Table i. Risk of reoperation for periprosthetic femoral fracture (PFF), and risk of femoral reoperation for any indication including osteosynthesis, for the brands of femoral component, stratified by sex.

Variable	Arthroplasties, n	Reoperated for PPFF		Reoperated for any cause*	
		Reoperated, n	aHRR (95% CI)†	Reoperated, n	aHRR (95% CI)†
Males					
Total	71,930	643		1,321	
Lubinus SPII	9,573	13	Reference	67	Reference
Exeter	17,118	242	8.8 (5.0 to 15.4)	388	2.5 (1.9 to 3.2)
C-Stem	3,402	48	12.3 (6.6 to 22.7)	53	3.1 (2.1 to 4.4)
MS-30	1,860	24	10.0 (5.1 to 19.6)	32	2.7 (1.8 to 4.1)
Corail collarless	15,173	208	9.5 (5.3 to 16.7)	461	2.6 (2.0 to 3.4)
POLARSTEM	2,586	20	12.0 (5.9 to 24.2)	40	3.1 (2.1 to 4.6)
Accolade 2	1,366	8	5.7 (2.4 to 14.0)	21	1.9 (1.2 to 3.1)
Corail collared	20,852	80	4.0 (2.2 to 7.2)	259	1.7 (1.3 to 2.3)
Females					
Total	132,111	1,002		1,704	
Lubinus SPII	22,613	56	Reference	116	Reference
Exeter	38,118	263	2.4 (1.8 to 3.2)	480	2.0 (1.6 to 2.4)
C-Stem	8,897	53	2.9 (2.0 to 4.3)	87	2.5 (1.9 to 3.3)
MS-30	4,853	31	2.8 (1.8 to 4.4)	48	2.1 (1.5 to 3.0)
Corail collarless	24,809	410	6.2 (4.6 to 8.3)	614	3.8 (2.6 to 5.6)
POLARSTEM	2,682	20	5.1 (3.0 to 8.5)	25	2.3 (1.5 to 3.5)
Accolade 2	1,615	16	6.1 (3.5 to 10.7)	34	3.8 (2.6 to 5.6)
Corail collared	28,524	153	2.8 (2.1 to 3.9)	300	1.9 (1.6 to 2.4)

*Including osteosyntheses.

†Cox regression analysis, adjusted for age, American Society of Anesthesiologists grade, indication for primary arthroplasty and year of primary surgery.

aHRR, adjusted hazard rate ratio.

Table ii. Risk of reoperation for periprosthetic femoral fracture (PFF), and risk of femoral reoperation for any cause (including osteosynthesis), for the femoral component design and method of fixation groups.

Reoperated for periprosthetic femoral fracture																								
Femoral component	**< 60 years**			**60 to 64 years**			**65 to 69 years**			**70 to 74 years**			**75 to 79 years**			**80 to 84 years**			**85 to 89 years**			**> 90 years**		
Males	**Components, n**	**Reoperated for PFF, n**	**aHRR (95% CI)**	**Components, n**	**Reoperated for PFF, n**	**aHRR (95% CI)**	**Components, n**	**Reoperated for PFF, n**	**aHRR (95% CI)**	**Components, n**	**Reoperated for PFF, n**	**aHRR (95% CI)**	**Components, n**	**Reoperated for PFF, n**	**aHRR (95% CI)**	**Components, n**	**Reoperated for PFF, n**	**aHRR (95% CI)**	**Components, n**	**Reoperated for PFF, n**	**aHRR (95% CI)**	**Components, n**	**Reoperated for PFF, n**	**aHRR (95% CI)**
Cemented composite beam	377	1	1	495	1	1	915	0	N/A	1,559	6	1	2,164	1	1	1,884	0	N.A.†	1349	2	1	830	2	1
Cemented polished taper-slip	1,278	20	7.3 (1.0 to 54.6)	1,418	22	7.5 (1.0 to 56.1)	2,464	34	2.4 (1.2 to 5.0)	3,696	56	3.3 (1.4 to 7.8)	4,541	73	30.0 (4.1 to 216)	4,058	61	1.7 (0.9 to 3.2)	2946	33	8.4 (2.0 to 35.6)	1,979	15	3.5 (0.8 to 15.2)
Uncemented collarless	6,295	42	6.1 (0.8 to 46.2)	3,400	25	4.8 (0.6 to 36.1)	3,220	39	2.4 (1.2 to 4.9)	2,536	55	4.4 (1.9 to 10.3)	1,674	32	29.0 (3.9 to 213)	1,078	27	2.5 (1.2 to 5.1)	643	11	9.2 (1.9 to 45.0)	279	5	9.8 (1.7 to 55.6)
Uncemented collared	5,820	8	1.6 (0.2 to 13.0)	3,129	10	3.3 (0.4 to 26.4)	3,715	11	1	3,693	18	1.5 (0.6 to 3.7)	2,393	14	12.2 (1.6 to 92.9)	1,182	11	1	578	6	5.3 (1.0 to 28.1)	342	2	2.8 (0.4 to 21.1)
	13,770	71		8.442	58		10.314	84		11.484	135		10.772	120		8.202	99		5.516	52		3430	24	
Females																								
Cemented composite beam	652	2	1	1,078	3	1	2,118	5	1	4,046	8	1	5,319	19	1	4,291	13	1	3002	1	1	2,107	5	1
Cemented polished taper-slip	1,962	18	3.0 (0.7 to 13.1)	2,718	17	1.8 (0.5 to 6.1)	5,277	29	1.9 (0.7 to 5.0)	8,546	65	3.2 (1.5 to 6.7)	11,131	81	1.8 (1.1 to 2.9)	9,991	71	2.2 (1.2 to 3.9)	7509	46	16.3 (2.2 to 119)	4,734	20	1.9 (0.7 to 5.2)
Uncemented collarless	8,160	49	2.5 (0.6 to 11.0)	5,039	57	3.7 (1.2 to 12.1)	5,056	79	5.7 (2.8 to 14.1)	4,145	105	9.1 (4.4 to 18.9)	2,773	83	5.7 (3.4 to 9.5)	1,958	48	6.2 (3.3 to 11.7)	1280	16	28.1 (3.7 to 215)	695	9	5.9 (1.8 to 19.2)
Uncemented collared	7,158	15	1.1 (0.2 to 5.1)	4,551	12	1.5 (0.4 to 5.6)	5,471	25	2.3 (0.9 to 6.1)	5,049	29	2.9 (1.3 to 6.4)	2,722	27	2.1 (1.1 to 3.8)	1,717	22	3.1 (1.5 to 6.2)	1148	14	23.4 (3.0 to 182)	708	9	5.8 (1.8 to 18.6)
	17,932	84		13.386	89		17.922	138		21.786	207		21.945	210		17.957	154		12939	77		8.244	43	
Femoral component reoperated for any cause*																								
Males	**Components, n**	**Femur reoperated for any cause, n*,**	**aHRR (95% CI)**	**Components, n**	**Femur reoperated for any cause, n*,**	**aHRR (95% CI)**	**Components, n**	**Femur reoperated for any cause, n*,**	**aHRR (95% CI)**	**Components, n**	**Femur reoperated for any cause, n*,**	**aHRR (95% CI)**	**Components, n**	**Femur reoperated for any cause, n*,**	**aHRR (95% CI)**	**Components, n**	**Femur reoperated for any cause, n*,**	**aHRR (95% CI)**	**Components, n**	**Femur reoperated for any cause, n*,**	**aHRR (95% CI)**	**Components, n**	**Femur reoperated for any cause, n*,**	**aHRR (95% CI)**
Cemented composite beam	377	4	1	495	10	1	915	16	1	1,559	15	1	2,164	12	1	1,884	4	1	1,349	4	1	830	2	1
Cemented polished taper-slip	1,278	44	2.7 (1.0 to 7.6)	1,418	53	1.6 (0.8 to 3.1)	2,464	57	1.1 (0.6 to 1.9)	3,696	90	2.1 (1.2 to 3.7)	4,541	104	3.6 (2.0 to 6.6)	4,058	73	7.6 (2.8 to 20.8)	2,946	37	5.1 (1.8 to 14.6)	1,979	15	3.4 (0.8 to 14.9)
Uncemented collarless	6,295	154	2.5 (0.9 to 6.8)	3,400	83	1.1 (0.6 to 2.2)	3,220	88	1.3 (0.7 to 2.2)	2,536	90	2.8 (1.6 to 4.8)	1,674	47	3.3 (1.8 to 6.3)	1,078	41	13.3 (4.7 to 37.6)	643	12	6.6 (2.0 to 21.1)	279	7	13.3 (2.5 to 70.1)
Uncemented collared	5,820	83	2.3 (0.8 to 6.3)	3,129	44	1.1 (0.5 to 2.1)	3,715	36	0.7 (0.4 to 1.4)	3,693	39	1.2 (0.7 to 2.2)	2,393	32	2.1 (1.1 to 4.1)	1,182	17	5.4 (1.8 to 16.0)	578	6	3.3 (1.0 to 11.9)	342	2	2.8 (0.4 to 20.8)
	13,770	285		8.442	190		10.314	197		11.484	234		10.772	195		8.202	135		5.516	59		3430	26	
Females																								
Cemented composite beam	652	7	1	1,078	13	1	2,118	24	1	4,046	20	1	5,319	29	1	4,291	16	1	3,002	2	1	2,107	5	1
Cemented polished taper-slip	1,962	65	2.4 (1.1 to 5.4)	2,718	60	1.4 (0.8 to 2.6)	5,277	76	1.0 (0.7 to 1.7)	8,546	114	2.3 (1.4 to 3.7)	11,131	125	1.8 (1.2 to 2.8)	9,991	95	2.4 (1.4 to 4.1)	7,509	57	11.6 (2.8 to 47.6)	4,734	23	2.3 (0.9 to 6.1)
Uncemented collarless	8,160	151	1.4 (0.6 to 2.9)	5,039	101	1.4 (0.8 to 2.5)	5,056	110	1.5 (1.0 to 2.4)	4,145	125	4.4 (2.7 to 7.0)	2,773	96	4.4 (2.9 to 6.8)	1,958	56	6.2 (3.5 to 11.0)	1,280	23	21.2 (4.9 to 91.2)	695	11	8.0 (2.6 to 25.0)
Uncemented collared	7,158	63	0.9 (0.4 to 2.1)	4,551	40	1.1 (0.6 to 2.1)	5,471	53	1.0 (0.6 to 1.6)	5,049	55	2.1 (1.2 to 3.5)	2,722	41	2.2 (1.3 to 3.5)	1,717	24	2.9 (1.5 to 5.5)	1,148	15	15.5 (3.5 to 68.2)	708	9	6.6 (2.1 to 21.2)
	17,932	286		13.386	214		17.922	263		21.786	314		21.945	291		17.957	191		12.939	97		8.244	48	

Males and females, in five year groups (from 60 to 90 years of age). Adjusted for ASA grade, indication for primary arthroplasty, and year of primary operation.
*Including osteosyntheses.
†N/A: not applicable
aHRR, adjusted hazard rate ratio; ASA, American Society of Anesthesiologists; N/A, not applicable.

Table iii. Risk of reoperation for periprosthetic femoral fracture (PFF), and risk of femoral reoperation for any indication, stratified by sex and age group, for the designs of the femoral component and methods of fixation groups.

Variable	Arthroplasties, n	Reoperated for PFF		Reoperated for any cause*	
		Total, n	aHRR (95% CI)†	Total, n	aHRR (95% CI)†
Males					
Age < 65 yrs					
Cemented composite beam	872	2	Reference	14	Reference
Cemented polished taper-slip	2,696	42	7.6 (1.8 to 31.5)	97	1.9 (1.1 to 3.3)
Uncemented collarless	9,695	67	5.6 (1.4 to 23.5)	237	1.5 (0.9 to 2.7)
Uncemented collared	8,949	18	2.3 (0.5 to 10.1)	127	1.4 (0.8 to 2.5)
Age 65 to 74 yrs					
Cemented composite beam	2,474	6	Reference	31	Reference
Cemented polished taper-slip	6,160	90	5.1 (2.2 to 11.6)	147	1.6 (1.1 to 2.3)
Uncemented collarless	5,756	94	6.1 (2.6 to 14.0)	178	2.0 (1.3 to 2.9)
Uncemented collared	7,408	29	2.2 (0.9 to 5.3)	75	1.0 (0.6 to 1.5)
Age 75 to 84 yrs					
Cemented composite beam	4,048	1	Reference	16	Reference
Cemented polished taper-slip	8,599	134	54.1 (7.6 to 387)	177	4.6 (2.8 to 7.7)
Uncemented collarless	2,752	59	63.5 (8.8 to 460)	88	5.6 (3.3 to 9.6)
Uncemented collared	3,575	25	26.1 (3.5 to 193)	49	2.9 (1.7 to 5.5)
Age ≥ 85 yrs					
Cemented composite beam	2,179	4	Reference	6	Reference
Cemented polished taper-slip	4,925	48	6.3 (2.2 to 17.4)	52	4.5 (1.9 to 10.5)
Uncemented collarless	922	16	11.2 (3.6 to 34.8)	19	5.6 (3.3 to 9.6)
Uncemented collared	920	8	5.1 (1.5 to 17.4)	8	2.9 (1.7 to 5.2)
Females					
Age < 65 yrs					
Cemented composite beam	1730	5	Reference	20	Reference
Cemented polished taper-slip	4680	35	2.2 (0.9 to 5.7)	125	1.8 (1.1 to 2.9)
Uncemented collarless	13,199	106	3.2 (1.3 to 7.9)	252	1.3 (0.8 to 2.1)
Uncemented collared	11,709	27	1.4 (0.5 to 3.6)	103	1.0 (0.6 to 1.6)
Age 65 to 74 yrs					
Cemented composite beam	6,164	13	Reference	44	Reference
Cemented polished taper-slip	13,823	94	2.8 (1.5 to 5.0)	190	1.6 (1.2 to 2.3)
Uncemented collarless	9,201	184	8.0 (4.5 to 14.1)	235	2.7 (2.0 to 3.8)
Uncemented collared	10,520	54	2.9 (1.6 to 5.2)	108	1.5 (1.1 to 2.2)
Age 75 to 84 yrs					
Cemented composite beam	9,610	32	Reference	45	Reference
Cemented polished taper-slip	21,122	152	1.9 (1.3 to 2.8)	190	2.1 (1.5 to 5.8)
Uncemented collarless	4,731	131	6.0 (4.0 to 8.0)	235	5.0 (3.6 to 7.1)
Uncemented collared	4,439	49	2.5 (1.6 to 3.9)	108	2.4 (1.6 to 3.5)
Age ≥ 85 yrs					
Cemented composite beam	5,109	6	Reference	7	Reference
Cemented polished taper-slip	12,243	66	4.7 (2.0 to 11.0)	80	5.0 (2.2 to 10.8)
Uncemented collarless	1,975	25	9.2 (3.7 to 23.0)	34	11.1 (4.8 to 25.5)
Uncemented collared	1,856	23	8.8 (3.5 to 22.1)	24	8.4 (3.6 to 19.8)

*Including osteosyntheses.

†Adjusted for American Society of Anesthesiologists grade, indication for primary arthroplasty, and year of primary surgery.

aHRR, adjusted hazard rate ratio.

Table VIII. Risk of reoperation for periprosthetic femoral fracture (PFF), and risk of all cause femoral reoperation including osteosynthesis, stratified by sex and age group, for the femoral prosthesis brands.

Age	Males					Females				
	Arthroplasties, n	Reoperated for PFF		Reoperated for any cause*		Arthroplasties, n	Reoperated for PFF		Reoperated for any cause*	
		Total, n	aHRR (95% CI)†	Total, n	aHRR (95% CI)†		Total, n	aHRR (95% CI)†	Total, n	aHRR (95% CI)†
< 65 yrs										
Lubinus SPII	872	2	1	14	1	1,730	5	1	20	1
Exeter	2,334	35	7.3 (1.7 to 30.6)	88	1.8 (1.1 to 3.3)	3,850	26	2.0 (0.7 to 5.1)	106	1.7 (1.1 to 2.8)
C-Stem	191	2	4.6 (0.6 to 32.9)	3	1.3 (0.4 to 4.7)	484	3	2.6 (0.6 to 10.9)	8	2.1 (0.9 to 4.8)
MS-30	171	5	13.3 (2.6 to 68.7)	6	2.4 (0.9 to 6.2)	346	6	6.5 (2.0 to 21.3)	11	2.9 (1.4 to 6.0)
Corail collarless	7,652	58	5.4 (1.3 to 22.8)	208	1.5 (0.9 to 2.7)	11,128	103	3.4 (1.4 to 8.6)	235	1.4 (0.9 to 2.2)
POLARSTEM	1,340	7	9.2 (1.9 to 45.6)	19	2.2 (1.1 to 4.6)	1,225	2	1.1 (0.2 to 6.0)	5	0.6 (0.2 to 1.7)
Accolade 2	701	2	3.0 (0.4 to 22.8)	10	1.3 (0.6 to 3.0)	846	1	0.6 (0.1 to 5.5)	12	1.4 (0.7 to 2.9)
Corail collared	8,949	18	2.3 (0.5 to 10.1)	127	1.4 (0.8 to 2.5)	11,709	27	1.3 (0.5 to 3.5)	103	1.0 (0.6 to 1.6)
65 to 74 yrs										
Lubinus SPII	2,474	6	1	31	1	6,164	13	1	44	1
Exeter	4,973	77	5.0 (2.2 to 11.5)	128	1.6 (1.1 to 2.4)	10,446	76	2.7 (1.5 to 4.9)	159	1.6 (1.2 to 2.3)
C-Stem	738	11	8.2 (3.0 to 22.4)	13	2.0 (1.0 to 3.9)	2,258	14	3.9 (1.8 to 8.5)	22	1.9 (1.1 to 3.2)
MS-30	449	2	2.0 (0.4 to 9.8)	6	1.1 (0.5 to 2.7)	1,119	4	1.8 (0.6 to 5.7)	9	1.2 (0.6 to 2.5)
Corail collarless	4,578	87	6.4 (2.8 to 14.7)	163	2.1 (1.4 to 3.0)	7,723	172	8.3 (4.7 to 14.7)	217	2.8 (2.0 to 3.9)
POLARSTEM	706	3	3.1 (0.8 to 12.3)	8	1.4 (0.6 to 3.0)	871	4	3.1 (1.0 to 9.4)	5	1.1 (0.4 to 2.7)
Accolade 2	472	4	4.4 (1.2 to 15.7)	7	1.3 (0.6 to 3.0)	607	8	8.4 (3.4 to 20.3)	13	3.4 (1.8 to 6.3)
Corail collared	7,408	29	2.2 (0.9 to 5.3)	75	1.0 (0.6 to 1.5)	10,520	54	2.8 (1.5 to 5.2)	108	1.5 (1.1 to 2.2)
75 to 84 yrs										
Lubinus SPII	4,048	1	1	16	1	9,610	32	1	45	1
Exeter	6,333	100	48.8 (6.8 to 350)	139	4.4 (2.6 to 7.5)	14,865	112	1.8 (1.2 to 2.7)	159	1.9 (1.4 to 2.6)
C-Stem	1,513	20	70.9 (9.5 to 531)	22	5.0 (2.6 to 9.7)	4,005	26	2.5 (1.5 to 4.2)	40	2.6 (1.7 to 4.1)
MS-30	753	14	82.5 (10.8 to 628)	16	6.1 (3.0 to 12.2)	2,252	14	2.2 (1.2 to 4.2)	21	2.3 (1.3 to 3.8)
Corail collarless	2,156	53	63.7 (8.8 to 462)	78	5.7 (3.3 to 9.9)	4,171	113	5.5 (3.7 to 8.2)	132	4.7 (3.3 to 6.6)
POLARSTEM	439	4	46.7 (5.2 to 419)	6	4.0 (1.6 to 10.3)	420	11	7.2 (3.6 to 14.3)	11	5.1 (2.6 to 9.8)
Accolade 2	157	2	46.9 (4.2 to 519)	4	5.2 (1.7 to 15.7)	140	7	11.1 (4.9 to 25.4)	9	10.3 (5.0 to 21.2)
Corail collared	3,575	25	25.8 (3.5 to 191)	49	2.9 (1.7 to 5.2)	4,439	49	2.4 (1.5 to 3.8)	65	2.4 (1.6 to 3.5)
> 85 yrs										
Lubinus SPII	2,179	4	1	6	1	5,109	6	1	7	1
Exeter	3,478	30	5.4 (1.9 to 15.5)	33	3.9 (1.6 to 9.4)	8,957	49	4.7 (2.0 to 11.1)	56	4.6 (2.1 to 10.2)
C-Stem	960	15	10.0 (3.3 to 30.3)	15	6.8 (2.6 to 17.8)	2,150	10	4.5 (1.6 to 12.5)	17	6.5 (2.7 to 15.7)
MS-30	487	3	3.5 (0.8 to 15.6)	4	3.2 (0.9 to 11.4)	1,136	7	5.5 (1.8 to 16.4)	7	4.7 (1.6 to 13.4)
Corail collarless	787	10	7.7 (2.3 to 25.9)	12	5.6 (2.0 to 15.8)	1,787	22	9.0 (3.6 to 23.0)	30	10.5 (4.5 to 24.6)
POLARSTEM	101	6	32.6 (9.1 to 116)	7	23.9 (8.0 to 71.6)	166	3	12.3 (3.0 to 49.6)	4	14.2 (4.1 to 48.8)

Age	Males					Females				
	Arthroplasties, n	Reoperated for PFF		Reoperated for any cause*		Arthroplasties, n	Reoperated for PFF		Reoperated for any cause*	
		Total, n	aHRR (95% CI)†	Total, n	aHRR (95% CI)†		Total, n	aHRR (95% CI)†	Total, n	aHRR (95% CI)†
Accolade 2	34	0	N/A‡	0	N/A‡	22	0	N/A‡	0	N/A‡
Corail collared	920	8	4.7 (1.4 to 16.0)	8	3.0 (1.0 to 8.7)	1,856	23	8.8 (3.5 to 22.0)	24	8.1 (3.4 to 19.2)

*Including osteosyntheses.†Cox regression analysis, adjusted for American Society of Anesthesiologists grade, indication for primary arthroplasty, and year of primary surgery.‡N/A: not applicable

aHRR, adjusted hazard rate ratio; N/A, not applicable.

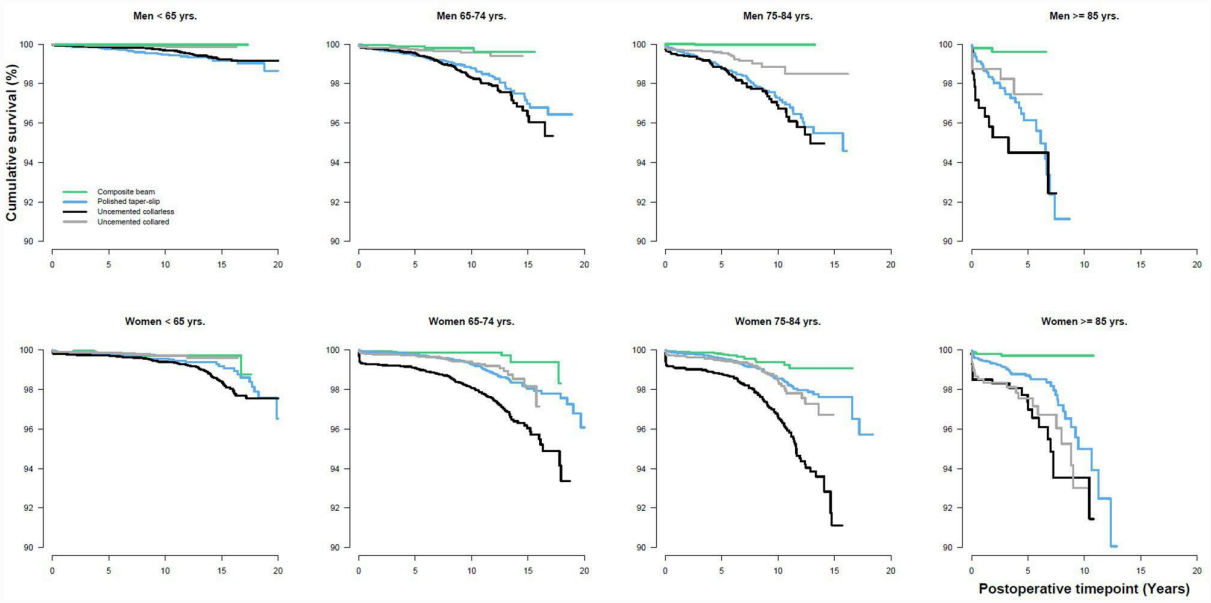


Figure a. Cox survival curves for reoperation for periprosthetic femoral fracture for the design of femoral component and method of fixation groups, stratified by sex and age groups. Adjusted for American Society of Anesthesiologists grade, indication for primary arthroplasty, and year of primary surgery.

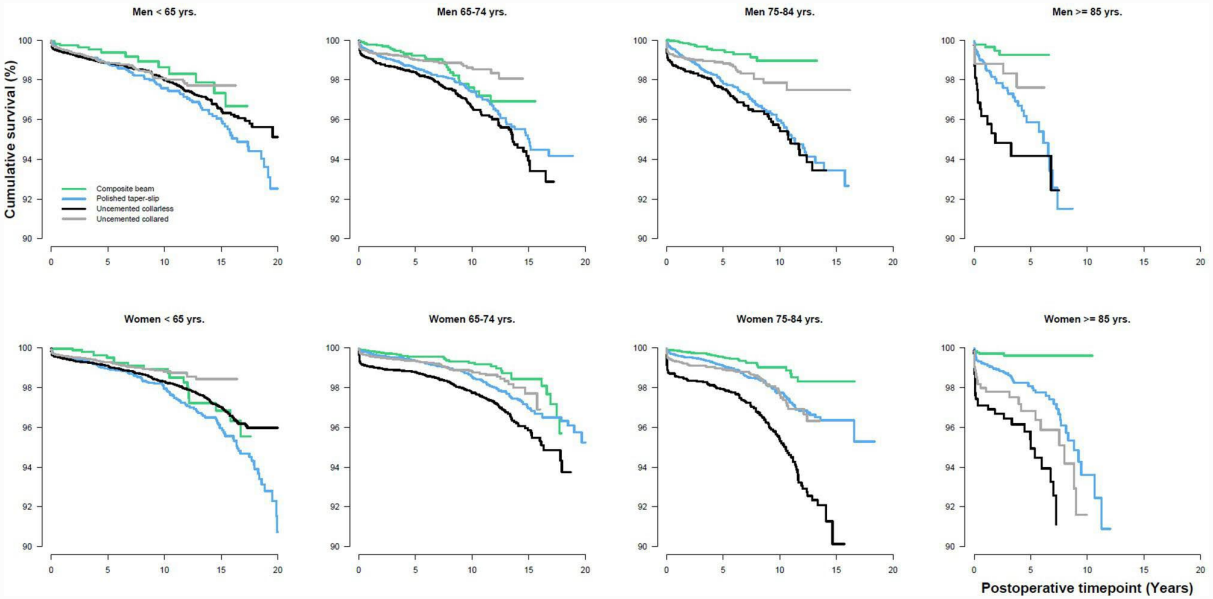


Figure b. Cox survival curves for all cause femoral reoperations including osteosynthesis for the design and method of fixation groups, stratified by sex and age groups. Adjusted for American Society of Anesthesiologists grade, indication for primary arthroplasty, and year of primary surgery.

Table IX. Risk of reoperation for periprosthetic femoral fracture (PFF) for the design and method of fixation groups for robust and frail males and females.

Variable	Robust patients*			Frail patients†		
	Arthroplasties, n	Reoperated, n	aHRR (95% CI)‡	Arthroplasties, n	Reoperated, n	aHRR (95% CI)‡
Males						
Total	24,991	165		11,176	90	
Cemented composite beam	1,129	2	Reference	2,709	2	Reference
Cemented polished taper-slip	3,601	62	9.8 (2.4 to 40.0)	6,600	59	12.0 (2.9 to 49.2)
Uncemented collarless	9,627	79	7.1 (1.7 to 29.1)	960	21	33.8 (7.7 to 148.9)
Uncemented collared	10,634	22	2.6 (0.6 to 11.3)	907	8	13.4 (2.8 to 64.6)
Females						
Total	44,137	309		20,326	88	
Cemented composite beam	4,000	8	Reference	4,686	7	Reference
Cemented polished taper-slip	9,263	74	3.4 (1.7 to 7.2)	12,277	48	2.5 (1.1 to 5.5)
Uncemented collarless	14,945	183	7.1 (3.5 to 14.4)	1,736	19	7.4 (3.0 to 18.7)
Uncemented collared	15,929	44	2.4 (1.1 to 5.1)	1,627	14	5.5 (2.1 to 14.1)

Notes: *Aged under 75 years, and ASA I or II, and arthroplasty due to osteoarthritis.†Aged over 75 years, and ASA III or IV, and arthroplasty due to acute hip fracture.‡Adjusted for year of primary surgery.

Abbreviations: aHRR, adjusted hazard rate ratio; ASA, American Society of Anesthesiologists.