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Highlights of a systematic review

Work activities and the development of osteoarthritis in men and women

Osteoarthritis (OA) is associated with significant pain, stiffness, fatigue and activity limitations; it's one of the top ten causes of disability worldwide. Many studies to date have looked at the relationship between the onset of OA and work factors. Some have looked at the link between OA and physically demanding occupations (e.g. farming, mining and floor-laying) and other activities at work (e.g. kneeling, squatting and heavy lifting).

The aging of the working population creates a greater impetus for examining the role of workplace factors potentially associated with OA. Older workers—who have often been in similar jobs for many years—may be exposed to hazards for longer duration. They may also be at greater risk of developing workplace musculoskeletal injuries than younger workers, which can increase the likelihood of developing OA.

As a result, workplace regulators and insurers are looking for greater guidance—not only on specific types of work activities that may put workers at risk of OA, but also on threshold levels related to the frequency, intensity and duration of these activities.

The Institute for Work & Health, at the request of WorkSafeBC, set out to fill this gap by conducting a systematic review of the existing evidence that asked the following questions:

What work activities are associated with greater risk of developing osteoarthritis? What threshold levels (frequency, intensity and duration) of work activities are associated with increased OA risks? What similarities and differences exist between men and women in the associations between work activities and the development of OA?

KEY MESSAGES

Strong and moderate evidence indicates that work exposures, including lifting, cumulative physical loads, full-body vibration and kneeling/squatting/bending, can increase the risks of developing osteoarthritis in men and women.

Strong and moderate evidence shows no increased risk of osteoarthritis related to sitting, standing and walking (hip and knee osteoarthritis); lifting and carrying (knee osteoarthritis); climbing ladders (knee osteoarthritis); driving (knee osteoarthritis); and highly repetitive tasks (hand osteoarthritis).

How was the study conducted?

The systematic review team consisted of eight researchers from Canada. The review team searched four databases for articles published up to December 2017 that examined diagnosed OA (as distinct from other conditions), focused on paid work and its impact on the development of an OA diagnosis, and were original quantitative research studies. In keeping with previous reviews on this topic, the team included longitudinal, observational, cohort, cross-sectional, case-control and intervention studies in its search.

A total of 4,134 articles were identified. After reviewing these studies for their relevance to the review question and the quality of their research methods, the team ended up with 39 high-quality studies and 30 medium-quality studies. Among them, study designs included retrospective cohorts (10 studies); prospective

Table 1: Level of evidence

Level of evidence	Minimum quality* and quantity	Consistency	Strength of message
Strong	3 high quality (H) studies	3 H studies agree; IF more than 3 studies, 3/4 of the H and M studies agree	Recommendations
Moderate	2 H studies OR 2 medium quality (M) studies and 1 H study	2 H studies agree OR 2 M studies and 1 H study agree; IF more than 3 studies, more than 2/3 of the M and H studies agree	Practice consideration
Limited	1 H study OR 2 M studies OR 1 M and 1 H study	1 H (if only one study); OR 2 M studies; OR 1 M and 1 H study; IF there are more than 2 studies, at least 1/2 of the M and H studies agree	Not enough evidence to make recommendation or practice consideration
Mixed	2 H and/or M studies	Findings are contradictory	Not enough evidence to make recommendation or practice consideration
Insufficient	No H studies OR M studies do not meet criteria above		Not enough evidence to make recommendation or practice consideration

*High quality studies scored >85% in the assessment of their quality; medium quality studies scored 50-85%

cohorts (14); case control (22) and cross-sectional (23).

The studies were conducted in 23 countries, with two-thirds of the studies looking at results among more than 500 people. The majority examined OA in the knees (41 studies) and hips (28). Smaller numbers of studies were found on OA of the wrists/hands/fingers (14), spine (6), shoulders (5), ankles/feet/toes (4), neck (3) and elbows (3).

Most of the studies used valid and reliable assessment methods for OA, including radiographic evidence or clinical exams. Their measures of work conditions and factors were less reliable. Although 70 per cent of studies provided reasonable descriptions of work activities, about 60 per cent used the overly broad description of "lifetime" to describe the duration of these activities. A majority of studies looked at workers from multiple industries. Many studies examined a mix of work activities. As a result, only 55 per cent of studies were considered to have valid and reliable measures of work history.

What were the main findings?

The table on the next page presents a summary of the evidence on the association between work activities and the risk of OA among men and women. There were too few studies to synthesize findings for OA of the neck, ankles/feet/toes, shoulders and elbows. Studies on OA of the hands, spine and combined joints did not analyze data for men and women separately.

Some of the findings above appear contradictory due to differences in how studies measured work activities. For example, when studies labeled their exposure "kneeling, squatting and bending," there was strong evidence for a risk of developing knee OA in both men and women. However, studies that examined kneeling separately found strong evidence for no increased risk of knee OA in both men and women. Likewise, squatting examined separately resulted in strong evidence for no increased risk of knee OA in men. Overall, when all studies that variously measured kneeling, squatting or bending in some form were combined, there was a moderate level of evidence for the development of knee OA among men only.

Data on dose-response—that is, the amount of exposure and the associated outcomes—were very diverse across the studies. As a result, synthesis of exposure levels was very limited. In general, an increased risk of developing OA in the knees or hips was linked to kneeling, squatting and bending for an hour or more a day, over multiple years.

Table 2: Summary of evidence

Work activities	OA Outcome	
	Men	Women
Strong evidence of increased risk for OA		
Lifting	Hip OA	Hip OA
Kneeling, squatting, bending	Knee OA	Knee OA
Heavy physical demands		Knee OA
Moderate evidence of increased risk for OA		
Vibration	Hip OA	
Cumulative physical load	Hip OA	
Kneeling, squatting and/or knee bending (all studies combined)	Knee OA	
Strong evidence of no increased risk for OA		
Sitting, standing, walking	Hip OA	
Kneeling	Knee OA	Knee OA
Squatting	Knee OA	
Climbing stairs/ladders		Knee OA
Moderate evidence of no increased risk for OA		
Sitting, standing, walking	Knee OA	Knee OA
Squatting		Knee OA
Lifting, carrying		Knee OA
Driving	Knee OA	Knee OA
Repetitive hand tasks	Wrist/hand/finger OA*	
Limited, mixed or insufficient evidence		
Jumping	Knee OA, Hip OA	Hip OA
Lifting	Knee OA, Spine OA†	Spine OA†
Heavy physical demands	Knee OA	
Vibration		Hip OA
Cumulative physical load and sitting, standing and walking		Hip OA
Cumulative physical load and jumping		Knee OA
†Separate analyses for men and women were not available		

What do the findings mean?

This was the first systematic review to include a wide range of joints affected by OA. It found strong or moderate evidence for the role of several work activities in the development of OA in hips and knees. However, due to the lack of clear dose-response information, as well as contradictory findings, the available evidence is limited in providing workplaces and regulators with the specific guidance they seek.

In men, strong evidence emerged for risk of hip OA related to lifting, as did moderate evidence for risk of hip OA related to cumulative physical loads and full-body vibration. This level of evidence is novel and warrants worker awareness and prevention efforts. Previous research has speculated about loads and prolonged vibration in occupations like farming; by focusing on work activities (e.g. driving tractors), this review offers more specific evidence. However, a lack of clear data on dose-response levels limits current practice recommendations on full-body vibration.

In women, strong evidence exists for an increased risk of hip OA related to lifting. This review, the first to have examined lifting activities separately for women, underscores the need for greater attention to the impact of this type of work activities among women.

Of interest was strong and moderate evidence for a lack of association among several activities and increased risks of hip, knee or hand OA. These included sitting, standing and walking (hip and knee OA); lifting and carrying (knee OA); climbing ladders (knee OA); driving (knee OA); and highly repetitive tasks (hand OA). Studies show no effects for many reasons, so caution should be used in drawing conclusions.

References and acknowledgements

These findings are based on the study: Gignac MAM, Irvin E, Cullen K, Van Eerd D, Beaton DE, Mahood Q, McLeod C, Backman CL, Men and women's occupational activities and the risk of developing osteoarthritis of the knee, hip or hands: A systematic review and recommendations for future research. *Arthritis Care & Research*, 2020; 72:3;378-396; doi 10.1002/acr.23855 [Epub 2020 Feb 27]. The full article is open access and available at: www.doi.org/10.1002/acr.23855

Conclusion

A synthesis of 69 studies from 23 countries found strong and moderate evidence for a link between several work activities and increased risks of OA in men and women. These include lifting, cumulative physical loads, full-body vibration, and kneeling/squatting/bending combined. Strong and moderate evidence exists for no increased risk of osteoarthritis related to sitting, standing and walking (hip and knee osteoarthritis); lifting and carrying (knee osteoarthritis); climbing ladders (knee osteoarthritis); driving (knee osteoarthritis); and highly repetitive tasks (hand osteoarthritis). The levels of evidence point to the potential for recommendations and practice considerations that can be tailored for women and men. However, additional attention is needed to overcome the limitations of the studies, particularly in the measurement and recall of work activities.

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