

Supplementary Table 1 Comparison of characteristics of cases and controls, 1 April 2007 to 31 March 2011, secondary analysis

	Categories	Controls	Other cases	High grade cases
		No (%)	No (%)	No (%)
Agegroup*	11 to <15yrs in 2007	127 (1)	32 (1)	5 (1)
	15 to <19yrs in 2007	4350 (28)	909 (38)	225 (26)
	19 to <23yrs in 2007	6155 (40)	993 (42)	408 (46)
	23 to <28yrs in 2007	4731 (31)	447 (19)	243 (28)
Socioeconomic quintile	1 (Most disadvantaged)	1756 (11)	289 (12)	113 (13)
	2	2798 (18)	415 (17)	173 (20)
	3	3810 (25)	588 (25)	214 (24)
	4	3997 (26)	647 (27)	215 (24)
	5 (Least disadvantaged)	3002 (20)	442 (19)	166 (19)
Remoteness category	Major Cities of Australia	10298 (67)	1563 (66)	550 (62)
	Inner Regional Australia	2575 (17)	380 (16)	157 (18)
	Outer Regional Australia	2219 (14)	374 (16)	147 (17)
	Remote/Very Remote Australia	271 (2)	64 (3)	27 (3)
Tests before index date	Tests=1	14223 (93)	2124 (89)	603 (68)
	Tests=2	1053 (7)	236 (10)	193 (22)
	Tests=3	83 (1)	19 (1)	66 (7)
	Tests=4	4 (0.03)	2 (0.1)	18 (2)
	Tests=5	0	0	1 (0.1)
Follow up periods**	Time from start of study to index date	1142 (921-1306)	1101 (876-1290)	984 (711-1194)
	Time from study start date to first vaccine dose	229 (173-382)	229 (142-387)	242 (185-421)
	Time from study start date to last vaccine dose	414 (317-600)	409 (298-600)	433 (330-624)
	Time from first vaccine dose to index date	824 (626-1042)	806 (565-1039)	650 (377-912)
	Time from last vaccine dose to index date	638 (436-862)	626 (368-854)	471 (217-701)
Follow up quartile (time to index date)	1 (between 0 and 906 days)	3605 (23)	678 (28)	384 (44)
	2 (between 906 and 1131 days)	3872 (25)	592 (25)	213 (24)
	3 (between 1131 and 1300 days)	3924 (26)	551 (23)	182 (21)
	4 (greater than 1300 days)	2962 (26)	560 (24)	102 (12)

* Australian Bureau of Statistics estimated resident populations for Queensland women in 2007 were 111,805 (11 to <15 years), 112,250 (15 to <19 years), 113,920 (19 to <23 Years) and 142,836 (23 to <28 years)

** Median time in days (lower quartile, upper quartile)

Supplementary Table 2 Frequency of cytological and histological diagnoses for cases, 1 April 2007 to 31 March 2011, secondary analysis

Case group	Category of cervical abnormality¶	Diagnosis	N (%)
	Histologically confirmed high-grade cervical abnormality		881 (100)
High grade cases§ N=881	Squamous abnormalities	Cervical intraepithelial neoplasia (CIN) 3	724 (82)
		Cervical intraepithelial neoplasia (CIN) 2	124 (14)
		Cervical intraepithelial neoplasia (CIN) not otherwise specified (NOS)	20 (2)
	Endocervical abnormalities	Adenocarcinoma, invasive	1 (0.1)
		Adenocarcinoma <i>in situ</i> (AIS)	12 (1)
	Histologically confirmed low-grade abnormality		183 (7.7)
Other cases N=2,381	Squamous abnormalities	Low grade squamous abnormality	183 (7.7)
	Cytological abnormality only		2,198 (92.3)
	Cytological squamous abnormalities	High grade squamous intraepithelial lesion (HSIL)	87 (3.7)
		Possible high grade squamous intraepithelial lesion (pHSIL)	82 (3.4)
		Low grade squamous intraepithelial lesion (LSIL)	1,000 (42.0)
		Possible low grade squamous intraepithelial lesion (pLSIL)	1,025 (43.0)
	Cytological endocervical abnormalitiesΨ	Possible high grade endocervical abnormality	2 (0.08)
		Atypical endocervical cells of unknown significance	2 (0.08)

¶ Histology and cytology reporting categories of the Australian National Cervical Screening Program. The Australian modified Bethesda System 2004 designates ASC-US as pLSIL and ASC-H as pHSIL

§ Index date for high grade cases is the date of the cytology test immediately preceding the histology test

Ψ 1 'other' case had mixed squamous and endocervical abnormalities and was classified according to the endocervical component: possible high grade endocervical abnormality (also had HSIL)

Supplementary Table 3 Effectiveness of quadrivalent HPV vaccine by number of doses, stratified by age in 2007, secondary analysis

Age in 2007	Doses	Controls		Other cases		No/total (%)	High grade cases	
		No/total (%)	No/total (%)	OR Crude	OR Adjusted*		OR Crude	OR Adjusted*
11 to <15yrs								
	0	15 (12)	4 (13)	reference	reference	2 (40)	reference	reference
	1	9 (7)	1 (3)	0.42 (0.04 to 4.33)	0.56 (0.05 to 6.92)	0	-	-
	2	17 (13)	11 (34)	2.43 (0.64 to 9.25)	2.02 (0.49 to 8.37)	1 (20)	0.44 (0.04 to 5.37)	-
	3	86 (68)	16 (50)	0.70 (0.21 to 2.38)	0.60 (0.16 to 2.31)	2 (20)	0.17 (0.02 to 1.34)	-
15 to <19yrs								
	0	649 (15)	168 (18)	reference	reference	41 (18)	reference	reference
	1	354 (8)	75 (8)	0.82 (0.61 to 1.11)	0.83 (0.61 to 1.12)	34 (15)	1.52 (0.95 to 2.44)	1.38 (0.85 to 2.22)
	2	790 (18)	166 (18)	0.81 (0.64 to 1.03)	0.82 (0.65 to 1.04)	45 (20)	0.90 (0.58 to 1.39)	0.88 (0.61 to 1.12)
	3	2557 (59)	500 (55)	0.76 (0.62 to 0.92)	0.75 (0.61 to 0.91)	105 (47)	0.65 (0.45 to 0.94)	0.71 (0.49 to 1.04)
19 to <23yrs								
	0	1566 (25)	266 (27)	reference	reference	134 (33)	reference	reference
	1	756 (12)	135 (14)	1.05 (0.84 to 1.32)	0.99 (0.79 to 1.24)	53 (13)	0.82 (0.59 to 1.14)	0.78 (0.56 to 1.09)
	2	1546 (25)	244 (24)	0.93 (0.77 to 1.12)	0.91 (0.75 to 1.10)	82 (20)	0.62 (0.47 to 0.82)	0.62 (0.47 to 0.83)
	3	2287 (37)	248 (35)	0.9 (0.75 to 1.06)	0.9 (0.76 to 1.08)	139 (34)	0.71 (0.56 to 0.91)	0.79 (0.61 to 1.01)
23 to <28yrs								
	0	2226 (47)	226 (51)	reference	reference	112 (46)	reference	reference
	1	453 (10)	46 (10)	1.0 (0.72 to 1.40)	0.90 (0.64 to 1.26)	32 (13)	1.40 (0.94 to 2.10)	1.21 (0.80 to 1.83)
	2	824 (17)	81 (18)	0.97 (0.74 to 1.26)	0.89 (0.67 to 1.16)	51 (21)	1.23 (0.88 to 1.73)	1.13 (0.8 to 1.60)
	3	1228 (26)	94 (21)	0.75 (0.59 to 0.97)	0.72 (0.55 to 1.13)	48 (20)	0.78 (0.55 to 1.10)	0.79 (0.55 to 0.93)
All ages								
	0	4456 (29)	664 (28)	reference	reference	289 (33)	reference	reference
	1	1572 (10)	257 (11)	1.1 (0.94 to 1.28)	0.91 (0.78 to 1.07)	119 (14)	1.17 (0.94 to 1.46)	1.01 (0.80 to 1.24)
	2	3177 (21)	502 (21)	1.06 (0.94 to 1.28)	0.88 (0.78 to 1.00)	179 (20)	0.87 (0.72 to 1.05)	0.80 (0.78 to 1.00)
	3	6158 (40)	958 (40)	1.04 (0.94 to 1.16)	0.81 (0.72 to 0.91)	294 (33)	0.74 (0.62 to 0.87)	0.77 (0.64 to 0.92)

* Adjusted for socio-economic status, rurality, year of birth, quartile of follow-up times

Supplementary Table 4 Effectiveness of quadrivalent HPV vaccine by number of doses, stratified by age in 2007, where time between last vaccine dose and index date >30 days, primary analysis

* Adjusted for socio-economic status, rurality, year of birth, quartile of follow-up times

Age in 2007	Doses	Controls		Other cases		High grade cases		
		No/total (%)	No/total (%)	OR Crude	OR Adjusted*	No/total (%)	OR Crude	OR Adjusted*
11 to <15yrs								
	0	619 (25)	102 (36)	reference	reference	4 (31)	reference	reference
	1	154 (6)	21 (7)	0.83 (0.50 to 1.37)	0.84 (0.50 to 1.39)	3 (23)	3.02 (0.67 to 13.6)	2.9 (0.62 to 13.6)
	2	317 (13)	35 (12)	0.67 (0.45 to 1.01)	0.67 (0.44 to 1.01)	0	-	-
	3	1394 (56)	126 (44)	0.55 (0.42 to 0.72)	0.59 (0.44 to 0.78)	6 (46)	0.67 (0.19 to 2.37)	0.75 (0.20 to 2.81)
15 to <19yrs								
	0	9918 (32)	1666 (43)	reference	reference	101 (51)	reference	reference
	1	2099 (7)	349 (9)	0.99 (0.87 to 1.12)	0.99 (0.88 to 1.13)	14 (7)	0.66 (0.37 to 1.15)	0.68 (0.39 to 1.20)
	2	3894 (13)	483 (12)	0.74 (0.66 to 0.82)	0.78 (0.70 to 0.87)	26 (13)	0.66 (0.43 to 1.01)	0.70 (0.45 to 1.08)
	3	15092 (49)	1421 (36)	0.56 (0.52 to 0.60)	0.63 (0.58 to 0.69)	58 (29)	0.38 (0.27 to 0.52)	0.43 (0.30 to 0.61)
19 to <23yrs								
	0	20896 (66)	2891 (74)	reference	reference	306 (75)	reference	reference
	1	3125 (10)	413 (11)	0.96 (0.86 to 1.07)	1.02 (0.92 to 1.14)	35 (9)	0.77 (0.54 to 1.09)	0.76 (0.53 to 1.08)
	2	3782 (12)	342 (9)	0.65 (0.58 to 0.74)	0.77 (0.68 to 0.87)	39 (10)	0.70 (0.50 to 0.98)	0.70 (0.50 to 0.99)
	3	3934 (12)	284 (7)	0.52 (0.46 to 0.59)	0.68 (0.60 to 0.78)	27 (7)	0.47 (0.32 to 0.70)	0.47 (0.31 to 0.70)
23 to <28yrs								
	0	21599 (80)	1862 (84)	reference	reference	318 (80)	reference	reference
	1	1833 (7)	133 (6)	0.84 (0.70 to 1.01)	0.84 (0.7 to 1.01)	34 (9)	1.26 (0.88 to 1.8)	1.38 (0.96 to 1.98)
	2	1824 (7)	123 (6)	0.78 (0.65 to 0.95)	0.85 (0.70 to 1.02)	23 (6)	0.86 (0.56 to 1.31)	0.94 (0.61 to 1.45)
	3	1863 (7)	100 (4)	0.62 (0.51 to 0.77)	0.73 (0.59 to 0.90)	22 (5)	0.80 (0.52 to 1.24)	0.90 (0.58 to 1.41)
All ages								
	0	53032 (57)	6521 (63)	reference	reference	729 (72)	reference	reference
	1	7211 (8)	916 (9)	1.03 (0.96 to 1.11)	0.97 (0.90 to 1.05)	86 (8)	0.87 (0.69 to 1.09)	0.96 (0.76 to 1.20)
	2	9817 (11)	983 (9)	0.81 (0.76 to 0.87)	0.78 (0.72 to 0.84)	88 (9)	0.65 (0.52 to 0.81)	0.77 (0.62 to 0.97)
	3	22283 (24)	1931 (19)	0.71 (0.67 to 0.74)	0.65 (0.61 to 0.69)	113 (11)	0.37 (0.30 to 0.45)	0.54 (0.43 to 0.67)

Supplementary Table 5 Effectiveness of quadrivalent HPV vaccine by number of doses, stratified by age in 2007, where time between last vaccine dose and index date >180 days, primary analysis

Age in 2007	Doses	Controls		Other cases		No/total (%)	High grade cases	
		No/total (%)	No/total (%)	OR Crude	OR Adjusted*		OR Crude	OR Adjusted*
11 to <15yrs								
	0	619 (27)	102 (39)	reference	reference	4 (36)	reference	reference
	1	134 (6)	18 (7)	0.82 (0.48 to 1.39)	0.86 (0.50 to 1.48)	3 (27)	3.47 (0.77 to 15.7)	3.8 (0.77 to 18.7)
	2	273 (12)	29 (11)	0.65 (0.42 to 1.00)	0.70 (0.45 to 1.09)	0	-	-
	3	1295 (56)	113 (43)	0.53 (0.40 to 0.70)	0.59 (0.43 to 0.80)	4 (36)	0.48 (0.12 to 1.92)	0.54 (0.12 to 2.39)
15 to <19yrs								
	0	9918 (35)	1666 (48)	reference	reference	101 (55)	reference	reference
	1	1390 (5)	198 (6)	0.85 (0.72 to 0.99)	0.94 (0.80 to 1.10)	10 (5)	0.71 (0.37 to 1.36)	0.73 (0.38 to 1.41)
	2	2932 (10)	332 (10)	0.67 (0.60 to 0.76)	0.76 (0.67 to 0.87)	19 (10)	0.64 (0.39 to 1.04)	0.66 (0.40 to 1.10)
	3	14086 (50)	1285 (8)	0.54 (0.50 to 0.59)	0.62 (0.57 to 0.68)	53 (29)	0.37 (0.27 to 0.52)	0.42 (0.29 to 0.60)
19 to <23yrs								
	0	20896 (74)	2891 (84)	reference	reference	306 (83)	reference	reference
	1	1752 (6)	175 (5)	0.72 (0.62 to 0.85)	0.90 (0.76 to 1.06)	16 (4)	0.62 (0.38 to 1.03)	0.59 (0.35 to 0.98)
	2	2461 (9)	176 (5)	0.52 (0.44 to 0.61)	0.66 (0.56 to 0.78)	25 (7)	0.69 (0.46 to 1.05)	0.68 (0.45 to 1.04)
	3	3089 (11)	205 (6)	0.48 (0.41 to 0.56)	0.63 (0.54 to 0.74)	23 (6)	0.51 (0.33 to 0.78)	0.50 (0.32 to 0.78)
23 to <28yrs								
	0	21599 (85)	1862 (90)	reference	reference	318 (87)	reference	reference
	1	1041 (4)	71 (3)	0.79 (0.62 to 1.01)	0.90 (0.70 to 1.15)	19 (5)	1.24 (0.78 to 1.98)	1.38 (0.86 to 2.21)
	2	1199 (5)	70 (3)	0.68 (0.53 to 0.87)	0.82 (0.64 to 1.05)	12 (3)	0.68 (0.38 to 1.21)	0.75 (0.42 to 1.34)
	3	1456 (6)	75 (4)	0.60 (0.47 to 0.76)	0.73 (0.57 to 0.92)	16 (5)	0.75 (0.45 to 1.24)	0.81 (0.49 to 1.36)
All ages								
	0	53032 (63)	6521 (70)	reference	reference	729 (78)	reference	reference
	1	4317 (5)	462 (5)	0.87 (0.79 to 0.96)	0.91 (0.82 to 1.01)	48 (5)	0.81 (0.60 to 1.09)	0.89 (0.66 to 1.20)
	2	6865 (8)	607 (7)	0.72 (0.66 to 0.78)	0.73 (0.67 to 0.80)	56 (6)	0.59 (0.45 to 0.78)	0.70 (0.53 to 0.93)
	3	19926 (24)	1678 (18)	0.69 (0.65 to 0.72)	0.63 (0.59 to 0.68)	96 (10)	0.35 (0.65 to 0.72)	0.51 (0.40 to 0.65)

* Adjusted for socio-economic status, rurality, year of birth, quartile of follow-up times

Supplementary Table 6 Effectiveness of quadrivalent HPV vaccine by number of doses, stratified by age in 2007, where time between last vaccine dose and index date >365 days, primary analysis

Age in 2007	Doses	Controls		Other cases	OR	No/total (%)	High grade cases	OR
		No/total (%)	No/total (%)	Crude	Adjusted*		Crude	Adjusted*
11 to <15yrs								
	0	619 (30)	102 (43)	reference	reference	4 (40)	reference	reference
	1	109 (5)	14 (6)	0.78 (0.43 to 1.41)	0.80 (0.44 to 1.47)	3 (30)	0.43 (0.94 to 19.3)	5.79 (1.06 to 31.5)
	2	225 (11)	22 (9)	0.59 (0.37 to 0.96)	0.63 (0.38 to 1.04)	0	-	-
	3	1114 (54)	99 (42)	0.54 (0.40 to 0.72)	0.62 (0.45 to 0.86)	3 (30)	0.42 (0.40 to 0.72)	0.52 (0.10 to 2.87)
15 to <19yrs								
	0	9918 (39)	1666 (53)	reference	reference	101 (59)	reference	reference
	1	1043 (4)	133 (4)	0.76 (0.63 to 0.92)	0.87 (0.72 to 1.06)	8 (5)	0.75 (0.37 to 1.55)	0.78 (0.38 to 1.63)
	2	2361 (9)	243 (8)	0.61 (0.53 to 0.71)	0.70 (0.61 to 0.82)	14 (8)	0.58 (0.33 to 1.02)	0.61 (0.34 to 1.09)
	3	12368 (48)	1077 (35)	0.52 (0.48 to 0.56)	0.59 (0.54 to 0.65)	49 (28)	0.39 (0.28 to 0.55)	0.45 (0.31 to 0.66)
19 to <23yrs								
	0	20896 (81)	2891 (90)	reference	reference	306 (88)	reference	reference
	1	1149 (5)	95 (3)	0.60 (0.48 to 0.74)	0.79 (0.64 to 0.98)	9 (3)	0.54 (0.28 to 1.04)	0.49 (0.25 to 0.96)
	2	1694 (6)	110 (3)	0.50 (0.41 to 1.13)	0.65 (0.53 to 0.80)	16 (5)	0.68 (0.41 to 1.13)	0.64 (0.38 to 1.07)
	3	2004 (8)	121 (4)	0.44 (0.36 to 0.53)	0.59 (0.48 to 0.72)	17 (5)	0.58 (0.36 to 0.95)	0.56 (0.34 to 0.93)
23 to <28yrs								
	0	21599 (90)	1862 (93)	reference	reference	318 (90)	reference	reference
	1	707 (3)	50 (2)	0.82 (0.61 to 1.10)	0.98 (0.73 to 1.31)	13 (4)	1.25 (0.71 to 2.19)	1.37 (0.78 to 2.43)
	2	802 (3)	34 (2)	0.49 (0.35 to 0.70)	0.60 (0.43 to 0.86)	10 (3)	0.85 (0.45 to 1.60)	0.90 (0.47 to 1.71)
	3	924 (4)	52 (3)	0.65 (0.49 to 0.87)	0.81 (0.60 to 1.08)	11 (3)	0.81 (0.44 to 1.48)	0.85 (0.46 to 1.58)
All ages								
	0	53032 (69)	6521 (76)	reference	reference		reference	reference
	1	3008 (4)	292 (3)	0.79 (0.70 to 0.89)	0.86 (0.76 to 0.98)	729 (83)	0.80 (0.56 to 1.13)	0.87 (0.61 to 1.24)
	2	4992 (6)	409 (5)	0.67 (0.60 to 0.74)	0.68 (0.61 to 0.76)	33 (4)	0.58 (0.42 to 0.80)	0.69 (0.49 to 0.95)
	3	16410 (21)	1349 (16)	0.67 (0.63 to 0.71)	0.61 (0.56 to 0.65)	40 (4)	0.36 (0.28 to 0.45)	0.53 (0.40 to 0.93)

* Adjusted for socio-economic status, rurality, year of birth, quartile of follow-up times

Supplementary Table 7 Effectiveness of quadrivalent HPV vaccine by number of doses, stratified by age in 2007, using provider assigned dose numbers to assign exposure status, primary analysis

Age in 2007	Controls		Other cases OR Crude	OR Adjusted*	No/total (%)	High grade cases		
	Doses	No/total (%)				OR Crude	OR Adjusted*	
11 to <15yrs								
	0	619 (24)	102 (35)	reference	reference	4 (31)	reference	reference
	1	140 (6)	19 (7)	0.82 (0.49 to 1.39)	0.79 (0.47 to 1.35)	3 (23)	3.32 (0.73 to 14.9)	3.15 (0.67 to 14.8)
	2	282 (11)	33 (11)	0.71 (0.47 to 1.08)	0.71 (0.46 to 1.08)	0	-	-
	3	1484 (59)	137 (47)	0.56 (0.43 to 0.74)	0.61 (0.46 to 0.81)	6 (46)	0.63 (0.18 to 2.23)	0.66 (0.18 to 2.46)
Total		2525	291			13		
15 to <19yrs								
	0	9918 (31)	1666 (41)	reference	reference	101 (47)	reference	reference
	1	1958 (6)	358 (9)	1.09 (0.96 to 1.23)	1.04 (0.92 to 1.35)	18 (9)	0.90 (0.55 to 1.49)	0.92 (0.56 to 1.53)
	2	3221 (10)	450 (11)	0.83 (0.74 to 0.93)	0.84 (0.75 to 0.94)	27 (13)	0.82 (0.54 to 1.26)	0.88 (0.57 to 1.35)
	3	16947 (53)	1626 (40)	0.57 (0.53 to 0.61)	0.64 (0.59 to 0.70)	67 (31)	0.39 (0.29 to 0.53)	0.44 (0.32 to 0.62)
Total		32044	4100			213		
19 to <23yrs								
	0	20896 (62)	2891 (69)	reference	reference	306 (72)	reference	reference
	1	2911 (9)	423 (10)	1.05 (0.94 to 1.17)	1.03 (0.92 to 1.15)	34 (8)	0.80 (0.56 to 1.14)	0.81 (0.56 to 1.15)
	2	3170 (9)	372 (9)	0.85 (0.76 to 0.95)	0.90 (0.81 to 1.02)	33 (8)	0.71 (0.50 to 1.02)	0.71 (0.50 to 1.03)
	3	6591 (20)	501 (12)	0.55 (0.50 to 0.61)	0.69 (0.62 to 0.77)	50 (12)	0.52 (0.38 to 0.70)	0.51 (0.38 to 0.70)
Total		33568	4187			423		
23 to <28yrs								
	0	21599 (76)	1862 (81)	reference	reference	318 (77)	reference	reference
	1	1732 (6)	134 (6)	0.90 (0.75 to 1.08)	0.81 (0.67 to 0.97)	31 (8)	1.22 (0.84, 1.76)	1.32 (0.90 to 1.92)
	2	1606 (6)	117 (5)	0.85 (0.70 to 1.03)	0.83 (0.68 to 1.01)	22 (5)	0.93 (0.60, 1.44)	1.00 (0.65 to 1.56)
	3	3330 (12)	196 (8)	0.68 (0.59 to 0.80)	0.78 (0.67 to 0.92)	42 (10)	0.86 (0.62, 1.18)	0.96 (0.69 to 1.34)
Total		28267	2309			413		
All ages								
	0	53032 (55)	6521 (60)	reference	reference	729 (69)	reference	reference
	1	6741 (7)	934 (9)	1.13 (1.05 to 1.21)	0.99 (0.92 to 1.06)	86 (8)	0.93 (0.74 to 1.16)	1.03 (0.82 to 1.29)
	2	8279 (9)	972 (9)	0.96 (0.89 to 1.03)	0.86 (0.80 to 0.92)	82 (8)	0.72 (0.57 to 0.91)	0.85 (0.68 to 1.08)
	3	28352 (29)	2460 (23)	0.71 (0.67 to 0.74)	0.67 (0.63 to 0.71)	165 (16)	0.42 (0.36 to 0.50)	0.58 (0.48 to 0.70)
Total		96404	10887			1062		

* Adjusted for socio-economic status, rurality, year of birth, quartile of follow-up times