

ONLINE SUPPLEMENTARY DATA

Supplementary Table 1: Proportion of participants with a positive serological response four weeks after completion of pneumococcal-vaccination. A positive serological response was defined as a 4-fold increase from baseline or achieving a level of >0.35 mg/L.

Serotype	Response (%) (95% CI)				
	csDMARD	bDMARD	Arm IA	Arm IB	Arm II
1	0.73 (0.54-0.86)	0.81 (0.69-0.89)	0.80 (0.55-0.93)	0.86 (0.63-0.96)	0.76 (0.52-0.91)
3	0.45 (0.29-0.63)	0.54 (0.41-0.66)	0.50 (0.28-0.72)	0.59 (0.36-0.78)	0.52 (0.30-0.74)
4	0.58 (0.40-0.74)	0.65 (0.52-0.76)	0.70 (0.45-0.87)	0.68 (0.45-0.85)	0.57 (0.34-0.77)
5	0.48 (0.31-0.66)	0.62 (0.49-0.73)	0.70 (0.45-0.87)	0.64 (0.41-0.82)	0.52 (0.30-0.74)
6B	0.61 (0.42-0.76)	0.78 (0.66-0.87)	0.85 (0.60-0.96)	0.77 (0.54-0.91)	0.71 (0.47-0.88)
7F	0.94 (0.77-0.99)	0.94 (0.84-0.98)	0.90 (0.64-0.98)	0.95 (0.70-0.99)	0.95 (0.69-0.99)
9V	0.64 (0.45-0.79)	0.79 (0.67-0.87)	0.75 (0.50-0.90)	0.82 (0.58-0.94)	0.81 (0.56-0.93)
14	0.88 (0.71-0.96)	0.87 (0.76-0.94)	0.90 (0.64-0.98)	0.86 (0.63-0.96)	0.86 (0.61-0.96)
18C	0.88 (0.71-0.96)	0.90 (0.80-0.96)	0.80 (0.55-0.93)	0.91 (0.67-0.98)	1 (-)
19A	0.97 (0.80-1.00)	0.89 (0.78-0.95)	0.90 (0.64-0.98)	0.91 (0.67-0.98)	0.86 (0.61-0.96)
19F	0.94 (0.77-0.99)	0.95 (0.86-0.99)	0.95 (0.68-0.99)	0.95 (0.70-0.99)	0.95 (0.69-0.99)
23F	0.91 (0.74-0.97)	0.90 (0.80-0.96)	0.85 (0.60-0.96)	0.91 (0.67-0.98)	0.95 (0.69-0.99)

csDMARD: conventional Disease Modifying Anti-Rheumatic Drugs, bDMARD: biological Disease Modifying Anti-Rheumatic Drugs

Supplementary table 2: Serotype specific immunoglobulin G (IgG) geometric mean concentration (GMC) pre-PCV13, post-PCV13, pre-PPV23, and post-PPV23 vaccination, by pneumococcal serotypes (mg/L) according to treatment with csDMARD or bDMARD; randomisation arm IA, IB or II; and to anti-TNF α , anti-IL6, CTLA-4 or RTX.

	Pre-PCV13 GMC (mg/L) (95%CI)	Post-PCV13 GMC (mg/L) (95%CI)	Pre-PPV23 GMC (mg/L) (95%CI)	Post-PPV23 GMC (mg/L) (95%CI)
csDMARD	N=35	N=35	N=33	N=33
1	0.15 (0.09-0.27)	1.40 (0.70-2.78)	0.93 (0.46-1.86)	0.82 (0.41-1.61)
3	0.07 (0.04-0.12)	0.27 (0.15-0.50)	0.19 (0.11-0.33)	0.19 (0.10-0.34)
4	0.04 (0.03-0.06)	0.37 (0.19-0.72)	0.29 (0.15-0.55)	0.27 (0.14-0.50)
5	0.08 (0.04-0.13)	0.28 (0.14-0.55)	0.26 (0.13-0.50)	0.23 (0.12-0.45)
6b	0.12 (0.07-0.20)	0.68 (0.33-1.39)	0.40 (0.19-0.85)	0.42 (0.21-0.83)
7f	0.50 (0.32-0.79)	6.53 (3.43-12.43)	4.50 (2.45-8.27)	3.71 (2.07-6.64)
9v	0.20 (0.13-0.31)	1.07 (0.61-1.87)	0.94 (0.52-1.72)	0.83 (0.44-1.57)
14	0.64 (0.35-1.18)	3.86 (2.14-6.96)	3.40 (1.85-6.25)	2.88 (1.56-5.34)
18c	0.41 (0.25-0.65)	2.83 (1.65-4.88)	2.08 (1.23-3.52)	1.71 (0.98-2.99)
19a	1.37 (0.69-2.72)	7.70 (4.02-14.74)	6.29 (3.14-12.62)	4.92 (2.49-9.74)
19f	0.87 (0.51-1.48)	4.46 (2.40-8.31)	3.45 (1.80-6.62)	2.81 (1.56-5.08)
23f	0.42 (0.24-0.75)	3.63 (1.88-7.01)	2.68 (1.38-5.19)	2.19 (1.23-3.92)
bDMARD	N=65	N=65	N=63	N=63
1	0.14 (0.10-0.20)	0.69 (0.45-1.08)	0.59 (0.38-0.91)	0.79 (0.52-1.20)
3	0.07 (0.05-0.09)	0.21 (0.14-0.31)	0.17 (0.12-0.26)	0.26 (0.17-0.39)
4	0.09 (0.06-0.12)	0.50 (0.31-0.80)	0.37 (0.24-0.57)	0.41 (0.26-0.65)
5	0.10 (0.08-0.14)	0.43 (0.28-0.65)	0.43 (0.28-0.65)	0.41 (0.28-0.61)
6b	0.24 (0.15-0.38)	1.23 (0.74-2.04)	0.92 (0.56-1.51)	0.92 (0.56-1.51)
7f	0.81 (0.57-1.15)	4.68 (2.94-7.45)	3.86 (2.54-5.86)	4.51 (3.02-6.72)
9v	0.25 (0.19-0.34)	1.09 (0.74-1.60)	0.89 (0.61-1.29)	1.02 (0.69-1.49)
14	0.90 (0.59-1.40)	3.17 (1.95-5.16)	2.81 (1.72-4.59)	3.58 (2.21-5.79)
18c	0.57 (0.43-0.75)	2.60 (1.81-3.74)	2.28 (1.61-3.23)	2.65 (1.84-3.80)
19a	1.75 (1.14-2.68)	7.09 (4.33-11.61)	5.25 (3.11-8.87)	5.93 (3.45-10.21)
19f	1.03 (0.75-1.42)	4.05 (2.63-6.22)	3.17 (2.06-4.88)	3.81 (2.49-5.83)
23f	0.50 (0.36-0.70)	3.73 (2.39-5.84)	3.03 (1.95-4.70)	3.29 (2.11-5.14)
Arm IA	N=21	N=21	N=20	N=20
1	0.11 (0.06-0.21)	0.60 (0.24-1.48)	0.48 (0.22-1.07)	0.68 (0.30-1.57)
3	0.07 (0.04-0.13)	0.19 (0.08-0.44)	0.15 (0.07-0.31)	0.25 (0.11-0.57)
4	0.07 (0.05-0.11)	0.39 (0.16-0.92)	0.30 (0.15-0.62)	0.36 (0.16-0.80)
5	0.09 (0.05-0.17)	0.49 (0.18-1.38)	0.40 (0.17-0.95)	0.49 (0.19-1.27)
6b	0.33 (0.15-0.74)	1.38 (0.53-3.61)	1.10 (0.44-2.76)	1.36 (0.61-3.07)

7f	0.56 (0.31-1.03)	3.24 (1.18-8.87)	2.33 (1.00-5.45)	2.87 (1.21-6.77)
9v	0.31 (0.16-0.59)	1.20 (0.52-2.75)	0.97 (0.45-2.09)	1.20 (0.55-2.61)
14	1.29 (0.68-2.45)	5.43 (2.39-12.35)	4.52 (2.10-9.73)	5.52 (2.54-12.01)
18c	0.57 (0.36-0.92)	2.51 (1.03-6.10)	2.21 (1.00-4.87)	2.76 (1.22-6.25)
19a	1.22 (0.65-2.29)	6.71 (2.64-17.03)	4.33 (1.66-11.28)	5.08 (1.90-13.61)
19f	1.49 (0.86-2.58)	5.81 (2.73-12.35)	4.25 (2.11-8.53)	4.79 (2.30-10.01)
23f	0.57 (0.31-1.05)	3.61 (1.67-7.81)	2.74 (1.37-5.47)	3.20 (1.52-6.72)
Arm IB	N=23	N=23	N=22	N=22
1	0.12 (0.06-0.25)	0.71 (0.30-1.67)	0.62 (0.28-1.38)	0.89 (0.42-1.89)
3	0.06 (0.04-0.10)	0.21 (0.11-0.40)	0.16 (0.09-0.29)	0.27 (0.14-0.53)
4	0.12 (0.07-0.19)	0.82 (0.41-1.66)	0.56 (0.30-1.03)	0.64 (0.32-1.26)
5	0.09 (0.06-0.15)	0.48 (0.24-0.96)	0.30 (0.15-0.57)	0.42 (0.23-0.76)
6b	0.20 (0.09-0.46)	1.63 (0.68-3.88)	1.06 (0.45-2.52)	1.08 (0.45-2.61)
7f	0.94 (0.51-1.74)	6.53 (2.91-14.69)	6.01 (3.14-11.50)	6.66 (3.49-12.70)
9v	0.23 (0.15-0.36)	1.24 (0.63-2.41)	0.99 (0.52-1.86)	1.12 (0.56-2.23)
14	0.53 (0.25-1.12)	2.01 (0.81-4.99)	1.73 (0.71-4.21)	2.37 (0.99-5.69)
18c	0.62 (0.40-0.98)	2.99 (1.67-5.35)	2.56 (1.40-4.68)	2.93 (1.53-5.60)
19a	1.98 (1.05-3.73)	11.91 (5.54-25.59)	8.78 (3.98-19.35)	11.00 (4.76-25.46)
19f	0.88 (0.52-1.49)	4.85 (2.02-11.65)	3.60 (1.48-8.77)	4.99 (2.07-12.07)
23f	0.48 (0.26-0.89)	5.17 (2.08-12.83)	4.32 (1.79-10.47)	4.73 (1.88-11.88)
Arm II	N=21	N=21	N=21	N=21
1	0.19 (0.11-0.34)	0.61 (0.34-1.07)	0.68 (0.30-1.51)	0.80 (0.39-1.64)
3	0.07 (0.04-0.13)	0.17 (0.10-0.28)	0.22 (0.10-0.48)	0.25 (0.11-0.56)
4	0.07 (0.03-0.14)	0.54 (0.28-1.03)	0.29 (0.10-0.79)	0.29 (0.11-0.79)
5	0.13 (0.08-0.21)	0.45 (0.27-0.75)	0.26 (0.15-0.44)	0.34 (0.20-0.58)
6b	0.21 (0.10-0.47)	1.08 (0.61-1.92)	0.65 (0.25-1.70)	0.65 (0.26-1.65)
7f	0.99 (0.50-1.97)	4.78 (2.72-8.42)	4.01 (1.93-8.35)	4.69 (2.47-8.91)
9v	0.23 (0.14-0.39)	0.99 (0.63-1.56)	0.73 (0.37-1.41)	0.79 (0.43-1.46)
14	1.14 (0.46-2.87)	2.76 (1.37-5.56)	2.99 (1.15-7.80)	3.64 (1.43-9.26)
18c	0.52 (0.29-0.91)	2.00 (1.22-3.28)	2.08 (1.26-3.45)	2.28 (1.39-3.76)
19a	2.19 (0.77-6.24)	5.74 (2.90-1.14)	3.69 (1.25-10.87)	3.60 (1.21-10.68)
19f	0.85 (0.44-1.63)	3.10 (1.99-4.82)	2.10 (1.03-4.31)	2.31 (1.23-4.34)
23f	0.46 (0.26-0.82)	3.35 (1.93-5.80)	2.30 (1.05-5.01)	2.31 (1.13-4.73)
Anti-TNFα	N=38	N=38	N=37	N=37
1	0.14 (0.08-0.23)	0.61 (0.34-1.07)	0.54 (0.30-0.96)	0.81 (0.47-1.40)
3	0.07 (0.05-0.10)	0.17 (0.10-0.28)	0.15 (0.09-0.24)	0.24 (0.15-0.41)
4	0.07 (0.05-0.11)	0.54 (0.28-1.03)	0.37 (0.21-0.67)	0.42 (0.23-0.78)
5	0.10 (0.07-0.15)	0.45 (0.27-0.75)	0.31 (0.20-0.48)	0.42 (0.27-0.68)
6b	0.23 (0.13-0.42)	1.08 (0.61-1.92)	0.82 (0.47-1.44)	0.91 (0.51-1.63)

7f	0.93 (0.60-1.45)	4.78 (2.72-8.42)	3.90 (2.38-6.38)	4.68 (2.91-7.50)
9v	0.27 (0.18-0.41)	0.99 (0.63-1.56)	0.82 (0.53-1.26)	1.01 (0.65-1.56)
14	0.79 (0.44-1.44)	2.76 (1.37-5.56)	2.46 (1.20-5.04)	3.44 (1.71-6.92)
18c	0.50 (0.34-0.74)	2.00 (1.22-3.28)	1.79 (1.15-2.79)	2.09 (1.30-3.36)
19a	1.29 (0.71-2.35)	5.74 (2.90-1.14)	4.02 (1.96-8.25)	4.76 (2.26-10.01)
19f	0.89 (0.57-1.40)	3.10 (1.99-4.82)	2.39 (1.58-3.60)	3.13 (2.03-4.83)
23f	0.46 (0.30-0.71)	3.35 (1.93-5.80)	2.72 (1.59-4.64)	3.14 (1.78-5.53)
Anti-IL6	N=9	N=9	N=9	N=9
1	0.19 (0.04-0.78)	1.66 (0.49-5.69)	1.58 (0.44-5.70)	1.82 (0.57-5.81)
3	0.11 (0.03-0.39)	0.53 (0.19-1.47)	0.47 (0.17-1.29)	0.75 (0.34-1.66)
4	0.08 (0.04-0.19)	0.60 (0.18-2.03)	0.50 (0.14-1.85)	0.59 (0.21-1.64)
5	0.09 (0.03-0.23)	0.49 (0.12-2.12)	0.45 (0.11-1.91)	0.54 (0.13-2.19)
6b	0.26 (0.07-1.04)	2.59 (0.44-15.37)	1.94 (0.30-12.69)	1.81 (0.33-9.89)
7f	0.90 (0.28-2.90)	13.42 (4.34-41.46)	10.71 (3.09-37.11)	10.62 (3.31-34.06)
9v	0.25 (0.09-0.67)	2.68 (0.69-10.39)	2.66 (0.67-10.61)	2.68 (0.88-8.21)
14	1.87 (0.43-8.15)	7.26 (2.02-26.14)	7.56 (2.31-24.73)	8.06 (2.47-26.35)
18c	0.99 (0.47-2.07)	9.24 (5.30-16.10)	9.90 (5.97-16.43)	9.41 (5.53-16.01)
19a	7.31 (2.48-21.59)	31.61 (11.13-89.75)	32.44 (11.53-91.29)	35.00 (12.34-99.27)
19f	1.52 (0.52-4.44)	11.82 (2.27-61.63)	12.09 (1.99-73.60)	12.83 (2.36-69.67)
23f	1.18 (0.42-3.29)	15.34 (4.34-54.24)	13.72 (3.74-50.34)	13.60 (4.62-40.01)
CTLA-4	N=14	N=14	N=14	N=14
1	0.11 (0.07-0.20)	0.95 (0.38-2.33)	0.68 (0.32-1.45)	0.75 (0.34-1.69)
3	0.07 (0.04-0.13)	0.35 (0.13-0.95)	0.24 (0.08-0.65)	0.29 (0.10-0.85)
4	0.12 (0.05-0.27)	0.67 (0.22-2.03)	0.52 (0.19-1.46)	0.59 (0.19-1.82)
5	0.14 (0.09-0.23)	0.53 (0.20-1.43)	0.37 (0.15-0.88)	0.51 (0.21-1.24)
6b	0.28 (0.08-0.91)	1.83 (0.43-7.83)	1.23 (0.28-5.36)	1.34 (0.35-5.17)
7f	0.78 (0.32-1.93)	5.60 (1.99-15.76)	3.27 (1.13-9.43)	3.61 (1.21-10.74)
9v	0.25 (0.17-0.36)	1.38 (0.70-2.71)	0.94 (0.49-1.80)	1.10 (0.53-2.27)
14	0.92 (0.39-2.18)	4.31 (1.79-10.38)	3.26 (1.38-7.66)	3.92 (1.72-8.93)
18c	0.63 (0.37-1.10)	3.87 (2.01-7.46)	2.79 (1.37-5.68)	3.84 (1.86-7.95)
19a	1.74 (0.75-4.05)	7.81 (2.74-22.31)	4.78 (1.49-15.40)	5.72 (1.72-19.02)
19f	1.36 (0.74-2.50)	6.70 (2.07-21.72)	4.59 (1.39-15.18)	4.95 (1.55-15.84)
23f	0.40 (0.18-0.87)	3.75 (1.30-10.79)	2.62 (0.92-7.43)	2.68 (0.93-7.72)
RTX	N=4	N=4	N=4	N=4
1	0.12 (0.01-1.61)	0.06 (0.00-4.09)	0.06 (0.01-0.54)	0.05- (0.03-0.14)
3	0.04 (0.00-0.28)	0.03 (0.01-0.23)	0.03 (0.00-0.21)	0.02 (0.00-0.14)
4	0.12 (0.01-2.37)	0.05 (0.01-0.55)	0.05 (0.00-0.55)	0.04 (0.00-0.41)

5	0.09 (0.00-1.99)	0.06 (0.00-5.10)	0.06 (0.00-2.38)	0.04 (0.00-3.34)
6b	0.18 (0.03-1.01)	0.18 (0.03-1.01)	0.18 (0.02-1.81)	0.18 (0.03-1.20)
7f	0.18 (0.03-1.09)	0.19 (0.03-1.25)	0.33 (0.15-0.74)	0.57 (0.07-4.59)
9v	0.15 (0.00-5.66)	0.15 (0.00-4.50)	0.13 (0.01-3.24)	0.10 (0.00-3.80)
14	0.57 (0.03-12.46)	0.61 (0.04-10.08)	0.66 (0.06-7.11)	0.62 (0.05-7.75)
18c	0.38 (0.09-1.67)	0.42 (0.14-1.29)	0.40 (0.19-0.85)	0.40 (0.19-0.84)
19a	1.12 (0.26-4.81)	1.23 (0.29-5.30)	1.39 (0.37-5.22)	0.95 (0.21-4.33)
19f	0.63 (0.09-4.33)	0.74 (0.12-4.68)	0.66 (0.08-5.55)	0.66 (0.09-4.80)
23f	0.39 (0.08-1.99)	0.42 (0.13-1.30)	0.45 (0.18-1.09)	0.41 (0.17-0.97)

GMC: Geometric mean concentration. PCV13: 13-valent protein conjugate pneumococcal vaccine. PPV23: 23-valent polysaccharide pneumococcal vaccine. 95%CI: 95% confidence interval. csDMARD: conventional Disease Modifying Anti-Rheumatic Drugs. bDMARD: biological Disease Modifying Anti-Rheumatic Drugs. Anti-TNF α : Tumour Necrosis Factor alpha inhibitors. Anti-IL6: Interleukin 6 inhibitors. CTLA-4: Abatacept, T-cell lymphocyte co-stimulation inhibitor. RTX: Rituximab, anti-CD20 monoclonal antibody.