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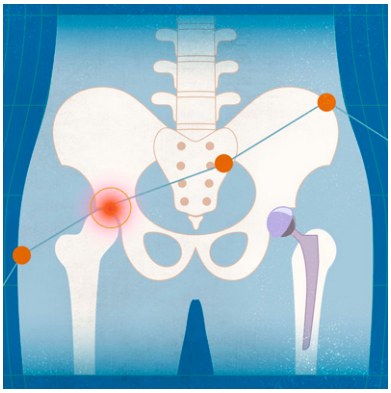

Patient Pathway Comparison for Total Hip Replacement in the United States and Germany — Why the Payment Model Matters

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As developed countries are faced with both the challenge of rising health care costs and the quest for improved medical outcomes, cross-global learnings can illuminate advances in medical best practices as well as the incentive system that leads to reduced costs and improved patient outcomes. Using the example of elective primary total hip replacements (THRs) for osteoarthritis — one of the most common elective surgical procedures in Organisation for Economic Co-operation and Development countries — the authors illustrate differences in clinical and financial practices between a capitation-based payment model used by Kaiser Permanente, a private, integrated health system in the United States, and a fee-for-service model used by the AOK Federation, a not-for-profit health insurance system that comprises 11 public health insurance plans with about 27 million insurees that is representative of Germany's public health care system. The authors also shed some light on the different incentive structures and how they contribute to Kaiser Permanente achieving significantly better medical outcomes while using notably fewer resources than its counterparts in Germany. Applying Kaiser Permanente's clinical

practices for its patients with THRs, Germany would be able to increase quality of care and reduce the number of inpatient hospital days by more than 1.5 million as well as the number of postacute care inpatient days by 3.5 million per annum.

Affecting more than 240 million people worldwide and an estimated 32 million in the United States, osteoarthritis is the most prevalent chronic joint disease in the world.[1,2] In 2018, when Germany's population was about 83 million, the number of sick-leave days associated with osteoarthritis of the hip amounted to 3,490,467; assuming a 5-day work week, that amounts to more than 13,000 lost years of work, which illustrates only one part of the socioeconomic burden of this disease.[3] Osteoarthritis is also one of the leading causes for elective surgeries. With 315 hip replacements per 100,000 inhabitants in 2019, Germany had the highest rate of total hip replacements (THRs) in the Organisation for Economic Co-operation and Development (OECD) countries, which are generally considered developed countries with high Human Development Index scores.[4] By comparison, based on 2013 data when the average for OECD countries was 162 per 100,000 population, although the United States was above the OECD average with 204 THRs per 100,000 inhabitants, Germany was much higher at 283 per 100,000.[5] The number of osteoarthritis-related hip and knee replacements is expected to increase in the coming years across all OECD countries (an organization of high-income, market-based economies that collaborates to develop policy standards to promote sustainable economic growth[6]); contributing factors include aging populations, obesity, physical inactivity, and smoking.[7] This will put an increasing financial burden on countries and health systems, making it worthwhile to explore differences in incidence rates and clinical practices among OECD countries to reduce hospital costs and improve patients' outcomes.

In the United States, integrated care organizations that use capitation payment models have long been regarded as spearheading innovation in health care delivery. Kaiser Permanente is one of the nation's largest nonprofit integrated health care delivery systems, serving more than 12.6 million members across eight geographic regions and the District of Columbia. Kaiser Permanente, which reported 2022 operating revenue of $95.4 billion, includes Kaiser Foundation Health Plan, Inc., Kaiser Foundation Hospitals, and the Permanente Medical Groups. Each entity shares responsibility for providing medical, hospital, and respective business management services.

Kaiser Foundation Health Plan, Inc. is licensed as a health care service plan, carrying the insurance for its members. For this purpose, it contracts with employers and individuals as well as with government programs such as Medicare and Medicaid. To provide or arrange for the provision of medical services for the insurees, the Kaiser Foundation Health Plan contracts with Kaiser Foundation Hospitals and the Permanente Medical Groups. Kaiser Foundation Hospitals owns and operates 39 community hospitals and 737 medical offices and outpatient facilities and provides or arranges for hospital and other facility services. The Permanente Medical Groups are self-governed, physician-led, prepaid, multispecialty medical groups composed of more than 23,000 physicians. The Permanente Medical Groups have mutual exclusivity contracts with the

Kaiser Foundation Health Plan to provide care for all clinical specialties in the Kaiser Foundation Hospitals. They are responsible for all clinical care decisions, and thus no prior authorization is needed from Kaiser Foundation Health Plan or Kaiser Foundation Hospitals to support patient-centered and physician-led care. To perform these services, the Permanente Medical Groups receive a capitated payment from which they finance the complete spectrum of care, including inpatient hospital care, ambulatory care, preventive care, postacute care, and medications. The physicians are employees of the medical group and paid a fixed salary as well as incentive payments based on various factors, such as quality of care and patient satisfaction as well as the financial performance of the respective medical group and the Kaiser Foundation Health Plan.

Combining health insurance and a care delivery system gives Kaiser Permanente an incentive to continually innovate care delivery for its members to achieve the quadruple aim of improving the patient's experience and outcome of care, the provider's experience of care delivery, the health of populations, and the cost of care delivery.[8] To this end, Kaiser Permanente has developed an elaborate system to measure and improve care for its members while at the same time reducing health care costs.

The German public health care system is characterized by a strong divide between health care providers and health insurance plans as well as high fragmentation among both the providers and the insurance plans. On the health insurance side, the dominant systems are 96 statutory public health insurance plans, which cover about 90% of the German population (i.e., 73 million of about 83 million people as of January 2023).[9] These wage tax–supported plans are administered by competing nonprofit organizations. Covered members of these public health insurance plans enjoy free and universal access to health care, with little to no copayment at the point of care.[10] Membership to any of the 96 statutory health insurances is open to anyone regardless of income, age, or comorbidities. The insurance package is the same for all insurees and does not differ significantly among the different public health plans. Health insurance contributions are shared by employer and employee. Although it is compulsory to have health insurance, it is possible to opt out of the public insurance system and choose a private health insurance plan if predefined income thresholds are met. In 2022, about 8.7% of the German population had private health insurance coverage.[11]

Ambulatory care, covering both primary care and specialist care, is provided in Germany by about 150,000 physicians, of whom 54% work in single-physician practices and 32% work in two-physician practices; only 14% work in larger health centers.[12] Ambulatory care physicians are reimbursed based on a national uniform fee-for-service scheme; the volume is capped on a regional level to disincentivize excessive expansion of care episodes. As a result, the ambulatory care physicians compete for patient head count within that cap and generally limit the time spent with each patient.

Inpatient care is provided by 1,887 hospitals with a total of 483,606 licensed beds.[13] The number of beds in Germany is considerably higher than the per capita average among OECD countries (8.0 per 1,000 for Germany and 2.9 per 1,000 for the United States, with an average of 5.1 per 1,000 for OECD countries[14]) and is widely considered to reflect an overcapacity.[15] Bed occupancy

rates, affected by Covid-19, had dropped to 68.2% in 2021.[16] However, even before the pandemic, in 2018, bed occupancy was less than 80% in Germany.[17] There are 65% more beds per capita than the European Union (EU) average, and the number of bed days per capita is 70% higher than the average of comparable EU countries.[18] Hospital services are paid for on a diagnosis-related group (DRG) basis per admission, giving hospitals the incentive to optimize volume over time.[19] Postacute care is predominantly conducted in inpatient care facilities. It is funded by the health insurance if the patient has already reached retirement age. If the patient has not reached retirement age, postacute care is funded by the public pension fund. The dominant payment mechanism is a day rate based on an agreed average length of stay (LOS) per diagnosis or on a case basis.[20] Structurally, there is only little cross-sector integration on the provider side in Germany.[15]

> *"The Permanente Medical Groups receive a capitated payment from which they finance the complete spectrum of care, including inpatient hospital care, ambulatory care, preventive care, postacute care, and medications."*

Intervention

For the purpose of the current study, we solely examined elective primary hip replacements for patients affected by osteoarthritis including the International Classification of Diseases (ICD-10) diagnosis codes M16.0, M16.1, M16.2, M16.3, M16.6, M16.7, and M16.9. To minimize variances and produce a homogeneous population of patients for comparison between Germany and the United States, we excluded THR for patients with osteonecrosis/avascular necrosis, posttraumatic arthritis, inflammatory arthritis, rheumatoid arthritis, and fracture-related replacements. Revision operations were also excluded. Our definition focuses on a subset of patients in the Kaiser Permanente National Total Joint Replacement Registry as well as a subset of the German definition of the "Qualitätssicherung mit Routinedaten" criteria for "Implantation einer Hüftgelenks-Endoprothese bei Coxarthrose."[21,22] Independent experts from the German Arthroplasty Registry validated the matching of both populations on the basis of the coding for the conducted procedure together with the inclusion and exclusion criteria.

To compare the quality of care, we used the hospital readmission rate 30 days' postdischarge and the revision rate after 365 days. Both measures are widely accepted as quality-of-care markers for total joint replacements (TJRs).[23] For both populations, our 30-day readmission rate does not differentiate if the readmission was based on the original procedure or was completely unrelated to it. The readmission rate includes both planned and unplanned stays. Revisions were defined as operations during which at least one part of the prothesis was removed.

Comorbidities affect the outcomes of THR and, as such, can increase the LOS and the short-term risk of hospital readmission as well as the long-term risk of revision surgery, with a positive association between the likelihood of revision after 1 year and the number of chronic

comorbidities.[24,25] The Elixhauser Comorbidity Index (EI) was used to compare both populations with respect to the load of comorbidities. The EI, developed by the Agency for Healthcare Research and Quality, is regarded as one of the most widely used measures to compare patient populations in health service research in general and specifically in patient populations for outcome analysis of surgical procedures. The 31 conditions reflected in the EI include hypertension, obesity, or diabetes — but not osteoarthritis.[26] The EI has been shown to be a good predictor for THR outcomes.[25-27] Comorbidities from the index were prevalent whenever a corresponding ICD-10 code was documented for the case.

For the purpose of this study, the German data were obtained from the AOK health insurance system, comprising 11 regional statutory health insurance plans covering a total of 26.5 million individuals across Germany, which reflects about 32% of the German population.[28] In Germany, all diagnoses, outcomes, and procedures have to be reported to the statutory health insurance entity for billing purposes. Therefore, the AOK system's administrative claims data include detailed information on patient characteristics, such as age, sex, length of hospital stay, diagnoses, comorbidities, operation procedure codes, and discharge type. Diagnoses are coded according to the German Modification of the ICD-10, and procedures are coded according to the Operation and Procedure (OPS) codes. Given that hospitals report these data for billing purposes, the reported data are checked and verified from both the hospitals and the health insurance entity. Consequently, it can be inferred that the data are accurate.

At Kaiser Permanente, standardized operative data for TJR are captured in the Kaiser Permanente National Total Joint Replacement Registry by the surgeon at the time of surgery. Data points captured include, but are not limited to, patient demographic characteristics, surgical technique, implant characteristics, and long-term patient outcome. The data are validated by using both the hospital utilization data as well as by independent chart review.[22] Through the registry, data on TJR are analyzed and used for population health management and quality improvement projects. Diagnoses are coded according to ICD-10, and procedures are coded according to the procedure coding system (i.e., ICD-10-PCS).

The ICD-10-PCS codes at Kaiser Permanente were matched with the OPS codes of the AOK system. This was also independently reviewed by experts from the German Arthroplasty Registry. Using administrative claims data of the AOK system and the data from the Kaiser Permanente data warehouse, we were able to extract primary THR data for the years 2017–2019. For this analysis, we used 2019 data, and only used the data from the years 2017–2018 to illustrate data consistency over the years. Although 2020 and 2021 data were available, we abstained from using them because of potential selection bias due to the Covid-19 pandemic.

> *"The German public health care system is characterized by a strong divide between health care providers and health insurance plans as well as high fragmentation among both the providers and the insurance plans."*

Patient Pathway in Germany

Preoperative Phase

TJR for the hip is one of the most commonly performed operations in Germany, with a total of 175,681 primary THRs in 2019.[29] Typically, the journey for a patient affected by osteoarthritis begins at the general practitioner. A patient might also seek specialist orthopedic care directly. Once conservative care with physiotherapy and pain medication is exhausted, a TJR will be considered.[30] In most cases, local specialists work solely in the ambulatory care sector and will not conduct TJRs themselves; hence, they transfer patients to a hospital of their choice.[15] Usually, there is little to no waiting time, and patients can undergo the operation within a few weeks after the initial referral to the hospital is made.[31]

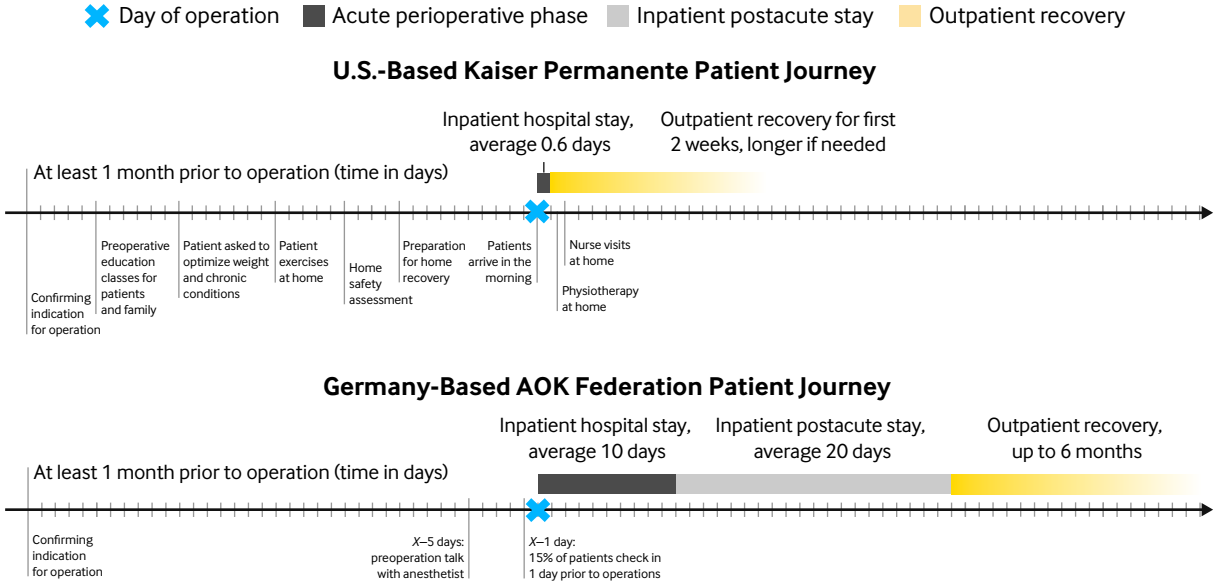
Before hospital admission, a patient typically sees a hospital-based specialist to confirm the indication for TJR (Figure 1).

In preparation for the procedure, necessary X-ray images are conducted either in the hospital or by an outpatient radiologist. Usually, a second appointment is scheduled for the patient a few

FIGURE 1

Comparing Two Models for the Patient Journey for Total Hip Replacement

The comparison of the patient pathways between U.S.-based Kaiser Permanente system and the German health care system illustrates the vast differences in the volume of resources used and the different allocation of resources along the care process.



Source: The authors

days before the operation for a preoperation meeting with the anesthetist in the setting of a preadmission clinical review. However, there is no further preparation of the patient before the operation by the hospital.

Acute Perioperative Phase

The average LOS in the acute care hospital for a THR is between 9 and 10 days.[32] Previous reports showed that 84% of patients for hip replacement were admitted to the hospital the evening before the planned surgery.[33] However, in most cases, the operation is now performed on the day of admission, with 15% of patients reporting for admission a day early. Regarding the implants used, 88.8% of the femoral heads are ceramic, and the most commonly used head sizes are 28–36 mm, with an increasing share of larger heads over the past years. In 74% of all cases, inserts are made from crosslinked polyethylene; 78% of primary hip replacements are uncemented.[34] During the following days, patients receive X-ray checkups, continued pain medication, physiotherapy for early mobilization, and lymphatic treatment if needed.

Postacute Hospital Care Phase

About 90% of all patients who underwent a primary THR received postacute care in a postacute care facility, which is an inpatient setting in most cases.[35] Usually, patients are directly transferred from the acute hospital to the inpatient postacute clinic. Only a minority of cases are discharged directly into their home environment without postacute rehabilitation.[35] Postacute care treatment is characterized by an intensive therapy program, including group and individual sessions consisting of movement therapy, occupational therapy, and physiotherapy as well as psychotherapy. This is supported by patient education covering pathogenesis, secondary prevention, and nutrition.[36] In Germany, the average duration for a postacute inpatient stay is approximately 20 days. After discharge from the postacute care clinic, patients are entitled to ambulatory follow-up care, consisting of physiotherapy and, potentially, additional occupational therapy for 3–6 months.[37]

Patient Pathway at Kaiser Permanente

Preoperative Phase

At Kaiser Permanente, the indication for TJR is performed by the orthopedic specialist or orthopedic total joint specialist. This occurs when the patient is referred to the orthopedic department via the primary care physician and after appropriate workup is completed and conservative treatment options are exhausted.

Once the decision to undergo a TJR is confirmed, a TJR case manager aids in the responsibility for the care process. The case manager serves as the patient's point of contact through the entire patient journey and, along with the surgeon, coordinates the care process, which begins no later than 1 month before surgery. However, contact is often further upstream for patients who require medical optimization, such as anemia correction and smoking cessation. The case manager works with the patient until the recovery has been completed. As such, the case manager ensures access

for patients and their families to preoperative classes, in which they learn about the procedure and are taught physical exercises to undergo presurgery and postsurgery. If needed, case managers encourage and support patients to optimize weight and chronic conditions (diabetes and anemia) before the operation. Patients are provided comprehensive information on how to prepare their house for home-based recovery. In this regard, patients may also receive a home assessment, during which the care team conducts a safety evaluation using standard home care criteria to ensure that patients are safe to be discharged home and that the home is appropriate as a setting for recovery. The case manager also ensures that the home care team has conducted all necessary assessments and is ready to take over care duties upon the patient's discharge. For the surgical operating team, the case manager ensures that all necessary laboratory tests are done on time and that the results are available for the operation team.

> *"The number of beds in Germany is considerably higher than the per capita average among OECD countries (8.0 per 1,000 for Germany and 2.9 per 1,000 for the United States, with an average of 5.1 per 1,000 for OECD countries) and is widely considered to reflect an overcapacity."*

Acute Perioperative Phase

Patients come to the hospital or outpatient surgery center (which may be located within a hospital facility or at a freestanding site) on the morning of the operation and are front-loaded on the operating room schedule to make sure they can be discharged that same evening, if medically possible. A Kaiser Permanente care protocol for THR designates standards for patient care, which the physicians are advised to follow, including but not limited to preparation, choice of anesthesia, operation technique, implants to be used, and anticoagulants to be used. At Kaiser Permanente, metal on crosslink polyethylene is the most common bearing surface (51%), followed by ceramic on crosslink polyethylene (36%). In the majority of cases (83%), femoral head sizes 28–36 mm are used; 95% of cases are uncemented.

During the inpatient stay, the case manager coordinates care in real time between the patient and the caregiver, nurse, physical therapist, pain management team, surgeon, and the discharge planner to ensure a smooth transition. The physical therapist ambulates same-day discharge patients in the recovery area directly after the operation. Once patients meet recovery criteria — including managed pain, return of sensation, and return of motor function — a physical therapist ensures that they can get out of bed, dress, navigate the bathroom and commode, walk 75 feet, and navigate stairs if present within the home. Once all criteria are met, the patient is discharged home.

Through constant systematic improvement of the care process, for THRs, Kaiser Permanente achieved an average LOS and a median LOS of less than 1 day in 2019.

Postacute Hospital Care Phase

The majority of patients undergoing THR at Kaiser Permanente are discharged on the day of surgery. Within 5 years, the share of THR procedures that did not involve a patient admission past midnight increased from 7.4% in 2016 to 92.9% in 2020. Over that period, the volumes of procedures were 9,731 in 2016, 10,521 in 2017, 11,139 in 2019, 11,406 in 2019, and 9,014 in 2020. At Kaiser Permanente, very few patients are discharged to a skilled nursing facility (SNF) or an inpatient postacute care facility. On average, only 3.37% of patients (1,755 of 51,811 patients undergoing a primary THR between 2016 and 2020) received care in an SNF postdischarge. The typical LOS after THR in an SNF is less than 7 days.

At home, the patients are contacted by the case manager. The case manager is responsible for all necessary home care steps, including ensuring that pain medications are ordered and that delivery of necessary equipment occurs; they are also responsible for ensuring that patients follow up with outpatient physical therapy, the anticoagulation clinic, and their primary care physician. The case manager also checks on the patients themselves to ensure the absence of symptoms such as deep vein thrombosis and wound issues.[38] Where medically necessary, patients with drains have a nurse visit at home within 24 hours. Also, within 24 hours of discharge, patients are seen by a home health physical therapist. Patients with THRs receive home care physical therapy for the first 2 weeks after the operation, unless the patients are significantly debilitated or are having some specific issue that requires further treatment. Only patients with knee replacements receive outpatient physical therapy stratified according to patient characteristics for typically 4–8 weeks.

Background: Development of Kaiser Permanente's National Total Joint Replacement Initiative

To address its quadruple aim goals, Kaiser Permanente initiated the National Total Joint Replacement Initiative (NTJRI) in 2016. This interdisciplinary and multiregional working group of clinical, analytical, and performance improvement experts developed a best-practice process for TJR at Kaiser Permanente. The group consolidated findings from earlier improvement projects across all Kaiser Permanente regions throughout the United States in terms of patient preparation, choice of anesthesia technique, operation technique,[39] implants to be used,[40] anticoagulants to be used,[41] and recovery postsurgery.[42] Building on these factors, a new standard was developed, including the preparation of patients before the operation and perioperative procedures along with postoperative care.[38]

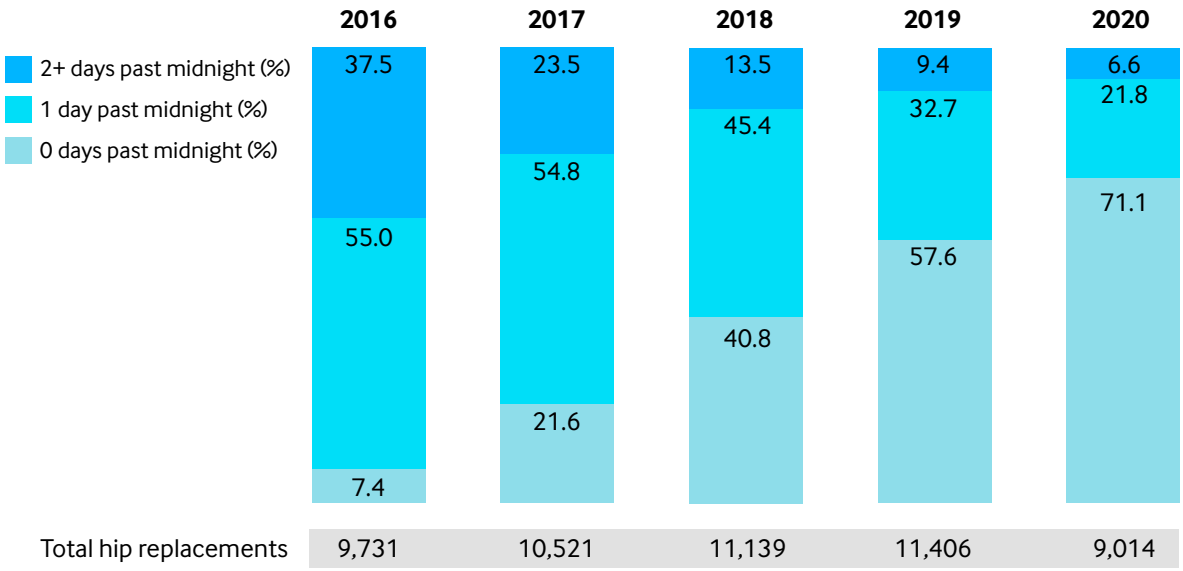
Between 2016 and 2020, the care process was rolled out through all Kaiser Permanente Medical Groups, driving down the LOS to less than 1 inpatient hospital day, without compromising quality of care (Figure 2).

As of 2020, satisfaction with overall care and surgical outcome was higher among patients discharged the same day than among those with longer stays after adjusting for patient, hospital,

FIGURE 2

Length of Stay for Kaiser Permanente Primary Total Hip Replacement Cases, 2016–2020

Within 5 years, the share of total hip replacement procedures that did not involve a patient admission past midnight increased from 7.4% in 2016 to 71.1% in 2020. Over that period, the volumes of procedures were 9,731 in 2016, 10,521 in 2017, 11,139 in 2018, 11,406 in 2019, and 9,014 in 2020.



Source: The authors

and surgical factors.[38] Physician satisfaction ratings were high, with about 80% of surgeons indicating that NTJRI had improved the joint replacement program.[43] Through this program, the share of patients who avoided any overnight stay increased from 7.4% in 2016 to 71.1% in 2020. Today, even patients with a high degree of comorbidities undergo same-day surgery at Kaiser Permanente.

This transition has been achieved without a negative impact on the quality of care. Across all patients with TJRs on lower extremities, the 7-day returns to care (urgent care and ED visits) and 30-day hospital readmissions were lower among patients with same-day procedures than among those with longer hospital stays, even after adjusting for patient, hospital, and surgical factors.[38,44] Over the years 2016–2020, the return to care rate within 7 days for patients receiving a primary THR without an overnight stay was 4.0% (803 of 20,509), which was lower than the rate for patients staying 1 night (5.0% [1,088 of 21,869]) or 2 or more nights (6.0% [561 of 9,290]).

> *Kaiser Permanente achieved an average length of stay and a median length of stay of less than 1 day for the 11,406 cases in 2019. For our German population, with 46,042 cases in 2019, the average length of stay amounted to 10 days, with a median length of stay of 9 days in 2019."*

Results

Using administrative claims data of the AOK system, we were able to identify 137,839 primary THRs following our definition for the years 2017–2019. This includes 46,042 primary THRs in 2019, the year we used for our analysis that includes a selection of metrics (Table 1).

For Kaiser Permanente, we were able to identify a total of 33,066 total primary hip replacements for the years 2017 (n = 10,521), 2018 (n = 11,139), and 2019 (n = 11,406). Against the respective populations, this translates into an incidence of 93.49 per 100,000 for Kaiser Permanente and 173.7 per 100,000 for the AOK population in 2019. Kaiser Permanente achieved an average LOS and a median LOS of less than 1 day for the 11,406 cases in 2019. For the German population, with 46,042 cases in 2019, the average LOS amounted to 10 days, with a median LOS of 9 days in 2019 (Figure 3).

For the German population in our study, 90% (n = 41,328) of the 46,042 patients in 2019 were admitted to an inpatient postacute rehabilitation facility within the first week after discharge, which includes the 31,068 (67%) patients who were admitted to a postacute rehabilitation directly from the hospital. At Kaiser Permanente, 2.57% of patients (n = 293 of the 11,406 cases in 2019) received inpatient postacute rehabilitation at an SNF in 2019.

Table 1. Selected 2019 Data: Patients with Total Hip Replacements and Total Hip Replacement Procedures

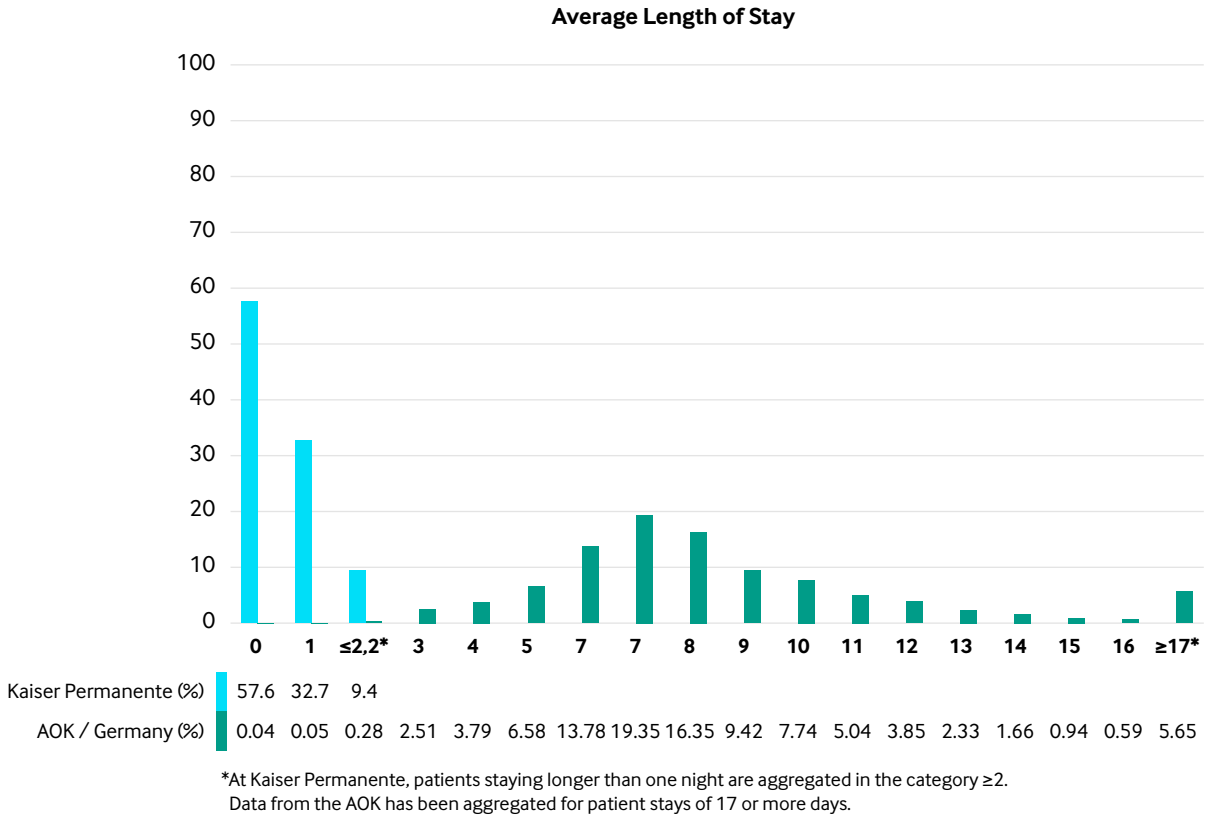
Description of Populations in Study	Kaiser Permanente	AOK
Population in millions	12.2	26.5
No. of patient cases	11,406	46,042
THR incidence per 100,000	93.49	173.7
Male*, **	4,836 (42%)	18,693 (41%)
Female*, **	6,568 (58%)	27,349 (59%)
Age, mean (SD)**	66.9 (9.8)	68.7 (11.5)
Elixhauser Comorbidity Index score, mean (SD)**	6.9 (10.8)	5.03 (9.09)
30-Day readmission to hospital, %**	2.27	6.37
365-Day revision operation, %**	1.67	2.54

THR = total hip replacement, SD = standard deviation. *For two patients, the category sex at Kaiser Permanente was missing. **Statistically significant ($P < 0.005$). Source: The authors

FIGURE 3

Distribution of Length of Stay for Total Hip Replacement, Kaiser Permanente and Germany (AOK), in Nights in the Hospital (2019)

The average length of stay for patients undergoing total hip replacement at Kaiser Permanente in 2019 was less than 1 day. Among patients undergoing the same procedure at AOK hospitals in Germany, the average length of stay was 10 days.



*At Kaiser Permanente, patients staying longer than one night are aggregated in the category ≥2.
Data from the AOK has been aggregated for patient stays of 17 or more days.

Source: The authors

> *In 2019, at Kaiser Permanente 2.27% (n = 259) of the patients with total hip replacements were readmitted to the hospital within 30 days, whereas in the German study population, 6.37% (n = 2,930) of patients were readmitted within 30 days."*

Population Demographic Characteristics

In terms of demographic characteristics, there was a higher share of female patients compared with male patients in both populations (Table 1). In 2019, at Kaiser Permanente, the share of female patients was 58% (n = 6,568), whereas the share was 59% (n = 27,349) female patients in the AOK sample. This difference is statistically significant ($P < 0.005$). Both populations are of a similar average age: 66.9 years at Kaiser Permanente and 68.7 years in Germany in 2019; the difference is statistically significant ($P < 0.005$). The comparison of the 2019 patient population also shows a statistically significantly higher burden of comorbidities on the side of Kaiser Permanente, with an average EI of 6.9 at Kaiser Permanente and 5.03 for the German population ($P < 0.005$).

Quality of Care

The patient outcome in terms of the percentage of readmissions to the hospital within 30 days' postdischarge was statistically significantly different between Kaiser Permanente and Germany. In 2019, at Kaiser Permanente, 2.27% (n = 259) of the patients with THRs were readmitted to the hospital within 30 days, whereas in the German study population, 6.37% (n = 2,930) of patients were readmitted within 30 days. For both populations, the data were generally stable or improving over the 3-year period of 2017–2019 (Table 2). The percentage of patients having to undergo a revision operation within 365 days in Germany was 2.54% (n = 1,142) for the 2019 cohort, whereas it was 1.67% (n = 190) for the population of Kaiser Permanente; this difference is statistically significant ($P < 0.005$). For this parameter, the outcome has improved every year at Kaiser Permanente, whereas it was stable in Germany between 2017 and 2019.

Discussion

One-on-one comparisons of health data and care processes should always be performed with caution, as differences in population characteristics, as well as in coding and calculation, exist between countries. Caution needs to be especially executed in comparing costs of care, as they are biased by salary levels, taxation, and other country-specific factors outside the health care system. Thus, the current article did not undertake a comparison of health care costs. We compared the care delivery process and needed resources along with outcome quality parameters against key demographic factors of the population undergoing the procedure.

Earlier comparisons between the German and U.S. systems show that the number of hip replacements is higher in Germany than in the United States — even after accounting for a difference in population characteristics.[45] We find the same in our data, with a 70% higher incidence rate for primary hip replacements in Germany compared with the population of Kaiser Permanente. We attribute the difference in part to the different incentives for the organization to conduct THR in both systems. At Kaiser Permanente, capitation and the integrated care delivery model incentivize physicians to optimize evidence-based conservative options before conducting an invasive hospital procedure such as TJR. In contrast, the fragmented German health care system — with an overcapacity of hospital resources and a fee-for-service payment system both in the hospital sectors and the ambulatory care sector — incentivizes local specialists to admit patients to the hospital for a joint replacement rather early in their course of care.

Table 2. Year-over-Year Data for Selected Metrics, 2017–2019

Comparison of Key Parameters of Both Populations	2017	2018	2019
Total no. of patients undergoing a THR procedure			
Kaiser Permanente	10,521	11,139	11,406
AOK	46,193	45,604	46,042
Comparison age of patients, mean (SD), y			
Kaiser Permanente	66.7 (9.8)	66.6 (9.9)	66.9 (9.8)
AOK	68.9 (11.4)	68.9 (11.5)	68.7 (11.5)
Elixhauser Comorbidity Index score (readmission weights) for THR, mean (SD)			
Kaiser Permanente	7.8 (11.3)	7.8 (11.3)	6.9 (10.8)
AOK	5.18 (9.10)	5.18 (9.14)	5.03 (9.09)
Readmissions to the hospital within the first 30 days after discharge for patients undergoing primary THR, %			
Kaiser Permanente	2.44	2.10	2.27
AOK	6.49	6.35	6.37
Revision operation within the first 365 days after discharge for patients undergoing primary THR, %			
Kaiser Permanente	2.72	1.85	1.67
AOK	2.65	2.36	2.54
No. (median) of THR surgeries performed per year per surgeon			
Kaiser Permanente	72 (65)	72 (65)	73 (66)
AOK	NA	NA	NA

THR = total hip replacement, SD = standard deviation, NA = not available. Source: The authors

There are statistically significant differences between the two populations in terms of demographic characteristics: age, sex, and the load of comorbidities. The nominal larger share of male patients and the higher load of comorbidities in the Kaiser Permanente population are associated with a higher risk for readmissions and revisions.[24,27,46] In contrast, the higher age in the AOK population indicates a higher likelihood for a revision operation for the German population. It is noteworthy that the sex distribution and the average age of the AOK population in our study exactly match the sex distribution along with the average age of the entire cohort of German subjects undergoing a primary THR in 2019.[29] Earlier studies also show a match between the sociodemographic data in our study.[31] At Kaiser Permanente, the demographic characteristics of our study match those of earlier publications on TJR at Kaiser Permanente.[47] However, although the two populations in our article have statistically significant differences, these differences are rather small in absolute numbers and are not of medical relevance. Thus, these differences, although statistically significant, cannot explain the relevant medical difference in terms of outcomes and do not explain differences in LOS.

We can show a strong difference in the patient pathway between Kaiser Permanente and Germany for patients undergoing primary THR. The pathway in Germany relies heavily on hospital and

inpatient postacute infrastructure. We found an average LOS of 10 days in our data, which is consistent with earlier publications of the LOS for THR in Germany.[48] This LOS reflects a decrease from earlier years, in which we saw an average LOS of around 12 days.[31] However, 90% of patients in our AOK population received a postacute rehabilitative stay, which is consistent with the earlier studies on postacute care for patients with hip replacements in Germany.[35]

> *"At Kaiser Permanente, capitation and the integrated care delivery model incentivize physicians to optimize evidence-based conservative options before conducting an invasive hospital procedure such as total joint replacement. In contrast, the fragmented German health care system — with an overcapacity of hospital resources and a fee-for-service payment system both in the hospital sectors and the ambulatory care sector — incentivizes local specialists to admit patients to the hospital for a joint replacement rather early in their course of care."*

At Kaiser Permanente, the majority of patients have an average LOS of less than 1 day. The percentage of patients receiving inpatient rehabilitation at an SNF is 3.37%, which is consistent with an earlier publication.[38]

At Kaiser Permanente, the vast majority of patients receive nursing and rehabilitative care at their own home as the standard of care (Figure 1). This is made possible by allocating resources at the beginning of the care process before the operation to optimize the preparation of the patient as well as by allocating home care resources that are available to the patient upon discharge. This timeliness of the overall workflow is ensured by a case manager who connects the interdisciplinary team across all sectors and along the entire medical process.

To measure quality of care, we chose parameters that are both internationally widely accepted as quality-of-care parameters for THR and collected in both systems to ensure high data validity. The analysis shows that a lean care pathway that is well organized — from the primary care clinician to the local specialist to the hospital to the postacute care program and back to the primary care clinician — can produce the same or higher-quality outcomes in terms of 30-day readmission rate and 365-day revision rate than a care pathway with an extended hospital stay.

For measuring short-term quality of care, we chose the 30-day hospital readmission rate. The hospital readmission rate of the population at Kaiser Permanente (2.27%) was statistically significantly lower than the readmission rate of the AOK population (6.37%). Both numbers match the 30-day hospital readmission rate published in earlier articles for patients undergoing THR at Kaiser Permanente and in Germany, respectively.[43,45,46]

This difference in the 30-day readmission rate after discharge is remarkable, as the AOK population in Germany stayed 8 days longer than the population at Kaiser Permanente in the hospital until their discharge; as such, those patients had 7 more days to recover before discharge. Thus, the German patients should have been more medically stable and less likely to have a readmission. Also, the Kaiser Permanente population carries a higher load of comorbidities, which should have increased the likelihood of readmissions. We had expected the rate of readmissions to be higher at Kaiser Permanente than in Germany, but the opposite occurred.

We looked at the 365-day revision rate as a long-term quality-of-care parameter. There was a statistically significant difference in the rate between both populations. At Kaiser Permanente, the revision rate was 1.67% compared with a revision rate of 2.54% in Germany. Again, the data in our study are in line with revision rates published in earlier studies for both populations.[42,45]

Given the high rate of comorbidities in the Kaiser Permanente patient population compared with the German population, along with the slightly larger share of male patients and the earlier discharge, we expected the rate of revision operations to be higher at Kaiser Permanente than in Germany, although again, the opposite was the case.

We attribute the difference in outcomes in part to Kaiser Permanente's rigid process optimization and care delivery improvement approach. As shown earlier, Kaiser Permanente has previously paid great attention to detail in standardizing care delivery. These standards are founded on a scientific approach using the Kaiser Permanente National Total Joint Replacement Registry, which includes data points on patient demographic characteristics, surgical technique, implant characteristics, and long-term outcomes. System-wide implementation across all its diverse geographic regions of these best practices leads to little variation among the surgeons. This is backed by financial incentives for physicians at Kaiser Permanente to follow best-practice protocols.

> *"Although the two populations in our article have statistically significant differences, these differences are rather small in absolute numbers and are not of medical relevance. Thus, these differences, although statistically significant, cannot explain relevant medical difference in terms of outcomes and do not explain differences in length of stay."*

Surgeons at Kaiser Permanente also receive reports from the registry that show their performance relative to that of their peers. In addition, the individual medical centers also review returns to ED, readmissions, and reoperations in real time using a Web-based report. This transparency leads to mutual learning opportunities. Also, close to 100% of THR procedures are conducted by fellowship-trained, specialized total joint surgeons.

Furthermore, surgeons at Kaiser Permanente on average conduct a high number of THR procedures per year. Annual THR volume for Kaiser Permanente surgeons was on average

73 (median of 66) procedures in 2019, a slight increase from 72 (median of 65) procedures per surgeon in 2017 and 2018. Although no numbers are published on the average hip replacements per surgeon for the German population, it is fair to assume that the number is lower than at Kaiser Permanente, as the 175,681 primary THRs in Germany in 2019 were conducted in 1,250 hospitals, equaling only 140 THRs on average per hospital.[29] We attribute the low rate of readmission at Kaiser Permanente to the thorough home care program, with close circles of contacts ensuring that a patient is well, catching potential complications that would otherwise lead to a readmission — such as wound infections — early on. This is supported by a previous study of Kaiser Permanente showing that even for patients with a high load of comorbidities, the same-day discharge process of Kaiser Permanente does not lead to an increased rate of readmissions within 30 days.[43]

Process optimization and improvements in care delivery at Kaiser Permanente are incentivized by capitation as a remuneration model, transferring the accountability for cost and quality of care from the insurance side to the clinical side. Through this remuneration model, Kaiser Permanente directly benefits from efficiency gains along with improvements in quality of care. This incentive of capitation permeates the organization, including the medical staff and administrative functions, thereby aligning goals to improve the quality and affordability of care.

The German care pathway is also driven by the incentive structure of the involved organizations. The primary care provider, local specialist, hospitals, and postacute care facilities are all largely paid on a fee-for-service basis. The fee-for-service payment gives no provider in the system responsibility or accountability for cost of care or quality of care for the entire process. Hence, all providers are solely incentivized to optimize their part of the care pathway. As such, German hospitals optimize the inpatient care process within the framework of the DRG payment system but do not allocate resources to medically prepare patients before the inpatient stay or to invest in more modern operational techniques to reduce the need for postacute care facility stay, as neither is covered in the DRG payment. Also, the DRG payment involves a minimum LOS, which does not allow for discharge on day 1 and thus hinders care process innovation.

Altogether, both the 30-day readmission rate and the 365-day revision rate show that the shorter LOS at Kaiser Permanente does not seem to have a negative impact on quality of care. In contrast, the trans-sectoral pathway at Kaiser Permanente seems to provide better care with fewer resources. Our findings are consistent with an earlier evaluation of same-day discharge after THR.[44,49]

By applying the Kaiser Permanente process of 1-day hospital-based procedures to the 175,000 primary THRs in Germany, some 1.5 million inpatient acute hospital days could be saved. In addition, by applying the Kaiser Permanente process of outpatient postacute care to the 175,000 primary THRs in Germany, some 3.5 million postacute inpatient rehabilitation days could be eliminated. This translates into the potential reduction of more than 4,000 inpatient hospital beds, reflecting almost 1% of all licensed inpatient hospital (N = 483,606),[13] and 9,500 postacute inpatient rehabilitation beds, reflecting almost 6% of all postacute inpatient rehabilitation beds (N = 162,014).[50]

Limitations

For Germany, we were limited to data from the AOK health insurance system, covering about 25 million publicly insured German individuals of a population of 83 million. However, systematic differences between the population of the entire country and that covered by AOK, although possible, are not likely. This assumption is backed by the exact match of average age and sex distribution between the AOK population in our study and the overall cohort of German subjects undergoing a primary THR in 2019.[29]

We paid detailed attention to matching the data sets, and it can be assumed that a sufficient match was achieved. However, it cannot be ruled out that there are smaller mismatches in the data sets (e.g., because of different coding practices between the United States and Germany).

Although we capture quality of the care in the 30-day readmission and the 365-day revision rates, we do not show the potential for long-term differences in revision rates over 10–15 years. Because Kaiser Permanente systematically switched to the new surgery patterns only within the past several years, no long-term effects are measurable to date.

> *"The analysis shows that a lean care pathway that is well organized — from the primary care clinician to the local specialist to the hospital to the postacute care program and back to the primary care clinician — can produce the same or higher-quality outcomes in terms of 30-day readmission rate and 365-day revision rate than a care pathway with an extended hospital stay."*

Potentially, the outcome parameters used in this study do not fully capture the quality of care that patients received. Other suitable parameters could have been patient-reported outcomes, functional outcomes, or outcomes looking at the ability to return to work. These outcomes, however, were not systematically accessible for both populations. Although we did not examine patient satisfaction as a quality parameter in our study, earlier publications of Kaiser Permanente illustrated a high patient satisfaction for those undergoing their patient journey pathway.[38]

Outcome data for each population were only obtainable if the patient stayed alive and did not change their health insurance coverage.

Looking Ahead

Rising health care costs in OECD countries drive the quest for optimized care processes as well as the quest for the ideal incentive structures for physicians and health care teams. The conducted analysis shows that, while treating a medically comparable population, Kaiser Permanente uses a fundamentally different care pathway for patients undergoing primary THR. With an average LOS of less than 1 day and little to no postacute inpatient care stay, Kaiser

Permanente uses only a fraction of the inpatient resources that Germany is using, with its average LOS of 10 days and a standard postacute inpatient care stay of 20 days in 2019. Despite this, the quality of care at Kaiser Permanente, measured in 30-day readmission as well as 365-day revision rates, is higher than the quality of care in Germany.

The authors of this article are convinced that a care process similar to the one at Kaiser Permanente will deliver the same high-quality results and fundamental cost savings in Germany or other OECD health systems, as other providers have also successfully implemented outpatient TJR.[51,52] This poses questions on the larger scale for health systems regarding the right fundamental incentives to achieve superior outcomes with lower resource utilization. The dominant driver behind the more efficient and more effective care process at Kaiser Permanente is the transfer of accountability for costs and quality of care from the health insurance to the provider by means of a capitation remuneration model.

Such a transfer of accountability is absent in Germany and other OECD countries. Although a full-scale capitation system is unlikely to be soon implementable in Germany or other OECD countries, steps could be taken to shift accountability for cost of care and quality of care toward care delivery organizations while giving them the incentive to financially benefit from saved costs and improved quality. The creation of regionally competing accountable care organizations, such as the Comprehensive Care for Joint Replacement and the Bundled Payments for Care Improvement programs in the United States, might be an example of how the fee-for-service landscape can be shifted toward accountability.

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