

Table 1. Characteristics of heart failure cases (n=15,426) and control populations without heart failure (n=41,221), stratified by total number of vaccine doses.

	0/1 dose (Unvaccinated/partially vaccinated)		2 doses (Fully vaccinated, not boosted)		3 doses (Boosted)		≥4 doses (Double-boosted)	
	Heart failure ^a	Control	Heart failure ^a	Control	Heart failure ^a	Control	Heart failure ^a	Control
Sex, no. (%)								
Female	442 (43.8)	1153 (44.7)	613 (44.8)	1455 (46.1)	3064 (41.3)	8313 (41.3)	2245 (39.9)	6124 (39.9)
Male	566 (56.2)	1426 (55.3)	756 (55.2)	1698 (53.9)	4354 (58.7)	11,839 (58.7)	3386 (60.1)	9213 (60.1)
Age, no. (%)								
18–29 years	3 (0.3)	9 (0.3)	3 (0.2)	9 (0.3)	27 (0.4)	79 (0.4)	5 (0.1)	13 (0.1)
30–39 years	7 (0.7)	18 (0.7)	15 (1.1)	39 (1.2)	127 (1.7)	353 (1.8)	44 (0.8)	118 (0.8)
40–49 years	31 (3.1)	82 (3.2)	31 (2.3)	62 (2.0)	431 (5.8)	1202 (6.0)	171 (3.0)	447 (2.9)
50–59 years	106 (10.5)	266 (10.3)	145 (10.6)	313 (9.9)	1080 (14.6)	2969 (14.7)	597 (10.6)	1615 (10.5)
60–69 years	203 (20.1)	536 (20.8)	322 (23.5)	743 (23.6)	2095 (28.2)	5758 (28.6)	1527 (27.1)	4230 (27.6)
70–79 years	224 (22.2)	585 (22.7)	392 (28.6)	899 (28.5)	1957 (26.4)	5348 (26.5)	1545 (27.4)	4256 (27.7)
≥80 years	434 (43.1)	1083 (42.0)	461 (33.7)	1088 (34.5)	1701 (22.9)	4443 (22.0)	1742 (30.9)	4658 (30.4)
Ethnicity, no. (%)								
Chinese	635 (63.0)	1712 (66.4)	843 (61.6)	2082 (66.0)	4841 (65.3)	13,459 (66.8)	4244 (75.4)	11,881 (77.5)
Indian	166 (16.5)	397 (15.4)	223 (16.3)	453 (14.4)	927 (12.5)	2376 (11.8)	428 (7.6)	1026 (6.7)
Malay	191 (18.9)	438 (17.0)	296 (21.6)	606 (19.2)	1590 (21.4)	4177 (20.7)	904 (16.1)	2295 (15.0)
Others	16 (1.6)	32 (1.2)	7 (0.5)	12 (0.4)	60 (0.8)	140 (0.7)	55 (1.0)	135 (0.9)
Socioeconomic status by housing type), no. (%)^b								
Public, 1–2 rooms	165 (16.4)	406 (15.7)	231 (16.9)	492 (15.6)	945 (12.7)	2434 (12.1)	634 (11.3)	1609 (10.5)
Public, 3 rooms	266 (26.4)	652 (25.3)	337 (24.6)	799 (25.3)	1823 (24.6)	4923 (24.4)	1260 (22.4)	3462 (22.6)
Public, 4 rooms	255 (25.3)	675 (26.2)	443 (32.4)	1016 (32.2)	2536 (34.2)	6972 (34.6)	1876 (33.3)	5169 (33.7)
Public, 5 rooms	229 (22.7)	603 (23.4)	274 (20.0)	644 (20.4)	1770 (23.9)	4906 (24.3)	1490 (26.5)	4151 (27.1)
Others	13 (1.3)	32 (1.2)	9 (0.7)	20 (0.6)	19 (0.3)	44 (0.2)	87 (1.5)	181 (1.2)
Private housing	80 (7.9)	211 (8.2)	75 (5.5)	182 (5.8)	325 (4.4)	873 (4.3)	284 (5.0)	765 (5.0)

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	0/1 dose (Unvaccinated/partially vaccinated)		2 doses (Fully vaccinated, not boosted)		3 doses (Boosted)		≥4 doses (Double-boosted)	
	Heart failure ^a	Control	Heart failure ^a	Control	Heart failure ^a	Control	Heart failure ^a	Control
Types of comorbidities no. (%)								
Ischaemic heart disease	654 (64.9)	488 (18.9)	944 (69.0)	662 (21.0)	4900 (66.1)	3772 (18.7)	3691 (65.5)	2737 (17.8)
Chronic obstructive pulmonary disease	137 (13.6)	188 (7.3)	229 (16.7)	306 (9.7)	861 (11.6)	1350 (6.7)	677 (12.0)	967 (6.3)
Cerebrovascular disorders	205 (20.3)	438 (17.0)	260 (19.0)	498 (15.8)	1127 (15.2)	2157 (10.7)	871 (15.5)	1414 (9.2)
Cancer	95 (9.4)	251 (9.7)	144 (10.5)	454 (14.4)	539 (7.3)	1489 (7.4)	464 (8.2)	1159 (7.6)
Chronic kidney disease	288 (28.6)	354 (13.7)	506 (37.0)	607 (19.3)	2126 (28.7)	2497 (12.4)	1481 (26.3)	1886 (12.3)
Chronic liver disease	39 (3.9)	36 (1.4)	41 (3.0)	64 (2.0)	192 (2.6)	271 (1.3)	135 (2.4)	182 (1.2)
Diabetes	538 (53.4)	1312 (50.9)	799 (58.4)	1749 (55.5)	4165 (56.1)	11,052 (54.8)	3008 (53.4)	8056 (52.5)
Hypertension	794 (78.8)	1974 (76.5)	1168 (85.3)	2637 (83.6)	6226 (83.9)	16,769 (83.2)	4815 (85.5)	13,071 (85.2)
Hyperlipidaemia	596 (59.1)	1483 (57.5)	886 (64.7)	2029 (64.4)	5069 (68.3)	13,743 (68.2)	3939 (70.0)	10,822 (70.6)
No. of comorbidities, no. (%)								
0 comorbidity	44 (4.4)	334 (13.0)	35 (2.6)	272 (8.6)	267 (3.6)	1628 (8.1)	188 (3.3)	1150 (7.5)
1 comorbidity	87 (8.6)	285 (11.1)	82 (6.0)	262 (8.3)	563 (7.6)	2278 (11.3)	408 (7.2)	1663 (10.8)
2 comorbidities	145 (14.4)	496 (19.2)	156 (11.4)	503 (16.0)	989 (13.3)	4206 (20.9)	752 (13.4)	3399 (22.2)
3–4 comorbidities	439 (43.6)	1120 (43.4)	577 (42.1)	1570 (49.8)	3517 (47.4)	10,151 (50.4)	2786 (49.5)	7821 (51.0)
≥5 comorbidities	293 (29.1)	344 (13.3)	519 (37.9)	546 (17.3)	2082 (28.1)	1889 (9.4)	1497 (26.6)	1304 (8.5)
COVID-19, no. (%)								
Infected ^c	398 (39.5)	735 (28.5)	626 (45.7)	1509 (47.9)	3162 (42.6)	8427 (41.8)	2432 (43.2)	6278 (40.9)
Hospitalised ^d	291 (28.9)	402 (15.6)	349 (25.5)	522 (16.6)	970 (13.1)	1111 (5.5)	589 (10.5)	615 (4.0)
Severe disease ^e	134 (13.3)	178 (6.9)	128 (9.3)	145 (4.6)	300 (4.0)	223 (1.1)	128 (2.3)	95 (0.6)
Death	42 (4.2)	72 (2.8)	28 (2.0)	47 (1.5)	31 (0.4)	26 (0.1)	5 (0.1)	6 (0.0)

^a Among cases of heart failure (n=15,426), 10,189 (66.1%) had a concurrent diagnosis of ischaemic heart disease.^b Housing type was used as an indicator of socioeconomic status.^c SARS-CoV-2 infection defined as positive test result (polymerase chain reaction [PCR] test or rapid antigen test [RAT]) recorded in the national COVID-19 registry.^d COVID-19 hospitalisation was defined as all-cause hospitalisations occurring within 30 days from a positive COVID-19 result (PCR/RAT).^e Severe disease was defined as COVID-19 infection with the resulting need for supplemental oxygen, intensive care admission or death.