Supplemental table 1. Baseline characteristics of the eligible trials included in this study.

Study	Trial Phase	Line of treatment	Cancer type	PD-L1 detection assay	PD-1/PD-L1 inhibitor	Dosage	Treatment duration, median(range), m	Median follow-up (range), m	Median PFS (95% CI), m	Median OS (95% CI), m
Balar,2017[1]	2	1	UC	Ventana SP142	Atezolizumab	1200 mg Q3W	3.8(0-25.5)	17.2(0.2-23.5)	2.7(2.1-4.2)	15.9(10.4-N)
Colevas,2018[2]	1	2+	HNC	Ventana SP142	Atezolizumab	15, 20mg/kg, 1200 mg Q3W	3.4(0.0-30.5)	<60.0	2.6(0.5-48.4)	6.0(0.5-51.6+)
Emens,2019[3]	1	1+	BC	Ventana SP142	Atezolizumab	15, 20mg/kg, 1200 mg Q3W	2.1(0-45.6)	25.3(0.4-45.6)	1.4(1.3-1.6)	17.6(10.2-N)
Eng,2019[4]	3	3+	CRC	Ventana SP142	Atezolizumab	1200 mg Q3W	1.4	NR	1.9(1.9-2.1)	7.1(6.1-10.1)
Fehrenbacher,2016[5]	2	2+	LC	Ventana SP142	Atezolizumab	1200 mg Q3W	3.7(0-19.0)	14.8(0.2-19.6)	2.7(2.0-4.7)	12.6(9.7-16.4)
Fehrenbacher,2018[6]	3	2+	LC	Ventana SP142	Atezolizumab	1200 mg Q3W	3.4(0.0-26.0)	26	2.8(2.6-3.0)	13.8(11.8-15.7)
Horn,2018[7]	1	2+	LC	Ventana SP142	Atezolizumab	1-20mg/kg, 1200 mg Q3W	3.5(0.0-62.0)	49.9(0.5-62.0)	NR	NR
Liu,2019[8]	1	1+	OC	Ventana SP142	Atezolizumab	15mg/kg, 1200 mg Q3W	2.8(0.0-33.4)	20.4(0.6-38.2)	2.9(1.3-5.5)	11.3(5.5-27.7)
Liu,2019[8]	1	1+	UrC	Ventana SP142	Atezolizumab	15mg/kg, 1200 mg Q3W	4.1(0.0-20.7)	20.4(0.6-38.2)	1.4(1.3-4.0)	9.6(6.8-13.8)

McDermott,2016[9]	1	1+	RC	Ventana SP142	Atezolizumab	0.3-20mg/kg,1200 mg Q3W	8.0(1.0-35.0)	23.9	5.6(3.9-8.2)	28.9(20.0-N)
McDermott,2018[10]	2	1	RC	Ventana SP142	Atezolizumab	1200 mg Q3W	7.6(0.0-33.1)	20.7	11.7(8.4-17.3)	NR
Peters,2017[11]	2	1+	LC	Ventana SP142	Atezolizumab	1200 mg Q3W	4.2(0.0-21.0)	>12.0	5.4(3.0-6.9)	23.5(18.1-N)
Petrylak,2018[12]	1	2+	UC	Ventana SP142	Atezolizumab	15mg/kg, 1200 mg Q3W	3.0(0.0-44.0)	37.8(0.7+-44.4)	2.7(1.4-4.3)	10.1(7.3-17.0)
Powles,2017[13]	3	2+	UC	Ventana SP142	Atezolizumab	1200 mg Q3W	2.8(0.0-24.0)	17.3(0.0-24.5)	2.1(2.1-2.2)	11.1(8.6-15.5)
Pujol,2019[14]	2	2	LC	Ventana SP142	Atezolizumab	1200 mg Q3W	NR	13.7	1.4(1.2-1.5)	9.5(3.2-14.4)
Rosenberg,2016[15]	2	2+	UC	Ventana SP142	Atezolizumab	1200 mg Q3W	3.0	11.7	2.1(2.1-2.1)	7.9(6.6-9.3)
Spigel,2018[16]	2	1+	LC	Ventana SP142	Atezolizumab	1200 mg Q3W	3.4	33.7	NR	NR
Sternberg,2019[17]	3	2+	UC	Ventana SP142	Atezolizumab	1200 mg Q3W	2.8(0.0-19.0)	12.7(0.0-19.7)	2.2(2.1-2.4)	8.7(7.8-9.9)
Apolo,2017[18]	1	2+	UC	Dako 73-10	Avelumab	10 mg/kg Q2W	3.5	16.5	2.9(1.5-4.4)	13.7(8.5-N)
Bang,2018[19]	3	3	GC/GEJC	Dako 73-10	Avelumab	10 mg/kg Q2W	2.0(0.5-16.5)	10.6(0.1-17.8)	1.4(1.4-1.5)	4.6(3.6-5.7)
Barlesi,2018 [20]	3	2+	LC	Dako 73-10	Avelumab	10 mg/kg Q2W	3.4	18.9	2.8(2.7-3.5)	11.4(9.4-13.9)
Chung,2019[21]	1	1+	GC/GEJC	Dako 73-10	Avelumab	10 mg/kg Q2W	2.8	35.1	2.8(2.3-4.1)	11.1(8.9-13.7)

D'Angelo,2018[22]	2	1	MCC	Dako 73-10	Avelumab	10 mg/kg Q2W	3.0(0.5-12.5)	5.1(0.3-11.3)	NR	NR
Dirix,2018[23]	1	2+	BC	Dako 73-10	Avelumab	10 mg/kg Q2W	2.0(0.5-12.5)	10.0(6.0-15.2)	NR	NR
Disis,2019[24]	1	2+	OC	Dako 73-10	Avelumab	10 mg/kg Q2W	2.8 (0.5-27.4)	26.6 (16-38)	2.6(1.4-2.8)	11.2(8.7-15.4)
Doi,2018[25]	1	2+	GC/GEJC	Dako 73-10	Avelumab	10 mg/kg Q2W	2.7(0.5-21.4)	19.3(0.4-22.9)	2.4(1.4-2.8)	9.1(7.2-11.2)
Gulley,2017[26]	1	2+	LC	Dako 73-10	Avelumab	10 mg/kg Q2W	3.1	8.8	2.9(2.1-3.4)	8.4(7.3-10.6)
Hassan,2019[27]	1	2+	Me	Dako 73-10	Avelumab	10 mg/kg Q2W	2.8 (0.9-28.1)	24.8 (16.8-27.8)	4.1(1.4-6.2)	10.7(6.4-20.2)
Heery,2017[28]	1	2+	ST	NR	Avelumab	1,3,10,20 mg/kg Q2W	3.0	22.2	NR	NR
Kaufman,2018[29]	2	2+	MCC	Dako 73-10	Avelumab	10 mg/kg Q2W	4.3	16.4(12.1-25.4)	2.7(1.4-6.9)	12.9(7.5-N)
Keilholz,2019[30]	1	2+	MC	Dako 73-10	Avelumab	10 mg/kg Q2W	3.2(0.5–27.2)	24.2(16.1–31.5)	3.1(1.4-6.3)	17.2(6.6-N)
Mego,2019[31]	2	2+	GCC	NR	Avelumab	10 mg/kg Q2W	NR	2.6(0.3-14.4)	0.9(0.5-1.9)	2.7(1.0-3.3)
Patel,2017[32]	1	2+	UC	Dako 73-10	Avelumab	10 mg/kg Q2W	3.0	9.9	1.6(1.5-2.5)	6.5(4.8-9.5)
Tourneau,2018[33]	1	2+	AdC	Dako 73-10	Avelumab	10 mg/kg Q2W	3.4 (0.5-24.8)	16.5 (11.7-27.6)	2.6(1.4-4.0)	10.6(7.4-15.0)
Migden,2018[34]	1	1+	CC	NR	Cemiplimab	3mg/kg Q2W	<12.0	11.0(1.1-17.0)	NR	NR
Migden,2018[34]	2	1+	CC	NR	Cemiplimab	3mg/kg Q2W	<24.0	7.9	NR	NR

Antonia,2018[35]	3	1+	LC	Ventana SP263	Durvalumab	10 mg/kg Q2W	9.4(0.2-12.6)	25.2(0.2-43.1)	17.2(13.1-23.9)	N(34.7-N)
Antonia,2019[36]	1/2	1+	LC	Ventana SP263	Durvalumab	10 mg/kg Q2W	3.5	40.1(0.3-52.2)	1.7(1.4-2.6)	12.4(9.3-15.2)
Garassino,2018[37]	2	3+	LC	Ventana SP263	Durvalumab	10 mg/kg Q2W	8.2(3.9-19.3)	6.7	NR	NR
Massard,2016[38]	1/2	2+	UC	Ventana SP263	Durvalumab	10 mg/kg Q2W	1.9(0.4-12.6)	4.3(0.3-14.8)	NR	NR
Necchi,2019[39]	2	1+	GCC	Ventana SP142	Durvalumab	1500 mg Q4W	NR	7.5	1.5	3.1
Powles,2017[40]	1/2	2	UC	Ventana SP263	Durvalumab	10 mg/kg Q2W	2.8(0.4-12.5)	5.8(0.4-25.9)	1.5(1.4-1.9)	18.2(8.1-N)
Segal,2019[41]	1/2	2+	HNC	Ventana SP263	Durvalumab	10 mg/kg Q2W	2.8(0.5-12.6)	43.0(1.4-49.2)	1.4(1.4-1.5)	8.4(5.7-12.3)
Siu,2018[42]	2	1+	HNC	Ventana SP263	Durvalumab	10 mg/kg Q2W	NR	6.0 (0.3-18.0)	1.9(1.8-2.8)	6.0(0.3-18.0)
Zandberg,2019[43]	2	1+	HNC	Ventana SP263	Durvalumab	10 mg/kg Q2W	3.5(0.3-12.2)	6.1(0.2-24.3)	2.1(1.9-3.7)	7.1(4.9-9.9)
Amaria,2018[44]	2	1	M	NR	Nivolumab	3 mg/kg Q2W	NR	15.0(5.8-22.6)	NR	NR
Ansell,2015[45]	1	3+	L	405.9A11	Nivolumab	3 mg/kg Q2W	9	10.0(0.0-18.8)	NR	NR
Ansell,2019[46]	2	2+	L	405.9A11	Nivolumab	3 mg/kg Q2W	NR	7.5(0.1-25.0)	1.9(1.7-1.9)	12.2(7.7-19.0)
Antonia,2016[47]	1/2	2+	LC	Dako 28-8	Nivolumab	3 mg/kg Q2W	2.6	6.6	1.4(1.4-1.9)	4.4(3.0-9.3)
Armand,2018[48]	2	3+	L	NR	Nivolumab	3 mg/kg Q2W	NR	18.0	14.7(11.3-18.5)	NR

Ascierto,2018[49]	3	1	M	Dako 28-2	Nivolumab	3 mg/kg Q2W	NR	>38.4	5.1(3.5-12.2)	37.5(25.5-N)
Ben-ami,2017[50]	2	2+	S	NR	Nivolumab	3 mg/kg Q2W	2.5(1.0-3.0)	NR	1.8(0.8-N)	NR
Borghaei,2015[51]	3	2+	LC	Dako 28-8	Nivolumab	3 mg/kg Q2W	NR	>17.2	2.3(2.2-3.3)	12.2(9.7-15.0)
Brahmer,2012[52]	1	1+	M	NR	Nivolumab	0.3,1,3,10 mg/kg Q2W	3.0(0.5-27.8)	NR	NR	NR
Brahmer,2012[52]	1	1+	RC	NR	Nivolumab	0.3,1,3,10 mg/kg Q2W	3.0(0.5-27.8)	NR	NR	NR
Brahmer,2012[52]	1	1+	LC	NR	Nivolumab	0.3,1,3,10 mg/kg Q2W	3.0(0.5-27.8)	NR	NR	NR
Brahmer,2012[52]	1	1+	OC	NR	Nivolumab	0.3,1,3,10 mg/kg Q2W	3.0(0.5-27.8)	NR	NR	NR
Brahmer,2015[53]	3	1+	LC	Dako 28-8	Nivolumab	3 mg/kg Q2W	6.0(0.8-36.0)	>11.0	3.5(2.1-4.9)	9.2(7.3-13.3)
Carbone,2017[54]	3	1	LC	Dako 28-8	Nivolumab	3 mg/kg Q2W	3.7(0-26.9+)	13.7	4.2(3.0-5.6)	14.4(11.7-17.4)
Carneiro,2019[55]	2	1+	AdC	NR	Nivolumab	240 mg Q2W	1.0	4.5(0.1-25.6)	1.8(0.1-4.3)	NR
D'angelo,2018[56]	2	2+	S	NR	Nivolumab	3 mg/kg Q2W	2.3	13.6	1.7(1.4-4.3)	10.7(5.5-19.4)
El-Khoueiry,2017[57]	1	2+	LC	NR	Nivolumab	0.3,1,3,10 mg/kg Q2W	NR	<45.0	NR	NR
El-Khoueiry,2017[57]	2	2+	LC	NR	Nivolumab	3 mg/kg Q2W	NR	<45.0	4.0(2.9-5.4)	NR
Ferris,2016[58]	3	2	HNC	Dako 28-8	Nivolumab	3 mg/kg Q2W	1.9	5.1(0.0-16.8)	2.0(1.9-2.1)	7.5(5.5-9.1)
Flippot,2019[59]	2	2+	RC	NR	Nivolumab	3 mg/kg Q2W	4.7(0.5-24.2)	21.9	NR	NR
Forde,2018[60]	2	Ne	LC	NR	Nivolumab	3 mg/kg Q2W	NR	12.0(0.8-19.7)	NR	NR

Fujimoto,2019[61]	2	2+	LC	NR	Nivolumab	3 mg/kg Q2W	NR	14.2(2.7-32.1)	7.4(1.8-16.8)	15.6(14.4-N)
Gettinger,2015[62]	1	2+	LC	NR	Nivolumab	1 ,3,10 mg/kg Q2W	NR	39.0(32.0-66.0)	2.3(1.8-16.8)	15.6(14.4-N)
Gettinger,2016[63]	1	1	LC	NR	Nivolumab	3 mg/kg Q2W	NR	14.3(0.2-30.1)	3.6(0.1-28.0)	19.4(0.2-35.8)
Hamanishi,2015[64]	2	3+	OC	27A2	Nivolumab	1,3 mg/kg Q2W	3.5(1.0-12.0)	11.0(3.0-32.0)	3.5(1.7-3.9)	20.0(7.0-N)
Hida,2017[65]	2	2+	LC	Dako 28-8	Nivolumab	3 mg/kg Q2W	3.6(0.5-29.3)	16.3(1.7-29.3)	4.2(1.4-7.1)	16.3(12.4-25.4)
Hodi,2018[66]	3	1	M	Dako 28-8	Nivolumab	3 mg/kg Q2W	7.5(0.5-19.0)	36.0	6.9(5.1-10.2)	36.9(28.3-N)
Janjigian,2018[67]	1/2	2+	GEJC	NR	Nivolumab	3 mg/kg Q2W	NR	28.0(17.0-35.0)	1.4(1.2-1.5)	6.2(3.4-12.4)
Kang,2017[68]	3	3+	GC/GEJC	Dako 28-8	Nivolumab	3 mg/kg Q2W	1.9	8.9	1.6(1.5-2.3)	5.3(4.6-6.4)
Katsuya,2019[69]	2	2+	TC	NR	Nivolumab	3 mg/kg Q2W	6.0(0.8-24.8)	14.1(2.4-17.5)	3.8(1.9-7.0)	14.1(11.1-N)
Kudo,2017[70]	2	1+	EC	NR	Nivolumab	3 mg/kg Q2W	2.3(0.8-7.5)	10.8	1.5(1.4-2.8)	10.8(7.4-13.3)
Larkin,2018[71]	3	2+	M	NR	Nivolumab	3 mg/kg Q2W	4.7	NR	3.1(2.3-3.5)	16.4(12.9-20.3)
Lee,2018[72]	2	2+	LC	NR	Nivolumab	3 mg/kg Q2W	2.5(0.0-22.5)	18	2.8(1.4-5.7)	13.9(10.8-18.5)
Lesokhin,2016[73]	1	3+	HC	405.9A11	Nivolumab	1,3 mg/kg Q2W	NR	16.7(0.4-33.0+)	NR	NR
Long,2018[74]	2	2+	M	NR	Nivolumab	3 mg/kg Q2W	NR	21.0	NR	NR
Ma,2018[75]	2	1+	NC	22C3	Nivolumab	3 mg/kg Q2W	2.3	12.5(2.2-22.0)	2.8(1.8-7.4)	17.1(10.9-N)

Ma,2019[76]	1/2	2+	NC	NR	Nivolumab	3 mg/kg Q2W	4.2(0.5-26.3)	7.5(0.8-24.7)	3.5(1.8-5.5)	NR
Maruyama,2017[77]	2	3+	L	NR	Nivolumab	3 mg/kg Q2W	7.0(1.4-10.6)	9.8(6.0-11.1)	NR	NR
McDermott,2015[78]	1	2+	RC	NR	Nivolumab	1,10 mg/kg Q2W	NR	45.2(25.9-57.9)	7.3(3.6-10.9)	22.4(12.5-N)
Morris,2017[79]	2	1+	AC	E1L3N	Nivolumab	3 mg/kg Q2W	NR	10.1	4.1(3.0-7.9)	11.5(7.1-N)
Motzer,2015[80]	3	1+	RC	Dako 28-8	Nivolumab	3 mg/kg Q2W	5.5(0.1-29.6)	>14.0	4.6(3.7-5.4)	25.0(21.8-N)
Motzer,2015[81]	2	2+	RC	Dako 28-8	Nivolumab	0.3,2,10 mg/kg Q3W	5.3(0.8-24.0)	<33.0	2.7(1.9-3.0)	18.2(16.2-24.0)
Nishio,2017[82]	2	2+	LC	Dako 28-8	Nivolumab	3 mg/kg Q2W	NR	16.6(0.9-31.9)	2.8(1.4-3.4)	17.1(13.3-23.0)
Okada,2019[83]	2	1+	Me	Dako 28-8	Nivolumab	240 mg Q2W	6.8(0.0-19.1)	16.8(1.8-20.2)	6.1(2.9-9.9)	17.3(11.5-N)
Omuro,2018[84]	1	2	GBM	Dako 28-8	Nivolumab	3 mg/kg Q2W	2.3(1.0-33.7)	33.7	1.9(1.3-4.6)	10.4(4.1-22.8)
Ornstein,2019[85]	2	2+	RC	NR	Nivolumab	240 mg Q2W	NR	12	8.0(5.4-N)	NR
Overman,2017[86]	2	1+	dMMR/MSI-H	Dako 28-8	Nivolumab	3 mg/kg Q2W	NR	12	14.3(4.3-N)	NR
Quispel-Janssen,2018[87]	2	2+	Me	NR	Nivolumab	3 mg/kg Q2W	2.8	27.5	2.6(2.2-5.5)	11.8(9.7-15.7)
Ramchandren,2019[88]	2	1	L	Dako 28-8	Nivolumab	240 mg Q2W	NR	11.1(1.2-16.4)	NR	NR
Rizvi,2015[89]	2	2+	LC	Dako 28-8	Nivolumab	3 mg/kg Q2W	2.3	>11.0	1.9(1.8-3.2)	8.2(6.1-10.9)
Scherpereel,2019[90]	2	2+	Me	Dako 28-8	Nivolumab	3 mg/kg Q2W	NR	20.1	4.0(2.8-5.7)	11.9(6.7-17.7)
Sharma,2019[91]	1/2	2+	UC	Dako 28-8	Nivolumab	3 mg/kg Q2W	3.5	>37.7	2.8(1.5-5.3)	9.9(7.3-21.1)

Sharma,2017[92]	2	1+	UC	Dako 28-8	Nivolumab	3 mg/kg Q2W	NR	7	2.0(1.9-2.6)	8.7(6.1-N)
Teraoka,2017[93]	2	3+	LC	Dako 22C3	Nivolumab	3 mg/kg Q2W	NR	NR	NR	NR
Topalian,2012[94]	1	1+	M	5H1	Nivolumab	0.1,0.3,1,3,10 mg/kg Q2W	NR	NR	NR	NR
Topalian,2012[94]	1	1+	LC	5H1	Nivolumab	0.1,0.3,1,3,10 mg/kg Q2W	NR	NR	NR	NR
Topalian,2012[94]	1	1+	RC	5H1	Nivolumab	0.1,0.3,1,3,10 mg/kg Q2W	NR	NR	NR	NR
Topalian,2012[94]	1	1+	PC	5H1	Nivolumab	0.1,0.3,1,3,10 mg/kg Q2W	NR	NR	NR	NR
Topalian,2012[94]	1	1+	CRC	5H1	Nivolumab	0.1,0.3,1,3,10 mg/kg Q2W	NR	NR	NR	NR
Topalian,2014[95]	1	2+	M	NR	Nivolumab	1,3,10 mg/kg Q2W	NR	NR	3.7(1.9-9.1)	16.8(12.5-31.6)
Ueno,2019[96]	1	2+	BTC	Dako 28-8	Nivolumab	240 mg, Q2W	NR	5.1	1.4(1.4-1.4)	5.2(4.5-8.7)
Voorwerk,2019[97]	2	1+	BC	Dako 22C3	Nivolumab	3 mg/kg Q2W	NR	19.9	NR	NR
Weber,2013[98]	1	2+	M	Dako 28-8	Nivolumab	1,3,10 mg/kg Q2W	NR	8.1	NR	NR
Weber,2016[99]	1/2	2+	M	NR	Nivolumab	3 mg/kg Q2W	NR	16.0	NR	NR
Wu,2019[100]	3	1+	LC	NR	Nivolumab	3 mg/kg Q2W	2.5	10.4(0.2-21.1)	2.8(2.4-3.4)	12.0(10.4-14.0)
Yamamoto,2017[101]	1	1+	ST	27A2	Nivolumab	1,3,10,20 mg/kg Q2W	NR	NR	NR	NR
Yamazaki,2017[102]	2	1	M	NR	Nivolumab	3 mg/kg Q2W	11.9(0.5-21.0)	18.8(2.0-21.5)	5.9	NR

Adams,2019[103]	2	1+	BC	Dako 22C3	Pembrolizumab	200 mg Q3W	3.5(0.0-22.9)	12.3(0.9-23.5)	2.0(1.9-2.0)	9.0(7.7-11.2)
Adams,2019[104]	2	1	BC	Dako 22C3	Pembrolizumab	200 mg Q3W	1.9(0.0-24.7)	9.6(0.1-25.7)	2.1(2.0-2.2)	18.0(12.9-23.0)
Adra,2017[105]	2	2+	GCC	Dako 22C3	Pembrolizumab	200 mg Q3W	1.5(0.8-6.0)	NR	NR	NR
Alley,2017[106]	1	1+	Me	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	5.1	18.7(10.4-24.0)	5.4(3.4-7.5)	18.0(9.4-N)
Armand,2016[107]	1	2+	L	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	17.6(10.6-22.5)	NR	NR
Armand,2019[108]	2	2+	L	NR	Pembrolizumab	200 mg Q3W	NR	NR	NR	NR
Balar,2017[109]	2	1	UC	Dako 22C3	Pembrolizumab	200 mg Q3W	3.0(0-16.0)	5.0	2.0(2.0-3.0)	NR
Barta,2019[110]	2	2+	L	Dako 22C3	Pembrolizumab	200 mg Q3W	NR	5.9	3.2(1.2-3.7)	10.6(3.2-100.0)
Bauml,2017[111]	2	3+	HNC	Dako 22C3	Pembrolizumab	200 mg Q3W	3.0(0.0-13.4)	7.0(0.0-17.0)	2.1(2.1-2.1)	8.0(6.0-11.0)
Carlino,2018[112]	3	1	M	NR	Pembrolizumab	10 mg/kg Q2W or Q3W	6.5(0.0-27.0)	33.9	6.6(4.4-9.8)	NR
Chen,2017[113]	2	1+	L	NR	Pembrolizumab	200 mg Q3W	8.3(0.0-15.0)	10.1(1.0-15.0)	NR	NR
Cho,2018[114]	2	2+	TC	Dako 22C3	Pembrolizumab	200 mg Q3W	NR	14.9	6.1(5.1-7.1)	NR
Chung,2019[115]	2	2+	CeC	Dako 22C3	Pembrolizumab	200 mg Q3W	2.9(0.0-22.1)	10.2(0.6-22.7)	2.1(2.0-2.2)	9.4(7.7-13.1)
Cohen,2018[116]	1	1+	SGC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	20.0(2.0-35.0)	4.0(2.0-5.0)	13.0(6.0-N)

Cohen,2019[117]	3	1+	HNC	Dako 22C3	Pembrolizumab	200 mg Q3W	NR	8.4	2.1(2.1-2.3)	8.4(6.4-9.4)
Doi,2018[118]	1	1+	EC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	7.0(1.0-33.0)	1.8(1.7-2.9)	7.0(4.3-17.7)
Feun,2019[119]	2	1+	LC	Dako 22C3	Pembrolizumab	200 mg Q3W	NR	17.0	4.5(2.0-7.0)	13.0(7.0-N)
Fradet,2019 [120]	3	2+	UC	Dako 22C3	Pembrolizumab	200 mg Q3W	3.5(0.0-20.0)	27.7	2.1(2.0-2.2)	10.1(8.0-12.3)
Frenel,2017[121]	1	2+	CeC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	11.0(1.3-32.2)	2.0(2.0-3.0)	11.0(4.0-15.0)
Fuchs,2018[122]	2	3+	GC/GEJC	Dako 22C3	Pembrolizumab	200 mg Q3W	2.1(0.0-21.4)	5.8(0.5-24.7)	2.0(2.0-2.1)	5.6(4.3-6.9)
Gadgeel,2018[123]	2	2	LC	Dako 22C3	Pembrolizumab	200 mg Q3W	3.0(0.3-19.5)	14.6	1.4(1.3-2.8)	9.6(7.0-12.0)
Giaccone,2018[124]	2	2+	TC	Dako 22C3	Pembrolizumab	200 mg Q3W	4.0(0.8-26.3)	20.0	4.2(2.9-10.3)	24.9(15.5-N)
Goldberg,2016[125]	2	1+	LC	NR	Pembrolizumab	10 mg/kg Q2W	NR	6.8	NR	7.7(3.5-N)
Hamid,2017[126]	2	3+	M	NR	Pembrolizumab	2,10 mg/kg Q2W	4.3(0.0-32.9)	28.1(24.1-35.5)	NR	NR
Hamid,2019[127]	1	1+	M	Dako 22C3	Pembrolizumab	2,10 mg/kg Q3W, Q2W	5.6(0.0-67.0)	55.0(48.0-69.0)	8.3(5.8-11.1)	23.8(20.2-30.4)
Hansen,2018[128]	1	1+	PC	NR	Pembrolizumab	10 mg/kg Q2W	NR	7.9(1.4-30.3)	3.5(1.7-6.5)	7.9(6.5-N)
Herbst,2019[129]	2/3	1+	LC	Dako 22C3	Pembrolizumab	2,10 mg/kg Q3W	3.5	31.0(23.0-41.0)	3.9(3.1-4.1)	10.4(9.4-11.9)
Hsu,2017[130]	1	1+	NC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	20.0(4.8-22.1+)	6.5(3.6-13.4)	16.5(10.1-N)
Huang,2019[131]	1	Ne	M	Dako	Pembrolizumab	200 mg	NR	25.0	NR	NR

				22C3						
Kluger,2019[132]	2	1+	M	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	34.0(28.0-43.0)	2.0(2.0-N)	17.0(10.0-N)
Leighl,2019[133]	1	1	LC	Dako 22C3	Pembrolizumab	2,10 mg/kg Q3W; Q2W	3.3	34.5	10.3(8.3-14.7)	22.3(17.1-31.5)
Levy,2019[134]	2	2	LC	Dako 22C3	Pembrolizumab	200 mg Q3W	6.0(0.8-15.0)	12.2	4.0	NR
Long,2019[135]	3	1	M	Dako 22C3	Pembrolizumab	200 mg Q3W	7.2	NR	4.9(2.9-6.8)	NR
Matulonis,2019[136]	2	2+	OC	Dako 22C3	Pembrolizumab	200 mg Q3W	NR	16.9(8.5-18.5)	2.1(2.1-2.2)	N(16.8-N)
Mehra,2018[137]	1	2+	HNC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W; 200 mg Q3W	3.5(0.0-26.8)	9.0(0.2-32.0)	2.1(1.9-2.1)	8.0(6.0-10.0)
Mok,2019[138]	3	1	LC	Dako 22C3	Pembrolizumab	200 mg Q3W	NR	12.8	NR	NR
Muro,2016[139]	1	1+	GC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	10.8	1.9(1.8-5.7)	11.4(3.1-N)
Nanda,2016[140]	1	1+	BC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	2.0(0.0-17.7)	10.0(0.4-19.5)	1.9(1.7-5.5)	11.2(5.3-N)
Nghiem2019[141]	2	1	MCC	Dako 22C3	Pembrolizumab	2 mg/kg Q3W	6.6(0.0-23.6)	14.9(0.4-36.4+)	16.8(4.6-N)	N(26.0-N)
Nishio,2018[142]	1	2+	LC	Dako 22C3	Pembrolizumab	10 mg/kg Q3W	NR	19.2(1.9-34.6)	3.9(2.0-6.2)	19.2(8.0-26.7)
Ott,2017[143]	1	2+	AC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	3.0(0.0-15.0)	10.6(0.3-15.0)	3.0(1.7-7.3)	9.3(5.9-N)
Ott,2017[144]	1	2+	LC	Dako	Pembrolizumab	10 mg/kg Q2W	NR	9.8(0.5-24.0)	1.9(1.7-5.9)	9.7(4.1-N)

				22C3						
Ott,2017[145]	1	1+	UrC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	19.1(0.7-23.6)	1.8(1.6-2.7)	N(4.3-N)
Ott,2019[146]	1	1+	BTC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	NR	1.8	6.2
Ott,2019[146]	1	1+	NeC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	NR	5.4	N
Ott,2019[146]	1	1+	CRC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	NR	1.8	5.3
Ott,2019[146]	1	1+	GBM	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	NR	2	26.6
Ott,2019[146]	1	1+	S	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	NR	NR	NR
Ott,2019[146]	1	1+	NeC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	NR	NR	NR
Ott,2019[146]	1	1+	PaC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	NR	1.7	3.9
Ott,2019[146]	1	1+	TC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	NR	6.8	NR
Ott,2019[146]	1	1+	VC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	NR	3.1	3.8
Plimack,2017[147]	1	1+	UC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	2.4(0.0-23.6)	13.0(1.0-26.0)	2.0(2.0-4.0)	13.0(5.0-N)
Reck,2019[148]	3	1	LC	Dako 22C3	Pembrolizumab	200 mg Q3W	7.9(0.0-28.8)	25.2(20.4-33.7)	NR	30.0(18.3-N)

Ribrag,2019[149]	1	1+	My	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	19.9(2.0-44.0)	2.7(1.4-3.7)	20.0(14.1-N)
Rugo,2018[150]	1	1+	BC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	9.7(0.7-31.8)	1.8(1.4-2.0)	8.6(7.3-11.6)
Seiwert,2016[151]	1	1+	HNC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	14.0	2.0(2.0-4.0)	13.0(5.0-N)
Shah,2018[152]	2	3+	EC	Dako 22C3	Pembrolizumab	200 mg Q3W	2.0(0.0-17.0)	5.8(0.2-18.3)	2.0(1.9-2.1)	5.8(4.5-7.2)
Shimizu,2016[153]	1	1+	ST	Dako 22C3	Pembrolizumab	2, 10 mg/kg Q2W	3.0(0.8-4.5)	NR	NR	NR
Shitara,2018[154]	3	2	GC/GEJC	Dako 22C3	Pembrolizumab	200 mg Q3W	4.4	8.5	1.5(1.4-2.0)	9.1(6.2-10.7)
Si,2019[155]	1	2	M	Dako 22C3	Pembrolizumab	2 mg/kg Q3W	NR	7.9(5.6-13.1)	2.8(2.7-3.5)	12.1(9.6-N)
Tawbi,2017[156]	2	1+	S	Dako 22C3	Pembrolizumab	200 mg Q3W	NR	19.1	4.5(2.0-5.3)	12.3(8.5-18.3)
Tawbi,2017[156]	2	1+	S	Dako 22C3	Pembrolizumab	200 mg Q3W	NR	16.6	4.5(2.0-5.3)	12.3(8.5-18.3)
Varga,2019[157]	1	1+	OC	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	15.4(2.3-33.9)	1.9(1.8-3.5)	13.8(6.7-18.8)
Yamazaki,2017[158]	1	1+	M	Dako 22C3	Pembrolizumab	2 mg/kg Q3W	7.1(0.0-12.8)	10.3(2.6-12.6)	NR	NR
Zhu,2018[159]	2	1+	LC	Dako 22C3	Pembrolizumab	200 mg Q3W	4.2	12.3	4.9(3.4-7.2)	12.9(9.7-15.5)
Zinzan,2017[160]	1	3+	L	Dako 22C3	Pembrolizumab	10 mg/kg Q2W	NR	11.3(3.4-27.4)	NR	NR

AC, Anal cancer; BC, Breast cancer; BTC, Biliary tract cancer; CC, Cutaneous cancer; CeC, Cervical cancer; CRC, Colorectal cancer; dMMR/MSI-H, DNA mismatch repair-deficient or microsatellite instability-high; EC, Esophageal cancer; GBM, Glioblastoma; GC, gastric cancer; GCC, Germ cell cancer; GEJC, gastro-esophageal junction cancer; HC, Hematologic cancer, HNC, Head and neck cancer; L, Lymphoma; LC, Lung cancer; M, Melanoma; Me, Mesothelioma; MCC, Merkel cell cancer; My, Myeloma; NC, Nasopharyngeal cancer; NeC, Neuroendocrine cancer; OC, Ovarian can-cer; OS, overall survival; PC, Prostate cancer; PaC, Pancreatic cancer; PFS, progression-free survival; RC, Renal cancer; S, Sarcoma; SGC, Salivary Gland cancer; ST, Solid tumor; TC, Thymic cancer; UC, Urothelial cancer; UrC, Uterine cancer; VC, Vulvar cancer; N, not reached; NR, Not reported.

Supplemental table 2. Basic characteristics included in the objective response analysis.

Study	No. of patients	Median time to response (range), m	Median duration of response (range), m	CR	PR	OR	PD-L1 positive				PD-L1 negative			
							No. of Patients	CR	PR	OR	No. of Patients	CR	PR	OR
Balar,2017[1]	119	2.1(1.8-10.5)	3.7-21.0+	11	16	27	80	8	11	19	39	3	5	8
Colevas,2018[2]	32	NR	7.4	0	7	7	25	0	6	6	7	0	1	1
Emens,2019[3]	112	NR	21.0(3.0-38.0+)	3	8	11	91	3	8	11	21	0	0	0
Eng,2019[4]	90	NR	4.8(3.8-5.8)	0	2	2	35	0	1	1	NR	NR	NR	NR
Fehrenbacher,2016[5]	144	NR	14.3	NR	NR	31	93	NR	NR	17	51	NR	NR	4
Fehrenbacher,2018[6]	613	NR	23.9	NR	NR	84	347	NR	NR	62	260	NR	NR	20
Horn,2018[7]	81	2.7(1.2-11.5)	16.4(7.2-53.4+)	1	19	20	63	1	17	18	18	0	2	2
Liu,2019[8]	9	NR	NR	1	1	2	8	1	1	2	1	0	0	0
Liu,2019[8]	15	NR	NR	0	2	2	5	0	2	2	10	0	0	0
McDermott,2016[9]	62	NR	17.4(7.6-26.9+)	1	8	9	33	1	5	6	22	0	2	2
McDermott,2018[10]	103	NR	NR	11	14	25	54	8	7	15	NR	NR	NR	NR
Peters,2017[11]	139	NR	9.8(5.6-N)	0	30	30	139	0	30	30	NR	NR	NR	NR
Peters,2017[11]	268	NR	N (8.3-N)	3	49	52	268	3	49	52	NR	NR	NR	NR
Peters,2017[11]	252	NR	11.8(6.9-N)	3	42	45	252	3	42	45	NR	NR	NR	NR
Petrylak,2018[12]	95	NR	22.1(2.8-41.0+)	9	16	25	50	8	12	20	44	1	4	5
Powles,2017[13]	467	NR	21.7	16	46	62	116	8	18	26	351	8	28	36
Pujol,2019[14]	43	NR	NR	0	1	1	NR	NR	NR	NR	NR	NR	NR	NR
Rosenberg,2016[15]	310	2.1	2.0-13.7+	16	42	58	207	13	24	37	103	2	6	8
Spigel,2018[16]	31	2.0	11.5	NR	NR	10	31	NR	NR	10	NR	NR	NR	NR
Spigel,2018[16]	92	2.6	17	NR	NR	19	92	NR	NR	19	NR	NR	NR	NR

Spigel,2018[16]	13	1.4	NR	NR	NR	3	13	NR	NR	3	NR	NR	NR	NR
Sternberg,2019[17]	1004	NR	13.2-N	29	106	135	NR	NR	NR	NR	NR	NR	NR	NR
Apolo,2017[18]	44	3.3	NR	5	3	8	13	2	5	7	24	0	1	1
Bang,2018[19]	185	3.1(1.4-4.4)	1.4-5.5	1	3	4	NR	NR	NR	NR	NR	NR	NR	NR
Barlesi,2018 [20]	396	NR	NR	5	54	59	264	4	46	50	132	1	8	9
Chung,2019[21]	150	1.7	21.4	2	8	10	26	1	1	2	51	0	2	2
D'Angelo,2018[22]	29	1.5(1.3-4.3)	1.2-8.3	4	14	18	NR	NR	NR	NR	NR	NR	NR	NR
Dirix,2018[23]	168	2.9(1.4-4.4)	28.7-N	1	4	5	12	NR	NR	2	124	NR	NR	2
Disis,2019[24]	125	2.2(1.3-5.9)	10.4	1	11	12	76	1	8	9	38	0	3	3
Doi,2018[25]	40	NR	2.8-17.7	1	3	4	11	0	3	3	27	1	0	1
Gulley,2017[26]	184	NR	0.1-13.5+	1	21	22	122	1	16	17	20	0	2	2
Hassan,2019[27]	53	NR	15.2 (11.1–N)	1	4	5	16	1	2	3	27	0	2	2
Heery,2017[28]	53	NR	NR	0	4	4	NR	NR	NR	NR	NR	NR	NR	NR
Kaufman,2018[29]	88	1.5(1.5-9.0)	8.3- N	10	19	29	58	NR	NR	21	16	NR	NR	3
Keilholz,2019[30]	51	NR	2.6- N	4	7	11	19	2	6	8	20	0	0	0
Mego,2019[31]	8	NR	NR	0	0	0	NR	NR	NR	NR	NR	NR	NR	NR
Patel,2017[32]	161	2.9	NR	9	18	27	63	6	9	15	76	8	2	10
Tourneau,2018[33]	50	NR	NR	0	3	3	12	0	2	2	29	0	1	1
Migden,2018[34]	26	2.3(1.7-7.3)	NR	0	13	13	NR	NR	NR	NR	NR	NR	NR	NR
Migden,2018[34]	59	1.9(1.7-6.0)	NR	4	24	28	NR	NR	NR	NR	NR	NR	NR	NR
Antonia,2018[35]	443	NR	27.4–N	8	125	133	NR	NR	NR	NR	NR	NR	NR	NR
Antonia,2019[36]	304	2.6	17.7 （1.4+-41.2+）	NR	NR	46	147	NR	NR	32	109	NR	NR	7
Garassino,2018[37]	444	2.0(1.8-3.7)	NR	1	61	62	288	1	53	54	121	0	8	8
Massard,2016[38]	42	1.5(1.3-2.8)	1.0+-11.5+	2	11	13	28	2	11	13	14	0	0	0
Necchi,2019[39]	11	NR	NR	0	0	0	NR	NR	NR	NR	NR	NR	NR	NR

Powles,2017[40]	191	1.4(1.2-7.2)	0.9+-19.9+	7	27	34	98	4	23	27	79	2	2	4
Segal,2019[41]	62	2.7(1.2-5.5)	12.4(3.5-20.5+)	0	4	4	20	0	3	3	39	0	1	1
Siu,2018[42]	65	4.1(2.0-6.0)	NR	0	6	6	NR	NR	NR	NR	65	0	6	6
Zandberg,2019[43]	112	2.0(1.6-9.2)	10.3	1	17	18	112	1	17	18	NR	NR	NR	NR
Amaria,2018[44]	12	NR	NR	3	0	3	NR	NR	NR	NR	NR	NR	NR	NR
Ansell,2015[45]	23	NR	NR	4	16	20	NR	NR	NR	NR	NR	NR	NR	NR
Ansell,2019[46]	121	1.9	10.4(2.0-19.0+)	3	7	10	NR	NR	NR	NR	NR	NR	NR	NR
Antonia,2016[47]	98	2	NR	0	10	10	NR	NR	NR	NR	NR	NR	NR	NR
Armand,2018[48]	243	2.1	16.6	40	128	168	NR	NR	NR	NR	NR	NR	NR	NR
Ascierto,2018[49]	210	2.1	NR	40	50	90	59	21	NR	NR	151	19	NR	NR
Ben-ami,2017[50]	12	NR	NR	0	0	0	NR	NR	NR	NR	NR	NR	NR	NR
Borghaei,2015[51]	292	2.1(1.2-8.6)	17.2(1.8-22.6+)	4	52	56	123	NR	NR	38	108	NR	NR	10
Brahmer,2012[52]	52	NR	NR	NR	NR	9	NR	NR	NR	NR	NR	NR	NR	NR
Brahmer,2012[52]	17	NR	NR	NR	NR	2	NR	NR	NR	NR	NR	NR	NR	NR
Brahmer,2012[52]	49	NR	NR	NR	NR	5	NR	NR	NR	NR	NR	NR	NR	NR
Brahmer,2012[52]	17	NR	NR	NR	NR	1	NR	NR	NR	NR	NR	NR	NR	NR
Brahmer,2015[53]	135	2.2(1.6-11.8)	2.9-20.5+	1	26	27	63	NR	NR	11	54	NR	NR	9
Carbone,2017[54]	271	2.8(1.2-13.2)	12.1(1.7-19.4+)	NR	NR	NR	211	4	51	55	NR	NR	NR	NR
Carneiro,2019[55]	10	2.0	NR	0	1	1	NR	NR	NR	NR	NR	NR	NR	NR
D'angelo,2018[56]	38	1.2(1.2-1.3)	7.4(3.2-11.6)	0	2	2	NR	NR	NR	NR	NR	NR	NR	NR
El-Khoueiry,2017[57]	48	<3.0	17.0	3	4	7	11	1	2	3	33	2	2	4
El-Khoueiry,2017[57]	214	<3.0	9.9(8.3-N)	3	39	42	34	1	8	9	140	2	24	26
Ferris,2016[58]	240	2.1(1.8-7.4)	9.7(2.8-32.8+)	6	26	32	88	NR	NR	15	73	NR	NR	9
Flippot,2019[59]	73	NR	7.2	4	7	11	NR	NR	NR	NR	NR	NR	NR	NR
Forde,2018[60]	20	NR	NR	3	6	9	7	1	2	3	8	1	1	2

Fujimoto,2019[61]	18	NR	NR	2	5	7	NR	NR	NR	NR	NR	NR	NR	NR
Gettinger,2015[62]	129	NR	17.0(1.4-36.8+)	NR	NR	22	33	NR	NR	5	35	NR	NR	3
Gettinger,2016[63]	52	NR	4.2-25.8+	4	8	12	32	NR	NR	9	14	NR	NR	2
Hamanishi,2015[64]	20	<3.0	NR	2	1	3	16	1	1	2	4	1	0	1
Hida,2017[65]	35	2.7(1.2-5.5)	3.0-22.9+	0	9	9	15	0	7	7	4	0	0	0
Hodi,2018[66]	316	2.8(1.1-11.6)	45.7-N	56	85	141	171	38	55	93	117	18	24	42
Janjigian,2018[67]	59	1.4(1.2-2.1)	14.1(2.8-14.1)	0	4	4	16	0	2	2	26	0	1	1
Kang,2017[68]	268	1.6(1.4-3.0)	9.5(6.1-9.8)	0	30	30	NR	NR	NR	NR	NR	NR	NR	NR
Katsuya,2019[69]	15	NR	NR	0	0	0	NR	NR	NR	NR	NR	NR	NR	NR
Kudo,2017[70]	64	1.5(1.4-3.0)	NR	1	10	11	NR	NR	NR	NR	NR	NR	NR	NR
Larkin,2018[71]	272	2.2	31.9	17	57	74	179	NR	NR	60	69	NR	NR	9
Lee,2018[72]	100	2.8	11.7(5.6-N)	2	18	20	NR	NR	NR	NR	NR	NR	NR	NR
Lesokhin,2016[73]	81	NR	5.8(1.5-20.4+)	4	9	13	NR	NR	NR	NR	NR	NR	NR	NR
Long,2018[74]	41	NR	NR	3	3	6	NR	NR	NR	NR	NR	NR	NR	NR
Ma,2018[75]	44	NR	9.3	1	8	9	18	NR	NR	6	23	NR	NR	3
Ma,2019[76]	32	NR	NR	0	4	4	NR	NR	NR	NR	NR	NR	NR	NR
Maruyama,2017[77]	16	2.0(1.8-9.0)	NR	4	9	13	NR	NR	NR	NR	NR	NR	NR	NR
McDermott,2015[78]	34	4.0(2.0-12.0)	12.9(8.4-29.1+)	1	9	10	NR	NR	NR	NR	NR	NR	NR	NR
Morris,2017[79]	37	NR	5.8	2	7	9	13	NR	NR	4	NR	NR	NR	NR
Motzer,2015[80]	410	3.5(1.4-24.8)	12.0(0.0-27.6)	4	99	103	NR	NR	NR	NR	NR	NR	NR	NR
Motzer,2015[81]	168	2.8(1.2-10)	4.2-N	2	33	35	29	NR	NR	9	78	NR	NR	14
Nishio,2017[82]	76	1.4(1.3-14.8)	1.6-29.1	2	15	17	27	NR	NR	9	13	NR	NR	3
Okada,2019[83]	34	2.6(1.0-6.9)	11.1	0	10	10	20	0	8	8	12	0	1	1
Omuro,2018[84]	9	NR	NR	0	1	1	NR	NR	NR	NR	NR	NR	NR	NR
Ornstein,2019[85]	14	NR	8.5(4.0-13.3)	0	4	4	NR	NR	NR	NR	NR	NR	NR	NR

Overman,2017[86]	74	2.8	1.4+-26.5+	2	22	24	21	NR	NR	7	47	NR	NR	13
Quispel-Janssen,2018[87]	34	2.6	7.0	0	9	9	NR	NR	NR	NR	NR	NR	NR	NR
Ramchandren,2019[88]	51	NR	NR	34	9	43	NR	NR	NR	NR	NR	NR	NR	NR
Rizvi,2015[89]	117	3.3	8.3-N	0	17	17	25	0	6	6	51	0	7	7
Scherpereel,2019[90]	54	NR	7.4	NR	NR	11	NR	NR	NR	NR	NR	NR	NR	NR
Sharma,2019[91]	78	2.0(1.0-8.3)	30.5	9	7	16	26	3	4	7	43	5	6	11
Sharma,2017[92]	265	1.9	7.4-N	6	46	52	122	5	24	29	143	1	22	23
Teraoka,2017[93]	43	NR	NR	NR	NR	11	NR	NR	NR	NR	NR	NR	NR	NR
Topalian,2012[94]	104	NR	NR	NR	NR	26	NR	NR	NR	NR	17	NR	NR	0
Topalian,2012[94]	122	NR	>6.0	NR	NR	14	NR	NR	NR	NR	NR	NR	NR	NR
Topalian,2012[94]	34	NR	NR	NR	NR	9	NR	NR	NR	NR	NR	NR	NR	NR
Topalian,2012[94]	17	NR	NR	NR	NR	0	NR	NR	NR	NR	NR	NR	NR	NR
Topalian,2012[94]	19	NR	NR	NR	NR	0	NR	NR	NR	NR	NR	NR	NR	NR
Topalian,2014[95]	107	NR	26.0	NR	NR	33	NR	NR	NR	NR	NR	NR	NR	NR
Ueno,2019[96]	30	1.4	12.7	0	1	1	18	0	1	1	10	0	0	0
Voorwerk,2019[97]	66	NR	9.0	2	11	13	NR	NR	NR	NR	NR	NR	NR	NR
Weber,2013[98]	87	NR	3.0-35.0+	2	20	22	23	NR	NR	9	21	NR	NR	5
Weber,2016[99]	92	NR	14.6	3	24	27	NR	NR	NR	NR	NR	NR	NR	NR
Wu,2019[100]	338	2.6(1.1-9.5)	2.3-19.2+	1	55	56	NR	NR	NR	NR	NR	NR	NR	NR
Yamamoto,2017[101]	17	NR	NR	1	2	3	8	0	2	2	3	0	0	0
Yamazaki,2017[102]	23	NR	1.4-17.1	2	6	8	NR	NR	NR	NR	NR	NR	NR	NR
Adams,2019[103]	84	2.0(1.7-6.2)	10.4(4.2-19.2+)	4	14	18	84	4	14	18	NR	NR	NR	NR
Adams,2019[104]	170	3.9(1.9-8.1)	1.2-21.5+	2	7	9	105	2	4	6	64	0	3	3
Adra,2017[105]	12	NR	NR	0	0	0	NR	NR	NR	NR	NR	NR	NR	NR
Alley,2017[106]	25	1.9(1.7-3.8)	12.0(3.7-N)	0	5	5	NR	NR	NR	NR	NR	NR	NR	NR

Armand,2016[107]	31	NR	0.04+-18.5+	5	15	20	NR	NR	NR	NR	NR	NR	NR	NR
Armand,2019[108]	30	1.1(0.9-1.4)	NR	25	0	25	NR	NR	NR	NR	NR	NR	NR	NR
Balar,2017[109]	370	2.0	NR	17	72	89	168	9	44	53	34	0	5	5
Barta,2019[110]	15	3.8(2.7-4.9)	2.9(0.0-10.1)	4	1	5	NR	NR	NR	NR	NR	NR	NR	NR
Bauml,2017[111]	171	2.0(2.0-5.0)	8.0(2.0+-12.0+)	1	27	28	140	1	24	25	26	0	3	3
Carlino,2018[112]	556	3.0(0.9-12.0)	1.9-24.8+	69	134	203	446	63	115	178	103	6	19	25
Chen,2017[113]	210	NR	NR	47	98	145	NR	NR	NR	NR	NR	NR	NR	NR
Cho,2018[114]	33	NR	9.7	0	7	7	14	0	5	5	10	0	0	0
Chung,2019[115]	98	2.1(1.6-4.1)	3.7+-18.6+	3	9	12	82	3	9	12	15	0	0	0
Cohen,2018[116]	26	1.9(1.6-2.1)	3.9(3.5-20.6)	0	3	3	26	0	3	3	NR	NR	NR	NR
Cohen,2019[117]	247	4.5	18.4	4	32	36	196	4	30	34	50	0	2	2
Doi,2018[118]	23	4.0(2.0-8.0)	15.0(6.0-26.0+)	0	7	7	23	0	7	7	NR	NR	NR	NR
Feun,2019[119]	28	NR	4.0+-20.0+	1	8	9	NR	NR	NR	NR	NR	NR	NR	NR
Fradet,2019[120]	270	2.1	1.6+-30.0+	25	32	57	74	5	11	16	NR	NR	NR	NR
Frenel,2017[121]	24	1.9(1.7-8.2)	5.4(4.1-7.5)	0	4	4	24	0	4	4	NR	NR	NR	NR
Fuchs,2018[122]	259	2.1(1.7-6.6)	8.4(1.6+-17.3+)	6	24	30	148	3	20	23	109	3	4	7
Gadgeel,2018[123]	34	NR	10.8	0	5	5	8	0	3	3	12	0	1	1
Giaccone,2018[124]	40	1.5(1.5-6.0)	22.4	1	8	9	10	0	6	6	27	0	0	0
Goldberg,2016[125]	18	NR	3.2+-7.0+	4	2	6	18	4	2	6	NR	NR	NR	NR
Hamid,2017[126]	361	3.5	22.8(1.4+-25.3+)	NR	NR	90	NR	NR	NR	NR	NR	NR	NR	NR
Hamid,2019[127]	655	2.8(0.5-49.6)	1.3+-66.3+	104	163	267	344	NR	NR	130	107	NR	NR	11
Hansen,2018[128]	23	2.7(1.8-5.7)	13.5(6.5-14.2)	0	4	4	NR	NR	NR	NR	NR	NR	NR	NR
Herbst,2019[129]	690	2.3	NR	0	144	144	690	0	144	144	NR	NR	NR	NR
Hsu,2017[130]	27	1.9(1.4-16.4)	17.1(4.8-22.1+)	0	5	5	19	0	5	5	NR	NR	NR	NR
Huang,2019[131]	27	NR	NR	5	3	8	NR	NR	NR	NR	NR	NR	NR	NR

Kluger,2019[132]	23	NR	NR	4	2	6	NR	NR	NR	NR	NR	NR	NR	NR
Leighl,2019[133]	550	2.1(2.0-4.1)	30.3(1.0+-47.7+)	6	137	143	385	NR	NR	111	90	NR	NR	13
Levy,2019[134]	49	NR	NR	0	7	7	17	0	4	4	20	0	1	1
Long,2019[135]	352	2.8	NR	15	96	111	NR	NR	NR	NR	NR	NR	NR	NR
Matulonis,2019[136]	376	2.1(1.8-12.3)	8.2(3.3+-18.6)	7	23	30	197	7	13	20	141	0	7	7
Mehra,2018[137]	192	2.0(2.0-17.0)	2.0+-30.0+	8	26	34	152	NR	NR	32	36	NR	NR	2
Mok,2019[138]	637	2.1(2.0-4.1)	20.2(16.6-N)	3	171	174	637	3	171	174	NR	NR	NR	NR
Muro,2016[139]	36	2.0(1.8-2.0)	10.0(8.0-N)	0	8	8	36	0	8	8	NR	NR	NR	NR
Nanda,2016[140]	27	4.5(1.8-8.1)	3.8-11.8+	1	4	5	NR	NR	NR	NR	NR	NR	NR	NR
Nghiem2019[141]	50	2.8(1.5-9.7)	NR	12	16	28	41	NR	NR	24	6	NR	NR	3
Nishio,2018[142]	38	NR	22.8(3.9-29.1+)	0	8	8	37	0	8	8	1	0	0	0
Ott,2017[143]	24	3.6(1.6-4.8)	0.1-9.2+	0	4	4	NR	NR	NR	NR	NR	NR	NR	NR
Ott,2017[144]	24	2.0(1.7-3.7)	19.4(3.6+-20.0+)	1	7	8	NR	NR	NR	NR	NR	NR	NR	NR
Ott,2017[145]	23	2.0(1.9-2.0)	16.1-16.2+	0	3	3	23	0	3	3	NR	NR	NR	NR
Ott,2019[146]	23	NR	NR	1	3	4	NR	NR	NR	NR	NR	NR	NR	NR
Ott,2019[146]	25	NR	NR	0	3	3	NR	NR	NR	NR	NR	NR	NR	NR
Ott,2019[146]	23	NR	NR	0	1	1	NR	NR	NR	NR	NR	NR	NR	NR
Ott,2019[146]	25	NR	NR	0	2	2	NR	NR	NR	NR	NR	NR	NR	NR
Ott,2019[146]	24	NR	NR	0	1	1	NR	NR	NR	NR	NR	NR	NR	NR
Ott,2019[146]	16	NR	NR	0	1	1	NR	NR	NR	NR	NR	NR	NR	NR
Ott,2019[146]	24	NR	NR	0	0	0	NR	NR	NR	NR	NR	NR	NR	NR
Ott,2019[146]	22	NR	NR	0	2	2	NR	NR	NR	NR	NR	NR	NR	NR
Ott,2019[146]	18	NR	NR	0	1	1	NR	NR	NR	NR	NR	NR	NR	NR
Plimack,2017[147]	27	2.0(2.0-13.0)	10.0(4.0-22.0+)	3	4	7	24	NR	NR	5	4	0	0	0
Reck,2019[148]	154	2.2(1.4-8.2)	1.9+-14.5+	NR	NR	69	154	NR	NR	69	NR	NR	NR	NR

Ribrag,2019[149]	30	NR	NR	0	0	0	NR	NR	NR	NR	NR	NR	NR	NR
Rugo,2018[150]	25	1.7(1.7-1.9)	12.0(7.4-15.9)	0	3	3	NR	NR	NR	NR	NR	NR	NR	NR
Seiwert,2016[151]	45	2(1.8-4.2)	13.3(3.3-N)	1	7	8	45	1	7	8	NR	NR	NR	NR
Shah,2018[152]	121	4.1(2.0-6.3)	1.9-14.4	0	12	12	58	0	8	8	63	0	4	4
Shimizu,2016[153]	9	1.5(1.4-1.6)	NR	0	2	2	2	0	0	0	3	0	1	1
Shitara,2018[154]	196	NR	18.0	7	24	31	196	7	24	31	NR	NR	NR	NR
Si,2019[155]	103	2.8(2.6-9.7)	8.4(1.1+-11.0+)	1	16	17	53	NR	NR	11	45	NR	NR	6
Tawbi,2017[156]	40	NR	8.3	1	6	7	2	1	1	2	38	0	0	0
Tawbi,2017[156]	40	NR	10.8	0	2	2	0	0	0	0	40	0	0	0
Varga,2019[157]	26	1.7(1.7-1.8)	20.5+-30.4+	1	2	3	26	1	2	3	NR	NR	NR	NR
Yamazaki,2017[158]	37	3.1(3.0-6.0)	4.3-9.3+	2	7	9	18	NR	NR	3	11	NR	NR	4
Zhu,2018[159]	104	2.1(2.1-4.1)	3.1-14.6	1	17	18	22	NR	NR	7	30	NR	NR	6
Zinzan,2017[160]	17	NR	2.3+-22.4+	2	5	7	NR	NR	NR	NR	NR	NR	NR	NR

CR, Complete response; OR, objective response; PR, partial response; NR, not reported; N, not reached.

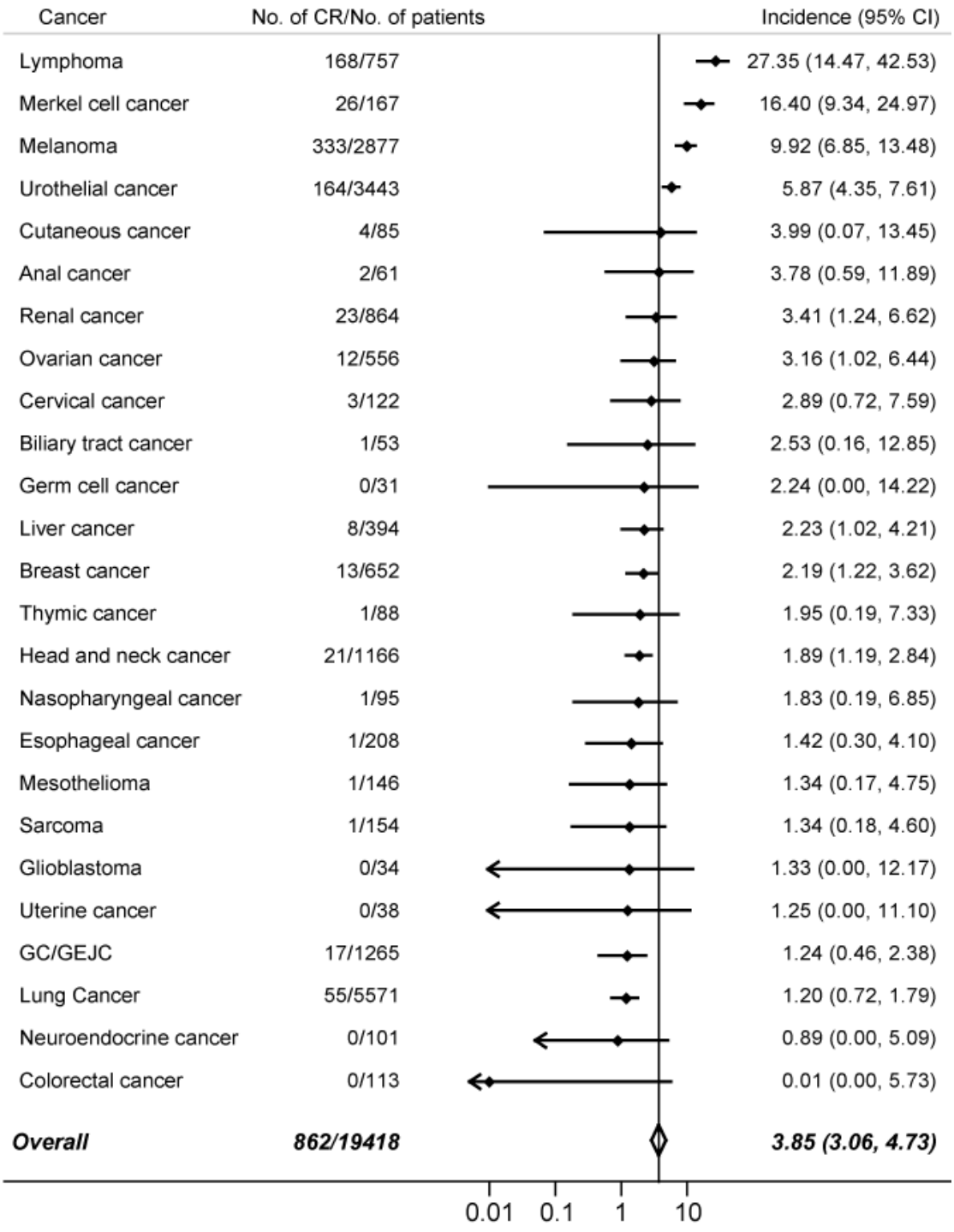
Supplemental table 3. Baseline characteristics of the eligible RCTs included in this study.

Study	Phase	Cancer type	Drug	No. of patients	Median age (range), y	Sex (M/F)	Treatment duration, median (range), m	Median follow-up (range), m	No. of PD-L1 positive patients	No. of PD-L1 negative patients	Jadad score
Eng,2019[4]	3	CRC	Atezolizumab	90	56(51-64)	59/31	1.4	NR	35	42	3
			Regorafenib	90	59(52-66)	51/39	1.7	NR	31	40	
Fehrenbacher,2016[5]	2	LC	Atezolizumab	144	62(42-82)	93/51	3.7(0-19.0)	14.8(0.2-19.6)	93	51	3
			Docetaxel	143	62(36-84)	76/67	2.1(0-17.0)	15.7(0.1-18.7)	102	41	
Fehrenbacher,2018[6]	3	LC	Atezolizumab	613	63(25-84)	379/234	3.4(0.0-26.0)	26	347	260	4
			Docetaxel	612	64(34-85)	379/233	2.1(0.0-23.0)	NR	337	271	
Mcdermott,2018[10]	2	RC	Atezolizumab	103	61(27-81)	77/26	7.6(0.0-33.1)	20.7	54	NR	2
			Sunitinib	101	61(25-85)	79/22	6.7(0.1-33.1)	NR	60	NR	
Powles,2017[40]	3	UC	Atezolizumab	467	67(33-88)	357/110	2.8(0-24.0)	17.3(0-24.5)	116	351	4
			ICC	464	67(31-84)	361/103	2.1(0-23.0)	NR	118	346	
Pujol,2019[14]	2	LC	Atezolizumab	49	66(51-86)	30/19	NR	13.7	NR	NR	2
			ICC	24	64(52-81)	13/11	NR	NR	NR	NR	
Bang,2018[19]	3	GC/GEJC	Avelumab	185	59 (29–86)	140/45	2.0(0.5-16.5)	10.6(0.1-17.8)	NR	NR	3
			ICC	186	61(18-82)	127/59	2.3(1.0-14.5)	10.6(0.0-17.6)	NR	NR	
Barlesi,2018[20]	3	LC	Avelumab	396	64 (58–69)	269/127	3.4	18.9	264	132	4
			Docetaxel	396	63(57-69)	273/123	2.8	17.8	265	131	
Antonia,2018[35]	3	LC	Durvalumab	476	64(31-84)	334/142	9.4(0.2-12.6)	25.2(0.2-43.1)	NR	NR	4
			Placebo	237	64(23-90)	166/71	7.0(0.3-13.3)	NR	NR	NR	
			Nivolumab	210	64(18-86)	121/89	NR	>38.4	59	151	

Ascierto,2018[49]	3	M	Dacarbazine	208	66(25-87)	125/83	NR	>38.5	61	147	3
Borghaei,2015[51]	3	LC	Nivolumab	292	61(37-84)	151/141	NR	>17.2	123	108	3
			Docetaxel	290	64(21-85)	168/122	NR	NR	123	101	
Brahmer,2015[53]	3	LC	Nivolumab	135	62(39-85)	111/24	6.0(0.8-36.0)	>11.0	63	54	3
			Docetaxel	137	64(42-84)	97/40	2.3(0.8-21.8)	NR	56	52	
Carbone,2017[54]	3	LC	Nivolumab	271	63(32-89)	184/87	3.7(0-26.9+)	13.7	211	NR	4
			ICC	270	65(29-87)	148/122	3.4(0.0-20.9+)	13.5	212	NR	
Ferris,2016[58]	3	HNC	Nivolumab	240	59(29-83)	197/43	1.9	5.1(0.0-16.8)	88	73	3
			ICC	121	61(28-78)	103/18	1.9	NR	61	38	
Kang,2017[68]	3	GC/GEJC	Nivolumab	330	62(54-69)	229/101	1.9	8.9	NR	NR	3
			Placebo	163	61(53-68)	119/44	1.1	8.6	NR	NR	
Larkin,2018[71]	3	M	Nivolumab	272	59(23-88)	176/96	4.7	NR	179	69	4
			ICC	133	62(29-85)	85/48	2.0	NR	74	25	
Motzer,2015[80]	3	RC	Nivolumab	410	62(23-88)	315/95	5.5(0.1-29.6)	>14.0	94	276	4
			Everolimus	411	62(18-86)	304/107	3.7(0.2-25.7)	NR	87	299	
Wu,2019[100]	3	LC	Nivolumab	338	60(27-78)	263/75	2.5	10.4(0.2-21.1)	NR	NR	3
			Docetaxel	166	60(38-78)	134/32	1.3	8.8(0-18.7)	NR	NR	
Cohen,2018[116]	3	HNC	Pembrolizumab	247	60(55-66)	207/40	NR	8.4	196	50	4
			ICC	248	60(54-66)	205/43	NR	7.1	191	54	
Fradet,2019[120]	3	UC	Pembrolizumab	270	67(29-88)	200/70	3.5(0-20.0)	27.7	74	NR	4
			ICC	272	65(26-84)	202/70	NR	NR	90	NR	
Hamid,2017[126]	2	M	Pembrolizumab	361	61(15-89)	213/148	4.3(0-32.9)	28.1(24.1-35.5)	NR	NR	3
			ICC	179	63(27-87)	114/65	2.1(0-16.4)	NR	NR	NR	
			Pembrolizumab	690	63(56-69)	425/265	3.5	31(23-41)	690	NR	

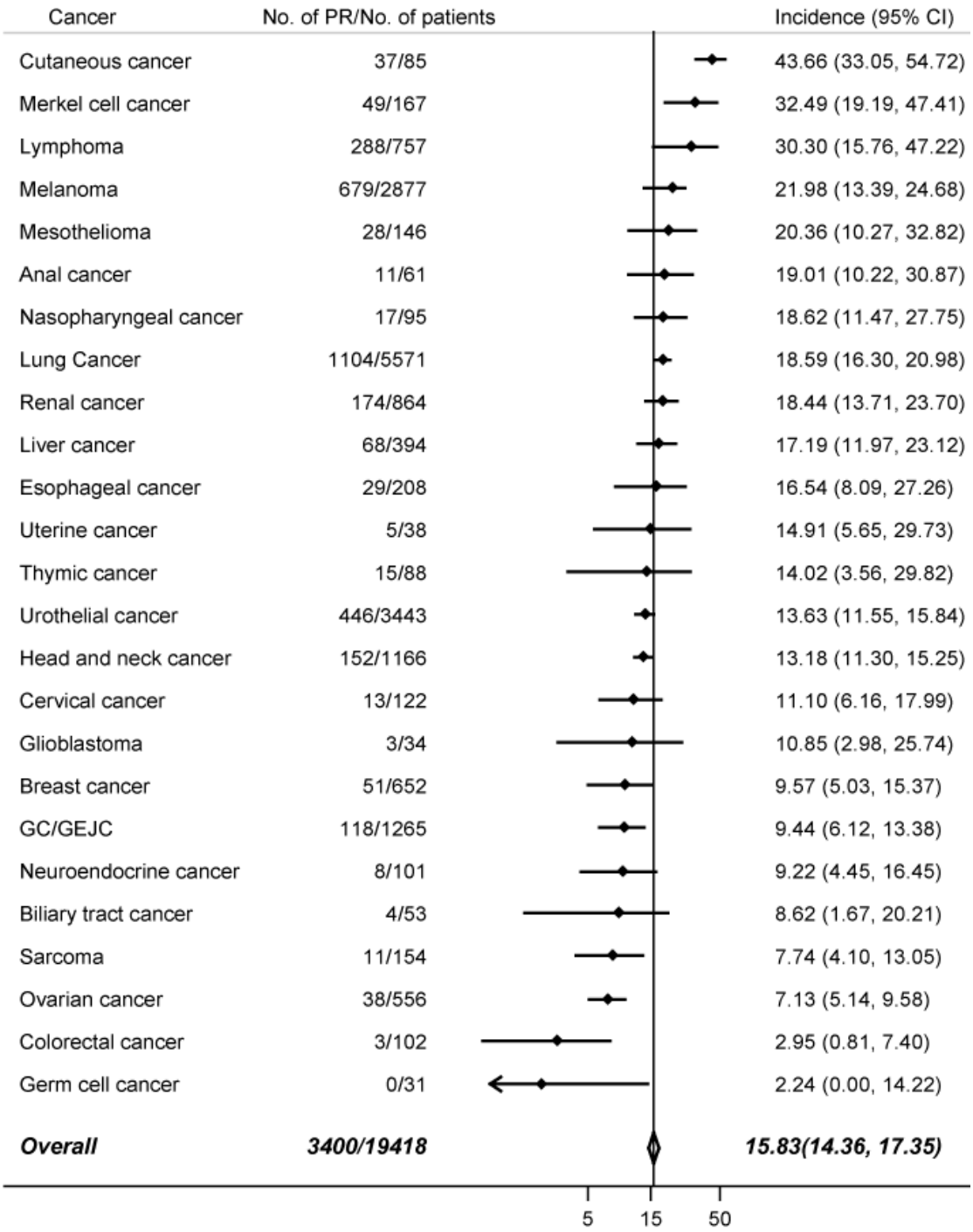
Herbst,2019[129]	2/3	LC	Docetaxel	343	62(56-69)	209/134	2.0	NR	343	NR	4
Mok,2019[138]	3	LC	Pembrolizumab	637	63(57-69)	450/187	NR	12.8	637	NR	4
			ICC	637	63(57-69)	452/185	NR	NR	637	NR	
Reck,2019[148]	3	LC	Pembrolizumab	154	65(33-90)	92/62	7.9(0.0-28.8)	25.2(20.4-33.7)	154	NR	3
			ICC	151	66(38-85)	95/56	3.5(0.0-30.5)	NR	151	NR	
Shitara,2018[154]	3	GC/GEJC	Pembrolizumab	196	64(57-71)	146/50	4.4	8.5	196	NR	3
			Paclitaxel	199	61(54-68)	140/59	3.5	NR	199	NR	

CRC, Colorectal cancer; GC/GEJC, gastric or gastro-esophageal junction cancer; HNC, Head and neck cancer; ICC, Investigators' choice of chemotherapy; LC, Lung cancer; M, Melanoma; NR, Not reported; RC, Renal cancer; RCT, randomized controlled trial; UC, Urothelial cancer.



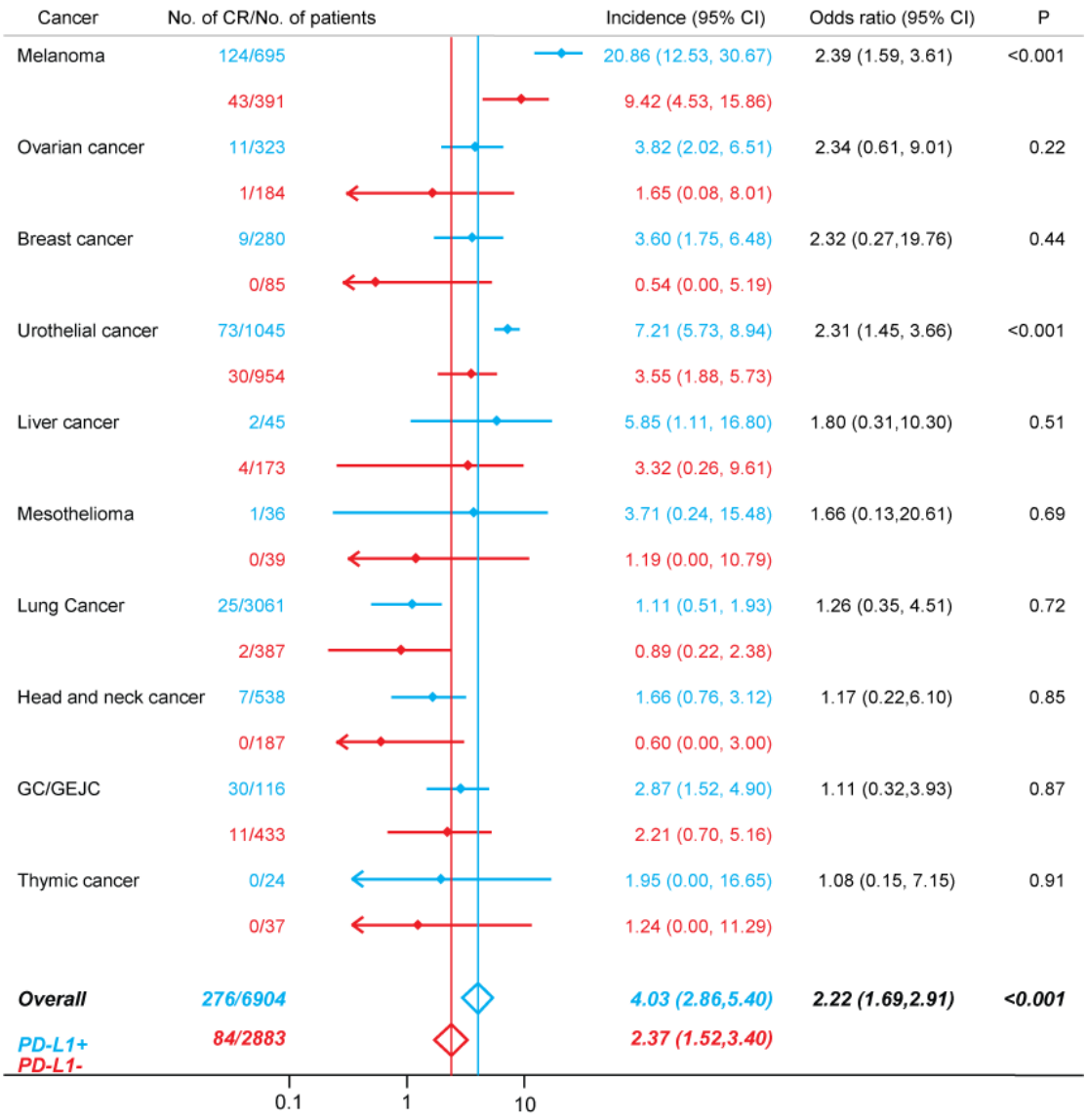
Supplemental figure 1.

The incidences of complete response (CR) in 25 different types of tumors. Vertical line indicates the overall mean incidence of CR to PD-1 and PD-L1 blockade immunotherapy.



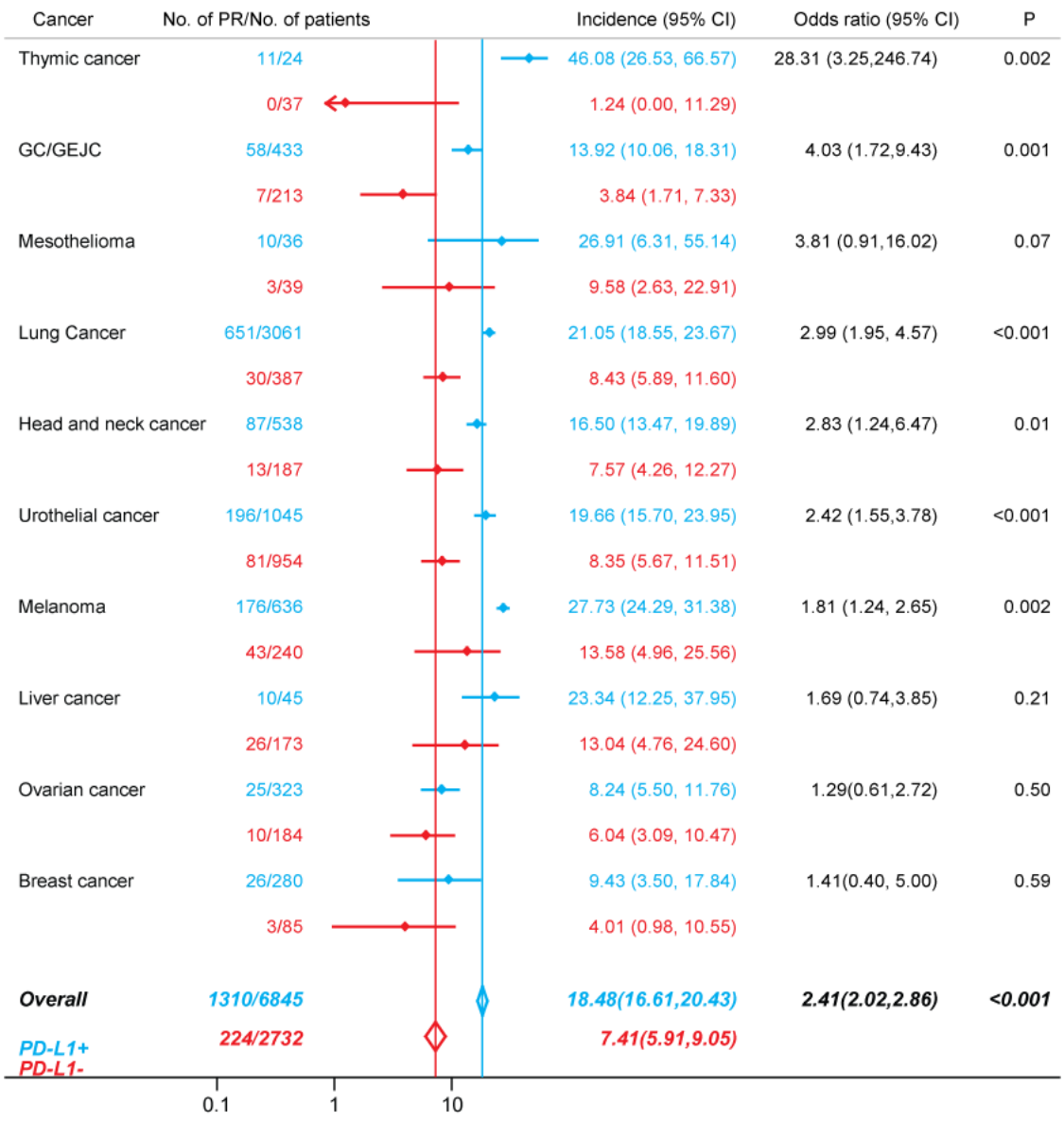
Supplemental figure 2.

The incidences of partial response (PR) in 25 different types of tumors. Vertical line indicates the overall mean incidence of PR to PD-1 and PD-L1 blockade immunotherapy.



Supplemental figure 3.

Comparison of the incidences of complete response (CR) between PD-L1 positive (blue) and PD-L1 negative (red) patient with cancer. Vertical lines indicate the overall mean incidence of CR to PD-1 and PD-L1 blockade immunotherapy.



Supplemental figure 4.

Comparison of the incidences of partial response (PR) between PD-L1 positive (blue) and PD-L1 negative (red) patient with cancer. Vertical lines indicate the overall mean incidence of PR to PD-1 and PD-L1 blockade immunotherapy.

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