

# Unified Algorithm as an Ergonomic Solution for Safe Patient Transfers

## Unificirani algoritam kao ergonomsko rješenje za siguran transfer pacijenata

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### Abstract

Studies show that nurses have high incidence of low back pain (LBP) due to the physical activities often required to manipulate patients and to the occurrence of sudden awkward lifts in cramped spaces, long hours at the computer terminal, or driving in ambulances. This may lead to lower productivity, high absenteeism and unsatisfactory patient care, and with cost of treating and caring for patients with LBP well over \$100 billion annually in the USA alone, makes this a public health concern.

Epidemiological studies identified numerous biomechanical factors that cause disc degeneration; exposure to vibrations, prolonged sitting and, especially, high compressive loadings that occur on the L3 disc during lifting, sitting, flexion and hyperextension of the spinal column. This puts certain occupations, such as health care workers, in higher risk group for developing degenerative problems with intervertebral discs.

Preventative measures include: avoiding axial torsion, changing positions frequently, using lumbar support and arm rests as well as appropriate lifting techniques with bend knees and straight back. However, these are not always possible in health care settings. Assistive technology (lifting aids, slings, sliding aids etc.) although affordable is still rarely used due to budgetary issues or the unwillingness of the staff to use them. Educational efforts must be directed so that health care workers understand the biomechanical risks associated with their work and how to perform everyday tasks with minimal risk. We propose an easy to follow diagram based on the current literature with instructions how to safely transfer patients from bed to chair, chair to chair, bed to trolley, up from the floor and repositioning in the bed with minimal risk of LBP. Hopefully this will lead to healthier and more productive staff and increase the quality level of health care provided.

**Key words:** patient transfers, nurses, assistive technology, low back pain

### Sažetak

Rezultati do danas publiciranih studija verificiraju visoku učestalost nastanka boli u slabinskom dijelu kralježnice u populaciji medicinskih sestara/tehničara. Ovo je posebice uzrokovano zbog potrebitosti svakodnevne višesatne manipulacija sa bolesnicima u za to skućenim prostorima te dugotrajna uporaba kompjuterske tehnologije zbog potrebe ispunjavanja sestrinske dokumentacije. Bol u slabinskom dijelu kralježnice uzrokuje smanjenje produktivnosti, visoki stupanj izostanka sa aktivnih radnih zadataka, nezadovoljavajuću kvalitetu zdravstvene njge. Bolnost slabinske regije kralježnice uzrokuje značajne troškove u zdravstvenom sustavu, primjerice u Sjedinjenim Američkim Državama ista iznosi preko 100 milijardi dolara na godišnjoj razini. Stoga kronična bol slabinske kralježnice predstavlja značajan javnozdravstveni problem.

Epidemiološke studije verificiraju brojne biomehaničke čimbenike koji uzrokuju nastanak bolnosti, i to: Degeneracija diska; izloženost vibracijama, dugotrajno sjedenje i, posebno visoke vrijednosti tlačnog opterećenja koja se javljaju na L3 disku tijekom dizanja, sjedenja, savijanja i hiperekstenzije kralježnice. U populaciji posebice je značajna incidencija nastanka u određenim zanimanjima kao što su zdravstveni djelatnici, kod kojih je posebice verificiran visok stupanj nastanka degenerativnih bolesti i volosti intervertebralnog diska. Preventivne mjere uključuju: izbjegavanje aksijalne torzije tijela, često mijenjanje položaja tijela, odmaranje gornjim ekstremiteta, metode pridizanja sa savijenim koljenima i fiksiranim stražnjim dijelovima tijela.

Međutim, navedene metode nije u zadovoljavajućem obimu moguće koristiti u tijeku radnog procesa. Stoga su u uporabi tzv. pomoćne tehnologije za prevenciju nastanka kronične boli slabinske regije [fiksna pomagala, remenje, klizna pomagala, i sl.]. Opisana pomagala su pristupačna ali do danas nisu u zadovoljavajućem obimu u uporabi to zbog cijene koštanja ili nespremnosti medicinskih djelatnika da ih koriste.

Edukacija u svrhu povećanja stupnja znanja o bolnosti slabinske regije mora biti usmjeren takoda zdravstveni djelatnici razumiju biomehaničke rizične mehanizme povezanekoji su u izravnoj svezi sa svakodnevnim izvršavanjem radnih zadataka.

U članku su opisane metode koje preporučujemo uporabiti, a prema rezultatima znanstvenih studija, kako izvoditi prijenos pacijenata iz kreveta na stolicu, iz stolica u drugu stolicu, sa krevetana kolica, pridizanje s poda i repositioniranje u krevetu s minimalnim rizikom za nastanak kronične boli slabinske regije. Nadamo se da opisne metode mogu značajno smanjiti stupanj nastanka kroničnog bolnog sindroma slabinske kralježnice te istovremeno povećati stupanj kvalitete zdravstvene zaštite.

**Ključne riječi:** transfer pacijenata, medicinske sestre i tehničari, pomagala, bol u leđima

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## Introduction

Musculoskeletal issues present a major burden on individuals and health systems with indirect costs being predominant [1]. Low back pain (LBP) affects people of all ages and is a very frequent reason for seeking medical help with estimation that LBP is among the top 10 diseases and injuries that account for the highest number of Disability Adjusted Life Years (DALYs) worldwide [2].

It was reported that 4 out of 5 Canadians experience acute LBP at some point in life and in general the lifetime prevalence of non-specific LBP is estimated at 60% to 70% in industrialized countries [1,3]. In the United States of America (USA), an estimated 149 million work days are lost every year because of LBP which together with treatment costs, lower productivity and associated disability payments creates costs estimated at US\$ 100 to 200 billion a year [iii-4,5,6]. In 2003 musculoskeletal disorders accounted for one third of all injuries with days away from work in the USA [7].

The work absence related to back pain is the same between men and women, however women are more likely to have longer periods of absence and are more likely to experience repeat episodes of back pain than men in the same occupation [8,9]. The present situation makes these issues a substantial public health problem, and with treatment costs being high and not always efficient preventative measures present a valuable solution.

## Work related risks of LBP

World Health Organisation (WHO) defines musculoskeletal disorders as multifactorial, meaning that work issues can significantly contribute to the aetiology but not exclusively [10]. Epidemiological studies established numerous work-related risk factors for the various types of musculoskeletal disorders which include physical (lifting and carrying heavy loads), ergonomic (exposure to vibrations, working in unergonomic positions) and psychosocial factors (stress). According to Eurostat 17 % of all workers in Europe are exposed to vibrations, 33% to painful or tiring positions, 23% to moving or carrying heavy loads, 46 % to repeated hand or arm movements and 31% are working with the computer for at least half of their work time [11]. About 33% of European workers consider that their work affects their health in the form of backache. Agriculture, construction as well as health and social work have the highest proportion of such workers (40-50%), more or less equally among men and women. According to the 1999 Labour Force Survey standardised prevalence for musculoskeletal problems that were caused or made worse by work was by far greater in the health and social care sector. This is not surprising as health care workers are exposed to load bearings during long periods of standing, carrying or pulling heavy loads (such as patient transfers [12,13]), vibrations (handling tools or driving in ambulances).

Ergonomic professionals have observed individual variability in work techniques even in workers that perform highly structured tasks, although posture and force variability have rarely been investigated. However some studies have found that up to 80% of exposure to uncomfortable posture was related to variance within workers [14], while in lifting up to 40% of performed motions are due to individual workers techniques. Twisting motions found to be very hazardous; can be avoided by pivoting with the feet with good muscle coordination being crucial. Changes in acceleration need to be avoided at all costs. As bad lifting techniques are associated with increased risks for back injuries, lifting technique is an important issue.

LBP can arise from any of the spinal structures and depending on the forces (biomechanical stress) applied to a structure the influence to the structures varies. The biomechanical response to the biomechanical stress caused by these forces may be immunologic, inflammatory, or neurochemical, depending on the structures being traumatized [15].

## Nursing and LBP

Nursing staff has one of the highest incidences of LBP with an estimated 40 000 nurses in 1992 reporting musculoskeletal illnesses each year and the numbers are steadily inclining after that. In the USA generally 52 % of nurses complain of chronic back pain, 12% are changing professions due to problems with LBP and 38% had such severe pain that they needed to take time off for treatment [16]. The vast majority of these issues were related to transfer tasks, due to biomechanical issues of the transferring technique. Transfers are usually done in small or cramped hospital rooms, where bending and axial torsion is needed.

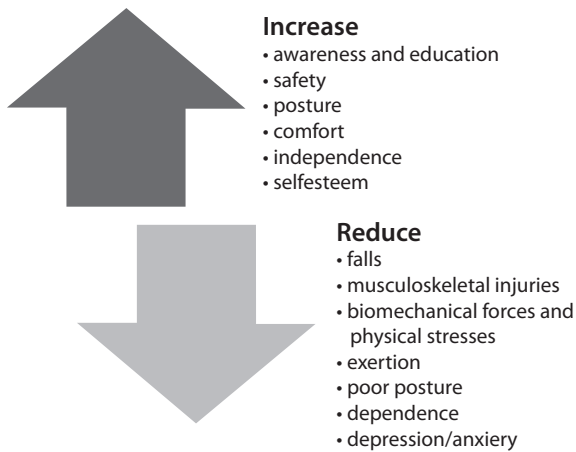
The lack of a pre-planned approach to a certain patient is usually lacking and there is not a truly individual approach to patient transfer plans. As nursing staff doesn't have enough time to prepare the transfer this leads to hasty decisions usually based on task performance and not on personal protection and patient safety in mind.

This problem has been identified by numerous nursing associations who have declared that action should be taken in ensuring safe transferring techniques. This was also the main reason we wanted to propose a solution for health care workers who perform such tasks.

## The Unified Algorithm for Safe Patient Transfer

The Unified Algorithm for Safe Patient Transfer (UASPT) was primarily developed in order to increase the patients' and nurses' awareness, safety and comfort. Clinical consequences of improper patient handling and movement for a nur-

<sup>1</sup>The authors would like to note that as the words "patient" and "client" have a different background, it is important to inform the readers that throughout this article, the term "patient" is used for both "patients" and "clients" and regardless of the patient's gender.



**FIGURE [1]** Benefits of proper education on patient transfer.

se, as well as patients are numerous and well documented, and have harmful effect on the quality of care [xii]. Modest or inappropriate education and training of health care workers involved with patient transfers is the leading factor in providing poor and improper quality of care, from which musculoskeletal injuries and related disorders, pain, fear, increased discomfort and dependency as well as other consequences may arise.

Reasons to develop this algorithm were to raise awareness about proper transfer techniques among nursing staff but also within occupational medicine and safety specialists. Right transfer techniques are also safer for the health care worker performing the transfer but also to the patient. Allowing for the right amount of help given (depending on

the abilities of the patient) increases self-esteem, comfort and confidence of the patient. We hope that the proper use of the algorithm will lead to less exertion and physical and psychological stress while performing transfers. The reasons are graphically shown in **Figure [1]**.

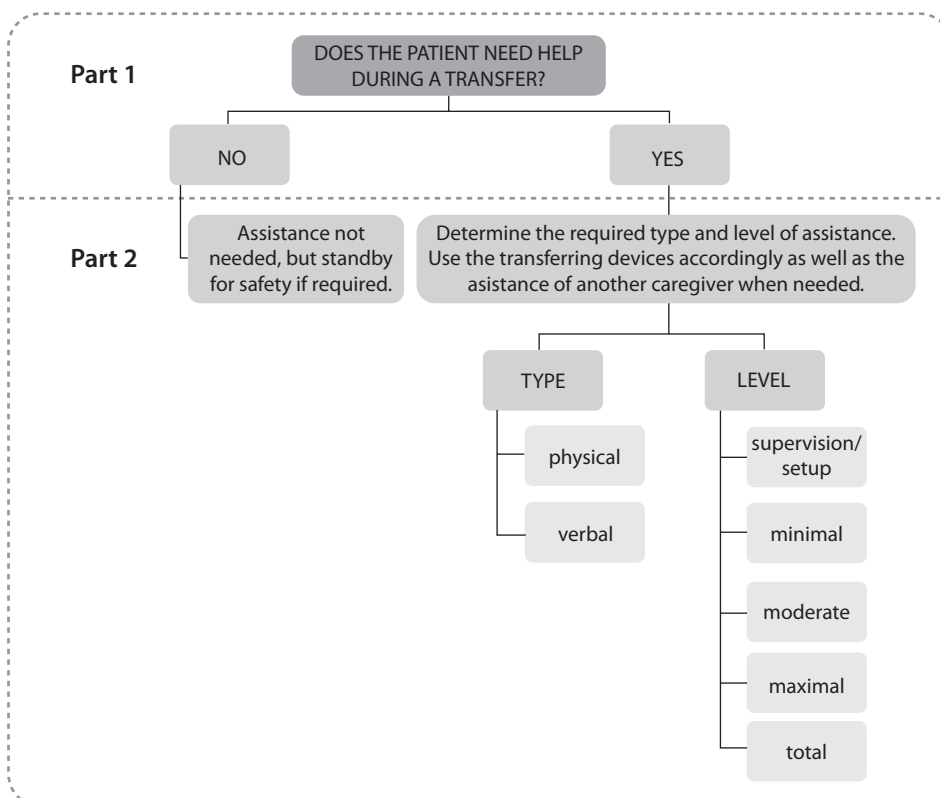
The UASPT algorithm is meant to serve as an organizational technique in different workplace settings. As such it is a form of primary and tertiary prevention on an organizational level. Considering our wish to implement the algorithm in practice, we made a graphical representation as shown in *Figure 2*, which is for the purposes of this article divided into two parts.

The first part takes into consideration the above-mentioned assessments on the level of assistance that is needed and if so how much assistance is necessary. If it is assessed that the patient requires assistance, the algorithm follows to serve as a reminder on what sort of transfer assistance is needed.

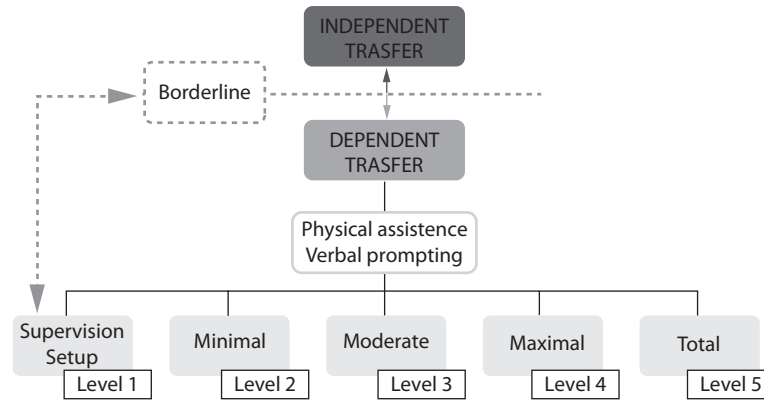
We emphasize that this algorithm is not a substitute for a structured education of young health care practitioners or for continuing education of more experienced workers. It serves as a reminder and orientation in practice so that patient transfers are done with more before-thought and planning.

**When does a patient require assistance?**

Patient handling tasks occur in clinical and non-clinical settings and may vary from one to another. As previously reported [17-,18,19,20,21,22,23], these tasks are characteri-



**FIGURE 2** - Graphical representation of the UASPT.



**FIGURE [3]** Independent and Dependent Transfers.

zed as the high-risk tasks as they impose substantial bio-mechanical forces on the nurse and can put both patient and nurse at high risk of musculoskeletal injuries. Some of these tasks include lifting and holding patients’ extremities, repositioning them in bed, chair or wheelchair, bathing and toileting tasks, transferring patients on and off stretchers, doing vertical transfer with a patient and other.

By definition, a transfer is a movement from one place to another, for example a wheelchair to bed, and includes a sequence of events that must occur, both before and after the move [24]. Being aware of each patients’ medical conditions as well as potential cognitive and physical limitation is a must for each nurse before planning a transfer. The prerequisite to this is an open dialogue between all the members of a multidisciplinary team involved in patient treatment (medical doctors, occupational therapists, physiotherapists, psychologists etc.).

**Types and levels of assistance**

Two types of assistance in a nurse-patient interaction that are used individually or in combination are **physical assistance** and **verbal prompting** and these ranges from supervision alone to total assistance.

If the patient does not require any type of assistance from the nurse, that is, he independently performs a transfer; no assistance should be imposed from a nurse as the ultimate

goal is to have a patient who is independent in performing the transferring tasks.

If the patient is on the borderline between dependent and independent category as shown in **Figure 3** a nurse is advised to supervise the whole transferring process and standby for safety due to risk of falls and injuries.

It is important that the level of help given from the nurse or any other team member does not impede the patient’s remaining abilities of doing a transfer, thus facilitates his movement. The patient should be allowed to perform up to his maximum at all points as this is helpful not only physically but psychologically too.

Additionally, if required, a nurse should liaise with other members of the multidisciplinary team prior of doing a transfer, such as an occupational therapist, physiotherapist, respiratory therapist, nurses working in wound care and others, in order to get all the relevant information and thus become able to provide the best intervention and rehabilitation care while executing a transferring task.

**Determining the level of assistance**

Each type of assistance and each transferring session should be monitored and recorded individually as that will help to observe the patient’s progress through a particular transferring task.

**TABLE [1]** Determining the level of physical assistance

Physical assistance				
The patient’s rating depends on the specific contact assistance from a nurse. The most important part is what did a nurse actually do while assisting a patient.				
Level 1	Level 2	Level 3	Level 4	Level 5
Supervision / Setup	Minimal assistance	Moderate assistance	Maximal assistance	Total assistance
Standby assistance only with no physical contact	Contact guarding Slight touch	Lifting assistance from one nurse either to sit down or stand up	Lifting assistance from one nurse to sit down and stand up	Lifting assistance from two nurses to sit down and/or stand up
Bringing and/or positioning a transferring device	Steadying Lifting and/or lowering one extremity	Lifting and/or lowering two extremities	Lifting and/or lowering three extremities	The patient doesn’t perform the activity  Lifting and/or lowering all extremities

**TABLE [2]** Determining the level of verbal assistance

Verbal assistance				
The patient's rating depends on the degree of misunderstanding and the effect of that misunderstanding on the patient's ability to perform a safe transfer.				
Level 1	Level 2	Level 3	Level 4	Level 5
Standby prompting	Minimal prompting	Moderate prompting	Maximal prompting	Total prompting
Nurse prompts: 1 – 2 x	Nurse prompts: 3 – 4 x	Nurse prompts: 5 – 6 x	Nurse prompts: 7 – 8 x	Nurse prompts: ≥ 9 x
Cueing	Cueing	Cueing	Cueing	Cueing
Coaxing	Coaxing	Coaxing	Coaxing	Coaxing

Be advised that the time spent on the transferring task is not relevant for determining the level of assistance.

**Physical assistance**

To determine the appropriate assistance level, at least one item from **Table 1** should be present, however, if more items are present from different levels indicates the higher level of patients' assistance needed.

For example, a patient with the fracture of a lower leg who requires assistance to lift one extremity in and out of bed would require minimal assistance. However, the same patient who approaches a chair or bed with no more than contact assistance but requires lifting assistance from one nurse to sit down and stand up would require maximal assistance. If the patient doesn't perform the activity, he would require total assistance.

**Verbal assistance (prompting)**

The levels of verbal assistance as presented in **Table 2** are classified according to the amount of verbal and non-verbal prompting given to a patient such as cueing and coaxing. Verbal and non-verbal prompting, whether direct or indirect should encourage a patient to initiate or continue a task, or directly assist a patient with the completion of a task.

Slowed speech rate, use of repetition, stressing particular words or phrases, giving a hint or short verbal redirection, giving visual cues or graphics (such as arrows or color-coding the objects, or showing photos/videos of a task to be completed in a sequence or in one single image) are some of the examples of verbal assistance.

For instance, a patient with Alzheimer's disease whose functional impairment slowly increases but at the moment requires verbal facilitation and encouragement only three to four times during one transferring task, would require minimal assistance. However, the same patient who would understand only simple, commonly used spoken expressions or gestures and would require prompting eight times during one transferring task, would require maximal assistance.

**Transfer devices**

Before using assistive devices there are a number of pre-conditions that need to be satisfied: appropriate devices

need to be obtained depending on the unit needs and depending on the casework and common pathologies (for example, an acute neurology department might not need the same devices as a long term care department). A wide variety of these are available in different price ranges and appropriate funds need to be secured. Also, the staff needs to be properly trained in selection of the most appropriate devices, as well as to carry out a safe transfer for the patient and themselves. Nevertheless, the practitioner using any device should be familiar with the potential risks of using transferring equipment as well as the handling, storing and safety manufacturer's guidelines of the same.

Any transfer assistive device should be sized to fit the patient. All transferring devices are coming in different widths, lengths and other important features, thus it is essential that each device fits the patient appropriately. For the safety reasons, no device should be used if damaged or if not properly fitted!

The careful assessment of the patients' medical status, as mentioned above, including the cognitive, physical, sensory, behavioral and other abilities and limitations as well as the infection control issues, are the most important factors that should be taken into consideration before deciding what type of an assistive device should be used for a particular patient and how the transfer techniques should be done. If the patient is on the transmission based precautions due to infection, only the transferring equipment that is absolutely necessary should be brought into the patients' room and the same one must be cleaned thoroughly after each use following the facility guidelines [25]. If it is confirmed or assumed that the patient has any cognitive or physical limitations, it is important that the nurse assists in or supervises a transfer and asks for additional help when required.

Moreover, special care prior and during any transfer should be given to the patients with the pressure ulcers as the improper use or disuse of the same may cause a lot of damage to the already weakened skin and underlying tissue. In case of any injury caused prior or during a transfer, the nurse is obliged to follow the standard facility protocols and inform the superiors.

It is important that an each transferring device that is chosen for the patient facilitates his movement, increases comfort and safety and not impede it in any way.



Furthermore, a comprehensive risk assessment of an each transferring item must be carried out and regularly reviewed, especially when the patients' medical condition change. It is highly advisable to collaborate with the occupational therapists about this matter, as it is crucial that an each transferring device is adapted perfectly for a particular patient, including his abilities and limitations. Therefore, clear communication within the team caring for the patient is of the utmost importance. Occupational therapists that deal in postural management should be able to tailor an individual approach to each patient transfer according to patients' needs. Safe transfers can only be done if the caring team is confident and competent in doing it.

There are numerous options that may be used for safe patient transfer and these can often be combined. For example, a draw sheet could be used together with a transfer board if the patient does not have enough muscle power to drag himself from one surface to another or over the board.

### Slide sheets

Sliding sheets are used with dependent patients. They are made of specialized fabrics with low-friction inner surfaces that glide over themselves. They reduce frictional and shearing forces to patients' skin during the transfer and also reduce the amount of pushing and pulling. However, due to their slippery material, the sliding sheets may become very hazardous and should be removed after the repositioning the patient and properly stowed [26].

### Draw sheets

Draw sheet (roller sheets) should be used only by patients who are capable of gliding themselves over the surface but require some assistance (for example due to their muscle weakness). Opposed to the slide sheets, the draw sheets can be left under the patients [26] as they are not as slippery as the slide sheets.

### Slide boards

Slide boards (transfer boards) are typically made of plastic or wood material and are used to bridge the gaps between two surfaces (e.g. wheelchair to bed). Sliding boards are mostly used with patients who have lower extremity amputations, spinal cord injuries or bariatric patients. They enable safer and easier transfer from one surface to another by sliding or rolling along the board. However, patients must have good upper extremity strength [24, 26].

### Hoists and slings

Hoists and slings should be used with patients who should not weight bear and/or whose trunk stability is very limited or absent. Choosing a sling will depend upon the physical characteristic of each patient, including the height, weight, trunk control, head support and other factors [24, 27]. Besides, it is important to make sure that the sling and hoist are compatible.

### Waist belts

Waist belts (transfer belts) come in variety of sizes and shapes. They fasten with a clasp, a buckle or Velcro and are mostly used during a transfer over a sliding board to guide the patient during a movement [26].

### Turning discs

Turning discs may be flexible or solid. They consist of two circular discs that rotate against each other. The inner surfaces are made of low-friction material, while the outer surfaces are made of high-friction material. Turning discs are often used with transfer boards and/or transfer belts. The discs make a spinning motion, thus the assistance of another caregiver is mandatory [26].

### Conclusion

Transfer skills are the most important activities that must be mastered by each patient during the rehabilitation as well as in any stage of his everyday life.

As the nurses are the only health care professionals who are taking care for the patients twenty-four hours, seven days a week, it is extremely important that they become knowledgeable about the different types of transfers and transferring aids as well as how to operate them.

Additionally, as the transferring assistive devices and techniques can be immensely beneficial for the patients and nurses in terms of prevention and reduction of musculoskeletal injuries, biomechanical forces and other, they could become extremely hazardous if improperly used, thus the safe approach and methods should never be underestimated.

It is the obligation of each nurse to become familiar with the policies of manual handling in the institution where the work is taking place, as well to become familiar with the printed materials, brochures and manufacturer's guidelines of each transferring device in order to protect themselves and patients under their care.

To ensure evidence based practice when dealing with the transferring needs of the patients, all nurses and other caring team members should have an access to at least a regular and basic training in safe patients' handling.

### Authors declare no conflict of interest.

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