

Table1 Demographic characteristics of the enrolled studies.

ID	Authors (Year)	Location	Investigation years	Study design	Follow-up years	Sample size, n	Confounders adjusted	NOS
1	Bozic, et al (2014) [43]	North America	1990-2011	Prospective case-control	3.7	587	Multivariate	7
2	Burn, et al (2018) [19]	Europe	1995-2014	Retrospective cohort	0.25	10,260	Multivariate	7
3	Chee, et al (2010) [44]	Europe	1998-2003	Prospective cohort	5	110	Univariate	5
4	Choong, et al (2007) [45]	Asia-Pacific	1998-2004	Retrospective cohort	3.5	819	Univariate	5
5	Cordero-Ampuero, et al (2010) [46]	Europe	1997-2007	Prospective case-control	2.3	124	Univariate	5
6	Dale, et al (2011) [47]	Europe	2005-2009	Prospective cohort	1	5,540	Multivariate	7
7	Davis, et al (2011) [48]	Europe	1998-2005	Prospective cohort	5	1,617	Multivariate	8
8	de Boer, et al (2001) [49]	Europe	1996-1999	Retrospective cohort	1	12,588	Univariate	6
9	Dowsey, et al (2008) [12]	Asia-Pacific	1998-2005	Retrospective cohort	1	1,207	Univariate	5
10	Gittings, et al (2017) [50]	North America	2009-2014	Retrospective cohort	1	33	Univariate/ multivariate	6
11	Gonzalez, et al (2018) [51]	Europe	1996-2013	Prospective cohort	5.6	5,198	Multivariate	7
12	Huotari, et al (2007) [52]	Europe	2001-2004	Retrospective cohort	1	5,614	Univariate	5
13	Jansen, et al (2012) [14]	Europe	2002-2008	Retrospective cohort	1	3,266	Multivariate	7
14	Jung, et al (2017) [53]	Asia-Pacific	2013-2015	Retrospective cohort	0.25	10,690	Multivariate	6
15	Kildow, et al (2017) [16]	North America	2005-2012	Retrospective case-control	2	61,778	Multivariate	6
16	Kurtz, et al (2018) [54]	North America	2005-2015	Retrospective case-control	4.7	1,158,742	Multivariate	7
17	Lenguerrand, et al (2018) [26]	Europe	2003-2013	Prospective cohort	4.6	623,253	Multivariate	8
18	Lubbeke, et al (2007) [55]	Europe	1996-2005	Prospective cohort	5	2,495	Multivariate	7
19	Maoz, et al (2015) [56]	North America	2009-2011	Retrospective cohort	2	3,672	Multivariate	6
20	Marjo, et al (2007) [57]	Europe	2000-2002	Prospective cohort	1	1,922	Multivariate	7
21	McIntosh, et al (2006) [58]	North America	1998-2002	Retrospective cohort	2.7	448	Multivariate	6
22	Meermans, et al (2012) [59]	Europe	1998-2006	Retrospective cohort	5.9	364	Univariate	5
23	Muiliwijk, et al (2006) [60]	Europe	1996-2003	Retrospective cohort	1	26,127	Multivariate	7
24	Namba, et al (2012) [38]	North America	2001-2009	Retrospective cohort	1	30,491	Univariate/ multivariate	7
25	Ong, et al (2009) [61]	North America	1997-2006	Prospective cohort	10	39,929	Multivariate	7

26	Peel, et al (2011) [62]	Asia-Pacific	2000-2007	Prospective case-control	1	108	Univariate	5
27	Rondon, et al (2018) [63]	North America	2000-2016	Retrospective case-control	5.3	145	Univariate	6
28	Smith, et al (2018) [64]	Asia-Pacific	2000-2014	Prospective cohort	1	91,585	Multivariate	7
29	Song, et al (2012) [65]	Asia-Pacific	2006-2009	Retrospective cohort	1	3,422	Univariate/ multivariate	7
30	Surin, et al (1983) [25]	Europe	1970-1977	Retrospective cohort	3-10	803	Univariate	5
31	Tai, et al (2014) [66]	Asia-Pacific	1997-2003	Prospective cohort	10	1,420	Univariate	5
32	Triantafyllopoulos, et al (2018) [67]	North America	1999-2013	Retrospective cohort	8.6	36,494	Univariate/ multivariate	7
33	Vannini, et al (1984) [15]	Europe	1969-1979	Prospective case-control	2.9	1,042	Univariate	5
34	Yong, et al (2001) [68]	Asia-Pacific	1992-1998	Retrospective cohort	3.3	67	Multivariate	6

Table 2 Modifiable risk factors for periprosthetic joint infection and the outcomes of meta-analysis

Comparisons	Number of studies	RR (95% CI)	Heterogeneity I^2 , p -value*
1. BMI (kg/m ²)	18	2.07 (1.89-2.27)	12.4%, 0.308
BMI ≥ 30 vs. BMI < 30	11	2.02 (1.84-2.23)	19.5%, 0.257
BMI ≥ 35 vs. BMI < 35	4	2.46 (1.73-3.51)	0.0%, 0.796
BMI ≥ 40 vs. BMI < 40	3	3.64 (1.91-6.94)	0.0%, 0.613
2. Smoke vs. non	6	1.24 (0.85-1.82)	0.0%, 0.756
3. Alcohol abuse vs. non	2	2.84 (0.81-10.02)	66.7%, 0.083

Table 3 Non- modifiable risk factors for periprosthetic joint infection and the outcomes of meta-analysis

p-value* for Heterogeneity; *p*-value[#] for meta regression.

Comparisons	Number of studies	RR (95% CI)	Heterogeneity <i>I</i> ² , <i>p</i> -value*	<i>p</i> -value [#]
1. Gender	18	1.15 (1.00-1.32)	84.8%, <0.001	
1.1 Location				0.860
North America	6	1.09 (0.92-1.30)	72.5%, 0.003	
Asia-Pacific	5	1.22 (0.80-1.87)	67.7% , 0.015	
Europe	7	1.13 (0.78-1.63)	88.5%, <0.001	
1.2 Follow-up years				0.250
≥3	6	1.35 (1.13-1.62)	91.0%, <0.001	
<3	12	1.00 (0.78-1.28)	71.3%, <0.001	
1.3 Study design				0.022
Prospective	7	1.39 (1.13-1.72)	76.1%, <0.001	
Retrospective	11	1.00 (0.81-1.23)	76.9%, <0.001	
1.4 Confounders adjusted				0.868
Multivariate	14	1.13 (0.969-1.31)	88.3%, <0.001	
Univariate	4	1.30 (0.93-1.81)	0.0%, 0.841	
2. Age	7	0.85 (0.71-1.01)	59.0%, 0.023	

Table 4 Medical history characteristics for periprosthetic joint infection and the outcomes of meta-analysis

Comparisons	Number of studies	RR (95% CI)	Heterogeneity I^2 , p -value*	p -value [#]
1. DM vs. non-DM	15	1.75 (1.32-2.32)	87.4%, <0.001	
1.1 Location				0.792
North America	6	1.34 (0.82-2.22)	89.3%, <0.001	
Asia-Pacific	4	2.07 (1.33-3.21)	33.4%, 0.199	
Europe	5	2.59 (1.16-5.74)	68.8%, 0.022	
1.2 Follow-up years				0.588
≥3	6	1.29 (0.95-1.75)	54.0%, 0.054	
<3	9	2.04 (1.52-2.73)	56.9%, 0.017	
1.3 Design				0.436
Prospective	5	1.56 (1.09-2.25)	47.9%, 0.104	
Retrospective	10	1.82 (1.25-2.66)	80.8%, <0.001	
1.4 Confounders adjusted				0.583
Multivariate	9	1.61 (1.12-2.31)	91.7%, <0.001	
Univariate	6	2.01 (1.28-3.16)	50.1%, 0.075	
2. AVN vs. non	2	1.65 (1.07-2.56)	53.9%, 0.141	
3. femoral neck fracture vs. non	2	1.75 (1.39-2.20)	0.0%, 0.378	
4. RA vs. non	7	1.41 (1.17-1.69)	0.0%, 0.519	
5. CVD vs. non	7	1.52 (1.26-1.83)	0.0%, 0.538	
6. Chronic pulmonary disease vs. non	2	1.22 (1.09-1.37)	0.0%, 0.897	
7. Neurological diseases vs. non	2	1.93 (1.03-3.60)	0.0%, 0.518	
8. Dysplasia or dislocation vs. non	2	0.65 (0.45-0.93)	0.0%, 0.885	
9. OA vs. non	4	0.70 (0.62-0.79)	0.0%, 0.479	
10. Previous joint surgery vs. non	4	2.69 (0.67-10.72)	83.6%, <0.001	
11. Renal disease vs. non	3	1.49 (0.48-4.67)	97.6%, <0.001	
12. Hypertension vs. non	2	1.01 (0.75-1.36)	2.1%, 0.312	
13. Cancer vs. non	2	1.06 (0.87-1.29)	0.0%, 0.486	
14. Steroid use vs. non	6	1.80 (0.89-3.63)	9.2%, 0.357	

p -value* for Heterogeneity; p -value[#] for meta regression; AVN: avascular necrosis; CVD: cardiac vascular disease; DM: diabetes; OA: osteoarthritis; RA: rheumatoid arthritis.