Association of Years Duration of Shift Work and Night Shift Work with Osteoarthritis Risk

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INTRODUCTION: Evidence from clinical and animal studies suggests that circadian rhythm disruption contributes to osteoarthritis (OA). Shift work is one prevalent source of environmental circadian rhythm disruption. Recent studies indicate that shift work, particularly night shift work, is associated with higher risk of incident knee OA, total knee arthroplasty (TKA), and self-reported OA[1,2]. However, few studies have investigated the effect of duration of shift work on the risk of OA. Using the UK Biobank (UKB) we hypothesized that longer reported durations of shift work would be associated with higher rates of knee and hip OA, as well as TKA and total hip arthroplasty (THA), with the highest risk seen for those with long durations of night shift work.

METHODS: UK Biobank participants completed a baseline assessment which collected information such as demographics, body mass index (BMI), and medical history. Among the 500,000-participant UKB cohort, about 25% of participants also completed an online survey capturing lifetime job history, including history of shift work. Our study focused on this subgroup. Participants that had an inflammatory arthritis/autoimmune disorder were excluded, as well as participants that had an OA endpoint before UKB enrollment or self-reported OA during the baseline assessment. Four OA endpoints were evaluated: knee OA diagnosis, hip OA diagnosis, TKA, and THA. Hospital records were linked to the entire cohort and these records were used to identify TKA and THA cases. Half of the cohort was also linked to primary care records, and assessment of incident hip and knee OA diagnoses was limited to this subset. An incident OA case was defined as either the presence of ≥2 hip/knee OA diagnosis codes in primary care within six months or a hospital hip/knee OA diagnosis. Cox regression was used to estimate associations between shift work duration and OA outcomes adjusting for age, sex, education, race, Townsend Deprivation Index, frequency of manual work, and frequency of walking and standing. Associations were evaluated with and without adjustment for body mass index, since circadian clock disruption may influence OA though the effects of obesity.

RESULTS: Among 120,271 participants that completed the lifetime job history survey, 34,061 (28%) reported a history of shift work and 27,609 (23%) participants reported a history of night shift work. There were 66,850 (56%) female participants and 53421 (44%) male participants in the cohort. In the cohort, there were 3,854 TKA cases, 2,020 knee OA diagnoses, 3,977 THA cases, and 1,299 hip OA diagnoses. Compared to workers that reported no shift work history, participants with a history of shift work had higher risk of TKA and knee OA, though associations with specific durations of shift work were only statistically significant for TKA (Table 1). TKA risk was highest among participants working longer durations of shift work. In BMI-unadjusted models, those that worked 21-30 years of shift work had 40% higher TKA risk (95%CI=16%-69%, P<0.001) and 26% higher knee OA risk (95%CI=-3%-65%, P=0.088) compared to those with no shift work history. Participants that worked >30 years of shift work had 51% higher TKA risk (95%CI=29%-76%, P<0.001) and 28% higher knee OA risk (95%CI=0%-65%, P=0.052). A history of night shift work was associated with higher knee OA and TKA risk, particularly among participants who worked greater than 20 years of night shifts (Table 1). In BMI-unadjusted models, participants that worked 21-30 years of night shift work had 52% higher TKA risk (95%CI=21%-90%, P<0.001) and 57% higher knee OA risk (95%CI=14%-114%, P=0.008) compared to those with no night shift work history. Those that worked >30 years of night shift work had 77% higher TKA risk (95%CI=43%-119%, P=0.005) and 73% higher knee OA risk (95%CI=25%-139%, P=0.001). Results were attenuated in BMI-adjusted models, though associations with TKA and knee OA remained statistically significant (Table 1). We did not observe associations between shift work history and hip OA or THA.

DISCUSSION: Our findings show evidence of increased knee OA and TKA risk with any duration of shift work, and risk increased with longer durations of shift work, particularly night shift work. The highest risk was observed among workers who had done shift work for decades. These results suggest a cumulative effect of circadian clock disruption on knee OA. The lack of association with hip OA and THA is consistent with previous studies of shift work.

SIGNIFICANCE/CLINICAL RELEVANCE: This study provides further evidence that circadian disruption, particularly due to night shift work, increases knee OA risk. It is unclear that there is a safe duration of shift work, but multiple decades of shift work is associated with the highest risk. Interventions to reduce circadian clock disruption in shift workers and minimizing the duration of time workers are assigned to night shifts could mitigate knee OA risk.

REFERENCES: 1. Hashmi et al. (2025). *Osteoarthr Cart Open*, 7(1), 100565. **2.** Yanik EL et al. Night Shift Work is Associated with Elevated Risk of Knee Osteoarthritis and Total Knee Arthroplasty. Abstract presented at: Orthopaedic Research Society Annual Meeting. Long Beach, CA, 2-6 Feb 2024.

Table 1. Association of shift work duration with Knee OA and TKA

Shift Work Duration	*Without* adjustment for BMI				*With* adjustment for BMI			
	Knee OA		**TKA**		**Knee OA**		**TKA**	
	HR (95%CI)	P-value	HR (95%CI)	P-value	HR (95%CI)	P-value	HR (95%CI)	P-value
Years=0	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
0< Years ≤5	1.19(0.94-1.51)	0.158	1.27(1.08-1.49)	0.004	1.13(0.89-1.44)	0.315	1.20(1.02-1.41)	0.029
5< Years ≤10	1.34(1.00-1.80)	0.052	1.34(1.10-1.64)	0.004	1.23(0.92-1.65)	0.168	1.25(1.02-1.53)	0.030
10< Years ≤20	1.09(0.82-1.45)	0.566	1.32(1.09-1.59)	0.004	1.00(0.75-1.34)	0.981	1.19(0.98-1.43)	0.073
20< Years ≤30	1.26(0.97-1.65)	0.088	1.40(1.16-1.69)	<0.001	1.16(0.89-1.52)	0.269	1.29(1.07-1.55)	0.008
Years >30	1.28(1.00-1.65)	0.052	1.51(1.29-1.76)	<0.001	1.15(0.90-1.48)	0.269	1.31(1.12-1.54)	0.001
Night Shift Work Duration								
Years=0	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
0< Years ≤5	1.20(0.97-1.49)	0.087	1.18(1.02-1.36)	0.028	1.13(0.91-1.40)	0.261	1.10(0.95-1.27)	0.217
5< Years ≤10	1.04(0.73-1.47)	0.847	1.34(1.08-1.65)	0.007	0.95(0.67-1.34)	0.751	1.22(0.99-1.51)	0.064
10< Years ≤20	1.12(0.82-1.53)	0.473	1.33(1.08-1.63)	0.006	1.02(0.75-1.39)	0.914	1.15(0.94-1.42)	0.172
20< Years ≤30	1.57(1.14-2.14)	0.005	1.52(1.21-1.90)	<0.001	1.40(1.02-1.92)	0.036	1.36(1.08-1.70)	0.008
Years >30	1.73(1.25-2.39)	0.001	1.77(1.43-2.19)	<0.001	1.47(1.06-2.04)	0.021	1.49(1.20-1.85)	<0.001

*All models adjusted for age, sex, education, race, Townsend Deprivation Index, and frequency of manual/physical labor, and frequency of walking/standing.
HR=Hazard Ratio, CI = Confidence Interval