <12 years of age (randomized 2:1 to receive BNT162b2 10 µg or placebo) and 500 participants 12-<16 years of age (open label receipt of BNT162b2 30 µg).
Objective of proposed actions	• Labelling communicates the risk of myocarditis and pericarditis. • C4591009: To assess the occurrence of safety events of interest, including myocarditis and pericarditis, in the general US population of all ages, pregnant women, the immunocompromised and persons with a prior history of COVID-19 within selected data sources participating in the US Sentinel System. • C4591011: To assess whether individuals in the US DoD Military Health System (MHS) experience increased risk of safety events of interest, including myocarditis and pericarditis, following receipt of the Pfizer-BioNTech COVID-19 Vaccine. • C4591012: To assess whether individuals in the US Veteran's Affairs Health System experience increased risk of safety events of interest, including myocarditis and pericarditis, following receipt of the Pfizer-BioNTech COVID-19 Vaccine.

Table 52. Action Plan for Important Identified Risk "Myocarditis and Pericarditis"

	• C4591021: To assess the potential increased risk of adverse events of special interest (AESI), including myocarditis/pericarditis after being vaccinated with COVID-19 vaccine. • C4591038 (former, C4591021 substudy): To describe the natural history of post-vaccination myocarditis/pericarditis, including recovery status, risk factors, and/or identification of serious cardiovascular outcomes within 1 year of myocarditis/pericarditis diagnosis among individuals vaccinated with BNT162b2 as well as individuals not vaccinated with a COVID-19 vaccine. • C4591036: Pediatric Heart Network Study: To characterize the clinical course, risk factors, resolution, long-term sequelae, and quality of life in children and young adults <21 years with acute post-vaccine myocarditis/pericarditis. • C4591031 substudy B: To obtain serum samples within the first ~4 days after vaccination for potential Troponin I testing, in order to evaluate the frequency of subclinical myocarditis amongst individuals 12 to 30 years of age. • C4591007 substudy – Troponin group: To obtain serum samples within the first ~4 days after vaccination for potential Troponin I testing, in order to evaluate the frequency of subclinical myocarditis amongst individuals 5 to <16 years of age.
Rationale for proposed actions	• Labeling communicates to health care provider the risk of myocarditis and pericarditis. • C4591009 and C4591021: Robust surveillance is needed to ensure comprehensive understanding of real-world safety of the Pfizer-BioNTech COVID-19 Vaccine in large samples of general US (C4591009) and EU (C4591021) populations and in subcohorts of interest, including pregnant women, immunocompromised individuals and persons with a prior history of COVID-19 infection. • C4591011 and C4591012: Robust surveillance is needed to ensure comprehensive understanding of real-world safety. This surveillance strategy consists of complementary approaches to ensure timely signal identification and evaluation in populations who have received the Pfizer-BioNTech COVID-19 Vaccine under an Emergency Use Authorization (EUA). • C4591038 (former, C4591021 substudy): Study is needed to describe natural history of myocarditis and pericarditis in persons after vaccination with Pfizer-BioNTech COVID-19 vaccine and in unvaccinated persons. Use in persons <12 will be captured as age is not a criterion for study eligibility. • C4591036: Pediatric Heart Network Study: Need to collect evidence of safety of patients <21 years presenting to PHN sites after receiving a first or second dose of a COVID-19 vaccine and who were diagnosed with myocarditis/pericarditis • C4591031 substudy B: The first ~4 days post-vaccination is the time period when symptomatic myocarditis cases have most frequently been reported. Elevated Troponin I may be an indicator of subclinical myocarditis. • C4591007 substudy – Troponin group: The first ~4 days post-vaccination is the time period when symptomatic myocarditis cases have most frequently been reported. Elevated Troponin I may be an indicator of subclinical myocarditis.

Table 52. Action Plan for Important Identified Risk "Myocarditis and Pericarditis"

Monitoring by the sponsor for safety issue and proposed actions	• C4591009: Post-approval observational studies using real-world data are needed to assess the association between Pfizer-BioNTech COVID-19 Vaccine and safety events of interest, among persons administered the vaccine in both the overall US population and in populations of interest (e.g., pregnant women, the immunocompromised and persons with a prior history of COVID-19 infection). This observational study will capture safety events (based on AESI) including myocarditis and pericarditis, in individuals of any age who received the Pfizer-BioNTech COVID-19 Vaccine since its availability under an EUA using electronic health records and claims data from data partners participating in the Sentinel System. This study, will capture hospitalizations, deaths and serious safety events of interest, including myocarditis and pericarditis, as well as selected pregnancy-related and birth outcomes. • C4591011 and C4591012: 1. The collection of safety data in vaccine recipients is critical to our understanding of the vaccine safety profile and to enable safety signal detection and, if needed, further risk mitigation during the EUA. In addition to the collection and monitoring of AEs reported voluntarily by healthcare professionals providing the vaccine and by individuals receiving the vaccine, active surveillance studies of the Pfizer-BioNTech COVID-19 Vaccine under EUA are also planned. 2. Active surveillance of large numbers of individuals vaccinated with the Pfizer-BioNTech COVID-19 Vaccine is necessary to confirm the safety profile demonstrated in the clinical study in a broader population under real-world conditions. Pfizer-BioNTech is conducting active surveillance studies of individuals vaccinated with the Pfizer-BioNTech COVID-19 Vaccine under an EUA in populations prioritized in the early stages of the EUA, e.g., active military and elderly, as described in the study protocols C4591011 (study planned) and C4591012 (study ongoing) submitted to FDA on 29 January 2021. The study period is/will be approximately 30 months following availability of vaccine under EUA. The studies capture hospitalizations, deaths and serious safety events of interest, including myocarditis and pericarditis. • C4591021/C4591038 (former, C4591021 substudy): Post-approval observational studies using real-world data are needed to assess the association between Pfizer-BioNTech COVID-19 Vaccine and safety events of interest, among large numbers of persons administered the vaccine in both the overall population and in populations of interest (e.g., pregnant women, the immunocompromised) and to assess the natural history of post-vaccination myocarditis/pericarditis, including recovery status, risk factors, and/or identification of serious cardiovascular outcomes within 1 year of myocarditis/pericarditis diagnosis among individuals vaccinated with BNT162b2 as well as individuals not vaccinated with a COVID-19 vaccine. • C4591036: Pediatric Heart Network Study: Prospective cohort study on patients <21 years presenting to PHN sites after receiving a first or second dose of a COVID-19 vaccine and who were diagnosed with myocarditis/pericarditis. This study characterizes the clinical course, risk factors, long-term sequelae, and quality of life in children and young adults <21 years with acute post-vaccine myocarditis/pericarditis. • C4591031 substudy B: If testing of Troponin I levels in individuals who did not receive BNT162b2 (currently in preparation) indicates that Troponin I

Table 52. Action Plan for Important Identified Risk "Myocarditis and Pericarditis"

	could be a reliable indicator of potential subclinical myocarditis, obtaining serum samples for potential Troponin I testing during the period of increased risk of clinical myocarditis may help characterize the absence/presence and frequency of subclinical myocarditis amongst individuals 12 to 30 years of age. • C4591007 substudy – Troponin group: If testing of Troponin I levels in individuals who did not receive BNT162b2 (currently in preparation) indicates that Troponin I could be a reliable indicator of potential subclinical myocarditis, obtaining serum samples for potential Troponin I testing during the period of increased risk of clinical myocarditis may help characterize the absence/presence and frequency of subclinical myocarditis amongst individuals 5 to <16 years of age.

Milestones for evaluation and reporting	• C4591009:
	  • Protocol submission: 31 August 2021
	  • Monitoring report submission: 31 October 2022
	  • Interim Analysis submission: 31 October 2023
	  • Study completion: 30 June 2025
	  • Final study report submission: 31 October 2025.
	• C4591011:
	  • Not applicable[a]
	• C4591012
	  • Protocol amendment submission: 31 August 2021
	  • Interim study reports will be submitted on the following dates based on data collected post-EUA in target populations:
	  o 31 December 2021
	  o 30 June 2022
	  o 31 December 2022
	  • Study completion: 30 June 2023
	  • Final study reports submission: 31 December 2023.
	• C4591021
	  • Protocol submission: 11 August 2021
	  • Progress report submission: 30 September 2021
	  • Interim study reports will be submitted on the following dates:
	  o 31 March 2022
	  o 30 September 2022
	  o 31 March 2023
	  o 30 September 2023
	  o 31 March 2024
	  • Study completion: 31 March 2024
	  • Final study report submission: 30 September 2024
	• C4591038 (former, C4591021 substudy)
	  • Final protocol submission: 31 January 2022
	  • Study completion: 31 March 2024
	  • Final study report submission: 30 September 2024.
	• C4591036
	  • Protocol submission: 30 November 2021

Table 52. Action Plan for Important Identified Risk "Myocarditis and Pericarditis"

	• Study completion: 31 December 2026 • Final study report submission: 31 May 2027 • C4591031 substudy B • Final protocol submission: 30 November 2021 • Study completion: 30 June 2022 • Final study report submission: 31 December 2022 • C4591007 substudy – Troponin group • Final protocol submission: 30 September 2021 • Study completion: 30 November 2023 • Final study report submission: 31 May 2024

a. Milestones deleted as this is a voluntary sponsor study (as per FDA Information Request received to BLA 125742/0, dated 13 August 2021, where the FDA characterized both studies as "voluntary" and therefore no longer commitment).

Table 53. Action Plan for Important Identified Risk "Anaphylaxis"

Actions proposed	• Communication of this important identified risk via label (Sections 4 - *Contraindications*, 5.1 - *Management of Acute Allergic Reactions,* Section 6 - *Adverse reactions* - and 6.2 - *Post Authorization Experience*). • C4591001: Phase 1/2/3, placebo-controlled, randomized, observer-blind, dose-finding study to evaluate the safety, tolerability, immunogenicity, and efficacy of SARS-CoV-2 RNA vaccine candidates against COVID-19 in healthy individuals. • C4591009: A non-interventional post-approval safety study of the Pfizer-BioNTech COVID-19 vaccine in the United States. • C4591011: Active safety surveillance of the Pfizer-BioNTech COVID-19 vaccine in the US Department of Defense population following Emergency Use Authorization. • C4591012: Post-emergency use authorization active safety surveillance study among individuals in the Veteran's Affairs Health System receiving Pfizer-BioNTech Coronavirus Disease 2019 (COVID-19) vaccine. • C4591021: Post Conditional approval active surveillance study among individuals in Europe receiving the Pfizer BioNTech Coronavirus Disease 2019 (COVID-19) vaccine.
Objective of proposed actions	• Labelling communicates the risk of anaphylaxis. • C4591001: To evaluate the safety, tolerability, immunogenicity, and efficacy of BNT162b2. Further, an unfavorable imbalance between the vaccine and control groups in the frequency of COVID-19 disease, in particular for severe COVID-19 disease, may indicate the occurrence of VAED/VAERD. Surveillance is planned for 2 years following Dose 2. • C4591009: To assess the occurrence of safety events of interest in the general US population of all ages, pregnant women, the immunocompromised and persons with a prior history of COVID-19 within selected data sources participating in the US Sentinel System.

Table 53. Action Plan for Important Identified Risk "Anaphylaxis"

	• C4591011: To assess whether individuals in the US DoD Military Health System (MHS) experience increased risk of safety events of interest, following receipt of the BNT162b2. • C4591012: To assess whether individuals in the US Veteran's Affairs Health System experience increased risk of safety events of interest, following receipt of the BNT162b2. • C4591021: To assess the potential increased risk of adverse events of special interest (AESI), including anaphylaxis after being vaccinated with COVID 19 vaccine.
Rationale for proposed actions	• Labeling communicates to health care provider the risk of anaphylaxis. • C4591001: Long-term monitoring throughout the clinical study for up to 2 years to assess the risk for vaccine-associated enhanced disease. • C4591009: Robust surveillance is needed to ensure comprehensive understanding of real-world safety of the BNT162b2 in the in large samples of general US population and in subcohorts of interest, including pregnant women, immunocompromised individuals and persons with a prior history of COVID-19 infection. • C4591011 and C4591012: Robust surveillance is needed to ensure comprehensive understanding of real-world safety. This surveillance strategy consists of complementary approaches to ensure timely signal identification and evaluation in populations expected to receive the BNT162b2 under an Emergency Use Authorization (EUA). • C4591021: Robust surveillance is needed to ensure comprehensive understanding of real-world safety of the Pfizer-BioNTech COVID-19 Vaccine in the general EU population.
Monitoring by the sponsor for safety issue and proposed actions	• C4591001: Safety evaluations will include AESI, including anaphylaxis; these will be collected systemically and monitored throughout the Phase 3 study. • C4591009 and C4591021: Post-approval observational studies using real-world data are needed to assess the association between BNT162b2 and safety events of interest, among persons administered the vaccine in both the overall US (C4591009) and EU (C4591021) population and in populations of interest (e.g., pregnant women, the immunocompromised and persons with a prior history of COVID-19 infection). This observational study will capture safety events (based on AESI) including anaphylaxis, in individuals of any age who received the BNT162b2 since its availability under an EUA using electronic health records and claims data from data partners participating in the Sentinel System. This study, will capture hospitalizations, deaths and serious safety events of interest, including anaphylaxis, as well as selected pregnancy-related and birth outcomes. • C4591011 and C4591012: 1. The collection of safety data in vaccine recipients is critical to our understanding of the vaccine safety profile and to enable safety signal detection and, if needed, further risk mitigation during the EUA. In addition to the collection and monitoring of AEs reported voluntarily by healthcare professionals providing the vaccine and by individuals receiving the vaccine, active surveillance studies of the BNT162b2 under EUA are also planned. 2. Active surveillance of large numbers of individuals vaccinated with the BNT162b2 is necessary to confirm the safety profile demonstrated in the

Table 53. Action Plan for Important Identified Risk "Anaphylaxis"

	clinical study in a broader population under real-world conditions. Pfizer-BioNTech plans to conduct active surveillance studies of individuals vaccinated with the BNT162b2 under an EUA in populations prioritized in the early stages of the EUA, e.g., active military and elderly, as described in the study protocols C4591011 and C4591012 submitted to FDA on 29 January 2021. The study period will be approximately 30 months following availability of vaccine under EUA. The studies will capture hospitalizations, deaths and serious safety events of interest, including anaphylaxis. • C4591021: The collection of safety data in vaccine recipients, including pregnant women, is critical to our understanding of the vaccine safety profile and to enable robust safety signal detection and evaluation and, if needed, further risk mitigation under BLA.
Milestones for evaluation and reporting	• C4591001 (ongoing Study): o CSR submission upon regulatory request: at any time o Final CSR submission with supplemental follow-up: 31 August 2023. • C4591009: o Protocol submission: 31 August 2021 o Monitoring report submission: 31 October 2022 o Interim Analysis submission: 31 October 2023 o Study completion: 30 June 2025 o Final study report submission: 31 October 2025. • C4591011 • Not applicable[a] • C4591012 • Protocol amendment submission: 31 August 2021 • Interim study reports will be submitted on the following dates based on data collected post-EUA in target populations: o 31 December 2021 o 30 June 2022 o 31 December 2022 • Study completion: 30 June 2023 • Final study reports submission: 31 December 2023. • C4591021 • Protocol submission: 11 August 2021 • Progress report submission: 30 September 2021 • Interim study reports will be submitted on the following dates: o 31 March 2022 o 30 September 2022 o 31 March 2023 o 30 September 2023 o 31 March 2024 • Study completion: 31 March 2024 • Final study report submission: 30 September 2024

a. Milestones deleted as this is a voluntary sponsor study (as per FDA Information Request received to BLA 125742/0, dated 13 August 2021, where the FDA characterized both studies as "voluntary" and therefore no longer commitment).

Action Plan for Important Potential Risks

Table 54. Action Plan for Important Potential Risk "Vaccine-associated enhanced disease (VAED) including Vaccine-associated enhanced respiratory disease (VAERD)"

Actions proposed	• C4591001: Phase 1/2/3, placebo-controlled, randomized, observer-blind, dose-finding study to evaluate the safety, tolerability, immunogenicity, and efficacy of SARS-CoV-2 RNA vaccine candidates against COVID-19 in healthy individuals. • C4591008: HERO Together: A post-Emergency Use Authorization observational cohort study to evaluate the safety of the Pfizer-BioNTech COVID-19 Vaccine in US healthcare workers, their families, and their communities. • C4591009: A non-interventional post-approval safety study of the Pfizer-BioNTech COVID-19 vaccine in the United States. • C4591011: Active safety surveillance of the Pfizer-BioNTech COVID-19 vaccine in the US Department of Defense population following Emergency Use Authorization. • C4591012: Post-emergency use authorization active safety surveillance study among individuals in the Veteran's Affairs Health System receiving Pfizer-BioNTech Coronavirus Disease 2019 (COVID-19) vaccine. • C4591021: Post Conditional approval active surveillance study among individuals in Europe receiving the Pfizer BioNTech Coronavirus Disease 2019 (COVID-19) vaccine.
Objective of proposed actions	• C4591001: to evaluate the safety, tolerability, immunogenicity, and efficacy of BNT162b2. An unfavorable imbalance between the vaccine and control groups in the frequency of COVID-19 disease, in particular for severe COVID-19 disease, may indicate the occurrence of VAED/VAERD. Surveillance is planned for 2 years following Dose 2. • C4591008, C4591009, C4591011, C4591012, and C4591021: to characterize the real-world incidence of safety events of interest, including events indicative of severe or atypical COVID-19 disease, among individuals vaccinated with the BNT162b2 since EUA.
Rationale for proposed actions	• C4591001: Robust and long-term monitoring throughout the clinical study for up to 2 years to assess the risk for vaccine-associated enhanced disease. • C4591008, C4591009, C4591011, C4591012 and C4591021: Robust surveillance is needed to ensure comprehensive understanding of real-world safety. This surveillance strategy consists of complementary approaches to ensure timely signal identification and evaluation in populations expected to receive the vaccine in the early stages of an EUA as well as with broader vaccination roll-out.
Monitoring by the sponsor for safety issue and proposed actions	• C4591001: Protocol prespecified stopping and alert rules were set for detecting enhanced COVID-19. Participants in all stages of the study will be monitored for COVID-19 illness including severe COVID-19 from Visit 1 onward. Cases will undergo blinded review to identify whether any features of each case appear unusual, in particular greater severity. Indicators of severity may include accelerated deterioration, need for hospitalization, need for ventilation, or death. The Data Monitoring Committee, supported by an unblinded medical monitor, will look for adverse imbalances between vaccine and control groups in COVID-19 disease outcomes, in particular for cases of severe COVID-19, that may be a signal for vaccine-associated enhanced disease on an ongoing basis and at interim analyses. Stopping

Table 54. Action Plan for Important Potential Risk "Vaccine-associated enhanced disease (VAED) including Vaccine-associated enhanced respiratory disease (VAERD)"

	rules were set so that enrollment could be paused in the event of an adverse imbalance. Additional safety evaluations will include AESI that could represent symptoms of severe COVID-19 disease; these will be collected systemically and monitored throughout the Phase 3 study. • C4591008, C4591011, C4591012: The collection of safety data in vaccine recipients is critical to our understanding of the vaccine safety profile and to enable efficient safety signal detection and, if needed, further risk mitigation during the EUA. In addition to the collection and monitoring of AEs reported voluntarily by healthcare professionals providing the vaccine and by individuals receiving the vaccine, active surveillance studies of the BNT162b2 under EUA are also planned. Active surveillance of large numbers of individuals vaccinated with the BNT162b2 is necessary to confirm the safety profile demonstrated in the clinical study in a broader population under real-world conditions. Pfizer-BioNTech plans to conduct active surveillance studies of vaccinated individuals in populations prioritized in the early stages of the EUA, e.g., healthcare workers, active military, and elderly, as described in C4591008 protocol submitted to FDA on 28 January 2021; C4591011 protocol submitted to FDA on 29 January 2021 and C4591012 protocol submitted to FDA on 29 January 2021. The study period will be approximately 30 months following availability of vaccine under EUA. The studies will capture hospitalizations, deaths and serious safety events of interest, including severe COVID-19 (which, if associated with vaccination, may indicate VAED/VAERD). • C4591009 and C4591021: Surveillance of large numbers of individuals vaccinated with the BNT162b2 is necessary to confirm the safety profile demonstrated in the clinical study in a broader population under real-world conditions. This study is intended to capture a broader sample of vaccinated individuals of any age in the general US (C4591009) and EU (C4591021) population using large scale data sources.

Milestones for evaluation and reporting	• C4591001 (ongoing Study):
	  • CSR submission upon regulatory request: at any time
	  • Final CSR submission with supplemental follow-up: 31 August 2023.
	• Two observational post-authorization safety studies for EUA (C4591011, and C4591012) and 1 voluntary study (C4591008):
	  • C4591008[a]
	  o Not applicable
	  • C4591012:
	  o Protocol amendment submission: 31 August 2021
	  o Interim study reports will be submitted on the following dates based on data collected post-EUA in target populations:
	  o 31 December 2021
	  o 30 June 2022
	  o 31 December 2022
	  o Study completion: 30 June 2023
	  o Final study reports submission: 31 December 2023.
	  • C4591011:

Table 54. Action Plan for Important Potential Risk "Vaccine-associated enhanced disease (VAED) including Vaccine-associated enhanced respiratory disease (VAERD)"

	○ Not applicable[a] • C4591009: ○ Protocol submission: 31 August 2021 ○ Monitoring report submission: 31 October 2022 ○ Interim Analysis submission: 31 October 2023 ○ Study completion: 30 June 2025 ○ Final study report submission: 31 October 2025. • C4591021 • Protocol submission: 11 August 2021 • Progress report submission: 30 September 2021 • Interim study reports will be submitted on the following dates: ○ 31 March 2022 ○ 30 September 2022 ○ 31 March 2023 ○ 30 September 2023 ○ 31 March 2024 • Study completion: 31 March 2024 • Final study report submission: 30 September 2024

a. Milestones deleted as this is a voluntary sponsor study (as per FDA Information Request received to BLA 125742/0, dated 13 August 2021, where the FDA characterized both studies as "voluntary" and therefore no longer commitment).

Action Plan for Missing Information

Table 55. Action Plan for Missing Information "Use in Pregnancy and Lactation"

Actions proposed	• C4591015[a]: A phase 2/3, placebo-controlled, randomized, observer blind study to evaluate the safety, tolerability, and immunogenicity of a SARS-CoV-2 RNA vaccine candidate (BNT162b2) against COVID-19 in healthy pregnant women 18 years of age and older. • C4591009: A non-interventional post-approval safety study of the Pfizer-BioNTech COVID-19 vaccine in the United States. • C4591011: Active safety surveillance of the Pfizer-BioNTech COVID-19 Vaccine in the US Department of Defense population following Emergency Use Authorization. • C4591021: Post Conditional approval active surveillance study among individuals in Europe receiving the Pfizer BioNTech Coronavirus Disease 2019 (COVID-19) vaccine • C4591022: Pfizer-BioNTech COVID-19 Vaccine exposure during pregnancy: A non-interventional post-approval safety study of pregnancy and infant outcomes in the Organization of Teratology Information Specialists (OTIS)/MotherToBaby Pregnancy Registry.
Objective of proposed actions	• C4591015[a]: To assess safety and immunogenicity of BNT162b2 in pregnant women. In addition, exploratory objectives include:

Table 55. Action Plan for Missing Information "Use in Pregnancy and Lactation"

	To describe the immune response in infants born to breastfeeding maternal participants vaccinated with prophylactic BNT162b2 during pregnancy. To describe the safety of maternal immunization in infants born to breastfeeding maternal participants vaccinated with prophylactic BNT162b2 during pregnancy. • C4591009[b]: To assess whether pregnant women experience increased risk of safety events of interest following receipt of the BNT162b2. • C4591011[b]: To assess whether sub-cohorts of interest, such as pregnant women, in the MHS experience increased risk of safety events of interest following receipt of the BNT162b2. • C4591021[b]: To assess whether pregnant women experience increased risk of safety events of interest following receipt of the BNT162b2. • C4591022[b]: To assess whether pregnant women receiving BNT162b2 experience increased risk of pregnancy and infant safety outcomes, including major congenital malformations, spontaneous abortion, stillbirth, preterm delivery, small for gestational age, and small for age postnatal growth to one year of age.
Rationale for proposed actions	Acquisition of data in an unstudied population with potentially different safety considerations from the time vaccine is available.
Monitoring by the sponsor for safety issue and proposed actions	• C4591015: Monitoring via ongoing clinical study. • C4591009: Post-approval observational studies using real-world data are needed to assess the association between Pfizer-BioNTech COVID-19 Vaccine and safety events of interest, among persons administered the vaccine in both the overall US population and in populations of interest (e.g., pregnant women, the immunocompromised and persons with a prior history of COVID-19 infection). This observational study will capture safety events (based on AESI) including myocarditis and pericarditis, in individuals of any age who received the Pfizer-BioNTech COVID-19 Vaccine since its availability under an EUA using electronic health records and claims data from data partners participating in the Sentinel System. This study will capture hospitalizations, deaths and serious safety events of interest, including myocarditis and pericarditis, as well as selected pregnancy-related and birth outcomes. • C4591011: 1. The collection of safety data in vaccine recipients is critical to our understanding of the vaccine safety profile and to enable efficient safety signal detection and, if needed, further risk mitigation. Active surveillance studies of the BNT162b2 under EUA are also planned. 2. Active surveillance of large numbers of individuals vaccinated with the BNT162b2 is necessary to confirm the safety profile demonstrated in the clinical study in a broader population under real-world conditions. Pfizer-BioNTech plans to conduct active surveillance studies of individuals vaccinated with the BNT162b2 under an EUA in populations prioritized in the early stages of the EUA, e.g., active military and their family members, as described in C4591011 (protocol submitted to FDA on 29 January 2021). The study period will be approximately 30 months following availability of vaccine under EUA. The study will capture hospitalizations, deaths and serious safety events of interest, including anaphylaxis. • C4591021: The collection of safety data in vaccine recipients, including pregnant women, is critical to our understanding of the vaccine safety profile and to enable robust safety signal detection and evaluation and, if needed, further risk mitigation under BLA.

Table 55. Action Plan for Missing Information "Use in Pregnancy and Lactation"

	• C4591022: This study will monitor rates of pregnancy and infant outcomes in planned and unplanned pregnancies exposed to BNT162b2 using an established pregnancy registry. Women receiving BNT162b2 during pregnancy will be followed from exposure to one-year post-partum. Analyses will be conducted to evaluate if the pregnant women receiving the vaccine during pregnancy experience increased risk of pregnancy and infant outcomes compared with 1) pregnant women who are unvaccinated and 2) pregnant women who have received an influenza or tetanus, diphtheria, and acellular pertussis (Tdap) vaccine during pregnancy.

Milestones for evaluation and reporting	• C4591015[a]:
	  • Study completion: 31 August 2022
	  • Final study report submission: 31 March 2023.
	• C4591009:
	  • Protocol submission: 31 August 2021
	  • Monitoring report submission: 31 October 2022
	  • Interim Analysis submission: 31 October 2023
	  • Study completion: 30 June 2025
	  • Final study report submission: 31 October 2025.
	• C4591011:
	  • Not applicable[c]
	• C4591021
	  • Protocol submission: 11 August 2021
	  • Progress report submission: 30 September 2021
	  • Interim study reports will be submitted on the following dates:
	  o 31 March 2022
	  o 30 September 2022
	  o 31 March 2023
	  o 30 September 2023
	  o 31 March 2024
	  • Study completion: 31 March 2024
	  • Final study report submission: 30 September 2024
	• C4591022:
	  • Interim reports submission:
	  o 31 January 2022
	  o 31 January 2023
	  o 31 January 2024
	  o 31 January 2025
	  • Study completion: 30 June 2025
	  • Final study report submission: 31 December 2025

a. Enrolment of participants into study C4591015 was stopped due to recruitment challenges as a result of global recommendations for COVID 19 vaccination in pregnant women and the increased availability of COVID 19 vaccines. Enrolment of new participants was stopped on 25 October 2021. Participants already enrolled will continue follow up evaluations until study end as planned. For this reason, study completion date was changed from 31 October 2022 to 31 August 2022 and final study report submission date was changed from 31 May 2023 to 31 March 2023".
b. Study assesses pregnancy only.

Table 55. Action Plan for Missing Information "Use in Pregnancy and Lactation"

c. Milestones deleted as this is a voluntary sponsor study (as per FDA Information Request received to BLA 125742/0, dated 13 August 2021, where the FDA characterized both studies as "voluntary" and therefore no longer commitment).

Table 56. Action Plan for Missing Information "Vaccine Effectiveness"

Action proposed	• C4591014: Pfizer-BioNTech COVID-19 BNT162b2 Vaccine Effectiveness Study - Kaiser Permanente Southern California. • WI235284: Determining RSV Burden and Outcomes in Pregnant Women and Older Adults Requiring Hospitalization. COVID-19 Amendment for COVID VE/ Sub-study 6. • WI255886: Avon Community Acquired Pneumonia Surveillance Study: A Pan-pandemic Acute Lower Respiratory Tract Disease Surveillance Study. • BNT162-01 cohort 13: Immunogenicity of Pfizer-BioNTech COVID-19 Vaccine in immunocompromised subjects, including assessment of antibody responses and cell-mediated responses. • C4591007 substudy – Lower dose evaluation group: To study lower dose levels of BNT162b2 in individuals 12 through <18 years of age.
Objective of proposed actions	• C4591014: To estimate the effectiveness of 2 doses of BNT162b2 against hospitalization and emergency department admission for acute respiratory illness due to SARS-CoV-2 infection. • WI235284: To estimate the effectiveness of 2 doses of BNT162b2 against hospitalization for acute respiratory illness due to SARS-CoV-2 infection. • WI255886: To estimate the effectiveness of 2 doses of BNT162b2 against hospitalization for acute respiratory illness due to SARS-CoV-2 infection. • BNT-162-01 cohort 13: To assess potentially protective immune responses in immunocompromised adults. • C4591007 substudy – Lower dose evaluation group: To evaluate the immunogenicity and safety of lower dose levels of BNT162b2 in individuals 12 through <18 years of age.
Rationale for proposed actions	• C4591014: To determine the effectiveness of BNT162b2 when administered outside of the clinical setting. • WI235284: To determine the effectiveness of BNT162b2 when administered outside of the clinical setting. • WI255886: To determine the effectiveness of BNT162b2 when administered outside of the clinical setting. • BNT-162-01 cohort 13: To determine whether the BNT162b2 has potential to protect immunocompromised adults. • C4591007 substudy – Lower dose evaluation group: To assess whether lower dose levels of BNT162b2 could provide an adequate immune response with improved tolerability.

Table 56. Action Plan for Missing Information "Vaccine Effectiveness"

Monitoring by the sponsor for safety issue and proposed actions	• C4591014: Use of primary and secondary data sources to monitor COVID-19 infection in vaccinated individuals. • WI235284: Use of primary and secondary data sources to monitor COVID-19 infection in vaccinated individuals. • WI255886: Use of primary and secondary data sources to monitor COVID-19 infection in vaccinated individuals. • BNT-162-01 cohort 13: Reactogenicity, AE and SAE assessment. • C4591007 substudy – Lower dose evaluation group: Reactogenicity, AE and SAE and immunogenicity assessment.

Milestones for evaluation and reporting	• C4591014:
	  • Study completion: 31 December 2022
	  • Final CSR submission: 30 June 2023.
	• WI235284: Final CSR submission: 30 June 2023.
	• WI255886: Final CSR submission: 30 June 2023.
	• BNT-162-01 cohort 13: First IA submission: 30 September 2021.
	• C4591007 substudy - Lower dose evaluation group:
	  • Final protocol submission: 30 September 2021
	  • Study completion: 30 November 2023
	  • Final report submission: 31 May 2024

Table 57. Action Plan for Missing Information "Use in Paediatric Individuals <5 Years of Age"

Actions proposed	• C4591001 ≥12 to ≤15 years of age: Phase 1/2/3, placebo-controlled, randomized, observer-blind, dose-finding study to evaluate the safety, tolerability, immunogenicity, and efficacy of SARS-CoV-2 RNA vaccine candidates against COVID-19 in healthy individuals[a].
	Randomised placebo-controlled study in 2000 participants (1000 active recipients) of 2 doses of BNT162b2 at a 21-day interval.
	• C4591007 - Lower dose evaluation group:
	  o Phase 1 (low dose evaluation): open label study that will evaluate the safety, tolerability, and immunogenicity of 10 µg BNT162b2 from 2 schedule in 2 age groups (participants 12 to <16 and 16 to <18 years of age).
	  o Phase 2/3 – lower dose evaluation: Is the portion of the study that will evaluate the safety, tolerability, and immunogenicity in each age group (12 to <16 years and 16 to <18 years of age).at the selected dose schedule from the Phase 1 lower-dose evaluation. In this open-label study, all participants will have blood drawn at baseline prior to Dose 1 and at 1, 6, and 12 months after Dose 2. Immunobinding to comparator participants in the C4591001 study will be based on immunogenicity data collected at baseline and 1 month after Dose 2. The persistence of the immune response will be based on immunogenicity data collected in participants at baseline and 1, 6, and 12 months after Dose 2. (300 participants per age group).
	• C4591007 substudy – Troponin group: A Phase 3 substudy of 750 participants 5 to <12 years of age (randomized 2:1 to receive BNT162b2 10 µg or placebo) and 500 participants 12-<16 years of age (open label receipt of BNT162b2 30 µg).

Table 57. Action Plan for Missing Information "Use in Paediatric Individuals <5 Years of Age"

	• C4591009: A non-interventional post-approval safety study of the Pfizer-BioNTech COVID-19 vaccine in the United States. • C4591021/ C4591038 (former, C4591021 substudy: Post Conditional approval active surveillance study among individuals in Europe receiving the Pfizer- BioNTech Coronavirus Disease 2019 (COVID-19) vaccine. Substudy to investigate natural history of post-vaccination myocarditis and pericarditis. • C4591023: Phase 1 open label dose-finding study to evaluate safety, tolerability, and immunogenicity and phase 2/3 placebo-controlled, observer- blinded safety, tolerability, and immunogenicity study of a SARS-CoV-2 mRNA vaccine candidate against COVID-19 in healthy infants <6 months of age. Phase 1: open-label dose finding portion up to 3 dose levels with 16 participants per dose level. Phase 2/3: Children ≥5 to <12 years of age are randomized 2:1 at selected dose level of BNT162b2 at a 21-day interval. Design and subject numbers to be confirmed. • C4591036: Pediatric Heart Network Study: Low Interventional Cohort Study of Myocarditis/Pericarditis Associated with Comirnaty in persons less than 21 years of age.
Objective of proposed actions	• C4591001 ≥12 to ≤15 years of age: Safety compared to placebo and immune-non-inferiority of neutralizing antibody immune response compared to subjects 16-25 years of age. • C4591007 – Lower dose evaluation group: Immunobridging analysis of immune responses in participants within each age group (participants ≥5 to <12 years, ≥2 to <5 years, and ≥6 months to <2 years of age) to those in participants 16 to 25 years of age in the Phase 3 C4591001 efficacy study. Efficacy if sufficient cases accrue. • C4591007 substudy – Troponin group: To obtain serum samples within the first ~4 days after vaccination for potential Troponin I testing, in order to evaluate the frequency of subclinical myocarditis amongst individuals 5 to <16 years of age. • C4591009: To assess the use of vaccine in persons <12 and occurrence of safety events of interest, including myocarditis and pericarditis, in the general US populations within selected data sources participating in the US sentinel system. • C4591021: To assess the potential increased risk of Adverse Events of Special Interest (AESI), including myocarditis/pericarditis after being vaccinated with COVID-19 vaccine. • C4591038 (former, C4591021 substudy: To describe the natural history of post-vaccination myocarditis/pericarditis, including recovery status, risk factors, and/or identification of serious cardiovascular outcomes within 1 year of myocarditis/pericarditis diagnosis among individuals, including any individuals <12 years, vaccinated with BNT162b2 as well as individuals not vaccinated with a COVID-19 vaccine. • C4591023: To evaluate safety, tolerability, and immunogenicity of a SARS-CoV-2 RNA vaccine candidate against COVID-19 in healthy infants <6 months of age. • C4591036: Pediatric Heart Network Study: To characterize the clinical course, risk factors, resolution, long-term sequelae, and quality of life in children and young adults <21 years, including any individuals <12 years, with acute post-vaccine myocarditis/pericarditis.

Table 57. Action Plan for Missing Information "Use in Paediatric Individuals <5 Years of Age"

Rationale for proposed actions	• C4591001 ≥12 to ≤15 years of age: Need to collect evidence of safety and effectiveness to support immunization in this age group. • C4591007 – Lower dose evaluation group: Need to collect evidence of safety and effectiveness to support immunization in this age group. • C4591007 substudy – Troponin group: The first ~4 days post-vaccination is the time period when symptomatic myocarditis cases have most frequently been reported. Elevated Troponin I may be an indicator of subclinical myocarditis. • C4591009 and C4591021: Long-term surveillance of large numbers of individuals vaccinated with the BNT162b2 is necessary to confirm the safety profile demonstrated in the clinical study in a broader population under real-world conditions. Use in persons <12 will be captured as age is not a criterion for study eligibility • C4591038 (former, C4591021 substudy): Study is needed to describe natural history of myocarditis and pericarditis in persons after vaccination with Pfizer-BioNTech COVID-19 vaccine and in unvaccinated persons. Use in persons <12 will be captured as age is not a criterion for study eligibility • C4591023: Need to collect evidence of safety and effectiveness to support immunization in this age group. • C4591036: Pediatric Heart Network Study: Study is necessary to characterize the clinical course, risk factors, resolution, long-term sequelae, and quality of life in children and young adults <21 years with acute post-vaccine myocarditis/pericarditis. Use in children <12 will be captured as age is not a criterion for study eligibility

Monitoring by the sponsor for safety issue and proposed actions	• C4591001 ≥12 to ≤15 years of age:
	  • Electronic diary for reactogenicity 7 days following each dose of vaccine.
	  • Adverse events for one month after second dose.
	  • Serious Adverse Events for 6 months after the second dose.
	  • Related SAEs and related deaths for 24 months after the second dose.
	  • Collection of COVID-19 and MIS-C cases up to 24 months after the second dose.
	• C4591007 – Lower dose group/C4591007 substudy – Troponin group:
	  • Electronic diary for reactogenicity 7 days following each dose of vaccine.
	  • Adverse events for one month after second dose.
	  • Serious Adverse Events for 6 months after the second dose.
	  • Related SAEs and related deaths for 24 months after the second dose for < 12 years.
	  • Collection of COVID-19 and MIS-C cases up to 24 months after the second dose < 12 years.
	• C4591009:
	  • Longitudinal medical care information on outpatient medication dispensing, vaccine administrations, and inpatient and outpatient diagnoses and procedures in addition to adjudication of select events via medical records.
	  • Incidence rates and comparative incidence rate ratios of safety events of interest (AESIs from FDA's BEST System[94] and CDC's Vaccine Safety Datalink[95] in addition to vaccine-associated enhanced respirator disease).

Table 57. Action Plan for Missing Information "Use in Paediatric Individuals <5 Years of Age"

	• Study period to start on date that BNT162b2 became available under EUA (December 11, 2020) and will end a minimum of 3 years after this date. • Risk windows will be defined for safety events of interest that have a hypothesized increased risk during specific time periods following vaccination. For other safety events of interest, patients will be followed for a maximum of 1 year. • C4591021: • Longitudinal medical care and vaccination information. • Incidence rates and comparative incidence rate ratios of safety events of interest. • Study period to start on date that BNT162b2 became available in EU and will end after 2-3 years depending on outcome. • Risk windows will be defined for safety events of interest that have a hypothesized increased risk during specific time periods following vaccination. • C4591038 (former, C4591021 substudy): o Describe natural history of post-vaccination myocarditis/pericarditis, including recovery status, risk factors, and/or identification of serious cardiovascular outcomes for 1 year o Study population includes individuals vaccinated with BNT162b2 as well as individuals not vaccinated with a COVID-19 vaccine • C4591023 < 6 months of age • Electronic diary for reactogenicity 7 days following each dose of vaccine. • Adverse events for one month after second dose. • Serious Adverse Events for 6 months after the second dose. • Related SAEs and related deaths for 12 months after the second dose for < 12 years. • Collection of COVID-19 and MIS-C cases up to 12 months after the second dose < 12 years. • C4591036: Pediatric Heart Network Study: Prospective cohort study on patients <21 years presenting to PHN sites after receiving a first or second dose of a COVID-19 vaccine and who were diagnosed with myocarditis. This study characterizes the clinical course, risk factors, long-term sequelae, resolution and quality of life in children and young adults <21 years with acute post-vaccine myocarditis/pericarditis.
Milestones for evaluation and reporting	• C4591001 ≥12 to ≤15 years of age: • Reports: o 6-month post dose 2 (safety): 31 December 2021[b] o 24-month post dose 2 (safety): 30 April 2023[c]. • Study completion: 31 May 2023 • Final report submission: 31 October 2023 • C4591007 – Lower dose group: • First report with up to 1-month post dose 2 in ≥5 to <12 years of age (safety): 30 September 2021 • Further reports: o 6-month post dose 2 (safety): 31 March 2022

Table 57. Action Plan for Missing Information "Use in Paediatric Individuals <5 Years of Age"

	○ 24-month post dose 2 (safety): 30 September 2023. • Study Completion: 30 November 2023 • Final Report Submission: 31 May 2024 • C4591007 substudy - Troponin group: • Final protocol submission: 30 September 2021 • Study completion: 30 November 2023 • Final report submission: 31 May 2024 • C4591009: • Protocol submission: 31 August 2021 • Monitoring report submission: 31 October 2022 • Interim Analysis submission: 31 October 2023 • Study completion: 30 June 2025 • Final study report submission: 31 October 2025. • C4591021: • Protocol submission: 11 August 2021 • Progress report submission: 30 September 2021 • Interim study reports will be submitted on the following dates: ○ 31 March 2022 ○ 30 September 2022 ○ 31 March 2023 ○ 30 September 2023 ○ 31 March 2024 • Study completion: 31 March 2024 • Final study report submission: 30 September 2024 • C4591038 (former, C4591021 substudy • Final protocol submission: 31 January 2022 • Study completion: 31 March 2024 • Final study report submission: 30 September 2024. • C4591023 • Final protocol submission: 31 January 2022 • Study completion: 31 July 2024 • Final study report submission: 31 October 2024. • C4591036: • Protocol submission: 30 November 2021 • Study completion: 31 December 2026 • Final study report submission: 31 May 2027

a. Study originally included in the PVP to address the Missing Information "Use in pediatric individuals < 16 years of age".
b. Due date updated from 31 October 2021 to 31 December 2021 to implement additional CBER requests (received on 24 September 2021) for the 12 to ≤15 years sBLA (FDA already informed of this change on 22 October 2021).
c. Due date updated from 31 January 2023 for the same reason above.

3.1.4. Summary of Actions to be Completed, Including Milestones

Table 58. Summary of Safety Concerns and Action Plans

Safety Concerns	Ongoing/Planned Action	Summary of Objectives	Milestones	Due dates
Myocarditis and Pericarditis	C4591009: A non-interventional post-approval safety study of the Pfizer-BioNTech COVID-19 vaccine in the United States. *Planned*	To assess the occurrence of safety events of interest, including myocarditis and pericarditis, in the general US population of all ages, pregnant women, the immunocompromised and persons with a prior history of COVID-19 within selected data sources participating in the US Sentinel System	• Protocol submission: • Monitoring report submission: • Interim analysis submission: • Study completion: • Final study report submission:	• 31 August 2021 • 31 October 2022 • 31 October 2023 • 30 June 2025 • 31 October 2025
	C4591011: Active safety surveillance of the Pfizer-BioNTech COVID-19 Vaccine in the US Department of Defense population following Emergency Use Authorization *Planned*	To assess whether individuals in the US DoD Military Health System (MHS) experience increased risk of safety events of interest, including myocarditis and pericarditis, following receipt of the Pfizer-BioNTech COVID-19 Vaccine.	• Not applicable*	• Not applicable*
	C4591012: Post-emergency use authorization active safety surveillance study among individuals in the Veteran's Affairs Health System receiving Pfizer-BioNTech Coronavirus Disease 2019 (COVID-19) Vaccine. *Ongoing*	To assess whether individuals in the US Veteran's Affairs Health System experience increased risk of safety events of interest, including myocarditis and pericarditis, following receipt of the Pfizer-BioNTech COVID-19 Vaccine	• Protocol amendment submission: • Interim reports submission: • Study completion: • Final study report submission:	• 31 August 2021 • 31 December 2021 30 June 2022 31 December 2022 • 30 June 2023 • 31 December 2023
	C4591021: Post Conditional approval active surveillance study among individuals in Europe receiving the Pfizer	To assess the potential increased risk of adverse events of special interest (AESI), including myocarditis/pericarditis after	• Protocol submission • Progress report submission: • Interim analysis submission:	• 11 August 2021 • 30 September 2021 • 31 March 2022 30 September 2022

Table 58. Summary of Safety Concerns and Action Plans

Safety Concerns	Ongoing/Planned Action	Summary of Objectives	Milestones	Due dates
	BioNTech Coronavirus Disease 2019 (COVID-19) vaccine *Ongoing*	being vaccinated with COVID-19 vaccine.	• Study completion: • Final study report submission:	31 March 2023 30 September 2023 31 March 2024 • 31 March 2024 • 30 September 2024
	C4591038 (former, C4591021 substudy): Post Conditional approval active surveillance study among individuals in Europe receiving the Pfizer BioNTech Coronavirus Disease 2019 (COVID-19) vaccine. Substudy to investigate natural history of post-vaccination myocarditis and pericarditis. *Planned*	To describe the natural history of post-vaccination myocarditis/pericarditis, including recovery status, risk factors, and/or identification of serious cardiovascular outcomes within 1 year of myocarditis/pericarditis diagnosis among individuals vaccinated with BNT162b2 as well as individuals not vaccinated with a COVID-19 vaccine.	• Final protocol submission: • Study completion: • Final study report submission	• 31 January 2022 • 31 March 2024 • 30 September 2024.
	C4591036: Pediatric Heart Network Study: Low interventional cohort study of myocarditis/pericarditis associated with Comirnaty in persons less than 21 years of age *Planned*	To characterize the clinical course, risk factors, resolution, long-term sequelae, and quality of life in children and young adults <21 years with acute post-vaccine myocarditis/pericarditis.	• Protocol submission: • Study completion: • Final study report submission:	• 30 November 2021 • 31 December 2026 • 31 May 2027
	C4591031 substudy B: A randomized, placebo-controlled, observer-blind, cross-over substudy to evaluate the safety and tolerability of a booster (third) dose of BNT162b2. Participants ≥12 years of age to ≤30 years of age	To obtain serum samples within the first ~4 days after vaccination for potential Troponin I testing, in order to evaluate the frequency of subclinical myocarditis amongst individuals 12 to 30 years of age.	• Final protocol submission: • Study completion: • Final study report submission:	• 30 November 2021 • 30 June 2022 • 31 December 2022

Table 58. Summary of Safety Concerns and Action Plans

Safety Concerns	Ongoing/Planned Action	Summary of Objectives	Milestones	Due dates
	who have completed a 2-dose primary series of BNT162b2 (30 µg doses) at least 6 months (≥12 months for those 12-17 years of age) prior to randomization will be enrolled. *Planned*			
	C4591007 substudy – Troponin group: A Phase 3 substudy of 750 participants 5 to <12 years of age (randomized 2:1 to receive BNT162b2 10 µg or placebo) and 500 participants 12-<16 years of age (open label receipt of BNT162b2 30 µg). *Ongoing*	To obtain serum samples within the first ~4 days after vaccination for potential Troponin I testing, in order to evaluate the frequency of subclinical myocarditis amongst individuals 5 to <16 years of age.	• Final protocol submission: • Study completion: • Final study report submission:	• 30 September 2021 • 30 November 2023 • 31 May 2024
Anaphylaxis	C4591001: Phase 1/2/3, placebo-controlled, randomized, observer-blind, dose-finding study to evaluate the safety, tolerability, immunogenicity, and efficacy of SARS-CoV-2 RNA vaccine candidates against COVID-19 in healthy individuals. *Ongoing*	To evaluate the safety, tolerability, immunogenicity, and efficacy of BNT162b2. An unfavorable imbalance between the vaccine and control groups in the frequency of COVID-19 disease, in particular for severe COVID-19 disease, may indicate the occurrence of VAED/VAERD. Surveillance is planned for 2 years following Dose 2.	• CSR submission upon regulatory request: • Final CSR submission with supplemental follow-up:	• At any time • 31 August 2023
	C4591009: A non-interventional post-approval safety study of the Pfizer-BioNTech COVID-19 Vaccine in the United States.	To assess the occurrence of safety events of interest in the general US population of all ages, pregnant women, the immunocompromised and	• Protocol submission: • Monitoring report submission: • Interim analysis submission: • Study completion: • Final study report submission:	• 31 August 2021 • 31 October 2022 • 31 October 2023 • 30 June 2025 • 31 October 2025

Table 58. Summary of Safety Concerns and Action Plans

Safety Concerns	Ongoing/Planned Action	Summary of Objectives	Milestones	Due dates
	Planned	persons with a prior history of COVID-19 within selected data sources participating in the US Sentinel System.		
	C4591011: Active safety surveillance of the Pfizer-BioNTech COVID-19 Vaccine in the US Department of Defense population following Emergency Use Authorization. *Planned*	To assess whether individuals in the US DoD Military Health System (MHS) experience increased risk of safety events of interest, following receipt of the BNT162b2.	• Not applicable*	• Not applicable*
	C4591012: Post-emergency use authorization active safety surveillance study among individuals in the Veteran's Affairs Health System receiving Pfizer-BioNTech Coronavirus Disease 2019 (COVID-19) Vaccine. *Ongoing*	To assess whether individuals in the US Veteran's Affairs Health System experience increased risk of safety events of interest, following receipt of the BNT162b2.	• Protocol amendment submission: • Interim reports submission: • Study completion: • Final study report submission:	• 31 August 2021 • 31 December 2021 30 June 2022 31 December 2022 • 30 June 2023 • 31 December 2023
	C4591021: Post Conditional approval active surveillance study among individuals in Europe receiving the Pfizer BioNTech Coronavirus Disease 2019 (COVID-19) vaccine *Ongoing*	To assess the potential increased risk of adverse events of special interest (AESI), including anaphylaxis after being vaccinated with COVID 19 vaccine.	• Protocol submission: • Progress report submission: • Interim analysis submission: • Study completion: • Final study report submission:	• 11 August 2021 • 30 September 2021 • 31 March 2022 30 September 2022 31 March 2023 30 September 2023 31 March 2024 • 31 March 2024 • 30 September 2024

Table 58. Summary of Safety Concerns and Action Plans

Safety Concerns	Ongoing/Planned Action	Summary of Objectives	Milestones	Due dates
Vaccine-associated enhanced disease (VAED) including vaccine-associated enhanced respiratory disease (VAERD)	C4591001: Phase 1/2/3, placebo-controlled, randomized, observer-blind, dose-finding study to evaluate the safety, tolerability, immunogenicity, and efficacy of SARS-CoV-2 RNA vaccine candidates against COVID-19 in healthy individuals. *Ongoing*	To evaluate the safety, tolerability, immunogenicity, and efficacy of BNT162b2. An unfavorable imbalance between the vaccine and control groups in the frequency of COVID-19 disease, in particular for severe COVID-19 disease, may suggest the occurrence of VAED/VAERD. Surveillance is planned for 2 years following Dose 2	• CSR submission upon regulatory request: • Final CSR submission with supplemental follow-up:	• Any time • 31 August 2023
	C4591008 HERO Together: A post-Emergency Use Authorization observational cohort study to evaluate the safety of the Pfizer-BioNTech COVID-19 Vaccine in US healthcare workers, their families, and their communities. C4591008: *Ongoing*	To characterize the real-world incidence of safety events of interest, including events indicative of severe or atypical COVID-19 disease, among individuals vaccinated with the BNT162b2 since EUA	• Not applicable*	• Not applicable*
	C4591012: Post-emergency use authorization active safety surveillance study among individuals in the Veteran's Affairs Health System receiving Pfizer-BioNTech Coronavirus Disease 2019 (COVID-19) vaccine. *Ongoing*	To characterize the real-world incidence of safety events of interest, including events indicative of severe or atypical COVID-19 disease, among individuals vaccinated with the BNT162b2 since EUA	• Protocol amendment submission: • Interim reports submission: • Study completion: • Final study report submission:	• 31 August 2021 • 31 December 2021 30 June 2022 31 December 2022 • 30 June 2023 • 31 December 2023

Table 58. Summary of Safety Concerns and Action Plans

Safety Concerns	Ongoing/Planned Action	Summary of Objectives	Milestones	Due dates
	C4591011: Active safety surveillance of the Pfizer-BioNTech COVID-19 Vaccine in the US Department of Defense population following Emergency Use Authorization *Planned*	To characterize the real-world incidence of safety events of interest, including events indicative of severe or atypical COVID-19 disease, among individuals vaccinated with the BNT162b2 since EUA	• Not applicable*	• Not applicable*
	C4591009: A non-interventional post-approval safety study of the Pfizer-BioNTech COVID-19 Vaccine in the United States *Planned*	To characterize the real-world incidence of safety events of interest, including events indicative of severe or atypical COVID-19 disease, among individuals vaccinated with the BNT162b2 since EUA	• Protocol submission: • Monitoring report submission: • Interim analysis submission: • Study completion • Final study report submission:	• 31 August 2021 • 31 October 2022 • 31 October 2023 • 30 June 2025 • 31 October 2025
	C4591021: Post Conditional approval active surveillance study among individuals in Europe receiving the Pfizer BioNTech Coronavirus Disease 2019 (COVID-19) vaccine *Ongoing*	To characterize the real-world incidence of safety events of interest, including events indicative of severe or atypical COVID-19 disease, among individuals vaccinated with the BNT162b2 since EUA.	• Protocol submission • Progress report submission: • Interim analysis submission: • Study completion • Final study report submission:	• 11 August 2021 • 30 September 2021 • 31 March 2022 30 September 2022 31 March 2023 30 September 2023 31 March 2024 • 31 March 2024 • 30 September 2024

Table 58. Summary of Safety Concerns and Action Plans

Safety Concerns	Ongoing/Planned Action	Summary of Objectives	Milestones	Due dates
Use in pregnancy and lactation	C4591015: A phase 2/3, placebo-controlled, randomized, observer-blind study to evaluate the safety, tolerability, and immunogenicity of a SARS-CoV-2 RNA vaccine candidate (BNT162b2) against COVID-19 in healthy pregnant women 18 years of age and older. *Ongoing*	To assess safety and immunogenicity of BNT162b2 in pregnant women. Exploratory objectives include: To describe the immune response in infants born to breastfeeding maternal participants vaccinated with prophylactic BNT162b2 during pregnancy. To describe the safety of maternal immunization in infants born to breastfeeding maternal participants vaccinated with prophylactic BNT162b2 during pregnancy.	• Study completion[a]: • Final study report submission:	• 31 August 2022 • 31 March 2023
	C4591011: Active safety surveillance of the Pfizer-BioNTech COVID-19 Vaccine in the United States Department of Defense population following Emergency Use Authorization *Planned*	To assess whether sub-cohorts of interest, such as pregnant women, in the MHS experience increased risk of safety events of interest following receipt of the BNT162b2.	• Not applicable*	• Not applicable*
	C4591009: A non-interventional post-approval safety study of the Pfizer-BioNTech COVID-19 Vaccine in the United States. *Planned*	To assess whether pregnant women, experience increased risk of safety events of interest following receipt of the BNT162b2.	• Protocol submission: • Monitoring report submission: • Interim analysis submission: • Study completion: • Final study report submission:	• 31 August 2021 • 31 October 2022 • 31 October 2023 • 30 June 2025 • 31 October 2025

Table 58. Summary of Safety Concerns and Action Plans

Safety Concerns	Ongoing/Planned Action	Summary of Objectives	Milestones	Due dates
	C4591021: Post Conditional approval active surveillance study among individuals in Europe receiving the Pfizer BioNTech Coronavirus Disease 2019 (COVID-19) vaccine *Ongoing*	To assess whether pregnant women experience increased risk of safety events of interest following receipt of the BNT162b2.	• Protocol submission: • Progress report submission: • Interim analysis submission: • Study completion: • Final study report submission:	• 11 August 2021 • 30 September 2021 • 31 March 2022 • 30 September 2022 • 31 March 2023 • 30 September 2023 • 31 March 2024 • 31 March 2024 • 30 September 2024
	C4591022: Pfizer-BioNTech COVID-19 Vaccine exposure during pregnancy: A non-interventional post-approval safety study of pregnancy and infant outcomes in the Organization of Teratology Information Specialists (OTIS)/MotherToBaby Pregnancy Registry *Ongoing*	To assess whether pregnant women receiving BNT162b2 experience increased risk of pregnancy and infant safety outcomes, including major congenital malformations, spontaneous abortion, stillbirth, preterm delivery, small for gestational age, and small for age postnatal growth to one year of age.	• Interim reports submission: • Study completion: • Final study report submission:	• 31 January 2022 31 January 2023 31 January 2024 31 January 2025 • 30 June 2025 • 31 December 2025
Vaccine effectiveness	C4591014: Pfizer-BioNTech COVID-19 BNT162b2 Vaccine Effectiveness Study - Kaiser Permanente Southern California. *Ongoing*	To estimate the effectiveness of 2 doses of BNT162b2 against hospitalization and emergency department admission for acute respiratory illness due to SARS-CoV-2 infection.	• Study completion: • Final CSR submission:	• 31 December 2022 • 30 June 2023

Table 58. Summary of Safety Concerns and Action Plans

Safety Concerns	Ongoing/Planned Action	Summary of Objectives	Milestones	Due dates
Vaccine effectiveness *(Cont'd)*	WI235284: Determining RSV Burden and Outcomes in Pregnant Women and Older Adults Requiring Hospitalization. Amendment for COVID VE/ Sub-study 6. *Ongoing*	To estimate the effectiveness of 2 dosed of BNT162b2 against hospitalization for acute respiratory illness due to SARS-CoV-2 infection.	• Final CSR submission:	• 30 June 2023
	WI255886: Avon Community Acquired Pneumonia Surveillance Study: A Pan-pandemic Acute Lower Respiratory Tract Disease Surveillance Study. *Ongoing*	To estimate the effectiveness of 2 doses of BNT162b2 against hospitalization for acute respiratory illness due to SARS-CoV-2 infection.	• Final CSR submission:	• 30 June 2023
	BNT162-01 cohort 13: Immunogenicity of Pfizer-BioNTech COVID-19 Vaccine in immunocompromised subjects, including assessment of antibody responses and cell-mediated responses. *Ongoing*	To assess potentially protective immune responses in immunocompromised adults.	• First IA submission:	• 30 September 2021

Table 58. Summary of Safety Concerns and Action Plans

Safety Concerns	Ongoing/Planned Action	Summary of Objectives	Milestones	Due dates
	C4591007 substudy – Lower dose evaluation group: To study lower dose levels of BNT162b2 in individuals 12 through <18 years of age. *Planned*	To evaluate the immunogenicity and safety of lower dose levels of BNT162b2 in individuals 12 through <18 years of age	• Final protocol submission: • Study completion: • Final report submission:	• 30 September 2021 • 30 November 2023 • 31 May 2024
Use in pediatric individuals <5 years of age	C4591001 ≥12 to ≤15 years of age: Phase 1/2/3, placebo-controlled, randomized, observer-blind, dose-finding study to evaluate the safety, tolerability, immunogenicity, and efficacy of SARS-CoV-2 RNA vaccine candidates against COVID-19 in healthy individuals[b]. *Ongoing*	Safety compared to placebo and immune-non-inferiority of neutralizing antibody immune response compared to subjects 16-25 years of age.	• Report 6-month post dose 2 (safety): • Report 24-month post dose 2 (safety): • Study completion: • Final report submission:	• 31 December 2021[c] • 30 April 2023[d] • 31 May 2023 • 31 October 2023
	C4591007 Lower dose evaluation group: Phase 1 open label dose-finding study to evaluate safety, tolerability, and immunogenicity and phase 2/3 placebo-controlled, observer blinded safety, tolerability, and immunogenicity, study of a SARS-CoV-2 RNA vaccine candidate against COVID-19 in healthy children <12 years of age. *Planned*	Immunobridging analysis of immune responses in participants within each age group (participants ≥5 to <12 years, ≥2 to <5 years, and ≥6 months to <2 years of age) to those in participants 16 to 25 years of age in the Phase 3 C4591001 efficacy study. Efficacy if sufficient cases accrue.	• First report with up to 1-month post dose 2 (safety) in ≥5 to <12 years of age: • Report 6-month post dose 2 (safety) in ≥5 to <12 years of age: • Report 24-month post dose 2 (safety) in ≥5 to <12 years of age: • Study completion date: • Final Report Submission:	• 30 September 2021 • 31 March 2022 • 30 September 2023 • 30 November 2023 • 31 May 2024

Table 58. Summary of Safety Concerns and Action Plans

Safety Concerns	Ongoing/Planned Action	Summary of Objectives	Milestones	Due dates
	C4591007 substudy – Troponin group: A Phase 3 substudy to evaluate subclinical myocarditis in participants 5 to <12 years of age (randomized 2:1 to receive BNT162b2 10 µg or placebo) and 12-<16 years of age (open label receipt of BNT162b2 30 µg). *Ongoing*	To obtain serum samples within the first ~4 days after vaccination for potential Troponin I testing, in order to evaluate the frequency of subclinical myocarditis amongst individuals 5 to <16 years of age.	• Final protocol submission: • Study completion: • Final report submission:	• 30 September 2021 • 30 November 2023 • 31 May 2024
	C4591009: A non-interventional post-approval safety study of the Pfizer-BioNTech COVID-19 vaccine in the United States. *Planned*	To assess the occurrence of safety events of interest, including myocarditis and pericarditis in the general US population (including use in persons <12 years administered vaccine) within selected broad population-based data sources participating in the US sentinel system.	• Protocol submission: • Monitoring report submission: • Interim analysis submission: • Study completion: • Final study report submission:	• 31 August 2021 • 31 October 2022 • 31 October 2023 • 30 June 2025 • 31 October 2025
	C4591021: Post Conditional approval active surveillance study among individuals in Europe receiving the Pfizer BioNTech Coronavirus Disease 2019 (COVID-19) vaccine *Ongoing*	To assess the potential increased risk of Adverse Events of Special Interest (AESI), including myocarditis/pericarditis after being vaccinated with COVID-19 vaccine	• Protocol submission • Progress report submission: • Interim analysis submission: • Study completion: • Final study report submission:	• 11 August 2021 • 30 September 2021 • 31 March 2022 • 30 September 2022 • 31 March 2023 • 30 September 2023 • 31 March 2024 • 31 March 2024 • 30 September 2024
	C4591038 (former, C4591021 substudy: Post Conditional approval active surveillance study among individuals in	To describe the natural history of post-vaccination myocarditis/pericarditis, including recovery status, risk	• Final protocol submission: • Study completion: • Final study report submission:	• 31 January 2022 • 31 March 2024 • 30 September 2024

Table 58. Summary of Safety Concerns and Action Plans

Safety Concerns	Ongoing/Planned Action	Summary of Objectives	Milestones	Due dates
	Europe receiving the Pfizer-BioNTech Coronavirus Disease 2019 (COVID-19) vaccine. Substudy to investigate natural history of post-vaccination myocarditis and pericarditis. *Planned*	factors, and/or identification of serious cardiovascular outcomes within 1 year of myocarditis/pericarditis diagnosis among individuals vaccinated with BNT162b2 including any use in <12 year-old as well as individuals not vaccinated with a COVID-19 vaccine.		
	C4591023: Phase 1 open label dose-finding study to evaluate safety, tolerability, and immunogenicity and phase 2/3 placebo-controlled, observer-blinded safety, tolerability, and immunogenicity study of a SARS-CoV-2 mRNA vaccine candidate against COVID-19 in healthy infants <6 months of age. Phase 1: open-label dose finding portion up to 3 dose levels with 16 participants per dose level. Phase 2/3: Children ≥5 to <12 years of age are randomized 2:1 at selected dose level of BNT162b2 at a 21-day interval. Design and subject numbers to be confirmed. *Planned*	To evaluate safety, tolerability, and immunogenicity of a SARS-CoV-2 RNA vaccine candidate against COVID-19 in healthy infants < 6 months of age.	• Final protocol submission: • Study completion: • Final study report submission:	• 31 January 2022 • 31 July 2024 • 31 October 2024

Table 58. Summary of Safety Concerns and Action Plans

Safety Concerns	Ongoing/Planned Action	Summary of Objectives	Milestones	Due dates
	C4591036: Pediatric Heart Network Study: Low interventional cohort study of myocarditis/pericarditis associated with Comirnaty in persons less than 21 years of age. *Planned*	To characterize the clinical course, risk factors, resolution, long-term sequelae, and quality of life in children and young adults <21 years, including any use in < 12-year old, with acute post-vaccine myocarditis/pericarditis.	• Protocol submission: • Study completion: • Final study report submission:	• 30 November 2021 • 31 December 2026 • 31 May 2027

a. Enrolment of participants into study C4591015 was stopped due to recruitment challenges as a result of global recommendations for COVID-19 vaccination in pregnant women and the increased availability of COVID-19 vaccines. Enrolment of new participants was stopped on 25 October 2021. Participants already enrolled will continue follow up evaluations until study end as planned. For this reason, study completion date was changed from 31 October 2022 to 31 August 2022 and final study report submission date was changed from 31 May 2023 to 31 March 2023".
b. Study originally included in the PVP to address the Missing Information "Use in pediatric individuals < 16 years of age".
c. Due date updated from 31 October 2021 to 31 December 2021 to implement additional CBER requests (received on 24 September 2021) for the 12 to ≤15 years sBLA (FDA already informed of this change on 22 October 2021).
d. Due date updated from 31 January 2023 for the same reason above.
* Milestones deleted as this a voluntary sponsor study (as per FDA Information Request received to BLA 125742/0, dated 13 August 2021, where the FDA characterized both studies as "voluntary" and therefore no longer commitment).

ANNEX

3.2. Pharmacovigilance Methods

- BNT162b2 Vaccine: BNT162b2 Data Capture Aids:
    - Pfizer-BioNTech COVID-19 Vaccine VAED Data Capture Aid.
    - Pfizer-BioNTech COVID-19 Vaccine Anaphylactic Reaction Data Capture Aid.

3.2.1. List of Studies Included in the Pharmacovigilance Plan

C4591001

C4591007

C4591007 substudy (Troponin group)

C4591007 substudy (Lower dose evaluation group)

C4591008

C4591009

C4591011

C4591012

C4591014

C4591015

C4591021

C4591038 (former, C4591021 substudy

C4591022

C4591023

C4591031 substudy B

BNT162-01 cohort 13

WI235284

WI255886

C4591036

REFERENCES

1 Lambert PH, Ambrosino DM, Andersen SR, et al. Consensus summary report for CEPI/BC March 12–13, 2020 meeting: Assessment of risk of disease enhancement with COVID-19 vaccines. Vaccine 2020;38(31):4783-4791.

2 Singh DK, Ganatra SR, Singh B, et al. SARS-CoV-2 infection leads to acute infection with dynamic cellular and inflammatory flux in the lung that varies across nonhuman primate species. bioRxiv 2020:06.05.136481.

3 World Health Organization. Annex 1. WHO guidelines on nonclinical evaluation of vaccines. In: World Health Organization. WHO technical report series, no. 927. Geneva, Switzerland; World Health Organization; 2005:31-63.

4 Kozauer NA, Dunn WH, Unger EF, et al. CBER multi-discipline review of Onpattro. NDA 210922. 10 Aug 2018. NDA 210922 Patisiran Cross-Discipline Team Leader Review. (Center for Drug Evaluation and Research, Food and Drug Administration, https://www.accessdata.fda.gov/drugsatfda_docs/nda/2018/210922Orig1s000MultiR.pdf

5 Sedic M, Senn JJ, Lynn A, et al. Safety evaluation of lipid nanoparticle-formulated modified mRNA in the Sprague-Dawley rat and cynomolgus monkey. Vet Pathol 2018;55(2)(03):341-54.

6 Haynes BF, Corey L, Fernandes P, et al. Prospects for a safe COVID-19 vaccine. Sci Transl Med 2020;12(568):eabe0948.

7 Openshaw PJ, Culley FJ, Olszewska W. Immunopathogenesis of vaccine-enhanced RSV disease. Vaccine 2001;20(Suppl 1):S27-31.

8 Graham BS. Rapid COVID-19 vaccine development. Science 2020;368(6494):945-6.

9 Munoz FM, Cramer JP, Dekker CL. Vaccine-associated enhanced disease: case definition and guidelines for data collection, analysis, and presentation of immunization safety data. 19 October 2020. https://brightoncollaboration.us/vaed/

10 Sahin U, Muik A, Derhovanessian E, et al. Concurrent human antibody and TH1 type T-cell responses elicited by a COVID-19 RNA vaccine. medRxiv 2020.07.17.20140533.

11 Vogel AB, Kanevsky I, Che Ye, et al. A prefusion SARS-CoV-2 spike RNA vaccine is highly immunogenic and prevents lung infection in non-human primates. bioRxiv 2020.09.08.280818.

12 Zhu N, Zhang D, Wang W, et al. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med 2020;382(8):727-33.

[13] World Health Organization. 2020. Coronavirus Disease 2019 (COVID-19) Situation Report – 11.

[14] Worldometers.info 2021a. About. https://www.worldometers.info/about/. Accessed August 24, 2021.

[15] Worldometers.info 2021c. Reported Cases and Deaths by Country or Territory. https://www.worldometers.info/coronavirus/#countrieshttps://www.worldometers.info/coronavirus/#countries. Accessed August 15, 2021.

[16] Worldometers.info 2021b. Reported Cases and Deaths by Country or Territory. https://www.worldometers.info/coronavirus/#countrieshttps://www.worldometers.info/coronavirus/#countries. Accessed March 3, 2021.

[17] Worldometers.info 2021d. Worldometer COVID-19 Data. https://www.worldometers.info/coronavirus/about/. Accessed August 24, 2021.

[18] ECDC 2021a. COVID-19 Surveillance report. Week 31, 2021. 12 August 2021. "4 TESSy data quality. 4.2 Variable completeness". https://COVID19-surveillance-report.ecdc.europa.eu. Accessed on 15 August 2021.

[19] ECDC 2021b. COVID-19 Surveillance report. Week 31, 2021. 12 August 2021 (b). "2 Severity. 2.2 Age-sex pyramids". https://COVID19-surveillance-report.ecdc.europa.eu. Accessed on 15 August 2021.

[20] CDC 2021a. "COVID Data Tracker." https://covid.cdc.gov/covid-data-tracker/#demographics. Accessed on 15 August 2021.

[21] Leidman E, Duca LM, Omura JD, et al. COVID-19 Trends Among Persons Aged 0-24 Years - United States, March 1-December 12, 2020. MMWR Morb Mortal Wkly Rep 2021; 70(3):88-94.

[22] Cummings MJ, Baldwin MR, Abrams D, et al. Epidemiology, clinical course, and outcomes of critically ill adults with COVID-19 in New York City: a prospective cohort study. Lancet 2020;395(10239):1763-70.

[23] Price-Haywood EG, Burton J, Fort D, et al. Hospitalization and mortality among black patients and white patients with COVID-19. N Engl J Med 2020;382(26):2534-43.

[24] Petrilli CM, Jones SA, Yang J, et al. Factors associated with hospital admission and critical illness among 5279 people with coronavirus disease 2019 in New York City: prospective cohort study. BMJ 2020;369:m1966.

[25] Argenziano MG, Bruce SL, Slater CL, et al. Characterization and clinical course of 1000 patients with coronavirus disease 2019 in New York: retrospective case series. BMJ 2020;369:m1996.

[26] Richardson S, Hirsch JS, Narasimhan M, et al. Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York city area. JAMA 2020;323(20):2052-9.

[27] Azar KMJ, Shen Z, Romanelli RJ, et al. Disparities in outcomes among COVID-19 patients in a large health care system in California. Health Aff (Millwood) 2020;39(7):1253-62.

[28] Holmes L Jr, Enwere M, Williams J, et al. Black-white risk differentials in COVID-19 (SARS-COV2) transmission, mortality and case fatality in the United States: translational epidemiologic perspective and challenges. Int J Environ Res Public Health 2020;17(12):4322.

[29] Gold JAW, Rossen LM, Ahmad FB, et al. Race, ethnicity, and age trends in persons who died from COVID-19 - United States, May-August 2020. MMWR Morb Mortal Wkly Rep 2020; 69(42):1517-21.

[30] Rossen LM, Branum AM, Ahmad FB, Sutton PD, Anderson RN. Notes from the Field: Update on Excess Deaths Associated with the COVID-19 Pandemic - United States, January 26, 2020-February 27, 2021. MMWR Morbidity and mortality weekly report. 2021;70(15):570-571.

[31] Havers FP, Whitaker M, Self JL, et al. Hospitalization of Adolescents Aged 12-17 Years with Laboratory-Confirmed COVID-19 - COVID-NET, 14 States, March 1, 2020-April 24, 2021. MMWR Morbidity and mortality weekly report. 2021;70(23):851-857.

[32] Van Dyke ME, Mendoza MCB, Li W, et al. Racial and Ethnic Disparities in COVID-19 Incidence by Age, Sex, and Period Among Persons Aged <25 Years - 16 U.S. Jurisdictions, January 1-December 31, 2020. MMWR Morbidity and mortality weekly report. 2021;70(11):382-388.

[33] Bailey LC, Razzaghi H, Burrows EK, et al. Assessment of 135 794 Pediatric Patients Tested for Severe Acute Respiratory Syndrome Coronavirus 2 Across the United States. JAMA pediatrics. 2021;175(2):176-184.

[34] Preston LE, Chevinsky JR, Kompaniyets L, et al. Characteristics and Disease Severity of US Children and Adolescents Diagnosed With COVID-19. JAMA network open. 2021;4(4):e215298.

[35] Bouffanais R, Lim SS. Cities - try to predict superspreading hotspots for COVID-19. Nature 2020; 583(7816):352-5.

[36] Hawkins D. Differential occupational risk for COVID-19 and other infection exposure according to race and ethnicity. Am J Ind Med 2020; 63(9):817-20.

[37] Siebach MK, Piedimonte G, Ley SH. COVID-19 in childhood: Transmission, clinical presentation, complications and risk factors. Pediatr Pulmonol. 2021;56(6):1342-1356. doi:10.1002/ppul.25344.

[38] CDC 2021d. Risk for COVID-19 Infection, Hospitalization, and Death By Age Group. https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-age.html. Published 2021. Accessed August 15, 2021.

[39] CDC 2021e. Risk for COVID-19 Infection, Hospitalization, and Death By Race/Ethnicity. https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-race-ethnicity.html. Published 2021. Accessed August 15, 2021.

[40] Dai CL, Kornilov SA, Roper RT, et al. Characteristics and Factors Associated with COVID-19 Infection, Hospitalization, and Mortality Across Race and Ethnicity. Clin Infect Dis. 2021:ciab154. https://doi.org/10.1093/cid/ciab154.

[41] Booth A, Reed AB, Ponzo S, et al. Population risk factors for severe disease and mortality in COVID-19: A global systematic review and meta-analysis. PLoS One 2021; 16(3):e0247461. doi:10.1101/2020.12.21.20248610.

[42] Izcovich A, Ragusa MA, Tortosa F, et al. Prognostic factors for severity and mortality in patients infected with COVID-19: A systematic review. PLoS One. 2020;15(11):e0241955. doi:10.1371/journal.pone.0241955.

[43] Williamson E, Walker AJ, Bhaskaran K, et al. Factors associated with COVID-19-related death using Open SAFELY. Nature 2020; 584:430-43.

[44] Patel NA. Pediatric COVID-19 : Systematic review of the literature. Am J Otolaryngol. 2020;41:102573.

[45] Ludvigsson JF. Systematic review of COVID-19 in children shows milder cases and a better prognosis than adults. Acta Paediatr Int J Paediatr. 2020;109(6):1088-1095. doi:10.1111/apa.15270.

[46] Bhaskaran K, Bacon S, Evans SJ, et al. Factors associated with deaths due to COVID-19 versus other causes: population-based cohort analysis of UK primary care data and linked national death registrations within the OpenSAFELY platform. Lancet Reg Heal - Eur. 2021;6:100109. doi:10.1016/j.lanepe.2021.100109.

[47] CDC 2021b. Different Groups of People. https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/index.html. Published 2021. Accessed August 16, 2021.

[48] CDC 2021c. People with Certain Medical Conditions. https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html. Published 2021. Accessed August 16, 2021

[49] Graff K, Smith C, Silveira L, et al. Risk Factors for Severe COVID-19 in Children. Pediatr Infect Dis J. 2021;40(4):E137-E145. doi:10.1097/INF.0000000000003043.

[50] Moreira A, Chorath K, Rajasekaran K, et al. Demographic predictors of hospitalization and mortality in US children with COVID-19. Eur J Pediatr. 2021;180(5):1659-1663. doi:10.1007/s00431-021-03955-x.

[51] Tsankov BK, Allaire JM, Irvine MA, et al. Severe COVID-19 Infection and Pediatric Comorbidities: A Systematic Review and Meta-Analysis. Int J Infect Dis. 2021;103:246-256. doi:10.1016/j.ijid.2020.11.163.

[52] Kompaniyets L, Agathis NT, Nelson JM, et al. Underlying Medical Conditions Associated with Severe COVID-19 Illness among Children. JAMA Netw Open. 2021;4(6):1-14. doi:10.1001/jamanetworkopen.2021.11182.

[53] Zachariah P, Johnson CL, Halabi KC, et al. Epidemiology, Clinical Features, and Disease Severity in Patients with Coronavirus Disease 2019 (COVID-19) in a Children's Hospital in New York City, New York. JAMA Pediatr. 2020;174(10). doi:10.1001/jamapediatrics.2020.2430.

[54] Swann O V., Holden KA, Turtle L, et al. Clinical characteristics of children and young people admitted to hospital with covid-19 in United Kingdom: Prospective multicentre observational cohort study. BMJ. 2020;370. doi:10.1136/bmj.m3249.

[55] Pollock A M, Lancaster J. Asymptomatic transmission of COVID-19. BMJ 2020; 371:m4851 doi:10.1136/bmj.m4851.

[56] Toba N, Gupta S, Ali AY, et al. COVID-19 under 19: A meta-analysis. Pediatr Pulmonol 2021 Feb 25. doi: 10.1002/ppul.25312. Epub ahead of print. PMID: 33631060.

[57] Oran DP, Topol EJ. The Proportion of SARS-CoV-2 Infections That Are Asymptomatic: A Systematic Review. Ann Intern Med. 2021 May;174(5):655-662. doi: 10.7326/M20-6976. Epub 2021 Jan 22. PMID: 33481642; PMCID: PMC7839426.

[58] Sah P, Fitzpatrick MC, Zimmer CF, Abdollahi E, Juden-Kelly L, Moghadas SM, Singer BH, Galvani AP. Asymptomatic SARS-CoV-2 infection: A systematic review and

meta-analysis. Proc Natl Acad Sci U S A. 2021 Aug 24;118(34):e2109229118. doi: 10.1073/pnas.2109229118. PMID: 34376550.

59 CDC COVID-19 Response Team. Coronavirus Disease 2019 in Children - United States, February 12-April 2, 2020. MMWR Morb Mortal Wkly Rep 2020 Apr 10;69(14):422-426. doi: 10.15585/mmwr.mm6914e4. PMID: 32271728; PMCID: PMC7147903.

60 Yasuhara J, Watanabe K, Takagi H, Sumitomo N, Kuno T. COVID-19 and multisystem inflammatory syndrome in children: A systematic review and meta-analysis. Pediatr Pulmonol. 2021;56(5):837-848. doi: 10.1002/ppul.25245. Epub 2021 Jan 11. PMID: 33428826; PMCID: PMC8013394.

61 CDC Interim Clinical Guidance for Management of Patients with Confirmed Coronavirus Disease (COVID-19). https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-guidance-management-patients.html. Accessed on 07 March 2021.

62 Gandhi RT, Lynch JB, Del Rio C. Mild or moderate Covid-19. N Engl J Med 2020; 383(18):1757-1766. doi: 10.1056/NEJMcp2009249. Epub 2020 Apr 24. PMID: 32329974.

63 CDC 2021i. COVID Data Tracker New Hospital Admissions. https://covid.cdc.gov/covid-data-tracker/#new-hospital-admissions. Accessed 07 September 2021.

64 ECDC 2021e. Situation Report Week 34 Individual Indicators. https://covid19-surveillance-report.ecdc.europa.eu/#individual-indicators-week-34. Accessed 7 September 2021.

65 American Academy of Pediatrics 2021. Children and COVID-19: State-Level Data Report. https://www.aap.org/en/pages/2019-novel-coronavirus-covid-19-infections/children-and-covid-19-state-level-data-report/. Accessed 24 August 2021.

66 Hur K, Price CPE, Gray EL, et al. Factors associated with intubation and prolonged intubation in hospitalized patients with COVID-19. [published correction appears in Otolaryngol Head Neck Surg. 2020 Jul;163(1):NP1]. Otolaryngol Head Neck Surg 2020;163(1):170-8.

67 Burke RM, Killerby ME, Newton S, et al. Case Investigation Form Working Group. Symptom profiles of a convenience sample of patients with COVID-19 - United States, January-April 2020. MMWR Morb Mortal Wkly Rep 2020; 69(28):904-8. doi: 10.15585/mmwr.mm6928a2. PMID: 32673296; PMCID: PMC7366851.

[68] Gold JAW, Wong KK, Szablewski CM, et al. Characteristics and clinical outcomes of adult patients hospitalized with COVID-19 - Georgia, March 2020. MMWR Morb Mortal Wkly Rep 2020;69(18):545-50.

[69] Nowak B, Szymański P, Pańkowski I, et al. Clinical characteristics and short-term outcomes of patients with coronavirus disease 2019: a retrospective single-center experience of a designated hospital in Poland. Pol Arch Intern Med 2020;130(5):407-11.

[70] Tong JY, Wong A, Zhu D, Fastenberg JH, Tham T. The Prevalence of Olfactory and Gustatory Dysfunction in COVID-19 Patients: A Systematic Review and Meta-analysis. Otolaryngol Head Neck Surg. 2020 Jul;163(1):3-11. doi: 10.1177/0194599820926473. Epub 2020 May 5. PMID: 32369429.

[71] Iaccarino, G, Grassi G, Borghi C, et al. Age and multimorbidity predict death among COVID-19 Patients: Results of the SARS-RAS Study of the Italian Society of Hypertension. Hypertension 2020;76(2):366-72.

[72] ECDC. Weekly Surveillance Summary, Week 08, 2021. https://covid19-surveillance-report.ecdc.europa.eu/. Accessed on 07 March 2021.

[73] CDC 2021f. COVID Data Tracker as of 17Aug2021. https://covid.cdc.gov/covid-data-tracker/#datatracker-home. Accessed on 17 August 2021.

[74] ECDC 2021d. Situation Report. https://www.ecdc.europa.eu/en/cases-2019-ncov-eueea. Accessed on 17 August 2021.

[75] JHU COVID Map 2021. https://coronavirus.jhu.edu/map.html. Accessed on 17 August 2021.

[76] Odd D, Stoianova S, Williams T, *et al.* Child mortality in England during the COVID-19 pandemic. *Archives of Disease in Childhood* Published Online First: 21 June 2021. doi: 10.1136/archdischild-2020-320899.

[77] Jones S, Mason N, Palser T, et al. Trends in risk-adjusted 28-day mortality rates for patients hospitalized with COVID-19 in England. J Hosp Med. Published Online First February 5, 2021. DOI: 10.12788/jhm.3599

[78] Rao GG, Allen A, Papineni P, et al. London North West Healthcare Trust COVID-19 Research Group. Cross-sectional observational study of epidemiology of COVID-19 and clinical outcomes of hospitalised patients in North West London during March and April 2020. BMJ Open 2021;11(2):e044384. doi: 10.1136/bmjopen-2020-044384. PMID: 33602712; PMCID: PMC7896375.

[79] Horwitz LI, Jones SA, Cerfolio RJ, et al. Trends in COVID-19 risk-adjusted mortality rates. J Hosp Med 2021;2;90-2. Published Online First October 23, 2020. doi:10.12788/jhm.3552

[80] Wiersinga WJ, Rhodes A, Cheng AC, et al. Pathophysiology, transmission, diagnosis, and treatment of coronavirus disease 2019 (COVID-19): A Review. JAMA 2020;324(8):782-93.

[81] Malas MB, Naazie IN, Elsayed N, et al. Thromboembolism risk of COVID-19 is high and associated with a higher risk of mortality: A systematic review and meta-analysis. EClinicalMedicine 2020;29:100639. doi: 10.1016/j.eclinm.2020.100639. Epub 2020 Nov 20. PMID: 33251499; PMCID: PMC7679115.

[82] Carfì A, Bernabei R, Landi F. Gemelli Against COVID-19 Post-Acute Care Study Group. Persistent Symptoms in Patients After Acute COVID-19. JAMA 2020;324(6):603-5. doi: 10.1001/jama.2020.12603. PMID: 32644129; PMCID: PMC7349096.

[83] Greenhalgh T, Knight M, A'Court C, et al. Management of post-acute COVID-19 in primary care. BMJ 2020;370:m3026. doi: 10.1136/bmj.m3026. PMID: 32784198.

[84] NICE (National Institute for Health and Care Excellence). https://www.nice.org.uk/guidance/ng188/chapter/context#post-covid-19-syndrome. Accessed on 04 April 2021.

[85] Willi S, Lüthold R, Hunt A, e al. COVID-19 sequelae in adults aged less than 50 years: A systematic review. Travel Med Infect Dis 2021;40:101995. doi: 10.1016/j.tmaid.2021.101995. Epub ahead of print. PMID: 33631340; PMCID: PMC7898978.

[86] Say D, Crawford N, McNab S, Wurzel D, Steer A, Tosif S. Post-acute COVID-19 outcomes in children with mild and asymptomatic disease. Lancet Child Adolesc Health. 2021;5(6):e22-e23. doi:10.1016/S2352-4642(21)00124-3.

[87] Feldstein LR, Tenforde MW, Friedman KG, et al. Overcoming COVID-19 Investigators. Characteristics and outcomes of US children and adolescents with multisystem inflammatory syndrome in children (MIS-C) compared with severe acute COVID-19. JAMA 2021; 325(11):1074-1087. doi: 10.1001/jama.2021.2091. PMID: 33625505; PMCID: PMC7905703.

[88] Kelly MS, Fernandes ND, Carr AV, et al. Distinguishing features of patients evaluated for multisystem inflammatory syndrome in children. Pediatr Emerg Care 2021;37(3):179-184. doi: 10.1097/PEC.0000000000002344. PMID: 33651762.

[89] CDC 2021g. COVID Data Tracker Multi-system Inflammatory Syndrome. https://covid.cdc.gov/covid-data-tracker/#mis-national-surveillance. Accessed 24 August 2021.

[90] CDC 2021h. For Parents: Multisystem Inflammatory Syndrome in Children (MIS-C) associated with COVID-19. https://www.cdc.gov/mis/mis-c.html. Accessed 24 August 2021.

[91] ECDC 2021c. COVID-19 Surveillance report. Week 31, 2021. 12 August 2021 (b). "3 Risk groups most affected. 3.1 Preconditions: frequency distribution by severity". https://COVID19-surveillance-report.ecdc.europa.eu. Accessed on 15 August 2021.

[92] Iavarone C, O'hagan DT, Yu D, et al. Mechanism of action of RNA-based vaccines. Expert Rev Vaccines 2017; 16(9):871-81.

[93] Pardi N, Hogan MJ, Porter FW, et al. mRNA vaccines – a new era in vaccinology. Nat Rev Drug Discov 2018;17(4):261-79.

[94] https://www.bestinitiative.org/wp-content/uploads/2021/02/C19-Vaccine-Safety-Protocol-2021.pdf.

[95] https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2021-02/28-03-01/05-covid-Shimabukuro.pdf