First carpo-metacarpal osteoarthritis and its association with occupation (with an emphasis on clerical workers)

By

WorkSafeBC Evidence-Based Practice Group

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About this report

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About the Evidence-Based Practice Group
The Evidence-Based Practice Group was established to address the many medical and policy issues that WorkSafeBC officers deal with on a regular basis. Members apply established techniques of critical appraisal and evidence-based review of topics solicited from both WorkSafeBC staff and other interested parties such as surgeons, medical specialists, and rehabilitation providers.

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Background

Osteoarthritis (OA) is the most common joint disorder in the adult population and hand joints are the most commonly affected.\(^{(10,314,365,390,392)}\) In persons 55-64 years old, radiographic evidence of moderate and severe OA has been observed in 16% of women and 6.4% of men.\(^{(393)}\) The prevalence of OA increases with age with further evidence on sex-specific differences.\(^{(392)}\) In individuals younger than 50 years, the prevalence of OA in most joints is higher in men than women, but hand OA is more prevalent among women.\(^{(365,392)}\) At age 45, the greatest prevalence of OA is in the thumb carpometacarpal (1st CMC) joint and the distal interphalangeal joints, followed later by the tibiofemoral and hip joints.\(^{(394)}\) Experts have shown that the prevalence of radiographic hand OA ranges from 29% to 76%\(^{(390)}\) and that 20% of all women over the age of 40 suffer from OA of the thumb.\(^{(366)}\)

To date, the etiology and pathogenesis of OA, in general, have still not been clearly elucidated.\(^{(45,392)}\) A recent US National Institutes of Health conference on OA\(^{(392)}\) examined the available evidence, summarized the evidence, and, based on this evidence, hypothesized that the pathogenesis of OA is multifactorial in nature, involving various risk factors including systemic factors such as age, sex, ethnic characteristics, bone density, estrogen replacement therapy, nutritional factors, and genetics. Local biomechanical factors, such as obesity, joint injury, joint deformity, sports participation and muscle weakness likely also play a role.

Although hand joints are the joints most commonly affected by OA, established causal risk factors, especially those related to occupations, are still inconclusive.\(^{(314,389)}\) Identified factors, such as age, sex, genetics, BMI, grip strength, ethnicity, geographic and climatic factors, have shown contradictory results.\(^{(390)}\) Overuse of the joints has been proposed as one of the causal factors in the development of OA in general and hand joint OA in particular. With regard to hand joint OA, this hypothesis was based on the observation that an increased prevalence of OA in the right hand compared with the left hand was observed in right handed persons in the 1963 – 1967 New Haven Survey of Joint Diseases.\(^{(395)}\) In 1971, based on cadaveric experimentation on finger joint pressure, Radin et al.\(^{(396)}\) proposed a “wear and tear” hypothesis as the etiology of finger joint OA. Radin et al.\(^{(396)}\) hypothesized that destructive changes came from repeated stresses due to continued loading of the joints. Further, it was thought that job tasks that required intensive use (wear) of the same muscles or motions for a long duration increased the likelihood of both localized and general fatigue and in turn the likelihood of injury (tear). More recently, another study observed that symptomatic and radiographic OA were less prominent in the paralyzed limbs of patients with stroke when compared with the contra-lateral non-paretic side.\(^{(390)}\) However, epidemiological studies investigating prolonged or repeated overuse of a group of finger joints and its association with the development of finger OA (including 1st CMC OA) have demonstrated conflicting results.\(^{(314,366,389,390)}\)
Recently, the WorkSafeBC Evidence-Based Practice Group (EBPG) was asked to investigate the potential causal association of or potential aggravation of pre-existing 1st CMC OA and working as a medical record clerk/health information processing clerk. In this particular case, the worker was a 58-year-old, right-hand-dominant female who had been working as a health information processing clerk over the preceding five years. Her right thumb symptoms started in 2008. Approximately 70 charts daily were pulled/retrieved by this worker (she did not file the charts back). The charts were of varying sizes and 40 – 50 were pulled in a 1.5 hour time span. Worksite assessment revealed varying work tasks with no evidence of repetitive movement of either hand or thumb; occasional and intermittent awkward posture due to the location of charts in the filing cabinet; and varying increased force due to use of pinch grip or span grip depending on the size of the charts. No other risk factors, such as vibration or extreme temperatures were identified. As such, we were further asked to review what types of occupations may predispose an individual to develop 1st CMC OA.

As such, the objectives of this systematic review are to investigate any causal association between clerical work, especially pinching and/or pulling, and the development or aggravation of 1st CMC OA, and to investigate what occupations, if any, may predispose one to develop 1st CMC OA.
Methods

A systematic literature search was undertaken on July 23, 2010. This search was conducted on commercial medical literature databases, including MEDLINE, MEDLINE Daily Update, MEDLINE In-Process, Other Non-Indexed Citations, EMBASE, and BIOSIS Previews, that are available through the OvidSP interface.

The literature search was done by employing the combination keywords:

(((first carpometacarpal) OR (first carpo-metacarpal) OR (trapeziometacarpal) OR (trapezio-metacarpal) OR (thumb)) AND (arthritis OR osteoarthritis)) AND (pinch OR pinching OR pulling OR occupation* OR work* OR job* OR clerk OR secretary OR clerical OR secretarial OR risk factor*).

This search included available evidence from the inception of each database until the search date of July 23, 2010 and did not employ any limitations on age or sex, or language or country of publication.

Three hundred eighty-one (1-381) papers were identified through this search. (Appendix 1) Upon examination of titles and abstracts of these 381 articles, (1-381) 22 were thought to be relevant and were retrieved in full. (10,31,45,51,91,104,109,117,121,144,168,169,174,175,232,311,314,315,320,341,365,366)

Manual searching was also conducted on the references of these 22 articles that were retrieved in full. (10,31,45,51,91,104,109,117,121,144,168,169,174,175,232,311,314,315,320,341,365,366) This manual searching yielded a further 15 papers (382-396) that were then retrieved in full as well. Overall, electronic and manual searching yielded 37 articles that were retrieved in full. (10,31,45,51,91,104,109,117,121,144,168,169,174,175,232,311,314,315,320,341,365,366,382-396) These 37 papers were then read in full and critically appraised. Upon appraisal of these 37 articles, 12 were thought to be relevant to addressing our objectives and are presented below. (The 25 articles that were not included in this review were in the form of expert reviews or did not provide any data that would be helpful in elucidating any potential association between occupation and 1st CMC OA.) Level of evidence was assigned according to the EBPG level of evidence guide as listed in Appendix 2 of this review.

It should be noted that any causal inference was assessed according to the criteria that the EBPG published previously, (397) which mimic Sir Bradford Hill’s nine factors in assessing causal association. (398) Briefly, these criteria include assessment on the strength of the association, consistency, specificity, temporality, dose response (biological gradient), biological plausibility, coherence, experimental evidence, and analogy.
Results

Evidence from systematic reviews (level of evidence 1. Appendix 2)

1. Jensen et al. conducted a systematic review investigating potential causal association between working conditions and arthritis of the finger joints (any joint, including 1st CMC OA). This systematic review involved a comprehensive literature search on the evidence available up to early January 1998. Further, critical appraisal of the primary studies were provided as part of the discussion in this paper. In this review, the authors included 24 relevant publications that consisted of 13 case reports and 11 cross sectional and case control studies. With regard to 1st CMC OA, Jensen et al. found that 1st CMC OA was reported in a pharmaceutical pricing officer (this study was identified in our own literature search and presented separately below), two carpenters, one case control study among various workers, and one cross sectional study among cotton operatives (these two studies among cotton operatives were identified in our own literature search and are presented separately below). Based on the available evidence, Jensen et al. concluded that it was not possible to assess any causal association between those occupations and finger joints arthritis. With regard to 1st CMC OA, the authors concluded that 1st CMC OA was not associated with any specific occupational tasks.

Evidence from case-control studies (level of evidence 3. Appendix 2)

1. Elsner et al. conducted an age- and sex-matched case control study investigating the association between finger joint (including 1st CMC) OA and various work-related factors (the authors described this as “occupational strain”). Patients diagnosed with OA of the hands were recruited from orthopaedic practices. Sixty-one percent of all patients recruited returned the questionnaires. These patients included 37 persons (31 females and 6 males) diagnosed with 1st CMC OA and 44 persons (35 females and 9 males) diagnosed with finger (MCP, PIP, and DIP) OA. Controls were recruited from GPs and ophthalmologists practicing in the same geographical area with the orthopaedists. Participant recruitment was undertaken from June 1989 - June 1993. Exposures and other information of interest were collected through a self administered questionnaire. The exposures of interest included working (lifting and carrying) with hand tools (5-20 kg or > 20 kg); partial body vibration; climate-related stress factors such as dampness, coldness, and draft; work related time (deadlines) and other stress factors (e.g. performance-related bonuses); monotony and repetitiveness of work; and the use of fingers at work. These were the only variables on exposures of interest that the authors provided in the methodology section of the paper. There was no other information available regarding occupation. Further, there was no information regarding any specific hypothesis or sample size. There was no statistical analysis including the calculation of adjusted odds ratio to work factors as a measure of association between exposure and disease presented in this paper. In Table 5 of this paper, Elsner et al.
calculated that the odds ratio (OR) of having 1st CMC OA in females based on occupations in which participants have worked for at least half a year during their career. The only statistically significant occupation associated with having 1st CMC OA was that of typist. Being a typist demonstrated a five times risk of having 1st CMC OA (OR 5.0; 95% CI 1.3 – 19.6) compared to working in retail occupations. It should be noted that this was an unadjusted odds ratio. As such, it is difficult to conclude with any certainty the effect of being a typist and having 1st CMC OA since many of the potential confounders (with the exception of age and sex) were not taken into account in this calculation. It is not clear how the authors came to categorize the occupations into retail occupations, salaried executives, and typists as was presented in Table 5 of their paper.

2. Fontana et al.\(^{(117)}\) conducted a case-control study investigating the potential association between occupational factors, including hand postures and tasks involving the 1st CMC joint, among women who ultimately required surgery for their 1st CMC OA. Age- and ethnicity-matched controls were recruited from the orthopaedic department for injuries due to motor vehicle accidents or falls. Sixty-one females surgically treated for advanced primary 1st CMC OA were recruited as cases and 120 females without 1st CMC OA were recruited as controls. It is not clear how many patients were eligible either as cases or controls and there was no information about differences, if any, among those who declined and those who participated in this study. Interviewers collected data on age, smoking, medical history, lifestyle history, leisure activities, and occupations that were held for at least 6 months since leaving high school. Additionally, for their main occupation or for the occupation that was held longest, participants were asked (in a yes/no format) regarding hand posture/tasks involving requirements presumed to cause a strain or high load on the 1st CMC joint such as in repetitive thumb use (> 20 movements/minute and/or thumb flexion-extension at least once/minute); fine or strong pinch actions (tip, lateral or palmar pinch); gripping/grasping and pressure on the pad of the thumb; whole body vibration; working with hand-held vibrating tools; working with gloves; exposure to cold; and perceived adverse psychosocial or organizational conditions at work. Occupations were coded according to the International Standard Classification of Occupation (ISCO-88) of the International Labour Office (4 digit codes). The ISCO-88 codes were categorized further into unit groups (4 digit codes, finest category of occupation), minor groups (3 digit categories) and major groups (1 digit categories). It should be noted that only the longest held occupation was included in the analysis.

Occupations were also categorized into those being assumed at risk for 1st CMC OA and occupations not at risk. Occupations being assumed at risk for 1st CMC OA included computing professionals, computer associate professionals, secretaries and keyboard operating clerks, numerical clerks, material recording and transport clerks, library, mail and related clerks, other office clerks, personal care and related workers, textile, garment
and related trades workers, textile, fur and leather products machine operators, and domestic and related helpers, cleaners and launderers. It should be noted that these various classifications of the exposures of interest reinforced the authors’ initial statement on the exploratory nature of this study. Given the exploratory nature of this study, there was no hypothesis or sample size reported in this paper. It should also be noted that these occupations were not analyzed individually (they were analyzed in groupings). As such, we cannot identify specific jobs, if any, to be associated with the development of 1st CMC OA. This case-control study was purported to be age- and ethnicity-matched. The data actually demonstrated that cases were older than controls. Further, as a matched case-control design, the authors should have employed conditional logistic regression methods in their modeling; however, there was no statement of such a method being employed. In this study, potential confounders were collected based on interviews; as such, recall bias cannot be discounted in this study. After adjustment for age, smoking status, obesity, 1st CMC OA family history, hysterectomy history, parity, and occasional jobs, the authors found that the following occupational factors were significantly associated with an increased risk of 1st CMC OA:

- Occupations presumed to be at risk for 1st CMC OA (please see previous paragraph for the list of occupations included in this category); OR=3.8 (95% CI 1.2-11.9). The occupations observed in this population mainly included tailors, dressmakers, hatters, secretaries, sewers, embroiderers and related workers, domestic helpers and cleaners.

- Repetitive thumb use; OR 11.9 (95% CI 3.6-38.9)

- Jobs perceived by participants as having “not enough rest breaks during a day”; OR=5.6 (95% CI 1.7-21.3)

The authors also found that after adjusting for non-occupational factors, no significant association was observed between 1st CMC OA and the other studied occupational factors including:

- general manual occupation
- fine or strong pinch actions
- gripping/grasping
- pressure on the pad of thumb
- whole body vibration
- working with a handheld vibrating tool
- working with gloves
- exposure to cold
In summary, this study did not provide any evidence on the association of being a clerk with the development or aggravation of 1st CMC OA.

3. Haara et al. (144) conducted a nested case-control study investigating the determinants of 1st CMC OA and its association with disability and mortality in the original cohort of 8000 adult Finnish individuals participating in the Mini-Finland Health Survey. Overall, 3595 persons participated in this nested case-control in which 598 were diagnosed with grade 2-4 Kellgren Lawrence 1st CMC OA. A questionnaire was administered in order to collect information on present and previous occupations involving lifting or carrying heavy objects; stooped, twisted or other awkward work posture; whole body vibration or use of vibrating tools; continuously repeated series of movements; and work paced by a machine. It should be noted that only exposures related to the current or last occupation were taken into account. These questions were coded as yes or no and the total number was summed to create a “sum index of physical stress at work”. It should also be noted that even though this study was nested within a cohort of participants, all data were gathered retrospectively, including the fact that there was no guarantee participants were free from 1st CMC OA when they entered the cohort. As such, potential recall bias cannot be discounted from this study. Even though the authors did not provide any hypothesis or sample size calculations, the calculation of prevalence and modeling were done by employing appropriate statistical methods. However, not all confounders, especially the unknown ones, were taken into account in the analysis of the data. The authors found that the adjusted prevalence of symmetrical 1st CMC OA was 6% in women and 2.6% in men. In this study, age (in years), being female, and body mass index (BMI) (kg/m²) were the only factors found to be associated with having 1st CMC OA. Most interestingly, after adjusting for age, gender, educational level, history of smoking, and history of workload, the authors found that BMI was directly proportional to the prevalence of 1st CMC OA in both sexes. The adjusted OR was 1.3 (95% CI 1.1-1.4) per 5 kg/m² increment of BMI. The authors did not find any of the work-related factors to be associated with the prevalence of 1st CMC OA.

4. Hunter et al. (169) conducted an age- and sex-matched nested case-control study, among participants of the Framingham (cohort) Osteoarthritis Study, investigating the association between radial subluxation and the incidence of radiographic 1st CMC OA. In this study, the authors only examined right hands and participants of Caucasian origin. Those diagnosed with rheumatoid arthritis were excluded from participation. A case was defined as a random sample of participants who did not have radiographic 1st CMC OA at baseline and had developed incident 1st CMC OA at the time of follow up. Radiographic 1st CMC OA was defined as those who developed Kellgren Lawrence ≥ grade 2 OA at
the time of 22\textsuperscript{nd} follow up. Overall, there were 287 cases (72 males and 215 females) and 347 controls (131 males and 216 females) included in this analysis. \textit{Even though there was no hypothesis statement with its corresponding sample size calculation presented in this paper, Hunter et al. conducted an appropriate statistical analysis in order to answer their objective.} Adjusted for age, handedness, number of other hand joints with OA, and grip strength, the authors found that the OR for the risk of developing 1\textsuperscript{st} CMC OA in males were 1.0 (reference), 1.8 (95% CI 0.7-4.4), 2.7 (95% CI 1.0-6.9) and 3.1 (95% CI 1.2-8.2) (test for trend \(p = 0.01\)) from the lowest quartile of radial subluxation to the highest quartile, respectively. The same association was not observed among females. Given this result, the authors hypothesized that grasping activities and high grip strength predispose subsequent joint instability and subluxation which then predispose the joint to OA in males. \textit{It should be noted that the follow up period on this cohort spanned 26 years. As such, survival bias could not be discounted from this study. The authors did not adjust for occupation in this study; however, they found that occupation did not affect the development of OA in their other studies of hand OA.}

\textbf{Evidence from cross sectional studies (level of evidence 4. Appendix 2)}

1. In a population-based survey among elderly Chinese individuals living in Beijing, China, Hunter et al.\textsuperscript{[168]} investigated whether chopstick use (i.e. increased joint loading, due to the pinching-like act of holding chopsticks, in the 1\textsuperscript{st} through 3\textsuperscript{rd} fingers) was associated with prevalent hand OA. Neighborhood-based cluster random samples from persons aged \(\geq 60\) years were recruited. 1008 males and 1499 females participated in this study. Radiographic hand OA was defined as having radiographic OA in \(\geq 1\) joints of the hand with Kellgren-Lawrence score of \(\geq 2\). For the exposure of interest, participants answered questions about the hand with which they used chopsticks, handedness, and pincer grip activities. \textit{The authors did not provide any information about those who refused to participate and how they might differ from those who participated. However, in general, sampling and data analysis was undertaken appropriately in this study. The authors conducted match-based data analysis on various variables including age, sex, BMI, and education. Even though this study was not designed specifically to investigate the effect of chopstick holding on the 1\textsuperscript{st} CMC joint, this study did provide some interesting data on the association between chopstick holding and 1\textsuperscript{st} CMC OA.} With regard to radiographic 1\textsuperscript{st} CMC OA, the authors found that the prevalence among chopstick-use hand and non-chopstick use hand was 13.1\% and 16.6\% among males and 8.8\% and 12.0\% among females, respectively. \textit{This data suggests that chopstick use (i.e. the act of pinching and
increasing joint loading) seems to provide a protective effect toward the development of finger joint OA in the 1st to 3rd finger joints. The prevalence ratios for males and females were 0.8 (95% CI 0.7-0.9) and 0.7 (95% CI 0.6-0.8), respectively. With regard to the 1st CMC joint, it is not clear how the mechanism of holding chopsticks may provide “protection” in the development of OA.

2. Hadler et al.\(^{(384)}\) investigated the influence of repetitive, non-traumatic, stereotyped manual tasks in the pattern of development of hand (finger) OA among female textile workers. Participants were recruited from a relatively stable population with regard to personnel (low job mobility) and tasks from a worsted mill in a small rural Virginia town. Three different manual tasks, including burlers, winders, and spinners, that employed a large percentage of workers were chosen since the task descriptions had changed little in the past decades. Even though only winding was perceived by the workers as a bimanual task, all tasks as burlers or spinners were highly repetitive, stereotyped, and complex so that to some extent they were all bimanual. Winding differed from burling and spinning mainly in that it predominantly involved wrist motion and the employment of power grip with little fine finger motion. Burling and spinning differed in that spinning involved utilizing three fingers of the hand to spare use of digits four and five. Only females working continuously in their respective tasks for at least 20 years were considered eligible to participate. Overall, 64 females, including 29 burlers, 16 winders, and 19 spinners, participated in this study. In general, this cross sectional study was well done with regard to its sampling, outcome measurements (the study even employed blinding in the assessment of outcomes), and data analysis. However, it should be noted that, due to the retrospective nature of the study, potential selection and information bias could not be discounted. With regard to the association between different tasks and 1st CMC joint pathology, Hadler et al. found that task differences did not statistically significantly affect differences in range of motion or the occurrence of degenerative joint disease.

3. In an “age- and sex-matched case-control-like” cross sectional based study, Lawrence\(^{(385)}\) explored the association between cotton mill workers and non cotton mill workers in their complaints of rheumatism, radiographic osteoarthritis, and radiographic disc degeneration. A total of 345 cotton mill workers (117 males and 228 females) and 345 randomly age- and sex-matched non cotton mill workers were recruited in this study. It is not clear how this random matching was undertaken in this study. Further, it is not clear whether this matching worked since one of the analyses was presented by adjusting for age. Cotton mill workers were divided into three groups according to their occupation in the mills, as weavers, spinners, or others. Lawrence found that rheumatic symptoms were less frequent in the cotton mill workers than in the controls and loss of work from rheumatism was less frequent in the male cotton workers than male controls. With regard to the prevalence of radiological OA, OA of the distal and interphalangeal joints of the fingers and the 1st CMC joint was more frequent in the male cotton workers than the male
controls. Among males, the prevalence of 1st CMC Kellgren-Lawrence (K/L) grade 2-4 OA was 25% and 12%, respectively, among cotton workers and controls. While female cotton workers had a similar pattern of OA when compared to their male counterparts, their prevalence of OA, in any joint including the 1st CMC, was not statistically different from female controls. With regard to specific occupation within cotton mill workers, male weavers had a higher prevalence of 1st CMC OA compared to spinners and others (prevalence of 1st CMC OA with K/L grade 2-4 was 29% and 18%, respectively). Among females, even though the prevalence of K/L grade 2-4 1st CMC OA was higher among weavers than spinners and doublers or others (prevalence was 35%, 26% and 21%, respectively), this difference disappeared when the data was adjusted for age. Even though this cross sectional study had a large sample size, potential selection bias, such as the healthy worker effect, was possibly influential in this study. Due to the retrospective nature of data collection, potential information bias cannot be discounted as well. Further, except for age and sex, it is not clear what role confounders may have played in this study.

In summary, these three cross sectional studies\(^{(168,384,385)}\) provide some evidence that working in a cotton mill may be associated with the development of 1st CMC OA among males (but not females). Further, increased joint loading due to pinching (such as in holding chopsticks) may be protective against the development of 1st CMC OA. However, this summary needs to be interpreted with caution due to potential selection and information biases not taken into account in any of these studies.

Evidence from case reports (level of evidence 5. Appendix 2)

1. Brandfonbrener et al.\(^{(31)}\) reported the occurrence of 1st CMC OA in a 49-year-old female professional pianist and professor at a community music college. The patient complained of bilateral thumb pain of six months duration. The past summer she began to play golf more intensively than previously and noticed that her thumbs were tender after playing. She said that she first noticed it rather acutely in the left thumb only, but soon it became bilateral. The patient started playing piano when she was five years old and had been playing piano since with undergraduate, masters, and doctoral degrees in piano performance. Before she started having thumb pain, she routinely played piano for at least five to eight hours per day. Radiological study confirmed the presence of moderate bilateral 1st CMC OA (and OA of the interphalangeal joints).

2. Jensen and Sherson\(^{(174)}\) reported the development of bilateral 1st CMC OA in a 44-year-old male industrial worker. This patient worked in a company manufacturing various building components including folding doors for use in agricultural and industrial construction. The folding doors were made of individual panels of either aluminum or steel plates with a layer of polyurethane foam between them. The panels were hinged
together to make a flexible folding door. On a large, chest-high table, the panels were fitted by hand with plastic mouldings. The mouldings were made of hard plastic approximately 3 centimetres wide. The edges were bent at 90° and were fitted with small hooks that were fashioned to grab the bent edges of the panels. This worker would undertake this activity by applying pressure with both thumbs on the moulding until the hooks would snap into their fittings. This act required a powerful grip, pressing both thumbs in ulnar flexion while achieving counter pressure with the rest of the fingers. The patient would then move his hands a few centimetres between each grip, gradually working his way along the edge until he reached the end of the moulding. The patient made between 20 to 30 panels a day of which 80% were eight metres long. After five years making panels, he developed pain at the base of his left thumb, especially when applying pressure or gripping. Subsequent x-rays showed severe joint space narrowing of the 1st CMC joints.

3. Turner (341) reported a 1st CMC OA case that developed in a 57-year-old female who had been working as a department of health pharmaceutical pricing officer for 32 years. Pharmaceutical pricing is the activity of pricing a doctor’s prescription and is a sedentary occupation involving sitting in a constrained posture for hours. With regard to thumb or finger movements, during the pricing of a single prescription the left thumb was held, initially in a position of hyperextension at the CMC joint. It was then moved forward in a flicking action from this position, making contact with the prescription at the tip of the thumb. The patient’s thumb then swept forward to about 65° (in the palmar plane) and terminated in a position parallel to the long axis of the forearm. The axis of this movement was through the base of the thumb at the CMC joint. Further activity, called ‘investigations’, involved flicking the script with the right thumb and removing the relevant scripts with the left hand. Pricing officers were expected to price a minimum of 200 prescriptions per hour (and this was later changed to a minimum of 300 prescriptions per hour) in order to achieve a monetary bonus that was implemented in the department. This particular worker was able to price up to 400 prescriptions per hour. Radiological examination revealed bilateral moderate 1st CMC OA.

4. Ming et al. (383) reported on a 48-year-old left-handed man with isolated pain and swelling at the base of the left thumb. This problem had started two years previously and had worsened over the last half year together with increasing pain at the base of the right thumb. History and system review were all normal except for a history of excessive mobile phone use and active texting on the mobile phone for more than three years. Eventually, with his left hand pain, he had increased the use of his right hand and the pain had started in his right thumb as well. Radiological examination showed a subluxation of the 1st CMC joint and the patient was subsequently diagnosed with 1st CMC OA of the left hand.
In summary, there was anecdotal evidence on the association between certain occupations or activities, e.g. pianist,\textsuperscript{(31)} folding door manufacturing related activities,\textsuperscript{(174)} pharmaceutical pricing,\textsuperscript{(341)} and excessive mobile phone texting,\textsuperscript{(383)} and the diagnosis of 1\textsuperscript{st} CMC OA. By the very nature of the type of study these papers describe (case reports), they are potentially only hypothesis generating and cannot be used as ‘evidence’ of either association or causation when addressing 1\textsuperscript{st} CMC OA and work activity.
Summary/Conclusion

- At present, there is no evidence on the causal association between certain occupations or activities and the development of 1st CMC OA.
- At present, it is not possible to identify any specific occupation or activities that may predispose an individual to develop 1st CMC OA.
- At present, there is anecdotal evidence on the potential aggravation of pre-existing 1st CMC OA by occupations or activities.
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Appendix 1

Flow diagram (Study selection)

Abstracts of potentially relevant citations were retrieved (n= 381)

359 abstracts were deemed not relevant and discarded

Full texts of relevant studies were retrieved (n= 22)

Additional studies were selected through hand search of references of selected articles (n= 15)

25 articles were deemed not relevant and discarded

Total number of studies reviewed: 12
Appendix 2

WorkSafeBC Evidence-Based Practice Group levels of evidence (adapted from 1,2,3,4)

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Evidence from at least 1 properly randomized controlled trial (RCT) or systematic review of RCTs.</td>
</tr>
<tr>
<td>2</td>
<td>Evidence from well-designed controlled trials without randomization or systematic reviews of observational studies.</td>
</tr>
<tr>
<td>3</td>
<td>Evidence from well-designed cohort or case-control analytic studies, preferably from more than 1 centre or research group.</td>
</tr>
<tr>
<td>4</td>
<td>Evidence from comparisons between times or places with or without the intervention. Dramatic results in uncontrolled experiments could also be included here.</td>
</tr>
<tr>
<td>5</td>
<td>Opinions of respected authorities, based on clinical experience, descriptive studies or reports of expert committees.</td>
</tr>
</tbody>
</table>

References