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Authors	Dros,J.T.; van Dijk,C.E.; Bos,I.; Meijer,W.M. et al
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Healthcare utilization patterns for knee and hip osteoarthritis before and after changes in national health insurance coverage: a data linkage study from the Netherlands

Jesper T. Dros^{a,b,c,*}, Christel E. van Dijk^b, Isabelle Bos^a, Willemijn M. Meijer^a, Astrid Chorus^b, Harald Miedema^b, Cindy Veenhof^d, Ilgin G. Arslan^a, Bert R. Meijboom^c, Robert A. Verheij^{a,b,c}

^a Netherlands Institute for Health Services Research (NIVEL), Utrecht, the Netherlands

^b National Health Care Institute, Diemen, the Netherlands

^c Tilburg School of Social and Behavioral Sciences, Tilburg University, Tilburg, the Netherlands

^d University Medical Centre Utrecht, Utrecht, the Netherlands

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ABSTRACT

Introduction: Medical guidelines aim to stimulate stepped care for knee and hip osteoarthritis, redirecting treatments from hospitals to primary care. In the Netherlands, this development was supported by changing health insurance coverage for physio/exercise therapy. The aim of this study was to evaluate healthcare utilization patterns before and after health changes in health insurance coverage.

Method: We analyzed electronic health records and claims data from patients with osteoarthritis in the knee ($N = 32,091$) and hip ($N = 16,313$). Changes between 2013 and 2019 in the proportion of patients treated by the general practitioner, physio/exercise therapist or orthopedic surgeon within 6 months after onset were assessed. **Results:** Joint replacement surgeries decreased for knee (OR 0.47 [0.41–0.54]) and hip (OR 0.81 [0.71–0.93]) osteoarthritis between 2013–2019. The use of physio/exercise therapy increased (knee: OR 1.38 [1.24–1.53], hip: OR 1.26 [1.08–1.47]). However, the proportion treated by a physio/exercise therapist decreased for patients that had not depleted their annual deductibles (knee: OR 0.86 [0.79 – 0.94], hip: OR 0.90 [0.79 – 1.02]). This might be affected by the inclusion of physio/exercise therapy in basic health insurance in 2018.

Conclusion: We have found a shift from hospitals to primary care in knee and hip osteoarthritis care. However, the use of physio/exercise therapy declined after changes in insurance coverage for patients that had not depleted their deductibles.

1. Introduction

In order to contain rising healthcare costs, health policy measures have increasingly focused on shifting care from hospitals to primary care [1–7]. This is known as substitution of care, defined as the replacement of (a part of) an existing facility for (a part of) a different facility for the same patient population, while the original function of the facility is maintained [8]. The general idea is that primary care might be able to deliver the same quality and accessibility of care for certain patient groups, at lower costs and with fewer risks of adverse events [8–13]. One way to establish the intended shift to primary care, is through applying the principles of stepped care. Stepped care is the stepwise increase of treatment modalities from conservative to more invasive treatments,

with the aim of increasing quality and accessibility of care [14–16].

The treatment of patients with knee or hip osteoarthritis (KHOA) is an example of stepped care with potentially large impact on healthcare costs. Currently, 303 million patients currently suffer from this disease globally [14–21]. Finding the right treatment for patients with KHOA is essential, as treatment can be expensive and both absenteeism and loss of productivity are substantial [22]. International guidelines published from 2012 onwards recommend to only consider joint replacement surgery for KHOA when maximal conservative treatments rendered insufficient results, at least 3 months after onset [23–26]. Conservative treatments include education, (lifestyle) advice, pain medication, intra-articular injections and physio/exercise therapy (PET) [14]. In the Netherlands, several efforts have been made to shift care from hospitals to primary care by encouraging stepped care for KHOA. In 2013, a

* Corresponding author.

E-mail address: j.dros@nivel.nl (J.T. Dros).

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Abbreviations

BHI	Basic Health Insurance
DRG	Diagnosis Related Groups
GP	General Practitioner
ICPC	International Classification of Primary Care
KHOA	Knee or Hip Osteoarthritis
Nivel-PCD	Nivel Primary Care Database
OR	Odds Ratio
OS	Orthopedic Surgeon
PET	Physio/exercise therapist
SES	Socioeconomic Status
SHI	Supplementary health insurance

program that systematically evaluated care for KHOA was initiated by the National Health Care Institute. Within this program, the National Health Care Institute evaluated the appropriateness of care for KHOA together with all relevant actors, including healthcare providers and health insurers. A report was published with possibilities for improvement [27], along with agreements on how to utilize these possibilities. Important agreements for improvement were the inclusion of stepped care in clinical guidelines. Stepped care was included in the Dutch General Practitioner Society (NHG) guideline in 2016, and in the guidelines of the Dutch Orthopedic surgeon society (NOV) and of the Royal Dutch Society of Physiotherapist (KNGF)/ Association of Exercise Therapists Cesar and Mensendieck (VvOCM) in 2018.

Another important development following the systemic evaluation of care for KHOA was that from 2018 onwards, twelve PET treatments were included in obligatory basic health insurance (BHI) instead of voluntary supplementary health insurance (SHI) [27]. Policy makers expected a shift from hospitals to primary care, based on research showing that PET can postpone or substitute joint replacement surgeries [28–31]. However, including care in the BHI as a financial incentive to stimulate PET may be counteracted by other financial incentives within the Dutch healthcare system. All Dutch inhabitants are obliged to have BHI, through which care provided by healthcare professionals in hospitals, general practices, mental healthcare practices, maternity and home nursing care is paid for, among others. A mandatory deductible of 385 euro is in place for all insured inhabitants of 18 years or above, excluding GP consultations, maternity care and home nursing care. The general practitioner functions as a gatekeeper and has to refer patients to the hospital before they can see a specialist. PET in primary care can be visited directly – without referral – and is for most diseases paid from SHI, for which deductibles do not apply. For specific diseases, PET is paid from the BHI. Within the Dutch regulated healthcare market, actors can be steered in choosing the most appropriate type of care, by financially incentivizing them to do so. Considering the extra costs associated with SHI, patients might be reluctant to obtain certain treatments from a PET compared to treatments in hospitals or at the general practitioner (GP). However, since basic health insurance comes with the obligation to pay deductibles, this reluctance also depends on the extent to which patients have already used care previously that year. Since 2018, the first 12 treatments for knee and hip osteoarthritis are paid from BHI. Being treated by a PET costs between 28–35 euro per treatment and 42 euro for an intake including examination. Thereby, 12 visits cost between 350 and 432 euro. Patients that have not used their deductibles, have to pay most of these costs out-of-pocket. Thereby, moving the coverage from additional to basic health insurance might unintentionally make some patients more reluctant to use PET [32–37].

The main aim of this study is to investigate to what extent treatment for patients with KHOA shifted from hospitals to primary care in the Netherlands between 2013 and 2019. The revision of several clinical guidelines for KHOA is expected to contribute to this shift, as they

recommend not to perform joint replacement surgery within the first 3 months without maximal conservative treatment efforts. Therefore, we hypothesized that the proportion of patients who are treated by a GP or PET in the initial phase of their treatment (<6 months) increased over time. We expected that the proportion of patients who were treated by an orthopedic surgeon (OS) or underwent joint replacement surgery in the first 6 months after diagnosis decreased. In addition, we expected the proportion of patients who received PET to be higher for patients who had depleted their deductibles after inclusion of PET in the BHI. Therefore, healthcare utilization patterns in the period before and after the introduction of guidelines and the inclusion of exercise therapy in the BHI were compared. We addressed the following research questions:

1. To what extent has treatment for patients with osteoarthritis in the knee or hip shifted from hospital care to primary care between 2013 and 2019?
2. What effect does depletion of deductibles have on being treated in primary care for patients with osteoarthritis in the knee or hip?

Within this study, substitution of care for patients with KHOA was defined as an increase in the proportion of patients receiving treatment in primary care and a decrease in the proportion of patients undergoing joint replacement surgery within the first six months after their initial contact for KHOA. An increase in primary care could be either at the GP (e.g. lifestyle advice) or at the PET (e.g. exercise therapy).

2. Method

2.1. Study design

This is an observational study based on pseudonymized claims data from all Dutch health insurers provided by the center for information of Dutch health insurers (Vektis) linked with data from electronic health records (EHR) from GPs participating in Nivel Primary Care Database (Nivel-PCD). Vektis collects data from all health insurers which include insurance claims of medical specialist care and allied healthcare, among others. Nivel-PCD includes data of Dutch GPs and PETs, among others.

2.2. Patient sample

Healthcare utilization patterns were analyzed for 48,404 newly diagnosed patients with osteoarthritis in the knee ($N = 32,091$) and hip ($N = 16,313$), starting from their first contact for KHOA. This can be either a GP, medical specialist, or PET. This was based on the following diagnostic codes (see also Appendix I):

1. Episodes with the International Classification of Primary Care (ICPC) code for KHOA (L89 and L90), as recorded by their GP. These patients were selected from the EHR of the Nivel-PCD. Episodes of care were constructed using the algorithms developed by Nielen et al. (2019) [38].
2. The Diagnosis Related Groups (DRGs) [39] for KHOA in hospitals (0305–1701 and 0305–1801). These patients were selected from the medical claims data.
3. The Diagnostic Coding System of Paramedical Help code for KHOA (6223 and 7023). These patients were also selected from the medical claims data.

Pseudonymized social security numbers allowed for data linkage on patient level. Inclusion criteria were: 1) known age, sex and neighborhood social economic status (SES) 2) aged older than 45 years [24,40], 3) registered as patients in a general practice participating in Nivel-PCD, 4) complete EHR registration of GP practices, 5) no residency at a nursing home (in a nursing home, patients are no longer under formal supervision of their GP), 6) complete claims data based on care costs at health insurer level for medical specialist care, PET and GP care. These

inclusion criteria were applied in the year before and after initial registration. Patients that were enlisted in two or more general practices over time were excluded as well (<5%), since irregularities can occur in their EHR. A flowchart visualizing the in- and exclusion of patients can be found in Appendix II. Patients were followed for six months after initial diagnosis. This timespan was chosen based on medical guidelines (conservative treatment for at least 3 months) [40], combined with data-driven analyses described in Appendix III. Patients with an initial KHOA registration after September 30th 2019 were excluded, as healthcare delivery was impacted by the first Covid-19 wave in March 2020 in the Netherlands.

2.2.1. Variables

Several dependent variables were defined based on whether patients were treated for KHOA by a GP, PET, OS or OS with joint replacement (GP treatment = 1, no GP treatment = 0; PET treatment = 1, no PET treatment = 0; OS treatment = 1, no OS treatment = 0; OS treatment with joint replacement = 1, no OS treatment with joint replacement = 0). Treatment for KOA (registered with ICPC code L90) or HOA (registered with ICPC code L89) by a GP was derived from EHR's. Treatment by the OS for KOA and HOA (registered with 0305-1801 and 0305-1701, respectively) was derived from claims data using the DRG classification system for hospital claims data [39]. Treatment by a PET for KOA and HOA (registered with diagnostic code 7023 and 6223, respectively) was derived from claims data [41].

Independent variables were time in years (year of diagnosis), age, gender, neighborhood SES, depletion of deductibles and comorbidities. Time in years was included in every registered treatment, both in the EHR and claims data. Comorbidities were based on ICPC codes in EHR's by GP's. Presence of an ICPC code for the most prevalent comorbidities [42] within six months after initial KHOA registration was included in the dataset as a separate dichotomous variable for each comorbidity. Age, gender and ZIP-code were available from the claims data. The neighborhood SES score was also included, as relative status scores between neighborhoods derived from education, income and position on the labor market of inhabitants [43]. The most recent edition of SES score was used, which date from 2016. Within the claims data all expenses made by patients within the Health Insurance Act are registered. Hence, the share of deductibles paid could be calculated by subtracting GP consultations, maternity care and home nursing care costs from the total annual healthcare costs on patient level. Expenses made at a PET were also subtracted, as these costs would otherwise interfere with the outcome of using PET.

2.3. Statistical analyses

First, descriptive statistics were performed. To investigate development in healthcare utilization in the period 2013–2019, logistic multi-level regression analyses were conducted with a random intercept at general practice level using the lme4 package in R. The main determinant was time in years. For the overall trend, we included time in years as one variable. Also, year was included as several dummy variables. Every year was iteratively set as reference year, allowing odds ratios (ORs) to be calculated per year per healthcare provider. All analyses were corrected for gender, age, neighborhood SES and comorbidities. The interaction between time in years and depletion of deductibles was assessed by adding depletion of deductibles and an interaction term with time in years and depletion of deductibles to the regression model. Subgroup analyses were performed for patients who underwent joint replacement surgery. For this subgroup, we analyzed whether the proportion of patients treated at a PET in the year prior to joint replacement surgery (dependent variable) changed between 2016–2019 (independent variables). Data preparation and linkage was conducted in SAS Enterprise Guide version 7.15, statistical analyses were conducted in RStudio version 2021.09.2

2.3.1. Sensitivity analyses

We performed several sensitivity analyses for downcoding KHOA on diagnoses closely related to KHOA, like knee or hip complaints at a GP (L13 and L15) or at a PET (62xx and 70xx), as reported in literature [44]. Related diagnostic codes can be found in Appendix I.

3. Results

Table 1 shows the characteristic of patients with KHOA in the study period. Patients with KOA were on average 66 years (SD±10) and 60% was female. Most patients had their first record of KOA at the OS (46%), followed by the GP (39%) and PET (14%). Patients with hip osteoarthritis (HOA) were on average 69 years (SD±10) and 63% was female. For most patients their episode of HOA started with a first contact record at their GP (51%), followed by the OS (36%) and PET (12%) (Table 1). Patients with KHOA lived in neighborhoods with lower socioeconomic status more often, as compared to the national average.

3.1. Changes in healthcare utilization 2013–2019

For patients with KOA, as well as patients with HOA between 2013 and 2019, treatments in primary care increased while treatments in hospitals decreased (Figs. 1 and 2). KOA patients consulted a GP (OR [95% CI] = 1.08 [0.99–1.18]) and a PET (OR [95% CI] = 1.38 [1.24–1.53]) more often in 2019 compared with 2013 (Fig. 1). At the same time, KOA patients consulted the OS less often overall (OR [95% CI] = 0.95 [0.87–1.04]), and significantly less often underwent knee replacement surgery (OR [95% CI] = 0.47 [0.41–0.54]). Full regression output can be found in Appendix VIII, Table A8–1. Also, patient pathways for PET relative to joint replacement surgeries can be found in Appendix IX, which confirm the results

For HOA patients, similar trends were observed. HOA patients consulted the GP (OR [95%] = 1.28 [1.13–1.44]) and PET (OR [95%] = 1.26 [1.08–1.47]) more often in 2019 as compared to 2013 (Fig. 2). At the same time, HOA patients consulted the OS less often overall (OR [95%] = 0.91 [0.81–1.03]), but significantly less often underwent knee replacement surgery (OR [95% CI] = 0.81 [0.71–0.93]). However, these trends are not linear as changes in insurance coverage seem to have unintended health policy effects. Full regression output can be found in Appendix VIII, Table A8–2. Also, patient pathways for PET relative to joint replacements surgeries can be found in Appendix IX, which confirm the results

3.1.1. Unintended policy effects: changes in insurance coverage

Since 2018, a shift back from primary care to hospital care was observed, which was most pronounced in patients with KOA. The proportion of patients with osteoarthritis treated at a PET decreases significantly from 2017 to 2018 for KOA (OR 0.81 [0.74–0.88], Fig. 1B) and not significantly for HOA (OR 0.89 [0.78–1.00], Fig. 2B). At the same time, the proportion of patients at the OS increases for KOA (OR 1.10 [1.02–1.20], Fig. 1C). The trend in total knee replacements was unaffected (Fig. 1D). For HOA patients, an increase in the proportion of patients consulting the OS was observed in 2019 compared to 2013 with 1.18 higher odds (95% CI 1.06–1.32, Fig. 2C), which can also be seen for total hip replacements (OR [95% CI] = 1.17 [1.03–1.33], Fig. 2D).

3.1.2. Depletion of deductibles

Different trends in GP and PET usage over time were observed for patients that had or had not depleted their deductibles by the end of each year (Fig. 3). For patients that had not depleted their deductibles, the odds of seeing their GP increased every year for KOA (OR [95% CI] 1.16 [1.07–1.26], Fig. 3A) and HOA (OR [95% CI] 1.28 [1.13–1.45], Fig. 3B) on average between 2016 and 2019 as compared to the patients that had not depleted their deductibles. In the same period, for patients that had not depleted their deductibles, the odds of seeing their PET decreased every year for KOA (OR [95% CI] 0.86 [0.79–0.94], Fig. 3C) and HOA

Table 1
Patient characteristics and initial contacts for patients with initial registration of knee or hip osteoarthritis between 2013–2019.

	2013	2014	2015	2016	2017	2018	2019	Overall
Knee osteoarthritis patients (N)	4501	4571	2984	4052	5443	5884	4656	32,091
Age in years (mean±SD)	64.9 ± 9.7	65.1 ± 9.8	65.1 ± 9.9	66.0 ± 10.1	66.1 ± 10.4	66.1 ± 10.6	66.5 ± 10.8	65.7 ± 10.3
46–64	2212 (49.1%)	2215 (48.5%)	1432 (48.0%)	1829 (45.1%)	2444 (44.9%)	2669 (45.4%)	2093 (44.0%)	14,894 (46.4%)
65–74	1490 (33.1%)	1522 (33.3%)	1007 (33.8%)	1339 (33.1%)	1778 (32.7%)	1861 (31.6%)	1418 (30.5%)	10,415 (32.5%)
75–84	720 (16.0%)	707 (15.5%)	474 (15.9%)	750 (18.5%)	993 (18.2%)	1082 (18.4%)	889 (19.1%)	5615 (17.5%)
85+	79 (1.8%)	127 (2.8%)	71 (2.4%)	134 (3.3%)	228 (4.2%)	272 (4.6%)	256 (5.5%)	1167 (3.6%)
Female (N,%)	2772 (61.6%)	2804 (61.3%)	1750 (58.7%)	2458 (60.7%)	3252 (59.8%)	3428 (58.3%)	2725 (58.5%)	19,189 (59.8%)
Socioeconomic status (N,%)								
Low	1223 (27.2%)	1282 (28.1%)	916 (30.7%)	1157 (28.6%)	1491 (27.4%)	1558 (26.5%)	1253 (26.9%)	8880 (27.7%)
Medium-low	1263 (28.1%)	1324 (20.0%)	899 (30.1%)	1170 (28.9%)	1616 (29.7%)	1592 (27.0%)	1252 (26.9%)	9116 (28.4%)
Medium-high	1133 (25.2%)	1096 (24.0%)	742 (24.9%)	1008 (24.9%)	1311 (24.1%)	1588 (27.0%)	1297 (27.9%)	8175 (25.5%)
High	882 (19.6%)	868 (19.0%)	427 (14.3%)	717 (17.7%)	1024 (18.8%)	1143 (19.3%)	854 (18.3%)	5915 (18.4%)
Deductibles depleted (N,%)	n/a	3987 (87.2%)	2516 (84.3%)	3446 (85.0%)	4584 (84.2%)	5105 (86.8%)	4056 (87.1%)	23,694 (85.9%)
Deductibles depleted, excl. PET (N, %)	n/a	3984 (87.2%)	2513 (84.2%)	3442 (85.0%)	4580 (84.1%)	5047 (85.8%)	3989 (85.7%)	23,555 (85.4%)
Initial KOA registration (N,%)								
General practitioner	1753 (39.1%)	1898 (41.7%)	1204 (40.7%)	1552 (38.6%)	2055 (38.2%)	2386 (40.9%)	1793 (38.9%)	12,641 (39.4%)
Orthopedic surgeon	2249 (50.2%)	2062 (45.3%)	1363 (46.0%)	1825 (45.4%)	2376 (44.1%)	2656 (45.6%)	2167 (47.0%)	14,698 (45.8%)
Physio/exercise therapist	481 (10.7%)	588 (12.9%)	394 (13.3%)	643 (16.0%)	956 (17.8%)	787 (13.5%)	647 (14.0%)	4496 (14.0%)
Hip osteoarthritis patients (N)	2366	2265	1530	2033	2774	3009	2336	16,313
Age in years (mean±SD)	67.3 ± 9.5	67.8 ± 9.6	67.8 ± 9.6	69.0 ± 9.7	69.1 ± 10.2	69.5 ± 10.1	69.5 ± 10.4	68.6 ± 9.9
46–64	881 (37.2%)	816 (36.0%)	551 (36.0%)	640 (31.5%)	899 (38.5%)	939 (31.2%)	726 (31.1%)	5452 (33.4%)
65–74	886 (37.5%)	857 (37.8%)	573 (37.5%)	791 (38.9%)	1008 (36.3%)	1108 (36.8%)	822 (35.2%)	6045 (37.1%)
75–84	541 (22.9%)	523 (23.1%)	362 (23.6%)	506 (24.9%)	715 (25.78%)	756 (25.1%)	622 (26.6%)	4025 (24.7%)
85+	58 (2.5%)	69 (3.1%)	44 (2.9%)	96 (4.7%)	152 (5.5%)	206 (6.9%)	166 (7.1%)	791 (4.8%)
Female (N,%)	1490 (63.0%)	1469 (64.9%)	966 (63.1%)	1280 (63.0%)	1705 (61.5%)	1844 (61.3%)	1456 (62.3%)	10,210 (62.6%)
Socioeconomic status (N,%)								
Low	623 (26.3%)	589 (26.0%)	462 (30.2%)	588 (28.9%)	797 (28.7%)	822 (27.3%)	612 (26.2%)	4493 (27.5%)
Medium-low	666 (28.2%)	628 (27.7%)	503 (32.8%)	602 (29.6%)	755 (27.2%)	765 (25.4%)	625 (26.8%)	4544 (27.9%)
Medium-high	593 (25.1%)	570 (25.2%)	348 (22.7%)	487 (24.0%)	724 (26.1%)	819 (27.2%)	646 (27.7%)	4187 (25.7%)
High	484 (20.5%)	478 (21.1%)	217 (14.2%)	355 (17.5%)	496 (17.9%)	603 (20.0%)	453 (19.4%)	3086 (18.9%)
Deductibles depleted (N,%)	n/a	1980 (87.4%)	1311 (85.7%)	1749 (86.0%)	2413 (87.0%)	2700 (89.7%)	2105 (90.1%)	12,258 (87.9%)
Deductibles depleted, excl. PET (N, %)	n/a	1975 (87.2%)	1311 (85.7%)	1748 (86.0%)	2413 (87.0%)	2677 (89.0%)	2069 (88.6%)	12,193 (87.4%)
Initial HOA registration (N,%)								
General practitioner	1131 (48.1%)	1133 (50.4%)	803 (53.1%)	1030 (51.3%)	1422 (51.9%)	1624 (54.7%)	1194 (51.9%)	8337 (51.1%)
Orthopedic surgeon	1005 (42.8%)	858 (38.1%)	539 (35.6%)	686 (34.2%)	906 (33.0%)	955 (32.2%)	840 (36.5%)	5789 (35.5%)
Physio/exercise therapist	214 (9.1%)	259 (11.5%)	171 (11.3%)	293 (14.6%)	414 (15.1%)	389 (13.1%)	267 (11.6%)	2007 (12.3%)

SD= standard deviation. KOA= knee osteoarthritis. HOA= hip osteoarthritis. PET=physio/exercise therapy.

(OR [95% CI] 0.90 [0.79 – 1.02], Fig. 3D) on average. The underlying regression model for Fig. 3 can be found in Appendix VI. About 85% of all patients with KOA and 87% of patients with HOA had depleted their deductibles between 2016 and 2019, as can be seen in Table 1.

3.1.3. Sensitivity analyses

The results of our sensitivity analyses for treatment registration by the GP are shown in Appendix IV. These analyses show that there is a difference of up to 10% annually in the proportion of patients receiving care, but trends over time remain the same. Consequently, under-registration of GP care does not seem to cause biased results in trends over time.

Appendix V shows the results of our sensitivity analyses for treatment registration by a PET. For the knee, including related or all knee

diseases did not result in a different trend of received PET over time. For the hip however, including related diseases in the model resulted in a flattening of the decrease after 2018. Moreover, including all hip diseases resulted in a slight increase in PET after 2018, instead of a decrease. Thus, there might be an under-registration in PET for HOA after 2018. The percentage of patients who received PET prior to joint replacement surgery increased (Appendix VII). The largest increase can be seen in 2016, after implementation of the renewed GP guideline. For HOA however, an underestimation of patients receiving PET can be seen since 2018, in line with the sensitivity analyses from Appendix V.

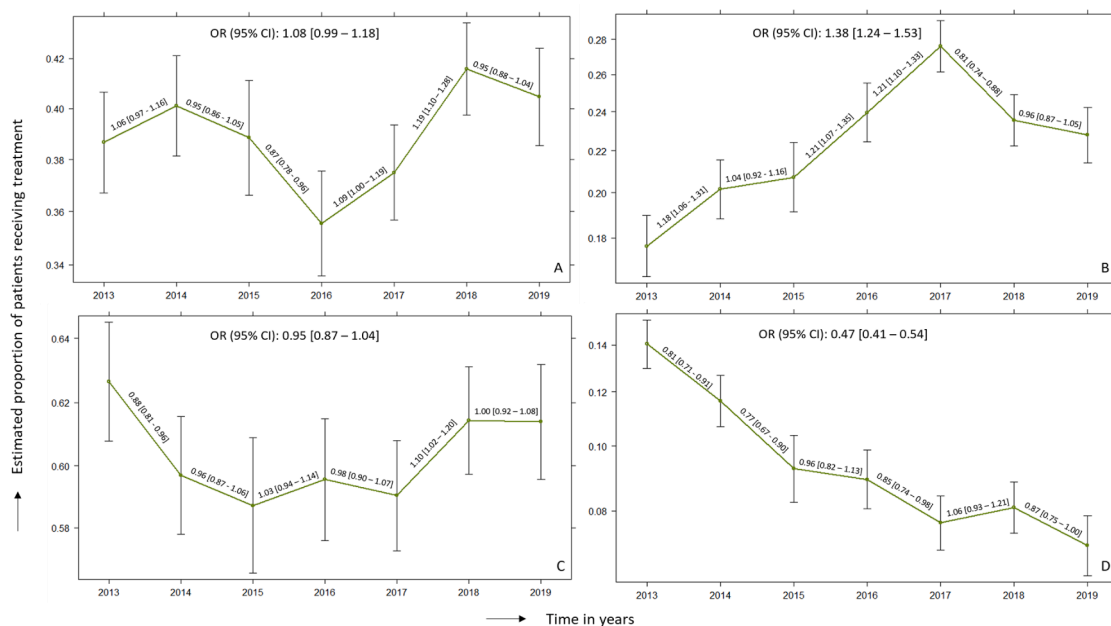


Fig. 1. Estimated proportion of newly diagnosed patients with knee osteoarthritis that received care between 2013–2019. Both point estimates and 95% confidence intervals are shown per year, corrected for age, gender, socioeconomic status and most prevalent comorbidities (Appendix II) per healthcare provider (A=General Practitioner, B=Physio/exercise therapist, C=Orthopedic Surgeon, D=Total Knee Replacement). Note: the y-axis differs between the graphs, as graphs should not be compared in absolute terms. Relevant is the relative change of estimated probabilities of receiving care within each graph (per healthcare provider).

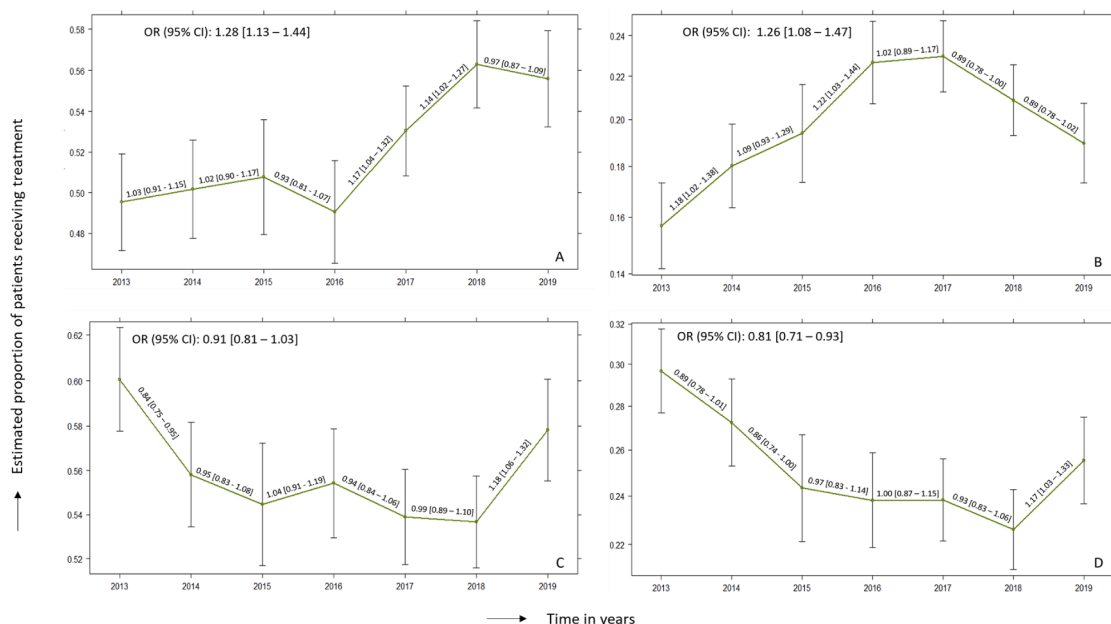


Fig. 2. Estimated proportion of newly diagnosed patients with hip osteoarthritis that received care between 2013–2019. Both point estimates and 95% confidence intervals are shown per year, corrected for age, gender, socioeconomic status and most prevalent comorbidities (Appendix II) per healthcare provider (A=General Practitioner, B=Physio/exercise therapist, C=Orthopedic Surgeon, D=Total Hip Replacement). Note: the y-axis differs between the graphs, as graphs should not be compared in absolute terms. Relevant is the relative change of estimated probabilities of receiving care within each graph (per healthcare provider).

4. Discussion

4.1. Main findings

The main aim of this study was to investigate to what extent policy measures promoting substitution from hospitals to primary care actually resulted in substitution. For patients with knee or hip osteoarthritis new guidelines and inclusion of PET in BHI as policy measures were intended to increase substitution. From 2013 until 2017, the intended shift from

hospitals to primary care seems to have taken place. However, from 2018 onwards, an opposite trend was observed with a shift back from primary care to hospital care. Treatment in hospitals increased significantly again, only knee replacement surgeries continue to decrease. After inclusion of PET in the BHI in 2018, patients who had not yet depleted their annual deductibles were less likely to be treated by a PET. This may signify a reluctance of patients to visit health care providers for which they have to pay for themselves through deductibles. Deductibles might be a microeconomic barrier for substitution of care for patients

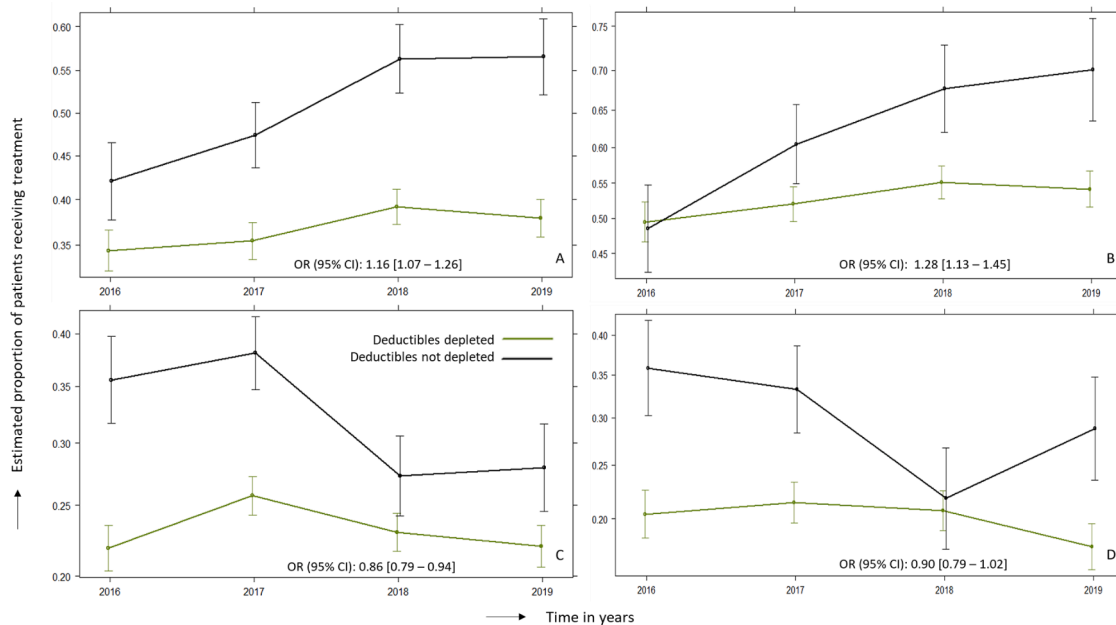


Fig. 3. treatment at the general practitioner or physio/exercise therapist stratified by depletion of deductibles. The overall odds ratio for the interaction term between time in years and depletion of deductibles (ref: not depleted) is shown per provider for knee and hip osteoarthritis. (A=General Practitioner, knee osteoarthritis, B= General Practitioner, hip osteoarthritis, C= Physio/exercise therapist, knee osteoarthritis, D= Physio/exercise therapist, hip osteoarthritis). Note: the y-axis differs between the graphs, as graphs should not be compared in absolute terms. Relevant is the relative change of estimated probabilities of receiving care within each graph (per healthcare provider).

with osteoarthritis of the knee or hip, resulting in unintended effects of the policy measure taken.

4.2. Barriers and facilitators of substitution

Medical guidelines should facilitate stepped care, but seem to be counteracted by negative financial incentives. This is in line with existing research on the incentives that derive from the payment of deductibles and other coinsurance structures [32,36,37,45]. The fact that patients who have not depleted their deductibles in a specific year have to pay for PET themselves might explain these differences. These patients are exempted from paying their deductibles if they choose to go to a GP. As basic insurance comes with the obligation of paying deductibles, patients with previously little healthcare uptake have to pay this out-of-pocket. This policy measure therefore might actually elevate the threshold for those patients who have not used their deductibles yet [36,37,45]. Patients cannot reinsure against the deductible in the Netherlands. Deductibles do not apply for SHI, so this health policy measure is mainly attractive for people who already used their deductibles in previously received care or people without additional insurance. The percentage of people within the Netherlands that have supplementary health insurance has consistently been between 83–91% over the last decade [46,47].

If patients who expect to deplete their deductibles would drop their SHI, reimbursement in BHI could stimulate PET use for KHOA. However, SHI covers PET use for other conditions and often also has coverage for other types of care, which are not included in the BHI. We expect patients not to drop their SHI because of the relative small change in BHI coverage for KHOA. Especially since our study population consists of newly diagnosed KHOA patients. Insured inhabitants can normally change health insurer, both SHI and BHI, only at the end of the year. So, the included patients in our analyses could not have anticipated their choice for SHI on their future diagnoses of KHOA.

Besides financial incentives, beliefs of OSs might play an important role as well. A previous study showed that some OSs view physical therapy for HOA as not effective [48]. These views were associated, as expected, with decreased referrals to the physiotherapist. However,

many studies have found that PET is an effective treatment for KHOA [28,30,31,49]. Studies on joint consultations of GP’s with OSs for patients with KHOA, have also found that this so called intermediate care significantly increases referrals to the physiotherapist. Changing these beliefs might therefore be a key factor in better implementation of stepped care.

We note that patients that had not depleted their deductibles were more likely to use primary care. For PET, a potential explanation could be that having SHI stimulates substitution to PET, as patients may opt for treatment options that are covered by SHI in order to make use of their coverage. This would explain why the use of PET diminishes since the introduction into BHI. However, SHI does not apply for treatment at the GP and would therefore not explain the higher uptake among patients that had not depleted their deductibles. A more logical explanation might therefore be that patients that had depleted their deductibles, are more often in treated secondary care (hence the depletion), and not in primary care. However, additional research including SHI data is needed to conclude causality for both arguments.

4.3. Strengths and limitations

For this study we used routinely recorded electronic health records and claims data. This has several advantages and disadvantages [50,51]. One advantage is the size of the dataset which increases the generalizability of our findings. Moreover, due to the combination of both EHR and medical claims data, we were able to select patients diagnosed along a large spectrum of health service providers regarding our study population. We enriched this data with patient characteristics and healthcare expenditure on patient level. Therefore, we were able to relate policy developments within the mandatory basic health insurance to changes in healthcare utilization patterns. Finally, we were able to compare large numbers of patients over seven consecutive years, which allowed us to gain a unique insight into shifts in care over a time.

However, some limitations apply to our study as well. Firstly, no causal relationships can be tested within our study design. Therefore, no causal interpretations can be made from the associations between substitution policies and shifts in care. Secondly, patients were assumed to

be newly diagnosed patients with KHOA if they had not had a registered contact in the previous year. Therefore, if patients were diagnosed with KHOA before 2012 without having received care for more than one year, these patients were incorrectly included in our study. Thirdly, not every patient with osteoarthritis is registered with L89 (hip osteoarthritis) or L90 (knee osteoarthritis) at their GP [44,52]. Some patients are registered with L13 (hip complaints) or L15 (knee complaints) at a GP, but are diagnosed at a later moment in time with osteoarthritis at a PET or OS. An underestimation of patients with KHOA with an initial contact at a GP can be present. Therefore, we performed sensitivity analyses by including the possible deviating codes L13 and L15 in the regression analyses, which can be found in Appendix IV. Fourthly, variance in the number of included cases per year is high, due to the fact that the completeness of EHR data from general practices and claims data of health insurers varies over the years. Fifthly, due to the lack of out-of-pocket payments in medical claims data, between 5–8% of PET consultations was found to be missing compared to EHR data annually. Lastly, within our study we had no information regarding which patients had a SHI or not. Therefore, we could not make a comparison between these patients. This limits our conclusion regarding SHI.

4.3.1. Policy implications

Our results show that efforts to enhance substitution of hospital care, might have unintended effects. If financial incentives for patients are not sufficiently aligned, the potential of substitution of care is not fully realized. Adequate financial incentives are an important precondition for appropriate care, as they could unintentionally influence treatments choices [53,54]. Even though little reduction in moral hazard from deductibles is expected for high risk patients, deductibles can form a substantial incentive in the choice of care for low risk patients [32]. As the height of deductibles has increased from 150 euro in 2006 to 385 euro in 2016, this incentive has increased over time. This is especially the case for PET, as price elasticity for PET is likely to be higher in the Netherlands as compared to joint replacement surgery. Patients that have not depleted their deductibles pay all PET treatments themselves, but pay only a small fraction of total joint replacements costs (10,433 euro for knee replacements and 9849 euro for hip replacements, of which deductibles are 3–4% [55,56]). Incentives deriving from deductibles might be misaligned with appropriate care. Deductible exemptions for appropriate care or value-based-insurance design might therefore be relevant policy options.

5. Conclusion

Between 2013 and 2019, care for patients with KHOA has shifted from hospital care to primary care (GP and PETs). However, the full potential of substitution of care for patients with KHOA has not yet been realized, as financial incentives due to patient's deductibles seem to have had unintended effects. Additional research is necessary to infer causal reimbursement effects and distill specific policy recommendations.

Ethics approval and consent to participate

Study methods were carried out in accordance with the Declaration of Helsinki and other relevant regulations and guidelines. The use of electronic health records for research purposes is allowed under certain conditions. When these conditions are fulfilled, neither obtaining informed consent from patients nor approval by a medical ethics committee is obligatory for this type of observational studies, containing no directly identifiable data (art. 24 GDPR Implementation Act jo art. 9.2 sub j GDPR). In order to protect the privacy of individual patients, healthcare professionals and providers like hospitals and primary care practices, an agreement on the handling of data has been signed by all researchers. In the privacy regulations for the Primary Care Database, NIVEL states what data is collected, how it is managed and what the

rights of registered participants are. The General Data Protection Regulation (GDPR) is adhered to. Steering committees with representatives from healthcare provider's national associations take part in the decision making process of the use of data (see <https://www.nivel.nl/en/nivel-zorgregistraties-eerste-lijn/nivel-primary-care-database> for more information). This study has been approved according to the governance code of Nivel Primary Care Database, under number NZR-00,321.003.

Availability of data and materials

The data that support the findings of this study are available from Nivel and the NHCI but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of Nivel and the NHCI.

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CRedit authorship contribution statement

CD and RV were involved in the funding acquisition. IB, JD, CD, BM, RV, WM, HM, AC and CV contributed to the conceptualization of the study. JD, IB and CD curated the data and contributed to the methodology. JD performed the formal analysis, which was reviewed by CD, IB and IGA. JD wrote the original draft of the manuscript. All authors reviewed and edited the original draft in close collaboration with JD. All authors contributed to manuscript revision, read, and approved the submitted version. Project administration was carried out by IB, CD, RV and JD. Supervision was carried out by IB, CD and RV.

Declaration of Competing Interest

None.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.healthpol.2023.104825](https://doi.org/10.1016/j.healthpol.2023.104825).

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