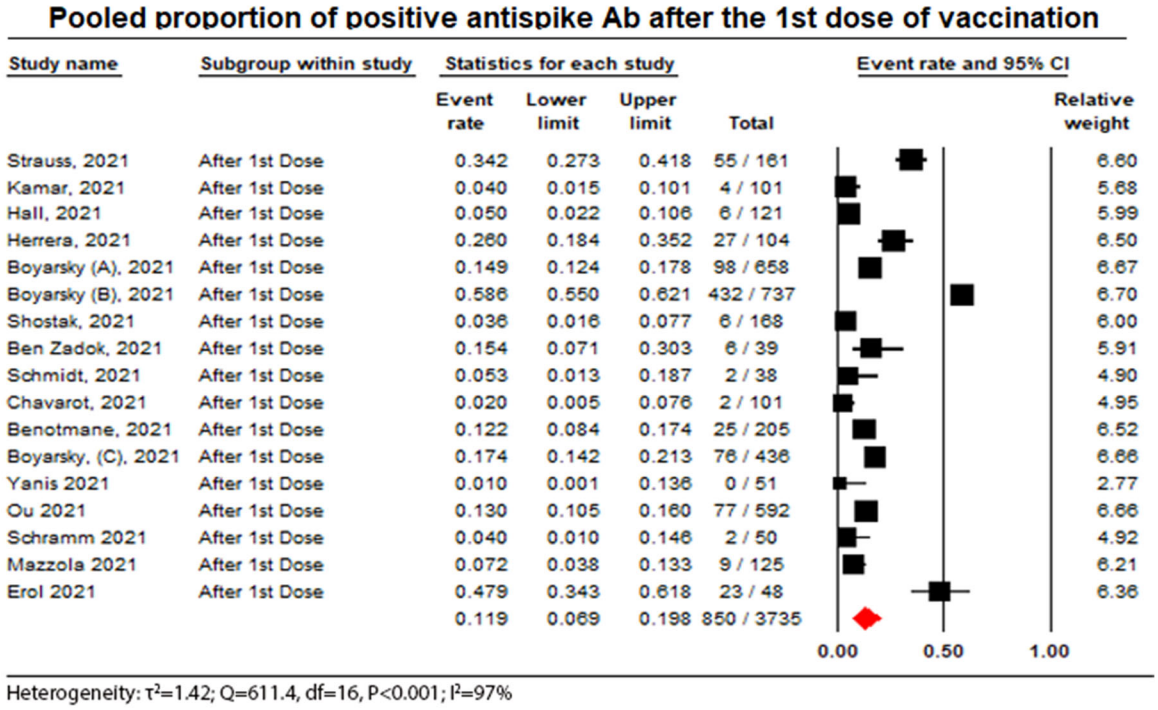
Figure (S1): Pooled proportion of +ve antispike Ab after the first dose administration:



#Studies: 17 #Patients: 3735 #Response: 850
#Proportion (95%CI): 0.12 (0.07 to 0.2)

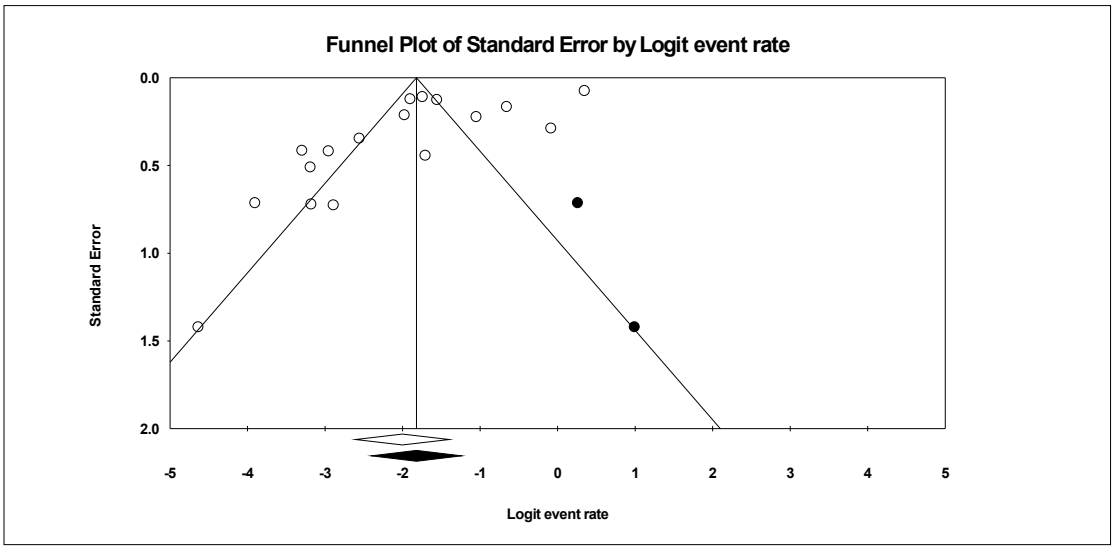
The pooled proportion of positive antispike Ab after the first dose of vaccination from the random effects model is 0.12 (95%CI: 0.07 to 0.2). There is a considerable heterogeneity between studies reporting seroconversion after administration of the second dose of the vaccine (I^2 = 81.6%).

Table (S1): sensitivity analysis showing the results after one study removal from the 17 studies used in the above forest plot:

Studies	Statistics with study removed			
	Estimate	Lower limit	Upper limit	p-Value
Strauss, 2021	0.108	0.059	0.189	< 0.001
Kamar, 2021	0.127	0.073	0.212	< 0.001
Hall, 2021	0.126	0.072	0.210	< 0.001
Herrera, 2021	0.111	0.062	0.192	< 0.001
Boyarsky (A), 2021	0.116	0.063	0.202	< 0.001
Boyarsky (B), 2021	0.116	0.082	0.161	< 0.001
Shostak, 2021	0.128	0.074	0.214	< 0.001
Ben Zadok, 2021	0.117	0.066	0.198	< 0.001
Schmidt, 2021	0.124	0.071	0.208	< 0.001
Chavarot, 2021	0.130	0.075	0.216	< 0.001
Benotmane, 2021	0.118	0.067	0.202	< 0.001
Boyarsky, (C), 2021	0.114	0.062	0.200	< 0.001
Yanis 2021	0.127	0.073	0.211	< 0.001
Ou 2021	0.117	0.065	0.202	< 0.001
Schramm 2021	0.125	0.072	0.210	< 0.001
Mazzola 2021	0.123	0.070	0.207	< 0.001
Erol 2021	0.106	0.059	0.182	< 0.001
Random	0.119	0.069	0.198	< 0.001

This table of sensitivity analysis indicates that the results are robust in the sense that the pooled seroconversion after the first dose of vaccination will remain essentially the same (range from 10.6% to 13%) with any one study removed.

Figure (S2) funnel plot of the 17 studies showing the immune response after the first dose:



Egger's regression intercept

Intercept	-5.58311
Standard error	2.06943
95% lower limit (2-tailed)	-9.99400
95% upper limit (2-tailed)	-1.17223
t-value	2.69790
df	15.00000
P-value (1-tailed)	0.00826
P-value (2-tailed)	0.01653

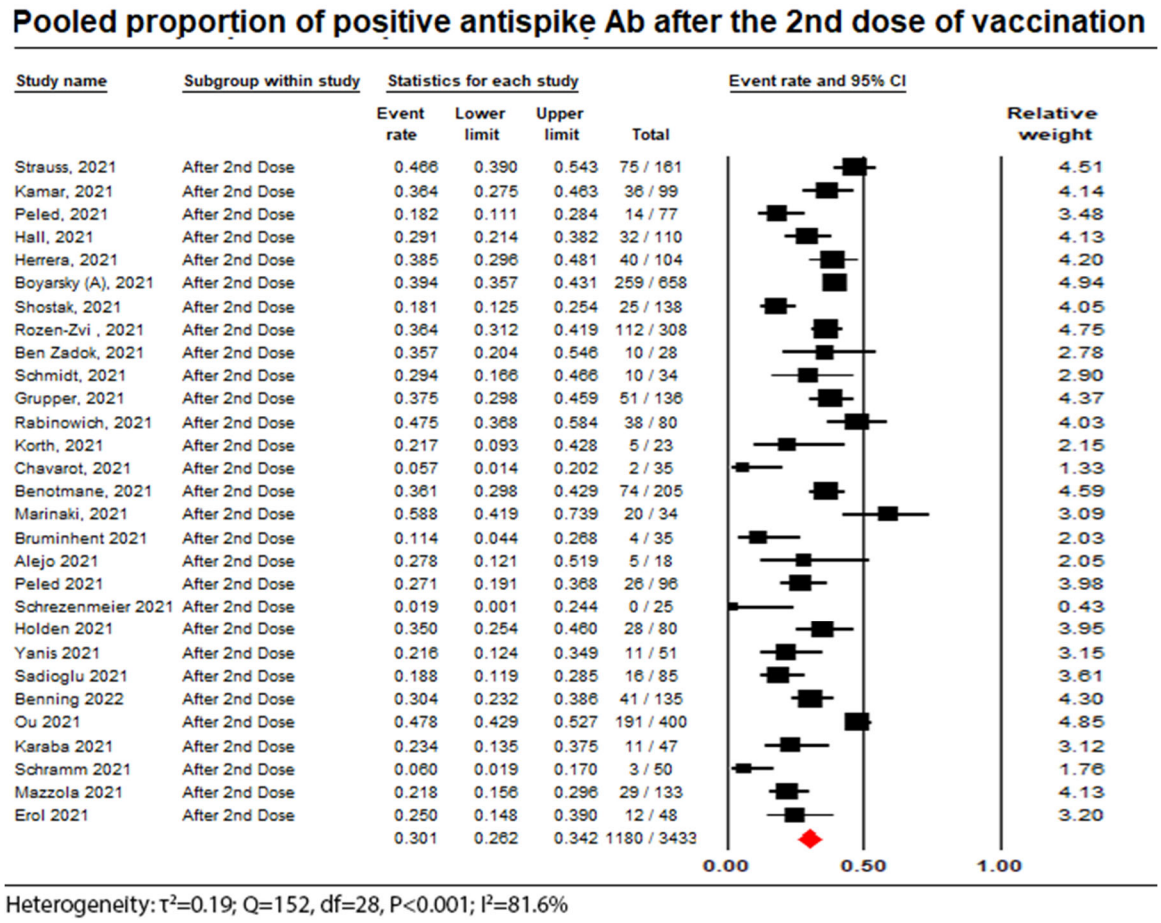
Duval and Tweedie's trim and fill

		Fixed Effects			Random Effects			Q Value
	Studies Trimmed	Point Estimate	Lower Limit	Upper Limit	Point Estimate	Lower Limit	Upper Limit	
Observed values		0.27674	0.25982	0.29432	0.11886	0.06861	0.19807	611.36414
Adjusted values	2	0.27804	0.26111	0.29562	0.13919	0.08284	0.22448	616.15791

There is evidence of publication bias in the pooled analysis of seroconversion after the first dose of vaccination. There are two studies resided at the left of the funnel are more than those on the right side. The Egger's regression intercept (B0) is -5.58, (95%CI: -9.99, -1.17), with t=2.7, df=15. The 1-tailed p-value (recommended) is 0.00826, and the 2-tailed p-value is 0.01653.; indicating the possibly of publication bias.

Using Trim and Fill method, the adjusted pooled proportion (random effect) of seroconversion after the second dose of vaccination would increase from to 0.12 to 0.14 (95% CI: 0.08 to 0.22) if the publication bias was not existed.

Figure (S3): Pooled proportion of +ve antispike Ab after the second dose administration:



#Studies: 29 #Patients: 3433 #Response: 1180
#Proportion (95%CI): 0.30 (0.26 to 0.34)

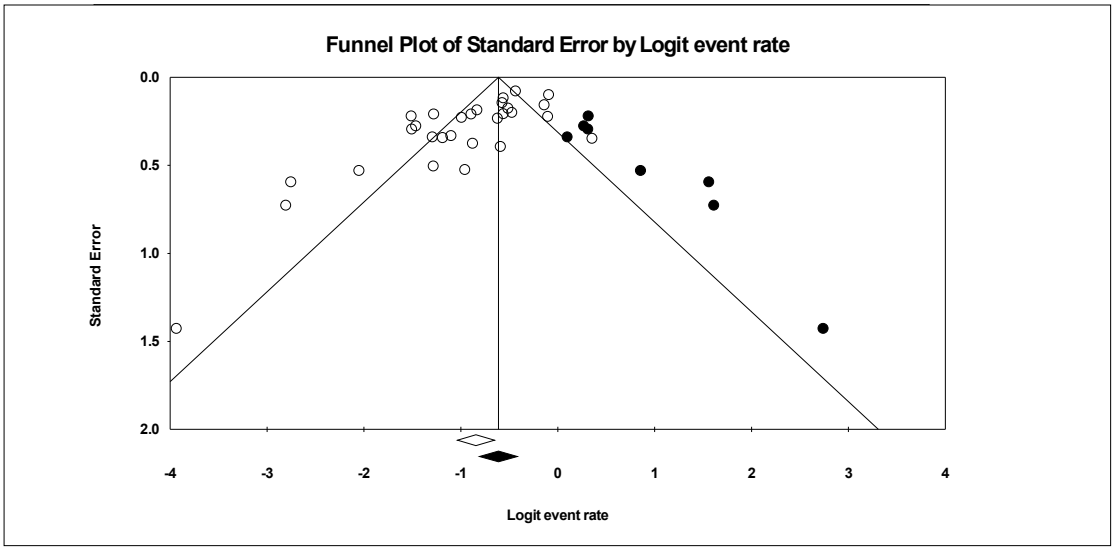
The pooled proportion of positive antispike Ab after the second dose of vaccination from the random effects model is 0.3 (95%CI: 0.26 to 0.34; N = 3433). There is a substantial heterogeneity between studies reporting seroconversion after administration of the second dose of the vaccine (I^2 = 81.6%). Worth to notice that the seroconversion was increased from 12% after the first dose to 30% after the second dose.

Table (S2): sensitivity analysis showing the results after one study removal from the 29 studies used in the above forest plot:

Study name	Statistics with study removed			
	Point	Lower limit	Upper limit	p-Value
Strauss, 2021	0.29	0.25	0.336	< 0.001
Kamar, 2021	0.30	0.26	0.341	< 0.001
Peled, 2021	0.31	0.27	0.348	< 0.001
Hall, 2021	0.30	0.26	0.344	< 0.001
Herrera, 2021	0.30	0.26	0.340	< 0.001
Boyarsky (A), 2021	0.29	0.25	0.339	< 0.001
Shostak, 2021	0.31	0.27	0.350	< 0.001
Rozen-Zvi , 2021	0.30	0.26	0.340	< 0.001
Ben Zadok, 2021	0.30	0.26	0.341	< 0.001
Schmidt, 2021	0.30	0.26	0.343	< 0.001
Grupper, 2021	0.30	0.26	0.340	< 0.001
Rabinowich, 2021	0.29	0.26	0.336	< 0.001
Korth, 2021	0.30	0.26	0.345	< 0.001
Chavarot, 2021	0.31	0.27	0.348	< 0.001
Benotmane, 2021	0.30	0.26	0.340	< 0.001
Marinaki, 2021	0.29	0.26	0.335	< 0.001
Bruminhent 2021	0.31	0.27	0.348	< 0.001
Alejo 2021	0.30	0.26	0.343	< 0.001
Peled 2021	0.30	0.26	0.345	< 0.001
Schrezenmeier 2021	0.30	0.27	0.345	< 0.001
Holden 2021	0.30	0.26	0.341	< 0.001
Yanis 2021	0.30	0.26	0.346	< 0.001
Sadioglu 2021	0.31	0.27	0.348	< 0.001
Benning 2022	0.30	0.26	0.343	< 0.001
Ou 2021	0.29	0.26	0.335	< 0.001
Karaba 2021	0.30	0.26	0.346	< 0.001
Schramm 2021	0.31	0.27	0.350	< 0.001
Mazzola 2021	0.31	0.27	0.348	< 0.001
Erol 2021	0.30	0.26	0.345	< 0.001
Random	0.30	0.26	0.342	< 0.001

This table of sensitivity analysis indicates that the results are robust in the sense that the pooled seroconversion after the second dose of vaccination will remain essentially the same (range from 29% to 31%) with any one study removed.

Figure (S4) funnel plot of the 29 studies showing the immune response after the second dose:



Egger's regression intercept

Intercept	-2.94099
Standard error	0.64939
95% lower limit (2-tailed)	-4.27343
95% upper limit (2-tailed)	-1.60855
t-value	4.52883
df	27.00000
P-value (1-tailed)	0.00005
P-value (2-tailed)	0.00011

Duval and Tweedie's trim and fill

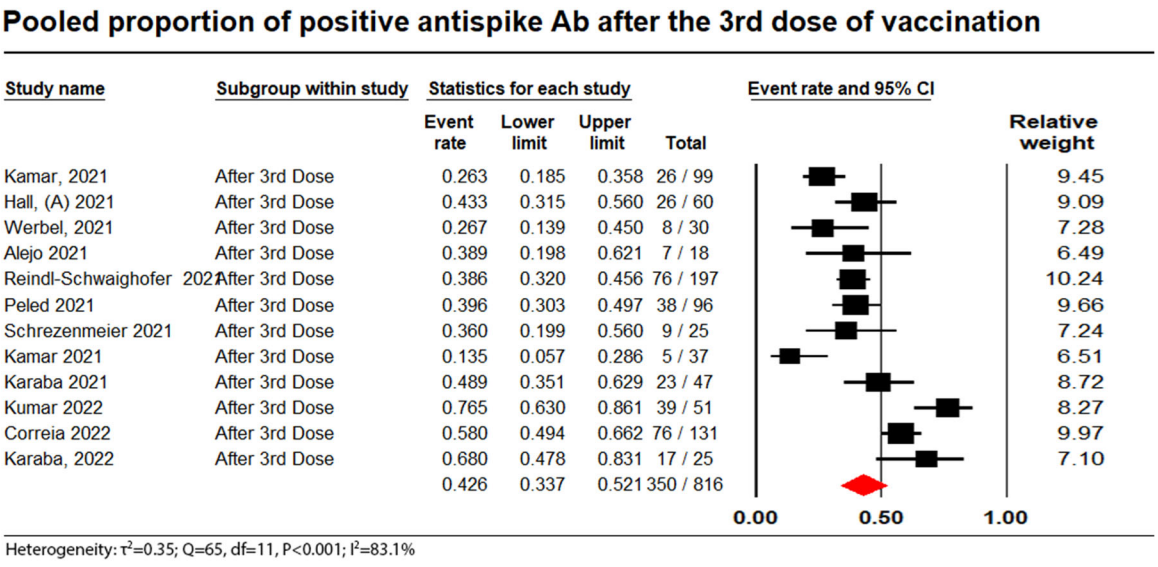
		Fixed Effects			Random Effects			Q Value
	Studies Trimmed	Point Estimate	Lower Limit	Upper Limit	Point Estimate	Lower Limit	Upper Limit	
Observed values		0.35755	0.34112	0.37433	0.30072	0.26213	0.34235	151.96234
Adjusted values	8	0.37586	0.35972	0.39228	0.35153	0.30832	0.39732	221.62012

There is evidence of publication bias in the pooled analysis of seroconversion after the second dose of vaccination. There are eight studies resided at the left of the

funnel are more than those on the right side. The Egger's regression intercept (B0) is -2.94099, (95%CI: -4.27343 to -1.60855), with t=4.53 df=27. The 1-tailed p-value (recommended) is 0.00005, and the 2-tailed p-value is 0.00011; indicating the possibly of publication bias.

Using Trim and Fill method, the adjusted pooled proportion (random effect) of seroconversion after the second dose of vaccination would increase from to 0.3 to 0.38 (95% CI: 0.31 to 0.4) if the publication bias was not existed.

Figure (S5): Pooled proportion of +ve antispike Ab after the third dose administration:



#Studies: 12 #Patients: 816 #Response: 350
#Proportion (95%CI): 0.43 (0.34 to 0.52)

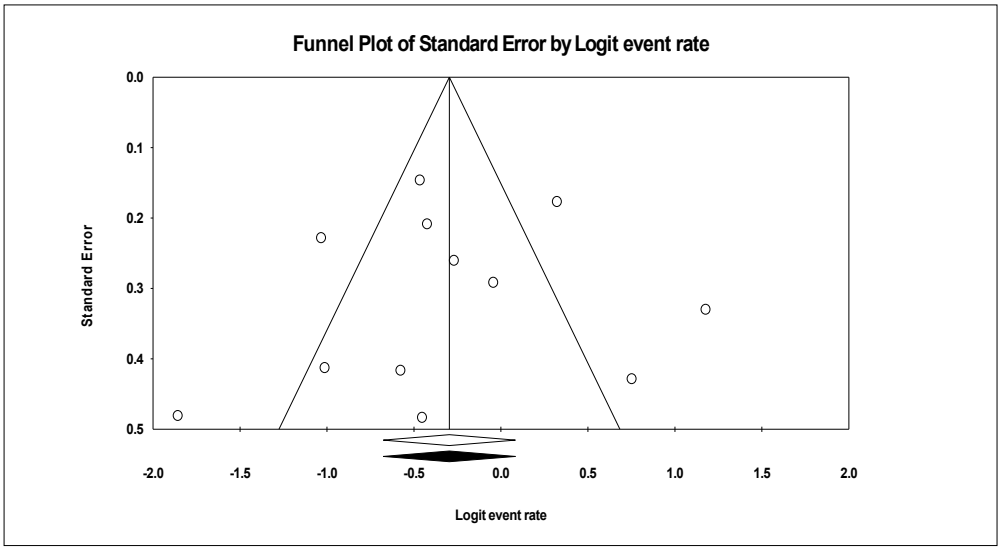
The pooled proportion of positive antispike Ab after the third dose of vaccination from the random effects model is 0.43 (95%CI: 0.34 to 0.52; N = 816). There is a substantial heterogeneity between studies reporting seroconversion after administration of the third dose of the vaccine (I^2 = 83.3%).

Table (S3): sensitivity analysis showing the results after one study removal from the 12 studies used in the above forest plot:

Study name	Statistics with study removed			
	Point	Lower limit	Upper limit	p-Value
Kamar, 2021	0.45	0.35	0.54	0.27
Hall, (A) 2021	0.43	0.33	0.53	0.16
Werbel, 2021	0.44	0.35	0.54	0.23
Alejo 2021	0.43	0.33	0.53	0.16
Reindl-Schwaighofer 2021	0.43	0.33	0.54	0.21
Peled 2021	0.43	0.33	0.54	0.19
Schrezenmeier 2021	0.43	0.34	0.53	0.18
Kamar 2021	0.45	0.36	0.54	0.31
Karaba 2021	0.42	0.32	0.52	0.13
Kumar 2022	0.40	0.32	0.48	0.02
Correia 2022	0.41	0.32	0.51	0.07
Karaba, 2022	0.41	0.32	0.50	0.06
Random	0.43	0.34	0.52	0.13

This table of sensitivity analysis indicates that the results are robust in the sense that the pooled seroconversion after the third dose of vaccination will remain essentially the same (range from 40% to 45%) with any one study removed.

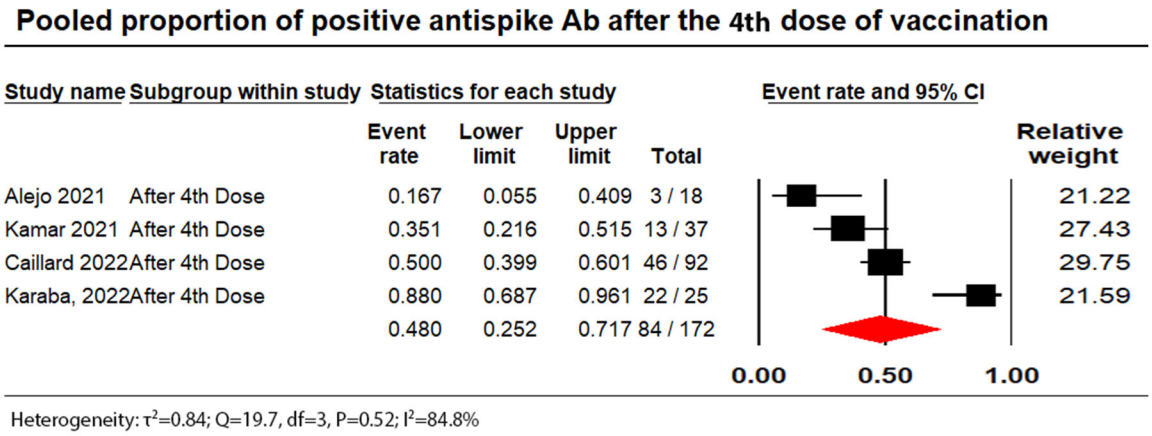
Figure (S6) funnel plot of the 12 studies showing the immune response after the third dose:



Egger's regression intercept	
Intercept	-0.33503
Standard error	1.93866
95% lower limit (2-tailed)	-4.65463
95% upper limit (2-tailed)	3.98457
t-value	0.17281
df	10.00000
P-value (1-tailed)	0.43312
P-value (2-tailed)	0.86625

According to the funnel plot, where the pooled studies symmetry around the mean effect size, and Egger's regression intercept test ($P > 0.05$), there is no evidence of publication bias in this analysis. Moreover, with the random effects model the point estimate and 95% confidence interval for the pooled studies using Duval and Tweedie's Trim and Fill are unchanged.

Figure (S7): Pooled proportion of +ve antispike Ab after the fourth dose administration:



#Studies: 4 #Patients: 172 #Response: 84
#Proportion (95%CI): 0.48 (0.25 to 0.72)

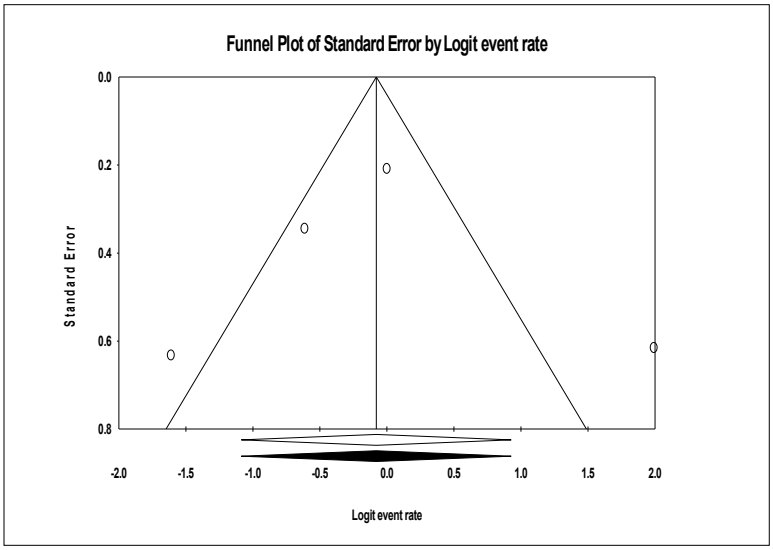
The pooled proportion of positive antispike Ab after the fourth dose of vaccination from the random effects model is 0.48 (95%CI: 0.25 to 0.72; N = 172). There is a substantial heterogeneity between studies reporting seroconversion after administration of the second dose of the vaccine (I^2 = 84.8%).

Table (S4): sensitivity analysis showing the results after one study removal from the 4 studies used in the above forest plot:

Study name	Statistics with study removed			
	Point	Lower limit	Upper limit	p-Value
Alejo 2021	0.58	0.32	0.80	0.56
Kamar 2021	0.53	0.19	0.85	0.88
Caillard 2022	0.48	0.13	0.85	0.92
Karaba, 2022	0.36	0.21	0.55	0.15
Random	0.48	0.25	0.72	0.88

This table of sensitivity analysis indicates that the results are not robust since the pooled seroconversion declined to 36% when Karaba 2022 (relative weight of study is 21.2%) study removed and increased to 58% when Alejo 2021 (relative weight of study is 21.2%) study removed from the analysis. However, the low number of studies included in the analysis may explain the compromised sensitivity analysis.

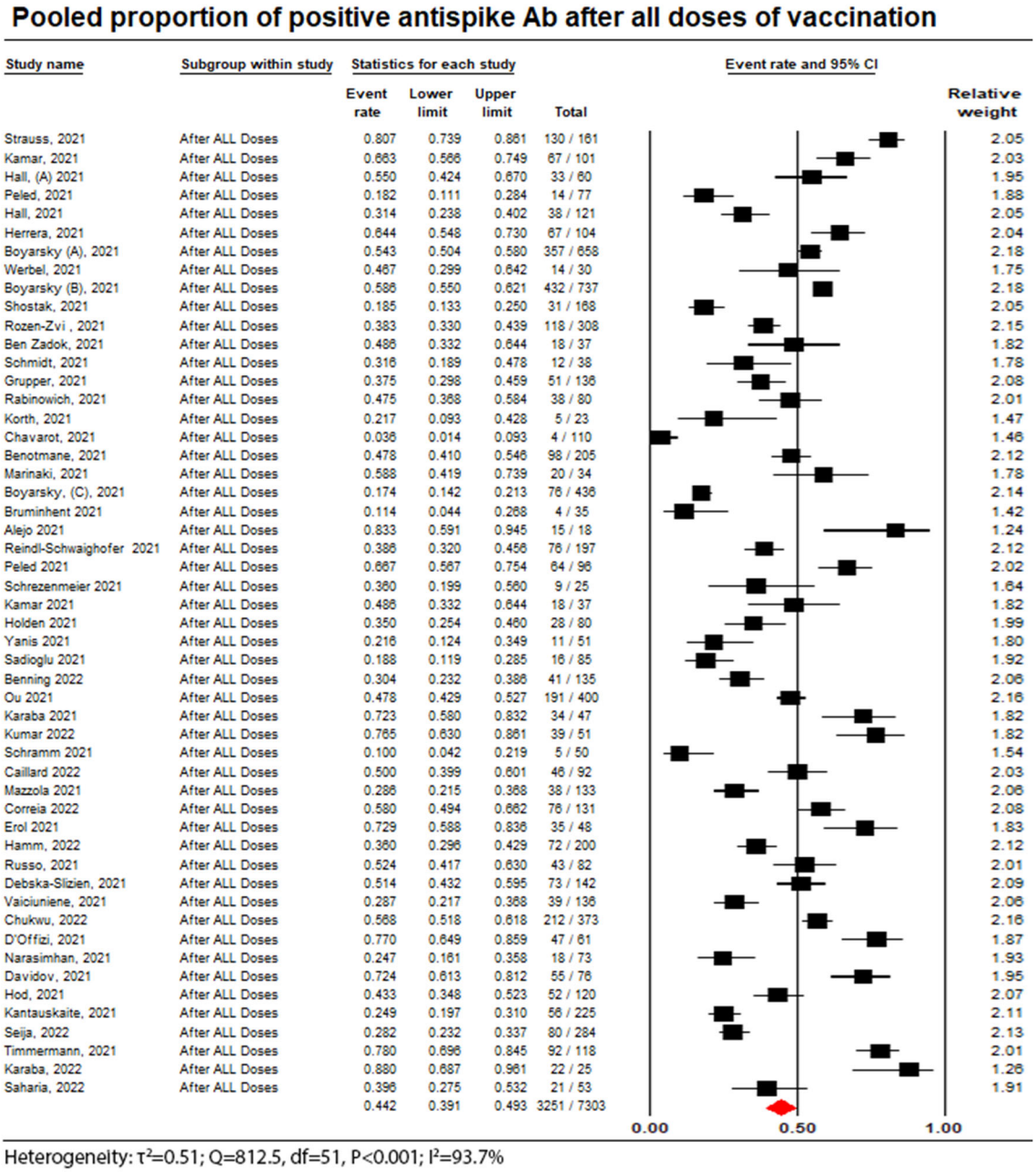
Figure (S8) funnel plot of the 4 studies showing the immune response after the Fourth dose:



Egger's regression intercept	
Intercept	0.11384
Standard error	3.62815
95% lower limit (2-tailed)	-15.49683
95% upper limit (2-tailed)	15.72450
t-value	0.03138
df	2.00000
P-value (1-tailed)	0.48891
P-value (2-tailed)	0.97782

According to the funnel plot, where the pooled studies symmetry around the mean effect size, and Egger's regression intercept test ($P > 0.05$), there is no evidence of publication bias in this analysis. Moreover, with the random effects model the point estimate and 95% confidence interval for the pooled studies using Duval and Tweedie's Trim and Fill are unchanged.

Figure (S9): Pooled proportion of +ve antispike Ab after all doses administration:



#Studies: 52 #Patients: 7303 #Response: 3251
#Proportion (95%CI): 0.44 (0.39 to 0.49)

The pooled proportion of positive antispike Ab after the administration of all doses of vaccination from the random effects model is 0.44 (95%CI: 0.39 to 0.49; N = 7303). There is a considerable heterogeneity between studies reporting seroconversion after administration of all doses of the vaccine (I^2 = 93.7%).

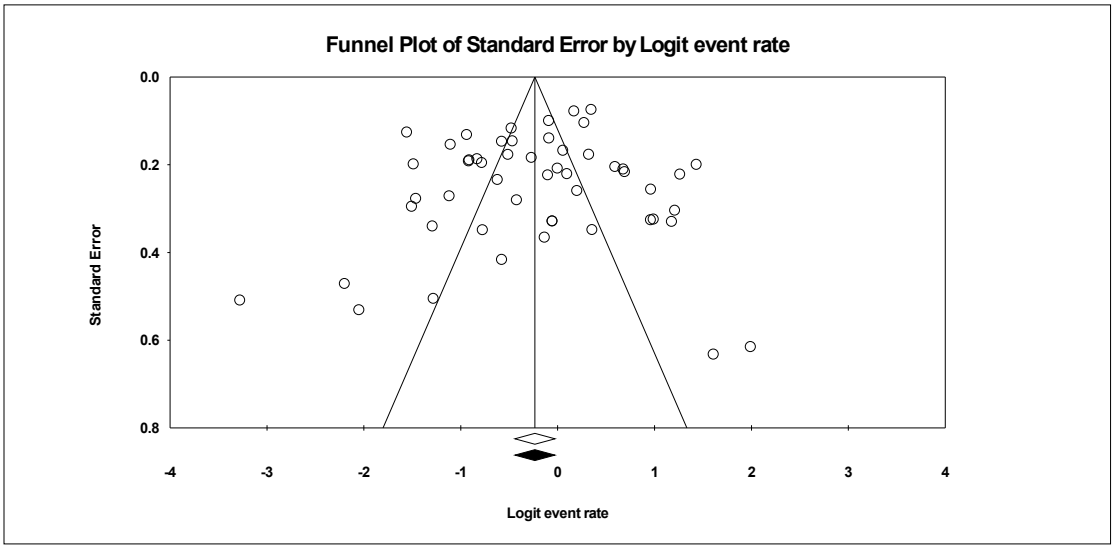
Table (S5): sensitivity analysis showing the results after one study removal from the 52 studies used in the above forest plot:

Study name	Statistics with study removed			
	Point	Lower limit	Upper limit	p-Value
Strauss, 2021	0.43	0.38	0.48	0.01
Kamar, 2021	0.44	0.39	0.49	0.02
Hall, (A) 2021	0.44	0.39	0.49	0.02
Peled, 2021	0.45	0.40	0.50	0.05
Hall, 2021	0.44	0.39	0.50	0.04
Herrera, 2021	0.44	0.39	0.49	0.02
Boyarsky (A), 2021	0.44	0.39	0.49	0.03
Werbel, 2021	0.44	0.39	0.49	0.03
Boyarsky (B), 2021	0.44	0.39	0.49	0.02
Shostak, 2021	0.45	0.40	0.50	0.05
Rozen-Zvi , 2021	0.44	0.39	0.50	0.04
Ben Zadok, 2021	0.44	0.39	0.49	0.03
Schmidt, 2021	0.44	0.39	0.50	0.04
Grupper, 2021	0.44	0.39	0.50	0.03
Rabinowich, 2021	0.44	0.39	0.49	0.03
Korth, 2021	0.45	0.40	0.50	0.04
Chavarot, 2021	0.45	0.40	0.50	0.07
Benotmane, 2021	0.44	0.39	0.49	0.03
Marinaki, 2021	0.44	0.39	0.49	0.02
Boyarsky, (C), 2021	0.45	0.40	0.50	0.04
Bruminhent 2021	0.45	0.40	0.50	0.05
Alejo 2021	0.44	0.39	0.49	0.02
Reindl-Schwaighofer 2021	0.44	0.39	0.50	0.03
Peled 2021	0.44	0.39	0.49	0.02
Schrezenmeier 2021	0.44	0.39	0.50	0.03
Kamar 2021	0.44	0.39	0.49	0.03
Holden 2021	0.44	0.39	0.50	0.04
Yanis 2021	0.45	0.40	0.50	0.04
Sadioglu 2021	0.45	0.40	0.50	0.05
Benning 2022	0.44	0.39	0.50	0.04
Ou 2021	0.44	0.39	0.49	0.03
Karaba 2021	0.44	0.39	0.49	0.02
Kumar 2022	0.44	0.39	0.49	0.01
Schramm 2021	0.45	0.40	0.50	0.05
Caillard 2022	0.44	0.39	0.49	0.03
Mazzola 2021	0.45	0.39	0.50	0.04
Correia 2022	0.44	0.39	0.49	0.02
Erol 2021	0.44	0.39	0.49	0.02
Hamm, 2022	0.44	0.39	0.50	0.04

Russo, 2021	0.44	0.39	0.49	0.03
Debska-Slizien, 2021	0.44	0.39	0.49	0.03
Vaiciuniene, 2021	0.45	0.39	0.50	0.04
Chukwu, 2022	0.44	0.39	0.49	0.02
D'Offizi, 2021	0.43	0.39	0.49	0.01
Narasimhan, 2021	0.45	0.40	0.50	0.04
Davidov, 2021	0.44	0.39	0.49	0.02
Hod, 2021	0.44	0.39	0.49	0.03
Kantauskaite, 2021	0.45	0.40	0.50	0.04
Seija, 2022	0.45	0.39	0.50	0.04
Timmermann, 2021	0.43	0.38	0.49	0.01
Karaba, 2022	0.43	0.38	0.49	0.01
Saharia, 2022	0.44	0.39	0.50	0.03
Random	0.44	0.39	0.49	0.03

This table of sensitivity analysis indicates that the results are robust in the sense that the pooled seroconversion after the administration of all doses of vaccination will remain essentially the same (range from 43% to 45%) with any one study removed.

Figure (S10) funnel plot of the 52 studies showing the total accumulated seroconversion after the administration of the 4 doses



Egger's regression intercept

Intercept	-0.97796
Standard error	1.19657
95% lower limit (2-tailed)	-3.38135
95% upper limit (2-tailed)	1.42542
t-value	0.81730
df	50.00000
P-value (1-tailed)	0.20882
P-value (2-tailed)	0.41763

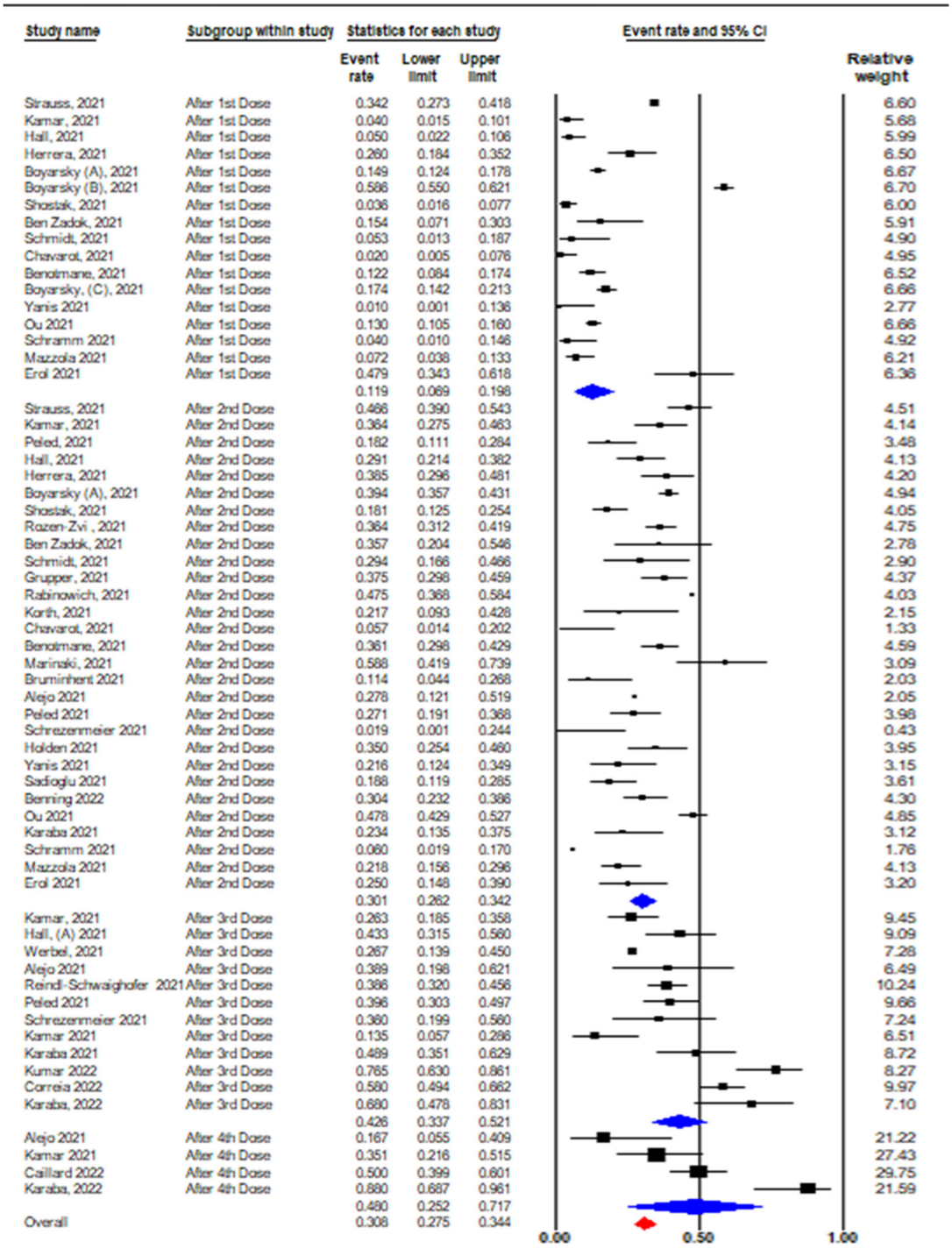
Duval and Tweedie's trim and fill

		Fixed Effects			Random Effects			Q Value
	Studies Trimmed	Point Estimate	Lower Limit	Upper Limit	Point Estimate	Lower Limit	Upper Limit	
Observed values		0.45700	0.44475	0.46931	0.44155	0.39114	0.49321	812.51658
Adjusted values	0	0.45700	0.44475	0.46931	0.44155	0.39114	0.49321	812.51658

According to the funnel plot, where the pooled studies symmetry around the mean effect size, and Egger's regression intercept test ($P > 0.05$), there is no evidence of publication bias in this analysis. Moreover, with the random effects model the point

estimate and 95% confidence interval for the combined studies is 0.44 (0.39, 0.49). Using Duval and Tweedie's Trim and Fill approach these values are unchanged; confirming absence of publication bias reported above from funnel plot and Egger's test.

Subgroup comaprison of seroconversion according to number of vaccine doses

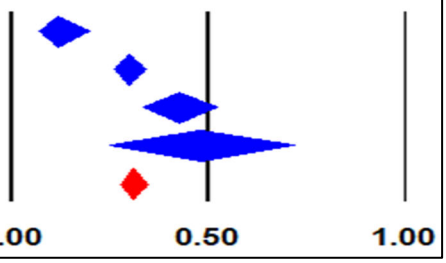


Overall heterogeneity: τ^2=0.63; Q=937.3, df=61, P<0.001; I^2=93.5%

#Studies: 62 (Not mutually exclusive)
#Patients: 8156 #Response: 2464
#Proportion (95%CI): 0.31 (0.28 to 0.34)

Subgroup comparison of seroconversion according to number of vaccine doses

Group by Subgroup within study	Event rate	Lower limit	Upper limit	Total
After 1st Dose	0.119	0.069	0.198	850 / 3735
After 2nd Dose	0.301	0.262	0.342	1180 / 3433
After 3rd Dose	0.426	0.337	0.521	350 / 816
After 4th Dose	0.480	0.252	0.717	84 / 172
Overall	0.308	0.275	0.344	2464 / 8156



Overall heterogeneity: τ^2=0.63; Q=937.3, df=61, P<0.001; I^2=93.5%