Expert Panel Recommendations

Musculoskeletal Disorders and Commercial Motor Vehicle Driver Safety

Medical Expert Panel Members

Nortin Hadler, MD FACP FACR FACOEM

W. Monroe Keyserling, Ph.D

Joel Press, MD

Presented to

The Federal Motor Carrier Safety Administration

March 14, 2008

Table of Contents

Introduction 1

Scope of Recommendations Document 1

Composition of the MEP 2

Methodology 3

- Brief Overview of Evidence Report Methodology 3
- The MEP Meeting and Recommendation Formulation 3

MEP Commentary on Findings of Evidence Report 4

Recommendations to the FMCSA from the MEP 4

- Recommendation 1: Current FMCSA Standards 4
- Recommendation 2: Functional Test of Capacity/Fitness for Duty Test 4
- Recommendation 3: Development of a Functional Screening Protocol 6
- Recommendation 4: The Role of Musculoskeletal Disorders in CMV Crashes 6
- Recommendation 5: Specific Disorders and CMV Driving 7

APPENDIX A: Findings of Evidence Report 8

- Identification of Evidence Bases 8
- Grading the Strength of Evidence 8
- Presentation of Findings 8
- Evidence-Based Findings 9

APPENDIX B: Current Standards and Guidelines for Musculoskeletal Disorders 12

- Relevant Medical Standards and/or Guidelines and from Other Countries 16

Introduction

The primary mission of the U.S. Department of Transportation's (DOT's) Federal Motor Carrier Safety Administration (FMCSA) is to reduce crashes, injuries and fatalities involving commercial motor vehicles, or CMV's, (including large trucks and buses) in the United States of America. One mechanism by which the FMCSA aims to meet this commitment is to ensure that individuals who drive CMV's are physically qualified to do so. While physical qualification standards do exist and all CMV drivers must be certified by a qualified medical examiner as meeting these standards on a biennial basis, the standards have been criticized as being outdated. In addition, a number of disorders exist that are not addressed by the current standards. As a consequence, the FMCSA has embarked on a program whereby it will review all of its current physical qualification standards and begin the process of updating them as necessary by 2009.

At the present time the FMCSA has physical qualification standards directly pertaining to individuals with musculoskeletal disorders. These qualifications are found in Appendix A of this document. The FMCSA determined that it was necessary to re-examine whether musculoskeletal disorders were likely to have a deleterious impact on driver safety and, if they do, to determine how this might best be mitigated. Consequently, the FMCSA requested that Manila Consulting and its research team summarize the best available evidence on the impact that musculoskeletal disorders may have on driver safety. In addition, the agency asked Manila Consulting to convene an expert panel to provide recommendations to the agency as to whether and, under what conditions, individuals with musculoskeletal disorders may be considered physically qualified to drive a commercial motor vehicle.

This report serves the purpose of summarizing the considerations and recommendations of a panel of three experts from the field of musculoskeletal disorders (henceforth termed the Medical Expert Panel, or MEP) who examined the FMCSA's current guidelines for medical examiners pertaining to these disorders.

Scope of Recommendations Document

The impact on CMV driver safety of a number of musculoskeletal disorders were considered by the MEP. These disorders included:

- Amputation
- Inflammatory Arthritides and Osteoarthritis
- Range of Motion issues specifically targeting the cervical, thoracic, and lumbar spine
- Vehicle modifications and Prosthetics

Composition of the MEP

Members of the MEP charged with making recommendations to the FMCSA on their view as to whether the current guidelines for musculoskeletal disorders need to be updated are listed in Table 1.

Table 1 Members of MEP

Name	Current Position
Dr. Nortin Hadler	Nortin Hadler MD, FACP, FACR, FACOEM (North Carolina) is Professor of Medicine and Professor of Microbiology/Immunology at the University of North Carolina's Thurston Arthritis Research Center. He graduated in 1964 with an A.B. from Yale University, and received his Doctorate of Medicine from Harvard Medical School in 1968. Over the past 25 years, he has authored / co-authored nearly 200 papers and 10 books. Areas of emphasis include analyses of the approach taken by many nations to the challenges of applying disability and compensation insurance schemes to such predicaments as back pain and arm pain in the workplace. Dr. Hadler is widely regarded for his critical assessment of the limitations of certainty regarding medical and surgical management of the regional musculoskeletal disorders. His areas of interest include health policy regarding disability schemes for musculoskeletal disorders, effectiveness of interventions for the regional musculoskeletal disorders and analyses of medicalization and the social construction of illness.
Dr. W.Monroe Keyserling	W. Monroe Keyserling received his Ph.D. in Industrial and Operations Engineering and Industrial Health Science in 1979 from The University of Michigan. He also holds a B.I.E. from Georgia Tech (1974), and Masters degrees in IOE (1976) and Industrial Health (1977) from Michigan. From 1979 through 1983, he was an Assistant Professor of Environmental Health Science at Harvard University. He returned to Michigan in 1984 as a faculty member in Engineering and Public Health. He teaches courses in safety engineering, work measurement, and ergonomics. Prof. Keyserling's primary research interests include development and application of ergonomic job analysis methods, prevention of work-related injuries in manufacturing and service operations, and workplace design to accommodate persons with disabilities. He has authored over 100 peer-reviewed publications, 20 book chapters, and has served on the Editorial Board of the International Journal of Industrial Ergonomics, the American Industrial Hygiene Association Journal, and the Journal of Occupational and Environmental Health. Prof. Keyserling received the 1994 Liberty Mutual Award for his research on the effectiveness of ergonomic interventions in General Motors manufacturing and warehousing facilities. He was elected a Fellow of the American Industrial Hygiene Association in 2003, and was selected as the 2005 Visiting Scholar at the Liberty Mutual Research Institute for Safety. He previously served as President of the Association of University Programs in Occupational Safety and Health, as a member of the NIH-NIOSH Study Section on Occupational Safety and Health, as a member of the American Trucking Foundation's Medical Advisory Board, and as Director of the University of Michigan's Center for Occupational Health and Safety Engineering.
Dr. Joel Press	Joel Press MD (Illinois) is the Medical Director for the Center for Spine, Sports and Occupational Rehabilitation in Chicago. He graduated from the University of Michigan in 1980 with a B.S. Degree-with distinction, Microbiology. He received his Doctorate of Medicine from the University of Illinois College of Medicine in 1984, and did his Internship at Northwestern Memorial Hospital, Northwestern University Medical School in 1984-85. He completed his Residency at Northwestern University Medical School, Rehabilitation Institute of Chicago in 1988. He has been an attending physician at Rehabilitation Institute of Chicago since 1988 and in 1989 he founded and directed the Sports Rehabilitation Program at Rehabilitation Institute of Chicago. In December of 1994, Dr. Press was instrumental in the opening of the Center for Spine, Sports, and Occupational Rehabilitation, with Dr. Press as its Medical Director. He has published numerous articles, edited a textbook, chaired numerous courses, and been invited to lecture many times. Dr. Press is an Assistant Professor of Clinical Physical Medicine and Rehabilitation, Northwestern University Medical School. Dr. Press is a Diplomat of the National Board of Medical Examiners and board certified by The American Board of Physical Medicine and Rehabilitation and American Board of Electrodiagnostic Medicine. He is the current Vice President of the American Academy of Physical Medicine and Rehabilitation, past President of The Physiatric Association of Spine, Sports and Occupational Rehabilitation, been an Oral Board Examiner and Written Board Examination-item writer. He is currently the President-Elect of the North American Spine Society.

Methodology

Brief Overview of Evidence Report Methodology

The recommendations of the MEP presented in this report were informed in part on the interpretation and assimilation of information presented in a comprehensive evidence report summarizing the best evidence that is currently available in the literature. This evidence report, titled "Musculoskeletal Disorders and Commercial Motor Vehicle Driver Safety," was developed following a systematic search for evidence accessible through several electronic databases. The electronic databases included (but were not limited to) Medline, PubMed (pre Medline), EMBASE, PsycINFO, CINAHL, and the Cochrane Library (through August 14, 2007). All searches were supplemented by hand searches of the published literature (e.g. bibliographies of identified relevant articles) and "gray literature" resources (e.g., Web searches).

The MEP Meeting and Recommendation Formulation

On February 14, 2008, the FMCSA, Manila Consulting, the ECRI Institute, and the three members of the MEP convened a one-day conference. The goals of this meeting included the following:

- To review the existing FMCSA guidelines for medical examiners on the certification and recertification of individuals who have, or are suspected of having, musculoskeletal disorders.
- To discuss the available evidence in the evidence report and other sources on the consequences to public safety of certifying individuals with musculoskeletal disorders as medically fit to drive a CMV.
- To recommend changes to existing FMCSA guidelines deemed necessary following the critical assessment of the available evidence.

In developing their recommendations to the FMCSA, members of the MEP were guided by three central principles. These are:

- Recommendations pertaining to physical qualification standards (or guidance to medical examiners) should be based on scientific evidence whenever possible[1].
- Recommendations pertaining to physical qualification standards (or guidance to medical examiners) should be concise and explicit.
- Recommendations pertaining to physical qualification standards (or guidance to medical examiners) should be actionable.

[1]Recommendations from the MEP, for which no supporting evidence was identified and which are thus based on expert opinion alone, are identified as such.

This document summarizes the recommendations derived from this process.

MEP Commentary on Findings of Evidence Report

The MEP agreed with the findings of FMCSA's Evidence Report titled, "Musculoskeletal Disorders and Commercial Motor Vehicle Driver Safety." The executive summary of this evidence report can be found in Appendix A.

Recommendations to the FMCSA from the MEP

The MEP believes that, while evidence is sparse, some individuals with musculoskeletal disorders may constitute an additional risk to road safety. In light of this, the MEP made several specific recommendations to the FMCSA. These are presented below.

Recommendation 1: Current FMCSA Standards

The MEP expressed the opinion that the current FMCSA standards for musculoskeletal disorders (391.41(b)(7)) should be altered (see Appendix B for current standards).

Justification

The MEP opined that the current standards for musculoskeletal disorders are far too general and in their present state are not appropriate to the broad spectrum of conditions which comprise the category of musculoskeletal disorders.

Recommendation 2: Functional Test of Capacity/Fitness for Duty Test

The MEP recommended that the FMCSA utilize trained driving testers to perform functional capacity examinations of CMV drivers under the premise that there must be a minimum level of musculoskeletal disorder capability required to safely operate a CMV. The process for the Skills Performance Evaluation (SPE) as currently constituted need not be altered. Specifically, the MEP made the following recommendations:

- A functional capacity evaluation would be required of any individual with an episodic and/or potentially progressive musculoskeletal disorder who had required evaluation and/or treatment by a physician/health care provider for their particular disorder in the prior 12 months.
- This functional examination of musculoskeletal capacity should take place every two years, regardless of type or severity of impairment.
    - If there is a significant confounding medical problem- exacerbation, progression, or new symptoms that require evaluation and/or treatment, re-examination may need to be done sooner.
- A thorough assessment, including a functional driving test and testing of ability to perform pre-trip and en route vehicular safety checks, dictated by the type of

impairment, should be performed by trained driving testers to determine whether the individual in question should be allowed to operate a commercial CMV.

  - The tests would not need to be administered by a medical examiner. Instead, they may be administered by a physician or others as approved by the FMCSA.
  - The tests need to be sensitive and specific to the disorder.
  - It should be required that individuals who undergo the assessment do so in the CMV they intend to operate, using whatever adaptive equipment required to operate said CMV.
  - If the examination is comprehensive (includes 100% of all safety skills), and the individual passes the examination using their adaptive equipment, in the vehicle they intend to operate, then that individual has satisfied the requirements.

- A restriction should be instituted requiring the individual to use their adaptive equipment when operating a CMV. This restriction would operate in much the same way as the requirement for private motor vehicle operators to wear corrective lenses while driving to address visual disorders such as myopia.

Justification

Because it is at least plausible that musculoskeletal disorders may have a deleterious impact on road safety, the MEP considered it *theoretically possible* that these individuals could be banned from driving. The MEP agreed that it was impracticable to ban these individuals from driving, and opined that there was no reason to disallow an individual with a musculoskeletal disorder from operating a CMV provided they: 1) successfully passed the requirements set forth in a functional driving examination performed by a trained and qualified driving assessor, and 2) comply at all times with adaptive equipment restrictions established at the time of the driving examination.

The MEP discussed the practicality of demanding that all CMV drivers have a functional capacity examination every two years as part of the medical certification process. It was decided that this would be impractical for static conditions such as amputation. The opinion was expressed that this two-year testing requirement would be practical for individuals with episodic and/or potentially progressive musculoskeletal disorders such as arthritis, with re-examination performed sooner when there is a significant confounding medical problem- exacerbation, progression, or new symptoms that require evaluation and/or treatment.

Recommendation 3: Development of a Functional Screening Protocol

As stated in Recommendation 2, the MEP recommended that a functional capacity test to determine whether the individual is physically qualified to operate a CMV should be performed. Currently no such test exists.

The MEP recommended that further research be performed to determine the elements of the functional screening protocol. This research should include the following:

- A determination of the physical requirements needed to safety operate a CMV, including pre-trip and en route vehicle safety checks. Possible physical requirements include:
    - Body size requirements, reach and range of motion (ROM) requirements, strength requirements, and similar metrics need to be characterized in the context of tasks required to safely operate a CMV.
- Once the metrics have been characterized, a panel of experts should be convened to decide the following:
    - Which tests would best examine these metrics.
    - The parameters for passing or failing these tests.
    - Ideally the functional capacity test would consist of 3 - 7 'vital skills' to assess the ability of an individual with a musculoskeletal disorder to safely operate a CMV.
    - The panel of experts may consist of physicians, ergonomists, occupational therapists, industry, union and advocacy group representatives, and individuals with specific academic or industry expertise in motor vehicle safety and musculoskeletal function.

Justification

The MEP opined that the mere presence of musculoskeletal disorder does not, in and of itself, provide grounds for restricting the driving privileges of all individuals with the disorders. Some individuals with musculoskeletal disorders may be certified as physically qualified to drive a CMV. Who these individuals are should be determined using a functional capacity test.

Recommendation 4: The Role of Musculoskeletal Disorders in CMV Crashes

There is currently not enough evidence on musculoskeletal disorders and crash to make a determination as to the possible risk of motor vehicle crash associated with the disorders. Possible avenues to explore might include:

- The convening of an expert panel to advise how to use existing data bases and/or how to design future studies to answer the critical questions.

- Creating a sampling plan of some subset of at-fault or partially at fault to investigate some of the causal factors for crash as was used in the *Large Truck Crash Causation Study* (LTCCS).
- Information on crashes may be available from trucking fleets, the United States military, the US postal service, and manufacturers of trucks, etc.
    - These organizations should be approached for assistance.

Justification

The MEP advocates further research into crash risk and causation associated with musculoskeletal disorders in order to inform future FMCSA guidelines.

Supporting References

U.S. Department of Transportation (DOT)/FMCSA/National Highway Traffic Safety Administration (NHTSA): LTCCS found at: http://ai.fmcsa.dot.gov/ltccs/default.asp

Recommendation 5: Specific Disorders and CMV Driving

The MEP recommended that an individual with a musculoskeletal disorder should be allowed to drive provided they pass the functional capacity testing.

- The CMV operator with an episodic and/or progressive condition and/or impairment should be responsible for identifying an exacerbation and disease residuals and planning their driving accordingly.
- CMV operators who are recent amputees should receive counseling on driving pedal techniques.

Justification

The current musculoskeletal standards for CMV drivers are too general and do not address the specific details of different disorders. The recommendations were made to act both as guidelines for specific disorders and an example of how guidelines can address a specific disorder.

APPENDIX A: Findings of Evidence Report

This appendix summarizes the findings of the Evidence Report titled, "Musculoskeletal Disorders and Commercial Motor Vehicle Driver Safety (Comprehensive Review)." The purpose of this evidence report was to address several key questions posed by the FMCSA. Each of the key questions was developed by the FMCSA such that the answers would provide information the Agency believed would be useful in updating its current medical examination guidelines. The four key questions addressed were:

- Key Question 1: Does amputation of an extremity increase crash risk and/or affect driving ability?
- Key Question 2: Does inflammatory arthritis (e.g. rheumatoid arthritis or similar) increase crash risk and/or affect driving ability?
- Key Question 3: Does decreased angle of rotation at the level of the spine and neck (as might be the result of ankylosis and/or other vertebral injury) increase crash risk and/or affect driving ability?
- Key Question 4: Do vehicle modifications and/or appropriate limb prosthetics decrease crash risk in disabled individuals?

Identification of Evidence Bases

Separate evidence bases for each of the key questions addressed by the evidence report were identified through a comprehensive search of the literature, examination of abstracts of identified studies to determine which articles would be retrieved, and selection of the actual articles that would be included in each evidence base.

A total of seven electronic databases (Medline, PubMed [pre Medline], EMBASE, PsycINFO, CINAHL, TRIS, the Cochrane library) were searched (through August 14, 2007). In addition, we examined the reference lists of all obtained articles to identify relevant articles not identified by our electronic searches. We also did hand searches of the "gray literature." Admission of an article into an evidence base was determined by formal retrieval and inclusion criteria determined a priori.

Grading the Strength of Evidence

Quality assessment of the evidence took into account not only the quality of the individual studies that comprise the evidence base for each key question; we also considered the interplay between the quality, quantity, robustness, and consistency of the overall body of evidence.

Presentation of Findings

The strength-of-evidence ratings assigned to our conclusions are defined in Table 2.

Table 2. Strength of Evidence Ratings

Strength of Conclusion	*Interpretation*
Strong evidence	Evidence supporting the qualitative conclusion is convincing. It is highly unlikely that new evidence will lead to a change in this conclusion.
Moderate	Evidence supporting the qualitative conclusion is somewhat convincing. There is a small chance that new evidence will overturn or strengthen our conclusion. ECRI Institute recommends regular monitoring of the relevant literature for moderate-strength conclusions.
Acceptable	Although some evidence exists to support the qualitative conclusion, this evidence is tentative and perishable. There is a reasonable chance that new evidence will either overturn or strengthen our conclusions. ECRI Institute recommends frequent monitoring of the relevant literature.
Unacceptable	Although some evidence exists, the evidence is insufficient to warrant drawing an evidence-based conclusion. ECRI Institute recommends frequent monitoring of the relevant literature.

Evidence-Based Findings

The findings of our analyses of the data pertaining to the four key questions addressed in the evidence report are summarized below.

Key Question 1: Does amputation of an extremity increase crash risk and/or affect driving ability?

Whether amputees who drive a commercial motor vehicle (CMV) are at an increased risk for a crash cannot be determined at the present time.

Our searches did not identify any studies that examined crash risk or a surrogate marker for crash risk among CMV drivers who have undergone an amputation.

While evidence suggests that driving performance in some amputees (drawn from the general driver population) may be compromised, there is currently no compelling evidence to support the contention that such individuals are at an increased risk for a motor vehicle crash when compared to comparable individuals who do not have an amputation (Strength of Evidence: Minimally Acceptable).

Direct Evidence: To date, only two studies have examined the impact of amputation on crash risk and neither provided evidence that individuals with an amputation who drive a motor vehicle are at increased risk for a motor vehicle crash.

Indirect Evidence: A single, moderate quality study found that individuals with an amputation below the knee of the right leg demonstrated some reductions in foot pedal reaction time. The use of adaptive driving techniques, however, appeared to eliminate this reduction.

Key Question 2: Does inflammatory arthritis (e.g. rheumatoid arthritis or similar) increase crash risk and/or affect driving ability?

Whether the presence of an arthritide is associated with an increased risk for a crash among CMV drivers cannot be determined at this time.

Our searches did not identify any studies that examined crash risk (or a surrogate marker for crash risk) among individuals who drive a CMV and have an arthritide.

Although arthritides appear to be associated with reduced driving performance and is cited as a reason for giving up driving by some individuals, it remains unclear whether those among the general driver population who choose to drive with arthritis are at an increased risk for experiencing a crash (Strength of Evidence: Acceptable).

Direct Evidence: Three included studies (Median Quality: Moderate) directly examined the relationship between the arthritides and crash risk using a case-control design. None of these studies provided evidence to support the contention that arthritis is associated with an increased risk for a motor vehicle crash. Because of the small size of the included studies, and their consequent low power to detect an increase in crash risk, we cannot conclude that no association between arthritides and crash exists. It remains unclear whether drivers with arthritis are at an increased risk for a crash.

Indirect Evidence: Because the findings of the only studies to have examined the risk for a crash among individuals with arthritis are inconclusive, we looked for other sources of evidence that may provide some insight into the relationship between arthritis and driver safety. Our searches identified four such studies. One study found that elderly individuals with arthritic disorders were more likely to fail a driving test. Another study found that many individuals with rheumatoid arthritis gave up driving as a direct consequence of their disorder suggesting that this arthritide does impact driving ability. A third study found that rheumatoid or osteoarthritis had a deleterious impact on driving ability. Individuals with rheumatoid arthritis appeared to experience the highest percentages of driving disabilities, with the disorder affecting several important driving tasks including steering and cornering, mirror adjustment, use of the gears, and use of the handbrake. Individuals with osteoarthritis experienced the second highest percentages of driving disabilities, with osteoarthritis impacting driving tasks such as reversing (where it exceeded the rheumatoid arthritis percentages) and steering/cornering. In addition the latter group experienced significant problems with attaining seat comfort. The final study demonstrated that individuals who underwent an exercise –based rehabilitation program designed to improve mobility showed improvements in range of motion and in one driving task (observing) when compared to similar individuals who did not receive rehabilitation training.

Key Question 3: Does decreased angle of rotation at the level of the spine and neck (as might be the result of ankylosis and/or other vertebral injury) increase crash risk and/or affect driving ability?

While it is plausible that the presence of a disorder which limits spinal/cervical range of motion (ROM) such as ankylosing spondylitis, cervical spondylosis, degenerative disc disease, osteoporosis, or spinal stenosis may have a deleterious impact on driving ability, one cannot determine whether these disorders are associated with an increased risk for a motor vehicle crash at this time (Strength of Evidence: Acceptable).

Three studies met the inclusion criteria for Key Question 3. No included studies directly assessed the impact of restricted spinal/cervical ROM on crash risks.

Indirect Evidence: The first included study used a cross-sectional design to establish that functional limitations introduced with spinal and/or cervical structural changes may be a factor in reduced driving performance, including a diminished ability to turn the head while driving. The second included study used a prospective crossover design to determine the relationship between cervical immobility (as imposed by the use of a cervical orthosis) and driver performance. It was found that the orthosis did alter driving performance, including a decrease in lateral acceleration and slower driving speed overall. The final included study used a cohort study design to determine whether increased functional impairment to the cervical spine was associated with increased decision time at T-intersection. This study found an inverse association between the degree of functional impairment and driving performance: the greater the functional impairment reported, the longer the decision time associated with negotiating a T-intersection. The longest decision time was among impaired drivers in the older age group (age 60-80).

Key Question 4: Do vehicle modifications and/or appropriate limb prosthetics decrease crash risk in disabled individuals?

Because no studies met the inclusion criteria for Key Question 4, we are precluded from drawing an evidence-based conclusion pertaining to the relationship between vehicle modifications and appropriate limb prosthetics and decreased crash risk at this time.

None of the studies identified by our searches fulfilled the inclusion criteria for this key question. The primary reason for exclusion was that no identified study examined a decrease in crash risk associated with the use of vehicle modifications or appropriate limb prosthetics.

APPENDIX B: Current Standards and Guidelines for Musculoskeletal Disorders

Current United States Federal Regulatory and Medical Advisory Criteria for CMV Operators

FMCSA Regulations, found in 49 Code of Federal Regulations (CFRs) 301 through 399, cover businesses that operate CMVs in interstate commerce. FMCSA regulations that pertain to fitness to drive a commercial vehicle are found in 49 CFR 391 Subpart E. Only motor carriers engaged purely in intrastate commerce are not directly subject to these regulations. However, intrastate motor carriers are subject to state regulations, which must be identical to, or compatible with, the federal regulations in order for states to receive motor carrier safety grants from FMCSA. States have the option of exempting CMVs with a gross vehicle weight rating of less than 26,001 lbs.

The current medical qualification standard for fitness to drive a CMV (49 CFR 391.41(b) subpart 5) states the following (see: http://www.fmcsa.dot.gov/rules-regulations/administration/fmcsr/fmcsrruletext.asp?section=391.41):

A person is physically qualified to drive a CMV if that person —

- Has no loss of a foot, a leg, a hand, or an arm, or has been granted a skill performance evaluation certificate pursuant to § 391.49.
- Has no impairment of :
    1. A hand or finger which interferes with prehension or power grasping; or
    2. An arm, foot, or leg which interferes with the ability to perform normal tasks associated with operating a CMV; or any other significant limb defect or limitation which interferes with the ability to perform normal tasks associated with operating a CMV; or has been granted a SPE certificate pursuant to §391.49
- Has no established medical history or clinical diagnosis of rheumatic, arthritic, orthopedic, muscular, neuromuscular, or vascular disease which interferes with his/her ability to control and operate a CMV safely (49 CFR 391.41(b)(7)).

49 CFR 391.49 Alternative physical qualification standards for the loss or impairment of limbs

49 CFR 391.49(a) states the following, “A person who is not physically qualified to drive under § 391.41(b)(1) or (b)(2) and who is otherwise qualified to drive a commercial motor

vehicle, may drive a commercial motor vehicle, if the Division Administrator, FMCSA, has granted a Skill Performance Evaluation (SPE) Certificate to that person."

Table 3 Standards and Guidelines Pertaining to Individuals with Musculoskeletal Disorders: FAA, Railroad, and Merchant Marine

Condition	FAA* (all classes of airmen)	Railroad†	Merchant Marine‡
Musculoskeletal Disorders	Examiners may re-issue an airman medical certificate under the provisions of an Authorization, if the applicant provides the following: • An Authorization granted by the FAA; • The type of arthritis; • A general assessment of condition and effect on daily activities • The name and dosage of medication(s) used for treatment and/or prevention with comment regarding side effects; and • Comments regarding ROM of neck, upper and lower extremities, hands, etc Guide for Aviation Medical Examiners Decision Considerations Disease Protocols Musculoskeletal Evaluaiton The Examiner should defer issuance. An applicant with a history of musculoskeletal conditions must submit the following if consideration for medical certification is desired: Current status report Functional status report Degree of impairment as measured by strength, range of motion, pain Note: If the applicant is otherwise qualified, the FAA may issue a limited certificate. This certificate will permit the applicant to proceed with flight training until ready for a medical flight test. At that time, and at the applicant's request, the FAA (usually the AMCD)	No specific standards or guidelines	Potentially disqualifying conditions listed in the Physical Evaluation Guidelines for Merchant Mariner's Documents and Licenses included any disease or constitutional defect which would result in gradual deterioration of performance of duties, sudden incapacitation or otherwise compromise shipboard safety, including required response in an emergency situation. Orthopedic conditions such as amputation, deformity, or arthritis resulting in impairment of motion or use of limbs or back would require: • Requests for waivers should include a report of a practical demonstration of mobility • Details of the test shall be determined by the OCMI using the Marine Safety Manuel as a guide • The test should be conducted under conditions appropriate for the credential, route, and tonnage the applicant is applying for • Applicant should be able to respond adequately in emergency situations

Condition	FAA* (all classes of airmen)	Railroad†	Merchant Marine‡
	will authorize the student pilot to take a medical flight test in conjunction with the regular flight test. The medical flight test and regular private pilot flight test are conducted by an FAA inspector. This affords the student an opportunity to demonstrate the ability to control the aircraft despite the handicap. The FAA inspector prepares a written report and indicates whether there is a safety problem. A medical certificate and statement of demonstrated ability (SODA), without the student limitation, may be provided to the inspector for issuance to the applicant, or the inspector may be required to send the report to the FAA medical officer who authorized the test. When prostheses are used or additional control devices are installed in an aircraft to assist the amputee, those found qualified by special certification procedures will have their certificates limited to require that the device(s) (and, if necessary, even the specific aircraft) must always be used when exercising the privileges of the airman certificate.		

*Source of information for FAA Regulations and Guidelines: http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/ame/guide/special_iss/all_classes/arthritis/

http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/ame/guide/dec_cons/disease_prot/musculoskeletal/

†Source of information for Federal Railroad Administration Guidelines: http://www.fra.dot.gov/us/content/1586

‡ Source of information for Merchant Mariner Guidelines: http://www.uscg.mil/hq/g-m/nvic/2_98/n2-98.pdf

Relevant Medical Standards and/or Guidelines and from Other Countries

Internationally, standards have been established to assess and determine the fitness of drivers operating CMVs. Regulatory standards and guidance pertaining to musculoskeletal disorders and CMV driving have been developed in Australia, Canada, European Union, Malta, People's Republic of China, Singapore, Kingdom of Bahrain, United Kingdom, New Zealand, India, Ireland and Sweden. These standards appear in Table 4 and Table 5.

Table 4. Regulations and Guidelines Pertaining to Musculoskeletal Disorders and CMV Driving from Selected Countries (Australia, Canada, United Kingdom, New Zealand, European Union, and Sweden)

Musculoskeletal disorder	Australia	Canada	UK	New Zealand	European Union	Sweden
Reference Source	Assessing Fitness to Drive (For Commercial and Private Vehicle Drivers) Medical Standards for Licensing and Clinical Management Guidelines. Austroads and NTC (National Transport Commission) Australia (2006)	Determining medical fitness to Operate Motor Vehicles. CMA (Canadian Medical Association) Driver's Guide 7th edition. (2006)	At a glance Guide to the current Medical Standards of Fitness to Drive (for Medical Practitioners) Issued by Drivers Medical Group. DVLA, Swansea (February 2007)	Medical aspects of fitness to drive: A Guide for Medical Practitioners. Land Transport Safety Authority. (May 2002)	European Commission on Transport and Road Safety, Annex III to Directive 91/439/EEC; Council Directive 96/47/EC July 1996 amending Directive 91/439/EEC; IP/06/381 Member States Agree on the European Driving Licence 27 March 2006 ▪ Countries involved include: Austria*,Finland*, Sweden*, Belgium, Ireland, Denmark, Italy, Germany, Luxembourg, Greece, The Netherlands, Spain, Portugal, France and The United Kingdom (29 July 1991) ▪ Member states had to apply directive 91/439/EEC by 1 July 1996. ▪ European member states have to stay within a Council directive: they can be more restrictive, but not more liberal. *added in Council Directive 96/47/EC July 1996	Swedish National Road Administration (1999)
Loss of limbs, deformities and prosthetics	The criteria for an unconditional license are NOT met: • If there is an amputation or congenital absence of a limb (whole or part) required to operate a hand or foot control; or • If the thumbs are missing from both hands.	Those with a loss or deformity of the upper or lower extremities may drive any vehicle provided they can demonstrate their ability to drive to the satisfaction of the driver examiner. Many people with an amputation or deformity of one arm are able to drive a private vehicle safely. Some people with an	Some disabilities may be compatible with the driving of large vehicles if mild and non-progressive. Individual assessment will be required.	Driving should cease: ▪ If there is an amputation or congenital loss or functional loss of a limb required to operate a hand or foot control where no modification is practicable. ▪ If there is an amputation or congenital loss or functional loss of both	Not mentioned	Licence denied if ability to drive safely is impaired. May continue to drive if prosthesis and/or vehicle modifications can compensate for disability.

Musculoskeletal disorder	Australia	Canada	UK	New Zealand	European Union	Sweden
	A conditional license may be granted by the Driver Licensing Authority, taking into account the opinion of an appropriate specialist, and the nature of the driving task, and subject to practical assessment and periodic review: • If the person has a lower limb prosthesis for a below knee amputation and does not have to operate a brake pedal with the prosthesis, and the clutch pedal (if present) has been modified for use by a prosthesis. Automatic transmission and/or modification to hand controls may also be required. A spinner knob will be needed if a power-boosted handbrake control has been added; or • The person has the forefoot, first metatarsophalangeal joint or large toe amputated; or • The person has less than a thumb and two fingers on each hand or only one arm, provided a spinner knob or other device is fitted to the vehicle.	amputation below the elbow who are fitted with an adequate prosthesis may operate any class of vehicle provided they demonstrate their ability to a driver examiner. People who have an amputation below the knee of one or both legs are usually able to drive any class of motor vehicle safely provided they have full strength and movement in their back, hips and knee joints and a properly fitted prosthesis or prostheses.		upper or both lower limbs or one upper and one lower limb where no modification is practicable. Driving may resume or may occur in the following condition if the individual is able to demonstrate his or her ability to meet all necessary practical driving requirements: ▪ Absence of both thumbs * A full 'off-road' and 'on-road' driving assessment from a suitably trained occupational therapist is often necessary. Individuals with musculoskeletal conditions such as a below knee prosthesis or a forefoot amputation, may be considered fit for a license with conditions, provided that suitable vehicle modifications are in place, such as automatic transmission, spinner knobs, hand controls or other necessary adaptations, and provided they have been able to show a satisfactory level of driving competence. Such persons should be fully assessed on an individual basis before any decision is made.		
Arthritis	Painful joints may arise due to inflammatory or degenerative arthritis. Persons who have persistent pain and marked reduction in range of movement in shoulders, elbows, wrists, hands, hips, knees, ankles or feet may not meet the criteria (listed below). They may be	Degenerative or inflammatory arthritis can result in pain, loss of muscle strength, range of motion and function of the involved joint(s). People with arthritis may have difficulty turning their head to perform safety checks due to pain and stiffness of their cervical and	Some disabilities may be compatible with the driving of large vehicles if mild and non-progressive. Individual assessment will be required.	Not mentioned	Not mentioned	Licence denied if ability to drive safely is impaired. May continue to drive vehicle if vehicle modifications can compensate for disability.

Musculoskeletal disorder	Australia	Canada	UK	New Zealand	European Union	Sweden
	usefully assessed by a driver assessor. The criteria for an unconditional license are NOT met: • If rotation of the cervical spine is chronically restricted to less than 45° to the left of right; or • If chronic pain and restriction of peripheral joint movement interferes with the relevant movements or concentration such that a vehicle cannot be operated safely; or • If there is ankylosis or chronic loss of joint movement of sufficient severity that control of vehicle is not safe. A conditional license may be granted by the Driver Licensing Authority, taking into account the opinion of an appropriate specialist, and the nature of the driving task, and subject to practical assessment and periodic review: • If there is pain and stiffness in any joint, or a joint replacement, having regard for the range of movement and muscle power required to operate a heavy vehicle and the task of getting in and out of vehicles. A practical driver assessment is helpful for most final decisions.	thoracolumbar spine. Inflammatory arthritis can result in persistent pain and reduced range of movement in multiple joints including knees, ankles, hips, shoulders, elbows, wrists and hands. A patient should be restricted from driving if pain adversely affects their ability to drive safely or if he or she lacks range of movement or strength to execute the coordinated activities required. Most difficulties can be overcome by simple modifications to the vehicle or adjustment of driving technique. However, if there are concerns, the individual should be required to demonstrate his or her ability to a driver examiner.				

Musculoskeletal disorder	Australia	Canada	UK	New Zealand	European Union	Sweden
Ankylosing Spondylitis	Not mentioned	Not mentioned	Some disabilities may be compatible with the driving of large vehicles if mild and non-progressive. Individual assessment will be required.	Not mentioned	Not mentioned	Not mentioned
General Spinal			Driving is possible in both static and progressive or relapsing disorders but vehicle modification may be needed.			Licence denied if ability to drive safely is impaired. May continue to drive if vehicle modifications can compensate for disability.
Cervical	Person with severe neck pain and very reduced mobility including that arising from wearing soft collars or braces should be advised not to drive for the duration of their treatment. Some loss of neck movement is allowable if the vehicle is fitted with adequate outside mirrors. In the case of permanent disability, the criteria may not be met (see criteria listed under Arthritis)	Some degree of loss of movement of the head and neck may be permitted, but the driver should then be restricted to driving vehicles equipped with panoramic mirrors, which may alleviate the need to do shoulder checks. People wearing a neck brace or cast or those with severe pain or very restricted range of movement should be advised not to drive until pain and restrictions of movement are minimal or appropriate adaptive devices are in place.		Driving may resume or may occur in the following condition if the individual is able to demonstrate his or her ability to meet all necessary practical driving requirements: ▪ Reduction in rotation of the cervical spine to less than 45 degrees either to right or left		
Thoracic	Persons with severe pain and reduced mobility of the thoracolumbar region, including those required to wear a brace or body cast that severely limits mobility, should be advised not to drive for the duration of their treatment. In the case of permanent disability, the criteria may not be met (see criteria listed under Arthritis).	People with a marked deformity or painfully restricted motion in the thoracic vertebrae are not able to drive large commercial transport or passenger-carrying vehicles safely. Their ability to drive private vehicles can best be determined by a driver examiner. Patients wearing braces or body casts must be evaluated on the basis of their ability to move free of pain, operate the controls and observe approaching vehicles.				

Musculoskeletal disorder	Australia	Canada	UK	New Zealand	European Union	Sweden
Lumbar		Applicants for a license to drive a passenger transport or heavy commercial vehicle should be free of back pain that limits movement, attention or judgment. Less stringent standards may be applied to private-vehicle drivers. However, this group may need to be restricted to driving vehicles with power-assisted brakes.				
Paraplegia and quadriplegia		On the basis of a favorable recommendation from a medical specialist in physical medicine and rehabilitation, patients with new paraplegia or quadriplegia (below C4) may receive a learner's license. With the permit, these patients may then take driving lessons in an adapted vehicle fitted with special, modified controls.				
Hemiplegia/Cerebral Palsy			Driving is possible in both static and progressive or relapsing disorders but vehicle modification may be needed.			
Pain or severe discomfort	Individuals should not drive with severe pain from spinal conditions that interfere with movement of the spine or shoulder of pelvic girdles.			Some discomfort from joints may be severe enough to distract an individual's attention and thus pose a danger on the road. Acute neck pain, severe back pain, knee or elbow problems, especially when associated with locking, may present situations where it may be necessary to recommend the individual refrain from driving especially for drivers of heavy vehicles or those driving commercially.		

Musculoskeletal disorder	Australia	Canada	UK	New Zealand	European Union	Sweden
General	In the case of commercial vehicle drivers, the opinion of a medical specialist is required for recommendation of a conditional license. This requirement reflects the higher safety risk for commercial vehicle drivers and the consequent importance of expert opinion. The Driver Licensing Authority may consider issuing a conditional commercial vehicle license in certain circumstances. For example, in situations where crash risk exposure is reduced: ▪ 'off road' driving of commercial vehicle, e.g., in quarries or other properties where public vehicle access is limited.		Refusal or revocation of license if muscle or movement disorder is likely to affect vehicle control because of impairment of coordination and muscle power. If driving would not be impaired and condition stable, licensing will be considered subject to satisfactory reports and annual review. At age 70, the DVLA requires confirmation that no medical disability is present. After 70, the maximum licence period is three years, subject to a satisfactory completion of medical questions. Drivers have an obligation to declare medical conditions that may affect driving safety.		For persons with a locomotor disability: Driving licenses shall not be issued to or renewed for applicants or drivers suffering from complaints or abnormalities of the locomotor system which makes it dangerous to drive a power-driven vehicle. The competent medical authority shall give due consideration to the additional risks and dangers involved in the driving of vehicles covered by the definition of this group (CMV drivers). On March 27, 2006 member states agree to one single model of license in credit card format to replace 110 different models currently in circulation. A 10 year validity period is foreseen which member states may raise to 15 years. At the time of license renewal, member states are free to organize medical examinations.	

Table 5. Regulations and Guidelines Pertaining to Musculoskeletal Disorders and CMV Driving from Selected Countries (Ireland, India, Malta, People's Republic of China, Singapore, and Kingdom of Bahrain)

Musculoskeletal disorder	Ireland	India	Malta	People's Republic of China	Singapore	Kingdom of Bahrain
Reference Source	Irish Statute Book, Statutory Instruments, S.I. No. 340/1986 – Road Traffic (Licensing of Drivers) (Amendment) (No. 2) Regulations, 1986	Government of India The Motor Vehicle Act, 1988 Delhi Traffic Police FAQs related to Disabilities and Driving Driver Checkup; Ideal Performance for a driver's health report	Malta Transport Driving License	Law of the People's Republic of China on Road Traffic Safety (Order of the President No.8) Chapter 2, Article 22	Singapore Road Traffic Act	General Directorate of Traffic and Licensing, Ministry of the Interior. Vehicle Driving License Article 231
Loss of limbs, deformities and prosthetics	The medical examination shall cover the full range of body movements – strength, control and co-ordination- and, in particular, movements of the upper and lower limbs. Fitness to drive shall not be certified if the applicant has any disablement which is likely to prevent the proper and safe control of such vehicles (classes D, E or H which include heavy vehicles)	A person is unfit to drive if he has: ▪ Physical disability with fist strength of less than 35 pounds ▪ Physical disability with reaction time of less than 15 seconds in walking and returning 10 feet space ▪ Reach out test of less than 6 inches on standing A person who has undergone an amputation will need to consult with their doctor, who may: Issue a doctor's certificate that states the person should be restricted to an automatic vehicle and/or the vehicle should be fitted with special mechanical devices; or refer them to a driving assessment service. There is usually no difficulty in adapting an artificial limb to a vehicle or a vehicle to a limb.	We may issue Driving Licenses, subject to certain restrictions, to drivers with special needs following consultation with a competent medical authority. A Driving License may be issued stipulating modifications to the vehicle that is to be driven by this person, if this is the case.			

Musculoskeletal disorder	Ireland	India	Malta	People's Republic of China	Singapore	Kingdom of Bahrain
Arthritis		Progressive disabilities such as arthritis may subject a person's body to changes that interfere with their ability to drive safely. It is important that people know of the effect these conditions may have on a person's ability to control a vehicle safely. It is not safe to assume that a person's driving will be unaffected. Someone with a progressive disability may need to adjust their driving as changes occur. If a person takes medicine, of if any medications changes, care will be needed to ensure that their driving is not affected. Medical guidance should be obtained.				
Paraplegia and quadriplegia	If you are suffering from a lesion with damage to spinal cord and resultant paraplegia a medical report is required in order to get a driving license, regardless of age. You may be allowed a one-year license only or a three-year or ten-year license.					
General		Before someone can start driving: ensure that you have obtained a written medical clearance to drive from a doctor or specialist. If the licensing authority has reasonable grounds to believe that the holder of the driving license is, by virtue of any disease or disability, unfit to drive a motor vehicle and where the authority revoking a driving license is not the	If, after you obtain a license, you develop a medical condition or any medical condition you may have worsens, it is your responsibility to inform the Licensing and Testing Directorate. These include but are not restricted to reporting the following: locomotor disabilities.	A person who suffers from disease that prevent him from driving a motor vehicle safely, or cannot drive safely due to over-fatigue shall not drive a motor vehicle.	On an application for the grant of a driving license, the applicant shall make a declaration in the prescribed form as to whether or not he is suffering from any such disease or physical disability as may be specified in the form or any other disease or physical disability which would be likely to cause the driving by him of a motor vehicle, being a motor vehicle os such a class or description as he would be authorized by	The applicant must be free of any disability which would prevent him from driving. In case of any doubts, the officials in the Directorate of Traffic and Licensing refer him to the medical expert or the Public Security physician for examination and presentation of an official certificate proving that he is free of any disability which would prevent him from driving.

Musculoskeletal disorder	Ireland	India	Malta	People's Republic of China	Singapore	Kingdom of Bahrain
		authority which issued the same, it shall intimate the fact of revocation to the authority which issued that license.			the license to drive, to be a source of danger to the public	