Ontario Emergency Medical Services
Section 21 Sub Committee

Emergency Medical Services Guidance Note #10:

Prevention of Musculoskeletal Disorders (MSDs)

PREAMBLE

Paramedics are exposed to musculoskeletal disorder (MSD) hazards when performing lifting, carrying, pushing, pulling and driving-related tasks during the course of their duties. Exposure to MSD hazards increases the risk of developing an MSD.

> **Musculoskeletal Disorder (MSD)**, also known as sprains and strains, refer to a broad range of injuries to the musculoskeletal system (e.g., muscles, tendons, nerves, ligaments, etc.) that can be caused or aggravated by various hazards or risk factors in the workplace.

Presently, MSDs are the most frequent cause of lost-time injuries reported (i.e. allowed lost-time claims) to the Workplace Safety and Insurance Board (WSIB) in Ontario, and WSIB data available[1] indicates that the Emergency Medical Services (EMS) sector has traditionally reported a higher rate of MSDs than any other work sector.

Within the paramedic community, it is unlikely that exposures to MSD hazards in tasks such as lifting, carrying, pushing, pulling and driving can be completely eliminated; however, the use of preventative strategies to reduce exposure to MSD hazards when performing paramedic related tasks can help to reduce the risk of MSDs. The purpose of this Guidance Note is to establish a best practice approach to preventing MSDs in the unique and dynamic work environment of Ontario paramedics.

OCCUPATIONAL HEALTH AND SAFETY PRECAUTIONS AND CONTROL MEASURES

MSD prevention can be achieved by eliminating or reducing exposure to MSD hazards. Paramedic services should consider principles of effective MSD prevention including:

- a systems-based approach that considers interactions between people and components of the work system, such as tasks, equipment, workspace, work organization, and the environment;
- a user-centred approach that accommodates a broad range of worker characteristics;
- worker participation and involvement; and,
- integration into the service's existing occupational health and safety and/or quality management systems.

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[1] WSIB, Enterprise Information Warehouse, Firm Experience and Injury Analysis Schemas

A Plan-Do-Check-Act[2] process can be applied, where services should routinely identify hazards, assess risks, implement appropriate controls, and follow-up.

EMS services should implement engineering and/or administrative based controls to *limit* exposure to MSD hazards when lifting, carrying, pushing, pulling and driving to reduce and prevent MSDs.

> **Engineering controls** include modifications to the vehicle, equipment or processes that eliminate or reduce the exposure. (Readers should note that any modifications must still meet applicable vehicles or equipment standards from the Ministry of Health and Long-Term Care (MOHLTC)).
>
> **Administrative controls** alter the way work is done, including policies, practices, operating procedures and training to reduce the exposure.

Prior to introducing controls to limit exposure to MSD hazards when lifting, carrying, pushing, pulling, and driving to reduce and prevent MSD, two best practices should be considered:

1) Engineering controls should be attempted before administrative controls when possible as adherence to administrative controls can be difficult in high stress situations, like those faced by paramedics.
2) To facilitate adoption of an intervention, paramedic services should:
    a. demonstrate the ergonomic advantage to paramedic health and well-being, and/or to patient care that is afforded by the intervention;
    b. involve paramedics in trialing and testing of equipment, and related decision making processes;
    c. involve workplace Joint Health and Safety Committee (JHSC) or the Health and Safety Representative (as appropriate to the workplace) in the process; and
    d. provide appropriate training, including information, instruction and supervision as required by the Occupational Health and Safety Act.

Engineering and administrative control options that have been shown to reduce MSDs among paramedics, based on available peer-reviewed research, are listed below.

<u>Examples of Engineering Controls:</u>

1) Powered stretchers (also referred to as a “cot, lift-assist” in the Provincial Equipment Standards for Ontario Ambulance Services v3.0) with load systems should be considered where appropriate to limit exposures to physically demanding stretcher

[2] A Plan-Do-Check-Act process is further outlined in Canadian Standards Association (CSA) Z1004-12, *Workplace Ergonomics – A Management and Implementation Standard*

handling activities including raising/lowering and loading/unloading. In the event that powered load systems are not feasible, powered stretchers should be considered where appropriate to limit exposures to stretcher raising and lowering activities.

Powered stretchers are heavier than manual stretchers (also referred to as "cot, lift-in" in the Provincial Equipment Standards for Ontario Ambulance Services v3.0) and pose an increased risk when lifted, carried, or loaded/unloaded to/from the ambulance manually, reinforcing the importance of powered load functionality.

2) Lateral transfer devices, such as slider boards, should be used where appropriate to reduce forceful efforts required to transfer patients to or from the stretcher. A single rod design coupled with a bridgeboard has been shown as the most beneficial lateral transfer device particularly as compared to a sheet drag.

   When considering lateral transfer devices consider designs that:

   - Provide the greatest reduction in friction between the patient and the stretcher
   - Provide suitable hand grips for the user
   - Are easy to use and to store
   - Can be easily cleaned

3) Stair-chairs (also referred to as "lifting chair" in the Provincial Equipment Standards for Ontario Ambulance Services v3.0) with adjustable handles should be used where appropriate to limit exposures to lifting when navigating stairs. Consistent with the principles noted above, adjustable designs are recommended that accommodate a broad range of worker characteristics. Powered stair-chair designs may further *limit* exposures.

4) The weight of medical bags should be reduced where possible while maintaining minimum equipment requirements described in the Provincial Equipment Standards for Ontario Ambulance Services v3.0.

5) Layout of the patient care compartment should be addressed to reduce reaching. Frequently used medical supplies should be stored within arm's reach from the attending paramedic where possible. All storage spaces should be clearly labelled.

6) Sitting in an ambulance while the vehicle is idling or in motion increases paramedics to whole-body vibration. Ambulance type, seat type, among other vehicle-design related factors can affect whole-body vibration exposures. Whole-body vibration exposures should be assessed to ensure that exposure values are not exceeded according to standards (American Conference of Governmental Industrial Hygienists, ISO 2631-1 and/or EU Directive 2002/44/EC). Where whole-body vibration exposures exceed acceptable threshold limits controls should be considered that reduce the intensity and/or duration of exposures. Engineering controls that consider seat type, seat

suspension and/or cabin suspension can reduce intensity and duration. Administrative controls that consider the duration of exposure (i.e., deployment models) can reduce the duration of whole-body vibration exposure.

Examples of Administrative Controls:

1) Where possible, lifts should be performed by a minimum of two persons to reduce the possibility of injury to the paramedic. Performing a two-person lift distributes the load reducing the exposure dose to any one individual. Paramedic services should have a clear policy to indicate when a call for additional lift assistance should be made.
2) Paramedics should consider alternating roles between calls when and where appropriate to reduce exposures. Consciously alternating roles such as the leader or follower in stair navigation can help to equalize exposures between paramedics.
    - This strategy will tend to equalize exposures, increasing exposure to one paramedic, while decreasing exposure to the other. This may not be effective if the physical capacities of the paramedics are vastly different from each other.
3) Consistently engaging in an exercise training program can help paramedics to maintain strength and cardiovascular capability. Paramedic services may consider opportunities to facilitate paramedics in engaging in exercise training, such as access to kinesiologists and/or exercise facilities. While this control will not reduce exposure to hazards, it may improve the capacity to better tolerate exposures.
4) Avoid manually lifting or carrying any stretcher by using alternate equipment (e.g., stair chair, scoop, board, etc.) to support interim patient conveyance between the scene and the stretcher when obstructions (e.g., stairs, porch steps) are present.
5) Paramedic services may consider workplace programs targeting general health and well-being. While this control will not reduce exposure to hazards, it may improve the capacity to better tolerate exposures.

SOME RELEVANT OCCUPATIONAL HEALTH AND SAFETY ACT REQUIREMENTS

Employers are required by the Occupational Health and Safety Act (OHSA) to:

- Ensure that the equipment, materials and protective devices provided by the employer are maintained in good condition – OHSA clause 25 (1)(b).
- Acquaint a worker or person in authority over a worker with any hazard in the work – OHSA clause 25 (2)(d)
- Provide information, instruction and supervision to a worker to protect the health or safety of the worker – OHSA clause 25(2)(a)
- Take every precaution reasonable in the circumstances for the protection of a worker –

OHSA clause 25(2)(h).

Supervisors are required under the OHSA to:

- Ensure that a worker uses or wears the equipment, protective devices or clothing that the worker's employer requires to be used or worn – OHSA Clause 27(1) (b).
- Advice a worker of the existence of any potential or actual danger to the health and safety of the worker of which the supervisor is aware – OHSA clause 27(2)(a).
- Take every precaution reasonable in the circumstances for the protection of a worker – OHSA clause 27(2)(c).

Workers are required under the OHSA to:

- Work in compliance with the provisions of the Act and the regulations – OHSA clause 28(1)(a).
- Use or wear the equipment, protective devices or clothing that the worker's employer requires – OHSA clause 28(1)(b).
- Report to an employer or supervisor the absence of, or defect in any equipment or protective devices of which the worker is aware and which may endanger the health or safety of a worker – OHSA clause 28(1)(c).
- Report to a supervisor or employer any contraventions of the Act or regulations or the existence of any hazard of which he or she is aware – OHSA clause 28(1)(d).

REFERENCES AND RESOURCE INFORMATION

- American Conference of Governmental Industrial Hygienists (ACGIH); Threshold Limit values for Chemical and Physical Agents and Biological Exposure Indices – Whole Body Vibration. www.acgih.org.
- Canadian Standards Association (CSA) Z1004-12, Workplace Ergonomics – A Management and Implementation Standard
- Centre of Research Expertise for the Prevention of Musculoskeletal Disorders (CRE-MSD)
- European Agency for Safety and Health at Work - EU Directive 2002/44/EC – Vibration
- ISO 2631-1 Mechanical Vibration and Shock - Evaluation of Human Exposure to Whole-Body Vibration – Part 1: General Requirements
- Ministry of Health and Long Term Care, Provincial Equipment Standards for Ontario Ambulance Services

(A comprehensive list of published academic papers is available - see Appendix #1 to this document)

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This document should be shared with the workplace Joint Health and Safety Committee or Health and Safety Representative, incorporated into the workplace occupational health and safety policy and program where appropriate, and posted on the Public Services Health & Safety Association website and the websites of other interested stakeholders.

This Guidance Note has been prepared to assist the workplace parties in understanding some of their obligations under the Occupational Health and Safety Act (OHSA) and the regulations. It is not intended to replace the OHSA or the regulations and reference should always be made to the official version of the legislation.

It is the responsibility of the workplace parties to ensure compliance with the legislation. This Guidance note does not constitute legal advice. If you require assistance with respect to the interpretation of the legislation and its potential application in specific circumstances, please contact your legal counsel.

While this Guidance Note will also be available to Ministry of Labour inspectors, they will apply and enforce the OHSA and its regulations based on the facts as they may find them in the workplace. This Guidance Note does not affect their enforcement discretion in any way.

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APPENDIX #1:

List of published academic papers related to MSD and MSD prevention:

Aasa, U., Angquist, K.-A., & Barnekow-Bergkvist, M. (2008). The effects of a 1-year physical exercise programme on development of fatigue during a simulated ambulance work task. *Ergonomics*, *51*(July 2014), 1179–1194. https://doi.org/10.1080/00140130802116471

Arial, M., Benoit, D., & Wild, P. (2014). Exploring implicit preventive strategies in prehospital emergency workers: A novel approach for preventing back problems. *Applied Ergonomics*, *45*(4), 1003–1009. https://doi.org/10.1016/j.apergo.2013.12.005

Armstrong, D., Ferron, R., Taylor, C., McLeod, B., Fletcher, S., MacPhee, R., & Fischer, S. (submitted). Implementing powered stretcher and load systems was a cost effective intervention to reduce the incidence rates of stretcher related injuries in a paramedic service.

Biesbroek, S., & Teteris, E. (2012). Human Factors Review of EMS Ground Ambulance Design. *2012 Symposium on Human Factors and Ergonomics in Health Care*, 95–101.

Broniecki, M., Esterman, A., May, E., & Grantham, H. (2010). Musculoskeletal disorder prevalence and risk factors in ambulance officers. *Journal of Back and Musculoskeletal Rehabilitation*, *23*(4), 165–174. https://doi.org/10.3233/BMR-2010-0265

Canadian Centre for Occupational Health and Safety. (2016). Work-related Musculoskeletal Disorders.

Coffey, B., MacPhee, R., Socha, D., & Fischer, S. L. (2016). A physical demands description of paramedic work in Canada. International Journal of Industrial Ergonomics, *53*, 355-362.

Conrad, K. M., Reichelt, P. A., Lavender, S. A., Gacki-Smith, J., & Hattle, S. (2008). Designing ergonomic interventions for EMS workers: Concept generation of patient-handling devices. *Applied Ergonomics*, *39*(6), 792–802. https://doi.org/10.1016/j.apergo.2007.12.001

Cooper, G., & Ghassemieh, E. (2007). Risk assessment of patient handling with ambulance stretcher systems (ramp/(winch), easi-loader, tail-lift) using biomechanical failure criteria. *Medical Engineering and Physics*, *29*(7), 775–787. https://doi.org/10.1016/j.medengphy.2006.08.008

Ferreira, J., & Hignett, S. (2005). Reviewing ambulance design for clinical efficiency and paramedic safety. *Applied Ergonomics*, *36*(1), 97–105. https://doi.org/10.1016/j.apergo.2004.07.003

Fredericks, T. K., Butt, S. E., & Hovenkamp, A. (2009). The Impact of Gurney Design on Ems Personnel, (June), 112–117.

Gilad, I., & Byran, E. (2007). Ergonomic evaluation of the ambulance interior to reduce paramedic discomfort and posture stress. *Human Factors*, *49*(6), 1019–1032. https://doi.org/10.1518/001872007X249884

Hansen, C. D., Rasmussen, K., Kyed, M., Nielsen, K. J., & Andersen, J. H. (2012). Physical and psychosocial work environment factors and their association with health outcomes in Danish ambulance personnel - a cross-sectional study. *BMC Public Health*, *12*, 534. https://doi.org/10.1186/1471-2458-12-534

Hignett, S., Crumpton, E., & Coleman, R. (2009). Designing emergency ambulances for the 21st century. *Emergency Medicine Journal : EMJ*, *26*, 135–140. https://doi.org/10.1136/emj.2007.056580

Johnson, M. R., Lavender, S. A., Crawford, J. M., Reichelt, P. a., & Fernandez, a. R. (2010). Understanding Factors that Affect the Adoption of Ergonomic Interventions among Ems Workers. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *54*(15), 1234–1238. https://doi.org/10.1177/154193121005401531

Lavender, S. A., Conrad, K. M., Reichelt, P. A., Gacki-Smith, J., & Kohok, A. K. (2007). Designing ergonomic interventions for EMS workers, Part I: Transporting patients down the stairs. *Applied Ergonomics*, *38*(1), 71–81. https://doi.org/10.1016/j.apergo.2005.12.005

Lavender, S. A., Mehta, J. P., Hedman, G. E., Park, S., Reichelt, P. A., & Conrad, K. M. (2015). Evaluating the physical demands when using sled-type stair descent devices to evacuate mobility-limited occupants from high-rise buildings. *Applied Ergonomics*, *50*(3), 87–97. https://doi.org/10.1016/j.apergo.2015.02.008

Massad, R., Gambin, C., & Duval, L. (2000). The Contribution of Ergonomics to the Prevention of Musculo-Skeletal Lesions among Ambulance Technicians. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *44*(26), 201–204. https://doi.org/10.1177/154193120004402617

Paterson, J. L., Sofianopoulos, S., & Williams, B. (2014). What paramedics think about when they think about fatigue: Contributing factors. *EMA - Emergency Medicine Australasia*, *26*(2), 139–144. https://doi.org/10.1111/1742-6723.12216

Prairie, J., & Corbeil, P. (2014). Paramedics on the job: Dynamic trunk motion assessment at the workplace. *Applied Ergonomics*, *45*(4), 895–903. https://doi.org/10.1016/j.apergo.2013.11.006

Sommerich, C., Lavender, S., Umar, R. R., Park, S., Li, J., & Dutt, M. (2013). Powered Ambulance Cots: Effects of design differences on muscle activity and subjective perceptions of operators. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *57*(1), 972–975. https://doi.org/10.1177/1541931213571217

Sommerich, C. M., Lavender, S. A., Radin Umar, R. Z., Li, J., Park, S., & Dutt, M. (2015). A biomechanical and subjective comparison of two powered ambulance cots. *Ergonomics*, *58*(11), 1885–1896. https://doi.org/http://dx.doi.org/10.1080/00140139.2015.1039604

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Studnek, J. R., Crawford, J. M., Wilkins, R. L., & Pennell, Mi. (2010). Back problems among emergency medical services. *American Journal of Industrial Medicine*, *53*(1), 12–22. https://doi.org/10.1002/ajim.20783.

Studnek, J. R., & Crawford, J. M. (2007). Factors associated with back problems among emergency medical technicians. *American Journal of Industrial Medicine*, *50*(6), 464–469. https://doi.org/10.1002/ajim.20463

Studnek, J. R., Crawford, J. M., & Fernandez, A. R. (2012). Evaluation of occupational injuries in an urban emergency medical services system before and after implementation of electrically powered stretchers. *Applied Ergonomics*. https://doi.org/10.1016/j.apergo.2011.05.001

Tiemessen, I. J., Hulshof, C. T., & Frings-Dresen, M. H. (2007). An overview of strategies to reduce whole-body vibration exposure on drivers: A systematic review. International Journal of Industrial Ergonomics, 37(3), 245-256.

Wiitavaara, B., Lundman, B., Barnekow-Bergkvist, M., & Brulin, C. (2007). Striking a balance-health experiences of male ambulance personnel with musculoskeletal symptoms: A grounded theory. *International Journal of Nursing Studies*, *44*(5), 770–779. https://doi.org/10.1016/j.ijnurstu.2006.02.007

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