

Supplementary data

Table 3. Standardized incidence ratio (SIR) analysis of the complete cohort and sub-cohorts divided by bearings into: non-metal-on-metal (non-MoM), metal-on-metal (MoM)

Primary site (ICD-10)	Whole cohort			non-MoM bearings			MoM bearings		
	Obs	Exp	SIR (95% CI)	Obs	Exp	SIR (95% CI)	Obs	Exp	SIR (95% CI)
All sites (C00–C96)	1,405	1438.4	0.98 (0.93–1.03)	1,329	1372.0	0.97 (0.92–1.02)	76	66.4	1.14 (0.91–1.43)
Melanoma (C43)	35	39.5	0.89 (0.64–1.23)	34	37.6	0.90 (0.65–1.27)	1	1.9	0.52 (0.07–3.71)
Corpus uteri (C54)	38	38.5	0.99 (0.72–1.36)	38	36.3	1.05 (0.76–1.44)	0	2.2	0.00
Prostate (C61)	194	144.1	1.35 (1.17–1.55) ^a	180	138.3	1.30 (1.13–1.51) ^a	14	5.9	2.41 (1.43–4.08) ^a
Hematolymphatic cancers (C81–C96)	71	104.4	0.68 (0.54–0.86) ^a	69	99.9	0.69 (0.54–0.87) ^a	2	4.5	0.45 (0.11–1.80)
Stomach (C16)	58	69.1	0.84 (0.65–1.09)	56	66.0	0.85 (0.65–1.10)	2	3.0	0.66 (0.16–2.63)
Lung and bronchi (C33–C34)	126	152.4	0.83 (0.69–0.98) ^a	121	144.5	0.84 (0.70–1.00)	5	7.9	0.63 (0.26–1.51)
Breast (C50)	125	123.6	1.01 (0.85–1.21)	117	116.8	1.00 (0.84–1.20)	8	6.8	1.17 (0.59–2.34)
Lymphomas (C81–C85)	31	39.2	0.79 (0.56–1.12)	29	37.5	0.77 (0.54–1.11)	2	1.7	1.16 (0.29–4.64)
Gastrointestinal tract (C15–C20)	229	284.9	0.80 (0.71–0.92) ^a	217	271.7	0.80 (0.70–0.91) ^a	12	13.1	0.91 (0.52–1.61)
Urotract (C64–C67)	89	83.8	1.06 (0.86–1.31)	83	80.0	1.04 (0.84–1.29)	6	3.9	1.56 (0.70–3.46)
Kidney and renal pelvis (C64–C65)	51	37.8	1.35 (1.03–1.78) ^a	48	35.9	1.34 (1.01–1.77) ^a	3	1.9	1.60 (0.51–4.95)
Bladder (C67)	38	43.8	0.87 (0.63–1.19)	35	41.9	0.83 (0.60–1.16)	3	1.9	1.60 (0.51–4.95)
Liver (C22)	16	22.6	0.71 (0.43–1.16)	16	21.5	0.75 (0.46–1.22)	0	1.1	0.00
Central nervous system (C70–C72)	14	12.0	1.16 (0.69–1.96)	14	11.3	1.23 (0.73–2.08)	0	0.7	0.00
Plasmacytoma (C90)	13	16.6	0.78 (0.45–1.35)	13	15.9	0.82 (0.48–1.41)	0	0.7	0.00
Leukemias (C91–C95)	13	31.3	0.41 (0.24–0.71) ^a	13	30.0	0.43 (0.25–0.75) ^a	0	1.4	0.00
Colon and rectum (C18–C20)	165	201.1	0.82 (0.70–0.96) ^a	155	191.8	0.81 (0.69–0.95) ^a	10	9.3	1.08 (0.58–2.00)
Liver and gall bladder (C22–C23)	35	33.7	1.04 (0.75–1.45)	35	32.2	1.09 (0.78–1.51)	0	1.5	0.00
Pancreas (C25)	47	47.6	0.99 (0.74–1.31)	45	45.6	0.99 (0.74–1.32)	2	2.0	1.00 (0.25–4.01)
Skin cancer other than melanoma (C44)	301	285	1.06 (0.94–1.18)	283	273.6	1.03 (0.92–1.16)	18	11.4	1.58 (0.99–2.50)

Abbreviations: Obs = observed number of cases; Exp = expected number of cases; CI = 95% confidence interval.

^a p < 0.05.

Table 4. Standardized incidence ratio (SIR) analysis of the sub-cohorts divided by stem material into: titanium alloy (Ti-alloy), cobalt chrome alloy (CoCr-alloy), stainless steel (Fe-alloy); and by use of bone cement into non-cemented and cemented

Stem material: Primary site (ICD-10)	Ti-alloy			CoCr-alloy			Fe-alloy		
	Obs	Exp	SIR (95% CI)	Obs	Exp	SIR (95% CI)	Obs	Exp	SIR (95% CI)
All sites (C00–C96)	1,220	1,239.2	0.98 (0.93–1.04)	156	163.6	0.95 (0.82–1.12)	29	35.6	0.81 (0.57–1.17)
Melanoma (C43)	30	34.6	0.87 (0.61–1.24)	4	4.0	1.00 (0.37–2.66)	1	0.9	1.13 (0.16–8.01)
Corpus uteri (C54)	32	33.7	0.95 (0.67–1.34)	5	3.9	1.29 (0.54–3.10)	1	1.0	1.02 (0.14–7.26)
Prostate (C61)	185	131.1	1.41 (1.22–1.63) ^a	9	11.8	0.76 (0.40–1.47)	0	1.2	0.00
Hematolymphatic cancers (C81–C96)	58	87.7	0.66 (0.51–0.86) ^a	11	13.7	0.80 (0.44–1.45)	2	3.0	0.68 (0.17–2.70)
Stomach (C16)	49	57.9	0.84 (0.64–1.12)	8	9.2	0.87 (0.43–1.73)	1	1.9	0.52 (0.07–3.72)
Lung and bronchi (C33–C34)	112	134.6	0.83 (0.69–1.00)	11	14.7	0.75 (0.41–1.35)	3	3.2	0.95 (0.31–2.94)
Breast (C50)	107	106.7	1.00 (0.83–1.21)	14	13.5	1.04 (0.61–1.75)	4	3.4	1.18 (0.44–3.15)
Lymphomas (C81–C85)	25	33.3	0.75 (0.51–1.11)	4	4.9	0.82 (0.31–2.19)	2	1.0	1.92 (0.48–7.67)
Gastrointestinal tract (C15–C20)	199	243.9	0.82 (0.71–0.94) ^a	27	33.8	0.80 (0.55–1.17)	3	7.1	0.42 (0.14–1.30)
Urotract (C64–C67)	78	71.9	1.08 (0.87–1.35)	7	9.8	0.72 (0.34–1.50)	4	2.1	1.89 (0.71–5.03)
Kidney and renal pelvis (C64–C65)	46	33.2	1.39 (1.04–1.85) ^a	4	3.8	1.06 (0.40–2.82)	1	0.8	1.21 (0.17–8.56)
Bladder (C67)	32	36.9	0.87 (0.61–1.23)	3	5.7	0.53 (0.17–1.63)	3	1.2	2.44 (0.79–7.57)
Liver (C22)	16	19.9	0.81 (0.49–1.32)	0	2.2	0.00	0	0.5	0.00
Central nervous system (C70–C72)	13	10.9	1.20 (0.69–2.06)	1	1.0	1.04 (0.15–7.39)	0	0.2	0.00
Plasmacytoma (C90)	12	14.2	0.85 (0.48–1.49)	1	2.0	0.49 (0.07–3.49)	0	0.4	0.00
Leukemias (C91–C95)	9	26.2	0.34 (0.18–0.66) ^a	4	4.2	0.94 (0.35–2.51)	0	0.9	0.00
Colon and rectum (C18–C20)	144	173.1	0.83 (0.71–0.98) ^a	19	23.0	0.83 (0.53–1.29)	2	4.9	0.41 (0.10–1.62)
Liver and gall bladder (C22–C23)	34	28.9	1.18 (0.84–1.64)	1	3.9	0.25 (0.04–1.80)	0	0.8	0.00
Pancreas (C25)	41	40.0	1.03 (0.75–1.39)	5	6.3	0.80 (0.33–1.91)	1	1.4	0.74 (0.10–5.25)
Skin cancer other than melanoma (C44)	245	238.2	1.03 (0.91–1.16)	49	38.3	1.28 (0.97–1.69)	7	8.5	0.83 (0.39–1.73)
Use of bone cement:									
Primary site (ICD-10)	Obs	Non-cemented		Obs	Cemented				
		Exp	SIR (95% CI)		Exp	SIR (95% CI)			
All sites (C00–C96)	1,156	1,170.2	0.99 (0.93–1.05)	249	268.2	0.93 (0.82–1.05)			
Melanoma (C43)	29	32.9	0.88 (0.61–1.26)	6	6.6	0.91 (0.41–2.03)			
Corpus uteri (C54)	28	31.7	0.88 (0.61–1.28)	10	6.8	1.47 (0.79–2.74)			
Prostate (C61)	178	127.2	1.40 (1.21–1.62) ^a	16	16.9	0.95 (0.58–1.55)			
Hematolymphatic cancers (C81–C96)	54	82.2	0.66 (0.50–0.86) ^a	17	22.2	0.77 (0.48–1.23)			
Stomach (C16)	49	54.1	0.91 (0.68–1.20)	9	15.0	0.60 (0.31–1.16)			
Lung and bronchi (C33–C34)	109	128.0	0.85 (0.71–1.03)	17	24.4	0.70 (0.43–1.12)			
Breast (C50)	102	100.2	1.02 (0.84–1.24)	23	23.4	0.98 (0.65–1.48)			
Lymphomas (C81–C85)	22	31.3	0.70 (0.46–1.07)	9	7.9	1.14 (0.59–2.20)			
Gastrointestinal tract (C15–C20)	190	229.6	0.83 (0.72–0.95) ^a	39	55.3	0.71 (0.52–0.97) ^a			
Urotract (C64–C67)	76	67.9	1.12 (0.89–1.40)	13	16.0	0.81 (0.47–1.40)			
Kidney and renal pelvis (C64–C65)	46	31.5	1.46 (1.09–1.95) ^a	5	6.2	0.80 (0.33–1.93)			
Bladder (C67)	30	34.6	0.87 (0.61–1.24)	8	9.3	0.86 (0.43–1.73)			
Liver (C22)	14	18.9	0.74 (0.44–1.25)	2	3.7	0.54 (0.14–2.16)			
Central nervous system (C70–C72)	11	10.4	1.06 (0.58–1.91)	3	1.6	1.86 (0.60–5.76)			
Plasmacytoma (C90)	12	13.3	0.90 (0.51–1.59)	1	3.3	0.30 (0.04–2.15)			
Leukemias (C91–C95)	8	24.5	0.33 (0.16–0.65) ^a	5	6.9	0.73 (0.30–1.75)			
Colon and rectum (C18–C20)	135	163.3	0.83 (0.70–0.98) ^a	30	37.8	0.80 (0.56–1.14)			
Liver and gall bladder (C22–C23)	32	27.3	1.17 (0.83–1.66)	3	6.5	0.46 (0.15–1.44)			
Pancreas (C25)	39	37.5	1.04 (0.76–1.42)	8	10.2	0.79 (0.39–1.57)			
Skin cancer other than melanoma (C44)	226	223.1	1.01 (0.89–1.15)	75	61.9	1.21 (0.97–1.52)			

Abbreviations: Obs = observed number of cases; Exp = expected number of cases; CI = 95% confidence interval.

^a p < 0.05.

Table 5. Poisson analysis of the sub-cohorts divided by bearings: metal-on-metal (MoM) relative to non-metal-on-metal (non-MoM); by stem material: cobalt chrome alloy (CoCr), stainless steel (Fe) relative to titanium alloy (Ti); by use of bone cement (cemented relative to non-cemented)

Primary site (ICD-10)	Bearings		Stem material		Use of bone cement cemented/non-cemented RR (95% CI)
	MoM/non-MoM RR (95% CI)	RR (95% CI)	CoCr/Ti RR (95% CI)	Fe/Ti RR (95% CI)	
All sites (C00–C96)	1.56 (1.23–1.95) ^a	0.93 (0.79–1.10)	0.75 (0.52–1.08)	0.92 (0.81–1.06)	
Melanoma (C43)	0.78 (0.11–5.69)	0.99 (0.35–2.81)	1.06 (0.14–7.76)	0.91 (0.38–2.20)	
Corpus uteri (C54)		1.27 (0.50–3.27)	0.95 (0.13–6.99)	1.60 (0.78–3.30)	
Prostate (C61)	2.02 (1.17–3.48) ^a	0.61 (0.31–1.19)		0.80 (0.48–1.33)	
Hematolymphatic cancers (C81–C96)	0.83 (0.20–3.40)	1.19 (0.63–2.27)	0.93 (0.23–3.81)	1.17 (0.68–2.02)	
Stomach (C16)	1.02 (0.25–4.17)	1.04 (0.49–2.20)	0.57 (0.08–4.15)	0.69 (0.34–1.40)	
Lung and bronchi (C33–C34)	1.02 (0.42–2.48)	0.88 (0.47–1.64)	1.05 (0.33–3.32)	0.82 (0.49–1.38)	
Breast (C50)	1.71 (0.83–3.49)	0.93 (0.54–1.63)	0.98 (0.36–2.66)	0.88 (0.56–1.39)	
Lymphomas (C81–C85)	1.93 (0.46–8.10)	1.06 (0.37–3.04)	2.28 (0.54–9.61)	1.61 (0.74–3.50)	
Gastrointestinal tract (C15–C20)	1.52 (0.85–2.72)	0.96 (0.64–1.44)	0.46 (0.15–1.43)	0.86 (0.61–1.21)	
Urotract (C64–C67)	2.02 (0.88–4.64)	0.60 (0.28–1.30)	1.46 (0.54–4.00)	0.68 (0.37–1.22)	
Kidney and renal pelvis (C64–C65)	1.64 (0.51–5.25)	0.66 (0.24–1.85)	0.72 (0.10–5.20)	0.49 (0.20–1.24)	
Bladder (C67)	2.51 (0.77–8.17)	0.57 (0.17–1.86)	2.47 (0.76–8.06)	0.96 (0.44–2.09)	
Liver (C22)				0.82 (0.19–3.62)	
Central nervous system (C70–C72)		1.00 (0.13–7.68)		2.06 (0.58–7.39)	
Plasmacytoma (C90)		0.53 (0.07–4.08)		0.32 (0.04–2.42)	
Leukemias (C91–C95)		2.71 (0.83–8.77)		2.25 (0.74–6.89)	
Colon and rectum (C18–C20)	1.75 (0.92–3.32)	0.96 (0.59–1.54)	0.43 (0.11–1.75)	0.95 (0.64–1.41)	
Liver and gall bladder (C22–C23)		0.23 (0.03–1.68)		0.43 (0.13–1.41)	
Pancreas (C25)	1.29 (0.31–5.32)	0.76 (0.30–1.93)	0.66 (0.09–4.78)	0.75 (0.35–1.62)	
Skin cancer other than melanoma (C44)	1.92 (1.19–3.10) ^a	1.24 (0.91–1.69)	0.74 (0.35–1.57)	1.21 (0.93–1.58)	

Abbreviations: RR = relative risk; CI = 95% confidence interval.
^a p < 0.05.

Table 6. Poisson analyses mutually adjusted to bearing surface, cementation, and stem material. Bearings: metal-on-metal (MoM) relative to non-metal-on-metal (non-MoM); stem material: cobalt chrome alloy (CoCr), stainless steel (Fe) relative to titanium alloy (Ti); use of bone cement (cemented relative to non-cemented)

Primary site (ICD-10)	Bearings		Stem material		Use of bone cement cemented/non-cemented RR (95% CI)
	MoM/non-MoM RR (95% CI)	RR (95% CI)	CoCr/Ti RR (95% CI)	Fe/Ti RR (95% CI)	
All sites (C00–C96)	1.54 (1.22–1.93) ^a	0.91 (0.68–1.21)	0.74 (0.47–1.14)	1.04 (0.81–1.34)	
Melanoma (C43)	0.77 (0.10–5.61)	1.47 (0.16–13.2)	1.57 (0.10–25.05)	0.66 (0.09–4.83)	
Corpus uteri (C54)		0.56 (0.15–2.09)	0.42 (0.05–3.76)	2.33 (0.82–6.65)	
Prostate (C61)	2.07 (1.20–3.57) ^a	0.32 (0.12–0.87) ^a		1.87 (0.88–3.99)	
Hematolymphatic cancers (C81–C96)	0.86 (0.21–3.51)	0.99 (0.32–3.11)	0.77 (0.14–4.22)	1.21 (0.44–3.35)	
Stomach (C16)	0.95 (0.23–3.90)				
Lung and bronchi (C33–C34)	0.99 (0.41–2.43)	1.45 (0.40–5.20)	1.73 (0.35–8.59)	0.60 (0.19–1.88)	
Breast (C50)	1.68 (0.81–3.45)	1.23 (0.44–3.41)	1.29 (0.35–4.81)	0.77 (0.31–1.90)	
Lymphomas (C81–C85)	2.19 (0.52–9.33)	0.47 (0.11–2.11)	1.03 (0.17–6.14)	2.50 (0.74–8.41)	
Gastrointestinal tract (C15–C20)	1.48 (0.83–2.66)	1.11 (0.52–2.36)	0.53 (0.14–1.96)	0.87 (0.45–1.70)	
Urotract (C64–C67)	1.93 (0.84–4.43)	1.26 (0.26–6.07)	3.12 (0.57–17.0)	0.47 (0.12–1.93)	
Kidney and renal pelvis (C64–C65)	1.51 (0.47–4.86)				
Bladder (C67)	2.56 (0.78–8.41)	0.53 (0.09–3.16)	2.32 (0.39–13.9)	1.14 (0.27–4.78)	
Liver (C22)				3.13 (0.71–13.8)	
Central nervous system (C70–C72)		0.24 (0.02–2.63)		5.87 (1.21–28.5) ^a	
Plasmacytoma (C90)					
Leukemias (C91–C95)		1.46 (0.16–13.08)		1.90 (0.24–15.2)	
Colon and rectum (C18–C20)	1.74 (0.92–3.31)	0.80 (0.36–1.76)	0.37 (0.08–1.69)	1.24 (0.63–2.44)	
Liver and gall bladder (C22–C23)		0.20 (0.02–2.17)		1.15 (0.28–4.79)	
Pancreas (C25)	1.24 (0.30–5.12)	0.90 (0.18–4.66)	0.78 (0.07–8.59)	0.84 (0.20–3.50)	
Skin cancer other than melanoma (C44)	2.01 (1.24–3.25) ^a	0.92 (0.54–1.56)	0.55 (0.23–1.32)	1.42 (0.89–2.27)	

Abbreviations: RR = relative risk; CI = 95% confidence interval.
^a p < 0.05.