

The work of emergency medical technician-paramedics: Understanding the risks in order to prevent musculoskeletal disorders

► DS-999



Source

P. Corbeil, A. Plamondon, A. Tremblay, J. Prairie, D. Larouche, S. Hegg-Deloye, *Measurement of emergency medical technician-paramedics' exposure to musculoskeletal risk factors*, report R-944, Institut de recherche Robert-Sauvé en santé et en sécurité du travail, Montreal, 2017.

Acknowledgments

The authors would like to thank Lisette Duval, occupational health and safety advisor at ASSTSAS, and Emmanuelle Bourdon, instructor at Collège Ahuntsic, for reviewing this document and for their informative comments throughout the preparation process. Special thanks to Dominique Larouche, research assistant, who filmed and interviewed the workers during the study.

Comments

Do you have any comments or suggestions about this document?
Contact webmestre@irsst.qc.ca

Author

Philippe Corbeil, Université Laval

Coordination and preparation

Louise Sutton and Linda Savoie, IRSST

Translation

Zofia Laubitz

Graphic design

Lucie Chagnon

Illustrations

Jacques Perrault

The illustrations contained in this document are used only for explanatory purposes and are not intended to perfectly reproduce work situations.

Legal deposit

Bibliothèque et Archives nationales
du Québec 2017
ISBN 978-2-89631-978-7
ISSN 2292-9444
December 2017

IRSST

Communications and Knowledge Transfer Division

505 De Maisonneuve Blvd. West
Montreal, Quebec H3A 3C2
Telephone: 514 288-1551
www.irsst.qc.ca

© Institut de recherche Robert-Sauvé en santé
et en sécurité du travail

The work of emergency medical technician-paramedics: Understanding the risks in order to prevent musculoskeletal disorders

DS-999

Table of contents

An advocacy document	4
An innovative study	5
Measuring exposure to risks	7
Risk factors	7
Characteristics of work situations	9
The profession of EMT-P: a little-known reality	10
Exposure to risk factors and preventive measures	13
Preventive measures associated with the characteristics of work situations	26
Conclusion	30

An advocacy document

Who is this for?

- Prevention officers and trainers at ambulance companies
- Occupational health and safety workers, safety practitioners and prevention consultants (CNESST, joint sector-based associations, prevention mutual groups, etc.)
- Union representatives
- Employers and decision-makers
- Instructors of prehospital emergency care
- Emergency medical technician-paramedics

This document summarizes the key results of a major study of the risks of musculoskeletal disorders (MSDs) in emergency medical technician-paramedics (EMT-Ps) with the intent of:

- ▶ making stakeholders aware of the risks of MSDs associated with the profession of EMT-P
- ▶ encouraging the development and implementation of various preventive measures and the enhancement of training and professional development activities

On the basis of factual data, the researchers propose some preventive solutions to reduce the frequency and severity of MSDs. In this way, we hope to contribute to reducing the high staff turnover rate and the resulting loss of valuable experience in this sector, since EMT-Ps often take early retirement for medical reasons or leave their jobs in search of less demanding tasks or better working conditions as they grow older.

An innovative study

Motivated by the challenge of conducting the first study in Quebec to use a large sample of EMT-Ps, researcher Philippe Corbeil, of Université Laval, and his team of researchers carried out a study titled *Measurement of emergency medical technician-paramedics' exposure to musculoskeletal risk factors*.¹

HIGH PREVALENCE OF EMPLOYMENT INJURIES

The available data² indicate that EMT-Ps are at the borderline between high risk and extreme risk of occupational diseases and workplace accidents. In light of the prevalence of employment injuries affecting EMT-Ps, this topic is vital for the prehospital care sector.

INDICATIVE DATA

Data reported by the CNESST for the ambulance services sector in Quebec between 1997 and 2006.

4,579 cases of compensated injuries resulting in an absence from work

290,713 days of absence caused by employment injuries

2+ months: mean duration of absence from work

47% of injuries affected the **back and spinal column**

8% of injuries affected the **shoulders**

1. P. Corbeil, A. Plamondon, A. Tremblay, J. Prairie, D. Larouche, S. Hegg-Deloye, *Measurement of emergency medical technician-paramedics' exposure to musculoskeletal risk factors*, report R-944, Institut de recherche Robert-Sauvé en santé et en sécurité du travail, Montreal, 2017.

2. Statistics for 2011, Commission des normes, de l'équité, de la santé et de la sécurité du travail du Québec (CNESST).

HOW WAS THE STUDY CONDUCTED?

Thanks to the collaboration of three ambulance companies, the research team put 101 EMT-Ps “under the microscope” during 175 shifts in the Montreal and Quebec City areas between June 2011 and August 2013. The knowledge emerging from this study came from four sources:

- ▶ **Observation** of 628 prehospital interventions.
- ▶ **Three-dimensional (3D) recordings** of EMT-Ps’ back movements throughout their work shifts made with a leading-edge piece of equipment called a posture dosimeter, fine-tuned by the IRSST. This device was sufficiently light and comfortable not to hamper the EMT-Ps’ work.
- ▶ **Interviews:** Following an intervention, workers were questioned, mainly about the difficulties they had experienced during the prehospital intervention they had just carried out. This study was not limited to injuries but also takes into consideration the risk factors inherent in this profession, the characteristics of work situations and the discomfort that EMT-Ps experience.
- ▶ Finally, 54 participants agreed to have their **physical fitness** assessed by kinesiologists. Their results were compared to data for the general population.

Thus, we were able to do biomechanical, postural and statistical analyses, as well as analyses of the difficulties experienced and their causes. In addition, the results were compared based on workers’ sex, seniority and weight.

Measuring exposure to risks

To determine to what extent and during which tasks EMT-Ps are at risk of MSDs, the research team considered:

- ▶ known risk factors;
- ▶ the characteristics of work situations.

RISK FACTORS

The four main risk factors established in the scientific literature were included in the study and are defined below. Although there is no consensus on the critical values associated with risks of MSDs, the research team set its own reference thresholds for the purposes of this study.

[1]

Sagittal flexion



Lateral flexion



Torsion



WORKERS' POSTURES

Awkward back posture [illustration 1]

Workers' posture was considered to be awkward when their range of motion exceeded 40° in sagittal flexion (front/back) and 10° in lateral flexion (left/right) and torsion.³

Static posture

Static posture refers to holding a sagittal flexion for more than 5 seconds or a lateral flexion or a torsion for more than 1 second while executing a task.

3. Limitations: The combination of movements was not analyzed. The risk is higher when a sagittal flexion is accompanied by a lateral flexion or torsion of the back.

RISK FACTORS

Borg scale (perception of exertion)



Borg, G. "Psychophysical scaling with applications in physical work and the perception of exertion", *Scand J Work Environ Health*, 1990, vol. 16, suppl. 1, p. 55-58.

EXCESSIVE STRAIN

The concept of "excessive strain" designates a high degree of physical exertion, as perceived by the worker after executing a task (measured with the **Borg Scale**). Among other things, excessive strain was perceived when an EMT-P had to lift and move a heavy patient from one surface to another.

WORKLOAD

The concept of workload is based on the worker's perception of the level of difficulty of an intervention, considering the intensity of the efforts, both physical and mental, that had to be made, the EMT-P's satisfaction with the process, and the sense of urgency felt.

DYNAMIC WORK

The concept of dynamic work refers to the amount of physical fatigue resulting from an intervention, assessed on the basis of cardiovascular endurance and workload. This risk factor was included with the aim of determining whether the recovery period was sufficient to limit the onset of fatigue.

CHARACTERISTICS OF WORK SITUATIONS

In addition to the known risk factors, the researchers took the characteristics of work situations into consideration, as they impact EMT-Ps' degree of exposure to risk factors. These characteristics include factors that are specific to workers themselves, those that concern the physical and social setting of the intervention, the characteristics of the patient, the assignment from the health communication centre, and the work organization specific to each ambulance company. Certain characteristics can increase these risk factors, such as lack of an elevator, working with a patient in total assistance mode, or the layout of the ambulance's rear cabin.

Physical and social environment

- Call location (single-family home, multi-unit building, seniors' residence, public place, etc.)
- Presence or absence of staircases and elevators
- Type of staircase
- Rear cabin of ambulance
- Intervention executed indoors or out of doors
- Presence of friends or relatives
- Presence of other emergency workers

Patient

- Age
- Weight
- Health status
- Ability to communicate
- Mobility
- Behaviour

Organizational data

- Information provided by the health communication centre: assignment priority, nature of case, etc.
- Equipment used for the evacuation
- Assignment of EMT-Ps to patient care or driving*
- Composition of work team
- Shift (day/evening/night)
- Continuing education provided by the company

EMT-P

- Sex, age, weight
- History of MSDs
- Muscle capacity
- Cardiovascular endurance
- Years of experience
- Perceptions and beliefs
- Skills acquired during initial training

* In Quebec, there is only one official category of EMT-P. In reality, each team agrees that one of the EMT-Ps will be assigned to patient care and the other one to preparing the evacuation and driving the vehicle.

The profession of EMT-P: a little-known reality

This study spotlighted some of the realities of the profession of EMT-P and shed new light on certain beliefs.

The profession of EMT-P incorporates physically demanding work situations, which put these workers at risk of developing a musculoskeletal disorder.



EMT-Ps engage in activities that require them to lift, push and pull heavy loads.

The most demanding tasks are reported while moving patients in total assistance mode.



Evacuations in total assistance mode mean that the patient's entire weight has to be carried, which requires more physical exertion than evacuations in partial assistance mode or under supervision.

The prevalence of muscle soreness, discomfort and pain is extremely high in Quebec EMT-Ps.



88% of the 101 EMT-Ps we surveyed reported having experienced soreness, discomfort or pain during the year preceding their participation in the study; 30% of them said they had had a problem that prevented them from carrying out their usual work.

EMT-Ps with more than 15 years of experience are most at risk of injury.



Even though cardiorespiratory and muscle capacity declines with age and a sedentary lifestyle, the study revealed that EMT-Ps who had less than 5 years of experience (and more men than women) were more exposed to risks of injury and, among other things, to awkward and static postures.

EMT-Ps' work is most often done in a context requiring an urgent intervention.



Even though almost half of the assignments transmitted by the health communication centre have "urgent" priority,⁴ ultimately only 10% of patients were actually evacuated in urgent mode.

4. Immediate urgent priority assignment (priority 0) or immediate urgent assignment (priority 1) - Ministère de la Santé et des Services sociaux.

The nature of the case as transmitted by the health communication centre provides adequate information for the EMT-Ps.



The results show that 62% of codes (nature of cases) provided by the centre remained unchanged by the EMT-Ps. On the other hand, almost 40% of the assignments required decision-making in an unforeseen context, once the EMT-Ps were at the call location.

The main call codes that proved to be accurate at the call location were road accident (24 out of 26 cases), traumatic injury (10 out of 12), ingestion or overdose (9 out of 11), psychiatric or behavioural problems (15 out of 19) and abdominal pain (13 out of 17).

The exposure to the risk of injury is the same for both EMT-Ps, whether they are assigned to care or driving.



The exposure of the EMT-P assigned to care is higher than for the EMT-P assigned to driving, particularly in urgent interventions. Alternating the roles assigned to EMT-Ps from one urgent intervention to another enables them to better distribute the exposure to risk factors among teammates.

In an intervention coded as urgent,⁵ EMT-Ps save more time while driving than at the site of the intervention.



Minutes are saved primarily while driving and not during the intervention. Whether the case is classified urgent, immediate or non-urgent, the duration of the intervention at the call location for a given clinical protocol does not differ. EMT-Ps need to take the time to assess the situation and determine what care is needed and what evacuation mode is appropriate before they take action.

The helping relationship is a predominant factor in a prehospital intervention.



During the interventions we observed in the field, it appeared that Quebec EMT-Ps are front-line social case workers who need to have excellent interpersonal skills. Although these work situations may require little physical exertion, the psychological requirements of the role can increase the stress level, which is considered in the literature to be a risk factor for MSDs.

5. Immediate urgent priority assignment (priority 0) or immediate urgent assignment (priority 1) - Ministère de la Santé et des Services sociaux.

In urgent interventions, the workload is perceived as equally intense by female and male EMT-Ps.



In urgent interventions, female EMT-Ps perceived a heavier workload than male EMT-Ps. The difference is related to mental effort and feelings of urgency and not to physical exertion.

EMT-Ps who have greater than average muscle strength are less exposed to risks of MSDs than others.



EMT-Ps' physical fitness moderates their ability to carry out a physically demanding job. The fitter they are, the lower the perceived exertion will be. The risk of injury is lower if a worker handles a load corresponding to 15% of his/her maximum capacity than for 85%. In other words, it is safer not to have to work at maximum capacity.

EMT-Ps frequently work at their maximum cardiorespiratory capacity.



The frequency with which maximum cardiorespiratory capacity is called upon is low. Although this can happen occasionally, the rest periods are long enough in most situations for EMT-Ps to recover from their physical exertions.

EMT-Ps consider their work to be very physically demanding.

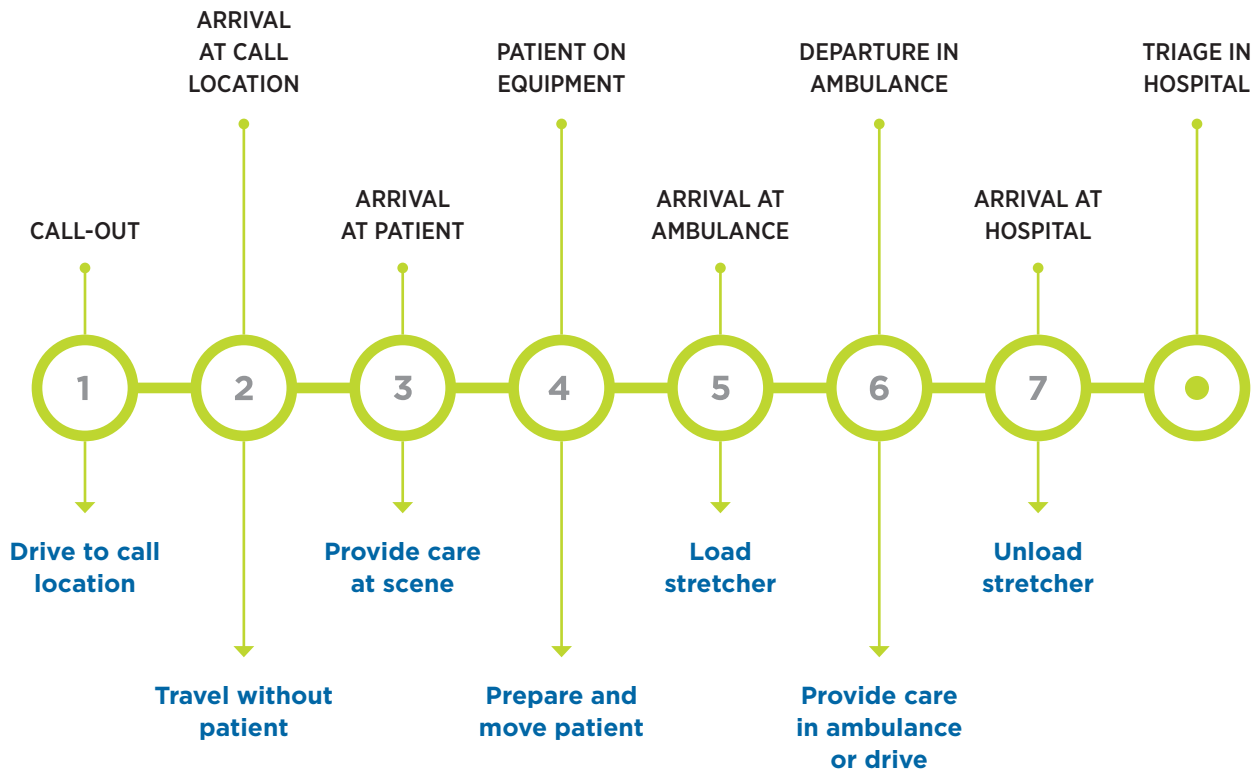


Situations perceived to be very hard (level 7 and higher on the Borg Scale) are extremely rare; only 9% of situations were even considered hard (level 5 and up). In fact, 79% of work situations were considered to require a moderate exertion level (0 to 3). One possibility is that, as EMT-Ps gain experience, they underestimate the difficulty of the situations they deal with.

Exposure to risk factors and preventive measures

This section presents the ► **risk factors** likely to result in an MSD, as identified by the research team on the basis of observations, interviews, measurement of back movements and analysis of video images. When possible, the research team has also indicated ► **preventive measures**.

To facilitate the processing of the data obtained, the prehospital intervention process was divided into **seven families of activities**. As the timeline below shows, the intervention starts at the time the team of EMT-Ps is called out by the health communication centre and ends when the patient is admitted for triage at the hospital.



ARRIVAL AT CALL LOCATION



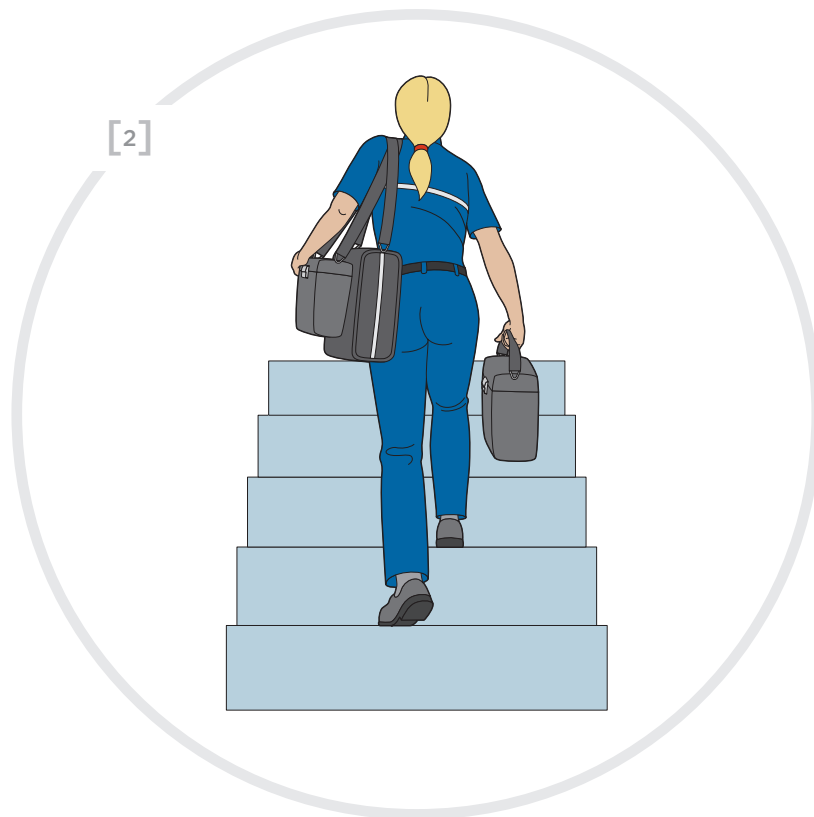
Travel without patient

RISK FACTORS

Awkward torsion posture

The torsion movement occurs when EMT-Ps are carrying a load slung over a shoulder (monitor, oxygen, first aid kit, etc.). This torsion is mainly meant to counterbalance the weight of the load being carried [illustration 2].

The lighter an EMT-P is, the greater the torsion, which is often the case for female EMT-Ps.



PREVENTIVE MEASURES

- Never carry a load slung over one shoulder.
- Opt to place equipment on the stretcher when moving about.
- Try to adopt a symmetrical posture by distributing loads on both the left and right sides (e.g., use a backpack or a bag on each shoulder).

ARRIVAL AT PATIENT



Provide care at scene

Care provided at the call location lasts from 4.2 to 11.8 minutes. Providing care at the location represented one of the three riskiest tasks for awkward postures.

It frequently requires EMT-Ps to hold awkward and static postures in all three planes of back movement, regardless of their role.

RISK FACTORS

Awkward and static postures

Unsafe postures occur especially:

- when care must be given to a patient who is on the ground before moving the patient to the transportation equipment;
- when working in a confined space and it is impossible to clear more space around the patient [illustration 3].



3

Provide care at scene

RISK
FACTORS

Awkward and static postures

In addition, while applying certain clinical protocols [see box below]:

- EMT-Ps assigned to driving are most exposed to awkward postures (sagittal flexion) in the case of the RÉA 1 protocol [illustration 4];



CLINICAL PROTOCOLS

APP Assessment of clinical condition
MED 1 Weakness
MED 8 Shortness of breath
MED 9 Abdominal pain
MED 10 Chest pain
MED 12 Intoxication and drug addiction

PSY 1 Behavioural problem
RÉA 1 Adult medical cardiorespiratory arrest
TRAU 0 Indications for spinal immobilization
TRAU 1 Adult trauma
TRAU 3 Isolated trauma of the extremities

3

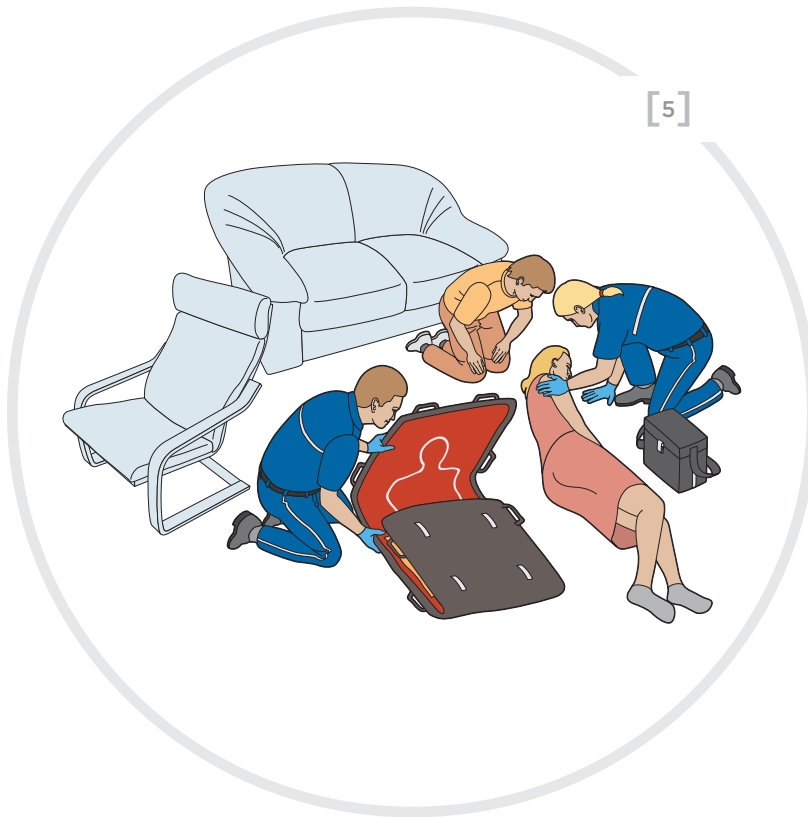
Provide care at scene

RISK
FACTORS

Awkward and static postures

- Exposure to awkward postures (sagittal flexion) is greatest for EMT-Ps assigned to care in the case of the TRAU 1 and 3 and MED 12 protocols [illustration 5];
- Female EMT-Ps are more exposed to risk than male EMT-Ps (greater sagittal flexion) in the case of the TRAU 1 protocol [illustration 5].

HYPOTHESIS: The difference between men and women may be related to how women experience patient helping relationships or do their work.



PREVENTIVE
MEASURES

Promote alternation of roles after each urgent intervention.

RISK
FACTORS

Excessive strain

When the situation requires urgent transportation, the level of difficulty perceived by EMT-Ps while providing care increases, regardless of their role (care or driving).

PATIENT ON EQUIPMENT



Prepare and move patient

Transfer in total assistance mode, on a spine board, on a stretcher or in a stair chair

50% of movements in a stair chair lasted from 0.5 to 1.6 minutes (maximum duration: 4.2 minutes).

Tasks related to moving a patient in total assistance mode to an item of transportation equipment frequently require EMT-Ps to hold awkward postures and exert excessive strain.

Moving a patient in a stair chair constitutes one of the three riskiest tasks for awkward postures and represents the most demanding and difficult task when a staircase has to be climbed.

RISK FACTORS

Awkward postures

The adoption of awkward postures (sagittal flexion and asymmetrical back movements with a high range of motion) was observed when patients were being moved by stair chair in a staircase [illustration 6].

- The EMT-P positioned facing the patient adopts significantly greater sagittal trunk flexions than the one at the back.
- When male EMT-Ps are facing the patient or at the head end, they adopt much greater sagittal back flexions than female EMT-Ps. These postural differences were observed when going both upstairs and downstairs.

EMT-Ps' height explains 33% of the variation in awkward back postures involving sagittal flexion (the taller EMT-Ps are, the more likely they are to flex their back).



[6]

PREVENTIVE MEASURES

Promote alternation of roles after each movement of a patient in a stair chair to make sure that the shorter EMT-P is not always positioned facing the patient.

4

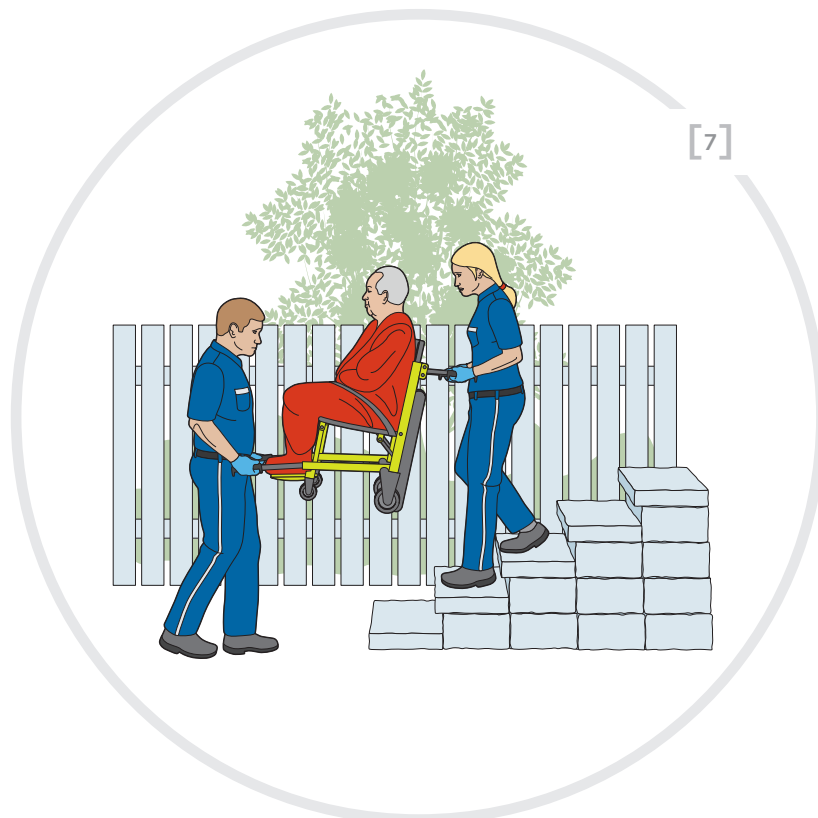
Prepare and move patient

RISK
FACTORS

Excessive strain

Moving a patient upstairs in a stair chair necessarily involves lifting. In urgent or immediate transportation mode, this is the task perceived as being the most difficult. In non-urgent mode, this task is perceived as the third most difficult. The perceived physical exertion is 5 on the Borg Scale; 75% of situations observed were associated with an exertion level of 4 or more on the scale.

- The efforts made to stabilize the upper body while walking (i.e., to counteract asymmetrical movements) are accentuated when going up- or downstairs.
- While going downstairs, the perceived exertion was assessed at 3.2 (moderate) when the situation required urgent or immediate transportation, and lower in non-urgent situations.
- The slide mechanism can be difficult to use in certain kinds of staircases (carpeted, wet, quarter turn, curved, spiral, narrow, or with irregular steps, especially outdoors), which forces EMT-Ps to lift the stair chair while going downstairs [illustration 7].
- Going upstairs with a patient is uncommon compared to going downstairs. It often occurs with basement apartments. Generally, there is one flight of stairs in that case, sometimes two.



4

Prepare and move patient

PREVENTIVE
MEASURES

- Promote alternation of roles after each movement of a patient in a stair chair to make sure that the shorter EMT-P is not always positioned facing the patient.
- The Stryker stair chair with a track reduces lifting during patient movements. This mechanism is only appropriate for going down a straight staircase with steps of equal height.
- The use of a compact stair chair – such as the Ferno stair chair – in confined spaces was mentioned as a facilitating factor.
- The use of a harness was only observed a few times. The EMT-Ps appreciated this technique since it allowed them to keep their hands free while going up- or downstairs. That can be useful, especially if they need to keep their balance by supporting themselves on the railings or walls.

RISK
FACTORS

Excessive strain

Although the instructions given to patients who are being moved in total assistance mode are clear (“keep your hands close to you and, most importantly, don’t grab onto anything”), some patient reactions can result in unforeseen efforts.

PREVENTIVE
MEASURES

- Take the time to position the patient safely on the transportation equipment.
- Remind patients of the instructions and ask them to keep hold of an item (safe and lightweight) to thwart their instinct to grab onto things.

4

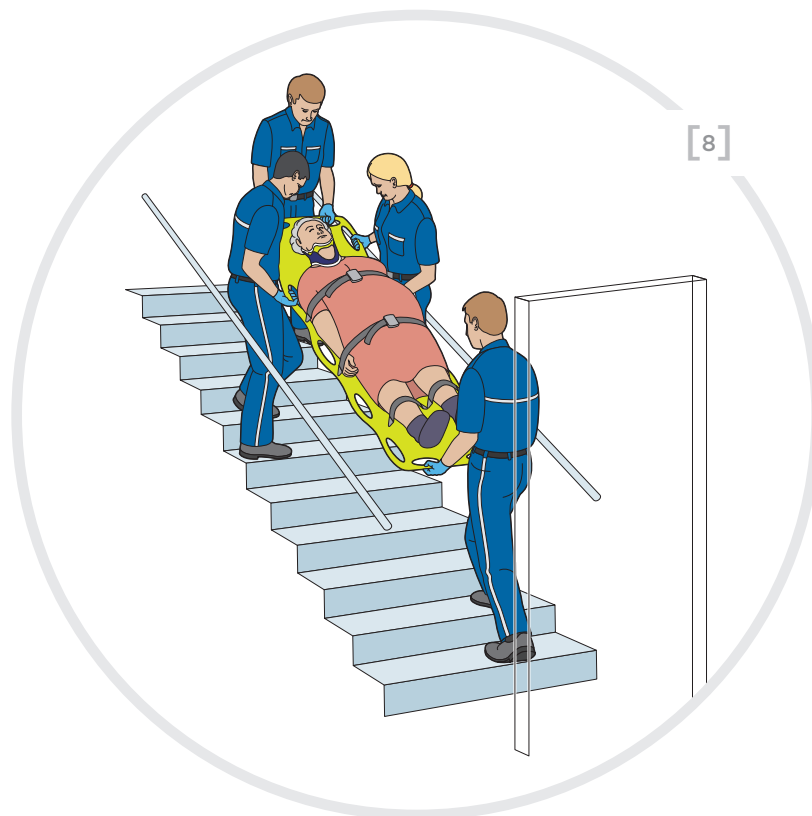
Prepare and move patient

RISK
FACTORS

Excessive strain

Moving the patient from his/her initial position to the transportation equipment, in total assistance and in urgent mode, is perceived as a hard task (exertion of 3 or more on the Borg Scale).

Movement on a spine board in a non-urgent situation is perceived as one of the hardest tasks; 67% of such movements were associated with an exertion level of 4 or more on the Borg Scale [illustration 8].



PREVENTIVE
MEASURES

- Apply the principles of safe patient handling (SPH).
- To reduce physical exertion and asymmetrical postures, ask for help from the patient's relatives or other emergency workers to clear space or make moving around easier.
- Exemplary physical fitness (upper limb strength, strength of stabilizer muscles in lower back [core] and cardiorespiratory endurance) can make this kind of extraordinary exertion easier.

4

Prepare and move patient

RISK
FACTORS

Excessive strain

The effort exerted to push and lift a stretcher or a stair chair is greater in certain specific situations, for example when going up or down an access ramp or when the wheels encounter a lot of resistance (snow on the ground, lawn, gravel) [illustration 9].

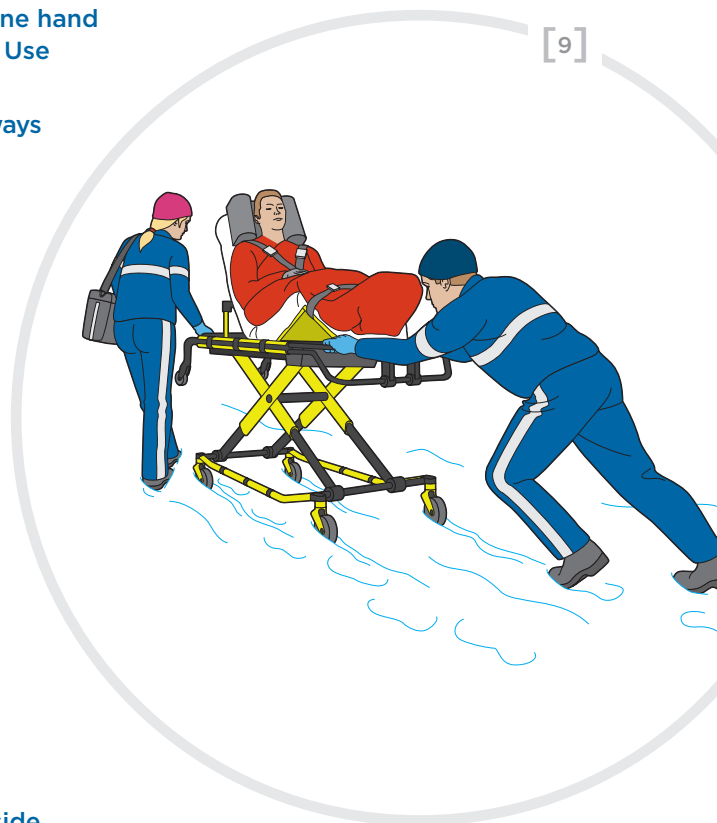
PREVENTIVE
MEASURES

- Do not carry additional equipment in one hand or on one shoulder during the process. Use the stretcher or make an extra trip.
- If there is an obstacle on the ground, always keep the stretcher in contact with the ground to avoid supporting its entire weight.
- Never take a staircase while supporting the stretcher's entire weight.
- Snow on the ground can make it much harder to transport a stair chair on a flat surface. To prevent the stair chair from tipping forward, some EMT-Ps prefer to pull the stair chair while walking backward rather than pushing it. In that case, it is important to make sure the path is safe beforehand.

Snowy or icy surfaces increase the risk of losing one's balance.

PREVENTIVE
MEASURES

Reduce the slipperiness of the surface outside the ambulance by spreading abrasive on icy surfaces.



ARRIVAL AT AMBULANCE



Load stretcher

Loading lasts 24 seconds on average, including lifting and repositioning the stretcher.

RISK FACTORS

Awkward postures / Significant sagittal flexion

Young men with healthy weight adopt more awkward postures than female EMT-Ps, EMT-Ps with 15 years of seniority or more, and obese EMT-Ps.

RISK FACTORS

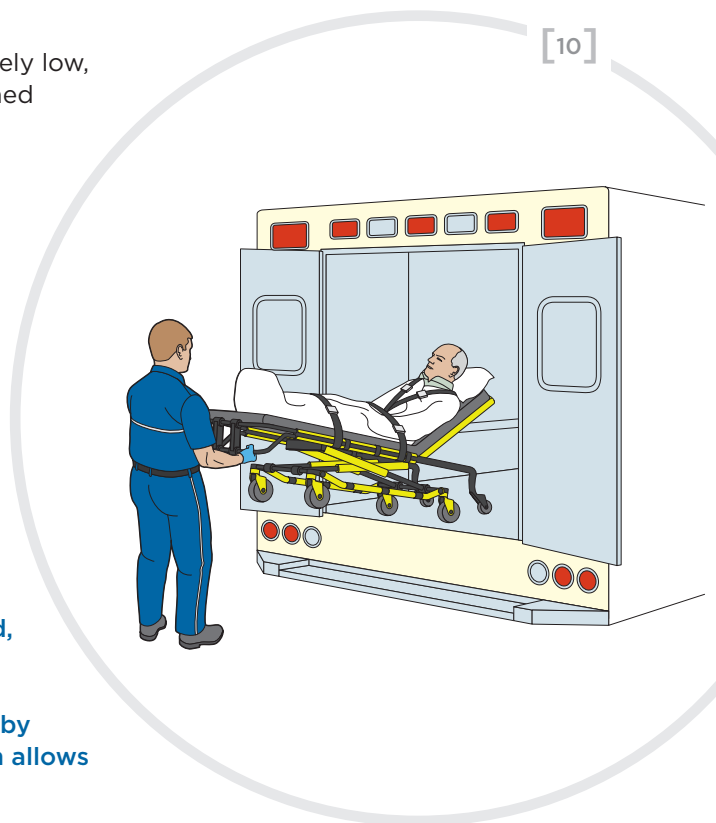
Excessive strain

The perception is that the exertion is relatively low, regardless of which role the EMT-P is assigned to (care or driving) and the urgency of the transportation. Nevertheless, a load is lifted and held in the air for several seconds.

The risk of shoulder injury when the load is being supported (while raising the wheels) is particularly high for short people.

PREVENTIVE MEASURES

- EMT-Ps should not lift a stretcher with one hand or alone [illustration 10].
- EMT-Ps should not carry additional equipment in one hand or on one shoulder while lifting.
- Even though powered stretchers are heavy and increase the load to be lifted, their use makes it possible to carry out the lifting task as a two-person team. The stretcher should always be loaded by both team members when the situation allows (lifting and repositioning).



Ice on the ground represents a source of risk that can result in unexpected exertion.

PREVENTIVE MEASURES

Reduce the slipperiness of the surface outside the ambulance by spreading abrasive on icy surfaces.

DEPARTURE IN AMBULANCE



Provide care in ambulance or drive

Care provided in the ambulance (50% of interventions) was spread over a period of 11.8 to 22 minutes. It is one of the three riskiest tasks for awkward postures.

RISK FACTORS

Awkward and static postures

In general, care provision is associated with maintaining awkward and static postures in all three planes of back movement.

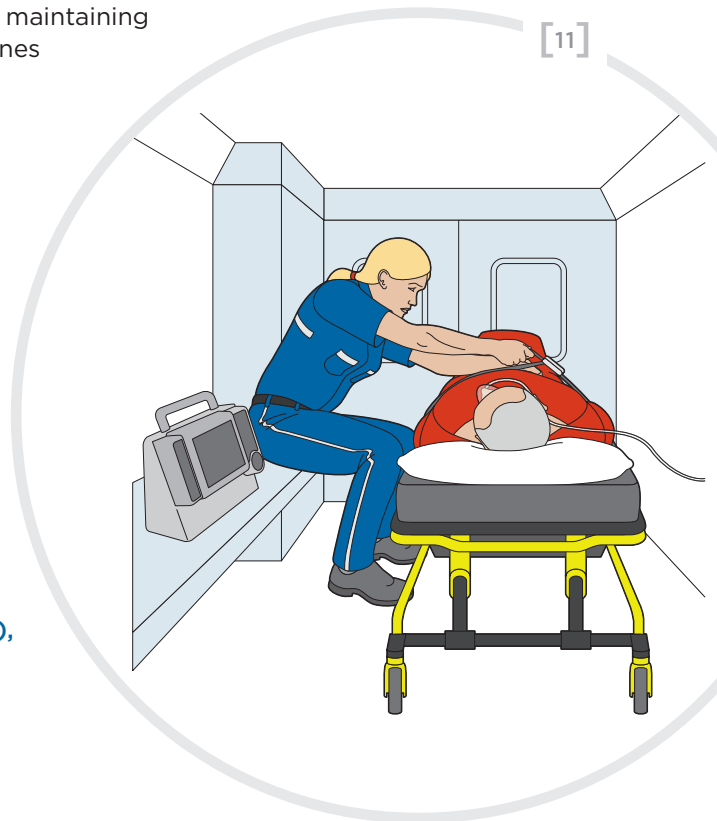
Being constrained to position oneself perpendicular to the road [illustration 11] in the back compartment of the ambulance is problematic due to:

- asymmetrical compensatory movements;
- the difficulty of anticipating sudden movements of the vehicle.

Exposure to awkward postures is reduced in female EMT-Ps and EMT-Ps with more seniority.

PREVENTIVE MEASURES

It would be advisable for the inside of the ambulance to include a swivel chair for the EMT-P assigned to care (to look at the road), the height and distance of which can be adjusted (to get closer to the patient on the stretcher).



ARRIVAL AT HOSPITAL



Unload stretcher

Unloading takes an average of 18 seconds.

RISK FACTORS

Awkward postures / Significant sagittal flexion

Young men with healthy weight adopt more awkward postures than female EMT-Ps, EMT-Ps with 15 years of seniority or more, and obese EMT-Ps.

RISK FACTORS

Excessive strain

The perception is that the exertion is relatively low, regardless of which role the EMT-P is assigned to (care or driving) and the urgency of the transportation. Nevertheless, a load is lifted and held in the air for several seconds.

The risk of shoulder injury when the load is being supported (while lowering the wheels) is particularly high for short people.

PREVENTIVE MEASURES

The stretcher should always be unloaded as a team.

Preventive measures associated with the characteristics of work situations

The risk factors related to tasks performed by EMT-Ps are moderated by some characteristics of the work situations. This section presents the preventive measures identified by the researchers for some of these variables.

Physical and social environment

PREVENTIVE MEASURES

Presence or absence of a staircase or elevator

Type of staircase

- Signage at the entrance to a building indicating whether there is an elevator and, if so, whether a stretcher can fit in it would help EMT-Ps to determine the most effective way of evacuating the patient.

Rear cabin of the ambulance

- It would be advisable for the inside of the ambulance to include a swivel chair for the EMT-P assigned to care (to look at the road), the height and distance of which can be adjusted (to get closer to the patient on the stretcher).

Intervention performed indoors or outdoors

- Make sure the ground is safe (spread abrasive, clear snow, etc.).

Presence of family members

- In total assistance mode, relatives can help by carrying equipment and assisting with the patient evacuation (opening and holding a door, clearing space, etc.).

Presence of other emergency workers

- Ask other emergency workers to help by carrying equipment to the ambulance or assisting with patient movement in total assistance mode (in a stair chair or on a spine board).

Patient

▼ PREVENTIVE MEASURES

- | | |
|------------------------|---|
| Ability to communicate | ■ Give instructions to the patient to ensure that he/she does not hinder the EMT-Ps' work. |
| Mobility | ■ When the EMT-Ps have verified the patient's condition and it is a non-urgent intervention, encourage cooperation and use his/her abilities (turning around, moving closer, sitting down, etc.). |
| Behaviour | ■ Remind the patient of the instructions and ask him/her to keep hold of an item to thwart the instinct to grab onto things. |

Organizational data

▼ PREVENTIVE MEASURES

- | | |
|---|--|
| Equipment used for evacuation | ■ Improve the design of the stair chair (so it can climb stairs and clear certain obstacles) in order to limit the number of lifts.
■ Improve the design of the spine board to reduce the load to be carried.
■ Use a mechanized system to load and unload the stretcher in the ambulance. |
| Assignment of EMT-Ps to care or driving | ■ Alternation of the roles assigned to EMT-Ps, particularly after urgent interventions, would better distribute exposure to risk factors among teammates. |
| Team composition | ■ It is advantageous for teammates to be of similar heights. |
| Corporate follow-up on training | ■ Plan and administer regular refresher courses. |

Emergency medical technician-paramedic

▼ PREVENTIVE MEASURES

- Weight
- Muscle capacity
- Cardiovascular endurance

- Adopt a healthy lifestyle (physical activity and nutrition) to maintain physical and psychological health over the long term.
- Strength and cardiorespiratory training has a positive effect on the ability to carry out physically demanding tasks (reduction in fatigue and perceived exertion).

Skills acquired during initial training

- Clinical knowledge
- Leadership
- Collaboration and communication
- Principles of safe patient handling
- Judgment and analytical skills

- Based on observations in the field, some skills should be covered in detail.

[See page 29]

Skills acquired during initial training

PREVENTIVE MEASURES

Leadership

- Know how to create cohesiveness with the teammate, other emergency workers and family members present at the call location.
- Ensure that everyone concerned knows their role during the intervention.
- Respect EMT-Ps' decision-making role during the intervention.

Collaboration and communication

- A good understanding favours consensus, which means that decisions will be safer, both physically and psychologically.
- Good communication is crucial in teamwork, especially to:
 - properly synchronize actions during patient evacuation;
 - take the time to jointly choose safe strategies to access the patient and take him/her to the ambulance;
 - be able to reassess decisions on the fly when necessary.

Principles of safe patient handling (SPH)

- Recognize awkward postures for yourself and your teammate.
- Apply SPH principles (preparation, positioning, hold and movements):
 - promote the patient's cooperation and participation as much as possible;
 - opt for symmetrical holds during exertion;
 - promote changes of posture;
 - favour sliding and avoid lifting;
 - use a clear start signal (mutual, visual or auditory) to synchronize lifting.

To find out more about SPH principles, consult the ASSTSAS website: <http://asstsas.qc.ca/fiches-pdsb>

Judgment and analytical skills

- Consider the determinants (characteristics of the patient and the physical and social environment, organizational data, specific characteristics of each EMT-P) and their impact on the intervention.
- Time management
- The sequence of tasks and the time allocated to each may vary as a function of the level of urgency, the care to be provided and EMT-Ps' safety.
- Movement management
 - choose which equipment to bring to the call location based on the nature of the case, its urgency and the characteristics of the call location;
 - choose the necessary tools to evacuate the patient;
 - plan for adjustments that will allow equipment to be used safely, particularly during evacuations in total assistance mode (e.g., the height of the stretcher when using a spine board, the height of the stretcher during movements, etc.);
 - assess how much space is needed before starting to move the patient;
 - identify the best route to access the patient and bring him/her to the ambulance;
 - decide on the best time and method to bring equipment back to the ambulance.

Conclusion

The study *Measurement of emergency medical technician-paramedics' exposure to musculoskeletal risk factors* represents a major advance in occupational health and safety research for this employment sector. The results presented here are intended to make all stakeholders in the ambulance sector more aware of the risks of MSDs associated with the EMT-P profession.

The researchers also hope to contribute to prevention by suggesting various methods and possibilities for action. To reduce risk exposure at the source, ambulance interiors should be improved, and stretcher loading and unloading could be done with a mechanized system. Improving the design of stair chairs and spine boards would also help to reduce exposure to excessive strain. In addition, alternation of the roles assigned to EMT-Ps from one urgent intervention to the next would better distribute exposure to risk factors among teammates.

The prevention of employment injuries or illnesses also relies on EMT-Ps' ability to make decisions with their own health and safety in mind, particularly when providing care at the call location, but also when moving equipment, with or without the patient. The relevant skills, especially those presented above under "Judgment and analytical skills," are key and they should be acquired during EMT-Ps' initial training by exposing learners to varied, realistic practice contexts. However, they can also be acquired in professional development courses. In addition, team cohesiveness, which is underpinned by mutual respect and an ability to make consensus-based decisions, also helps to prevent MSDs.

It is important not to neglect the positive impact of strength and cardiorespiratory training, as well as healthy eating habits. These choices enable EMT-Ps to protect their physical and mental health over the long term, as well as their ability to perform work that has a high to extreme risk of causing occupational illnesses and workplace injuries.

In addition, the study shows that female EMT-Ps perceived a higher workload than their male colleagues during urgent interventions. The current data are insufficient to explain this difference; a more in-depth study should shed light on explanations and appropriate intervention methods.

This study represents a new contribution to EMT-Ps' occupational health and safety. It is to be hoped that it will help to reduce the frequency and severity of the musculoskeletal disorders (MSDs) they are subject to. As a result, EMT-Ps will be able to work longer and stay healthier as they contribute to other people's health.

