

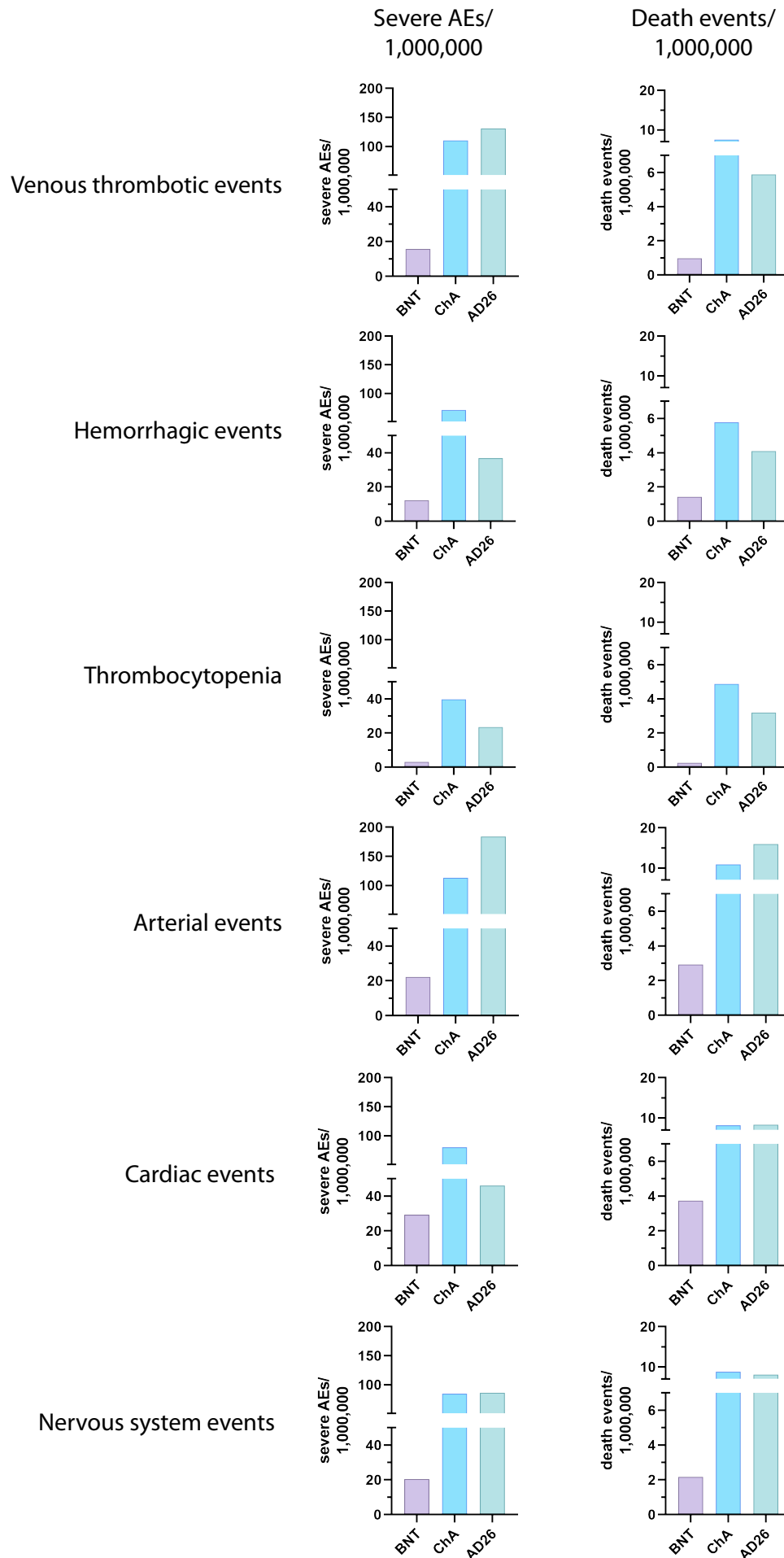
Cardiovascular, neurological, and pulmonary events following vaccination with the BNT162b2, ChAdOx1 nCoV-19, and Ad26.COV2.S vaccines: An analysis of European data

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Supplemental Material

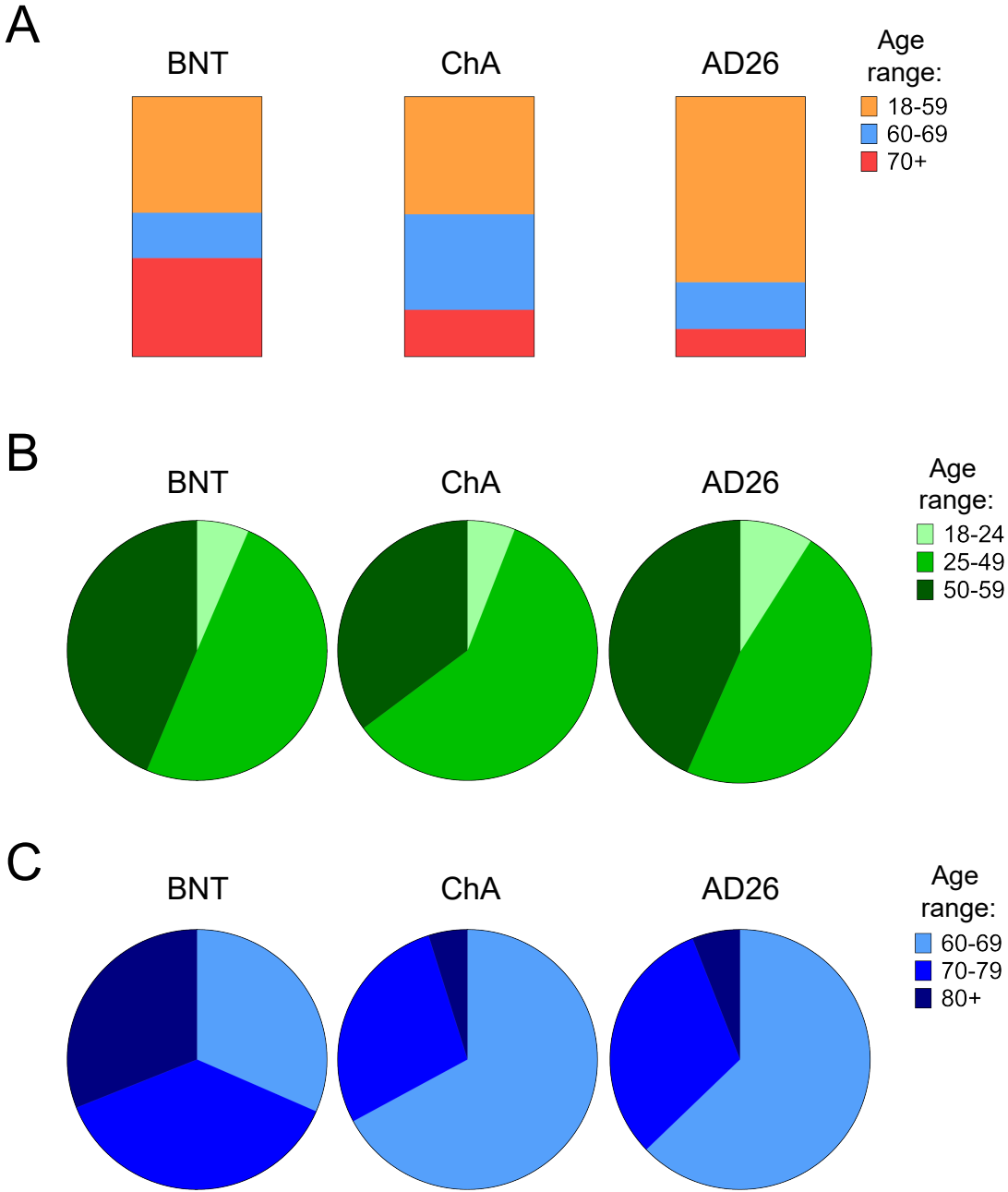
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Figure. S1. Frequency of individual cases with specific SAEs and SAE-related deaths among BNT, ChA, and AD26 recipients.



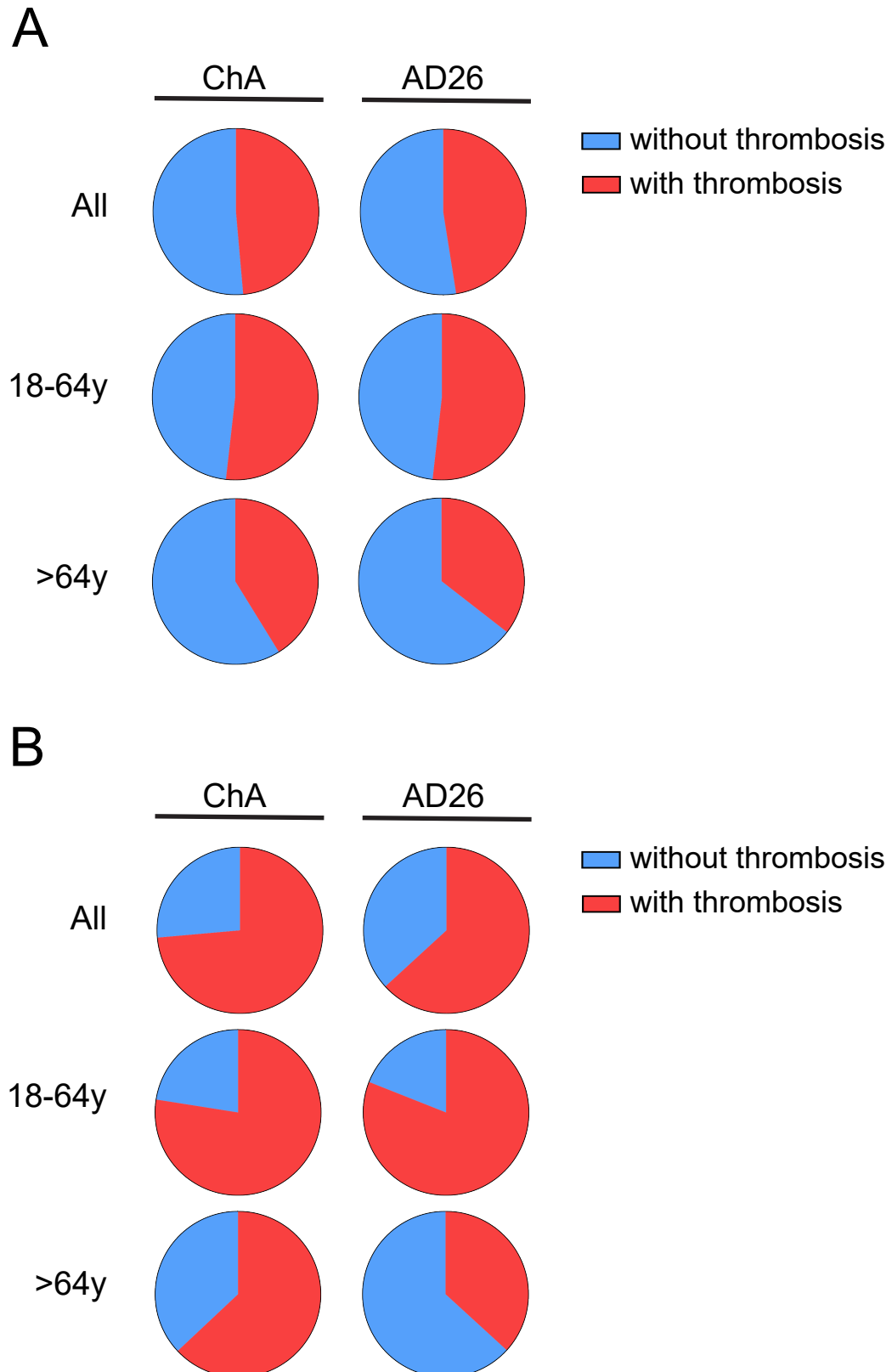
The frequency was obtained by normalizing the number of individual cases with the doses administered in Europe at week 23.

Figure. S2. Percentage of subjects with different ages who were vaccinated with BNT, ChA or AD26



(A) whole population, (B) population aged 18 to 59 years, (C) population aged ≥ 60 years

Figure. S3. Percentage of ChA and AD26 recipients with or without thrombosis-related events who suffered from thrombocytopenia.



(A) Percentage of ChA and AD26 recipients with or without thrombosis-related SAEs who suffered from thrombocytopenia. (B) Percentage of ChA and AD26 recipients with or without thrombosis-related SAEs who died from thrombocytopenia. The whole population, the population aged 18 to 64 years, and the population aged > 64 years are shown.

Table S1. Keywords used to download SAEs and deaths related to venous thrombosis.

Cerebral venous thrombosis	Splanchnic vein thrombosis	Thromboembolic disease	Other venous thrombotic events
Cerebral venous sinus thrombosis	Budd-Chiari syndrome	Deep vein thrombosis	Brachiocephalic vein thrombosis
Cerebral venous thrombosis	Hepatic vein thrombosis	Pulmonary embolism	Embolism venous
Superior sagittal sinus thrombosis	Mesenteric vein thrombosis	Pulmonary microemboli	Jugular vein occlusion
Transverse sinus thrombosis	Mesenteric venous occlusion		Jugular vein thrombosis
Cerebral thrombosis	Portal vein embolism		Ophthalmic vein thrombosis
Cerebral vascular occlusion	Portal vein occlusion		Ovarian vein thrombosis
	Portal vein thrombosis		Pelvic venous thrombosis
	Portosplenomesenteric venous thrombosis		Penile vein thrombosis
	Splenic vein occlusion		Peripheral vein occlusion
	Splenic vein thrombosis		Peripheral vein thrombus extension
	Venocclusive liver disease		Pulmonary venous thrombosis
	Visceral venous thrombosis		Renal vein embolism
	Hepatic vascular thrombosis		Renal vein occlusion
	Splenic thrombosis		Renal vein thrombosis
	Thrombosis mesenteric vessel		Retinal vein occlusion
			Retinal vein thrombosis
			Subclavian vein occlusion
			Subclavian vein stenosis
			Subclavian vein thrombosis
			Thrombosed varicose vein
			Vena cava embolism
			Vena cava thrombosis
			Venous occlusion
			Venous thrombosis
			Venous thrombosis limb

Table S2. Keywords used to download SAEs and deaths related to hemorrhage.

Nervous system hemorrhage	Gastrointestinal hemorrhage		Other hemorrhagic events		
Basal ganglia haematoma	Abdominal wall haematoma	Oesophageal haemorrhage	Abnormal uterine bleeding	Haemorrhagic adrenal infarction	Postmenopausal haemorrhage
Basal ganglia haemorrhage	Abdominal wall haemorrhage	Oesophageal ulcer haemorrhage	Adrenal haematoma	Haemorrhagic cyst	Prostatic haemorrhage
Brain stem haematoma	Anal fissure haemorrhage	Oesophageal varices haemorrhage	Adrenal haemorrhage	Haemorrhagic diathesis	Pulmonary alveolar haemorrhage
Brain stem haemorrhage	Anal haemorrhage	Oral mucosa haematoma	Adrenal haemorrhage	Haemorrhagic disorder	Pulmonary haemorrhage
Cerebellar haematoma	Diarrhoea haemorrhagic	Pancreatic haemorrhage	Auricular haematoma	Haemorrhagic thyroid cyst	Renal cyst haemorrhage
Cerebellar haemorrhage	Diverticulum intestinal haemorrhagic	Peptic ulcer haemorrhage	Breast haematoma	Haemothorax	Renal haemorrhage
Cerebral haematoma	Duodenal ulcer haemorrhage	Rectal haemorrhage	Breast haemorrhage	Heavy menstrual bleeding	Respiratory tract haemorrhage
Cerebral haemorrhage	Gastric haemorrhage	Retroperitoneal haematoma	Bursal haematoma	Increased tendency to bruise	Retinal haemorrhage
Epidural haemorrhage	Gastric ulcer haemorrhage	Retroperitoneal haemorrhage	Catheter site haemorrhage	Intermenstrual bleeding	Scleral haemorrhage
Haemorrhage intracranial	Gastric varices haemorrhage	Small intestinal haemorrhage	Cervix haemorrhage uterine	Internal haemorrhage	Shock haemorrhagic
Haemorrhagic cerebral infarction	Gastrointestinal haemorrhage	Splenic haemorrhage	Chest wall haematoma	Intraocular haematoma	Skin haemorrhage
Haemorrhagic stroke	Gastrointestinal vascular malformation haemorrhagic	Tongue haematoma	Coital bleeding	Joint microhaemorrhage	Soft tissue haemorrhage
Haemorrhagic transformation stroke	Gingival bleeding	Tongue haemorrhage	Conjunctival haemorrhage	Menometrorrhagia	Spontaneous haematoma
Intracranial haematoma	Haematemesis	Tonsillar haemorrhage	Corneal bleeding	Mucocutaneous haemorrhage	Spontaneous haemorrhage
Intraventricular haemorrhage	Haematochezia	Tooth socket haemorrhage	Ear haemorrhage	Mucosal haemorrhage	Subcutaneous haematoma
Putamen haemorrhage	Haemoperitoneum	Upper gastrointestinal haemorrhage	Extradural haematoma	Muscle haemorrhage	Subretinal haematoma
Spinal cord haematoma	Haemorrhoidal haemorrhage		Eye haematoma	Myocardial haemorrhage	Ulcer haemorrhage
Spinal cord haemorrhage	Hepatic haematoma		Eye haemorrhage	Ocular retrobulbar haemorrhage	Umbilical haematoma
Spinal epidural haematoma	Hepatic haemorrhage		Eyelid bleeding	Optic disc haemorrhage	Urethral haemorrhage
Spinal epidural haemorrhage	Intestinal haemorrhage		Eyelid haematoma	Orbital haematoma	Urinary bladder haemorrhage
Spinal subdural haemorrhage	Intra-abdominal haematoma		Genital haemorrhage	Ovarian haemorrhage	Urogenital haemorrhage
Subarachnoid haematoma	Intra-abdominal haemorrhage		Haemarthrosis	Paranasal sinus haemorrhage	Uterine haemorrhage
Subarachnoid haemorrhage	Large intestinal haemorrhage		Haematoma muscle	Pelvic haematoma	Vaginal haemorrhage
Subdural haematoma	Lip haematoma		Haemospermia	Pelvic haemorrhage	Venous haemorrhage
Subdural haemorrhage	Lip haemorrhage		Haematuria	Penile haemorrhage	Vitreous haemorrhage
Thalamus haemorrhage	Lower gastrointestinal haemorrhage		Haemoptysis	Pericardial haemorrhage	Vulval haematoma
	Melaena		Haemorrhage subcutaneous	Periorbital haematoma	Vulval haemorrhage
	Mesenteric haemorrhage		Haemorrhage subepidermal	Periorbital haemorrhage	
	Mouth haemorrhage		Haemorrhage urinary tract	Pharyngeal haemorrhage	

Table S3. Keywords used to download SAEs and deaths related to thrombocytopenia.

Thrombocytopenia
Autoimmune heparin-induced thrombocytopenia
Disseminated intravascular coagulation
Heparin-induced thrombocytopenia
Immune thrombocytopenia
Platelet disorder
Spontaneous heparin-induced thrombocytopenia syndrome
Thrombocytopenia
Thrombocytopenic purpura
Thrombotic microangiopathy
Thrombotic thrombocytopenic purpura

Table S4. Keywords used to download SAEs and deaths related to arterial events.

Cardiac arterial events (infarction)	Cerebral arterial events			Other arterial events		
Acute cardiac event	Basal ganglia infarction	Cerebral microembolism	Thrombotic cerebral infarction	Adrenal thrombosis	Mesenteric artery embolism	Renal vascular thrombosis
Acute coronary syndrome	Basal ganglia stroke	Cerebral microhaemorrhage	Thrombotic stroke	Arterial thrombosis	Mesenteric artery thrombosis	Retinal artery embolism
Acute coronary syndrome	Basilar artery occlusion	Cerebral microinfarction	Transient ischaemic attack	Arteriovenous fistula thrombosis	Mesenteric vascular occlusion	Retinal artery occlusion
Acute myocardial infarction	Basilar artery stenosis	Cerebral small vessel ischaemic disease	Vertebral artery occlusion	Catheter site thrombosis	Microembolism	Retinal artery thrombosis
Angina unstable	Basilar artery thrombosis	Cerebral thrombosis	Vertebral artery thrombosis	Device embolisation	Ocular ischaemic syndrome	Retinal infarction
Coronary artery disease	Brain stem infarction	Cerebral vascular occlusion	Vertebrobasilar stroke	Device related thrombosis	Ocular vascular disorder	Retinal ischaemia
Coronary artery embolism	Brain stem ischaemia	Cerebrovascular accident		Embolism	Ophthalmic artery thrombosis	Retinal vascular disorder
Coronary artery occlusion	Brain stem stroke	Cerebrovascular disorder		Embolism arterial	Pancreatic infarction	Retinal vascular occlusion
Coronary artery thrombosis	Brain stem thrombosis	Embolic cerebellar infarction		Eye infarction	Paradoxical embolism	Retinal vascular thrombosis
Ischaemic cardiomyopathy	Carotid artery occlusion	Embolic cerebral infarction		Femoral artery embolism	Peripheral artery occlusion	Splenic artery thrombosis
Myocardial infarction	Carotid artery thrombosis	Embolic stroke		Haemorrhoids thrombosed	Peripheral artery thrombosis	Splenic embolism
Myocardial ischaemia	Cerebellar artery occlusion	Internal capsule infarction		Hepatic artery embolism	Peripheral embolism	Splenic infarction
Myocardial necrosis	Cerebellar artery thrombosis	Ischaemic cerebral infarction		Hepatic artery thrombosis	Prosthetic cardiac valve thrombosis	Splenic thrombosis
	Cerebellar embolism	Ischaemic stroke		Hepatic infarction	Pulmonary artery occlusion	Subclavian artery thrombosis
	Cerebellar infarction	Lacunar infarction		Hepatic ischaemia	Pulmonary artery thrombosis	Thrombosis
	Cerebellar ischaemia	Lacunar stroke		Hepatic perfusion disorder	Pulmonary infarction	Thrombosis mesenteric vessel
	Cerebellar stroke	Precerebral artery thrombosis		Hepatic vascular thrombosis	Pulmonary thrombosis	Truncus coeliacus thrombosis
	Cerebral artery embolism	Spinal artery thrombosis		Iliac artery embolism	Pulmonary vascular disorder	Vascular access site thrombosis
	Cerebral artery occlusion	Spinal cord infarction		Iliac artery occlusion	Renal artery occlusion	Vascular occlusion
	Cerebral artery stenosis	Spinal cord ischaemia		Inner ear infarction	Renal artery thrombosis	Vascular stent occlusion
	Cerebral artery thrombosis	Spinal stroke		Intestinal infarction	Renal embolism	Vascular stent thrombosis
	Cerebral infarction	Stroke in evolution		Intestinal ischaemia	Renal infarct	
	Cerebral ischaemia	Thalamic infarction		Mesenteric arterial occlusion	Renal ischaemia	

Table S5. Keywords used to download SAEs and deaths related to cardiac events.

Cardiac arterial events (infarction)	Cardiac arrhythmias		Cardiac inflammations
Acute cardiac event	Arrhythmia	Paroxysmal arrhythmia	Autoimmune myocarditis
Acute coronary syndrome	Arrhythmia supraventricular	Pulseless electrical activity	Carditis
Acute coronary syndrome	Atrial fibrillation	Rhythm idioventricular	Immune-mediated myocarditis
Acute myocardial infarction	Atrial flutter	Sinus arrest	Myocarditis
Angina unstable	Atrial tachycardia	Sinus arrhythmia	Pericarditis
Coronary artery disease	Atrioventricular block	Sinus bradycardia	Pleuropericarditis
Coronary artery embolism	Atrioventricular block complete	Sinus node dysfunction	
Coronary artery occlusion	Atrioventricular block first degree	Sinus tachycardia	
Coronary artery thrombosis	Atrioventricular block second degree	Supraventricular extrasystoles	
Ischaemic cardiomyopathy	Bradycardia	Supraventricular tachyarrhythmia	
Myocardial infarction	Bradycardia	Supraventricular tachycardia	
Myocardial ischaemia	Bundle branch block	Tachyarrhythmia	
Myocardial necrosis	Bundle branch block left	Tachycardia	
	Bundle branch block right	Tachycardia paroxysmal	
	Cardiac arrest	Torsade de pointes	
	Cardiac fibrillation	Trifascicular block	
	Cardiac flutter	Ventricular arrhythmia	
	Cardio-respiratory arrest	Ventricular extrasystoles	
	Defect conduction intraventricular	Ventricular fibrillation	
	Extrasystoles	Ventricular flutter	
	Long QT syndrome	Ventricular tachycardia	
	Nodal arrhythmia		
	Nodal rhythm		

Table S6. Keywords used to download SAEs and deaths related to nervous system events.

Stroke		Venous stroke	Nervous system hemorrhage	Cranial nerves	
Basal ganglia infarction	Cerebral small vessel ischaemic disease	Cerebral venous sinus thrombosis	Basal ganglia haematoma	Acoustic neuritis	Trigeminal palsy
Basal ganglia stroke	Cerebral thrombosis	Cerebral venous thrombosis	Basal ganglia hemorrhage	Auditory nerve disorder	Vagus nerve disorder
Basilar artery occlusion	Cerebral vascular occlusion	Superior sagittal sinus thrombosis	Brain stem haematoma	Bell's palsy	Vagus nerve paralysis
Basilar artery stenosis	Cerebrovascular accident	Transverse sinus stenosis	Brain stem hemorrhage	Cranial nerve disorder	Vlth nerve disorder
Basilar artery thrombosis	Cerebrovascular disorder	Transverse sinus thrombosis	Cerebellar haematoma	Cranial nerve palsies multiple	Vlth nerve paralysis
Brain stem infarction	Embolic cerebellar infarction		Cerebellar hemorrhage	Cranial nerve paralysis	Vlth nerve paresis
Brain stem ischaemia	Embolic cerebral infarction		Cerebral haematoma	Facial nerve disorder	
Brain stem stroke	Embolic stroke		Cerebral hemorrhage	Facial neuralgia	
Brain stem thrombosis	Internal capsule infarction		Epidural hemorrhage	Glossopharyngeal nerve disorder	
Carotid artery occlusion	Ischaemic cerebral infarction		Haemorrhage intracranial	Hypoglossal nerve paresis	
Carotid artery thrombosis	Ischaemic stroke		Haemorrhagic cerebral infarction	Illrd nerve disorder	
Cerebellar artery occlusion	Lacunar infarction		Haemorrhagic stroke	Illrd nerve paralysis	
Cerebellar artery thrombosis	Lacunar stroke		Haemorrhagic transformation stroke	Illrd nerve paresis	
Cerebellar embolism	Precerebral artery thrombosis		Intracranial haematoma	IVth nerve disorder	
Cerebellar infarction	Spinal artery thrombosis		Intraventricular hemorrhage	IVth nerve paralysis	
Cerebellar ischaemia	Spinal cord infarction		Putamen haemorrhage	IVth nerve paresis	
Cerebellar stroke	Spinal cord ischaemia		Spinal cord haematoma	Microvascular cranial nerve palsy	
Cerebral artery embolism	Spinal stroke		Spinal cord hemorrhage	Neuritis cranial	
Cerebral artery occlusion	Stroke in evolution		Spinal epidural haematoma	Olfactory nerve disorder	
Cerebral artery stenosis	Thalamic infarction		Spinal epidural hemorrhage	Optic ischaemic neuropathy	
Cerebral artery thrombosis	Thrombotic cerebral infarction		Spinal subdural hemorrhage	Optic neuritis	
Cerebral infarction	Thrombotic stroke		Subarachnoid haematoma	Paresis cranial nerve	
Cerebral ischaemia	Transient ischaemic attack		Subarachnoid hemorrhage	Trigeminal nerve disorder	
Cerebral microembolism	Vertebral artery occlusion		Subdural haematoma	Trigeminal nerve paresis	
Cerebral microhaemorrhage	Vertebral artery thrombosis		Subdural hemorrhage	Trigeminal neuralgia	
Cerebral microinfarction	Vertebrobasilar stroke		Thalamus haemorrhage	Trigeminal neuritis	

Table S7. Percentage of vaccine doses administered in each age range in Europe.

	BNT162b2			ChAdOx1 nCoV-19			Ad26.COV2.S		
	<18y	18-64y	>64y	<18y	18-64y	>64y	<18y	18-64y	>64y
European countries that provides age groups data (W23)*	0.278%	53.24%	46.48%	0.001%	63.43%	36.57%	0.005%	80.41%	19.59%

* The data relating to the 25 of the 30 European countries (those that provided the number of vaccine doses administered to each age group) present in the European database of the European Center for Disease Prevention and Control (ECDC) are reported. The percentage of doses administered to the 18-64 age group was calculated considering the vaccine doses administered to the 18-24, 25-39, 40-49, 50-59 age groups, and half of the doses administered to the 60-69 age group. The percentage of doses administered to the age group > 64 was calculated considering the vaccine doses administered to half of the age group 60-69 and all doses administered to the age groups 70-79 and ≥ 80.

Table S8. Frequency, significance of the difference and hazard ratio (HR) of individual cases with specific SAEs among BNT, ChA, and AD26 recipients.

	18-64y*							>65y*						
	SAEs/ 1,000,000 administrations mean±SD			ChA/BNT		AD26/BNT		SAEs/ 1,000,000 administrations mean±SD			ChA/BNT		AD26/BNT	
	BNT	ChA	AD26	p value	HR mean±SD (95% CI)	p value	HR mean±SD (95% CI)	BNT	ChA	AD26	p value	HR mean±SD (95% CI)	p value	HR mean±SD (95% CI)
Venous thrombotic events	10.0 ± 0.50	107.4 ± 11.29	122.4 ± 6.21	p < 0.0001	10.71 ± 1.02 (9.65-11.78)	p < 0.0001	12.23 ± 0.74 (11.45-13.01)	23.6 ± 1.72	119.2 ± 17.99	167.4 ± 53.99	p = 0.0001	5.05 ± 0.65 (4.37-5.73)	p = 0.0034	7.14 ± 2.32 (4.70-9.58)
Hemorrhagic events	13.4 ± 0.67	96.3 ± 10.12	35.5 ± 1.80	p < 0.0001	7.21 ± 0.68 (6.49-7.93)	p < 0.0001	2.66 ± 0.16 (2.49-2.83)	11.0 ± 0.80	32.9 ± 4.96	43.4 ± 14.00	p = 0.0003	3.00 ± 0.38 (2.60-3.40)	p = 0.0064	3.98 ± 1.30 (2.62-5.34)
Thrombocytopenia	2.4 ± 0.12	46.5 ± 4.88	25.0 ± 1.27	p < 0.0001	19.47 ± 1.85 (17.52-21.41)	p < 0.0001	10.48 ± 0.64 (9.81-11.15)	4.0 ± 0.29	30.9 ± 4.67	18.3 ± 5.91	p < 0.0001	7.72 ± 0.98 (6.69-8.74)	p = 0.0052	4.60 ± 1.50 (3.03-6.18)
Arterial events	12.7 ± 0.64	106.8 ± 11.23	158.6 ± 8.04	p < 0.0001	8.41 ± 0.80 (7.57-9.24)	p < 0.0001	12.50 ± 0.76 (11.70-13.29)	35.2 ± 2.56	127.5 ± 19.24	285.9 ± 92.20	p = 0.0002	3.62 ± 0.46 (3.14-4.10)	p = 0.0031	8.17 ± 2.66 (5.38-10.97)
Cardiac events	31.7 ± 1.59	94.9 ± 9.98	40.0 ± 2.03	p < 0.0001	2.99 ± 0.28 (2.69-3.29)	p < 0.0001	1.26 ± 0.07 (1.18-1.34)	26.2 ± 1.90	59.3 ± 8.94	62.5 ± 20.14	p = 0.0008	2.27 ± 0.29 (1.97-2.57)	p = 0.0186	2.40 ± 0.78 (1.58-3.22)
Nervous system events	14.1 ± 0.71	83.0 ± 8.73	71.8 ± 3.64	p < 0.0001	5.89 ± 0.56 (5.30-6.47)	p < 0.0001	5.10 ± 0.31 (4.78-5.43)	29.2 ± 2.12	89.3 ± 13.48	143.5 ± 46.27	p = 0.0003	3.06 ± 0.39 (2.65-3.47)	p = 0.0048	4.95 ± 1.61 (3.26-6.65)

* The frequency of individual cases with specific AEs divided according to age range (18–64 years and >64 years) was obtained by normalizing the number of individual cases with the doses supposedly administered to each age range in Europe at week 23 (Table S7). To do this, we considered the doses administered by the European countries providing data on the administration of each vaccine to these age ranges and established a method for evaluating the variance of the doses (see the Method section for details).

Table S9. Frequency, significance of the difference and hazard ratio (HR) of individual cases with specific SAE-related deaths among BNT, ChA, and AD26 recipients.

	18-64y*							>65y*						
	death events/ 1,000,000 administrations mean±SD			ChA/BNT		AD26/BNT		death events/ 1,000,000 administrations mean±SD			ChA/BNT		AD26/BNT	
	BNT	ChA	AD26	p value	HR mean±SD (95% CI)	p value	HR mean±SD (95% CI)	BNT	ChA	AD26	p value	HR mean±SD (95% CI)	p value	HR mean±SD (95% CI)
Venous thrombotic events	0.4 ± 0.02	7.3 ± 0.77	6.1 ± 0.31	p < 0.0001	17.68 ± 1.68 (15.91-19.44)	p < 0.0001	14.77 ± 0.90 (13.83-15.71)	1.8 ± 0.13	8.2 ± 1.24	5.4 ± 1.74	p = 0.0001	4.62 ± 0.59 (4.01-5.24)	p = 0.0102	3.06 ± 1.00 (2.01-4.11)
Hemorrhagic events	0.3 ± 0.02	6.1 ± 0.64	3.6 ± 0.18	p < 0.0001	17.52 ± 1.67 (15.77-19.27)	p < 0.0001	10.21 ± 0.62 (9.55-10.86)	2.9 ± 0.21	5.5 ± 0.83	6.2 ± 2.00	p = 0.0009	1.87 ± 0.24 (1.62-2.12)	p = 0.0274	2.13 ± 0.69 (1.40-2.86)
Thrombocytopenia	0.1 ± 0.005	5.9 ± 0.63	3.1 ± 0.16	p < 0.0001	63.37 ± 6.02 (57.05-69.69)	p < 0.0001	32.98 ± 2.00 (30.88-35.08)	0.5 ± 0.03	3.4 ± 0.51	3.8 ± 1.22	p < 0.0001	7.20 ± 0.92 (6.23-8.16)	p = 0.0031	8.07 ± 2.63 (5.31-10.83)
Arterial events	0.7 ± 0.03	7.7 ± 0.81	10.1 ± 0.51	p < 0.0001	11.49 ± 1.09 (10.35-12.63)	p < 0.0001	15.09 ± 0.92 (14.13-16.05)	6.1 ± 0.44	16.3 ± 2.46	39.3 ± 12.69	p = 0.0005	2.69 ± 0.34 (2.33-3.05)	p = 0.0036	6.54 ± 2.13 (4.31-8.78)
Cardiac events	1.2 ± 0.06	5.6 ± 0.59	5.8 ± 0.29	p < 0.0001	4.67 ± 0.44 (4.20-5.13)	p < 0.0001	4.77 ± 0.29 (4.47-5.07)	7.2 ± 0.52	12.4 ± 1.87	14.1 ± 4.56	p = 0.0017	1.72 ± 0.22 (1.49-1.95)	p = 0.0365	1.98 ± 0.64 (1.30-2.66)
Nervous system events	0.4 ± 0.02	8.3 ± 0.87	5.8 ± 0.29	p < 0.0001	19.73 ± 1.87 (17.76-21.70)	p < 0.0001	13.83 ± 0.84 (12.95-14.71)	4.6 ± 0.33	9.8 ± 1.48	17.6 ± 5.66	p = 0.0010	2.15 ± 0.28 (1.86-2.44)	p = 0.0067	3.87 ± 1.26 (2.55-5.19)

* The frequency of individual cases with specific AEs divided according to age range (18–64 years and >64 years) was obtained by normalizing the number of individual cases with the doses supposedly administered to each age range in Europe at week 23 (Table S7). To do this, we considered the doses administered by the European countries providing data on the administration of each vaccine to these age ranges and established a method for evaluating the variance of the doses (see the Method section for details).

Table S10. Frequency of individual cases with venous thrombotic SAEs and SAE-related deaths, hemorrhagic SAEs and SAE-related deaths, TTS SAEs and SAE-related deaths and SAEs or death related to thrombocytopenia among ChA and AD26 recipients.

	SAEs/1,000,000 doses						death events/1,000,000 doses					
	ALL		18-64y		>64y		ALL		18-64y		>64y	
	ChA	AD26	ChA	AD26	ChA	AD26	ChA	AD26	ChA	AD26	ChA	AD26
Venous thrombotic events	110.6	131.2	107.4	122.4	119.2	167.4	7.55	5.90	7.30	6.08	8.20	5.39
Hemorrhagic events	70.7	37.0	96.3	35.5	32.9	43.4	5.78	4.10	6.10	3.55	5.47	6.19
Thrombocytopenia	39.9	23.6	46.4	25.0	30.9	18.3	4.89	3.20	5.95	3.08	3.40	3.79
Venous thrombosis, and/or hemorrhagia, and/or thrombocytopenia	194.8	172.8	215.9	163.7	167.7	221.4	12.08	9.51	11.22	9.22	13.85	11.30
TTS* (% of TTS within Venous thrombotic events)	19.41 (17.55%)	11.21 (8.54%)	24.08 (22.43%)	12.93 (10.56%)	12.76 (10.70%)	6.51 (3.89%)	3.6 (47.68%)	2.02 (32.24%)	4.61 (63.14%)	2.49 (40.93%)	2.14 (26.11%)	1.39 (25.78%)

* Individual cases with thrombosis and thrombocytopenia were considered to suffer of TTS

Table S11. Frequency of individual cases with cerebral venous thrombosis SAEs and SAE-related deaths, and cerebral venous thrombosis with thrombocytopenia (TTS) SAEs among ChA and AD26 recipients.

	SAEs/1,000,000 doses						death events/1,000,000 doses					
	ALL		18-64y		>64y		ALL		18-64y		>64y	
	ChA	AD26	ChA	AD26	ChA	AD26	ChA	AD26	ChA	AD26	ChA	AD26
Cerebral venous thrombosis	14.90	17.70	20.0	18.3	7.4	15.3	2.70	2.00	3.75	2.32	1.27	0.92
Cerebral venous thrombosis with thrombocytopenia (CVT-TTS) (%)	7.4 (49.4%)	7.5 (42.3%)	11.8 (59.0%)	9.7 (53.1%)	2.1 (29.0%)	0.9 (5.9%)	2.09 (77.3%)	1.33 (66.7%)	3.10 (82.7%)	1.86 (80.0%)	0.79 (62.4%)	0.00 (0.0%)

Table S12. Frequency and hazard ratio (HR) of individual cases with specific SAEs and SAE-related deaths among BNT, ChA, and AD26 recipients.

	SAEs					Death events				
	events/ 1,000,000 administrations			HR		events/ 1,000,000 administrations			HR	
	BNT	ChA	AD26	ChA/BNT	AD26/BNT	BNT	ChA	AD26	ChA/BNT	AD26/BNT
Cerebral venous thrombosis	1.1	14.9	17.7	13.31	15.80	0.1	2.7	2.0	26.59	19.72
Splanchnic vein thrombosis	0.4	4.8	4.1	11.50	9.75	0.1	0.8	0.3	14.40	6.03
Thromboembolic disease	12.7	84.4	105.7	6.62	8.30	0.8	4.5	3.9	5.42	4.75
Other venous thrombotic events	1.8	12.0	11.7	6.77	6.58	0.0	0.5	0.8	23.04	36.16
Nervous system hemorrhage	2.5	13.0	11.9	5.22	4.76	1.0	4.6	3.2	4.60	3.21
Gastrointestinal hemorrhage	2.9	12.7	9.2	4.31	3.12	0.3	0.7	0.7	2.49	2.26
Other hemorrhagic events	7.1	46.2	17.3	6.50	2.44	0.2	0.6	0.3	3.45	2.01
Thrombocytopenia	3.1	39.9	23.6	12.86	7.60	0.3	4.9	3.2	18.93	12.49
Cardiac arterial events (infarction)	4.4	16.8	21.7	3.79	4.91	1.3	4.0	4.8	2.95	3.55
Cerebral arterial events	12.2	53.8	65.3	4.40	5.34	1.2	4.3	4.9	3.52	4.00
Other arterial events	6.3	47.4	110.3	7.51	17.49	0.5	3.6	8.0	7.16	15.88
Cardiac arterial events (infarction)	4.4	16.8	21.7	3.79	4.91	1.3	4.0	4.8	2.95	3.55
Cardiac arrhythmias	22.2	60.7	24.4	2.73	1.10	2.6	4.8	4.6	1.85	1.77
Cardiac inflammations	3.5	4.3	3.2	1.22	0.91	0.1	0.1	0.0	2.05	0.00
Stroke	12.2	53.8	65.3	4.40	5.34	1.2	4.3	4.9	3.52	4.00
Venous stroke	0.7	11.7	11.9	17.54	17.82	0.1	2.0	1.4	39.48	26.30
Nervous system hemorrhage	2.5	13.0	11.9	5.22	4.76	1.0	4.6	3.2	4.60	3.21
Cranial nerves	5.6	12.6	5.4	2.25	0.97	0.0	0.0	0.0	N.A.*	N.A.*

* Not applicable, no death events reported for both vaccines

Table S13. Percentage of SAE-related deaths within each SAE in BNT, ChA, and AD26 recipients across age groups.

	% of death events within SAEs					
	18-64y			>64y		
	BNT	ChA	AD26	BNT	ChA	AD26
Cerebral venous thrombosis	7.5%	18.8%	12.7%	11.8%	17.2%	6.0%
Splanchnic vein thrombosis	14.3%	17.5%	11.5%	14.0%	14.6%	0.0%
Thromboembolic disease	3.8%	4.0%	4.1%	7.7%	6.8%	2.5%
Other venous thrombotic events	0.0%	6.3%	4.4%	2.5%	1.5%	20.2%
Nervous system hemorrhage	20.3%	36.1%	28.6%	48.7%	34.1%	24.1%
Gastrointestinal hemorrhage	2.9%	3.6%	4.6%	19.5%	12.9%	19.2%
Other hemorrhagic events	0.2%	0.7%	2.5%	10.0%	5.4%	0.0%
Thrombocytopenia	3.8%	12.8%	12.4%	11.7%	11.0%	20.7%
Cardiac arterial events (infarction)	16.1%	17.7%	18.8%	37.2%	30.7%	27.0%
Cerebral arterial events	2.5%	6.5%	5.7%	12.7%	9.6%	10.4%
Other arterial events	2.5%	5.3%	4.6%	12.8%	11.6%	14.6%
Cardiac arterial events (infarction)	16.1%	17.7%	18.8%	37.2%	30.7%	27.0%
Cardiac arrhythmias	3.5%	4.4%	14.4%	26.8%	18.2%	27.9%
Cardiac inflammations	0.9%	2.5%	0.0%	5.1%	4.7%	0.0%
Stroke	2.5%	6.5%	5.7%	12.8%	9.6%	10.4%
Venous stroke	7.7%	17.8%	11.3%	9.1%	15.4%	12.5%
Nervous system hemorrhage	20.3%	36.1%	28.6%	48.7%	34.1%	24.1%
Cranial nerves	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%