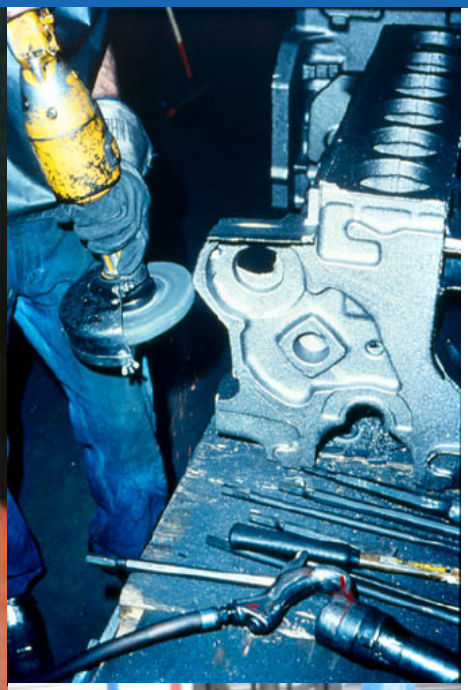
WHAT WE'VE LEARNED ABOUT...

# Hand-Arm Vibration Syndrome

A lay-language research synthesis from the Centre for Research Expertise in Occupational Disease (CREOD)



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# Background

## What is Hand-Arm Vibration Syndrome (HAVS)?

HAVS is an occupational disease that can affect workers' vascular system (e.g. a form of secondary Raynaud's phenomenon), sensorineural system (e.g. numbness/tingling in the fingers due to vibration-induced damage of blood vessels and nerve fibres) and musculoskeletal system (e.g. decreased finger/hand dexterity and loss of grip strength). Symptoms also typically include cold intolerance of the hands and cold-induced finger blanching.

## Who is at risk of Hand-Arm Vibration Syndrome (HAVS)?

Workers that hold vibrating tools or touch vibrating work surfaces are at risk of Hand-arm Vibration Syndrome (HAVS). In the construction industry, for example, steamfitters, pipefitters, welders, electricians and general labourers may all have significant exposure to hand-arm vibration. In mining, workers carrying out drilling have the highest exposures.

## How well do we understand HAVS?

The vascular component of HAVS, which is often referred to as "vibration white finger," has received the most clinical and research attention. It was first described by Loriga in Italy in 1911. Following this, Hamilton, in a landmark study in 1918, reported a high prevalence of VWF in the limestone quarry workers in Bedford, Indiana. This resulted in increased recognition of the problem and, by 1950, many published papers had indicated an association between hand-arm vibration exposure and the development of vibration white finger. Subsequently it was found that hand-arm vibration exposure was also associated with neurological and musculoskeletal abnormities and the term Hand-arm Vibration Syndrome was developed to include the three types of abnormalities associated with hand-arm vibration exposure. An international conference in Sweden led to the creation of classifications in the 1980's referred to as the Stockholm Workshop Scales for the vascular and sensorineural components of HAVS. These Stockholm classifications were based only on symptoms and physical examination, and it was indicated when the scales were first described that objective tests needed to be developed to measure the various components of HAVS. Such objective tests have now been developed, although there is some variation in the specific tests used in various countries and clinical settings.

## GENERAL REFERENCES:

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# Key Messages and Contents

**The following is a lay-language synthesis of CREOD's body of research on Hand-Arm Vibration Syndrome (HAVS), 2004-2016.**

## Key Messages

HAVS is common among workers that hold vibrating tools or touch vibrating work surfaces (e.g. construction and mining workers)

Many workers are at risk of HAVS, but don't know it

HAVS is preventable and some symptoms may also be reversible in the early stages; early recognition and management are crucial

HAVS prevention and education are low priorities in many Ontario workplaces

There are serious gaps in occupational health care delivery in Ontario. Many doctors don't ask patients about work exposures, including hand-arm vibration, and it often takes workers a long time to get a diagnosis of HAVS

The lack of awareness and recognition of HAVS results in lost opportunities for prevention

Early recognition and management of HAVS is important. Some components of HAVS may be reversible in the early stages but the more advanced stages are associated with general upper extremity disability, work-related disability and decreased quality of life

Workers with HAVS often do not file workers' compensation claims

## Contents

# Burden and Risk

**HAVS is common.** Hand-arm vibration is a common occupational exposure and many workers are at risk of developing HAVS. There is no detailed information, however, about how many Canadian workers are exposed to hand-arm vibration. In the U.S., the Bureau of Labor Statistics has estimated that 2.5 million workers are exposed to high levels of hand-arm vibration at work on a regular basis. The National Institute for Occupational Safety and Health (NIOSH) has estimated that about 50% of currently exposed workers in the U.S. have or will develop HAVS. HAVS symptoms can appear quite quickly - sometimes in less than two years, if the worker is exposed to a lot of vibration.

This combination of a high number of exposed workers, a high proportion of exposed workers developing HAVS and a relatively short latency indicate that HAVS is a common and urgent occupational health problem.[1]

**HAVS is under-recognized.** Despite the fact that HAVS is common, it is considerably under-recognized and under-reported in Ontario and Canada. To estimate the number of cases in Canada, CREOD used data from the U.S. and U.K. and adjusted for population size. The study estimated that there were between 72,000 and 144,000 prevalent cases of HAVS in Canada.[2] Despite this, there had been an average of only 198 accepted claims per year for HAVS in Canada over a six year period from the start of 2003 to the end of 2008.[2] These data indicate that most cases of HAVS are not being recognized due to a lack of awareness of the risks associated with hand-arm vibration exposure.

**Many industrial sectors are affected by HAVS.** The main industries (tools) that are associated with increased risk of HAVS are mining (jackleg drills, stopper drills), construction (hammer drills, Hilte guns, jackhammers, concrete breakers, grinders), forestry (chainsaws), automotive assembly (riveting guns, impact wrenches), metalworking (sanders, buffers), and foundries (grinders, chipping guns).

**Vibrating tools also put people at risk of vascular feet symptoms and noise-induced hearing loss.** Workers with HAVS also often report increased cold intolerance in their feet, although usually to a lesser extent than the cold intolerance in their hands. CREOD cold provocation digital plethysmography [3] and thermography [4] studies have confirmed that workers with HAVS do develop positive vascular test findings in their feet.

Changing technology in the mining sector has resulted in more foot-transmitted vibration. In particular, drilling is often done now on vibrating platforms using Jumbos and MacLean Bolter machines. Our research, involving collaboration of CREOD and the Centre for Research in Occupational Safety and Health (CROSH) has indicated that these new exposures are associated with the development of foot symptoms and positive vascular tests [5] that appear to be similar to the hand problems from hand-transmitted vibration.[6,7]

Vibrating tools are a source of both hand-arm vibration and noise, and the noise exposure is associated with hearing loss. Our research has indicated that the occurrence of the vascular component of HAVS in the hands is also associated with increased risk of hearing loss (the association remained after controlling for the noise exposure).[8] This means that the occurrence of the vascular component of HAVS augments the hearing loss from noise exposure. Our finding is in agreement with other published studies on this topic. The mechanism of increased risk of hearing loss from vascular HAVS is not clearly understood but may involve increased risk of cochlear vasospasm.

# Prevention

**HAVS can be prevented.** The keys to preventing HAVS are increased recognition of the risk posed by exposure to hand-arm vibration, and reduction of this exposure in industry. The focus should be on primary prevention: personal protective equipment (ISO approved AV gloves) as well as administrative controls, engineering controls, substitution and elimination.

**There is no legislation in Ontario that specifically addresses hand-arm vibration exposure.** The lack of specific legislation in Ontario is typical of the situation in the rest of Canada. We have reviewed the legislation for hand-arm vibration exposure in all of the 10 provinces and three territories of Canada.[2,9] Only two provinces (British Columbia and New Brunswick) have legislation that deals specifically with hand-arm vibration exposure and the legislation in both provinces references the ACGIH TLVs for hand-arm vibration. However it is unclear to what extent these exposure limits are enforced. Ontario has no legislation that deals specifically with hand-arm vibration exposure. In contrast the European Union has an EU Directive for allowable hand-arm vibration exposure per day that has been adopted by EU member countries including the U.K. Therefore, in Ontario we are well behind the preventive efforts in other countries.

**There is a significant lack of awareness regarding HAVS in Ontario's construction sector.** Many of the construction workers recruited for CREOD based studies from the Occupational Health Clinic at St. Michael's Hospital have indicated that they had no knowledge of the risks of hand-arm vibration exposure until they developed HAVS and no training about this hazard. However the construction sector does seem amenable to rectifying this lack of awareness.[10,11] We carried out a study of 100 construction workers with HAVS that involved developing educational materials about HAVS/HAV that workers could take back to their supervisors. Follow-up two months after providing the educational material indicated that 63% of participants reported subsequent changes in workplace practices including purchasing new lower-vibration tools, reduced vibration exposure time, changes in work processes to reduce vibration exposure and more education about HAVS provided by employers.[10]

# Diagnosis and Treatment: Health Care Services

# Outcomes for Workers

## Getting a diagnosis of HAVS can take a long time and many doctors' visits.

CREOD has carried out a number of studies to evaluate vascular[4,12,13] and neurological[14-16] diagnostic tests for HAVS and to develop an evidence-based method of clinical assessment for the various components of HAVS.[1,17]

The in-depth clinical assessments are carried out by CREOD Occupational Medicine specialists at St. Michael's Hospital. However it is often difficult for workers who develop symptoms of HAVS to have their problems recognized and to obtain appropriate referral by their primary health care providers. A CREOD study found that patients assessed for HAVS at the St. Michael's Hospital specialist clinic had waited an average of three years and six months from the onset of their HAVS symptoms before consulting a primary care physician. The average time between symptom onset and assessment at the specialist clinic was nine years,[18] which indicates considerable delay by primary care physicians in referring patients to get an appropriate clinical assessment for HAVS.

**The delay is in part related to the lack of workers' awareness of HAVS.** Our study also assessed the reasons why workers with HAVS had waited so long to seek care. The main reason (expressed by 70% of workers) was that they believed that their symptoms were a natural consequence of work or ageing. As well, 57% thought that their early symptoms of HAVS were not serious enough to seek medical attention and 49% thought that their symptoms would eventually get better.[18] These findings reveal a lack of understanding by workers of the early manifestations of HAVS and are rooted in the lack of education they have received about HAVS in the workplace.

**The delay is also in part related to the lack of health care providers' awareness of HAVS.** Our study also found that lack of awareness of HAVS by primary health care providers was a barrier to effective care. Most primary care physicians did not connect HAVS symptoms with workplace exposure to hand-arm vibration. For example only 17% of family doctors made a first diagnosis of possible HAVS. Only 38% of patients with HAVS were referred by their family physicians to a specialist and none were initially referred to specialists in Occupational Medicine.[18] These findings are consistent with studies in other countries that suggest that misdiagnosis and inappropriate referral are important causes of delayed diagnosis and management of HAVS.

**HAVS affects upper extremity disability.** Workers with HAVS have significantly more trouble using their hands and arms, when compared to workers without HAVS. Our research has confirmed this using the Disabilities of the Arm, Shoulder and Hand Questionnaire and the Stockholm sensorineural scale, plus a separate analysis of the DASH work module.[19,20] This research was carried out on workers who had had HAVS for many years and underscores the importance of primary prevention of HAVS as well as early recognition and management for secondary prevention of early HAVS cases.

**HAVS affects quality of life.** A CREOD study found that workers with HAVS have a significantly reduced physical and mental quality of life, when compared to the Canadian population.[21] This study used SF12-Physical and SF12-Mental questionnaires to measure quality of life, and controlled for age and sex.

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## About the Centre for Research Expertise in Occupational Disease (CREOD)

The Centre for Research Expertise in Occupational Disease is dedicated to improving understanding and prevention of occupational disease. Our research addresses the full spectrum of the health and safety continuum: from prevention, through exposure assessment, early recognition, diagnosis, treatment, return-to-work and outcomes. We work across disciplines and methodological paradigms to contribute to policy, knowledge and practice in both the workplace and clinical settings. Our programs include Occupational Lung Disease, Occupational Skin Disease, Hand-Arm Vibration Syndrome (HAVS) and Biological Hazards.

CREOD was founded in 2004 with the active support and generous funding of the Workplace Safety and Insurance Board. Since 2012 funding for CREOD has been provided by the Ontario Ministry of Labour. We are a collaborative program of the University of Toronto and St. Michael's Hospital.

To learn more about CREOD and to access plain language summaries of the studies referenced in this synthesis, visit our website at www.creod.on.ca.

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