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Secular trends in periprosthetic joint infections following primary hip and knee arthroplasties: A 15-year cohort study from the VINCat Program (2008–2022)

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ABSTRACT

Background: The VINCat program, established in Catalonia, Spain, in 2006, is a comprehensive infection prevention program for healthcare-associated infections. This study aims to analyze long-term trends in periprosthetic joint infections (PJI) following primary hip and knee arthroplasties over 15-year period (2008–2022).

Methods: PJI was defined according to CDC-NHSN criteria and updated in 2016 to incorporate the Musculoskeletal Infection Society classification. Data on PJI following total hip arthroplasty (THA), total knee arthroplasty (TKA), and hip hemiarthroplasty (HHA) were prospectively collected and analyzed across three periods: 2008–2012, 2013–2017, and 2018–2022.

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Results: Sixty-seven hospitals participated in the surveillance, reporting 189,063 procedures, including 61,267 THA (median age: 69 years, 47% female), 115,940 TKA (median age: 73 years, 68% female), and 11,856 HHA (median age: 86 years, 73% females). PJI incidence rates for THA were 0.9%, 1.1%, and 1.2% across the three periods (odds ratio (OR):1.14, 95% CI: 0.96–1.35). For TKA, rates were 0.9%, 1.0%, and 0.9% (OR:0.95, 95% CI: 0.83–1.09). The incidence of HHA-PJI declined from 3.4% to 2.3% and 1.8% (OR:0.77, 95% CI:0.58–1.03). Overall, the most common etiology was coagulase negative staphylococci followed by *Staphylococcus aureus*. PJIs were diagnosed after hospital discharge in 87.1% of THA, 89.6% of TKA, and 73.9% of HHA.

Conclusions: The incidence of PJI remains low despite an aging population undergoing orthopedic surgery, highlighting the effectiveness of current infection prevention strategies. A robust, long-term surveillance system is crucial for monitoring epidemiological trends and guiding the implementation of evidence-based preventive measures.

Palabras clave:
Artroplastia
Infección articular protésica o periprotésica
Sistema de vigilancia epidemiológica
Infecciones nosocomiales
Infecciones asociadas con la atención Sanitaria
Prevención y control

Tendencias seculares en infecciones articulares periprotésicas tras artroplastias primarias de cadera y rodilla: un estudio de cohorte de 15 años del Programa VINCat (2008-2022)

R E S U M E N

Antecedentes: El programa VINCat, establecido en Cataluña, España, en 2006, es un programa integral de prevención de infecciones relacionadas con la atención sanitaria. Este estudio analiza las tendencias a largo plazo de la infección periprotésica (IPP) tras artroplastias primarias de cadera y rodilla durante 15 años (2008-2022) en 67 centros públicos y privados adheridos al programa.

Métodos: La IPP se definió según los criterios CDC-NHSN, actualizados en 2016 para incluir la clasificación de la *Musculoskeletal Infection Society*. Se recopilaron y analizaron datos de IPP tras artroplastia total de cadera (ATC), artroplastia total de rodilla (ATR) y hemiartroplastia de cadera (HAC) en tres períodos: 2008-2012, 2013-2017 y 2018-2022.

Resultados: Participaron 67 hospitales, notificando 189.063 procedimientos: 61.267 ATC (edad mediana: 69 años, 47% mujeres), 115.940 ATR (edad mediana: 73 años, 68% mujeres) y 11.856 HAC (edad mediana: 86 años, 73% mujeres). Las tasas de IPP en ATC fueron del 0,9%, del 1,1% y del 1,2% (OR: 1,14; IC 95%: 0,96-1,35). En ATR, del 0,9%, del 1,0% y del 0,9% (OR: 0,95; IC 95%: 0,83-1,09). En HAC, la incidencia descendió del 3,4% al 2,3% y al 1,8% (OR: 0,77; IC 95%: 0,58-1,03). El principal agente etiológico fue *Staphylococcus* coagulasa-negativo, seguido de *Staphylococcus aureus*. La mayoría de IPP se diagnosticaron tras el alta hospitalaria.

Conclusiones: La incidencia de IPP sigue siendo baja pese al envejecimiento de la población sometida a cirugía ortopédica, lo que subraya la efectividad de las estrategias preventivas. La vigilancia a largo plazo es clave para monitorizar tendencias epidemiológicas y optimizar intervenciones basadas en la evidencia.

Introduction

Although infrequent, periprosthetic joint infections (PJI) are devastating and represent a major healthcare concern due to their preventability and the significant burden they place on patients and healthcare systems.[1,2] PJI often result in prolonged hospital stays, increased healthcare costs, complex treatment pathways, and negatively affects patients' ability to carry out everyday activities.[3–5] Many patients require additional surgeries and extended systemic antibiotic therapy, while in some cases, prosthesis replacement may be the only curative option.[1] Given these challenges, robust surveillance systems, early detection strategies, and targeted preventive measures are crucial to mitigating their impact and improving patient outcomes.

Since 1970, the National Nosocomial Infections Surveillance System (NNIS) has collected and analyzed data on healthcare-associated infections (HAIs) from voluntarily participating U.S. hospitals. One of its most significant findings was that providing feedback to healthcare workers is an effective strategy for reducing HAIs.[6]

The VINCat Program is a nationwide infection prevention and control program of HAI in Catalonia, Spain, established in 2006.[7] Since its inception, it has included surveillance of key surgical procedures, including orthopedic procedures. Currently, the program covers 67 hospitals, primarily within the public national health system, with participation from some private institutions. VINCat uses standardized surveillance methods to track and analyze surgical site infections trends, adjust infection rates for surgical risk, and evaluate the effectiveness of preventive interventions. Within its orthopedic surveillance module, a key objective is monitoring PJI following primary total hip arthroplasty (THA), primary total knee arthroplasty (TKA), and primary hip hemiarthroplasty (HHA).

This study explores long-term trends in PJI following THA, TKA, and HHA over a 15-year period (2008–2022), offering valuable insights into population and infection dynamics. Additionally, it aims to provide benchmarking data for orthopedic services and assist health authorities in defining evidence-based improvement objectives to enhance patient safety and surgical outcomes.

Materials and methods

Participation and study design

The VINCat Program conducts mandatory active, prospective surveillance of PJI in primary THA and TKA, while surveillance of primary HHA was voluntary. Surveillance is carried out continuously across 67 public and private hospitals in Catalonia, Spain by members of hospital infection control teams (ICT). Participating hospitals were categorized based on bed capacity: (a) large hospitals (>500 beds), (b) medium hospitals (200–500 beds), (c) small hospitals (<200 beds). Hospitals performing more than 100 procedures per year per category can choose to report either the first 100 consecutive cases or all procedures throughout the year. For hospitals performing fewer than 100 interventions, reporting all cases is mandatory, while hospitals conducting fewer than 10 procedures annually were excluded from analysis.

Inclusion criteria were restricted to patients receiving their first prosthetic replacement. Exclusion criteria included patients treated in hospitals performing fewer than 10 annual procedures of the same type and cases with incomplete or unreliable 90-day postoperative follow-up surveillance. Collected demographic and clinical data included data of procedure, age and gender, type of surgical procedure, American Society of Anesthesiologists (ASA) classification, NNISS operative risk score, adequacy of antibiotic surgical prophylaxis, surgical duration. The study analyzed data over three 5-year periods: 2008–2012, 2013–2017, 2018–2022.

Diagnostic criteria for PJI and surveillance period

- From 2008 to 2016, the CDC-NHSN for organ/space surgical site infection definition at that time was applied.[8]
- Since 2016, the updated 2015 CDC-NHSN criteria, incorporating the Musculoskeletal Infection Society (MSIS) definition, have been used.[9]
- If PJI symptoms emerge within the 90-day surveillance period, the symptom onset date takes precedence, even if the definitive diagnosis is made later.
- Surveillance must not be interrupted before day 90, except in cases of intraoperative death during the initial surgery

A detailed explanation of the standardization of surveillance across hospitals, including in-hospital and post-discharge monitoring, as well as data quality control during the study period, is provided in the Supplementary Material. To ensure methodological consistency, ICT members can consult experts from the VINCat Coordination Center via real-time email discussions for classification and diagnostic guidance. The surveillance process and its outcomes are periodically validated by trained researchers with expertise in epidemiological surveillance methodology.[10]

Interventions implemented during the study period

A detailed description of the interventions implemented during the study period is available in the Supplementary Material.

Ethical issues

Data extraction was approved by the VINCat Institutional Research Committee, and the study was approved by the Research Ethics Committee of the University Hospital of Bellvitge, Barcelona (Ref. PR066/18). The need for informed consent and for the provision of an information sheet was waived because the data were collected routinely as part of hospital surveillance and quality improvement practices. Anonymity and data confidentiality (access to records, data coding and archiving of information) were maintained throughout the research process. Confidential patient information was protected in accordance with European regulations. The study is reported in accordance with the STROCSS 2021 criteria.[11]

Statistical analysis

Categorical variables were summarized as frequencies and proportions, while continuous variables were presented as medians with interquartile ranges (IQR) or means with standard deviations (SD), depending on data distribution. Infection rates were expressed as cumulative incidence (percentage of SSIs per total procedures).

Analyses were stratified by 5-year periods, risk index category, and hospital group. Differences in percentages were assessed using chi-square or Fisher's exact tests, while continuous variables were compared using one-way ANOVA or Kruskal–Wallis tests, as appropriate. Odds ratios (OR) were calculated to compare SSI likelihood between time periods, using the earlier of the two as the reference.

Trend analysis included Spearman correlation (rho) to evaluate relationships between infection rates, 30-day mortality, length of stay (LOS), and post-discharge SSIs. To assess ordered trends, Jonckheere's trend test and the Cochran–Armitage test were applied. LOESS smoothing was used to enhance graphical data visualization.

All statistical tests were conducted at a 0.05 significance level using R statistical software (version 4.2.2, The R Foundation, Vienna, Austria).

Results

Demographic and surgical characteristics

The demographic and surgical characteristics of 189,063 procedures performed during the study period (2008–2022), including 61,267 THA, 115,940 TKA, and 11,856 HHA is summarized in Table 1. Over time, several trends were observed; for THA and TKA, the median patient age decreased, while the proportion of female patients declined. In contrast, HHA patients became progressively older, while the proportion of female patients remained high. Regarding surgical duration, a significant reduction was observed across all procedures. Additionally, the proportion of cases classified as NNISS risk index ≥ 1 declined in THA and TKA, while remaining stable for HHA. Compliance with adequate surgical antibiotic prophylaxis decreased over time in all three procedures.

Trends in periprosthetic joint infection rates according to surgical procedure

The incidence of PJIs for THA, TKA, and HHA over the three study periods is displayed in Table 2. The data show that PJI incidence in THA increased slightly over time, from 0.9% in Period 1 to 1.2% in Period 3. In contrast, PJI rates in TKA remained relatively stable, at 0.9% in both Period 1 and Period 3. Notably HHA-PJI incidence showed a significant decline, decreasing from 3.4% in Period 1 to 1.8% in Period 3.

Fig. 1 illustrates the annual evolution of PJI rates per 100 procedures from 2008 to 2022, further confirming the trends observed in Table 2. The incidence of PJI in HHA exhibited a significant downward trend, with rates declining sharply after 2012. Conversely, PJI rates in THA showed an increasing trend over time, particularly from 2015 onwards while in TKA, the infection rates remained stable.

Table 3 presents PJI incidence stratified by hospital size. In THA, PJI incidence was highest in large hospitals (1.7%) but increased significantly in medium-sized hospitals, rising from 0.8% in Period

Table 1
Demographic data of patients and surgical characteristics of the procedures included in the orthopedic surgery surveillance module.

Characteristics Total hip arthroplasty (THA)	Overall (2008–2022) N = 61,267	Period 1 (2008–2012) N = 15,583	Period 2 (2013–2017) N = 21,830	Period 3 (2018–2022) N = 23,854	*p*-Value[a]
Participating hospitals, *n*					
Number of hospitals	67	58	63	64	
Large	9	9	9	9	
Medium	18	16	17	17	
Small	40	33	37	38	
Age, median (IQR)	68.84 (59.43–76.58)	70.68 (61.07–77.57)	68.75 (59.34–76.59)	67.75 (58.62–75.68)	<0.001[b]
Female sex, n (%)	28,661 (46.78)	7901 (50.7)	10,117 (46.34)	10,643 (44.62)	<0.001
Duration of intervention (minutes), median (IQR)	90 (72–110)	94 (74–117)	90 (74–110)	85 (69–102)	<0.001
Adequate prophylaxis, n (%)	53,437 (87.22)	14,418 (92.52)	18,637 (85.37)	20,382 (85.44)	<0.001
ASA ≥ II, n (%)	55,267 (90.21)	14,156 (90.84)	19,636 (89.95)	21,475 (90.03)	0.008
NNISS ≥ 1, n (%)	20,940 (34.18)	6061 (38.89)	7591 (34.77)	7288 (30.55)	<0.001[c]
Total knee arthroplasty (TKA)	N = 115,940	N = 31,626	N = 42,793	N = 41,521	
Participating hospitals, *n*					
Number of hospitals	67	58	63	64	
Large	9	9	9	9	
Medium	18	16	17	17	
Small	40	33	37	38	
Age, median (IQR)	72.76 (66.91–77.78)	73.24 (67.27–77.79)	72.59 (67.05–77.94)	72.58 (66.42–77.6)	0.003[b]
Female sex, n (%)	79,275 (68.38)	22,433 (70.93)	29,416 (68.74)	27,426 (66.05)	<0.001
Duration of intervention (minutes), median (IQR)	90 (74–105)	94 (76–113)	89 (74–105)	85 (72–103)	<0.001
Adequate prophylaxis, n (%)	103,235 (89.04)	29,567 (93.49)	37,377 (87.34)	36,291 (87.4)	<0.001
ASA ≥ II, n (%)	110,586 (95.38)	30,152 (95.34)	40,848 (95.45)	39,586 (95.34)	0.665
NNISS ≥ 1, n (%)	38,911 (33.56)	11,611 (36.71)	14,027 (32.78)	13,273 (31.97)	<0.001[c]
Hip hemiarthroplasty (HHA)	N = 11,856	N = 2323	N = 4607	N = 4926	
Participating hospitals, *n*					
Number of hospitals	25	12	19	21	
Large	5	3	4	5	
Medium	7	3	5	7	
Small	13	6	10	9	
Age, median (IQR)	86.3 (81.56–90.37)	85.13 (80.32–89.23)	86.21 (81.51–90.35)	87.01 (82.37–90.83)	<0.001[b]
Female sex, n (%)	8644 (72.91)	1737 (74.77)	3369 (73.13)	3538 (71.82)	0.028
Duration of intervention (minutes), median (IQR)	74 (58–94)	80 (60–99)	69 (54–90)	74 (58–92)	<0.001
Adequate prophylaxis, n (%)	9598 (80.95)	2036 (87.65)	3648 (79.18)	3914 (79.46)	<0.001
ASA ≥ II, n (%)	11,482 (96.85)	2287 (98.45)	4447 (96.53)	4748 (96.39)	<0.001
NNISS ≥ 1, n (%)	8411 (70.94)	1667 (71.76)	3233 (70.18)	3511 (71.27)	0.971[c]

Large: hospitals with >500 beds; Medium: hospitals with 200–500 beds; Small: hospitals with ≤200 beds; IQR: Interquartile Range; ASA: American Society of Anesthesiologists; NNIS: National nosocomial infections surveillance system index. Adequate prophylaxis: type of antibiotic according to local guidelines, in addition to correct timing, dosage and duration.

[a] Kruskal–Wallis rank sum test; Pearson Chi-squared test.

[b] Jonckheere–Terpstra test for trend.

[c] Cochran–Armitage test for trend.

Table 2
Trends in periprosthetic joint infections rates (2008–2022).

Primary outcomes	Overall	Period 1	Period 2	Period 3	OR (95% CI)[a]
Total hip arthroplasty (THA)	N = 61,267	N = 15,583	N = 21,830	N = 23,854	
PJI, *n* (%)	692 (1.13)	148 (0.95)	243 (1.11)	301 (1.26)	1.14 (0.96–1.35)
Total knee arthroplasty (TKA)	N = 115,940	N = 31,626	N = 42,793	N = 41,521	
PJI, *n* (%)	1126 (0.97)	295 (0.93)	433 (1.01)	398 (0.96)	0.95 (0.83–1.09)
Hip hemiarthroplasty (HHA)	N = 11,856	N = 2323	N = 4607	N = 4926	
PJI, *n* (%)	277 (2.34)	81 (3.49)	107 (2.32)	89 (1.81)	0.77 (0.58–1.03)

PJI: periprosthetic joint infection; OR: odds ratio; CI: confidence interval.

[a] The OR are computed comparing Period 3 (2018–2022) to the reference period, Period 2 (2013–2017).

2 to 1.3% in Period 3, while small hospitals maintained stable PJI rates over time. In TKA, PJI rates remained stable across all hospital sizes, with no significant changes. In HHA, PJI rates declined in large and medium hospitals, whereas rates remained stable in small hospitals. Other outcomes, including length of hospital stay, 30-days and 90-days mortality, and rates of PJI after discharge are detailed in supplementary material and in table* S5.

Microbiological profile of periprosthetic joint infections

The microbiological distribution of pathogens isolated from PJIs in THA, TKA, and HHA across the study periods is presented in Table 4. The analysis shows that gram-positive bacteria remain the predominant causative agents across all procedures, although the proportion of gram-negative bacteria is more relevant in HHA PJIs.

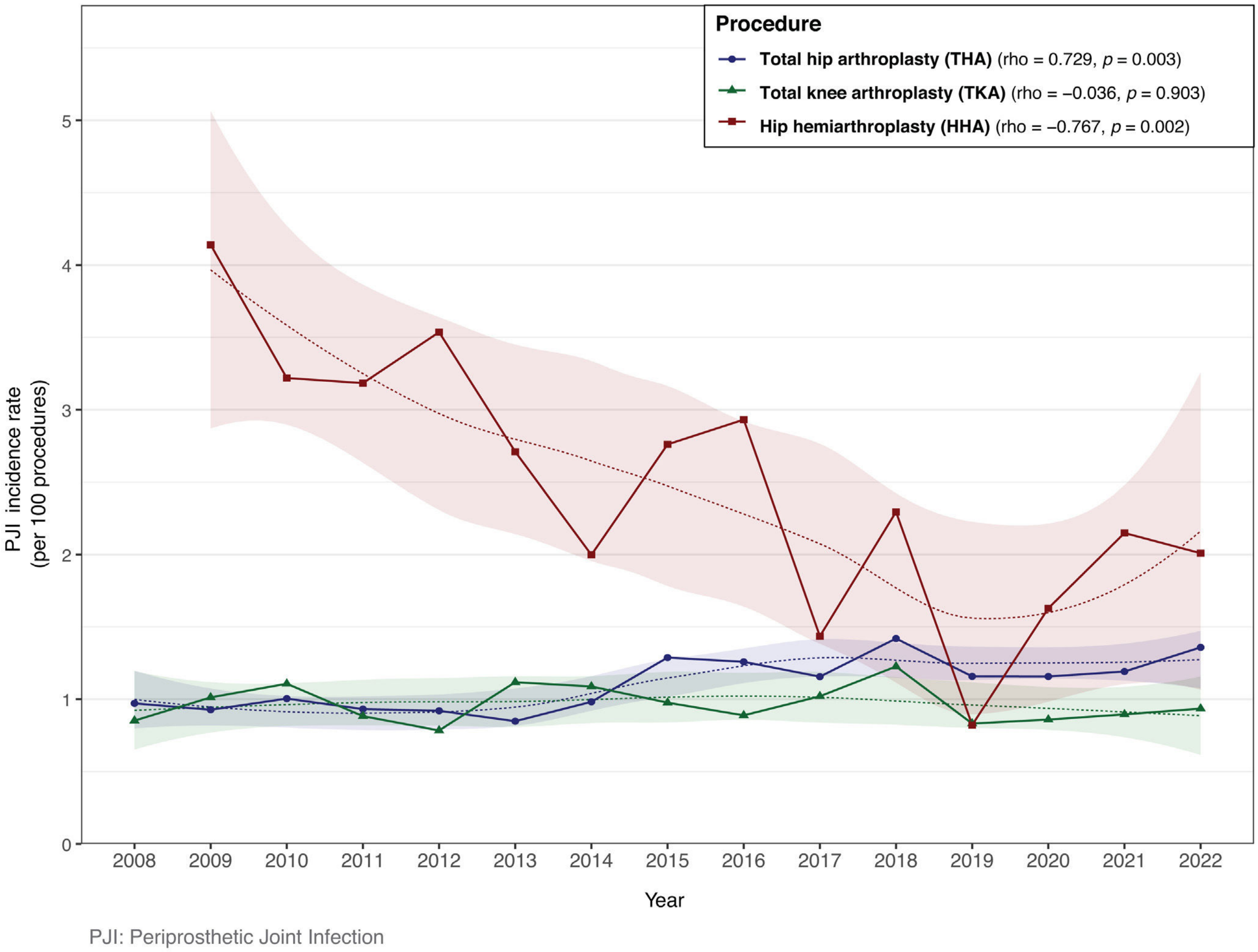

Fig. 1. Trends in periprosthetic joint infection rates during the surveillance period (2008–2022).

Notably, polymicrobial infections were highly prevalent, accounting for 20–25% of cases across all three procedures.

In THA-PJIs, gram-positive bacteria accounted for 61.3% of isolates, with Coagulase-Negative Staphylococci (CoNS) and *Staphylococcus aureus* being the most frequently identified microorganisms. The proportion of gram-negative bacteria was 31.8%, with the most common species being *Pseudomonas aeruginosa*, *Escherichia coli*, and *Enterobacter cloacae*. No significant variations were observed across study periods. For TKA-PJIs, gram-positive bacteria represented 66.3% of isolates, with *S. aureus* and CoNS as the leading causative agents. The incidence of gram-negative bacteria was 24.4%, with *E. cloacae*, *E. coli*, and *P. aeruginosa* being the most prevalent species. No statistically significant trends were noted over time. In contrast, HHA-PJIs exhibited a higher proportion of gram-negative bacteria (42.1%) compared to THA-PJIs and TKA-PJIs, with *P. aeruginosa* and *E. coli* being the most frequently identified species. Gram-positive bacteria accounted for 53% of isolates, with *S. aureus* and CoNS as the predominant species. While no statistically significant trends were observed, there was a slight declining trend in gram-positive bacteria over time, particularly in *S. aureus* isolates.

Discussion

This study provides one of the longest follow-ups and largest patient cohorts analyzed in the context of PJIs surveillance in hip and knee primary arthroplasty, following to a standardized and widely accepted PJI definition.[9] Our findings reveal over 15 years, relatively stable PJI rates for hip and knee arthroplasty and a significant reduction in hemiarthroplasty-PJI rates.

Throughout the study period, we perceived significant differences in the baseline characteristics of patients undergoing the three types of arthroplasty surveilled. Patients undergoing THA were younger and predominantly male compared to those receiving TKA or HHA. These differences became more pronounced over time, likely reflecting demographic shifts in Catalonia over the past two decades. In contrast, patients undergoing HHA, which is typically an emergency or urgent deferred procedure, represented an older and predominantly female population, likely with a higher burden of comorbidities. This distinction in patient profiles underscores the differing clinical and epidemiological contexts of these procedures, with THA and TKA increasingly performed in a younger, lower-risk population, while HHA remains associated with older, more vulnerable patients requiring urgent surgical intervention. The demographic profiles observed in our study for THA, TKA, and HHA are similar to those reported in other published cohorts.[12,13] Interestingly, a reduction in the duration of surgery in all three procedures was observed, probably related to the progressive increase in the number of procedures performed per year in all the hospitals and the resulting technical improvements and finally, the decrease in antibiotic prophylaxis adherence was associated with the stricter criteria implemented by the VINCat Program in 2013 as explained in supplementary material.

Table 3
Incidence rates of periprosthetic joint infections according to procedure and hospital size.

Microorganism	Overall, *n* (%)	Period 1, *n* (%)	Period 2, *n* (%)	Period 3, *n* (%)	*p*-Value[a]
THA-PJIs, N	692	148	243	301	
Total number of isolates, N	794	164	275	355	
Gram-positive bacteria	487 (61.34)	101 (61.59)	169 (61.45)	217 (61.13)	0.994
CoNS	228 (28.72)	42 (25.61)	81 (29.45)	105 (29.58)	0.614
S. aureus	185 (23.3)	45 (27.44)	61 (22.18)	79 (22.25)	0.371
Enterococcus spp.	39 (4.91)	8 (4.88)	12 (4.36)	19 (5.35)	0.850
Gram-negative bacteria	253 (31.86)	48 (29.27)	86 (31.27)	119 (33.52)	0.606
Pseudomonas aeruginosa	61 (7.68)	7 (4.27)	21 (7.64)	33 (9.3)	0.135
Escherichia coli	45 (5.67)	14 (8.54)	10 (3.64)	21 (5.92)	0.096
Enterobacter cloacae	35 (4.41)	11 (6.71)	9 (3.27)	15 (4.23)	0.231
Proteus mirabilis	35 (4.41)	3 (1.83)	15 (5.45)	17 (4.79)	0.164
Polymicrobial infections	158 (22.83)	32 (21.62)	51 (20.98)	75 (24.91)	0.513
TKA-PJIs, N	1126	295	433	398	
Total number of isolates, N	1252	342	483	427	
Gram-positive bacteria	831 (66.37)	231 (67.54)	313 (64.8)	287 (67.21)	0.645
S. aureus	399 (31.87)	106 (30.99)	154 (31.88)	139 (32.55)	0.899
CoNS	328 (26.2)	94 (27.49)	122 (25.26)	112 (26.23)	0.773
Enterococcus spp.	63 (5.03)	21 (6.14)	22 (4.55)	20 (4.68)	0.544
Gram-negative bacteria	306 (24.44)	78 (22.81)	130 (26.92)	98 (22.95)	0.271
Enterobacter cloacae	72 (5.75)	15 (4.39)	34 (7.04)	23 (5.39)	0.252
Escherichia coli	56 (4.47)	20 (5.85)	18 (3.73)	18 (4.22)	0.331
Pseudomonas aeruginosa	53 (4.23)	15 (4.39)	24 (4.97)	14 (3.28)	0.444
Proteus mirabilis	40 (3.19)	12 (3.51)	15 (3.11)	13 (3.04)	0.927
Polymicrobial infections	234 (20.78)	75 (25.42)	90 (20.78)	69 (17.33)	0.034
HHA-PJIs, N	277	81	107	89	
Total number of isolates, N	330	99	127	104	
Gram-positive bacteria	175 (53.03)	62 (62.63)	61 (48.03)	52 (50)	0.070
S. aureus	86 (26.06)	33 (33.33)	30 (23.62)	23 (22.12)	0.139
CoNS	70 (21.21)	22 (22.22)	26 (20.47)	22 (21.15)	0.950
Enterococcus spp.	17 (5.15)	7 (7.07)	5 (3.94)	5 (4.81)	0.561
Gram-negative bacteria	139 (42.12)	35 (35.35)	57 (44.88)	47 (45.19)	0.265
Pseudomonas aeruginosa	40 (12.12)	11 (11.11)	17 (13.39)	12 (11.54)	0.853
Escherichia coli	32 (9.7)	7 (7.07)	16 (12.6)	9 (8.65)	0.345
Klebsiella pneumoniae	24 (7.27)	3 (3.03)	9 (7.09)	12 (11.54)	0.067
Proteus mirabilis	13 (3.94)	3 (3.03)	6 (4.72)	4 (3.85)	0.937
Enterobacter cloacae	9 (2.73)	5 (5.05)	3 (2.36)	1 (0.96)	0.198
Morganella morganii	7 (2.12)	1 (1.01)	3 (2.36)	3 (2.88)	0.717
Polymicrobial infections	70 (25.27)	21 (25.92)	28 (26.16)	21 (23.59)	0.906

The most prevalent families and microorganisms for each surgical procedure have been selected, and the percentages are calculated based on the total number of isolates for each procedure.
THA: total hip arthroplasty; TKA: total knee arthroplasty; HHA: hip hemiarthroplasty; PJI: periprosthetic joint infection; CoNS: Coagulase-Negative Staphylococci; GPB: gram-positive bacteria; GNB: gram-negative bacteria.
[a] Pearson Chi-squared test or Fisher exact test.

Table 4
Etiology of periprosthetic joint infections according to procedure.

Hospital size	Overall *n* PJIs, (%)	Period 1 *n* PJIs, (%)	Period 2 *n* PJIs, (%)	Period 3 *n* PJIs, (%)	OR (95% CI)[a]
Total hip arthroplasty (THA)					
Large	255 (1.7)	65 (1.4)	100 (2)	90 (1.7)	0.85 (0.64–1.14)
Medium	233 (1)	37 (0.7)	68 (0.8)	128 (1.3)	1.70 (1.27–2.30)
Small	204 (0.9)	46 (0.8)	75 (1)	83 (1)	1.00 (0.73–1.38)
Total knee arthroplasty (TKA)					
Large	330 (1.4)	92 (1.2)	124 (1.5)	114 (1.4)	0.92 (0.71–1.19)
Medium	482 (1.1)	134 (1.2)	180 (1)	168 (1)	0.99 (0.80–1.22)
Small	314 (0.7)	69 (0.5)	129 (0.8)	116 (0.7)	0.92 (0.71–1.18)
Hip hemiarthroplasty (HHA)					
Large	166 (2.9)	59 (4)	67 (3.1)	40 (1.9)	0.61 (0.41–0.90)
Medium	86 (2.4)	20 (4)	24 (2.1)	42 (2.1)	1.03 (0.62–1.73)
Small	25 (1)	2 (0.6)	16 (1.3)	7 (0.8)	0.68 (0.26–1.62)

OR: odds ratio; CI: confidence interval.
[a] The OR are computed comparing Period 3 (2018–2022) to the reference period, Period 2 (2013–2017).

The incidence of PJI varies depending on the joint involved. Reported rates following THA and TKA range from 0.5% to 1% and 0.25% to 2%, respectively, although variations exist across studies due to differences in patient populations, diagnostic criteria, and follow-up duration.[14,3] In our series, the number of THA and TKA procedures has increased over time and is likely to continue rising. While standardized criteria for PJI incidence are lacking, our findings remain consistent with previously published reports. The significant decline in HHA infection rates during the study period further underscores the importance of the VINCat program's feedback to hospital professionals and managers.[15]

Regarding the etiology of primary THA and TKA, CNS and *S. aureus* were the predominant pathogens, with polymicrobial infections accounting for 20%–25% of cases. These findings are consistent with most published series.[16,17] However, the notable influence of *P. aeruginosa* among patients with Gram-negative infections is worth highlighting. The presence of Gram-negative pathogens in PJI underscores the need for targeted preventive measures, including strict skin disinfection, minimizing water exposure during surgical wound care, and effective control of water reservoirs—particularly given the rising incidence observed in HHA. Regarding additional infection prevention strategies, the VINCat program implemented *S. aureus* decolonization for carriers prior to arthroplasty in 2018; however, compliance could not be accurately assessed. Finally, although our sample size is too small to draw definitive conclusions, PJI appears to increase mortality risk within the first year after revision surgery.[18]

The study has the limitations inherent in studies of large databases that are conducted with the intention of carrying out epidemiological surveillance of health care related infections. The introduction of the new definition of PJI by the Musculoskeletal Infection Society is very relevant. However, the CDC-NHSN criteria for organ-space infections, applied prior to the new definition, largely corresponded to PJI. Therefore, they do not compromise the validity of our surveillance data. Finally, the reduction of the surveillance period for prosthetic surgeries from 365 to 90 days, implemented in VINCat and most surveillance systems worldwide around 2015, difficult trends interpretation. This change likely leads to an underestimation of incidence rates of varying. Excluding late infections may contribute to a relative decrease in gram-positive cocci infections.

In conclusion, a robust and well-established PJI surveillance program is an essential tool for understanding the current epidemiological landscape and guiding the implementation of effective preventive interventions.

Publishing ethics

The study was conducted by the coordination team of the VINCat Orthopedic Surgery Module as a performance improvement project.

The study complied with the principles of the Declaration of Helsinki, with international human rights, and with the legislation regulating biomedicine and personal data protection. All data were treated as confidential, and records were accessed anonymously.

This study was approved by the Ethics Committee of Bellvitge Hospital (Ref. PR066/18).

Patient data were anonymized, and the requirement for informed consent was waived by the Ethics Committee for Clinical Research. The study is reported in accordance with the STROCSS 2021 criteria.

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Conflicts of interest

All authors declare no conflict of interest relevant to this article. All authors submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and the conflicts that the editors consider relevant to this work are disclosed here.

Data availability statement

Restrictions apply to the availability of these data, which belong to a national database and are not publicly available. Data were obtained from VINCat and are only available with the permission of the VINCat Technical Committee.

This article is our original work, has not been previously published, and is not under consideration elsewhere. All named authors are appropriate co-authors, and have seen and agreed to the submitted version of the paper.

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Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.eimc.2025.02.007.

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