

Noteworthy Decision Summary

Decision: WCAT-2005-00530-AD **Panel:** Teresa White **Decision Date:** January 31, 2005

Occupational disease – Activity-Related Soft Tissue Disorders – Plantar fasciitis – Occupational vs. non-occupational risk factors – Related non-occupational risk factors – Vibration – Prolonged weight-bearing – Criteria of causality – Section 6 of the Workers Compensation Act – Policy item #27.40 of Rehabilitation Services and Claims Manual, Volume II

This was one of a group of similar decisions considering whether numerous workers developed plantar fasciitis as a result of working long shifts on a ship which vibrated. The decision demonstrates the difficulties in determining the cause of plantar fasciitis, and details the policies and considerations which assist in evaluating arguments of causation. In particular, it contains an analysis of the interaction between occupational and non-occupational factors in plantar fasciitis cases.

Eleven workers on a particular ship alleged that the long hours and vibration of the ship caused their plantar fasciitis. The Workers' Compensation Review Board accepted their argument and allowed their appeals. The employer appealed to the WCAT.

Plantar fasciitis is recognized as an occupational disease by regulation pursuant to section 1 of the *Workers Compensation Act* (Act). As such it is adjudicated with reference to section 6 of the Act which provides entitlement to compensation for occupational diseases due to the nature of employment. There is no presumption of causation.

The panel noted the lack of published policy on plantar fasciitis, and its inclusion in the *Activity Related Soft Tissue Disorder (ASTD) Reference Guide* (Guide), which is not a published policy. The Guide identifies age, weight, foot deformity, systemic disorders, footwear and recreational activities as "non-occupational risk factors for plantar fasciitis." Direct trauma and unaccustomed physical strain are listed as occupational factors. The Guide also states that it is thought that prolonged weight-bearing or standing on hard surfaces is more likely to bring the symptoms of plantar fasciitis to the attention of an individual, rather than being causative.

On the basis that plantar fasciitis is included in the Guide, the panel concluded that plantar fasciitis claims must be adjudicated in accordance with general published policies on ASTDs, particularly policy item #27.40 of the *Rehabilitation Services and Claims Manual, Volume II* (RSCM II). Item #27.40 of the RSCM II states that a "risk factor" is a general term for a factor which the medical/scientific research indicates may be relevant to the issue of causation. A decision-maker should consider the location of the structure affected (the foot), the magnitude/intensity of the risk factor, the time variation (frequency) of the risk factor, and the duration of the risk factor. Risk factors include repetition, force, static load, task variability, awkward postures, local mechanical stresses, shock, grip type, extremes of temperature and unaccustomed activity.

The determination of causation in plantar fasciitis cases is not simply an exercise in adding up the non-occupational and occupational risk factors and determining where the majority lies. The interaction of risk factors must be considered; weight-bearing at work puts an overweight worker with foot problems at a higher risk of developing plantar fasciitis, and the failure to wear

appropriate footwear at work does not preclude entitlement in a “no fault” system. In this way, some non-occupational risk factors are “related,” such as age, obesity and altered foot biomechanics, and some are not, such as recreational activities. Occupational risk factors need not be the only cause of the condition; they need only be a significant cause.

Medical/scientific information should be assessed in accordance with the criteria for evaluating causation set out in the March 2, 1993 *Protocol for the Assessment of Medical/Scientific Information, Industrial Diseases Standing Committee, Workers Compensation Board of British Columbia* (published at 9 WCR 429). It does not constitute published policy but does provide guidance in the interpretation of scientific evidence, and in particular epidemiological evidence. Those criteria of causality include temporal relationship, strength of the association, dose-response relationship, replication of the findings, biological plausibility (coherence with existing knowledge), consideration of alternative explanations, cessation of exposure, specificity of the association, and consistency with other knowledge.

Using the criteria for evaluating causation, the panel concluded that vibration *may* be a risk factor for plantar fasciitis, but there is insufficient scientific evidence at this time to conclude that it is. The panel also concluded that work-related weight-bearing is a risk factor for plantar fasciitis, but that it must be prolonged and/or unaccustomed. The magnitude of the weight-bearing risk in this case was not that great, because longer shifts meant longer periods of time off, reducing the cumulative exposure in the sense that the tissues were given time to rest and recover.

A temporal relationship may be necessary to prove causation, but it is certainly not proof of causation in occupational disease cases. In this case, the work drew the worker’s attention to the condition rather than caused it. (The same conclusion was reached in all the other cases.)

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Panel: Teresa White, Vice Chair

Introduction

This appeal is one of a group of employer appeals from findings of the former Workers' Compensation Review Board (Review Board). The appeals involve the same employer, which operates a ferry service. The workers involved in these appeals all worked on the same ferry, which is referred to in this decision as the "ship."

The individual worker involved in this appeal was born in 1952, and began working for the employer in 1975. The worker was employed primarily as a second officer, with some relief work as a chief officer commencing in 1997. The worker's application for compensation is dated April 1, 1998. He states that he had left and right foot and heel pain, which he believed was due to the "constant excessive vibration" while working on the ship for ten hours on deck. The worker said that the onset was gradual. The worker's claim was denied by the Workers' Compensation Board (Board) in a letter dated March 17, 1999. The Review Board found that the worker had bilateral plantar fasciitis and Achilles tendinitis which were due to the nature of his employment as a second officer and relief first officer on board the ship.

The Review Board panel heard eleven appeals relating to foot problems experienced by the employer's workers. Nine worked aboard the ship. The panel noted that the workers and their representatives waived confidentiality regarding information on the various claims. On that basis, information from the appellants about the conditions on the ship, whether in oral or written form, was included in the common evidence. I consider that approach to be appropriate under the circumstances of this appeal, and to facilitate a proper and complete analysis of the evidence and submissions. In particular, I consider that the parties' waiver of confidentiality as between them respecting the common evidence continues to be effective. To decide otherwise could unnecessarily complicate these appeals, and require that the evidence in common heard by the Review Board, and reflected in its findings, be re-heard in the context of each individual appeal. The parties' intentions are clearly that the common evidence be heard together and that the number, type and nature of all of the claims, and the other evidence in common, be considered in adjudicating the appeals.

Issue(s)

The issue is whether the worker's bilateral foot condition, diagnosed as plantar fasciitis and Achilles tendinitis, were due to the nature of his employment.

Jurisdiction

This appeal was filed with the former Appeal Division of the Board. On March 3, 2003, the Appeal Division and Review Board were replaced by the Workers' Compensation Appeal Tribunal (WCAT). As no panel of the Appeal Division had begun deliberations respecting these appeals, section 39(1)(a) of the transitional provisions contained in Part 2 of Bill 63, the *Workers Compensation Amendment Act (No. 2)*, 2002, provides that all appeal proceedings pending before the Appeal Division on March 3, 2003 are continued and must be completed as proceedings pending before WCAT (except that no time frame applies to the making of the WCAT decision).

WCAT may consider all questions of fact and law arising in an appeal, but is not bound by legal precedent (section 250(1) of the *Workers Compensation Act (Act)*). WCAT must make its decision on the merits and justice of the case, but in so doing, must apply a policy of the Board's board of directors that is applicable in the case. WCAT has exclusive jurisdiction to inquire into, hear and determine all those matters and questions of fact, law and discretion arising or required to be determined in an appeal before it (section 254).

The majority of the published policy applicable to this appeal is found in the *Rehabilitation Services and Claims Manual, Volume I* (RSCM I). In the event that any applicable policy is found in another source, such as *Volume II* of the RSCM (RSCM II), that fact will be specifically mentioned.

The appellant requested an oral hearing. The employer did not attend the oral hearing held by the Review Board. The request was denied by an appeal commissioner of the former Appeal Division on November 6, 2002. I retain jurisdiction to convene an oral hearing.

After reviewing the file and submissions, and listening to the audiotapes of the Review Board oral hearing, which is of sufficient quality, I agree that an oral hearing is not required. In that respect, I have had reference to the *WCAT Manual of Rules of Practice and Procedure* (MRPP), and find that the oral hearing criteria do not require an oral hearing be held. The basis for my decision follows.

The MRPP provides:

8.70 Method of Hearing

WCAT may conduct an appeal in the manner it considers necessary, including conducting hearings in writing, or orally with the parties present in person or by means of teleconference or videoconference facilities [s. 246(1)].

A request for an oral hearing will normally be granted where the appeal or application involves a significant issue of credibility. An oral hearing may also be granted where there are:

- (a) significant factual issues to be determined;
- (b) multiple appeals of a complex nature;
- (c) complex issues with important implications for the compensation system;
- (d) other compelling reasons for convening an oral hearing (e.g. where an unrepresented appellant has difficulty communicating in writing).

In these cases, a full and lengthy hearing was held by the Review Board in the proceedings leading to the decision under appeal. The audiotapes of that hearing are available, and the vast majority of the evidence on the audiotapes is intelligible. I have had the opportunity to review them. There are no significant issues of credibility. Although these appeals are, of course, important to the parties, there are no complex issues with important implications to the compensation system. I do not consider, given the lengthy and detailed written submissions, that there is any other compelling reason for an oral hearing. The employer has had a full opportunity to provide written submissions, and has done so, including providing an expert opinion.

Background and Evidence

There is extensive and detailed evidence regarding the worker, and the ship. I have read and considered all of it. I will not recite each and every piece of evidence, but instead will review it generally and make specific reference to those facts and submissions only as necessary to explain my decision.

Law, policy and other considerations relevant to causation

Plantar fasciitis is recognized as an occupational disease by inclusion in the *Occupational Disease Recognition Regulation, BC Reg. 71/99*, pursuant to section 1 of the Act. As such, it is designated as an occupational disease by the legislature of the Province, and it is neither necessary nor appropriate for me to engage in a review of the literature or any other inquiry for the purpose of determining whether plantar fasciitis is an occupational disease. It is so designated. However, the “risk factors” for the condition and the individual circumstances must be considered in determining whether, in each case, the condition is due to the nature of the particular worker’s employment.

Section 6 of the Act provides for compensation for occupational disease that is “due to the nature of any employment in which the worker was employed, whether under one or more employments.”

Although plantar fasciitis is recognized as an occupational disease, there is no specific policy guidance respecting risk factors important in plantar fasciitis. Policy item #27.30

in the RSCM I, which lists “ASTDs” (activity-related soft tissue disorders) that are recognized by regulation of general application, does not include plantar fasciitis.

The Board publishes an “ASTD Reference Guide” (the Guide), as an aid to adjudicators. The Guide is not published policy. It has been referred to in a number of previous decisions of appellate bodies. See, for example, *Appeal Division Decision #2001-1517*, dated July 31, 2001. That, and other decisions of the former Appeal Division and WCAT referring to the Guide, are available and searchable online. The Guide states that the following are “non-occupational risk factors for plantar fasciitis”:

- Age -- over the age of 40.
- Overweight -- body mass index greater than 25.
- Foot deformity -- flat feet or high instep.
- Systemic disorders -- systemic lupus erythematosus, rheumatoid arthritis, etc.
- Footwear -- inadequate arch support.
- Recreational activities -- direct trauma or unusual physical strain of the plantar fascia.

The Guide states that occupational risk factors include:

- Direct trauma, e.g. contusion.
- Unaccustomed physical strain of the plantar fascia, for example, walking or running for prolonged periods, weight bearing on the ball of the foot.

The Guide also states that it is thought that prolonged weight-bearing or standing on hard surfaces is more likely to bring the symptoms of plantar fasciitis to the attention of an individual, rather than being causative.

There is no mention of vibration, whole body or otherwise, as being potentially causative of plantar fasciitis, in published policy or the Guide. I also note that the Board published a “practice directive” respecting the adjudication of ASTD claims (which does not have the status of policy) effective June 16, 2004, which does not mention plantar fasciitis.

Policy item #13.12 “*Disablement from Vibrations*” in the RSCM I states as follows:

There are some situations in which a disablement from vibrations would be classified as an “injury”. For example:

1. If the vibrations are of a traumatic nature, causing an instant disablement to a worker, such as an explosion.
2. If, though the vibrations may have occurred over a long period of time, the result was an instant or sudden disablement, possibly because of some sudden breakdown in the worker’s system.

Apart from those cases, a gradual deterioration in a worker's condition resulting from exposure over time would not be an "injury", but would be classified as an occupational disease. For example, vibrating hand tools may cause the decalcification of small areas of the bones of the carpus, or damage to the soft tissues of the hand, or osteoarthritis in the elbows, wrists or shoulders, or vascular disturbances.

Policy item #27.13 in the RSCM I deals with hand-arm vibration syndrome (HAVS). It also has a short commentary regarding vibration complaints relating to the feet, which states:

Where a worker claims to have developed a disorder affecting one or both feet as a result of exposure to vibration, such as from standing on a vibrating platform or in vibrating machinery, such claim may be classified either as an injury or a disease, depending on the circumstances (see #13.12 and #27.34). Where such worker claims to have experienced a gradual deterioration in their feet due to exposure to vibration over time, such claim will be treated as an occupational disease. "Disablement from vibrations" has been designated or recognized as an occupational disease by regulation (see #26.03). Such a claim must be considered on its own merits (without the benefit of any presumption).

Thus, the only specific guidance from the Board regarding risk factors for plantar fasciitis is found in the Guide, which is not published policy. I have had reference to it only to the extent that it provides assistance in considering the relevant risk factors. Some guidance respecting disablement from vibration is provided in published policy, but the condition of plantar fasciitis is not mentioned. Policy does contemplate vibration causing a disorder affecting the feet.

On the basis that plantar fasciitis is included in the Guide, I have concluded that any claim for plantar fasciitis must be adjudicated in accordance with the general published policies on ASTD. Those policies address "risk factors" for ASTDs. Policy item #27.40 states that a "risk factor" is a general term for a factor which the medical/scientific research indicates may be relevant to the issue of causation. The presence or absence of some risk factors will suggest occupational causation, while the presence or absence of others will suggest non-occupational causation.

A decision-maker should consider the location of the structure affected (the foot), the magnitude/intensity of the risk factor, the time variation (frequency) of the risk factor, and the duration of the risk factor. Risk factors include repetition, force, static load, task variability, awkward postures, local mechanical stresses, shock, grip type, extremes of temperature and unaccustomed activity. Vibration is specifically mentioned in policy item #27.40 as follows:

[M]ay consist of hand/arm vibration (perhaps secondary to the use of hand held, vibrating tools) or whole-body vibration (perhaps secondary to sitting in a piece of machinery that vibrates). The greater the duration and/or intensity of the vibration, the higher is the potential for causing an ASTD.

In respect of the evaluation of risk factors for ASTDs, I agree generally with the reasoning found in *Appeal Division Decision #2002-0906*, which also involved plantar fasciitis. The panel said, at p. 6:

The determination of causation in cases such as this is not simply an exercise in adding up the non-occupational risk factors and occupational risk factors, and determining where the majority lies. The interaction of the risk factors must be considered. As was noted by the Review Board, non-occupational risk factors may have predisposed the worker to the condition by placing her in the “thin skull” category. If, as in this example, obese women over 40 with biomechanical problems in their feet are more prone to developing plantar fasciitis from standing and walking, they are at higher risk of developing a compensable plantar fasciitis if standing and walking are requirements of the work.

In particular, there is no indication, and it would be difficult to understand, how the non-occupational risk factors of obesity, foot deformity and poor footwear could operate as risk factors *without* weight-bearing on the foot. In addition, a “risk factor” such as poor footwear is of a type and nature similar to “failure to wear personal protective equipment,” which could contribute to an occupational disease or personal injury, but would not necessarily preclude entitlement to workers’ compensation benefits because the system is “no fault.” A worker who injures her eye in an accident arising out of and in the course of her employment because she failed to put on protective goggles would likely still be entitled to acceptance of her claim. Similarly, a worker who develops cancer because of substances inhaled due to the nature of his employment would likely still be entitled to acceptance of his claim, despite not having worn a protective mask (whether mandated by the employer or not). Yet, both the failure to wear goggles and the failure to wear a mask could be considered “non-occupational” risk factors in the same sense that poor footwear is a “non-occupational” risk factor for plantar fasciitis.

In that respect, I am aware of and have considered policy item #20.41 in the RSCM I, which states:

#20.41 Injuries Resulting from Workers Clothing or Footwear

Injuries resulting from the wearing of clothing or footwear are adjudicated according to the following principles:

1. The clothing in question must be necessary for the job.

2. As in all other cases, the injury must arise out of and in the course of employment. Therefore, if there is nothing in the employment activity which would reasonably cause an injury and that injury can be seen to be directly related to the ill-fitting nature of the clothes, the claim should be disallowed. However, even though the clothing may be ill-fitting, if the job involves certain activity which might in the ordinary course of events and with proper clothing cause the injury, the claim should be allowed.
3. Who purchased the clothing or item in question is irrelevant.

Causation of conditions such as plantar fasciitis is usually difficult to determine. Determination of causation involves the weighing of multiple potential “risk factors,” some of which may be personal to the worker, and some that may be due to the nature of the work. The causes of plantar fasciitis in particular are poorly understood and the subject of controversy, as these appeals illustrate. As such, it is particularly important that decisions be made on full consideration of the evidence. The Board has, by regulation, designated plantar fasciitis as an occupational disease. In my view, this constitutes recognition that occupational risk factors may be of causative significance in an appropriate case.

It is trite to state that it is not necessary that occupational risk factors be the *only* cause, or even the most significant cause or predominant cause. Occupational risks need only be a significant cause, beyond *de minimus*. In all cases, the risk factors must be carefully investigated, considered and weighed.

The parties have provided medical/scientific information respecting risk factors for plantar fasciitis, and in particular the effect of vibration. As such, it is necessary to have regard to the manner in which such medical/scientific information should be assessed.

The March 2, 1993 *Protocol for the Assessment of Medical/Scientific Information, Industrial Diseases Standing Committee, Workers Compensation Board of British Columbia*, is published at 9 WCR 429 (the Protocol). It does not constitute published policy (only decisions in volumes one to six of the *Workers' Compensation Reporter* which have not been “retired” are published policy), but does provide guidance in the interpretation of scientific evidence, and in particular epidemiological evidence.

The Protocol sets our criteria for evaluating causation based on epidemiologic studies. Those criteria originated in the work of Bradford Hill¹, and include:

¹ Bradford Hill, A. The Environment and Disease: Association or Causation? *58 Proc. Royal Soc'y Med.*, 295. Hill acknowledged that his factors could only serve to assist in the inferential process, stating that, “None of my nine viewpoints can bring indisputable evidence for or against the cause-and-effect hypothesis and none can be required as a *sine qua non*.”

- Temporal relationship
- Strength of the association
- Dose-response relationship
- Replication of the findings
- Biological plausibility (coherence with existing knowledge)
- Consideration of alternative explanations
- Cessation of exposure
- Specificity of the association
- Consistency with other knowledge

These are termed “criteria of causality.” I will address them in the order they appear in the Protocol, in an attempt to explain their meaning in the context of evaluating the medical/scientific evidence in this case.

The first is “*strength of association*.” The Protocol states that this means, “in simple language,” that the bigger the relative risk, the greater the likelihood of a true cause and effect mechanism at work. Relative risk is one of the cornerstones for causal inferences. For example, the estimated relative risk for lung cancer in smokers is about ten, indicating a very strong association, and making it difficult to imagine any bias or confounding factor that might account for it. Yet relative risk must be interpreted carefully, because a very high relative risk can result from low numbers of subjects. (This criterion to some extent subsumes the criterion of *consideration of alternate explanations* referred to by Bradford Hill, as the latter involves consideration of the possibility of bias and confounding.)

“*Consistency or reproducibility*” is the next criterion. The result from a single study may be a “fluke.” The Protocol notes that there is likely to be more variation in the size of the relative risk between studies if they are based on small numbers. However, very large numbers can also have inherent bias that might make such studies less accurate than smaller studies. Different studies that examine the same exposure with regard to causation should have similar results.

The next criterion is “*dose-response*.” A dose-response relationship can add strength to an otherwise unimpressive result, and if the relative risk is already large, the addition of a dose-response relationship makes the conclusion even stronger. Some causal agents do not exhibit a dose-response.

The next criterion is “*coherence*”, which also means “*biological plausibility*” or “*consistency with existing knowledge*.” The Protocol notes that this may be as simple as observing that an ingested or inhaled substance is most likely to affect the first organ it encounters – the stomach or the lung. The text cautions that, “unfortunately, with ingenuity, one can almost always find a plausible explanation for whatever is observed. Thus, plausibility is often of little help in sorting out convincing from unconvincing data.” When biological plausibility exists, it lends credence to an inference of causality.

“*Temporal relationship*” is the next criterion. The Protocol states that, “at a very elementary level, this is as simple as saying that a cause must precede an effect.” A temporal or chronological relationship must exist for causation.

“*Specificity*,” said in the Protocol to mean “one cause, one effect,” is the next criterion. This means that the exposure is associated with only a single disease or type of disease, such as is the case with asbestos, which is associated with mesothelioma. A study that finds an agent associated with many different diseases should be examined sceptically. The Protocol notes that “things are not always that simple. For example, cigarette smoking has many effects.”

The next criterion noted in the Protocol is “*statistical significance*.” This is stated in the Protocol to usually depend on two things: the strength of the association and the number of observations. The Protocol states that “the importance attached to statistical significance is not an all-or-none phenomenon. Rather, it must be taken into account together with other criteria, especially the strength of association” (at p. 448).

The Protocol notes the criteria are guidelines only, not inflexible rules.

This worker’s particular appeal is complicated by the fact that in addition to plantar fasciitis, his physician offered a diagnosis of Achilles tendinitis. At the time that this claim arose, tendinitis was designated as an occupational disease by inclusion in Schedule B to the Act. The effect of section 6(3) of the Act, in conjunction with Schedule B, was that where there was unaccustomed and repetitive use of the affected arm, hand, leg or foot, the tendinitis was deemed to be due to the nature of the worker’s employment unless the contrary was proven. If the presumption was not brought into play, a condition could still be found to be an occupational disease based on consideration of the individual merits.

Evidence Relating to the Ship

The ship, a car and passenger ferry, was built in 1964. In 1991 it underwent a major structural overhaul, which included the installation of four 4,500 horsepower engines, for a total of 18,000 horsepower. According to some evidence before the Review Board, the ship had been designed and built for engines of 8,000 horsepower. The evidence is further that the ship was the only one in the employer’s fleet that was overhauled in this manner.

There is a wealth of anecdotal and other evidence relating to the fact that after the overhaul, the ship had a “problem” with vibration. I have read and considered all of it and compared it to the Review Board findings.

The evidence suggests that since 1992 the ship had undergone more that \$60 million in refits in an attempt to reduce the vibration. Workers say that passengers complained,

and that the vibration was so bothersome that soup vibrated out of bowls, and desserts fell off display racks. Some evidence suggests that rudders had vibrated off and stanchion had been installed to keep the ship together.

There are also bulletins and letters from the union and other workers bringing the vibration to the employer's attention and stating that many crew members were having trouble with their feet. Anti-vibration insoles were the subject of some discussion and correspondence.

The Review Board panel noted that, based on information obtained from the employer by one of the appellants, in 1990 the ship was refit. In 1991 it was lifted and refit again. In 1992 it was lifted and refit. "Tank tests" were conducted. In 1993 the ship was lifted and refit again, and "engine governors" were added. There was another refit in 1994. In 1995 and 1996 there was "vibration research" and a rudder repair. In 1997 the ship was refit and the crankshaft repaired. In 1998 there were again rudder repairs and a refit. In 1999, the ship was again refit; there were "refit extras" and rudder repairs.

The Board's Prevention Division carried out studies of the vibration after worker concerns were reported. The Board's conclusion, based on measurements taken in 1992, was that the "most disturbing" vibration was due to the propeller blades. The Board's report noted that the measurement was not sufficient to pose a health problem.

The Board again made measurements in February 1994. The cruise level vibration had decreased, which was said to seem "largely due to the reduced power output of the diesels." There was also control of vibration at higher power settings.

There were more tests conducted by the Board in June 1994. The officer reported that he believed a large portion of the perception of vibration was due to an increase in noise rather than vibration.

The employer continued to conduct tests and receive reports with respect to vibration throughout 1995. In July 1995 the Board officer conducted follow-up tests and concluded that the whole body vibration levels were "comfortably below" the international standard (ISO) "fatigue-decreased proficiency boundary." The highest levels of vibration were at the galley entrance.

There were further vibration tests conducted by the Board in August/September 1997. A report in September 1997 from the employer's Occupational Safety and Health Department said that when compared with July 1995 levels, the vibration levels had increased slightly. However, the levels were still below the ISO fatigue-decreased proficiency boundary.

The Board again conducted tests in January 1998 as workers had once more raised concerns. The Board's officer reported that the vibration levels were very similar to those from August 1997 measurements. They were still below the fatigue-decreased

proficiency boundary and the vibration was not considered to constitute a risk to the crew's fatigue or health.

Additionally, there are documents relating to the refit of the ship and contracts awarded for same. For example, a letter dated August 23, 1994 states that the ship's vibration became objectionable above approximately 5,500 HP per shaft, with the "new propeller blades." At this power, a hull speed of about 19 to 19.5 knots was achieved. Someone has written on the document that the ship always went "20.5 to 21.5 KTS, full speed," to maintain schedule.

Much of the above information is very technical, but demonstrates that the ship was, without doubt, the subject of significant discussion and intervention because of "vibration" problems.

The Review Board panel who made the findings under appeal heard extensive evidence about the vibration of the ship at an oral hearing. There is extensive scientific evidence relating to the extent and nature of the vibration. There is also extensive evidence relating to whole body vibration, its hazards and effects, international standards, and levels measured on board the ship. Much of it is contentious. For example, the actual levels of vibration on board the ship were measured, and the parties disagree about the measurements. They disagree with respect to how and where the measurements were taken, and with respect to the standards that should be applied. It is, essentially, impossible to determine with any certainty the degree and extent of the vibration.

I have reviewed and carefully considered all of the evidence and submissions regarding the levels of vibration on board the ship. After that review, I have concluded that it is not, for the purposes of this decision, necessary for me to resolve all of the conflicts in the evidence, except to the extent that I accept:

- The ship "vibrated." The vibration was of a type and nature that falls within the general category of "whole body vibration," and was in several planes.
- The vibration was problematic in a number of ways, including the fact that it was unpleasant to people on the ship. It had the potential to or did cause structural damage to the ship.
- The ship vibrated more than other ships in the fleet.
- The employer took steps to measure the degree of vibration relative to international standards respecting whole body vibration, but the measurements are disputed, based on a number of factors, including the location of the measuring tools, the weather on the day(s) in question, and as is often the case, whether the employer took steps to reduce the level of vibration on the measuring dates.
- The employer did take steps to try and reduce the vibration levels, which were at least partially successful, but complaints about vibration continued.

- The employer and the union were both concerned about the vibration, and in particular about worker complaints.
- Education was undertaken by the employer, in conjunction with the union, about the effects of vibration on the human body.

As such, I agree with the factual conclusions about the ship and its vibration made by the Review Board panel that made the findings under appeal and find no compelling reason to deviate from any of them. I accept that the ship had a significant, ongoing problem with vibration, and that the workers were, as a result, exposed to greater levels of vibration than workers on other ships. As was noted by the Review Board panel, there is no dispute that a vibration problem existed, albeit there may be some dispute about the extent of the vibration and whether it was a health hazard.

I accept that the ship plied a route that took it over a longer, rougher area of the ocean than many of the other ships in the fleet. This meant that workers on the ship were required to work longer shifts per day, but less shifts per week, than workers on other ships. Workers were unhappy about the longer shifts. The longer shifts meant longer periods of standing and walking.

The ship also carried a larger percentage of commercial truck traffic because of its route. Workers say that, as a result, the schedules were required to be carefully maintained, and turnaround time when in port unloading and loading traffic had to be undertaken as quickly as possible. I accept the workers' evidence with respect to the schedules and the necessarily expeditious loading and unloading. This would contribute to less "rest time" in between sailings, and thus, again, longer periods of standing and walking.

I accept that the ship was required by its schedule and other factors to operate at a relatively high speed, which meant that it could not often slow down to a speed where the vibration problems were less evident. The larger volume of commercial traffic also meant that the ship was lower in the water and this enhanced the movement of the ship when it was sailing.

A "lecture series" regarding plantar fasciitis was presented to workers by two occupational therapists, at the worksite. The materials prepared for the presentation note that individuals who perform activities involving prolonged and/or repetitive weight-bearing and force loading through sections of the lower extremities may be at risk. Other possible risks are sudden gain in body weight or obesity, unaccustomed running or walking, repeated mechanical shock to the foot, shoes with poor cushioning, or tightness of the Achilles tendon. The document states that "although exposure to whole body vibration has been suspect as a risk factor, the Whole Body Vibration Sub-Committee has not been able to establish a scientific link correlating levels of vibration experienced on vessels checked and symptoms employees have experienced."

The lecture series document recommends the use of anti-fatigue matting, good quality and supportive footwear, orthotics, stretching exercises, strengthening exercises and the use of good body mechanics.

Submissions and Expert Evidence

There is a significant volume of common submissions and expert evidence. Most of this is also summarized in the Review Board findings, and although I have reviewed and considered all of it, it is not necessary to recite it in detail. However, a brief summary is necessary.

The union commissioned an expert report from the Ergonomics and Human Factors Group, B.C. Research Inc. (the BC Research Report).

The BC Research Report first reviews the risk factors for plantar fasciitis and “related foot disorders.” Related foot disorders are stated to include tarsal tunnel syndrome, calcaneal apophysitis, systemic syndromes (metabolic, diabetes, Paget’s, inflammatory arthritides, tumours, trauma, fat pad trauma, stress fracture, acute fracture, contusion, repetitive trauma, punctures) and fat pad atrophy.

I note that this list of “related foot disorders” includes many conditions that are not designated occupational diseases, including conditions such as diabetes and inflammatory arthritides which are, in most instances, not considered to be occupational diseases, but may cause foot pain.

The BC Research Report states that plantar fasciitis tends to develop from “repetitive tension (overload)” of the soft tissues that join the calcaneus (heel) to the metatarsophalangeal joints (base of the toes) on the underside of the foot. The report states that it is believed that this repetitive strain leads to “micro tears” of the plantar fascia, a chronic inflammatory response, and eventual thickening of the plantar fascia. The report cites Singh, D., et al. (1977) Fortnightly review: Plantar fasciitis. *British Medical Journal*, 315, 172-175 as authority for this statement respecting the underlying causes of plantar fasciitis.

The BC Research Report states that, “Activities such as stair climbing, walking backwards and squatting increase tension in the achilles [*sic*] tendon. Prolonged weight-bearing is a requirement for occupations that involve continuous walking or standing.” It also states that vibration has been shown to increase muscle activity, which will result in increased tension and functional shortening of the Achilles tendon if the vibration influences muscles of the leg and foot.

The BC Research Report was based on an ergonomic analysis, questionnaire (said to personnel perceive moderate to very severe pain in the lower back, legs, feet and heels.” Approximately half were said to experience discomfort during the first four hours

of a shift, and to continue to experience it two hours after the end of a shift. The respondents felt that vessel vibration, patrolling, standing on a hard steel surface, and standing in one position for long periods of time contributed to lower extremity discomfort.

Options to increase comfort suggested by the respondents included reducing vessel vibration, spending less time on feet and sitting when possible, “decreasing fatigue by not rotating through day and afternoon shifts,” access to better subsidized footwear and shoe inserts or orthotics, moving the galley forward to avoid higher levels of vibration, monitoring engine RPM, improved ventilation on car decks, changing jobs to a different vessel, and improved seating.

The “on-board ergonomic assessment” looked at deckhand/seaman, chief officer, cashier and galley.

The deckhand/seamen stand/walk for the majority of what was reported to be an eight to ten hour shift. The decks have a hard metal walking surface that “vibrates throughout the shift.” There are walking ledges with steel plate edges, which “may result in contact pressure on the soles of the feet.” Low frequency motion of the ship due to waves and docking requires compensation by postural muscles to maintain balance.

According to the BC Research Report, the chief officer’s position on the ship “has a history of foot disorders spanning several years.” It was reported that the onset of “foot soreness” tended to follow transfer to the position. This was said to be consistent with the risk factor of “unaccustomed walking.” The job requires standing/walking for approximately one half of the shift. There is frequent stair climbing and backward walking. The walking surface on the car deck, outer decks and stairs is predominately hard metal that vibrates when the ship is in motion.

Cashiers were in a weight-bearing position while standing at a cash desk or walking short distances. Anti-fatigue matting was available at the cash desk, and a high stool provided in the cafeteria but it was reportedly not used due to glare in the sitting position.

Galley staff were in a weight-bearing position for most of their shift on a hard floor or anti-fatigue matting. The staff are required to lean forward at the hips and shoulders while preparing food, “which results in tension in the posterior leg muscles and Achilles tendon.” Galley staff stand on a hard metal edge to prepare soup. The galley is subject to high levels of vibration and noise because of its location, in addition to vessel sway while the ship is underway or manoeuvring.

Under the heading “Observations,” the BC Research Report states that the occupations observed on the ship demonstrated risk factors and reported discomfort consistent with musculoskeletal stress and cumulative trauma to the legs and feet. These positions were said to involve multiple risk factors.

The report states that this suggests there are unique aspects of the work environment contributing to a high incident of discomfort and “injury” to the lower extremities.

The first unique feature was said to be vibration. The second unique aspect of the work was the shift schedule which was adopted to accommodate the longer crossing time.

The BC Research Report recommends education to the crew regarding risk factors and “early recognition” and reporting of symptoms relating to plantar fasciitis and related foot disorders. It recommends support and encouragement for early reporting, controlling vessel speed to minimize vibration, anti-fatigue matting, incentives and reminders for footwear and orthotics, exercise and stretching education, and “fatigue management” training.

The workers’ representative submitted a number of research and other background articles and materials. I have reviewed and considered all of them.²

In this appeal, the employer submitted a document titled “Plantar Fasciitis Review,” dated March 2003 and prepared by Byrne & Associates (the Byrne Report). The author has a Masters Degree in Science, and is a certified industrial hygienist and registered occupational hygienist.

The author also worked as an appeal commissioner in the former Appeal Division from 1991 to 2000. I note the author’s work as an appeal commissioner not because it supports a conclusion that he is an “expert” in plantar fasciitis or occupational causation, but in the context of considering the possibility of allegations of bias or perceived bias, because I too served as an appeal commissioner, from 1998 to 2002. In that respect, I have had specific reference to the MRPP, which states, in part:

23.30 Conflict of Interest / Reasonable Apprehension of Bias

WCAT members must exercise their duties and responsibilities in a neutral, impartial manner. WCAT members must avoid all real or apparent conflicts of interest and must arrange their private affairs in a manner intended to avoid the possibility of a real or apparent conflict of interest arising in their role as a WCAT member. A conflict of interest arises when a WCAT member’s relationships, financial interests or activities inhibit, or may reasonably be thought to inhibit, the impartial discharge of his or her obligations as a WCAT member.

A WCAT member must not participate in a proceeding where the member has (or has had within the last 12 months) a significant or close personal,

² **For example**, Hedlund, U. Raynaud’s phenomenon of fingers and toes of miners exposed to local and whole body vibration and cold. *Int Arch Occup Environ Health* (1989) 61: 457-461

professional or business relationship with a party, a party's representative, or witness to a proceeding.

For greater certainty:

(a) "real conflict of interest" occurs when a WCAT member has a personal attitude, interest (either pecuniary or non-pecuniary), relationship or association (past or present) that impairs the WCAT member's ability to discharge her/his duties fairly and impartially;

(b) an "apparent conflict of interest" exists when a reasonable, well-informed person could have a reasonable perception or apprehension that the existence of a personal attitude, interest (either pecuniary or nonpecuniary), relationship or association (past or present) could impair the WCAT member's ability to discharge her/his duties fairly and impartially;

(c) the fact that a WCAT extraordinary member has been appointed as having experience in employers' interests, or experience in workers' interests, and maintains active contact with the respective constituency, does not, by itself, place that WCAT member in a real or apparent conflict of interest;

(d) a "proceeding" includes any matter before WCAT, including an appeal, application, or request for reconsideration, and includes all preliminary and post-decision actions in relation to a matter.

It is the responsibility of each WCAT member to actively inquire into and consider any circumstance which might suggest a possible conflict of interest or raise a perception of bias regarding any of the member's responsibilities. On recognizing a possible conflict or an issue of bias, the WCAT member should consider whether it would be appropriate to withdraw. This may involve discussion with other panel members, if any, or the registrar, chair, or tribunal counsel.

I do not consider that our former association gives rise to an allegation of bias or perceived bias. More than 12 months has passed since I participated in any proceeding involving a significant or close personal, professional or business relationship with Mr. Byrne.

In particular, although we worked on the same tribunal, and on the same panel on a limited number of occasions, none of those decisions involved plantar fasciitis claims. My contact with the author since he left the Appeal Division has occurred only on the occasion of chance meetings in the community. In that respect, I can recall only one such brief chance meeting, during the summer of 2004.

The Byrne Report is stated to be a review with two purposes. The first was to evaluate the BC Research Report “in comparison with accepted scientific methods for determining causation of suspected work related risk factors.” The second was to review the scientific literature.

The author referred to and provided a copy of policy item #27.40 in the RSCM II. In that respect, it should be noted that the RSCM I contains the applicable policy, but there is no difference in the cited policy item between the two volumes. That policy item states that a risk factor is a general term for a factor that the medical/scientific research indicates may be relevant to the issue of causation. The Byrne Report also refers to the Protocol, described above.

The Byrne Report describes types of experimental studies. A “cluster” is typically a small number of cases of a certain disease that have occurred within a small geographical area over a relatively short period of time.

The Byrne Report expresses the opinion that the BC Research Report does not meet the criteria set out in the Protocol. It does not purport to be and is not an experimental study.

The report states that, “first and foremost,” it is unclear whether plantar fasciitis is the diagnosis in many of the cases discussed in the BC Research Report. The complaints fall into the broad general category of “foot related complaints.” The BC Research Report relied on information from questionnaires, which were not scientifically validated. No control group was used, the number of workers surveyed was too low to be statistically valid, and workers who had already filed claims for foot pain were included. Although workers thought ship vibration was the cause of their problems, worker “perception” is irrelevant in a scientific study.

With regard to the ergonomic assessments, the Byrne Report criticizes the BC Research Report, noting that although risk factors such as “walking on ledges” are identified, the report does not say how often this occurs. The assessments do not provide sufficient information to a reader to fully understand the nature of the worker methods and practices that might be related to plantar fasciitis.

The Byrne Report states, with respect to the scientific research, that the U.S. Center for Disease Control and Prevention, National Institute of Occupational Safety and Health (NIOSH) provides one of the most comprehensive databases and information available on work-related injuries and diseases. It does not mention plantar fasciitis.

The Byrne Report refers to an article by *Hurwitz et al.* published on the Internet (www.emedicine.com/orthoped/topic542.htm) in May 2002. The report states that this article is peer-reviewed, although there is no indication in the article itself that “*emedicine*” is a peer-reviewed publication. The article states that the nature of upright

human activity is repetitive tensile and compressive stress of the fascia that has a cumulative ability to damage or transform the tissues. Further, longer life spans and greater recreational expectations of working adults also contribute to the volume of individuals seeking attention for plantar fasciitis. The general consensus regarding frequency in the United States is that it is a “common condition” in adults older than 40 years. The primary morbidity is pain with weight-bearing activity.

With respect to causes, the *Hurwitz et al.* “emedicine” article cites obesity, repetitive stress activities, and age older than 40 years. It states that foot biomechanics are implicated, but no proven risk factor exists. In particular, the cavus foot with rigid high medial arch and limited heel pronation imparts increased stress within the substance of the plantar fascia. The flexible pes planus foot is also at risk with abduction of the forefoot and pronation of the hind foot causing large tensile strain in the plantar fascia. Contraction of the Achilles tendon and triceps sura also stress the plantar fascia.

The article notes that other possible relationships may exist with hard walking surfaces, the presence of a heel spur, height of heel and other shoe properties, and type of employment. The article states that, to date, “plantar fasciitis is not considered to be a work-related disorder for the purposes of compensation.” (In that respect, I note again that it is designated an occupational disease in this province.)

The Byrne Report concludes that the peer-reviewed scientific articles and research do not support the position that plantar fasciitis is a work-related condition. It states that the overwhelming bulk of the literature suggests it is either caused by personal health issues or sports-related activities. None of the science points to vibration, and the risk factors described by BC Research are not supported in the scientific literature. The report states that the Guide provides an overly generous view of the scientific literature by stating that “unaccustomed” walking or running on the ball of the foot are work-related risk factors.

In 2003 a group of authors published the results of a matched case-control study of risk factors for plantar fasciitis.³ A copy was provided in the workers’ submissions.

This study involved a study group of 50 consecutive persons with a diagnosis of unilateral plantar fasciitis referred to a physiotherapy clinic. Those with systemic arthritic conditions, tarsal tunnel syndrome or a calcaneal stress fracture were excluded, as were those with bilateral plantar fasciitis. The reason that only unilateral cases were included was that the authors wanted to compare dorsiflexion on the uninvolved side.

The authors reported that, “subjects who reported being on their feet for the majority of the workday also had a significantly increased risk of plantar fasciitis (odds ratio, 3.6; 95% confidence interval, 1.3 to 10.1)($p < 0.05$).”

³ Riddle et al. Risk Factors for Plantar Fasciitis: A Matched Case-Control Study. *The Journal of Bone & Joint Surgery*. Volume 85-A, Number 5. May 2003.

The discussion section of the report states that the findings “indirectly support” the hypothesis that limited ankle dorsiflexion, obesity and prolonged weight-bearing at work play a role in the etiology of plantar fasciitis. The authors state that these three risk factors all have biological plausibility.

The authors state that the primary problem with case control studies, such as the one reported, is that the temporal relationship between the risk factor and the disorder cannot be examined because cases are assessed only after the disorder has been diagnosed. They note that in particular the temporal relationship between limited dorsiflexion and plantar fasciitis was unclear (in layperson’s terms, I understand the problem to be one in the nature of the proverbial “chicken and egg”).

The authors state that they cannot exclude the possibility of chance or other confounders as an explanation for their findings. They do state that within the framework of a case-control study, they found what they consider to be good evidence of an association between plantar fasciitis and the three risk factors of limited ankle dorsiflexion, obesity and work-related weight-bearing. They also found a “dose-response” in the case of obesity and limited dorsiflexion.

The workers’ representative tendered a report prepared by Dr. Rudland, a family physician, dated June 17, 2003. He opined that in the workers’ cases, there is a complex mix of “repetitive motion,” steel decks, long shifts, backwards walking, stair climbing and vessel vibration. He said that these things set the workers on the ship apart from other worker groups. In response to a submission by the employer’s representative that the Review Board findings hinge on vibration, Dr. Rudland said it was based on an incomplete understanding of the “multifactor nature of the issue under review.” He said that, “Increased lengths of shifts compared to other vessels and standing on a steel deck that just happens to be vibrating more than other similar vessels, are all part of the equation.” Vibration is not the only factor.

Dr. Rudland said that while there are no published reports that find vibration a risk factor for plantar fasciitis, it is a risk factor in other conditions. In Dr. Rudland’s view, there is “overwhelming” evidence in support of vibration as a major cause in some conditions. He reviewed the causative significance of vibration in vibration white finger disease (hand-arm vibration syndrome), and “vibration-induced white toes.” He opined that the occurrence of any type of vibration-induced injury to foot structures raises the probability to much greater than 50% that the plantar fascia may be subject to vibration-induced injuries, either via direct injury to the fascia itself or via vascular injury and subsequent hypoxic damage.

Dr. Rudland also pointed to carpal tunnel syndrome, and noted that tendon sheaths are “relatively inert fibrous structures” like the plantar fascia. Vibration is considered a risk factor for carpal tunnel syndrome. He also referred to the relationship between whole body vibration and low back pain (which I note is the subject of scientific differences of opinion and significant controversy within the B.C. workers’ compensation system).

Dr. Rudland opined that endothelial injury to the small arteries can be caused by vibration, leading to fibrosis and scarring of vessel walls, leading to vessel loss. If the plantar fascia loses blood supply, scarring could occur. Vibration can also induce neuropathy, and there is a probable connection with Dupuytren's contracture.

In the case of plantar fasciitis, Dr. Rudland said that a number of risk factors set out in published policy may be acting. Foot structures are in contact with vibrating steel decks, ladders and stairs, "at all times," even when sitting, albeit without the body weight factor. Backward walking alters the mechanics of support. Walking and standing expose the foot to mechanical forces transmitted through footwear. The exposure is for long duration. Extended shifts increase "repetition." The tension in the plantar fascia is constantly adjusting to the pitch, roll and yaw of the ship, and pressure from the floor is applicable. Stair climbing and backward walking put different stresses on the plantar fascia. Vibration contributes, and temperature may be a contributing factor in "colder periods as the vehicle decks are not heated areas." The work is not usually unaccustomed but is "in the context of non-working conditions."

Dr. Rudland specifically addressed the risk factors in the Guide. He said that "age over 40" is at odds with the literature, which supports a conclusion that young runners and middle-aged women are the most common groups. Obesity is present in 90% of affected females but only 40% of males. With respect to altered foot biomechanics, Dr. Rudland noted that there were many people with foot architecture different from the norm who do not have plantar fasciitis. In his family practice, very few plantar fasciitis patients fall into that category. Systemic disorders are found in a cross-section of the population. Inadequate footwear may bring the condition to the worker's attention sooner, but Dr. Rudland asked whether this fundamentally altered the underlying causes of longer shifts standing on vibrating steel decks. Recreational activities may be a factor, but the unusual physical strain of standing on vibrating decks is more plausible. Unaccustomed physical strain is a factor, with standing on hard surfaces for extended hours, and vibration an added negative factor. Dr. Rudland also commented on the sample letter contained in the Guide, which refers to a specific incident, suggesting that plantar fasciitis is caused by a specific incident, which Dr. Rudland states it is not.

Dr. Rudland pointed to the fact that the research suggests an incidence in the population of about 1 per 150 individuals. Thus, 9 cases out of about 60 to 70 workers on the ship were a cluster, even if a formal medical report had not been published.

Dr. Rudland also commented on international standards for whole body vibration. He attached a number of references, all of which I have reviewed and considered.

Dr. Rudland suggested that the employer's appeals could only be allowed if the employer proved beyond a 50% doubt that:

- There is no connection between the length of shifts and extended walking on steel floors and the occurrence of plantar fasciitis in the affected workers.

- A 20-fold increase in incidence over the general population is coincidence.
- Vibration does not injure the foot structures.
- Vibration selectively avoids damage to foot structures.
- Plantar fasciitis is only caused by individual risk factors such as obesity or female gender.
- Foot abnormalities are causal, despite evidence to the contrary.
- The cases were not caused by the nature of the employment, nor were the atypical work conditions in any way responsible.
- The worker's failure to recover was not related to the ongoing exposure.

The workers' representative submitted that vibration was not the only factor that should be considered. There are multiple occupational risk factors, with vibration and long shift duration having been identified as unique to the ship. It must be noted that the workers were in a weight-bearing position for the majority of the shift. The workers' representative referred to a number of decisions of the former Appeal Division (#00-0507, #00-1497, #00-1847, #00-2064, #02-0906 and #02-2989). In all of those decisions, the representative submitted, the individuals spent the majority of their workday in a weight-bearing job, which placed them at risk for plantar fasciitis.

The employer's representative's comments regarding the BC Research Report were referred by the workers' representative back to the author (Dr. Robinson) of that report for comment. He provided a report with the footnote "Robinson Ergonomics" dated June 3, 2003.

Dr. Robinson stated that there is no peer-reviewed analysis in the English language literature that directly relates plantar fasciitis to vibration exposure, but there has not been any analysis that refutes a relationship either. The lack of published epidemiological studies does not mean that there are no scientific facts upon which to evaluate the plausibility of an association. Scientific merit may also be based on an examination of similar disorders for which epidemiologic evidence does exist.

Dr. Robinson noted that Dupuytren's contracture is a disease of the palmar fascia in which thickening of the fascia restricts the ability to straighten the fingers. He said this is similar to the thickening of the fascia that characterizes plantar fasciitis. Dr. Robinson said that a thorough review of the epidemiologic literature in 1996⁴ concluded that there was good support for an association between vibration exposure and Dupuytren's contracture. Thus, states Dr. Robinson, epidemiologic evidence exists that relates similar disorders to vibration exposure.

⁴ Liss, G.M. and Stock, S.R. 1996. Can Dupuytren's contracture be work-related?: a review of the evidence. *American Journal of Industrial Medicine*, 29(5): 521-532.

Dr. Robinson said that plantar fasciitis is believed to result from repetitive tensioning of the plantar fascia that results in microtears, anti-inflammatory responses, and thickening of the fascia.⁵ He states that, “from first principles,” activities that result in repetitive, prolonged or high levels of tension in the plantar fascia would present the potential for injury, with the level of risk dependent on the usual dimensions of exposure: the magnitude of the tension, the rate of repetition (frequency), and the duration of exposure. On that basis, activities that involve prolonged walking, running, weight-bearing, stair climbing, squatting or standing on the balls of the feet, and tension in the Achilles tendon or gastrocnemius and soleus muscles are risk factors. Dr. Robinson said that these activities resulted in increased tension of the plantar fascia. He also noted that unaccustomed walking is a risk factor for plantar fasciitis.

Dr. Robinson opined that the statement in the Guide that prolonged weight-bearing or standing on hard surfaces is more likely to bring the symptoms of plantar fasciitis to a worker’s attention than to be the cause, was “not consistent with the current medical literature.” Dr. Robinson specifically referred to the anatomy of the plantar fascia. He said that the plantar fascia acts to maintain the arch of the foot by applying tension between the heel and the ball of the foot. Weight-bearing generates forces that will tend to flatten the arch and flatten and splay the foot. These forces are opposed by increased tension in the plantar fascia as the foot flattens. Connective tissues such as the plantar fascia exhibit behaviour known as “viscoelastic creep.” Creep is an increase in length of the tissue with time when a constant force is applied (standing or squatting), or when force is applied repeatedly (walking or running). Tissue injury is related to physical deformation of the tissue (strain), and the greater the deformation or stretch of the tissue, the greater the likelihood of injury.

During ambulation the plantar fascia is stretched with each step. Upon heel strike, the tibia turns inward and the foot pronates and flattens to absorb the heel strike shock and to adjust to the shape of the ground. Hard surfaces and poor footwear generate large heel strike accelerations that result in greater stress to the plantar fascia.

Dr. Robinson reiterated that it is unreasonable to conclude that exposure to the mechanical and physiological influence of vibration played no contributory role in the aggravation of the plantar fascia. He stated that the BC Research Report was an ergonomic assessment that evaluates whether risk factors for plantar fasciitis and “related foot disorders” existed on the ship at the time of the assessment. He said that the methods used were consistent with standard practice in the performance of ergonomic assessments, that the interpretation of the results was appropriate and consistent with the scientific literature, and that the recommendations follow logically from the results and limitations of the assessment.

⁵ In support of this, Dr. Robinson cites Singh, D. et al., 1977. Fortnightly review: Plantar fasciitis. *British Medical Journal*, 315: 172-175.

Dr. Robinson said that the use of questionnaires was well accepted and the foot discomfort was found to be prevalent beyond the individuals who had outstanding claims. BC Research was asked to assess the presence of risk factors for plantar fasciitis and related foot disorders. Whether or not a worker has one of those foot disorders was not within the scope of the assessments. Dr. Robinson said he agreed with the Bryne report that the review of the first aid logs provided no useful information to assist in determining whether vibration is a risk factor for plantar fasciitis. No link was drawn. The report was not to determine whether vibration was a risk factor for plantar fasciitis. Rather, it was intended to examine the existence of recognized risk factors for plantar fasciitis and to recommend mitigation strategies. The existence of non-occupational risk factors for the workers is irrelevant to the assessment. The report examines multiple risk factors and vibration was not included in the primary risk factors. Low level vibration is not recognized as a primary risk factor for plantar fasciitis, but unaccustomed or unusual physical stress to the plantar fascia or other structures of the foot is an accepted risk factor, including the mechanical shock that can result when jumping from high places. The vibration and roll, pitch and yaw motion of the vessel provide potential sources of physical stress. What constitutes physical stress and what is an unacceptable level of physical stress is one of the difficult issues in identifying whether risk exists.

Dr. Robinson said that he was a technical expert on the Canadian Advisory Council to the ISO for the whole body vibration standard, and that he was aware of the strengths, limitations and applications of the standard. The health guidance is not relevant for disorders of the lower extremities. Dr. Robinson said that “we know that one large, singular event such as an impact on the foot can result in injury.” On the other end of the scale, “we know that the vibration associated with normal walking is usually safe.” We do not know at what point the threshold is crossed. The BC Research Report indicates what jobs are associated with exposure to vibration but makes no attempt at discerning actual vibration levels or determining whether those levels present a health risk.

Dr. Robinson said that, in retrospect, “backwards walking” warranted extra consideration in the report, as it was not made evident why backward walking should be considered a risk factor for plantar fasciitis. Backwards walking differs from the usual forward walking in that it requires higher levels of muscle activity, different muscle coordination and generates different ground reaction forces at the heel and toe. It is “clearly unaccustomed walking for most people, and as such presents a risk for plantar fasciitis.”

Dr. Robinson further said that the Bryne Report did not fully canvass the literature on the subject of risk factors in plantar fasciitis. This literature supports a conclusion that plantar fasciitis is “clearly and consistently related in the medical and scientific literature to exposure to repeated, prolonged or excessive tensile strain of the plantar fascia that leads to tissue damage.”

Dr. Robinson then re-stated the risk factors for the positions discussed in the BC Research Report.

The workers' representative submitted that in these cases, the workers' jobs required standing and walking over most of the shift. The physical acts of standing and walking are usual activities of everyday life, but the requirement to perform them were part of the work. The interaction of risk factors must be considered, and the issue is mainly one of medical causation. The workers' representative submitted that the employer has failed to show that the Review Board panel erred in law or fact, or that it contravened published policy.

The employer provided a further submission dated June 27, 2003, submitting first that each case must be adjudicated on its own merits.

The employer noted that of 11 appeals before the Review Board, 9 were allowed and two denied. The common denominator in the allowed appeals was work on the ship. The other two workers did not work on the ship. The employer submitted that the "overwhelming connection for the acceptance by the WCRD [Review Board], was that of vibration on the [ship]."

The employer submitted that each of the vessels in the employer's fleet vibrates. There are approximately 3,500 employees who work on those vessels. The employer's representative's submissions "would have us conclude that everyone should be suffering from PF [plantar fasciitis] who works on a vessel, or in the alternative, that everyone who is diagnosed with PF and who is employed at [the employer] has an Occupational Disease. Of course these two conclusions are incorrect."

The employer submitted that the merits of each case must be given equal measure. The Review Board "simply split those who were workers on [the ship]." There are hundreds of workers who have worked and continue to work on the ship.

The employer submitted that there was a "glaring lack of any discussion of any non-occupational cause of the worker's [*sic*] diagnosed condition." The employer submitted that none of the scientific articles or other information submitted by the workers speak to the issue of vibration and plantar fasciitis. The workers' representative is asking the panel to make "scientific leaps of judgement relating medical interpretation and studies from one category to another."

The employer referred to Dr. Rudland's statement that the Review Board findings were extensively researched and well-reasoned, and respectfully disagreed. In particular, the employer referred to its criticism of the BC Research Report.

The employer noted that the *Riddle et al.* article, *supra*, which confirmed that weight-bearing work is a risk factor, did not speak to vibration. The employer submitted that the Review Board erred in not assessing each case on its own merits.

Previous Appellate Decisions

Both the employer's and the workers' representative submitted a number of previous appellate decisions. Previous decisions are not binding on WCAT, but provide guidance respecting the approach to adjudication of appeals involving plantar fasciitis. They are all available on the Board's website.

Appeal Division Decision #00-0507 (April 14, 2000) involved a worker who claimed compensation for plantar fasciitis alleged to be due to stiff safety boots and extensive work-related walking. The worker's appeal was allowed. The appeal commissioner stated that while he appreciated that there is a range of potential causes for plantar fasciitis, the medical literature indicated that one of those causes may be extensive walking or extended periods of time on the feet.

Appeal Division Decision #00-1497 (September 25, 2000) involved a letter carrier who walked for prolonged periods carrying weight of approximately 35 pounds. There was conflicting evidence about whether the workload had increased, and the panel was not satisfied an increase had occurred. There were also conflicting medical opinions, but the Appeal Division panel preferred the opinion of the treating physician, and the worker's appeal was allowed. The panel concluded that, particularly in the case of occupational disease, the development of a condition over time was a valid consideration.

Appeal Division Decision #00-1847 (November 22, 2000) involved an electrical mechanic who was required by his work to walk, stand and squat on a concrete floor for prolonged periods of time. Again, there were conflicting medical opinions. The panel accepted that the worker's job duties required standing and lifting heavy items from a squatting position, and allowed his appeal. This panel also noted that generally, when a particular activity has been performed for a lengthy period it is assumed that the muscles and tendons are accustomed to the activity and unlikely to be affected by it. She noted that the policies also recognize that many conditions develop over a period of years and one of the factors that is used to distinguish an occupational disease from an injury is the development of the condition over time.

Appeal Division Decision #00-2064 (December 22, 2000) involved a nurse with right plantar fasciitis. She was exposed to constant standing and walking on concrete floors during 12 hour shifts. The panel allowed the worker's appeal, noting that it was not unusual for some, but not all workers, to develop a particular occupational disease, despite similar circumstances. The panel noted that there was little if any evidence to suggest that only very minimal standing and walking, such as would be necessary to carry out the activities of daily living, would be sufficient in the presence of the risk factors in the case. The panel found that there was insufficient evidence upon which to conclude that the worker, because of her other risk factors, would have developed plantar fasciitis from standing and walking other than at work, and that work activities

were as a result inconsequential. That conclusion was possible on the evidence but was rejected.

Appeal Division Decision #2002-0906 (April 15, 2002) involved a worker with a delivery job requiring her to stand, walk and drive throughout the day. The worker had poor foot biomechanics and was overweight. This may have predisposed the worker to her injury. The panel noted that determining causation in such cases was not simply an exercise in adding up risk factors and determining where the majority lay. The employer's appeal from the Board's acceptance of the claim was denied.

Appeal Division Decision #2002-2989 (November 27, 2002) also involved a worker who was required to stand and walk for long periods during the day. The panel found that the worker's plantar fasciitis was due to the nature of her employment.

Evidence respecting this individual worker

The worker began working for the employer in 1975. In February 1998 the worker completed a questionnaire for the Board. He indicated that he was 45 years old, 5'10" tall, and weighed 270 pounds. He said he first noticed the "beginnings of sore feet" after working a shift on the ship on June 13, 1997. His symptoms were worse in the evening. The worker indicated that he had a family history of diabetes and that he was a borderline diabetic.

The worker indicated on the questionnaire that he was unable to walk more than one block without pain developing in both of his heels. His shift rotation was five days on/five days off. There had been no recent changes to his shift schedule or an increase in duties. He had an approximately 25 minute break once every two hours.

In a March 3, 1998 letter to the case manager, the worker said that he first noticed in the spring of 1997 that his feet were sore, particularly in the evenings after working. The worker said he had been relieving as chief officer more frequently as time passed (there is little, if any, quantitative evidence relating to the extent of the worker's relief work as a chief officer). The worker said that he had the entire month of August 1997 off and during that time his feet improved but they still hurt after a round of golf, which involved walking four miles on soft green grass. When he returned to work in September his heel was sore after only one shift. The worker used insoles in his shoes. He then had the whole month of October off. He found it more difficult to recuperate after golfing, so ceased golfing.

When the worker returned to work in November, the ship was off the route and he worked on another ship. His heels were "okay for the most part until the last few days of the shift." He "chalked" the pain up to relieving as chief officer.

The ship returned to the route in December 1997 and this led to a reported increase in heel pain that meant he took his shoes off for relief regularly. The worker was on

holidays from December 11 to 25, 1997, and he found that if he took it easy his heels would improve slowly.

The worker described increased pain after resting, and stated that he was obtaining orthotics. By his fifth day off the pain was not as bad.

The physician's first report is from Dr. Blackshaw and is dated January 29, 1998. He notes that the worker had tenderness in the plantar fascia, left more than right, at the insertion of the plantar fascia into the calcaneus. The worker was to see a podiatrist, and to have hydrotherapy and stretching exercises. The diagnosis was "plantar fasciitis/achilles tendinitis."

There is no record on file of the podiatrist's assessment. The worker states that he had his feet casted for orthotics which cost approximately \$300.

A Board medical advisor reviewed the worker's claim and commented that plantar fasciitis or "painful heel" is a common complaint in the general public. The most common cause is an abnormal foot configuration such as pes cavus. No occupation has been shown to cause a substantially increased risk of developing the problem. In this case, there was "probably less than 50% direct causal relationship."

The BC Research Report contains a risk assessment specifically with reference to the chief officer's position. This was based on an "on board" ergonomic assessment and is described in the report.

The "history" of foot disorders in the chief officer's position was noted, and that the "onset of foot soreness tended to follow transfer to the position" from another position on board the ship. This was said to be consistent with the risk factor of unaccustomed walking.

The chief officer's duties include managing the deck crew, navigating the vessel, and performing security and inspection rounds. The chief officer also supervises unloading and loading of the main vehicle deck and the walk-on passengers. The duties required the chief officer to be in a weight-bearing position for approximately one half of the shift. The duties are spread among multiple levels of the ship and require frequent stair climbing. There is also frequent backward walking when loading and unloading. The walking is predominately on a hard metal deck that vibrates.

The second officer position was not the subject of a specific analysis.

The employer's representative provided a submission received by WCAT on April 14, 2003. With respect to the worker, the employer noted that he had a body mass index of 39, which was "morbidly obese." The worker participated in regular sports activities such as golf.

The employer's representative submitted that the risk factors showed that occupation had no causative significance.

The worker provided his own submission, dated May 16, 2003. He stated that he had spoken with Dr. Blackshaw, who said there was no correlation between diabetes and plantar fasciitis. The worker said that he did not have diabetes, nor does he have a history of flat feet or feet with high arches.

The worker acknowledged that he was overweight, but objected to the employer's representative's characterization of his condition as morbidly obese. The worker pointed out that many people who were overweight did not have plantar fasciitis, and some co-workers who were normal weight did have it. Furthermore, the worker did not have plantar fasciitis while working on other ships, despite his weight condition.

The worker said that he had received information from his podiatrist which was similar to that provided by the employer respecting plantar fasciitis.

With respect to footwear, the worker pointed out that crew were required to wear steel-toed shoes, which reduced the selection of footwear. Shoes provided by the employer were not of good quality. They were stiff and did not fit snugly. The shoes did not have arch support. The worker said that while away from work he wore a "running shoe."

The worker pointed to the evidence about vibration and stressed the fact that he did not have problems on other ships. He further stressed the fact that the ship had a vibration problem that was well documented.

Findings and Reasons

Plantar fasciitis is recognized as an occupational disease by regulation pursuant to section 1 of the Act. As such, it is adjudicated with reference to section 6 of the Act, which provides entitlement to compensation for occupational diseases due to the nature of employment. There is no presumption of causation in the case of plantar fasciitis, as there would be if it was included in Schedule B to the Act.

Section 250(4) of the Act provides that where in an appeal respecting the compensation of a worker, the evidence supporting different findings on an issue is evenly weighted, WCAT must resolve that issue in a manner that favours the worker.

It is clear from these cases, and from previous appellate decisions, that the status of plantar fasciitis as an occupational disease is not free from controversy. However, it is designated as an occupational disease, albeit without specific published policy guidance respecting the adjudication of plantar fasciitis claims. Furthermore, the medical/scientific literature does not provide a firm perspective on causation one way or the other.

Based on my review of all of the files, published policy, the Guide, and all of the submissions, including the medical and scientific literature, I have decided to approach the adjudication of all of these claims on a consistent basis, which is set out as follows.

The first question is whether or not there is a firm diagnosis. Some of the workers have a firm diagnosis of plantar fasciitis, and others do not. Given the time that has gone by and the consequent opportunity to provide detailed and carefully considered medical evidence and opinion, I consider that unless there is a firm diagnosis of plantar fasciitis, the adjudication of the individual claim should not be on the basis of that diagnosis.

In that respect, I am also not persuaded that “related foot disorders” as described in the BC Research Report, are necessarily subject to the same considerations respecting causation as are the instances where the evidence suggests, at least to the level of “evenly weighted,” that the worker had or has plantar fasciitis.

It is important to keep in mind that “sore feet,” “foot pain,” “foot discomfort” or related complaints are not diagnoses, nor are they occupational diseases. Rather, they are descriptions of subjective complaints. It is not necessary to have medical or scientific evidence to conclude that foot pain and discomfort is a very common complaint in individuals who are involved in prolonged or unaccustomed standing or walking. I consider it unlikely that anyone has escaped feeling foot discomfort after unaccustomed standing or walking, or that there are very many workers who do not experience, at the very least, a sensation of fatigue related to their feet after a day at work requiring prolonged standing or walking. Such a sensation is not a diagnosis. Although some conditions can be accepted as occupational diseases without a firm “diagnosis,” I do not consider “sore feet” to be an occupational disease. It is a symptom only.

Once it is established that a worker has plantar fasciitis, the “non-occupational” risk factors must be examined.

In the case of a condition like plantar fasciitis, it is important that the individual risk factors, both non-occupational and occupational, be considered carefully. It is not possible to generalize. The sources of guidance in cases of plantar fasciitis, taken together, make it clear that causation is a complex question involving the interaction of many risk factors. There may be potential risk factors in common in a group of workers, such as in this case where the appellants all worked on the ship, but individual risk factors must also be taken into account. Although these claims and these appeals have moved through the workers’ compensation system together, this is not a case where every worker on the ship has a confirmed diagnosis of plantar fasciitis or where the exposure to occupational risk factors was the same.

There is suggestion in the file, particularly in the BC Research Report, that certain of the positions have a “history” of foot disorders. That conclusion appears to be based on

anecdotal evidence and a limited number of cases, including those involved in these appeals. Based on the evidence relating to causation in plantar fasciitis, I consider it would be extraordinary that a “position” on a ship would give rise to a string of confirmed plantar fasciitis cases. I am not persuaded that any “history” in a particular position exists. I accept that there are a number of claims, but in the absence of epidemiologic evidence, I am not persuaded that an assertion of a “history” of foot disorders has significance with respect to occupational causation in these cases.

It is useful to consider the occupational risk factors together, but it would be unreasonable to reach one conclusion respecting the operation of occupational risk factors, and then allow all the appeals without carefully considering the individual merits and risk factors, including the diagnosis and its basis.

Although the Guide does not have the status of published policy, it does provide a summary of some of the non-occupational and occupational risk factors. In deciding how to approach these appeals, I have considered the Guide in conjunction with published policy on ASTDs, the scientific literature and the medical/scientific opinions provided in this case.

As such, I accept that work-related weight-bearing is a risk factor for the development of plantar fasciitis. However, I also accept that the work-related weight-bearing must be prolonged and/or unaccustomed. Such a conclusion is consistent with the whole of the evidence, including the Guide and published policy.

How should the interaction of non-occupational and occupational risk factors be considered in these cases? It is useful to break down the non-occupational risk factors into two groups -- “independent” non-occupational risk factors, and those which may act together with occupational risk factors to increase the likelihood that occupational risk factors will lead to plantar fasciitis. The second group I will refer to as “related” non-occupational risk factors.

I hasten to add that whether a “related” risk factor has any impact in a particular case must be considered in conjunction with all of the other risk factors, and their nature and extent.

I agree with the approach taken in previous appellate decisions that point out that some risk factors personal to the worker may operate in concert with occupational risk factors. Age, obesity and altered foot biomechanics are examples of “related” non-occupational risk factors in that they require standing and walking to operate. For example, there is no suggestion in any of the sources of information regarding risk factors that an obese person will acquire plantar fasciitis simply as a consequence of obesity, or that altered foot biomechanics can be responsible for the condition without weight-bearing on the foot.

I accept that as individuals age they may become more susceptible to injury and disease, including plantar fasciitis. I also accept that being overweight and having a foot deformity are personal risk factors for plantar fasciitis.

Age, obesity and altered foot biomechanics are “related” non-occupational risk factors that may interact with occupational risk factors to increase the likelihood of an individual worker developing plantar fasciitis.

Some personal risk factors have a more complex relationship to work causation. For example, it seems reasonable to conclude that the presence of a systemic disorder such as rheumatoid arthritis can be causative of inflammation of the plantar fascia, or may alter biomechanics. The presence of a systemic disorder such as systemic lupus erythematosus and rheumatoid arthritis are non-occupational risk factors that should be given considerable weight and which do not operate in the same manner as obesity and age. I accept that those systemic disorders can be causative without prolonged or unaccustomed weight-bearing, although weight-bearing can bring the presence of the condition to an individual’s attention. Thus, they are “independent” risk factors, although they may, in some instances, fall into a category that could be called “hybrid” risk factors because they may interact with occupational risk factors in a limited number of circumstances.

I also accept that a worker’s recreational activities are an important consideration, and that running or participation in sports or recreational activities requiring prolonged weight-bearing are independent non-occupational risk factors. Participation in sports-related activities may place increased stress on the plantar fascia, both by virtue of weight-bearing, and as a result of “toe extension” which is greater in athletic activity than in day-to-day standing and walking.

Wearing footwear with inadequate arch support or a lack of proper cushioning is likely a risk factor. However, I do not accept that it is a “non-occupational” risk factor except to the extent that it may interact with other non-occupational risk factors such as recreational or sporting activities. In a worker exposed to prolonged or unaccustomed work-related weight-bearing, or other occupational risk factors (such as, for example, activity requiring extension of the toes), improper footwear may increase the risk of plantar fasciitis but, as noted above, wearing such footwear is really no different than failing to wear personal protective equipment. It does not negate a work-relationship, unless there is sufficient evidence that a worker refused to take steps to prevent the development of the disease. Wearing poor footwear is a related non-occupational risk factor.

It is well-documented in the literature and policy that direct trauma can cause plantar fasciitis. I accept that it can. I also accept that prolonged pressure resulting from, for example, prolonged weight-bearing on a hard metal edge, may be a form of “direct trauma” to the plantar fascia, in that one particular area of the plantar fascia may be subject to undue pressure as a result.

The two “risk factors” asserted to be causative in these cases are longer weight-bearing due to longer shifts, and vibration.

In the decision under appeal, much is made of the fact that the ship vibrated more than other ships. This is also stressed in the submissions and medical/scientific opinions. The Review Board allowed all of the appeals involving workers who were employed on the ship, on the basis of vibration and longer shifts. I have already concluded, and in my view the weight of evidence supports a conclusion, that the ship did have a problem with what can be termed “excessive” vibration. That vibration was clearly identified as problematic by both the employer and the workers, at the very least in the sense that it was unpleasant.

The lack of consensus regarding the underlying causes of plantar fasciitis complicates any adjudication of an alleged work-related case of plantar fasciitis. The extensive submissions and research in these appeals have not uncovered any reference to vibration, whole body or otherwise, as a risk factor for plantar fasciitis. As such, I consider it important that the evidence in favour of a connection between plantar fasciitis and work exposures be evaluated in accordance with the Protocol, while at the same time keeping in mind that the criteria in the Protocol are guidelines, and not inflexible rules. While it is not published policy, the Protocol provides a framework for analysis of the evidence.

The first criterion is temporal relationship. As noted above, this means that the “exposure” must precede the development of the disease. The absence of a temporal relationship is certainly strong, if not absolutely persuasive, evidence of a lack of relationship. A temporal relationship appears to exist in all of these appeals, in the sense that those workers with a diagnosis of plantar fasciitis received that diagnosis *after* the exposure to the ship. However, it should be noted that in situations such as this, the temporal relationship between the risk factor and the disorder cannot be fully examined because the cases come forward only after the diagnosis of plantar fasciitis. In order to fully evaluate the temporal relationship, a group of individuals must be studied *both before and after exposure*. It should be noted that occupational disease claims almost always (or perhaps always) arise after the exposure in question. Further, from a lay person’s perspective, a temporal relationship may be much more persuasive (and provide the foundation of a firm belief) if such a relationship is from the perspective of those involved in scientific study and evaluation of evidence relating to causation.

Workers frequently assert “it started after I started working at job X” as the most important piece of evidence in favour of causation. Such an assertion must be approached with caution when evaluating an occupational disease claim. There is always a temporal relationship between *something* and the disease in question. As an example, degenerative joint conditions develop more frequently as we age. The result is that there is, in all likelihood, a relationship between osteoarthritis and retirement from the workforce, in the sense that many diagnoses of osteoarthritis occur after retirement.

However, there is likely no causative relationship between “retirement” and “osteoarthritis.” The relationship is one that appears only because both retirement and osteoarthritis are related to age.

A temporal relationship may be necessary for causation but it is certainly not proof of causation.

Strength of the association is the next criterion. It means that the bigger the relative risk, the greater the likelihood of a true cause and effect mechanism at work. In these cases, there is no published scientific/medical information demonstrating an association between vibration and plantar fasciitis. There is published information respecting “work-related” weight-bearing.

In the *Riddle et al.* article (which notes that the etiology of plantar fasciitis is poorly understood), the authors reported on a case-control study involving 50 consecutive patients with unilateral plantar fasciitis. The authors found an odds ratio of 3.6 (95% confidence interval, 1.3 to 10.1) for individuals who spent the majority of their workday “on their feet.” As I understand it, an odds ratio of 3.6 means that workers in the category of “spending the majority of the workday on their feet” were 3.6 times more likely to have a diagnosis of unilateral plantar fasciitis than the case control group, which were matched to the study participants age and gender. This means that the study’s authors, based on statistical analysis of the results, were 95% confident that the odds ratio was between 1.3 to 10.1. I note that this is a very large range, and that the lower end of the range is close to 1.0, which would be interpreted to mean there was no greater incidence than the controls. (An odds ratio of 1.0 represents the same incidence in the study population as in the control group. The more the odds ratio deviates from 1.0, the stronger the association between the exposure variable and the condition being studied.)

Whether or not an individual spent the “majority of the workday” on their feet was determined simply on the basis of the individual subject responding “yes” or “no” to the question, “Do you spend the majority of the workday on your feet?” In the discussion section the authors noted that, “Individuals who spent the majority of the workday weight-bearing and those who are obese also theoretically have increased tensile loads on the plantar fascia compared with those who spend less time weight-bearing and those who have a normal body weight.”

The *Riddle et al.* study thus did not approach a fundamental question with scientific rigor. The method used relies on subjective worker reports rather than structured objective scientific observation. It is also notable that workers’ weight was determined by worker report rather than independent determination by the study’s authors, with a reference cited that is said to support a conclusion that reported weights are reliable.

The next criterion is “dose-response.” The Protocol states that if the relative risk is already large, the addition of a dose-response relationship makes the conclusion even

stronger. The authors did not find a “dose-response” relationship with respect to the variable of work-related weight-bearing. I note that, in any event, such a relationship could not be examined in the *Riddle et al.* study because there was no objective or quantitative evaluation of the extent of work-related weight-bearing. The analysis was based on worker reports of “majority of workday on feet” as opposed to “not on feet.”

Replication of the findings is the next criteria. Prolonged weight-bearing is frequently hypothesized as a cause of plantar fasciitis. However, there is a dearth of scientific study confirming that hypothesis.

By far the majority of the evidence and scientific/medical evidence and opinion in these cases focus on biological plausibility (coherence with existing knowledge). Dr. Rudland, for example, makes a strenuous argument for the biological plausibility of a relationship between vibration and plantar fasciitis, based on better understood conditions such as hand-arm vibration.

I am persuaded by these arguments, and accept, that it is “biologically plausible” that both prolonged weight-bearing and vibration could have causative significance in plantar fasciitis. Based on my review of the information on all of the files, and the scientific/medical information and opinion, I have also concluded that prolonged standing on hard metal edges, and backward walking (which involves greater toe extension and creates more stress on the Achilles muscles than regular forward walking) are biologically plausible risk factors for plantar fasciitis.

The next criterion is consideration of alternative explanations. In the case of plantar fasciitis, the vast majority of the information, including the evidence and opinion in these appeals, hypothesizes regarding risk factors, based on biological plausibility. The categorization of risk factors as “occupational” and “non-occupational” suggests a consideration of alternative explanations. However, none of the opinions provided include a careful consideration of alternative explanations.

The criterion of “cessation of exposure” is the basis of submissions that workers’ foot problems improved when they were away from the ship and in this case is based on worker report (which is understandable given that plantar fasciitis is not characterized by objective findings, and subjective complaints are really the only way to determine improvement). At least one worker submits that he believes his feet have been permanently damaged by exposure to vibration on the ship.

Specificity of the association means that the determinant being studied can be isolated from others and shown to produce changes in the incidence of the disease. The distinct lack of definitive scientific study of the causes of plantar fasciitis means there is a lack of specificity of findings. For example, the *Riddle et al.* study looked at a limited number of hypothesized risk factors, although it is notable that individuals who had been diagnosed with a diagnosed systemic arthritic condition were excluded.

Consistency with other knowledge requires that an association be found regularly in a variety of medically valid and scientifically supported studies. The lack of consensus and a firm understanding of the risk factors for plantar fasciitis (and many other ASTDs) mean that there is a lack of consistency.

Dr. Rudland strenuously asserted in his opinion that vibration is an independent risk factor for plantar fasciitis. Dr. Rudland is not a qualified expert in epidemiology or the causation of ASTDs. However, I accept, based on his opinion, that it is biologically plausible that vibration could have a negative impact on the plantar fascia. He opined that vibration could have an impact on the plantar fascia similar to its impact on tissues in the upper extremity. However, biological plausibility is not sufficient to establish occupational causation for the purposes of the workers' compensation system.

In that respect, I am guided by the Protocol and the general medical/scientific literature respecting causation. There are many risk factors, for many diseases, that are biologically plausible but that alone does not establish causation.

There is also a "temporal relationship" suggested by the evidence, in that the workers assert that their foot problems arose only after they began working on the ship. A temporal relationship may be necessary in order to establish causation, but it is not sufficient proof of causation.

I consider that the facts of these cases may suggest to the scientific community that the hypothesis that vibration is a risk factor for plantar fasciitis is worthy of further study, but in the absence of any scientific literature directly addressing whether vibration is a risk factor for plantar fasciitis, I am not persuaded that exposure to whole body vibration through the feet is a risk factor for the development of plantar fasciitis. The fact that biological plausibility exists, and that there may be a temporal relationship between exposure to vibration on the ship and the development of plantar fasciitis in the workers is not sufficient evidence upon which to conclude that vibration is a risk factor for plantar fasciitis.

In addition to the vibration, the longer shifts on the ship were cited as unique features of work on the ship. As noted above, I accept that work-related weight-bearing may be a risk factor, but must be considered in conjunction with other risk factors. The magnitude of the risk factor must also be considered. In these cases, I accept that the workers worked longer shifts than workers on the majority of the other shifts. As such, they were exposed to the risk factor of weight-bearing for longer periods on a particular day. However, it should be noted that the longer shifts meant longer periods of time off, reducing the cumulative exposure in the sense that the tissues are given time to rest and recover.

On that basis, I am unable on the evidence to conclude that either vibration or the "longer shifts" were of sufficient causative significance in these workers' cases to result in acceptance of the claims without careful regard to individual risk factors. That does

not mean that either or both of these factors were not significant in bringing the condition to the attention of the workers involved.

I am mindful of the requirement in section 250(4) of the Act that if the evidence supporting different findings on an issue is evenly weighted in the case, I must resolve the issue in a manner that favours the worker. I do not consider the evidence with respect to vibration and the “longer shifts” to be evenly weighted. The Protocol is published in order to assist decision-makers in weighing evidence respecting causation, and the considerations set out in the Protocol do not lead to a conclusion that these two factors are distinct risk factors for the development of plantar fasciitis. As time passes, further epidemiological and other studies may lend support to such a conclusion. However, the lack of understanding of the risk factors and the lack of scientific confirmation of suspected risk factors is not currently sufficient.

Relating to this individual worker

The only medical report on the file suggests that the worker had bilateral plantar fasciitis and Achilles tendinitis. The objective findings described in the report from Dr. Blackshaw are tenderness of the plantar fascia and the insertion of the Achilles tendon into the calcaneus.

In addition, the worker has described increased pain with standing/walking and after a rest period.

Unfortunately, there is no report from the worker’s podiatrist. As such, there is no information whatsoever respecting the worker’s foot configuration.

Based on the limited evidence on file, the weight of which supports a conclusion that the worker did have bilateral plantar fasciitis, I accept that he did. I also accept that he had bilateral Achilles tendinitis. I note, however, that there is very little evidence respecting diagnosis.

The Review Board found that the vibration on board the ship was a “significant risk factor” that likely caused the worker’s “bilateral foot symptoms.” The panel noted that the worker’s physician (referred to as Dr. Blacksmith, but as Dr. Blackshaw’s report is the only one on the file, I consider that the panel meant to refer to Dr. Blackshaw), had “attributed the worker’s bilateral foot condition to the vibrations aboard the vessel.” The panel noted that although the physician did not provide a “clear and reasoned opinion,” he had reported the condition to the Board.

In that regard, I note that Dr. Blackshaw did not express an opinion on causation other than to state that the worker was employed in a “high vibration environment.” I do not consider this to be an opinion respecting causation. Dr. Blackshaw wrote the information about vibration in the area of the form reserved for “cause of injury or disease (worker’s statement).” The fact that Dr. Blackshaw sent a report to the Board is

not an opinion respecting causation, although it is “some evidence” that Dr. Blackshaw considered that work may have causative significance.

The worker’s podiatrist did not provide any opinion respecting causation. There are no records from the worker’s podiatrist.

There are two diagnoses in this case. The Review Board accepted the worker’s claim for *both* bilateral plantar fasciitis and Achilles tendinitis.

There is very little, if any, evidence relating to causation with respect to the worker’s Achilles tendinitis. As noted above, Schedule B in conjunction with section 6(3) provides a presumption of causation in cases of tendinitis where there was unaccustomed and repetitive use of the affected arm, hand, leg or foot.

I do not consider the evidence to support a conclusion that the worker had unaccustomed and repetitive use of both of his feet. There is a suggestion in the evidence that the first officer position required more standing and walking than work as a second officer. The worker was doing relief work as a first officer. Both positions require standing and walking. Although the first officer work may require more walking, the worker was doing progressively more relief work over time. This is not a case where the worker was suddenly required to do more standing and walking such that those activities were unaccustomed.

The expert and other evidence focuses on plantar fasciitis. The expert opinions do not suggest that vibration or the longer shifts on the ship are causative of Achilles tendinitis. I do not accept that the risk factors for “related foot disorders” are the same as those for plantar fasciitis or that the potential risk factors are the same for plantar fasciitis and Achilles tendinitis. I am not persuaded that the worker’s Achilles tendinitis was due to the nature of his employment.

That leaves the worker’s bilateral plantar fasciitis. As noted above, the physician’s first report from Dr. Blackshaw is the only medical evidence directly relating to the worker’s claim. It does not provide any specific commentary or opinion regarding causation.

The worker has at least three non-occupational risk factors, including age over 40, overweight and participation in a sport requiring prolonged standing and walking as well as body motions (the swing) that could place stress on one or both feet (golf). The worker’s evidence is that golf exacerbated his foot pain.

Both age and overweight are “related” risk factors in that they interact with weight-bearing to potentially increase the risk of plantar fasciitis. In the worker’s case he was significantly overweight. Given his age and his participation in non-occupational weight-bearing activities, I consider it more likely than not that the worker’s plantar fasciitis would have developed regardless of his work activities. I am not persuaded that the worker’s employment as a second officer on the ship, with relief work as a first

officer, was of causative significance in the worker's bilateral plantar fasciitis, or that his condition was significantly aggravated or accelerated by the nature of his employment. I consider it more likely that work brought the condition to the worker's attention rather than being of causative significance.

Conclusion

The employer's appeal is allowed and the Review Board findings varied. The worker's bilateral plantar fasciitis and Achilles tendinitis were not due to the nature of his employment.

Teresa White
Vice Chair

TW/dc/pm