CRE-MSD Centre of Research Expertise for the Prevention of Musculoskeletal Disorders

MSD Prevention for the Paramedic Sector

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Providing effective pre-hospital patient care exposes paramedics to MSD hazards. Paramedic services can limit exposure to MSD hazards by implementing evidence-based, best-practice strategies as prescribed in the Ontario Emergency Medical Services (EMS) Section 21 subcommittee Guidance Note #10: Musculoskeletal Disorders. This position paper highlights the evidence-base for the recommended best-practices as prescribed in the Guidance Note.

Key Messages

- Visit http://www.pshsa.ca/ems-section-21-guidance-notes/ for a list of MSD prevention strategies proposed by the Ontario EMS Section 21 Sub-committee.
- Powered stretcher and load systems can cost-effectively reduce MSD.
- Paramedic input, support and feedback will facilitate adoption of MSD prevention related strategies.

Power stretcher and load systems offer a cost-effective intervention to reduce MSD in the paramedic sector. By reducing the physical effort required to raise/lower and load/unload the stretcher to the touch of a button, powered stretcher and load systems significantly decrease muscle effort and spine loading relative to manual stretcher use.[1,2,3] Reduced physical demands offered by powered stretcher and load systems have translated into MSD reductions within paramedic services. For example, Niagara Emergency Medical Service (NEMS) observed a 78% reduction in stretcher related MSD incidents following the implementation of powered stretcher and load systems, where Hamilton Paramedic Service, a control group where powered stretchers were not yet available, did not observe any change in MSD incidents during the same time period.[4] These results are consistent with growing evidence where Fredericks et al.,[5] reported a 41% reduction in stretcher related MSD claims and Studnek et al.,[6] reported a 70% reduction in stretcher related incidents following the implementation of powered stretchers. Moreover, despite the initial capital investment, powered stretcher and load systems seem to offer a good return-on-investment. Using NEMS implementation (cost to purchase, training, yearly maintenance) and compensation costs (pre and post implementation), their power stretcher and load system intervention is anticipated to pay for itself in 5.8 years; 1.2 years less than the reported 7-year service life of the powered stretcher and load system implemented in NEMS.

Lateral transfer devices, such as slider boards, are recommended to reduce the load on paramedics in transfers of patients from stretcher to bed. Lateral transfer devices are designed to reduce friction between the patient and the surface they are on so that movement of the patient can be facilitated with a push or pull rather than a lift.[7] A single rod design coupled with a bridgeboard is reported as the most beneficial lateral transfer device as it has the greatest reduction of muscular demands compared to a sheet drag[8]; however, many other designs are commercially available, which have not been assessed in peer-reviewed research.

Stair chair designs can reduce the load on paramedics when conveying patients up and down stairs. Adjustable designs are recommended so that workers of all heights can comfortably operate the equipment. Stair chairs should be used whenever possible in stair navigation as they impose the lowest loads on the operators compared to other strategies such as carrying in a sling, or carrying a patient without use of equipment.[9] Powered stair chairs are also emerging as potentially useful devices; however, no research has been completed to-date to verify their effectiveness.

Medical bags and the cardiac monitor are routinely lifted and carried by paramedics. Coffey et al.,[10] report that the combined weight of the cardiac monitor, airway bag and medication bag can range from 20kg to nearly 40kg. However, Galbraith[11] highlighted that spine loading, a risk factor for MSD, can exceed recommended thresholds when paramedics carry more than 20kg regardless of whether that weight is in a single bag or as a combined weight from carrying two bags

or a bag and the cardiac monitor. Minimizing the weight of the cardiac monitor and bags, where possible, will help limit the potential for paramedics to lift and carry more than 20kg in cardiac monitor / bag weight.

Layout of the rear of the ambulance is an important consideration to prevent MSD among paramedics. To avoid extended reaches medical supply storage should be within arm's reach of paramedics when seated.[12,13] To reduce repetitive reaches all storage space should be clearly labelled.[14] Improving the layout and labeling can help to reduce reach and repetition, important MSD hazards.

Implications for the Prevention of MSD

- Power stretcher and load systems have been shown to decreased stretcher related MSD incidents by 70-78%.
- Power stretcher implementation cost can be recovered within the expected 7-year service life of the product.
- Many strategies are available to reduce and prevent MSD in the paramedic sector.

Two-person lifts are an effective control to reduce the potential for adopting poor postures. Particularly when under stress (i.e., during high acuity calls) paramedics tend to adopt poor postures compared to their posture in routine patient transfers.[15] Poor posture during physical exertions represents an increased MSD hazard exposure for paramedics.[16] Poor postures may be reduced by ensuring that all lifts are completed by a minimum of two people.[17] Performing a two-person lift distributes the load which would otherwise be placed solely on a single worker.

Alternating roles between paramedics can reduce the frequency of being exposed to forceful exertions. Paramedics who use strategies like alternating roles experience fewer MSDs.[18] Consciously alternating roles when performing physically demanding tasks, such as who is the leader or follower in stair navigation, can help to better share the exposures between two paramedics.

Engaging in an exercise training program can help paramedics to maintain strength[19] and cardiovascular capability. Low fitness has been identified as a risk factor for developing MSDs in paramedic work.[16, 20] By following a targeted fitness training program paramedics were able to improve fitness and perform better on simulated job tasks.[19] Moreover, a 2015 systematic review[21] of the broader MSD prevention literature (non-sector specific) found strong evidence in support of implementing a workplace-based resistance training exercise program to prevent and manage upper extremity MSD.

Adoption of interventions is an important consideration for paramedic services. In fact, including paramedics within the process of identifying and trialing a prospective intervention, demonstrating the ergonomic benefit of the proposed intervention,[22] and appropriate training[23] all serve as important facilitators in the adoption of MSD prevention related interventions. As an example, when NEMS initially trialed a powered stretcher product, without paramedic input in the initial selection process, paramedic feedback and perceptions were strongly negative. Recognizing this challenge, NEMS subsequently included paramedics into the process to identify and select product(s) to trial, which consistent with evidence, resulted in a more effective and mutually beneficial implementation process.

Conclusion

Paramedics are exposed to MSD hazards while performing their normal job duties. EMS Section 21 Subcommittee Guidance Note 10: Musculoskeletal Disorders prescribes evidence-based engineering and administrative controls that can effectively reduce MSD hazard exposures in the paramedic sector. This position paper summarizes that evidence-base, reinforcing the stated best-practice MSD prevention strategies. Adopting and implementing best-practice MSD prevention strategies targeted to the paramedic sector can help reduce MSD hazard exposures to paramedics. However, to maximize the benefits of implementing MSD prevention strategies it is important to include paramedics in the process.

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References

1. 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 & physics, 29(7), 775-787.
2. Lad, U., Oomen, N., Callaghan, J., & Fischer, S. L. (2016). Assessing the physical demands imposed on paramedics by different stretcher designs. Paper presented at the 47th Annual Conference of the Association of Canadian Ergonomists, Niagara Falls, Canada
3. 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.
4. Armstrong DP, Ferron R, Taylor C, McLeod B, Fletcher S, MacPhee RS, Fischer SL. (2017). Implementing powered stretcher and load systems was a cost effective intervention to reduce the incidence rates of stretcher related injuries in a paramedic service. Applied ergonomics, submitted.
5. Fredericks, T. K., Butt, S. E., & Hovenkamp, A. (2009). The impact of gurney design on EMS personnel. In Proceedings of the 21st Annual International Occupational Ergonomics and Safety Conference, 11-12. Dallas, TX.
6. Studnek, J.R., Crawford, J. Mac, & 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, 43(1), 198-202
7. Massad, R., Gambin, C., & Duval, L. (2000). The contribution of ergonomics to the prevention of musculoskeletal lesions among ambulance technicians. In Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 44(26), 201-204.
8. Lavender, S. A., Conrad, K. M., Reichelt, P. A., Kohok, A. K., & Gacki-Smith, J. (2007a). Designing ergonomic interventions for EMS workers—part II: lateral transfers. Applied ergonomics, 38(2), 227-236.
9. Lavender, S. A., Conrad, K. M., Reichelt, P. A., Gacki-Smith, J., & Kohok, A. K. (2007b). Designing ergonomic interventions for EMS workers, part I: transporting patients down the stairs. Applied ergonomics, 38(1), 71-81.
10. 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.
11. Galbraith, P. A. W. (2011). Development of a novel link-segment model for estimating lower back loading in paramedics. Unpublished MSc. Thesis, Queen's University.
12. Gilad, I., & Byran, E. (2007). Ergonomic evaluation of the ambulance interior to reduce paramedic discomfort and posture stress. Human factors, 49(6), 1019-1032.
13. Hignett, S., Crumpton, E., & Coleman, R. (2009). Designing emergency ambulances for the 21st century. Emergency medicine journal, 26(2), 135-140.
14. Biesbroek, S., & Teteris, E. (2012). Human factors review of EMS ground ambulance design. In Symposium on Human Factors and Ergonomics in Health Care, 1, 95-101.
15. Ferreira, J., & Hignett, S. (2005). Reviewing ambulance design for clinical efficiency and paramedic safety. Applied ergonomics, 36(1), 97-105.
16. 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.
17. Prairie, J., & Corbeil, P. (2014). Paramedics on the job: Dynamic trunk motion assessment at the workplace. Applied ergonomics, 45(4), 895-903.
18. Arial, M., Benoît, 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.
19. Aasa, U., Ängquist, 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(8), 1179-1194.
20. 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.
21. Van Eerd, D., Munhall, C., Irvin, E., Rempel, D., Brewer, S., Van der Beek, A. J., ... & Amick, B. (2015). Effectiveness of workplace interventions in the prevention of upper extremity musculoskeletal disorders and symptoms: an update of the evidence. Occupational and environmental medicine, oemed-2015.
22. Weiler, M. R., Lavender, S. A., Crawford, J. M., Reichelt, P. A., Conrad, K. M., & Browne, M. W. (2012). Identification of factors that affect the adoption of an ergonomic intervention among Emergency Medical Service workers. Ergonomics, 55(11), 1362-1372.
23. Johnson, M. R., Lavender, S. A., Mac Crawford, J., Reichelt, P. A., Conrad, K. M., & Fernandez, A. R. (2011). Identification of Factors that Affect the Adoption of Ergonomic Interventions Among EMS Workers. In Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 55(1), 1057-1061.