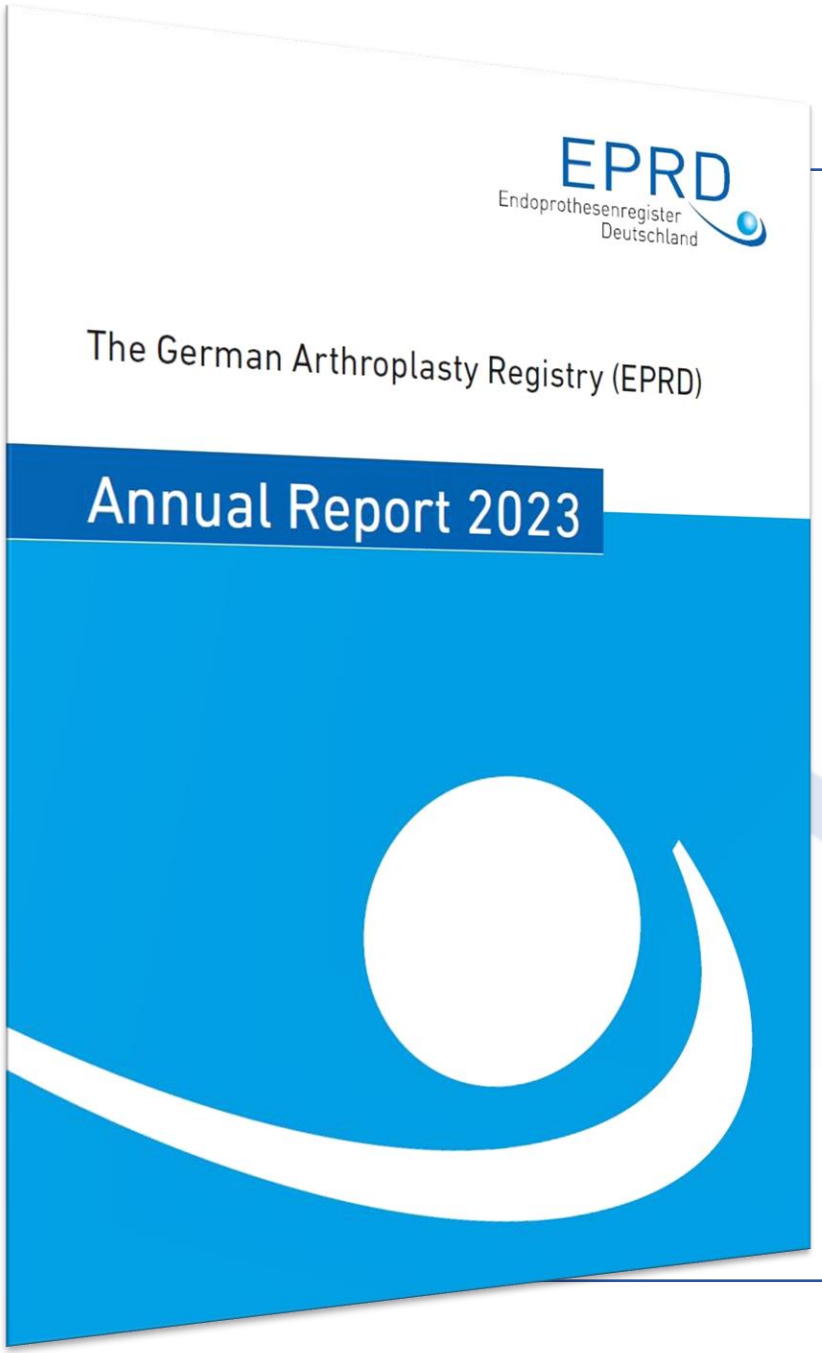

EPRD
Endoprothesenregister
Deutschland

EPRD Annual Report 2023

Authors:

Alexander Grimberg, Jörg Lützner, Oliver Melsheimer,
Michael Morlock, Arnd Steinbrück

Registry development

Registry development (I)

What is new in the 2023 report:

- 10 years of data collection in the EPRD: development of selected aspects presented
- Patient mortality following arthroplasty described in detail

Future developments:

- Recording of Patient Reported Outcome Measures (PROMs) from 2024: PROM questionnaire trial period started in the spring of 2023
- Regular operation of the hip and knee arthroplasty database of the national German Implant Registry (IRD) will not start until 2025

Registry development (II)

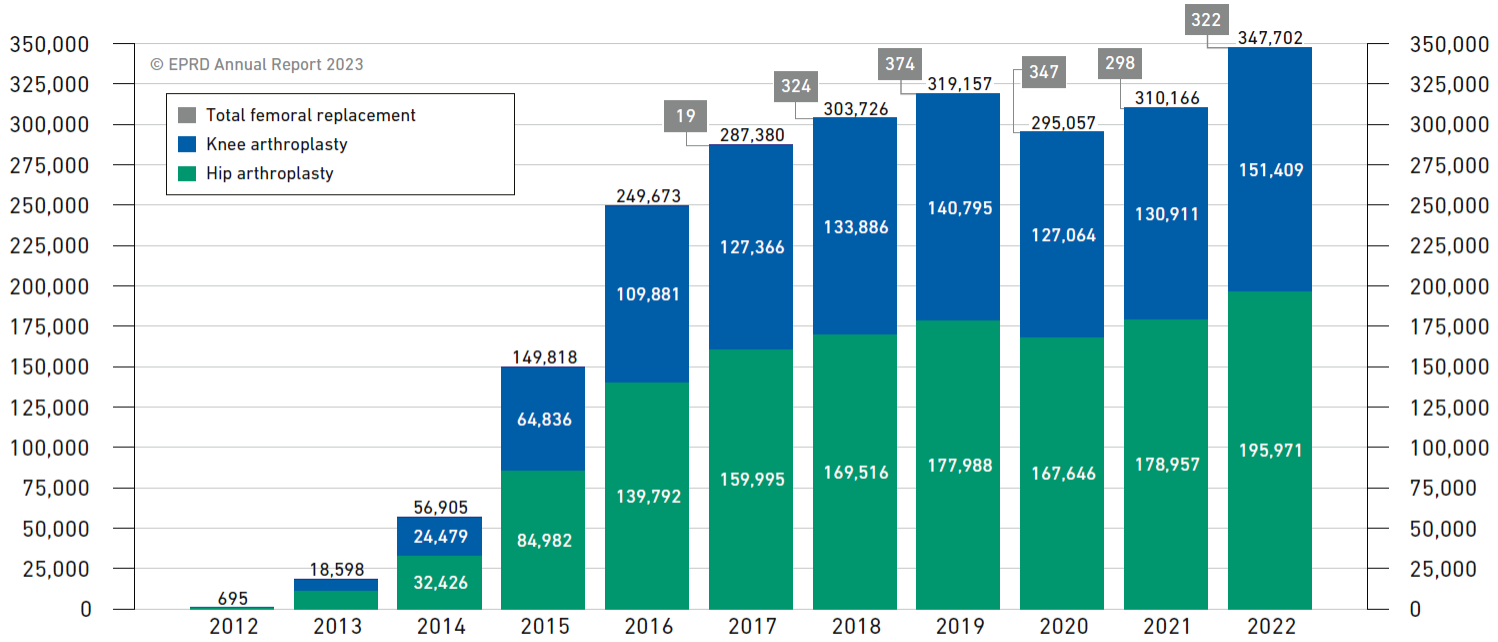

Figure 1: Annual procedure volume by operation date. The total number of documented procedures is shown in black above the respective bar.

- Up to the end of 2022 data on more than 2 million hip and knee arthroplasty procedures collected
- 347,702 operations added to the EPRD in 2022 → almost 9 % more than the previous maximum of 2019

Registry development (III)

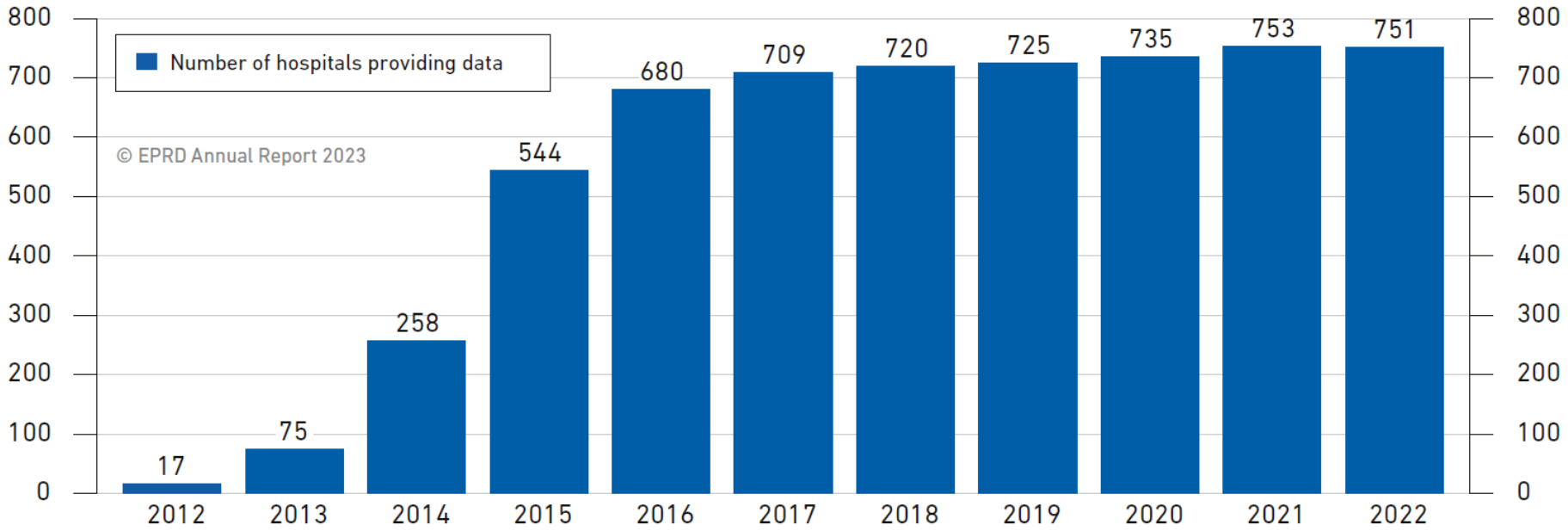

Figure 2: Number of hospitals submitting data each year. A hospital is considered a "data provider", if it submitted at least one surgical document to the EPRD during the calendar year.

- Commitment still high: but number of hospitals providing data not above previous year's value for the first time

Registry development (IV)

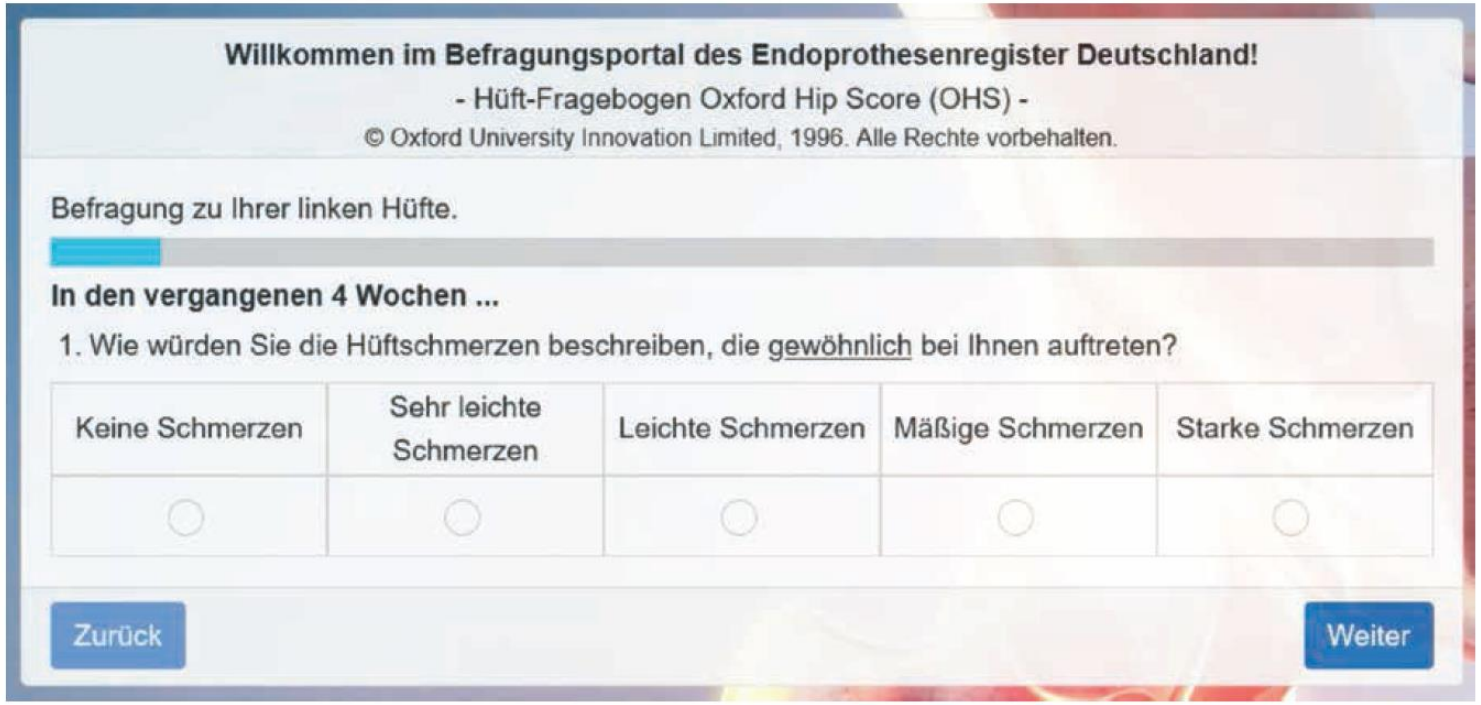

Illustration 1: Extract from the online PROM questionnaire of the Oxford Hip Score

- In the spring of 2023 the EPRD started its PROM questionnaire trial period in pilot hospitals

The 2022 operating year

Primary hip arthroplasty (I)

In brief

- Since 2014, the use of insert components made from highly cross-linked polyethylene (hXLPE) has risen by more than 28 %.
- The percentage of short-stem femoral components has roughly doubled to 13.3 % since 2015.
- 36 mm heads and shorter head-neck lengths have become increasingly popular.

Primary hip arthroplasty (II)

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- Highly cross-linked polyethylene insert components are used more and more each year

	Proportion [%]	Age	m/f [%]	BMI	ASA
hXLPE	58.0	70	40 / 60	27.2	2.2
hXLPE + antioxidant	22.7	69	42 / 58	27.4	2.2
Ceramic	7.5	63	46 / 54	27.4	2.1
mXLPE	6.1	73	44 / 56	27.3	2.3
PE	5.5	78	32 / 68	26.3	2.4
Metal	0.1	59	95 / 5	28.4	1.9
mXLPE + antioxidant	<0.1	71	100 / 0	26.2	2.0
Unknown	0.1	79	26 / 74	26.7	2.3

Table 14: Acetabular bearing materials in primary total hip arthroplasties in 2022

Primary hip arthroplasty (III)

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- Short stems reached a new high of 13.3 %

	Proportion [%]	Age	m/f [%]	BMI	ASA
Femoral stem with modular head	84.7	71	40 / 60	27.2	2.2
Short stem	13.3	63	48 / 52	27.6	2.1
Femoral neck prosthesis	1.0	62	48 / 52	27.5	1.9
Revision or tumour stem	0.5	78	35 / 65	26.0	2.6
Modular stem	0.3	74	32 / 68	26.9	2.3
Surface replacement	0.1	59	95 / 5	28.4	1.9
Unknown	0.1	73	29 / 71	28.3	2.2

Table 8: Stem types in primary total hip arthroplasties in 2022

Primary hip arthroplasty (IV)

- The trend favouring larger head components is also increasing. Compared to the previous year, 36 mm heads increased by 2.7 % to 47.1 %.

	Proportion [%]	Age	m/f [%]	BMI	ASA
28 mm	4.7	73	17 / 83	26.3	2.3
32 mm	47.8	70	30 / 70	27.0	2.2
36 mm	47.1	69	55 / 45	27.5	2.2
Other diameters	0.5	71	32 / 68	26.0	2.2
Unknown	<0.1	75.5	0 / 100	23.6	2.0

Table 12: Head sizes in primary total hip arthroplasties in 2022

Primary hip arthroplasty (V)

- 10 years of data acquisition: From 2014 to 2022, the combined use of XS and S head-neck lengths increased by more than 8 %.

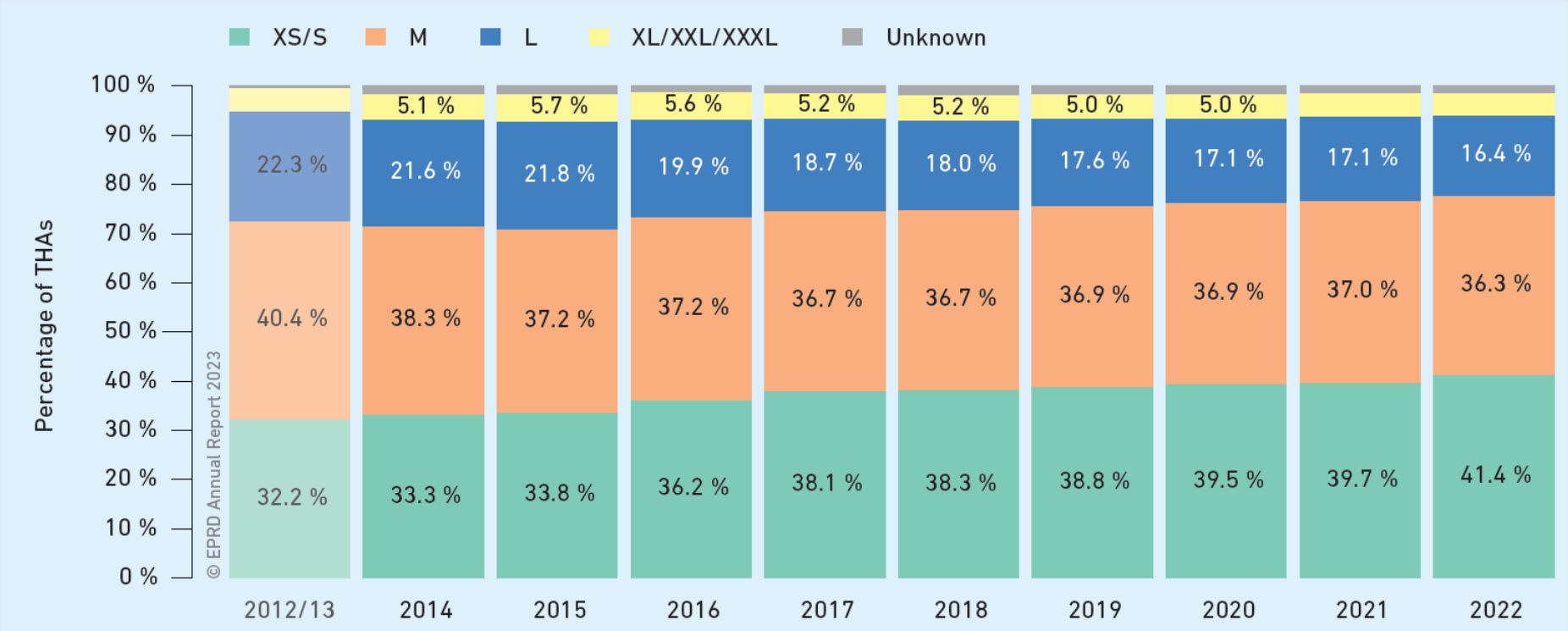

Figure 6: Trends in THA head-neck lengths over time

Primary hip arthroplasty (VI)

- 10 years of data acquisition: The proportion of acetabular inserts made of highly cross-linked polyethylene rose from 52.0 % to 80.7 % between 2014 and 2022.

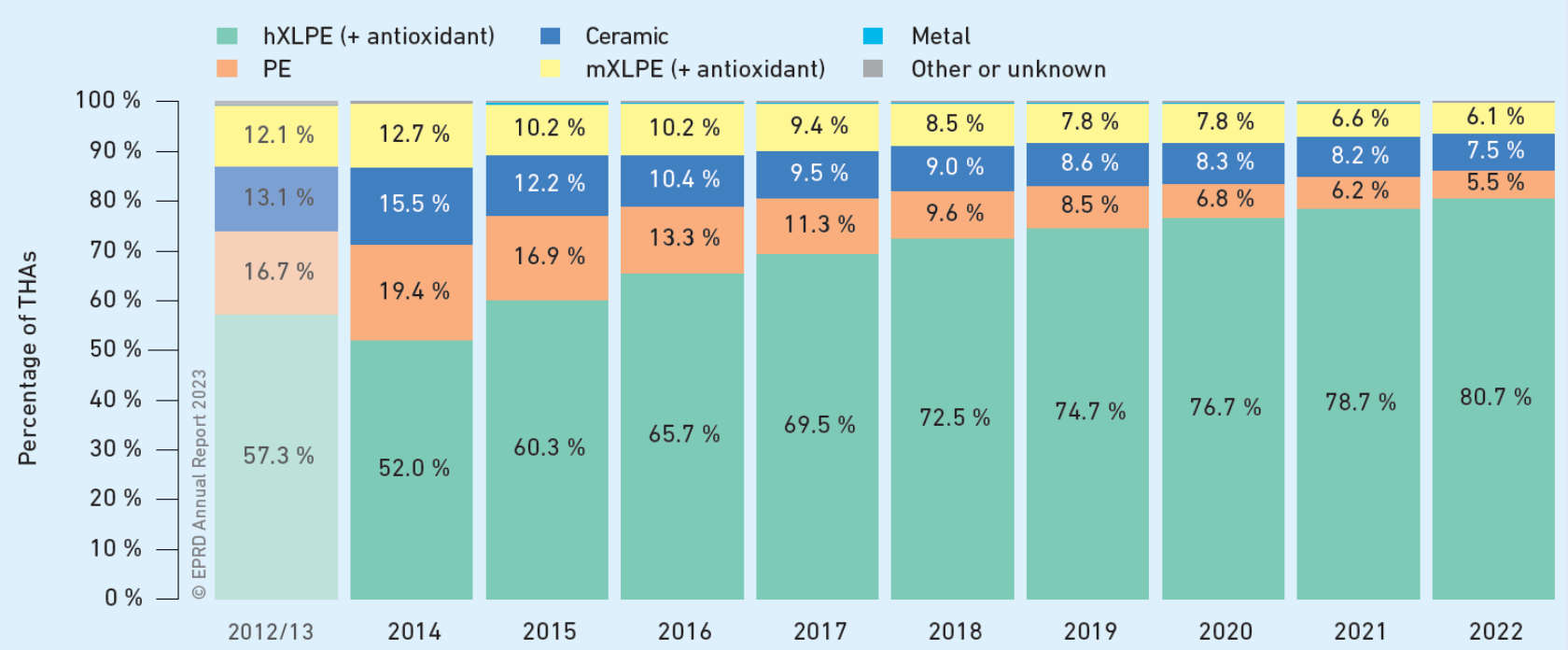

Figure 4: Trends in THA insert materials over time

Hip arthroplasty reoperations (I)

- In almost three quarters of reoperations, at least one component with a bony fixation was replaced

	Proportion [%]	Age	m/f [%]	BMI	ASA
Stem, head, cup, insert	26.2	73	48 / 52	27.5	2.6
Head, cup, insert	22.0	77	33 / 67	26.2	2.5
Head, insert	17.6	73	45 / 55	27.8	2.5
Stem, head	17.1	79	39 / 61	26.2	2.6
Head	7.7	79	40 / 60	26.5	2.7
Stem, head, insert	6.7	75	48 / 52	27.4	2.5
Cup, insert	1.4	77	35 / 65	26.6	2.5
Insert	0.7	73	40 / 60	26.3	2.5
Accessory parts only (e.g., screws)	0.5	78	36 / 64	27.0	2.7

Table 20: Components replaced or complemented[2] in hip reoperations in 2022

2 Only surgical documentation identifying all items in the product database are considered here. Explantations in two-stage revision procedures are counted as total replacements. In single-stage revisions the EPRD only registers the components implanted, but not those explanted. The explanted components are inferred based on the products documented at the time of the reoperation. If, for example, a new acetabular component is documented, it may be assumed that the existing acetabular component had to be explanted.

- Reasons for hip reoperations:
  - Loosening (22.7 %)
  - Infection (16.4 %)
  - Periprosthetic fracture(15.9 %)
  - Dislocation (13,6 %)

- Component failure is seldom mentioned as a reason for hip reoperations (2.1 %)

Hip arthroplasty reoperations (II)

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- 10 years of data acquisition: The reasons given for hip reoperations have changed considerably over the years.

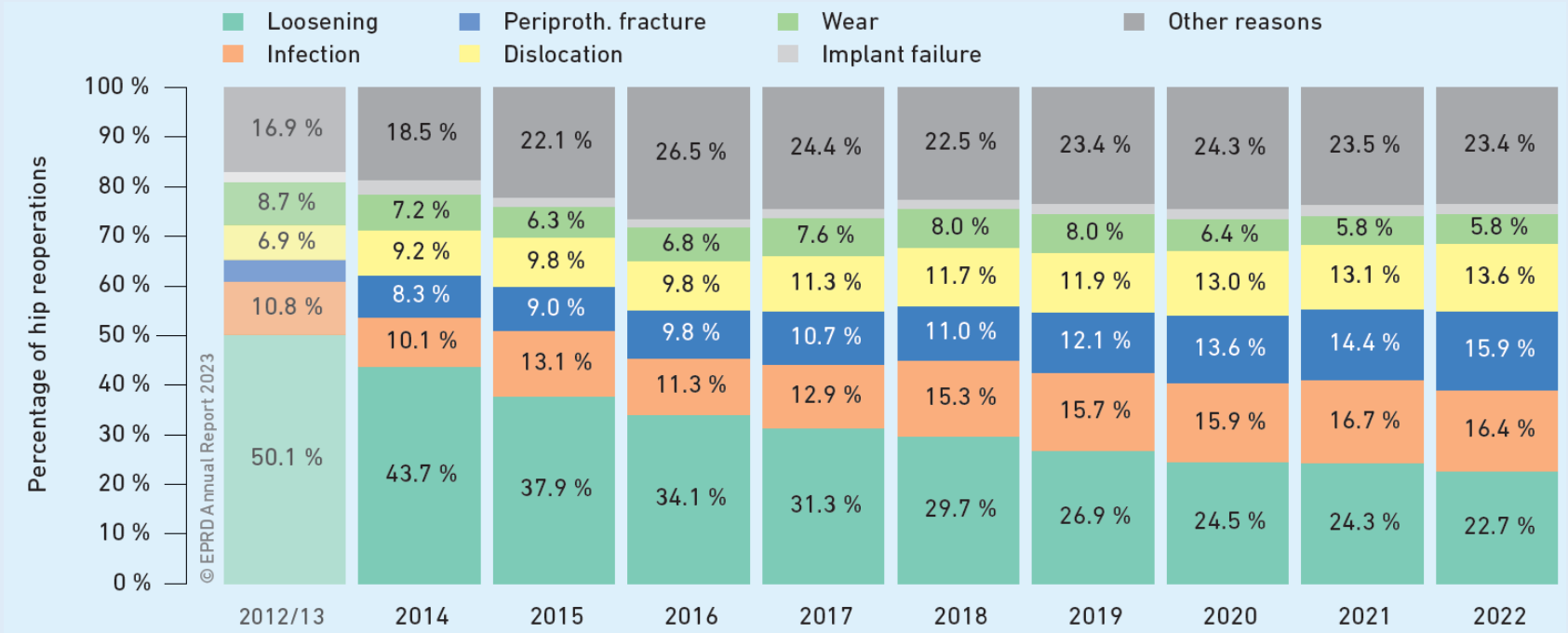

Figure 7: Trends in the reasons given for hip reoperations over time

Primary knee arthroplasty (I)

In brief

- More than 95 % of primary total knee arthroplasties (TKAs) and almost 89 % of unicondylar arthroplasties were fully cemented
- The use of mobile bearings in TKAs continued to decrease
- Since 2016, the proportion of posterior-stabilised (PS) systems has increased by 9 % to 25.6 %

Primary knee arthroplasty (II)

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- Continuing trend towards fully cemented systems

	Proportion [%]	Age	m/f [%]	BMI	ASA
Cemented implants	95.6	70	39 / 61	29.8	2.3
Hybrid implants	3.0	70	47 / 53	30.0	2.1
Uncemented implants	1.3	67	44 / 56	29.8	2.2
Reverse hybrid implants	<0.1	64.5	29 / 71	34.4	2.2
Unknown	0.1	72	36 / 64	25.9	2.6

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Table 25: Fixations in primary total knee arthroplasties in 2022

	Proportion [%]	Age	m/f [%]	BMI	ASA
Cemented implants	88.9	64	50 / 50	29.2	2.1
Uncemented implants	10.5	63	60 / 40	29.7	2.1
Hybrid implants	0.4	67	44 / 56	28.8	2.0
Unknown	0.1	60	47 / 53	30.0	1.9

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Table 26: Fixations in primary unicondylar knee arthroplasties in 2022

Primary knee arthroplasty (III)

- Continued decrease in the use of mobile bearings in TKA:
  At just 9.3 % it has more than halved from the 2016 level

	Proportion [%]	Age	m/f [%]	BMI	ASA
Fixed bearing	90.7	70	40 / 60	29.8	2.3
Mobile bearing	9.3	70	39 / 61	29.8	2.3

Table 27: Bearing mobility in primary total knee arthroplasties in 2022

- In unicondylar knee arthroplasty share of mobile bearings at 53.4 % in 2022 after a sustained decline, just above the previous year's value of 53.2 % for the first time

Primary knee arthroplasty (IV)

- 10 years of data acquisition: Cruciate-retaining (CR) systems are still the most widely used standard TKA system. However, their share has declined continuously since 2015 in favour of posterior-stabilised (PS) systems.

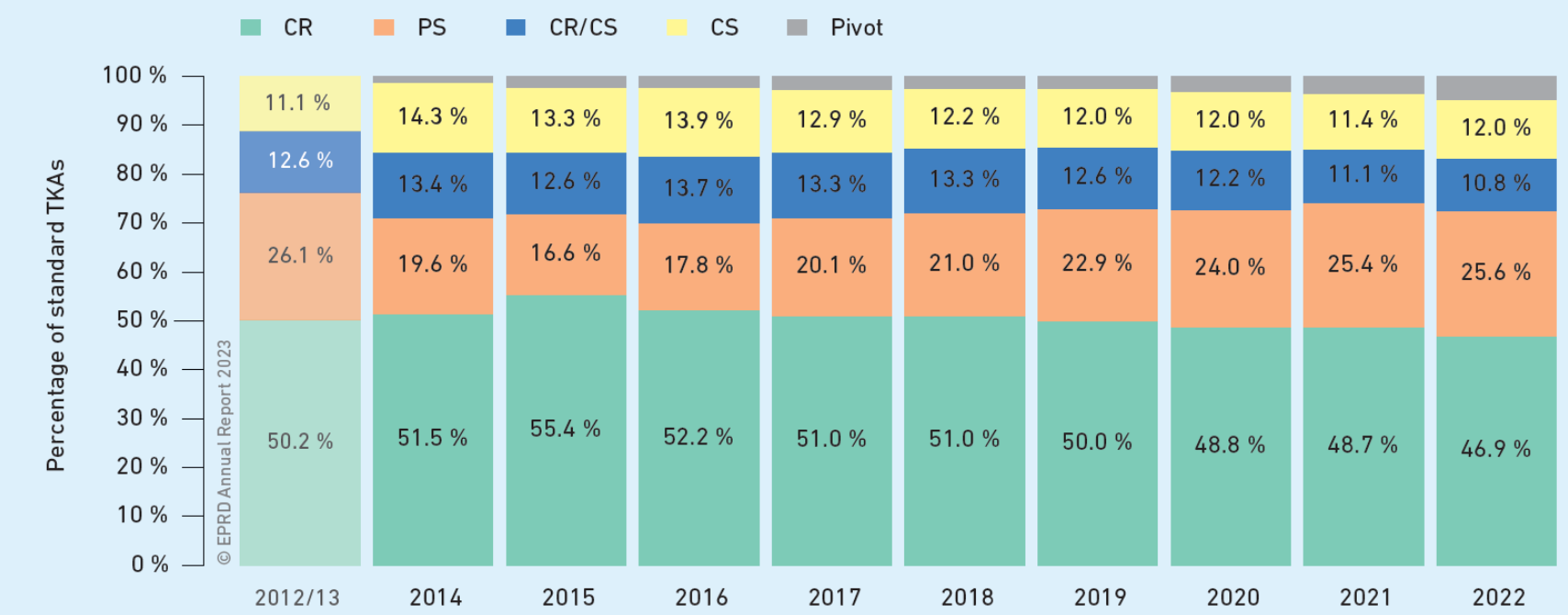

Figure 11: Trends in standard TKA knee systems over time

Primary knee arthroplasty (V)

- 10 years of data acquisition: Inserts made of highly cross-linked polyethylene reached a new high of 25 % in 2022.

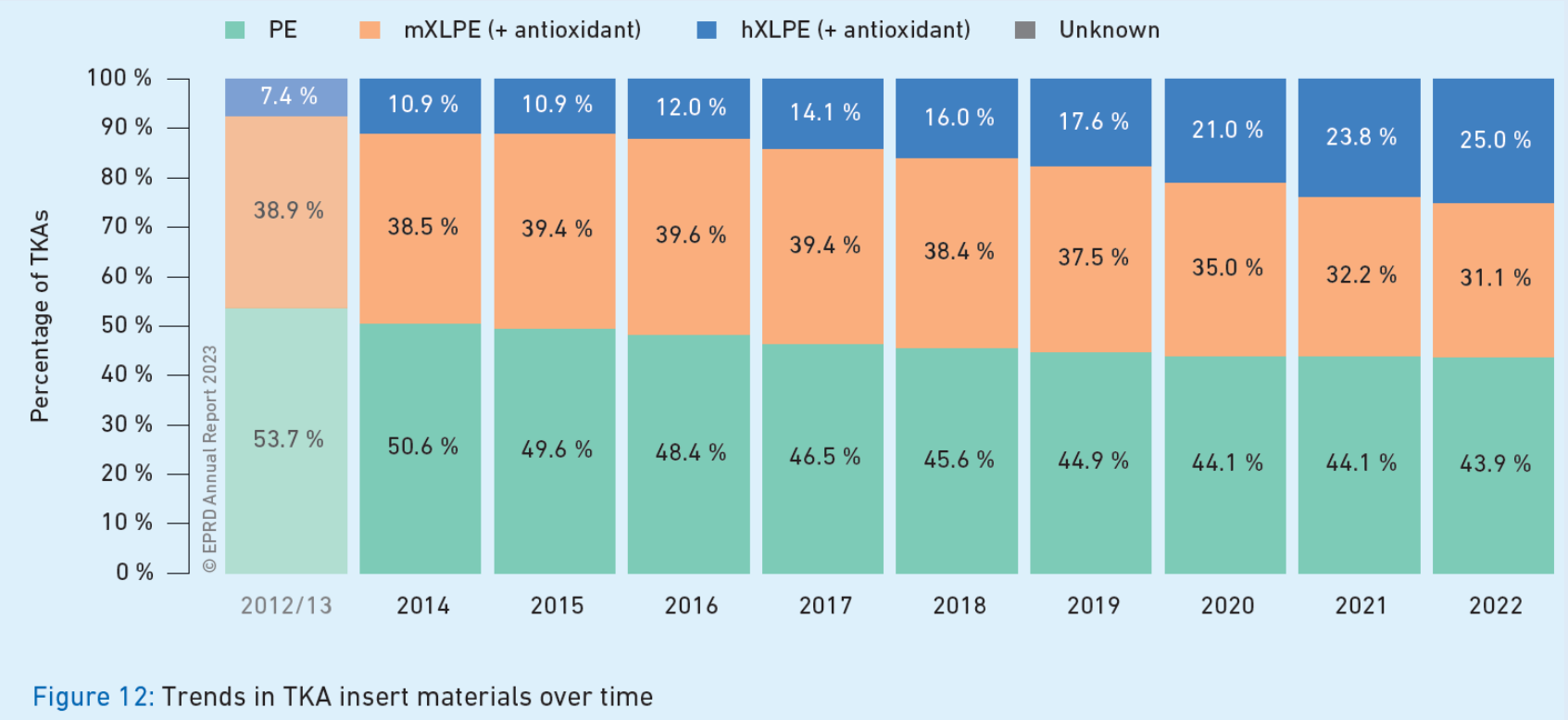

Figure 12: Trends in TKA insert materials over time

Knee arthroplasty reoperations (I)

	Proportion [%]	Age	m/f [%]	BMI	ASA
Infection	14.5	71	54 / 46	30.2	2.6
Loosening	22.8	70	42 / 58	30.4	2.4
Femoral component	4.4	72	44 / 56	29.8	2.4
Tibial tray	8.1	68	38 / 62	30.9	2.3
Patellar component	0.6	68	49 / 51	31.6	2.4
Several components	9.7	71	44 / 56	30.2	2.4
Osteolysis with fixed component	1.0	71	59 / 41	30.1	2.4
Femoral component	0.2	72	54 / 46	30.1	2.4
Tibial tray	0.2	73	61 / 39	30.4	2.4
Patellar component	0.1	71.5	50 / 50	32.4	2.2
Several components	0.4	70	62 / 38	29.8	2.3
Periprosthetic fracture	4.1	79	21 / 79	28.6	2.7
Ligament instability	8.4	67	32 / 68	30.1	2.4
Wear	5.6	71	41 / 59	30.5	2.4
Component failure	2.3	69	45 / 55	30.8	2.4
Prosthetic malalignment / Malrotation	1.4	68	34 / 66	29.4	2.3
Restricted mobility	5.2	66	39 / 61	30.5	2.3
Progression of arthrosis	6.9	69	39 / 61	29.8	2.3
Condition after removal	13.3	70	52 / 48	29.5	2.6
Other reasons	14.6	68	40 / 60	29.8	2.2

Table 37: Reasons for knee reoperations in 2022

- In more than half of reoperations, all prior arthroplasty components were exchanged – often with a switch to a more constrained system.
- Reasons for knee revisions:
  - Loosening (22.8 %)
  - Infection (14.5 %)
- Component failure is rare (2.3 %), wear (5.6 %).

Knee arthroplasty reoperations (II)

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- 10 years of data acquisition: Infection-related knee reoperations with bone fixation component replacements decreased - from over two thirds in 2014 to only half in 2022.

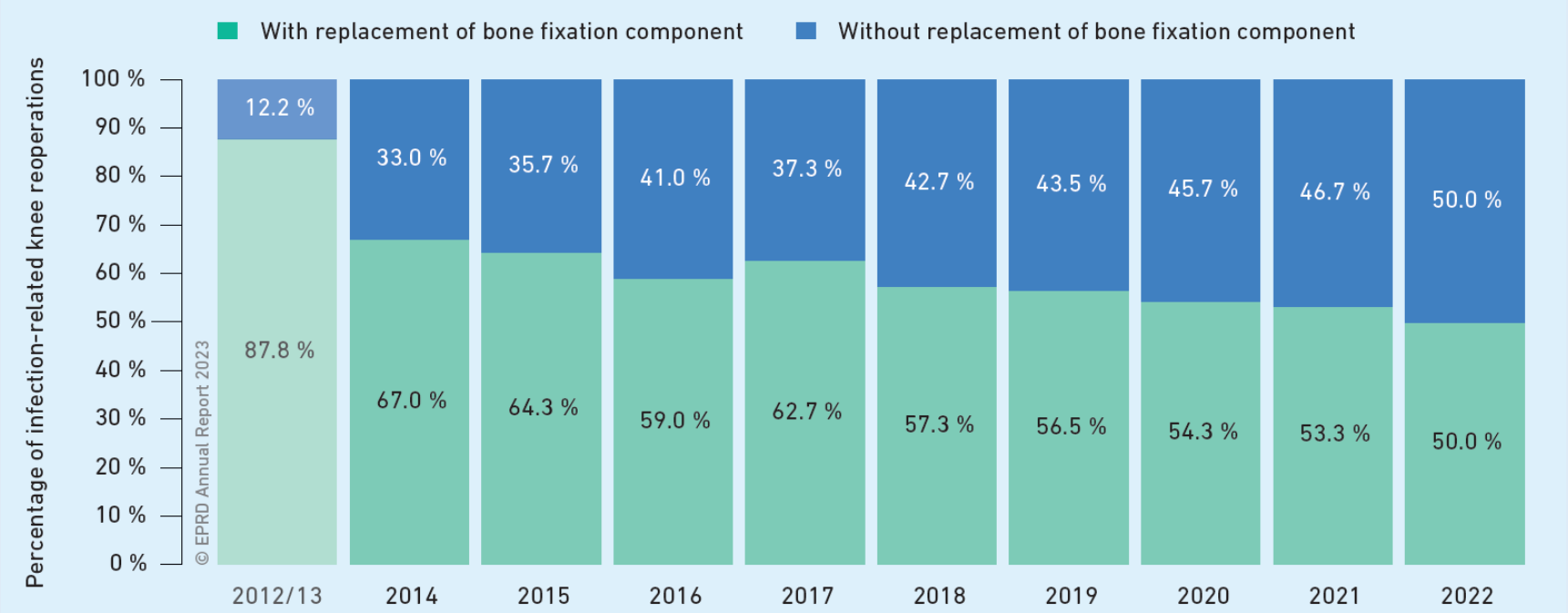


Figure 13: Trends in bone fixation component replacements for infection-related knee reoperations over time. Here, two-stage revisions are regarded as a single procedure.

Hip and knee arthroplasty survival

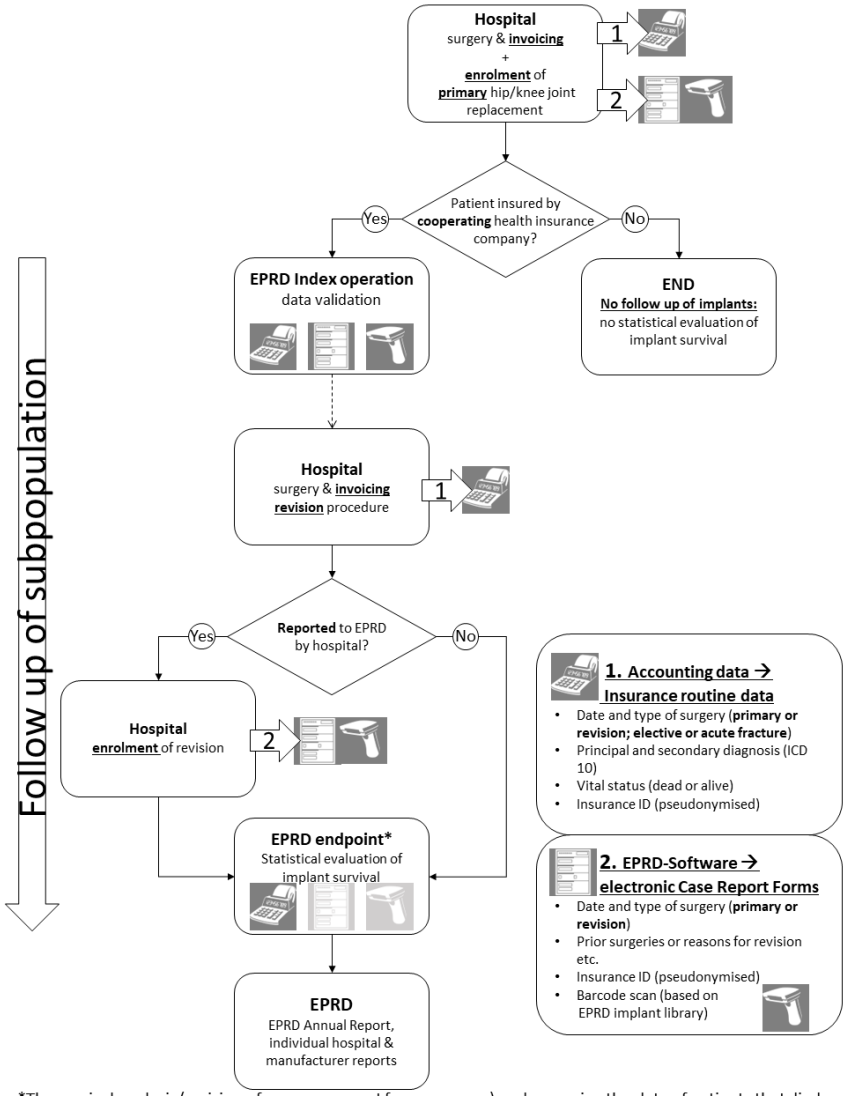
Study population follow-up (I)

Arthroplasty survival calculations:

Only data from patients insured with one of the regional health insurance providers (AOK) or one of the other statutory health insurance providers (Ersatzkassen) and with available billing data are included in the arthroplasty survival calculations.

Even though this means that only a part of the total number of data sets compiled in the EPRD is available for the arthroplasty survival analysis, an almost complete coverage of reoperations is guaranteed for this population.

This „Completeness of Revision“ is an essential quality feature of the EPRD.



*The survival analysis (revision of any component for any reason) and censoring the data of patients that died or suffered an amputation of the involved limb only requires (1) Accounting data -> insurance routine data.

Study population follow-up (II)

Arthroplasty survival analysis:

- Based on 960,000 primary procedures and 102,000 revision arthroplasties followed up.
- In addition to Revision probabilities, Reoperation probabilities are also examined.

Hip and knee arthroplasty survival

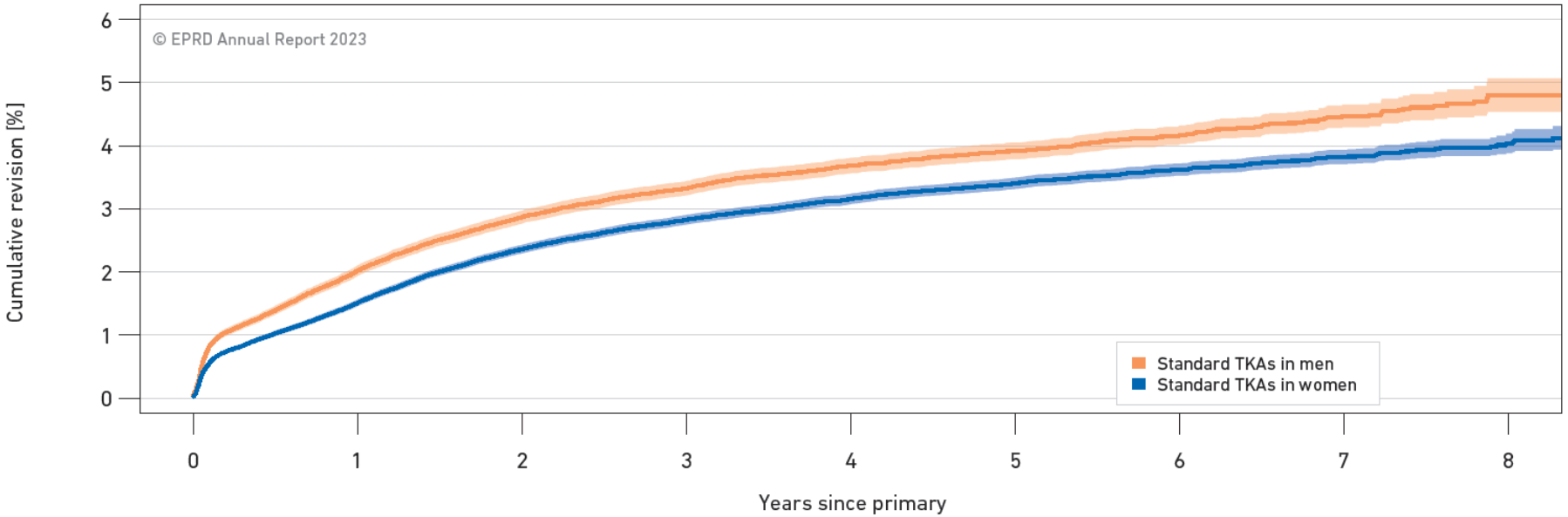
Endoprothesenregister Deutschland

<u>Important: Arthroplasty survival not only dependent on the implant used!</u>

- Patient-specific parameters such as age, sex, BMI and comorbidities have a significant impact on the probability of revision surgery
- Higher patient volumes per hospital tend to reduce the risk of revision arthroplasty
  - But, in individual cases, hospitals with high case volumes and poorer outcomes, as well as hospitals with lower case volumes and very good outcomes are also observed

Non-implant-related factors: Patient (I)

- Higher revision probabilities in male TKA (and total hip arthroplasty, THA) patients

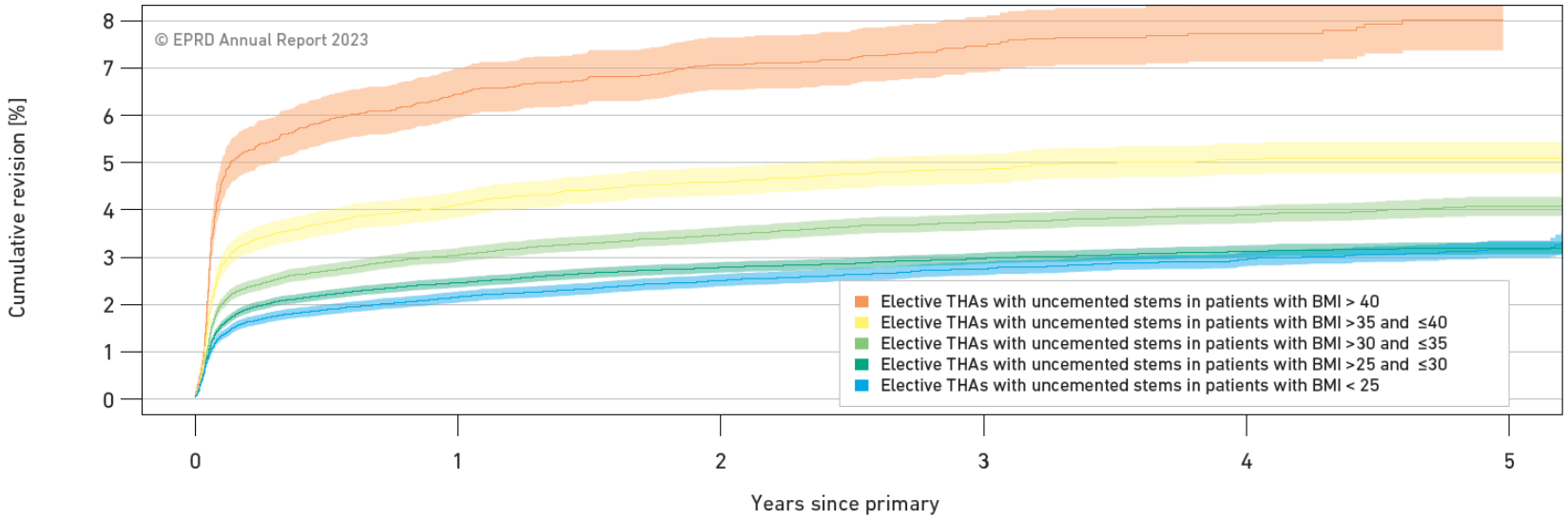


Numbers at risk									
Standard TKAs in men	120,833	97,819	79,436	61,855	44,314	28,592	15,680	6,304	1,696
Standard TKAs in women	230,698	190,485	157,253	125,520	92,548	61,824	35,125	14,485	3,828

Figure 20: Revision probabilities of standard total knee arthroplasties by patient sex *($p < 0.0001$)*

Non-implant-related factors: Patient (II)

- Patient body mass index is significant in specific types of arthroplasties



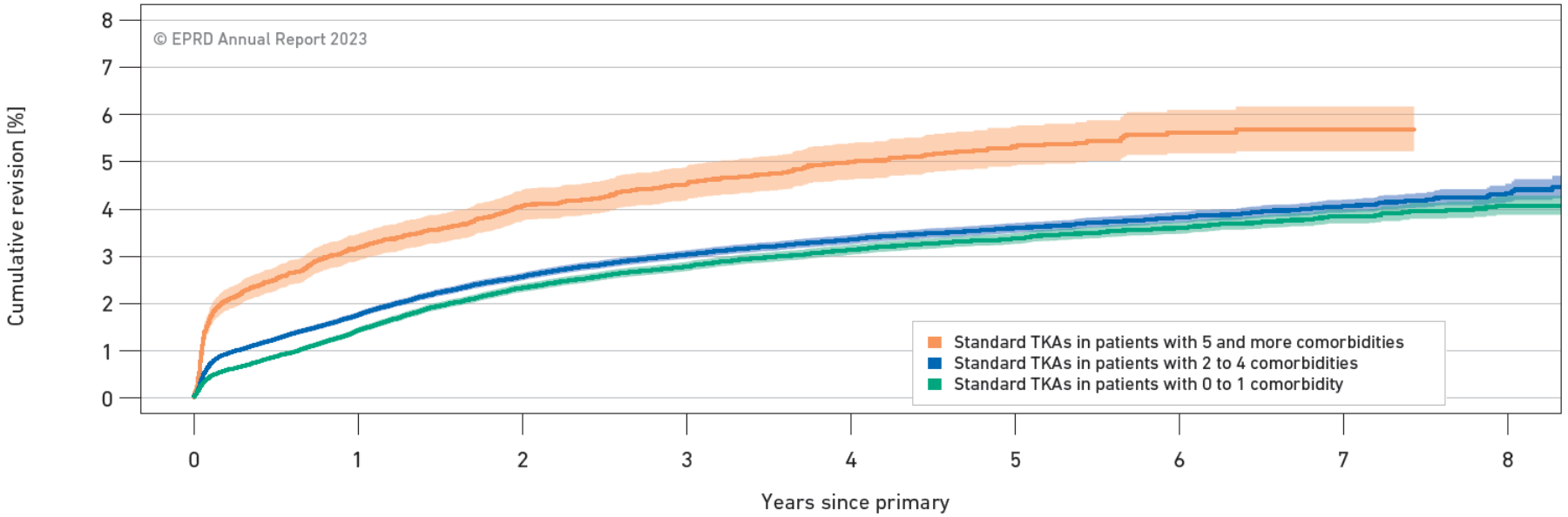
Numbers at risk

	8,951	6,596	4,860	3,362	1,867	
	21,295	15,845	11,748	8,062	4,350	1,107
	57,406	43,742	32,892	22,538	12,278	3,184
	96,735	74,174	56,317	38,968	21,441	5,564
	66,379	50,578	37,972	26,047	14,119	3,619

Figure 23: Revision probabilities of elective total hip arthroplasties with uncemented stems by patient body mass index *($p < 0.0001$)*. As patient height and weight have only been documented in the EPRD since 2017, the figure only includes the first five years after primary surgery.

Non-implant-related factors: Patient (III)

- Good general health enhances chance of treatment success

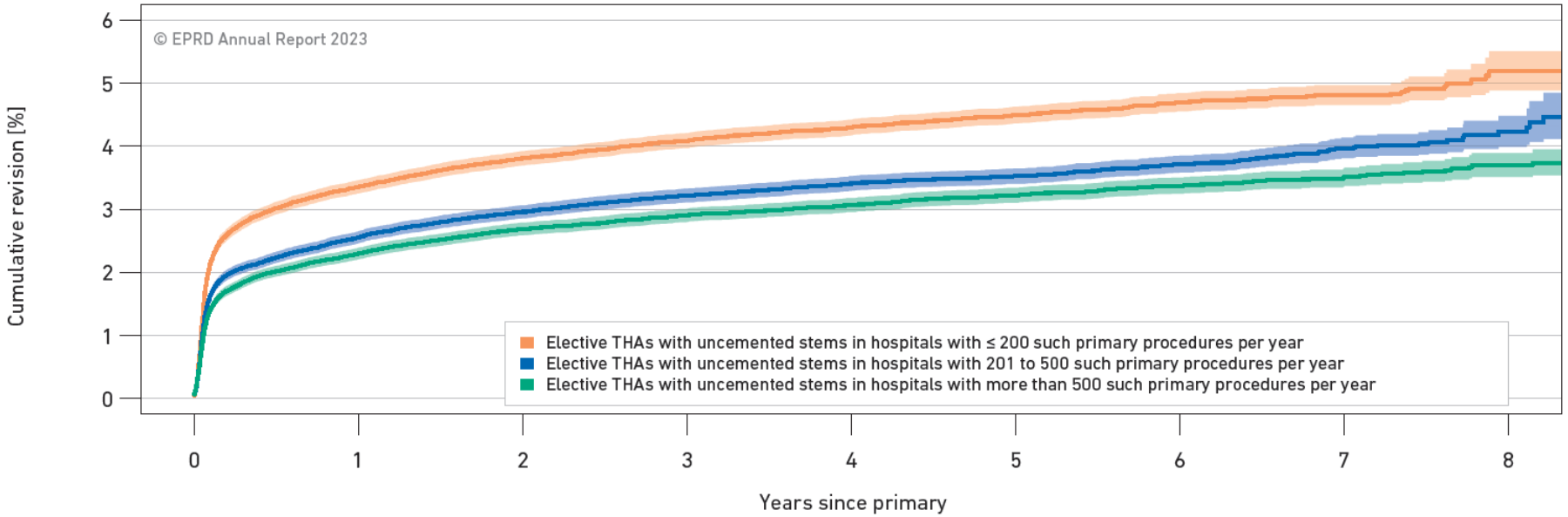


Numbers at risk									
Standard TKAs in patients with 5 and more comorbidities	15,925	12,917	10,558	8,219	5,857	3,731	2,089	817	
Standard TKAs in patients with 2 to 4 comorbidities	186,303	153,508	126,526	100,224	72,926	47,958	26,851	10,859	2,831
Standard TKAs in patients with 0 to 1 comorbidity	149,303	121,879	99,605	78,932	58,079	38,727	21,865	9,113	2,472

Figure 24: Revision probabilities of standard total knee arthroplasties by concomitant disease diagnoses included in the Elixhauser Comorbidity Score *($p < 0.0001$)*

Non-implant-related factors: Hospital (I)

- Revision probabilities of elective THAs with uncemented stems by the hospital's annual volume of primary hip arthroplasties

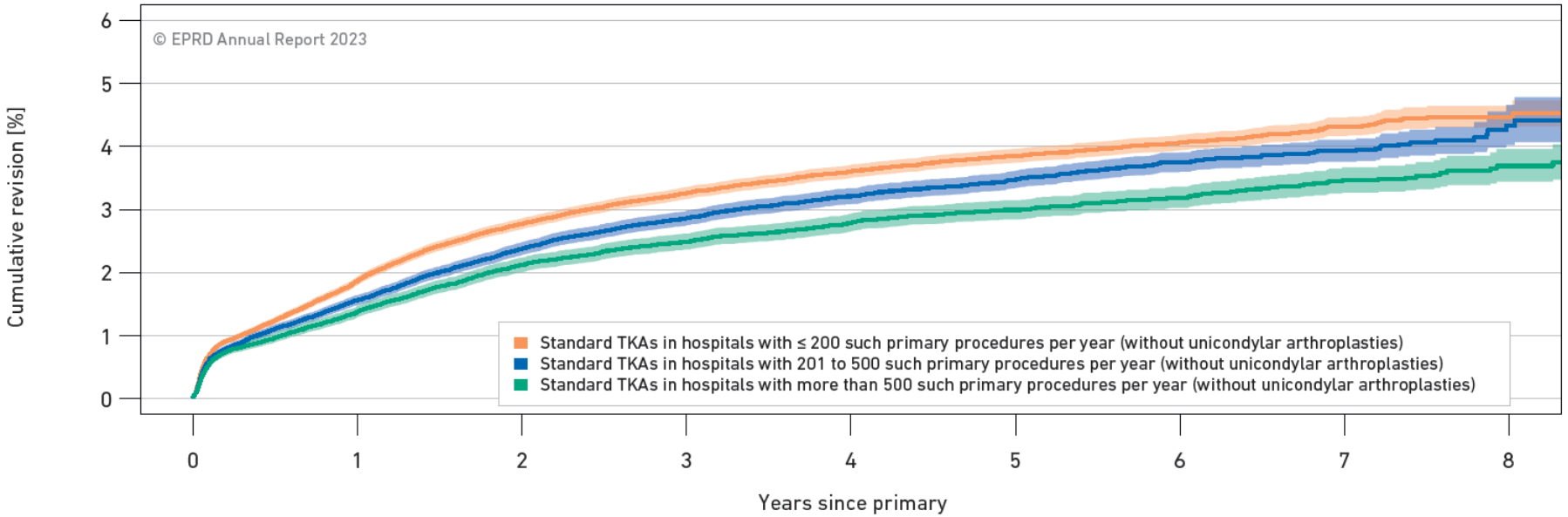


Numbers at risk									
	120,889	96,565	78,921	62,053	45,006	29,328	15,622	5,551	996
	112,882	91,302	74,491	58,893	43,356	29,271	16,932	7,117	1,583
	111,576	91,749	74,906	58,900	42,503	28,277	16,221	6,864	2,859

Figure 25: Revision probabilities of elective total hip arthroplasties with uncemented stems by the hospital´s annual volume of primary elective hip arthroplasties *($p < 0.0001$)*

Non-implant-related factors: Hospital (II)

- Revision probabilities of standard TKAs by the hospital's annual volume of primary TKAs

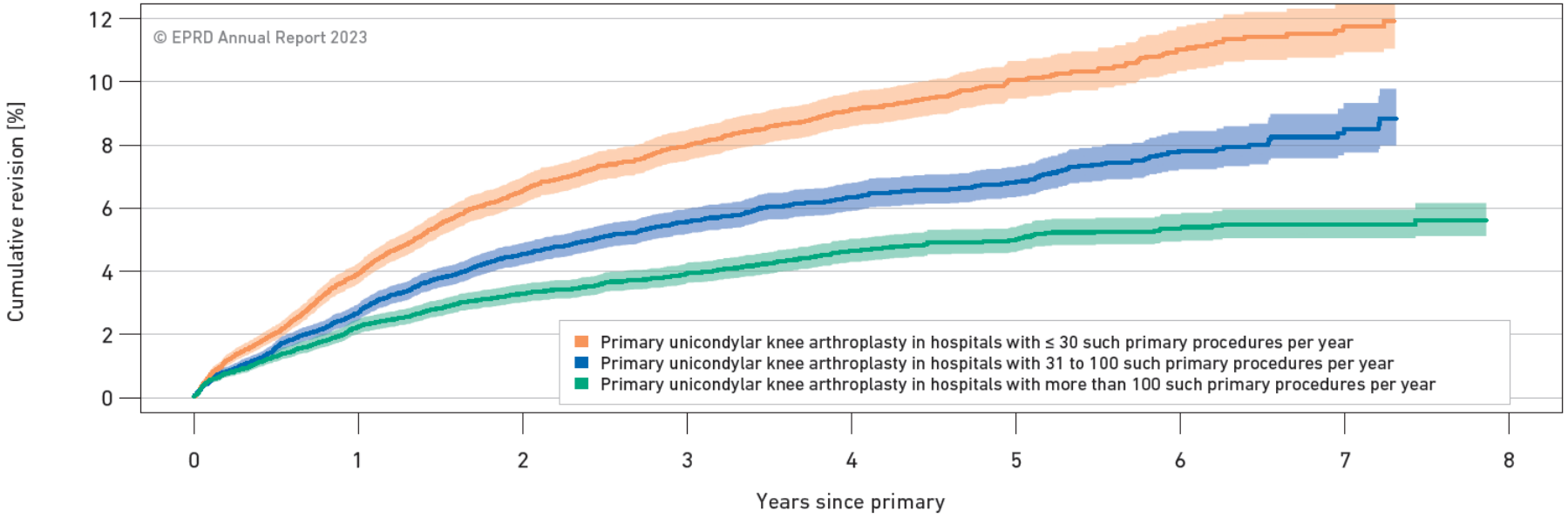


Numbers at risk									
	169,261	138,216	114,301	90,735	65,725	42,508	23,079	8,676	1,817
	103,705	84,678	68,734	54,037	39,426	25,882	14,354	5,731	1,285
	71,994	59,211	47,822	37,407	27,404	18,980	11,566	5,548	2,192

Figure 26: Revision probabilities of standard total knee arthroplasties by the hospital´s annual volume of primary total knee arthroplasties not including unicondylar arthroplasties *($p < 0.0001$)*

Non-implant-related factors: Hospital (III)

- Revision probabilities of unicondylar knee arthroplasties by the number of primary unicondylar knee arthroplasties performed



Numbers at risk								
15,656	12,489	10,050	7,763	5,574	3,513	1,789	710	
17,259	13,734	10,801	8,021	5,484	3,405	1,802	675	
18,138	14,874	12,089	9,514	6,916	4,513	2,545	942	

Figure 27: Revision probabilities of unicondylar knee arthroplasties by the hospital's annual volume of primary unicondylar knee arthroplasties *(p < 0.0001)*

Revision probabilities hip arthroplasty (I)

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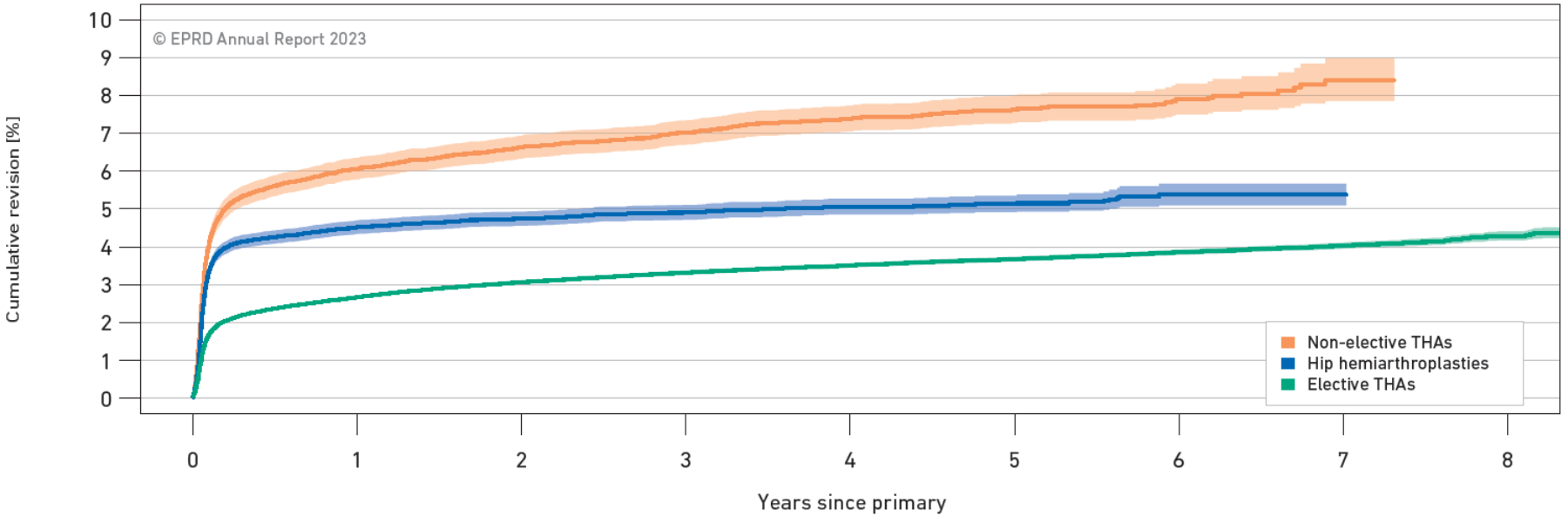
In brief

- Revision probabilities significantly higher for non-elective procedures.
- Arthroplasties with cemented femoral components have a lower revision probability. The reason for this is the better outcome in older patients.
- To date, there has been no noticeable decline in revision probabilities.

Revision probabilities hip arthroplasty (II)

- Differences between types of hip arthroplasties become apparent at an early stage



Numbers at risk									
Non-elective THAs	29,083	20,003	14,929	10,641	7,060	4,318	2,169	775	
Hip hemiarthroplasties	59,874	32,614	21,378	13,376	7,759	4,075	1,775	515	
Elective THAs	448,209	362,702	296,084	233,393	170,095	113,155	63,790	25,977	7.179

Figure 14: Revision probabilities of elective and non-elective hip arthroplasties *($p < 0.0001$)*

Revision probabilities hip arthroplasty (III)

- In the EPRD lower revision probabilitiy for arthroplasties with cemented femoral components

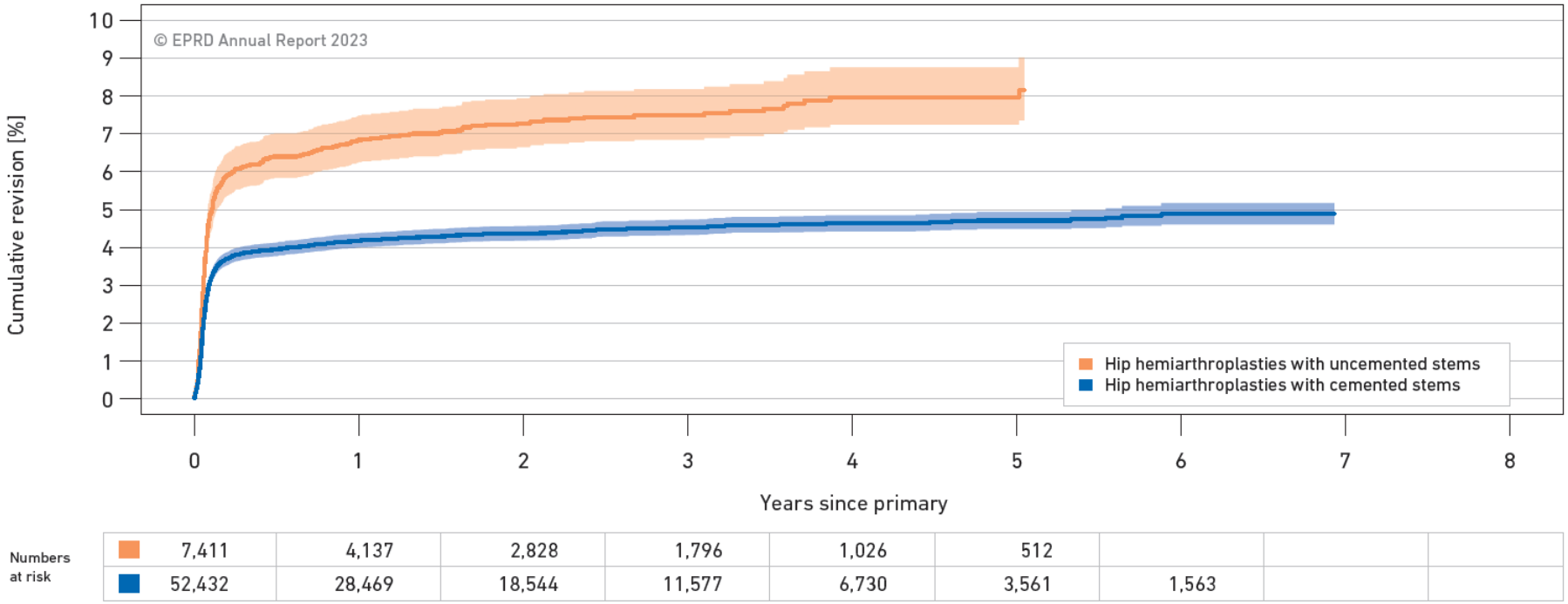


Figure 29: Revision probabilities of uncemented and cemented partial hip arthroplasties *(p < 0.0001)*

Revision probabilities hip arthroplasty (IV)

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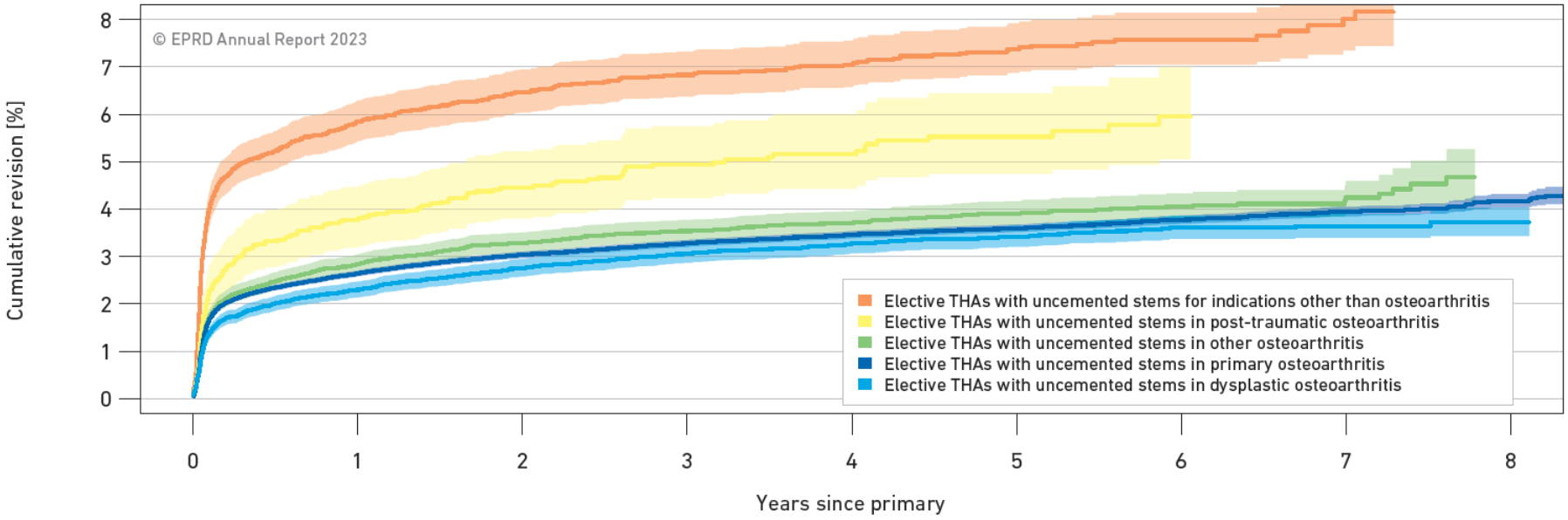
- Higher probability of revision with a primary diagnosis of post-traumatic hip osteoarthritis compared to other forms of hip osteoarthritis



Numbers at risk

	12,030	9,361	7,497	5,888	4,289	2,771	1,531	656	
	3,527	2,883	2,384	1,901	1,354	884	516		
	28,058	23,291	19,167	15,115	11,184	7,374	3,977	1,413	
	275,824	223,546	182,987	144,513	105,341	70,079	39,587	16,048	4,396
	32,633	26,785	22,091	17,512	12,856	8,718	4,879	1,989	583

Figure 16: Revision probabilities of elective total hip arthroplasties with uncemented stems by primary diagnosis *($p < 0.0001$)*

Revision probabilities hip arthroplasty (V)

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- 10 years of data acquisition: Revision probabilities by operating year have not yet decreased for elective THAs.

Elective THAs with uncemented stems		Revision probabilities after ...				
Operating year	Number	1 year	2 years	3 years	4 years	5 years
2012/13	2,983	2.5 [2.0; 3.1] (2,878)	3.3 [2.7; 4.0] (2,652)	3.4 [2.8; 4.2] (2,511)	3.7 [3.1; 4.5] (2,418)	4.0 [3.3; 4.7] (2,361)
2014	7,200	2.3 [2.0; 2.7] (6,880)	3.0 [2.7; 3.5] (6,646)	3.3 [2.9; 3.7] (6,504)	3.5 [3.1; 3.9] (6,363)	3.7 [3.2; 4.1] (6,208)
2015	21,936	2.4 [2.2; 2.6] (21,032)	2.8 [2.6; 3.0] (20,401)	3.1 [2.9; 3.3] (19,917)	3.3 [3.1; 3.6] (19,488)	3.5 [3.3; 3.8] (19,017)
2016	37,787	2.7 [2.5; 2.9] (35,974)	3.2 [3.0; 3.4] (35,140)	3.5 [3.3; 3.6] (34,419)	3.6 [3.4; 3.8] (33,672)	3.8 [3.6; 4.0] (32,835)
2017	44,452	2.8 [2.6; 2.9] (42,609)	3.1 [3.0; 3.3] (41,785)	3.4 [3.3; 3.6] (40,948)	3.6 [3.4; 3.8] (39,995)	3.7 [3.6; 3.9] (29,405)
2018	48,425	2.6 [2.5; 2.8] (46,546)	3.1 [2.9; 3.2] (45,617)	3.3 [3.1; 3.4] (44,672)	3.5 [3.3; 3.6] (33,088)	
2019	51,479	2.8 [2.6; 2.9] (49,490)	3.2 [3.0; 3.3] (48,452)	3.4 [3.3; 3.6] (35,958)		
2020	47,172	2.9 [2.8; 3.1] (45,228)	3.3 [3.1; 3.5] (33,433)			
2021	49,346	2.8 [2.7; 3.0] (35,229)				

Table 39: Revision probabilities of elective total hip arthroplasties with uncemented stems by operating year *(p = 0.2)*

Revision probabilities knee arthroplasty (I)

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In brief

- Unicondylar arthroplasties have a revision probability that is still almost twice that of TKAs.
- During the first few years, standard TKAs with fixed bearings have significantly lower revision probabilities.
- Whether or not surgery with patellar resurfacing at the primary TKA yields better outcomes strongly depends on the definition of the endpoint of arthroplasty survival and the knee system implanted.
- Over the last ten years, the revision probability of standard TKAs has been on the decline.

Revision probabilities knee arthroplasty (II)

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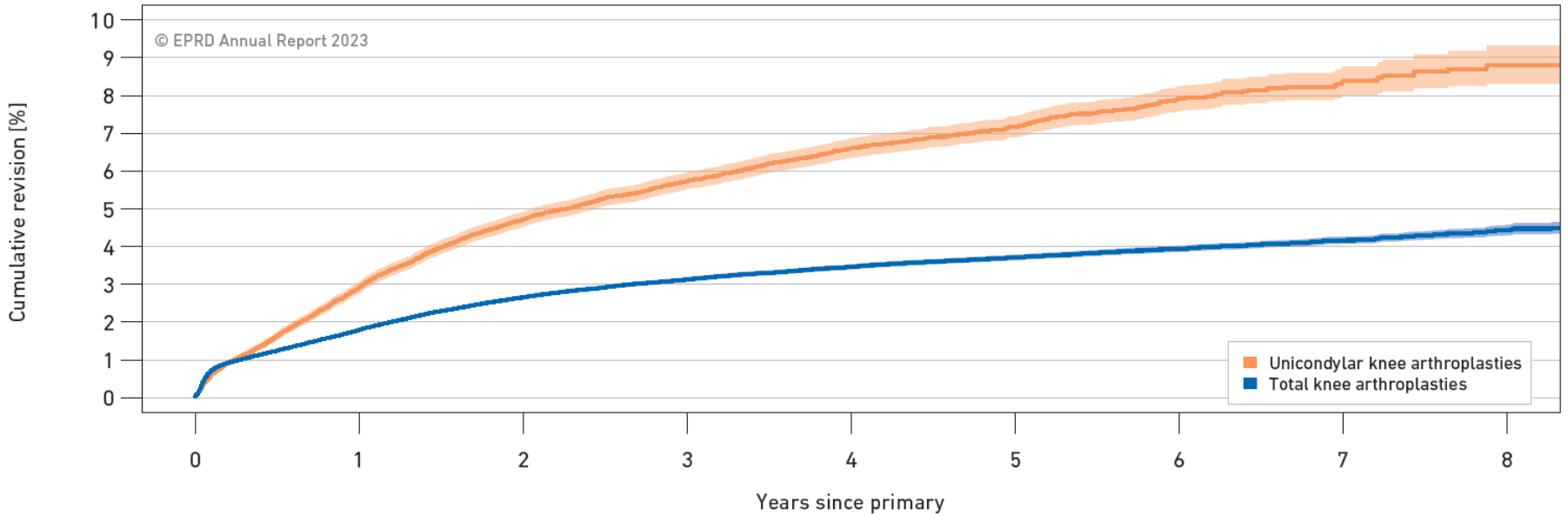
- Higher revision probabilities with unicondylar arthroplasties compared to TKAs



Numbers at risk									
Unicondylar knee arthroplasties	51,875	41,850	33,637	25,885	18,408	11,697	6,271	2,373	774
Total knee arthroplasties	369,131	302,071	247,752	195,952	142,944	94,326	52,881	21,647	5,725

Figure 17: Revision probabilities of total and unicondylar knee arthroplasties *($p < 0.0001$)*

Revision probabilities knee arthroplasty (III)

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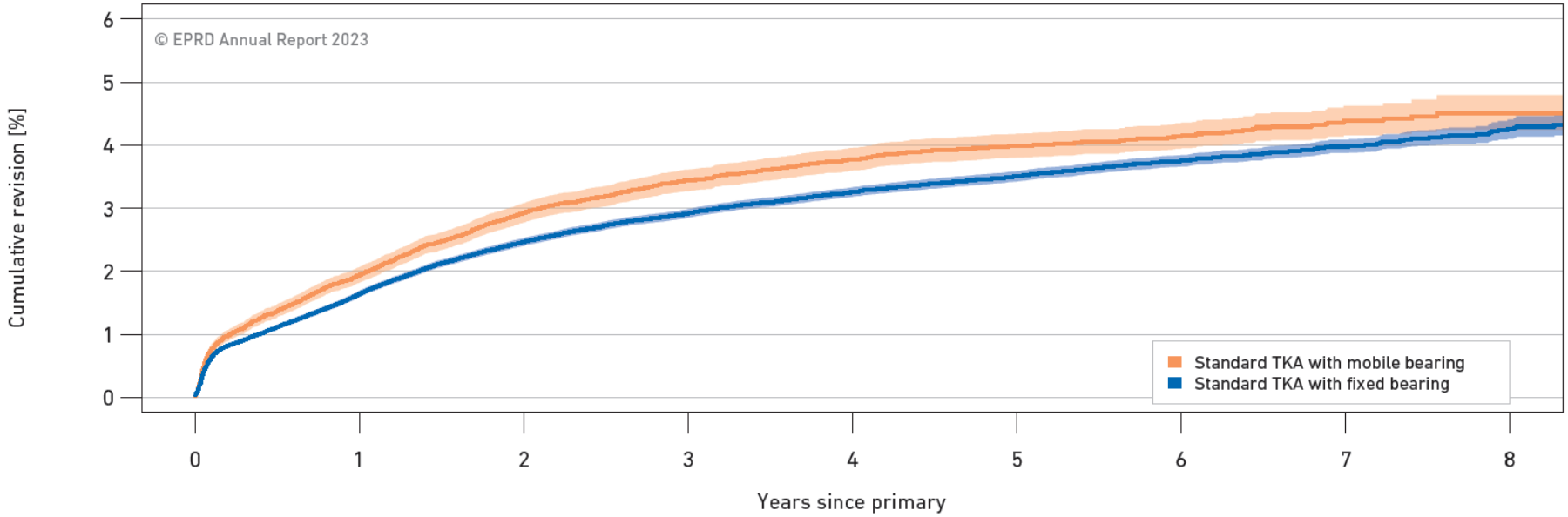
- Lower revision probabilities of standard TKAs with fixed bearings during the first few years



Numbers at risk									
Standard TKA with mobile bearing	52,224	45,207	38,912	32,286	24,902	17,318	9,871	3,662	812
Standard TKA with fixed bearing	299,307	243,097	197,777	155,089	111,960	73,098	40,934	17,127	4,712

Figure 34: Revision probabilities of standard total knee arthroplasties by bearing mobility *($p < 0.0001$)*

Revision probabilities knee arthroplasty (IV)

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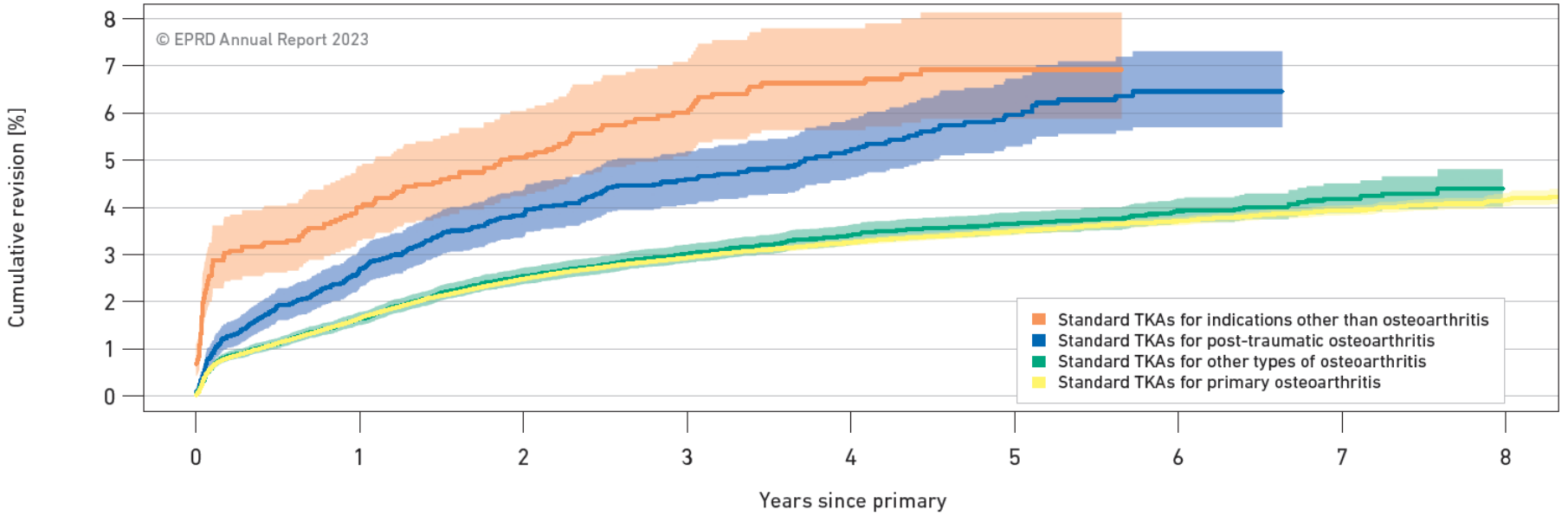
- Higher probability of revision with a primary diagnosis of post-traumatic knee osteoarthritis compared to other forms of knee osteoarthritis



Numbers at risk									
Standard TKAs for indications other than osteoarthritis	2,479	2,074	1,744	1,398	1,064	694			
Standard TKAs for post-traumatic osteoarthritis	6,702	5,382	4,305	3,408	2,448	1,610	852		
Standard TKAs for other types of osteoarthritis	37,102	31,135	25,645	20,223	14,656	9,942	5,542	2,072	
Standard TKAs for primary osteoarthritis	305,248	249,713	204,995	162,346	118,694	78,170	44,012	18,212	4,913

Figure 19: Revision probabilities of standard total knee arthroplasties by primary diagnosis (based on the documented ICD-10 codes) *($p < 0.0001$)*

Revision probabilities knee arthroplasty (V)

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- 10 years of data acquisition: Revision probabilities by operating year have decreased for standard TKAs.

Standard TKAs		Revision probabilities after ...				
Operating year	Number	1 year	2 years	3 years	4 years	5 years
2012/13	3,056	1.6 [1.2; 2.2] (2,985)	2.9 [2.4; 3.6] (2,751)	3.4 [2.8; 4.1] (2,568)	3.7 [3.1; 4.5] (2,448)	3.9 [3.2; 4.6] (2,366)
2014	7,513	1.7 [1.5; 2.1] (7,206)	2.8 [2.4; 3.2] (6,871)	3.3 [2.9; 3.8] (6,678)	3.7 [3.3; 4.2] (6,511)	4.0 [3.6; 4.5] (6,309)
2015	23,119	1.9 [1.7; 2.1] (22,236)	2.9 [2.7; 3.1] (21,458)	3.5 [3.3; 3.7] (20,865)	3.8 [3.6; 4.1] (20,289)	4.1 [3.8; 4.4] (19,699)
2016	37,740	1.7 [1.6; 1.9] (36,337)	2.7 [2.5; 2.9] (35,272)	3.2 [3.0; 3.3] (34,439)	3.6 [3.4; 3.8] (33,533)	3.8 [3.6; 4.0] (32,447)
2017	45,314	1.7 [1.6; 1.9] (43,991)	2.6 [2.5; 2.8] (42,908)	3.1 [2.9; 3.2] (41,899)	3.4 [3.2; 3.5] (40,791)	3.6 [3.4; 3.8] (29,595)
2018	48,772	1.6 [1.5; 1.7] (47,424)	2.4 [2.3; 2.6] (46,306)	2.9 [2.7; 3.0] (45,135)	3.2 [3.1; 3.4] (33,290)	
2019	51,062	1.6 [1.5; 1.7] (49,739)	2.3 [2.2; 2.5] (48,549)	2.8 [2.6; 2.9] (35,791)		
2020	45,986	1.8 [1.7; 1.9] (44,643)	2.5 [2.4; 2.7] (32,574)			
2021	47,540	1.6 [1.5; 1.8] (33,743)				

Table 42: Outcomes for standard total knee arthroplasties by operating year *(p < 0.0001)*

Revision probabilities for specific implant systems and component pairs (I)

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- The EPRD annual report again presents outcomes for specific implant systems (brands) and combinations in detail

Elective total hip arthroplasties							Revision probabilities after ...							
Femoral stem	Cup	Number	Hosp.	Age	m/f	Period	1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years
Hybrid fixation														
LCU Hip System, cemented, CoCrMo (Waldemar Link)	MobileLink, Cluster Hole (Waldemar Link)	318	7	78 (74 - 81)	28/72	2019-2022	3.7 [2.1; 6.6] (205)	*3.7 [2.1; 6.6]* (86)						
M.E.M. Geradschaft (Zimmer Biomet)	Allofit (Zimmer Biomet)	19,279	162	79 (75 - 82)	26/74	2012-2022	2.0 [1.8; 2.3] (15,032)	2.3 [2.1; 2.5] (11,750)	2.5 [2.2; 2.7] (8,905)	2.6 [2.3; 2.8] (6,132)	2.8 [2.6; 3.1] (3,818)	3.0 [2.7; 3.3] (1,944)	3.1 [2.8; 3.5] (758)	3.3 [2.8; 3.8] (159)
M.E.M. Geradschaft (Zimmer Biomet)	Allofit IT (Zimmer Biomet)	431	17	79 (75 - 83)	22/78	2013-2022	2.4 [1.3; 4.4] (351)	2.7 [1.5; 4.9] (274)	2.7 [1.5; 4.9] (209)	*4.0 [2.2; 7.1]* (133)	*4.0 [2.2; 7.1]* (82)			
M.E.M. Geradschaft (Zimmer Biomet)	Trilogy (Zimmer Biomet)	1,452	12	78 (74 - 81)	28/72	2012-2022	1.6 [1.0; 2.3] (1,261)	1.7 [1.2; 2.6] (1,111)	1.8 [1.2; 2.7] (980)	1.8 [1.2; 2.7] (799)	1.9 [1.3; 2.9] (613)	1.9 [1.3; 2.9] (411)	2.2 [1.5; 3.4] (216)	*2.2 [1.5; 3.4]* (97)
M.E.M. Geradschaft (Zimmer Biomet)	Trilogy IT (Zimmer Biomet)	330	3	81 (78 - 83)	25/75	2015-2022	1.9 [0.8; 4.1] (261)	1.9 [0.8; 4.1] (219)	1.9 [0.8; 4.1] (157)	*1.9 [0.8; 4.1]* (114)	*3.1 [1.2; 7.6]* (68)			
METABLOC (Zimmer Biomet)	Allofit (Zimmer Biomet)	1,508	24	78 (75 - 82)	28/72	2013-2022	2.3 [1.7; 3.2] (1,434)	2.7 [2.0; 3.6] (1,331)	2.9 [2.2; 3.9] (1,128)	2.9 [2.2; 3.9] (881)	3.1 [2.3; 4.1] (601)	3.2 [2.4; 4.4] (370)	3.2 [2.4; 4.4] (159)	
Knee arthroplasties without primary patellar resurfacing							Revision probabilities after ...							
Femoral component	Tibial component	Number	Hosp.	Age	m/f	Period	1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years
Standard TKA, cruciate-retaining/sacrificing, mobile bearing, cemented														
LCS™ COMPLETE™ Femur (DePuy)	MBT Tibia (DePuy)	5,188	58	72 (64 - 77)	36/64	2013-2022	2.1 [1.8; 2.5] (4,932)	3.1 [2.7; 3.6] (4,525)	3.6 [3.1; 4.1] (4,029)	3.9 [3.4; 4.5] (3,360)	4.1 [3.6; 4.8] (2,623)	4.3 [3.7; 4.9] (1,750)	4.6 [4.0; 5.4] (797)	*4.6 [4.0; 5.4]* (142)
SCORE (Amplitude)	SCORE (Amplitude)	322	7	72 (62 - 77)	30/70	2014-2022	1.9 [0.8; 4.1] (306)	3.2 [1.8; 5.9] (273)	4.0 [2.3; 7.0] (203)	5.1 [3.0; 8.5] (160)	*5.1 [3.0; 8.5]* (102)	*6.5 [3.6; 11.7]* (62)		
SIGMA™ Femur (DePuy)	MBT Tibia (DePuy)	2,081	29	72 (64 - 78)	37/63	2013-2022	2.6 [1.9; 3.3] (1,826)	3.2 [2.5; 4.1] (1,594)	4.0 [3.2; 5.0] (1,237)	4.3 [3.4; 5.3] (846)	4.3 [3.4; 5.3] (541)	4.3 [3.4; 5.3] (290)	*4.3 [3.4; 5.3]* (57)	
Standard TKA cruciate-sacrificing, fixed bearing, hybrid														
balanSys BICONDYLAR uncem. (Mathys)	balanSys BICONDYLAR fix (Mathys)	1,078	9	70 (63 - 77)	44/56	2013-2022	2.4 [1.7; 3.6] (1,013)	3.5 [2.6; 4.8] (907)	3.9 [2.9; 5.2] (729)	4.0 [3.0; 5.5] (488)	4.3 [3.1; 5.8] (317)	4.3 [3.1; 5.8] (157)	*4.3 [3.1; 5.8]* (81)	
INNEX CR (Zimmer Biomet)	Innex Fix (Zimmer Biomet)	313	4	71 (64 - 76)	48/52	2014-2022	2.0 [0.9; 4.3] (279)	2.7 [1.4; 5.3] (252)	3.5 [1.9; 6.4] (213)	3.5 [1.9; 6.4] (172)	*4.1 [2.3; 7.3]* (92)	*4.1 [2.3; 7.3]* (53)		

Revision probabilities for specific implant systems and component pairs (II)

- Note that hospital-related and patient-related factors may sometimes overlap with implant effects
  - Additional information on the patient population operated (median age and proportion of male and female patients) is therefore provided.
  - We also indicate when primary arthroplasties with the corresponding components became available.
- Important: If the procedure involves revision or explantation, this is considered to be the endpoint of the analysis – regardless of whether implant components were actually left *in situ* during the surgery or replaced.

Re-revision probability (I)

EPRD Endoprothesenregister Deutschland

In brief

- The probability of re-revision ...
  - increases with each additional revision, although the rate of increase is lower for infection-related revisions.
  - after periprosthetic infection is more than twice that of non-infection-related revisions.

Re-revision probability (II)

- The probability of re-revision increases with each additional revision and the proportion of non-infection-related and infection-related revisions is shifting

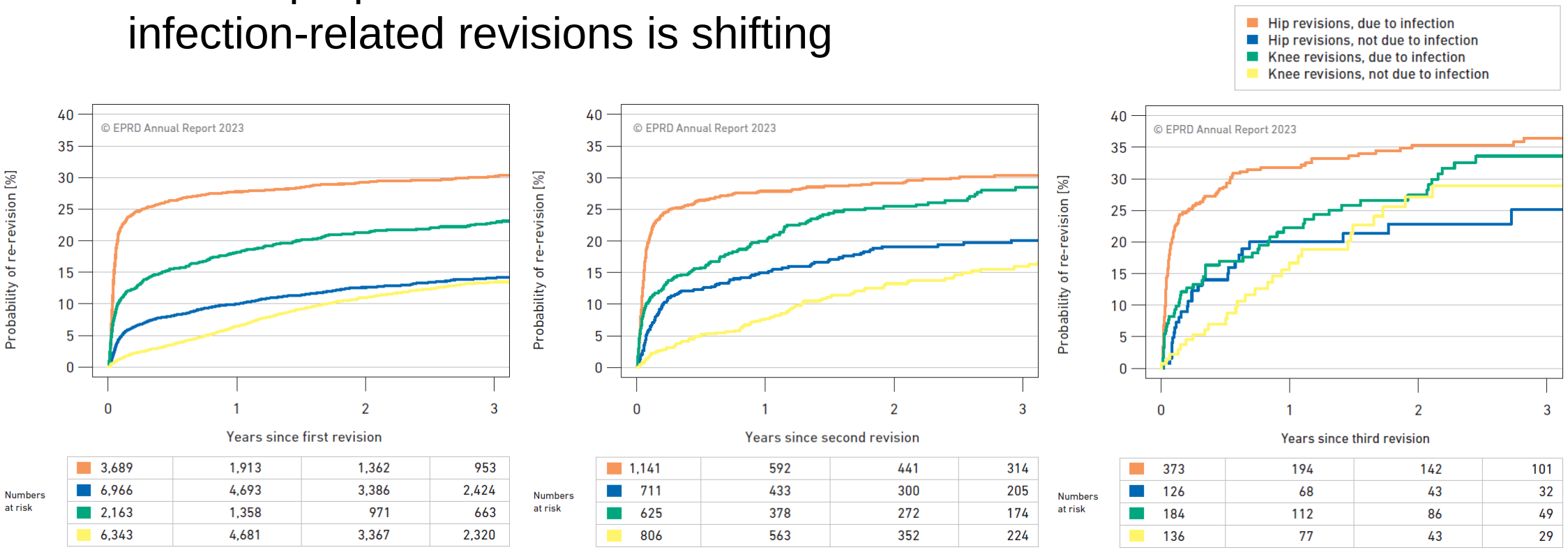
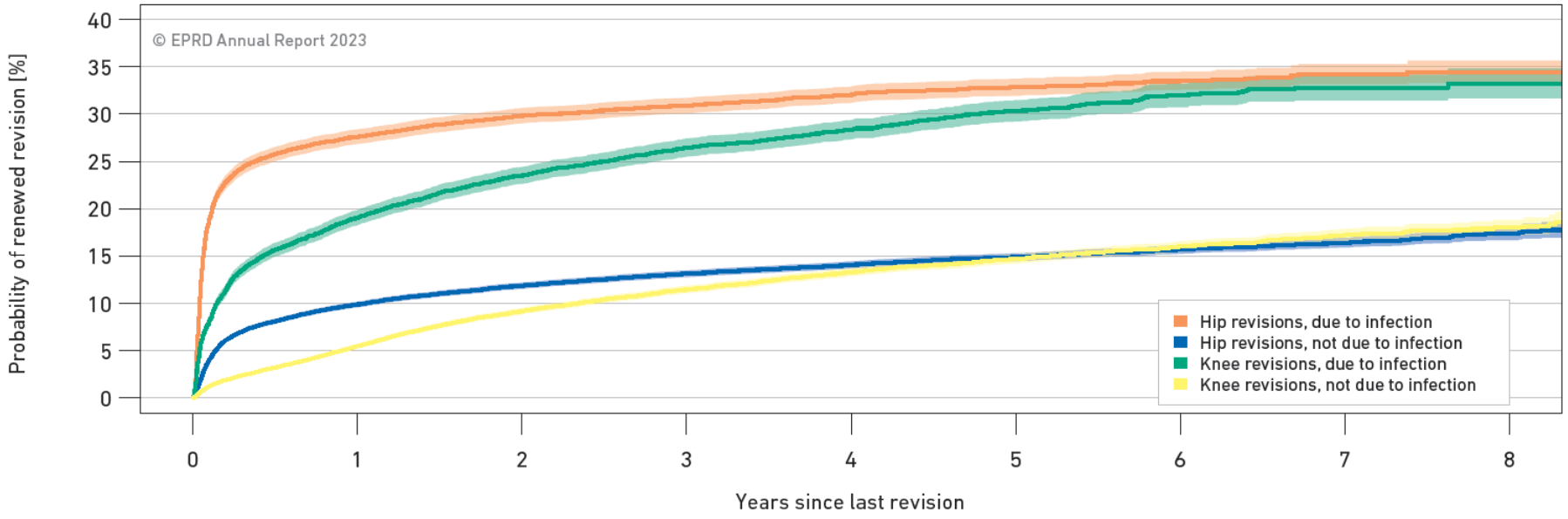


Figure 37: Probability of re-revision after first, second and third revision. Due to the low number of cases, confidence intervals have been omitted for clarity.

Re-revision probability (III)

- For infection-related revisions the risk of re-revision within two years is more than twice that of non-infection-related revisions



Numbers at risk									
Hip revisions, due to infection	13,860	7,859	6,022	4,538	3,093	1,917	1,055	430	101
Hip revisions, not due to infection	44,280	32,131	25,425	19,648	14,188	9,427	5,301	2,332	723
Knee revisions, due to infection	10,163	6,641	5,005	3,664	2,548	1,590	846	340	86
Knee revisions, not due to infection	33,702	26,776	21,025	16,149	11,614	7,700	4,366	1,869	543

29.7 % vs 11.8 % for hips and 23.4 % vs. 9.2 % for knees.

Figure 36: Probability of re-revision over time *($p < 0.0001$)*

Patient mortality

Patient mortality (I)

- Important: In patient mortality tables, the arthroplasty surgery and the death of the respective patient are not necessarily related.
  - Reason: Once a year, the EPRD receives information directly from participating federal health insurance provider associations on whether the patient is still alive or has died and in which month the death occurred. The cause of death is not included in this information.

Patient mortality (II)

- Non-elective THA or hemiarthroplasty patients have the highest mortality rate of all the primary procedures analysed.

	Type of procedure	Number	Age	%M	Mortality within ... 3 months	6 months	12 months	24 months	36 months
Primary arthroplasties	Elective THAs with uncemented stems	352,072	67	40.6	0.3 [0.3; 0.3] (337,232)	0.5 [0.5; 0.6] (322,416)	0.9 [0.9; 1.0] (293,716)	2.1 [2.0; 2.1] (241,464)	3.4 [3.4; 3.5] (191,126)
	Elective THAs with cemented stems	95,671	79	24.8	1.2 [1.1; 1.2] (90,613)	1.9 [1.8; 2.0] (86,020)	3.1 [3.0; 3.2] (78,146)	6.0 [5.9; 6.2] (63,319)	9.5 [9.2; 9.7] (49,677)
	Non-elective THAs	29,083	76	30.1	6.2 [5.9; 6.4] (26,113)	8.5 [8.2; 8.8] (24,359)	12.0 [11.6; 12.4] (21,173)	18.0 [17.5; 18.5] (15,838)	24.5 [24.0; 25.1] (11,361)
	Hemiarthroplasties	59,874	84	28.6	17.5 [17.2; 17.8] (47,249)	23.4 [23.1; 23.8] (41,719)	30.6 [30.2; 31.0] (33,815)	42.3 [41.9; 42.7] (22,207)	53.0 [52.6; 53.5] (13,928)
	Standard TKAs	351,531	70	34.4	0.2 [0.2; 0.3] (337,147)	0.4 [0.4; 0.4] (322,738)	0.8 [0.8; 0.9] (293,178)	2.0 [2.0; 2.1] (242,780)	3.7 [3.6; 3.7] (193,146)
	Constrained TKAs	17,600	75	23.9	1.2 [1.0; 1.4] (16,696)	2.0 [1.8; 2.3] (15,859)	3.4 [3.2; 3.7] (14,329)	6.5 [6.1; 6.9] (11,648)	10.1 [9.6; 10.6] (9,079)
	Unicondylar knee arthroplasties	51,875	63	44.4	0.1 [0.1; 0.1] (49,781)	0.2 [0.2; 0.3] (47,552)	0.5 [0.4; 0.5] (43,102)	1.1 [1.0; 1.1] (35,345)	2.0 [1.8; 2.1] (27,491)
	Patellofemoral arthroplasties	849	54	27.4	0.0 (819)	0.0 (780)	0.3 [0.1; 1.1] (712)	0.6 [0.2; 1.6] (563)	0.8 [0.3; 1.9] (437)
Revisions	Hip revisions, not due to infection	44,280	76	34.8	3.7 [3.5; 3.9] (41,237)	5.1 [4.9; 5.3] (39,166)	7.1 [6.8; 7.3] (35,501)	10.8 [10.5; 11.1] (28,713)	14.8 [14.4; 15.2] (22,500)
	Hip revisions, due to infection	13,860	74	45.6	5.8 [5.5; 6.2] (12,581)	8.3 [7.8; 8.7] (11,827)	10.7 [10.2; 11.2] (10,591)	14.7 [14.1; 15.3] (8,385)	18.8 [18.1; 19.5] (6,416)
	Knee revisions, not due to infection	33,702	70	33.2	0.9 [0.8; 1.0] (32,342)	1.4 [1.2; 1.5] (31,026)	2.2 [2.0; 2.4] (28,389)	4.1 [3.9; 4.4] (23,256)	6.3 [6.0; 6.6] (18,382)
	Knee revisions, due to infection	10,163	72	46.9	2.7 [2.4; 3.0] (9,532)	3.8 [3.5; 4.2] (9,071)	5.9 [5.5; 6.4] (8,217)	9.7 [9.1; 10.3] (6,603)	14.0 [13.2; 14.8] (5,073)

Table 53: Summary of patient mortality, 3, 6, 12, 24, and 36 months after primary arthroplasty or revision

Patient mortality (III)

- Separate men and women mortality rates with the corresponding figures calculated by the German Federal Statistical Office (DESTATIS)

Male patients		1-year mortality expressed as a percent of the age group ... (age in years)							
Type of procedure		≤54	55 to 59	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	≥85
Primary arthroplasties	Elective THAs with uncemented stems	0.42 [0.34; 0.51] (19.555)	0.57 [0.47; 0.69] (16.418)	0.73 [0.62; 0.85] (19.915)	0.99 [0.87; 1.13] (19.400)	1.17 [1.03; 1.33] (17.508)	2.18 [1.98; 2.41] (16.469)	3.64 [3.27; 4.06] (7.696)	5.87 [4.95; 6.95] (1.777)
	Elective THAs with cemented stems	3.41 [2.16; 5.37] (478)	6.06 [4.28; 8.56] (422)	5.79 [4.24; 7.87] (563)	5.95 [4.73; 7.47] (1.000)	4.13 [3.47; 4.92] (2.564)	3.69 [3.27; 4.17] (6.048)	4.42 [3.96; 4.93] (5.937)	7.44 [6.54; 8.46] (2.353)
	Non-elective THAs	6.09 [4.15; 8.89] (356)	8.40 [6.34; 11.10] (434)	10.82 [8.92; 13.11] (658)	10.47 [8.82; 12.41] (879)	10.88 [9.22; 12.81] (914)	14.78 [13.10; 16.65] (1.202)	20.00 [17.96; 22.24] (944)	36.06 [33.28; 38.99] (609)
	Hemiarthroplasties	24.12 [17.69; 32.38] (91)	23.88 [18.02; 31.25] (105)	28.76 [24.23; 33.94] (208)	29.48 [25.95; 33.37] (360)	30.94 [28.41; 33.64] (711)	33.46 [31.68; 35.32] (1.543)	36.72 [35.28; 38.20] (2.274)	47.44 [46.26; 48.65] (3.009)
	Standard TKAs	0.37 [0.26; 0.53] (7.740)	0.48 [0.37; 0.62] (11.146)	0.56 [0.46; 0.68] (16.424)	0.83 [0.70; 0.98] (15.730)	1.16 [1.01; 1.32] (17.301)	1.74 [1.57; 1.92] (19.111)	2.92 [2.63; 3.24] (10.052)	4.78 [4.04; 5.66] (2.320)
	Constrained TKAs	1.47 [0.61; 3.50] (307)	1.52 [0.64; 3.61] (315)	1.69 [0.85; 3.36] (417)	3.31 [2.10; 5.20] (470)	3.13 [1.98; 4.93] (504)	4.89 [3.56; 6.69] (670)	6.20 [4.55; 8.42] (522)	10.17 [7.03; 14.61] (198)
	Unicondylar knee arthroplasties	0.26 [0.13; 0.52] (2.919)	0.34 [0.20; 0.57] (3.622)	0.34 [0.20; 0.56] (3.947)	0.90 [0.62; 1.31] (2.697)	0.79 [0.52; 1.22] (2.406)	0.97 [0.65; 1.44] (2.245)	1.66 [1.04; 2.66] (895)	4.46 [2.34; 8.43] (172)
	Patellofemoral arthroplasties	0.00 (91)	0.00 (49)	0.00 (15)	0.00 (18)	14.29 [2.14; 66.59] (6)	0.00 (10)	0.00 (3)	0.00 (6)
Revisions	Hip revisions, not due to infection	0.90 [0.50; 1.62] (1.147)	1.27 [0.75; 2.13] (999)	2.17 [1.53; 3.07] (1.275)	3.81 [2.98; 4.86] (1.422)	5.11 [4.25; 6.15] (1.807)	6.61 [5.78; 7.55] (2.645)	11.60 [10.43; 12.89] (2.055)	26.77 [24.60; 29.09] (945)
	Hip revisions, due to infection	3.10 [1.96; 4.87] (526)	3.93 [2.58; 5.97] (469)	3.29 [2.21; 4.87] (635)	5.52 [4.12; 7.37] (669)	4.84 [3.59; 6.52] (733)	9.01 [7.49; 10.83] (960)	16.43 [14.23; 18.94] (720)	34.56 [30.14; 39.43] (226)
	Knee revisions, not due to infection	0.38 [0.14; 1.00] (1.025)	0.94 [0.53; 1.64] (1.159)	0.67 [0.37; 1.20] (1.470)	1.75 [1.20; 2.54] (1.386)	1.51 [1.02; 2.23] (1.478)	2.51 [1.89; 3.34] (1.643)	4.03 [3.00; 5.40] (922)	13.93 [10.71; 18.03] (274)
	Knee revisions, due to infection	2.92 [1.63; 5.21] (345)	2.80 [1.60; 4.88] (382)	2.12 [1.21; 3.71] (500)	2.38 [1.46; 3.85] (589)	7.43 [5.74; 9.60] (616)	5.81 [4.47; 7.53] (812)	13.80 [11.26; 16.85] (452)	22.37 [17.13; 28.91] (136)
Corresponding DESTATIS figures		<0.5	0.57 – 0.87	0.96 – 1.43	1.57 – 2.17	2.32 – 3.21	3.43 – 4.98	5.58 – 8.94	>10.0

Table 54: 1-year mortality after arthroplasty in male patients by age category and type of arthroplasty

Female patients		1-year mortality expressed as a percent of the age group ... (age in years)							
Type of procedure		≤ 54 years	55 to 59	60 to 64	65 to 69	70 to 74	75 to 79	80 to 84	≥85
Primary arthroplasties	Elective THAs with uncemented stems	0.25 [0.19; 0.33] (19.959)	0.25 [0.19; 0.32] (19.075)	0.37 [0.31; 0.44] (26.683)	0.44 [0.37; 0.51] (31.186)	0.67 [0.59; 0.77] (30.438)	1.06 [0.96; 1.18] (29.480)	1.93 [1.73; 2.15] (14.639)	4.27 [3.70; 4.94] (3.518)
	Elective THAs with cemented stems	6.64 [4.46; 9.83] (301)	6.27 [4.49; 8.71] (445)	3.39 [2.54; 4.52] (1.165)	2.38 [1.91; 2.95] (3.030)	1.49 [1.27; 1.76] (8.507)	1.85 [1.67; 2.04] (18.808)	2.37 [2.18; 2.59] (18.657)	5.38 [4.94; 5.86] (7.868)
	Non-elective THAs	4.34 [2.68; 7.00] (318)	4.55 [3.27; 6.31] (623)	5.36 [4.28; 6.69] (1.128)	5.45 [4.58; 6.48] (1.881)	5.46 [4.69; 6.35] (2.393)	7.05 [6.33; 7.85] (3.716)	11.98 [10.99; 13.05] (2.974)	24.42 [22.98; 25.94] (2.144)
	Hemiarthroplasties	21.78 [15.14; 30.75] (78)	26.78 [20.83; 34.02] (112)	26.56 [22.25; 31.53] (219)	21.18 [18.33; 24.41] (487)	21.59 [19.73; 23.60] (1.184)	19.55 [18.49; 20.65] (3.737)	21.14 [20.39; 21.92] (7.536)	32.58 [31.94; 33.22] (12.161)
	Standard TKAs	0.16 [0.11; 0.24] (13.780)	0.24 [0.18; 0.32] (18.491)	0.34 [0.28; 0.42] (26.337)	0.39 [0.33; 0.47] (31.017)	0.52 [0.45; 0.60] (34.567)	0.87 [0.78; 0.96] (40.362)	1.30 [1.17; 1.45] (23.325)	2.47 [2.11; 2.88] (5.475)
	Constrained TKAs	1.37 [0.69; 2.72] (538)	1.39 [0.75; 2.58] (632)	1.29 [0.76; 2.17] (941)	2.13 [1.51; 3.01] (1.338)	2.61 [2.00; 3.42] (1.753)	2.60 [2.06; 3.26] (2.451)	4.27 [3.57; 5.11] (2.332)	8.86 [7.37; 10.63] (941)
	Unicondylar knee arthroplasties	0.09 [0.03; 0.24] (4.257)	0.12 [0.05; 0.28] (3.979)	0.23 [0.13; 0.41] (4.224)	0.22 [0.11; 0.42] (3.750)	0.38 [0.23; 0.64] (3.396)	0.76 [0.51; 1.13] (2.994)	0.70 [0.38; 1.30] (1.325)	1.21 [0.46; 3.20] (274)
	Patellofemoral arthroplasties	0.00 (267)	0.00 (82)	1.16 [0.16; 7.97] (84)	0.00 (22)	0.00 (16)	0.00 (27)	0.00 (13)	0.00 (3)
Revisions	Hip revision, not due to infection	0.85 [0.49; 1.46] (1.422)	1.39 [0.90; 2.15] (1.273)	1.74 [1.25; 2.41] (1.843)	2.51 [1.98; 3.17] (2.359)	2.89 [2.39; 3.50] (3.109)	4.20 [3.72; 4.75] (5.186)	7.53 [6.89; 8.24] (4.875)	20.67 [19.51; 21.88] (3.139)
	Hip revision, due to infection	1.15 [0.48; 2.73] (374)	5.26 [3.46; 7.95] (346)	2.68 [1.65; 4.35] (517)	4.34 [3.09; 6.09] (638)	7.13 [5.72; 8.87] (865)	10.63 [9.21; 12.24] (1.315)	17.15 [15.27; 19.22] (1.026)	31.61 [28.79; 34.63] (572)
	Knee revisions, not due to infection	0.24 [0.10; 0.59] (1.895)	0.37 [0.18; 0.74] (1.980)	0.42 [0.23; 0.76] (2.506)	0.63 [0.39; 0.99] (2.630)	1.42 [1.07; 1.88] (3.128)	1.96 [1.57; 2.44] (3.653)	4.85 [4.10; 5.74] (2.297)	14.42 [12.60; 16.48] (943)
	Knee revisions, due to infection	1.94 [0.93; 4.03] (323)	1.50 [0.68; 3.31] (363)	1.43 [0.72; 2.84] (482)	3.81 [2.65; 5.48] (649)	2.93 [1.96; 4.38] (684)	7.25 [5.82; 9.01] (891)	8.84 [7.14; 10.92] (721)	16.44 [13.00; 20.68] (272)
Corresponding DESTATIS figures		<0.28	0.31 – 0.46	0.51 – 0.73	0.81 – 1.16	1.27 – 1.86	2.03 – 3.12	3.56 – 6.34	>7.33

Table 55: 1-year mortality after arthroplasty in female patients by age category and type of arthroplasty

Mismatch detection for more patient safety

Mismatch detection for more patient safety (I)

- In 2022, the EPRD identified 532 potential mismatch cases in otherwise plausibly documented primary arthroplasties.
- These included 55 THAs where the documented sizes of the head component and the insert or acetabular component (Monobloc) differed. The selected head was too large for the insert or cup in 27 cases and too small in 28 cases:

		Inner diameter of insert/acetabular component				
		22 mm	28 mm	32 mm	36 mm	40 mm
Head size	22 mm		3	1		
	28 mm			8	2	
	32 mm	1	6		13	
	36 mm		1	19		1

Table 56: Number of mismatches due to deviations between head size and inner diameter of insert or cup in 2022

Mismatch detection for more patient safety (II)

- Aim: Prevent mismatch cases by informing hospitals at an early stage about possible problems with component selection

- Currently, the hospitals are informed in two ways:
  - in the case queries provided with the monthly EPRD summary reports
  - since 2019, directly in the data acquisition software

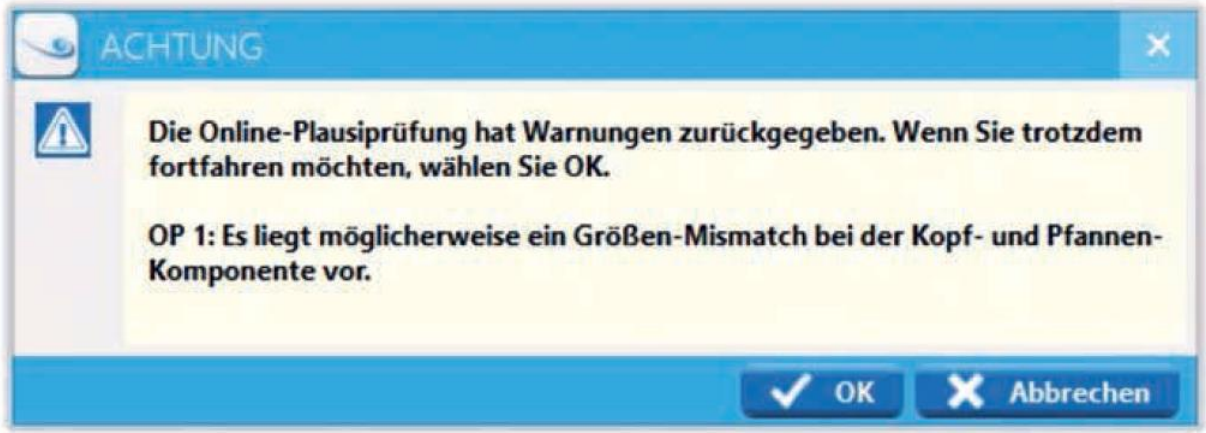
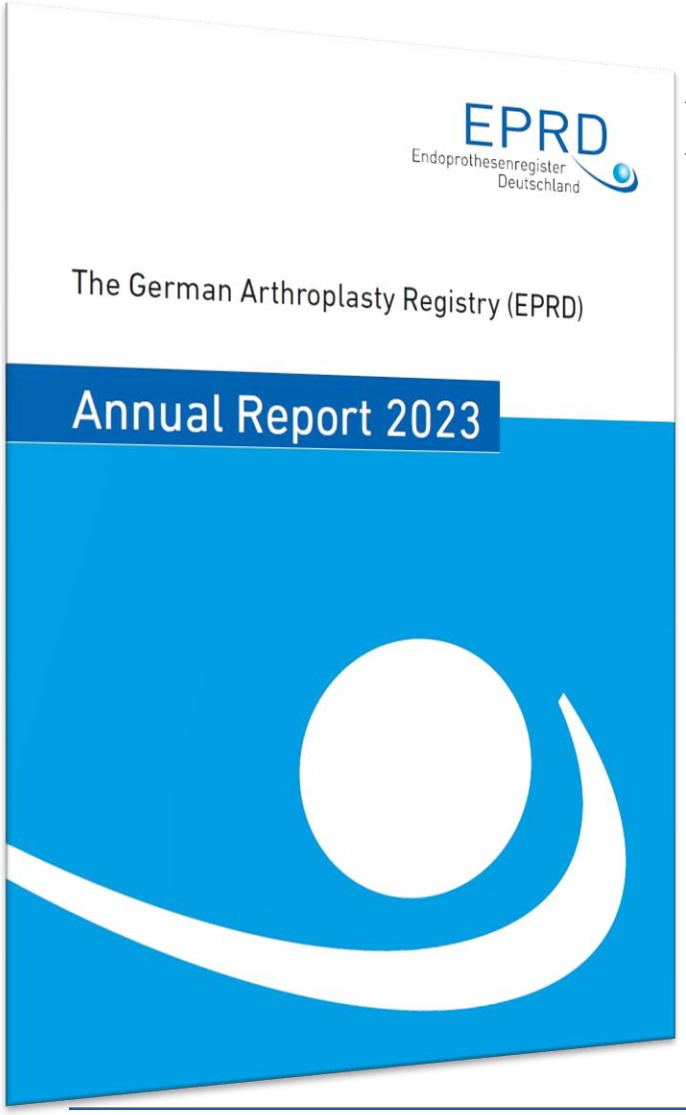


Illustration 5: An EPRD-Edit software mismatch notification during data entry. The text shown is: The online plausibility check has returned warnings. If you still want to continue, select ok. OP 1: There may be a size mismatch in the head and acetabular component.

Contact



- If you have any questions, please contact us at:

EPRD Deutsche Endoprothesenregister gGmbH
Straße des 17. Juni 106-108
10623 Berlin
Phone.: +49 - (0)30 - 340 60 36 40
Fax.: +49 - (0)30 - 340 60 36 41
Email: info@eprd.de
Web: https://www.eprd.de/en