Title

Acetabular Dysplasia Is A Risk Factor For Developing Radiographic Hip Osteoarthritis; Data From The World Coach Consortium

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Table 1:

	Total	MRI examinations			
		R-TFOA *	R-PFOA *	Ages 50 to 79 years	Patients with combined factors **
n patients	4,287	535	758	1,898	2,301
n MRIs	4,822	570	825	2,086	2,529
Age (years)	mean 49.1, median 48, SD 9.7	mean 52.3, median 52, SD 10.4	mean 51.1, median 50, SD 10.3	mean 58.1, median 56, SD 6.7	mean 55.3, median 55 SD 8.8
Sex (n patients)	F: 2,131 M: 2,156	F: 293 M: 242	F: 342 M: 416	F: 1,039 M: 859	F: 1,212 M: 1,089

** Up till 365 days before the MRI examination. ** Patients with combined factors: (R-TFOA OR R-PFOA) up till 365 days before the MRI examination OR ages 50 to 79 years. F: female. M: male. TFOA: tibiofemoral osteoarthritis. PFOA: patellofemoral osteoarthritis.*

79 years old. Local guidelines do not recommend a knee MRI for this patient group. An upcoming study will look into causes for appropriate MRIs, such as cancer suspect cases, joint infections, and locked knees. If no appropriate cases are found, 52.4 % of the performed MRI examinations could have been prevented to decrease the risk of MRI-initiated overtreatments among patients with OA and lower healthcare spending. A quarter of the patients had a recent radiographic examination at the same hospital; therefore, we have no confirmed radiographic findings for most patients. This study had two main limitations: 1) we had no access to radiographs from other hospitals and private clinics, and 2) the AP/PA radiographs were not reviewed for weight-bearing positions. OA conditions must be considered before booking a knee MRI. The referral reviewing process can be supported by automated AI-driven workflows that flag knee MRI bookings in patients with radiographic OA.

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ACETABULAR DYSPLASIA IS A RISK FACTOR FOR DEVELOPING RADIOGRAPHIC HIP OSTEOARTHRITIS; DATA FROM THE WORLD COACH CONSORTIUM

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Purpose: Osteoarthritis (OA) is the most prevalent joint disease, affecting at least 500 million people worldwide. Partly due to a lack of knowledge on its aetiology, OA currently cannot be cured. Hip morphology has been marked as an important risk factor for the development of hip OA, in particular acetabular dysplasia (AD). The under-coverage of the acetabulum relative to the femoral head in individuals with AD leads to increased joint load which may result in premature cartilage damage and ultimately cause hip OA. Attempts to relate AD to the development of hip OA from single cohort studies have yielded conflicting results as these studies may be underpowered to study this association. This study's aim was to determine the relation between AD at baseline and the risk of radiographic hip OA within 8 years follow-up, using data from the Worldwide Collaboration on OsteoArthritis prediCtion for the Hip (World COACH).

Methods: The World COACH consortium was established to collect and harmonize all available individual participant data from prospective cohort studies (n=9) that have sequential pelvic or hip imaging available. For the current study, we included the 6 cohorts that had baseline pelvic radiographs and radiographic OA scores available within a maximum of 8 years. Standardized anteroposterior (AP) pelvic and/or hip radiographs were taken at baseline and at a follow-up visit between 4-8 years in each included cohort. Scores for radiographic OA were already available for each cohort, either by Kellgren & Lawrence grade (K&L), (modified) Croft grade, or an adaptation. For this analysis we harmonized these scores into "definitely no OA" (any score 0), "doubtful OA" (any score 1), or "definite OA" (any score $\geq$2 or total hip replacement). We only included hips without OA (any score 0) at baseline. An automatic Bonefinder® search model was used to annotate all baseline radiographs, outlining the bony shape per hip. The Wiberg center edge angle (WCEA) is a measurement of coverage of the femoral head by the acetabulum. The WCEA is formed by a vertical line perpendicular to the horizontal reference line and a line from the center of the femoral head to the most lateral point of the weight bearing acetabulum (the sourcil), see Figure 1. From the outline of the hip shape, the WCEA was calculated automatically. The threshold used for AD is a WCEA $\leq 25°$. We excluded all hips with a lateral center edge angle (LCEA) $\geq 40°$ in order to exclude hips with pincer morphology, which is a hip shape that may also be associated with the development of hip OA. Development of radiographic hip OA was defined by K&L grade $\geq$2, Croft score $\geq$2, OA score =2 or total hip replacement (THR), depending on available scores per cohort. The associations between baseline AD and development of radiographic hip OA were estimated using a logistic regression model with generalized mixed effects with 3 levels: hip side (left/right), individual and cohort. The results are expressed as odds ratios (OR) and were adjusted for baseline age, sex, and BMI.

Results: The six cohorts included yielded radiographic hip OA data on 51,363 hips (Table 1). We excluded 5,004 hips with definite OA and 18,250 hips with doubtful OA or missing OA scores at baseline. This left 28,109 hips without OA at baseline. After exclusion of hips with other missing data, insufficient quality radiographs or pincer morphology, we included 13902 hips. Of the included hips 3731 hips (27%) had acetabular dysplasia. Within a maximum of 8 years (mean 6.1 $\pm$1.7) follow-up, 547 hips (4%) developed radiographic hip OA. AD was significantly associated with hip OA with an OR of 1.24 (95% CI 1.021-1.495).

Conclusions: The odds of developing radiographic hip OA within 8 years in a population with an average age of 62.2 and an average BMI of 27.2 for hips with AD is 1.24 times higher than in hips without AD. The large and heterogeneous sample size allowed for a robust estimate of

Table 1 Baseline characteristics of the study population

Characteristic	Study population (n=13902)
Women, n (%)	9720 (70)
Age, mean (sd)	62.2 (8.4)
BMI, mean (sd)	27.2 (4.4)
Cohort, n (%)	
CHECK	465 (3.3)
Chingford	543 (3.9)
Johnston County	358 (2.6)
OAI	4309 (31.0)
RS-I	1267 (9.1)
RS-II	1631 (11.7)
RS-III	2232 (16.1)
SOF	3097 (22.3)
WCEA ≤ 25°, n (%)	3731 (26.8)

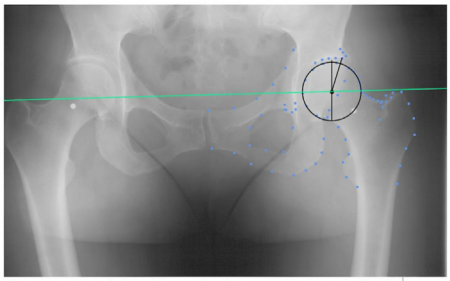

Figure 1. AP pelvic radiograph with automatic Bonefinder search model of hip shape (blue), horizontal reference line (green) and automatic calculation of WCEA (black).

this effect. Future studies within the World COACH consortium will elucidate whether this is an overall effect or if specific high-risk subgroups, for instance the younger individuals, are responsible for the association found.

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THE LONGITUDINAL ASSOCIATION OF HAND OSTEOARTHRITIS WITH PAID AND UNPAID WORK IMPAIRMENT AND RELATED COSTS: THE HAND OSTEOARTHRITIS IN SECONDARY CARE COHORT

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Purpose: Hand osteoarthritis (OA) presence is associated with impairment in paid and unpaid work and contributes to societal burden and costs. However, the longitudinal development of hand OA-related paid and unpaid work impairment and related societal costs are unknown. Therefore, we aimed to investigate the association of hand OA with paid and unpaid work production loss, hinder and societal costs longitudinally.
Methods: We used annual data of the Dutch Hand OSTeoArthritis in Secondary care (HOSTAS) cohort from baseline to four years of follow-up. Presence of primary hand OA was defined by the treating rheumatologist. Patient and OA characteristics were assessed with validated questionnaires on patient and hand OA characteristics and by physical examination. The Health and Labour Questionnaire (HLQ) - having a recall period of two weeks - was assessed each year to investigate hinder, hours of sick leave (absenteeism) and unproductive hours while at work as well as hinder and hours required to replace unpaid work tasks in relation to hand OA. The HLQ was added to the questionnaires after part of the cohort already had first or second follow-up assessment. Patients with HLQ data on >1 timepoint were included in this study. Societal costs of paid work loss (=all costs an employer makes in order to employ a worker, such as salary and social premiums) were estimated by multiplying the number of unproductive and sick leave hours due to hand OA by the average hourly costs of paid work in The Netherlands. Costs of unpaid work were estimated by multiplying the hours of unpaid work replaced by others by the Dutch gross average hourly salary of a household help (€12.50). Costs were adjusted to 2021 values and extrapolated to costs per year using conversion factors.
Results: Data on more than one timepoint was available for 470 patients. Baseline data were available for 381 patients, of whom 256 patients (67%) completed four years of follow-up, and 215 (56%) completed all five follow-up moments. Those who had baseline data but did not complete four years of follow-up (n=125), and those with data on all timepoints (n=215) did not differ substantially from those with at least data on baseline and four years of follow-up (n=256) in terms of baseline age, sex and AUSCAN pain score (data not shown). We focused on the group with at least data on baseline and four years, as patients in this group had a comparable and substantial follow-up duration. Baseline and four years follow-up data was present for 256 patients, of which 113 (52%) had paid work at baseline and 104 (41%) at four years (table 1 for characteristics of these patients). At baseline, 25/133 (19%) of working patients had unproductive hours due to hand OA (absenteeism or unproductive at work); 10/25 (40%) of them still worked at four years without unproductive hours, 7/25 (28%) still worked with unproductive hours, and 8/25 (32%) had retired. Median paid work hinder score (score range: 6-24) remained stable at 7 (interquartile range (IQR): 6;8) over the study period. Patients who transitioned from “no paid work hinder” at baseline to “paid work hinder” or “paid work unproductive hours” at four years (n=14) did not differ substantially from those who did not (n=90) in terms of baseline mean age, AUSCAN pain and AUSCAN function (data not shown). Unproductive hours at any timepoint were present for 84/470 patients (18%). Presence of these unproductive hours for individual patients fluctuates over time (figure 1). Regarding unpaid work, 105/255 (41%) required unpaid task replacement by others due to hand OA at baseline, of which 24 reported this no more at four years. Of those that had no replacement at baseline, 28 developed this at four years. Consequently, 108 (42%) had unpaid work replacement at four years. Unpaid work hinder was reported by 100/256 patients (39%) at baseline and 97/255 (36%) at four years. Societal paid and unpaid work-related costs were present at baseline for 136/256 patients, with a median of €62.50 ((IQR) 37.50;125) per two weeks (€1630 (978;3261 per year). At four years, these were present for 120/256 patients, with a median of €50 (37.50;100) per two weeks (€1304 (978;2609) per year).

Figure 1. Heatmap of adverse paid work outcomes over time per patient per year, for all patients having data for at least two timepoints and any production loss at any timepoint (baseline, 1, 2, 3, 4 year follow-up, n=84)

	Baseline, all patients (n = 256)	Baseline, paid work (133/255, 52%)	Four years, all patients (n = 256)	Four years, paid work (104/255, 41%)
Age, years	61.3 (8.0)	60.2 (7.5)	64.6 (8.4)	62.0 (8.1)
Sex, women, *n (%)*	204 (80%)	108 (82%)	204 (80%)	87 (84%)
BMI, kg/m^2	27.3 (4.7)	27.2 (4.7)	27.4 (5.0)	27.1 (4.7)
AUSCAN hand pain (0–20)	9 (4.3)	9.1 (4.6)	9.3 (4.3)	7.9 (4.5)
AUSCAN hand function (0–36)	15.1 (8.4)	14.6 (8.5)	15.2 (8.4)	14.5 (7.7)
HADS anxiety score (range 0–21)^	4 (2;6)	4 (2;6)	4 (2;6)	3 (2;6)
HADS depression score (range 0–21)^	2 (1;5)	2 (1;4)	2 (1;5)	1 (1;4)
Retired, *n (%)*	83 (32%)	–	95 (37%)	–

Numbers represent (SD) mean unless otherwise specified. ^median (interquartile range). Abbreviations: SD = standard deviation, BMI = Body Mass Index, HADS = Hospital Anxiety and Depression Scale, AUSCAN = Australian Canadian Osteoarthritis Hand Index.

Table 1 Osteoarthritis and Cartilage

Demographics and hand OA characteristics of patients with at least baseline and four years of follow-up data.