

Supplementary data

Table 2. Number of cases, absolute mortality risk, and relative risk (RR) of mortality in 4 specific comorbidity groups for the total study period, and stratified according to year of surgery. Adjustments have been made for age and gender

Comorbidity	No. of cases	Risk % (95% CI)	Adjusted RR (95% CI)
THA 1996–2013			
Diabetes	4,445	4.45 (4.32–4.58)	1.68 (1.26–2.24)
Cardiovascular disease	12,656	12.66 (12.6–12.9)	2.07 (1.71–2.50)
Cancer	5,487	8.80 (8.63–8.98)	1.16 (0.90–1.48)
Chronic pulmonary disease	8,799	5.49 (5.24–5.63)	0.82 (0.58–1.17)
THA 1996–1999			
Diabetes	357	2.38 (2.14–2.64)	1.97 (0.86–4.54)
Cardiovascular disease	1,407	9.38 (8.92–9.86)	1.87 (1.16–3.02)
Cancer	942	6.28 (5.90–6.68)	0.99 (0.48–2.05)
Chronic pulmonary disease	497	3.31 (3.03–3.61)	1.22 (0.43–3.48)
THA 2000–2004			
Diabetes	818	3.42 (3.19–3.65)	1.47 (0.81–2.68)
Cardiovascular disease	2,982	12.45 (12.1–12.9)	2.85 (2.04–3.98)
Cancer	1,856	7.75 (7.42–8.10)	1.15 (0.71–1.87)
Chronic pulmonary disease	1,213	5.07 (4.79–5.35)	0.55 (0.27–1.10)
THA 2005–2009			
Diabetes	1,564	4.87 (4.64–5.11)	1.50 (0.86–2.63)
Cardiovascular disease	4,249	13.23 (12.9–13.6)	2.13 (1.49–3.03)
Cancer	2,852	8.88 (8.57–9.20)	1.08 (0.67–1.75)
Chronic pulmonary disease	1,900	5.92 (5.66–6.18)	0.77 (0.38–1.56)
THA 2010–2013			
Diabetes	1,706	5.90 (5.63–6.18)	2.17 (1.35–3.50)
Cardiovascular disease	4,018	13.90 (13.5–14.3)	1.58 (1.07–2.33)
Cancer	3,149	10.90 (10.5–11.3)	1.49 (0.97–2.30)
Chronic pulmonary disease	1,877	6.50 (6.21–6.79)	1.06 (0.58–1.95)
TKA 1997–2013			
Diabetes	4,689	7.36 (7.16–7.56)	1.81 (1.27–2.58)
Cardiovascular disease	8,588	13.48 (13.2–13.8)	1.70 (1.29–2.24)
Cancer	4,025	9.51 (9.29–9.74)	1.14 (0.80–1.62)
Chronic pulmonary disease	6,062	6.32 (6.13–6.51)	0.74 (0.47–1.19)
TKA 1997–1999			
Diabetes	134	3.59 (3.01–4.23)	1.57 (0.21–11.8)
Cardiovascular disease	346	9.26 (8.35–10.2)	1.00 (0.23–4.39)
Cancer	253	6.77 (5.99–7.62)	0.68 (0.09–5.10)
Chronic pulmonary disease	141	3.77 (3.19–4.43)	–
TKA 2000–2004			
Diabetes	682	5.60 (5.20–6.02)	2.75 (1.33–5.70)
Cardiovascular disease	1,574	12.93 (12.3–13.5)	2.41 (1.35–4.30)
Cancer	1,031	8.47 (7.98–8.98)	0.94 (0.40–2.20)
Chronic pulmonary disease	636	5.22 (4.83–5.63)	1.20 (0.40–3.58)
TKA 2005–2009			
Diabetes	1,831	7.35 (7.03–7.68)	1.72 (0.99–3.00)
Cardiovascular disease	3,452	13.85 (13.4–14.3)	1.31 (0.84–2.04)
Cancer	2,369	9.51 (9.15–9.88)	1.29 (0.77–2.18)
Chronic pulmonary disease	1,614	6.48 (6.17–6.79)	0.33 (0.16–0.74)
TKA 2010–2013			
Diabetes	2,042	8.92 (8.56–9.30)	1.68 (0.90–3.15)
Cardiovascular disease	3,216	14.05 (13.6–14.5)	2.05 (1.25–3.35)
Cancer	2,409	10.53 (10.1–10.9)	1.18 (0.63–2.19)
Chronic pulmonary disease	1,634	7.14 (6.81–7.48)	1.83 (0.74–4.49)

Table 3. Number of deaths, absolute mortality risk, and the relative risk (RR) of 90-day mortality after total hip and knee arthroplasty (THA and TKA) according to year of surgery (1996/1997–1999, 2000–2004, 2005–2009, 2010–2013) and stratified according to comorbidity burden, measured with the Charlson comorbidity index. The RR estimates have been adjusted for age and gender and are presented with 95% confidence intervals (CIs)

CCI group	No. of deaths	Mortality risk (95% CI)	Crude RR (95% CI)	Adjusted RR (95% CI)
THA – All procedures				
1996–1999	105	0.70 (0.52–0.85)	Reference	Reference
2000–2004	159	0.66 (0.57–0.78)	0.95 (0.74–1.21)	0.97 (0.76–1.24)
2005–2009	152	0.47 (0.40–0.55)	0.67 (0.52–0.86)	0.71 (0.55–0.91)
2010–2013	131	0.45 (0.38–0.54)	0.64 (0.49–0.82)	0.66 (0.51–0.85)
THA CCI-none				
1996–1999	61	0.53 (0.41–0.68)	Reference	Reference
2000–2004	67	0.39 (0.31–0.50)	0.74 (0.53–1.05)	0.78 (0.55–1.11)
2005–2009	68	0.31 (0.24–0.39)	0.58 (0.41–.082)	0.64 (0.45–0.90)
2010–2013	49	0.26 (0.19–0.34)	0.47 (0.32–0.69)	0.52 (0.35–0.76)
THA CCI-low				
1996–1999	26	1.35 (0.89–1.98)	Reference	Reference
2000–2004	36	1.00 (0.70–1.38)	0.74 (0.45–1.22)	0.76 (0.46–1.27)
2005–2009	32	0.65 (0.44–0.92)	0.48 (0.28–0.80)	0.51 (0.30–0.84)
2010–2013	30	0.66 (0.44–0.93)	0.48 (0.29–0.82)	0.50 (0.29–0.84)
THA CCI-moderate				
1996–1999	12	1.04 (0.54–1.82)	Reference	Reference
2000–2004	33	1.48 (1.02–2.08)	1.42 (0.74–2.76)	1.34 (0.69–2.60)
2005–2009	21	0.63 (0.39–0.97)	0.61 (0.30–1.23)	0.60 (0.30–1.23)
2010–2013	22	0.65 (0.41–0.98)	0.62 (0.31–1.25)	0.63 (0.31–1.28)
THA CCI-high				
1996–1999	6	1.42 (0.52–3.05)	Reference	Reference
2000–2004	23	2.04 (1.30–3.04)	1.45 (0.59–3.55)	1.45 (0.59–3.55)
2005–2009	31	1.58 (1.07–2.23)	1.12 (0.47–2.68)	1.13 (0.47–2.71)
2010–2013	30	1.47 (1.00–2.10)	1.04 (0.43–2.50)	1.04 (0.43–2.49)
TKA – All procedures				
1997–1999	20	0.54 (0.33–0.83)	Reference	Reference
2000–2004	56	0.46 (0.35–0.60)	0.84 (0.51–1.41)	0.85 (0.51–1.41)
2005–2009	109	0.44 (0.36–0.53)	0.81 (0.50–1.30)	0.86 (0.53–1.38)
2010–2013	78	0.34 (0.27–0.43)	0.62 (0.38–1.01)	0.68 (0.41–1.11)
TKA CCI-none				
1997–1999	16	0.58 (0.33–0.95)	Reference	Reference
2000–2004	24	0.30 (0.19–0.44)	0.51 (0.27–0.95)	0.52 (0.27–0.97)
2005–2009	41	0.26 (0.18–0.35)	0.44 (0.25–0.78)	0.49 (0.27–0.87)
2010–2013	37	0.26 (0.18–0.36)	0.43 (0.24–0.78)	0.51 (0.28–0.91)
TKA CCI-low				
1997–1999	3	0.56 (0.12–1.62)	Reference	Reference
2000–2004	14	0.66 (0.36–1.11)	1.10 (0.31–3.87)	1.17 (0.33–4.10)
2005–2009	18	0.42 (0.25–0.66)	0.74 (0.22–2.53)	0.82 (0.24–2.78)
2010–2013	7	0.17 (0.07–0.35)	0.30 (0.08–1.17)	0.34 (0.09–1.30)
TKA CCI-moderate				
1997–1999	1	0.30 (0.01–1.68)	Reference	Reference
2000–2004	7	0.55 (0.22–1.12)	1.81 (0.22–14.7)	1.74 (0.21–14.1)
2005–2009	23	0.81 (0.51–1.21)	2.68 (0.36–19.8)	2.72 (0.37–20.1)
2010–2013	11	0.39 (0.20–0.70)	1.18 (0.15–9.20)	1.24 (0.17–9.72)
TKA CCI-high				
1997–1999	0	–	–	–
2000–2004	11	1.65 (0.83–2.94)	Reference	Reference
2005–2009	27	1.53 (1.01–2.22)	0.89 (0.44–1.80)	0.88 (0.44–1.79)
2010–2013	23	1.29 (0.82–1.93)	0.78 (0.38–1.60)	0.81 (0.39–1.67)

Appendix 1

Disease categories, with underlying ICD-8 and ICD-10 codes and scores used to calculate the Charlson comorbidity index. The index score was calculated by adding the points for each comorbid condition registered in a 10-year period before the primary procedure. ICD-8 codes were used from 1977 until 1993. ICD-10 codes were used from 1994 and onward

Disease category	ICD-8	ICD-10	Points
Myocardial infarction	410	I21-I23	1
Congestive heart failure	427.09-427.11, 427.19, 428.99, 782.49	I50, I11.0, I13.0, I13.2	1
Peripheral vascular disease	440-445	I70-I74, I77	1
Cerebrovascular disease	430-438	I60-I69, G45, G46	1
Dementia	290.09-290.19, 293.09	F00-F03, F05.1, G30	1
Chronic pulmonary disease	490-493, 515-518	J40-J47, J60-J67, J68.4, J70.1, J70.3, J84.1, J92.0, J96.1, J98.2-J98.3	1
Connective tissue disease	712, 716, 734, 446, 135.99	M05, M06, M08, M09, M30-M36, D86	1
Peptic ulcer disease	530.91, 530.98, 531-534	K22.1, K25-K28	1
Mild liver disease	571, 573.01, 573.04	B18, K70.0-K70.3, K70.9, K71, K73, K74, K76.0	1
Diabetes I and II	249.00, 249.06, 249.07, 249.09, 250.00, 250.06, 250.07, 250.09	E10.0, E10.1, E10.9, E11.0, E11.1, E11.9	1
Hemiplegia	344	G81, G82	2
Moderate to severe renal disease	403, 404, 580-584, 590.09, 593.19, 753.10-753.19, 792	I12, I13, N00-N05, N07, N11, N14, N17-N19, Q61	2
Diabetes with end organ damage	249.01-249.05, 249.08, 250.01-250.05, 250.08	E10.2-E10.8, E11.2-E11.8	2
Any tumor	140-194	C00-C75	2
Leukemia	204-207	C91-C85	2
Lymphoma	200-203, 275.59	C81-C85, C88, C90, C96	2
Moderate to severe liver disease	070.00, 070.02, 070.04, 070.06, 070.08, 573.00, 456.00-456.09	B15.0, B16.0, B16.2, B19.0, K70.4, K72, K76.6, I85	3
Metastatic solid tumor	195-199	C76-C80	6
AIDS	079.83	B21-B24	6

Appendix 2

Number of deaths within 90 days of the primary procedure according to comorbidity burden measured with the Charlson comorbidity index and time period. Mortality risks, and crude and adjusted relative risks (RRs) of dying within 90 days of the primary procedure according to comorbidity burden and stratified according to time period. RRs were adjusted for age and gender

CCI group	No. of deaths	Mortality risk (95% CI)	Crude RR (95% CI)	Adjusted RR (95% CI)
THA 1996–2013				
none	245	0.35 (0.31–0.40)	reference	reference
low	124	0.83 (0.66–0.98)	2.37 (1.91–2.94)	1.93 (1.55–2.39)
moderate	88	0.87 (0.70–1.07)	2.50 (1.96–3.19)	1.95 (1.52–2.49)
high	90	1.62 (1.30–1.99)	4.67 (3.66–5.94)	3.31 (2.59–4.23)
THA 1996–1999				
none	61	0.53 (0.41–0.68)	reference	reference
low	26	1.36 (0.89–1.98)	2.57 (1.62–4.06)	2.10 (1.32–3.33)
moderate	12	1.04 (0.54–1.82)	1.98 (1.06–3.67)	1.64 (0.88–3.05)
high	6	1.42 (0.52–3.05)	2.68 (1.16–6.20)	2.00 (0.86–4.63)
THA 2000–2004				
none	67	0.39 (0.31–0.50)	reference	reference
low	36	1.00 (0.70–1.38)	2.54 (1.70–3.81)	2.08 (1.39–3.13)
moderate	33	1.48 (1.02–2.08)	3.78 (2.49–5.74)	2.81 (1.85–4.28)
high	22	1.95 (1.23–2.94)	5.20 (3.24–8.36)	3.68 (2.28–5.84)
THA 2005–2009				
none	68	0.31 (0.24–0.39)	reference	reference
low	32	0.65 (0.44–0.92)	2.13 (1.40–3.24)	1.73 (1.13–2.63)
moderate	21	0.63 (0.39–0.97)	2.07 (1.27–3.39)	1.57 (0.96–2.57)
high	31	1.58 (1.07–2.23)	5.19 (3.39–7.94)	3.64 (2.37–5.60)
THA 2010–2013				
none	49	0.26 (0.19–0.34)	reference	reference
low	30	0.66 (0.44–0.93)	2.64 (1.67–4.17)	2.13 (1.34–3.38)
moderate	22	0.65 (0.41–0.98)	2.60 (1.57–4.32)	2.11 (1.27–3.52)
high	30	1.47 (1.00–2.10)	5.95 (3.76–9.41)	4.23 (2.65–6.74)
TKA 1997–2013				
none	118	0.29 (0.24–0.34)	reference	reference
low	42	0.38 (0.27–0.51)	1.29 (0.91–1.85)	1.13 (0.79–1.62)
moderate	42	0.58 (0.42–0.78)	1.98 (1.39–2.83)	1.62 (1.13–2.31)
high	61	1.41 (1.08–1.80)	4.88 (3.57–6.66)	3.74 (2.73–5.12)
TKA 1997–1999				
none	16	0.58 (0.33–0.95)	reference	reference
low	3	0.56 (0.12–1.62)	0.95 (0.28–3.27)	0.87 (0.25–3.01)
moderate	1	0.30 (0.01–1.68)	0.52 (0.07–3.90)	0.47 (0.06–3.53)
high	0	–	–	–
TKA 2000–2004				
none	24	0.30 (0.19–0.44)	reference	reference
low	14	0.66 (0.36–1.11)	2.08 (1.06–4.09)	1.92 (0.98–3.78)
moderate	7	0.55 (0.22–1.12)	1.85 (0.80–4.30)	1.52 (0.65–3.54)
high	11	1.65 (0.83–2.94)	5.64 (2.76–11.5)	4.48 (2.18–9.19)
TKA 2005–2009				
none	41	0.26 (0.18–0.35)	reference	reference
low	18	0.42 (0.25–0.66)	1.62 (0.93–2.82)	1.38 (0.79–2.41)
moderate	23	0.81 (0.51–1.21)	3.17 (1.90–5.27)	2.52 (1.51–4.23)
high	27	1.53 (1.01–2.22)	5.80 (3.33–9.48)	4.20 (2.55–6.91)
TKA 2010–2013				
none	37	0.26 (0.18–0.36)	reference	reference
low	7	0.17 (0.07–0.35)	0.67 (0.30–1.50)	0.58 (0.26–1.30)
moderate	11	0.39 (0.20–0.70)	1.40 (0.70–2.83)	1.14 (0.57–2.32)
high	23	1.29 (0.82–1.93)	5.11 (3.03–8.62)	3.94 (2.32–6.72)