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Ergonomics — Manual handling of people in the healthcare sector

Ergonomie — Manutention manuelle des personnes dans le secteur de la santé

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Foreword

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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ISO/TR 12296 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 3, *Anthropometry and biomechanics*.

Introduction

National and international statistics provide evidence that healthcare staff are subject to some of the highest risks of musculoskeletal disorders (particularly for the spine and shoulder), as compared with other jobs.

Manual patient handling often induces high loads on the musculoskeletal systems, in particular on the lower back. Manual patient handling ought to be avoided where possible[1)] or be performed in a low-risk manner.

Factors such as the number, capacity, experience and qualification of caregivers can interact with the following conditions to produce an increased risk of musculoskeletal disorders:

— number, type and condition of patients to be handled;

— awkward postures and force exertion;

— inadequacy (or absence) of equipment;

— restricted spaces where patients are handled;

— lack of education and training in caregivers' specific tasks.

An ergonomic approach can have a significant impact on reducing risk from manual patient handling.

A good analysis of work organization, including handling tasks and the above-mentioned risk determinants, is extremely important in reducing risks to caregivers.

The recommendations presented in this Technical Report allow identification of hazards, an estimation of the risk associated with manual patient handling and the application of solutions. They are based primarily on data integration from epidemiological and biomechanical approaches to manual (patient) handling and on the consensus of international experts in patient handling.

The assessment and control of risks associated with other aspects of manual handling can be found in ISO 11228-1, ISO 11228-2, ISO 11228-3 and ISO 11226.

1) As per European Council Directive 90/269/EEC on the minimum health and safety requirements for the manual handling of loads where there is a risk particularly of back injury to workers.

Ergonomics — Manual handling of people in the healthcare sector

1 Scope

This Technical Report provides guidance for assessing the problems and risks associated with manual patient handling in the healthcare sector, and for identifying and applying ergonomic strategies and solutions to those problems and risks.

Its main goals are

— to improve caregivers' working conditions by decreasing biomechanical overload risk, thus limiting work-related illness and injury, as well as the consequent costs and absenteeism, and

— to account for patients' care quality, safety, dignity and privacy as regards their needs, including specific personal care and hygiene.

It is intended for all users (or caregivers and workers) involved in healthcare manual handling and, in particular, healthcare managers and workers, occupational safety and health caregivers, producers of assistive devices and equipment, education and training supervisors, and designers of healthcare facilities.

Its recommendations are primarily applicable to the movement of people (adults and children) in the provision of healthcare services in purposely built or adapted buildings and environments. Some recommendations can also be applied to wider areas (e.g. home care, emergency care, voluntary caregivers, cadaver handling).

The recommendations for patient handling take into consideration work organization, type and number of patients to be handled, aids, spaces where patients are handled, as well as caregivers' education and awkward postures, but do not apply to object (movement, transfer, pushing and pulling) or animal handling. Task joint analysis in a daily shift involving patient handling, pulling and pushing or object handling and transport is not considered.

2 Terms, definitions and abbreviated terms

For the purposes of this document, the following terms, definitions and abbreviated terms apply.

2.1
aids and equipment
assistive devices eliminating or reducing the caregiver's physical effort during handling of a non- or partially cooperating patient

2.2
caregiver
individual required by his or her job specification to perform manual patient handling activities

2.3
environment
all physical conditions of the area where patients have to be handled, including space, climate and surfaces

2.4
manual patient handling
activity requiring force to push, pull, lift, lower, transfer or in some way move or support a person or body part of a person with or without assistive devices

2.5
patient
individual who requires assistance to move

Note 1 to entry: Types of patients include

— totally non-cooperating patients (to be fully handled by a caregiver),

— partially cooperating patients (to be partially handled by a caregiver).

— fully cooperating patients.

Note 2 to entry: Missing willingness of the patient for cooperation may induce an increase in musculoskeletal load for the caregiver.

Note 3 to entry: Other types of patient classifications are mentioned in C.4.

Abbreviated terms

NC	totally non-cooperating patient
PC	partially cooperating patient
MSD	musculoskeletal disorders
MPH	manual patient handling
LBP	low-back or lower-back pain
PU	pressure ulcer

3 Recommendations

3.1 General aspects

A systematic review of patient handling literature shows that a strategy for risk assessment, application of engineering controls and management must be comprehensive (multifactor interventions) to be successful.

Consequently, a strategy for risk prevention based on analytical assessment of the risk itself, all of its potential determinants (organizational, structural and educational), and on some key aspects of risk management is outlined below (see Figure 1).

The strategy includes the use of managerial processes and systems for reducing causes and effects of musculoskeletal and other organizational losses from healthcare institutions.

The participatory approach is emphasized in all aspects especially in changing work practices, defining training needs, purchasing technology/equipment and designing work environments.

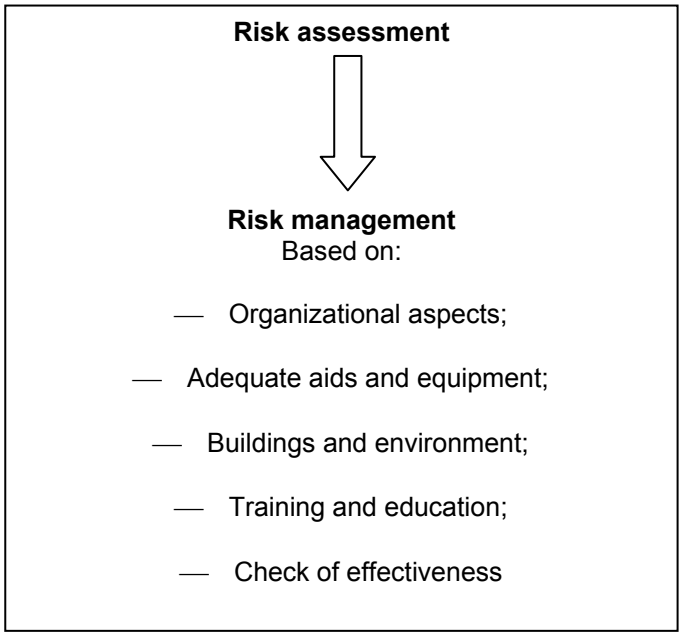

Figure 1 — Comprehensive strategy

The annexes present details of the main relevant aspects of the general strategy: risk assessment (Annex A); organizational aspects (Annex B); aids and equipment (Annex C); buildings and environment (Annex D); staff education and training (Annex E); effectiveness check (Annex F).

The following sections (3.2 and 3.3) describe the basic recommendations for this strategy.

3.2 Risk assessment

Risk assessment is one of the pillars of preventive strategies. Risk assessment consists of the following steps: hazard/problem identification, risk estimation/evaluation.

It is emphasized that for the purposes of this Technical Report, hazard identification and risk assessment are related not just at health risk identification but also in problem identification and problem solving.

A risk assessment is recommended when new equipment is introduced, organizational issues are modified (number of caregivers, number of non-cooperating patients), spaces are reorganized from an environmental viewpoint (rooms, services) and whenever other changes could affect risk characteristics, even if the previous condition was found to be acceptable.

For the purposes of this Technical Report, the risk assessment model shown in Figure 2 is used.

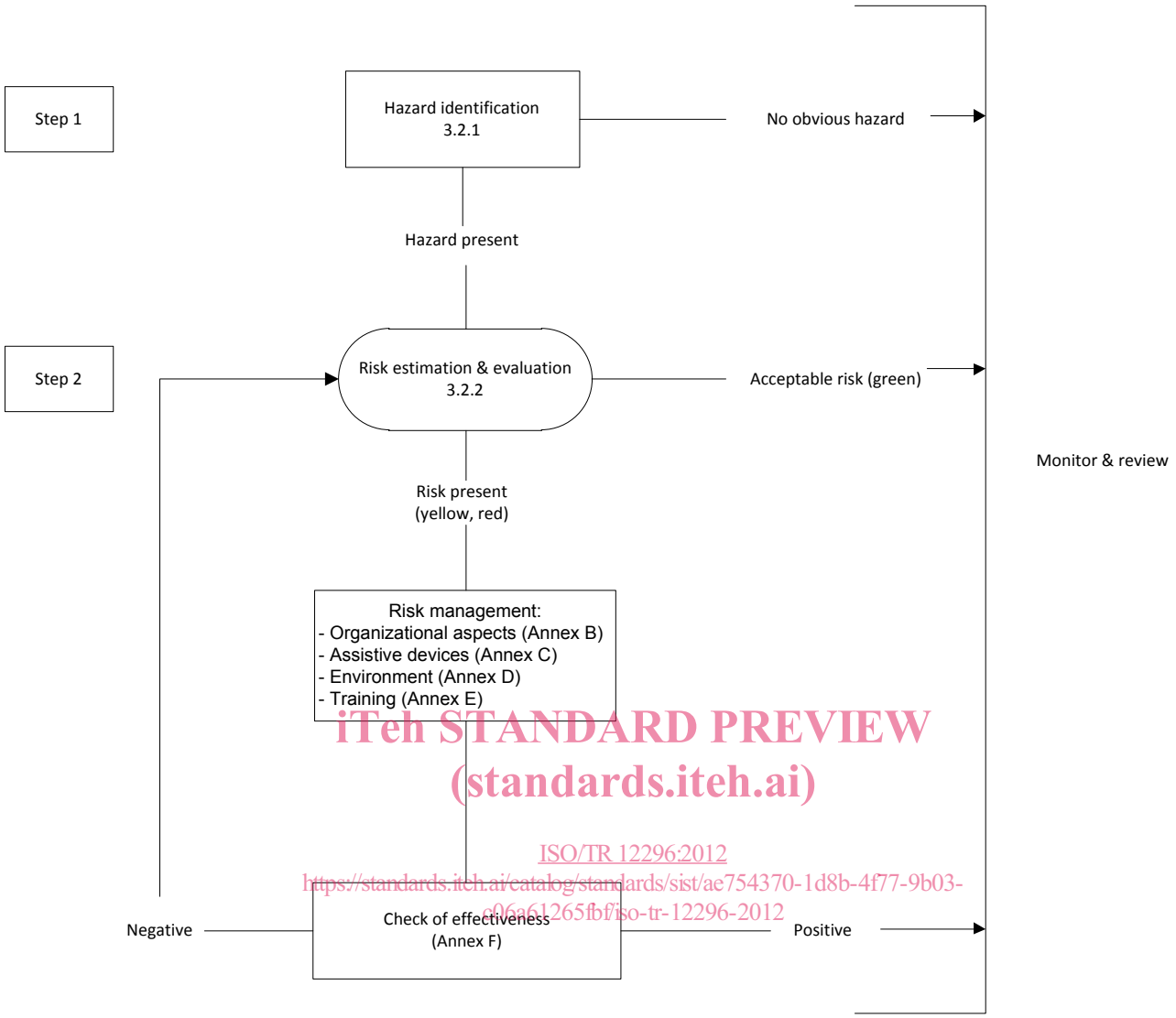

Figure 2 — Risk assessment model

3.2.1 Hazard identification

A hazard is present when patients are manually handled. The number and type of these patient transfers should be quantified (e.g. on a daily average) in different ways according to the healthcare area considered. For example: in operating theatres it would constitute the number of operations needing patient handling; in outpatient operations, the number of access requests for patients; in hospital wards, the number of patients. Patient quantification will be a preliminary factor to assess the time, number and frequency of handling.

Also the presence of a hazard requires that other factors should be taken into account that may address the subsequent risk evaluation.

3.2.1.1 Type of handling

The type of handling is defined by the task to be performed (e.g. repositioning a patient lying in the bed, or emplacing the bed pan) as well as by the handling technique applied for task execution. Task execution may be biomechanically improved, in particular, if small aids are additionally used. Furthermore, the type of patient (totally non-cooperating, partially or fully cooperating) and the type of assistive procedures will determine the handling method used by caregivers to a certain extent. The type of handling associated with patient's functional mobility level will define different hazard levels. A handling type used for cooperating patients may result in a low hazard while for a non-cooperating patient the same handling method may produce a much

higher hazard. Analysing patient handling currently carried out in a given healthcare area should lead to quantification of different types of handling necessary to address both the choice of most appropriate handling mode and usage of aids in that situation and also the number of caregivers needed throughout the day.

3.2.1.2 Work organization

The overall work organization can modify the risk of injury. The number of caregivers carrying out patient handling and their organization (one or more caregivers) over the day is a crucial factor to assess along with handling frequency and mode. Furthermore, caregivers should be trained to safely perform each task and how to recognize hazardous workplaces, tasks, equipment conditions and time allocated to the task.

3.2.1.3 Posture and force exertion

During patient-handling activities, the spinal column of caregivers, especially the lumbar section, is subject to high mechanical loading (i.e. compressive and sagittal or lateral shear forces at the intervertebral discs). Biomechanical load through patient handling is regarded as one of the most relevant factors inducing low-back pain and the development of degenerative disorders at lumbar spinal structures. Lumbar load strongly depends on the mobility status of the patient, equipment in use, posture adopted and the forces exerted by the caregiver to perform the handling action. Patient handling often coincides with postures and asymmetric forces with respect to the median sagittal plane that result in relatively high biomechanical load and an increased overload risk. Awkward postures due to various elements and conditions (available spaces, equipment used, number of caregivers handling the patient and education and training) often lead to decreased abilities for force exertions and increased risk of injury from high loads being placed on body joints or segments. For postures, asymmetry may be due to arm position or lateral trunk flexion or torsion. Forces may act laterally or are bilaterally imbalanced. A reduction of high lumbar loads can be achieved by using biomechanically efficient transfer methods.

The caregiver should exert the force with a stable and balanced posture enabling application of his/her body weight to their environment (e.g. bed, chair, patient) and thus minimizing the forces acting on the back and shoulders.

3.2.1.4 Assistive devices

The lack, absence or inappropriateness, of aids and equipment is a hazard during patient handling. The application of appropriate aids and equipment is strongly recommended to obtain a vital load reduction for the lumbar spine and to limit the biomechanical overload risk for the caregivers. Equipment and facilities must be currently and properly maintained for safe usage. The equipment purchase process should be based upon clear task requirements (type of handling) and the environment where they are used, and thus result in the selection of equipment fit for the specific workplace and task conditions.

3.2.1.5 Environment

The environment where patients are handled may be a hazard if inadequate. All spaces where patients are handled should be considered for equipment use and correct handling postures. Additional factors such as thermal constraints, steps, thresholds, obstacles and slippery floors should be considered.

3.2.1.6 Individual characteristics

Individual skills and capabilities, level of training, age, gender and health status of the caregiver should be considered when carrying out a risk assessment. Skill and experience are likely to benefit the caregiver when performing the task and reduce the risk of injury. Training may increase the level of skill and ability to carry out a task. Clothing and footwear should be functional and should facilitate movement and a stable posture.

3.2.1.7 Patient characteristics

The patient's body weight may be a hazard by itself. In particular, bariatric patients require adequate equipment and space for their needs. Handling of even a part of the body may produce biomechanical

overload. Special hazards may arise in case patients oppose the motion for psychiatric or cognitive problems or issues due to medication. In this case, biomechanical load of musculoskeletal structures could be high.

From an operative point of view it is recommended to proceed with the next step (risk estimation/ evaluation) whenever there is a presence of non- (or partially) cooperating patients and one or more of the above quoted hazards/problems are identified.

The next step (risk estimation/evaluation) should include patient characteristics such as non- (or partially) cooperating patient, and/or body size and mass.

3.2.2 Risk estimation and evaluation

An accurate analytical risk assessment, including data collection for consequent preventive measures, should consider the presence of several factors and their interrelationships: type of patient; induced “care load”; available caregiver staff; available and adequate equipment; building; environment and spaces and training and skill of nursing staff. Given the above factors, the use of consolidated methods applicable to manual handling of objects (such as those reported in ISO 11228-1 and ISO 11228-2) for patient handling is difficult.

Annex A is devoted to risk estimation and risk evaluation:

A.1 reports an “oriented” review of several methods useful for the purposes of risk estimation or evaluation as intended in this Technical Report, as derived from literature or from relevant national or international guidelines.

The methods described are classified primarily in relation to their simplicity/complexity. Complexity generally entails a more involved task of risk estimation or detailed risk evaluation. Methods can also be classified in relation to the healthcare sectors in which they could be most effectively applied.

Users of this Technical Report should start with the information in Annex A to select the appropriate method to use for a simple or detailed risk assessment, depending upon the kind of hazards and risk factors identified in step 1, the healthcare sectors examined and the experience of the analyst in the use of the proposed methods.

A.2 presents guidelines, taken primarily from national sources, for risk assessment for manual patient handling and provides suggestions on any relevant issue (aids, environment, caregivers' training and education, etc.) directed to reducing risk. As such they are not actual risk assessment tools but do provide useful information.

A.3 reports, on the basis of the same scenario, practical applications of four methods (Dortmund Approach, TilThermometer, MAPO and PTAI), so the intended users can choose the most appropriate one for the situation to be assessed.

The risk assessment method used (estimation, detailed evaluation) should allow the collection of pertinent data regarding the type and quantity of required handling, availability and requirements of handling aids and equipment and the level of specific training received (and the consequent training needs) of caregivers.

The method used for risk assessment should allow risk classification by the three-zone model (green, yellow, red) and address the consequent action to take according to criteria given in Table 1.

Table 1 — Risk estimation/evaluation — Final assessment criteria

Zone	Exposure classification	Consequences
GREEN	ACCEPTABLE	Acceptable, no consequences.
YELLOW	NOT RECOMMENDED	Advisable to set up improvements with regard to structural risk factors or to suggest other organizational and educational measures. Further evaluation is required and adequate measures have to be done if necessary.
RED	UNACCEPTABLE/TO BE AVOIDED	Redesign or take actions to lower the risks.

3.3 Risk reduction

Where a presence of risk/problems resulted from the previous step, a comprehensive approach (multifactor interventions) for risk reduction should be adopted. The comprehensive approach is most likely to be successful. This approach should be based on the results of the analytical risk assessment. A proper risk/problem assessment is the basis for appropriate choices in risk reduction.

Risk reduction can be achieved by combining improvements to different risk factors and should consider, among other things:

— The adequate number and the quality of the staff for taking care of the different kind of patients.

— The selection and correct use of appropriate aids for handling patients. Aids should be chosen according adequate ergonomics and quality criteria (see Annex C).

— Adequate programs of staff information, education and training considered as part of the risk management system of the organization and as complementary to the other interventions types here considered (literature reports that interventions based solely on technique training had no impact on working practices or injury rates).

— The definition of a general risk management system and of clear policies and procedures by the organization.

A check on the effectiveness of the intervention (part of the risk reduction strategy) is highly recommended.

Annex B presents organizational aspects of patient handling interventions.

Annex C presents criteria for the choice and use of adequate aids and equipment.

Annex D presents information on buildings and environment for the aspects involved in this Technical Report.

Annex E presents information regarding the fundamentals of staff education and training.

Annex F presents information regarding the evaluation of intervention effectiveness.

Annex A
(informative)

Risk estimation and risk evaluation

A.1 Methods of risk estimation and evaluation

This annex provides a synthetic description of risk estimation and risk evaluation methods found in scientific literature. For each of them the main characteristics are described.

Method	Quantified factors	Main determinant risk factor/s	Benefits	Limitations	Type of use	When and where applied (also grey literature)
OWAS (Karhu et. al. 1977)	Postures of whole body, force and frequency	Posture of all body segments	It allows scoring as well as analytical speed; it considers all body segments and is useful for redesign. It fits analysis of nearly all working tasks. It can be used in all healthcare sectors.	It analyses posture-related aspects as the only determinant. It makes it difficult to define selection criteria of postures to be analysed. It requires some time commitment.	Analysis of gesture modes; it can be used in an effectiveness check system.	Though it has not been designed for this specific goal, it has been applied in risk assessment of operating theatres.
LBP as a function of patient lifting frequency (Stobbe et. al. 1988)	Average frequency of manual lifting by shift	Lifting frequency	It determines the manual lifting frequency and analysis speed. It may predict effects on caregiver's health. It can be used in hospital departments and at home.	It analyses only some types of handling (bed–wheelchair and vice versa, wheelchair–wheelchair) and action frequency is the only risk determinant considered.	Rough analysis of areas-departments more at risk	
BIPP (Feldstein 1990)	Full movement analysis: from preparation to implementation	It assesses preparation to movement, caregiver's position at beginning of movement, dynamic behaviour and at the end of movement repositioning, if necessary.	Task analysis seems to be exhaustive. Seven items are used to identify a final score of movement modes through direct observation analysis. It can be applied in all healthcare areas and also at home.	It neglects all the other risk determinants (frequency, environment, work organization, etc.).	It can be used in an effectiveness check system.	

Method	Quantified factors	Main determinant risk factor/s	Benefits	Limitations	Type of use	When and where applied (also grey literature)
REBA (McAtamney and Hignett, 1995)	Postures of full body, force mainly determined by handled loads	Posture of all body segments	Determination of scores, analysis speed useful to identify ergonomic problems associated with awkward postures and load manual handling. Extremely useful in hospitals and can be used in all healthcare areas.	Like OWAS it practically assesses posture as the only risk determinant. Actually the load exceeding 10 kg always produces a similar score. It is difficult to define the selection criteria of postures to be analysed. It requires a moderate time commitment.	Analysis of gesture modes. It can be used in an effectiveness check system.	
PATE (Kjellberg et. al. 2000)	Full movement analysis: from preparation to implementation	It assesses preparation to movement, caregiver's position at movement beginning and dynamic behaviour.	Task analysis seems to be exhaustive. 17 items are used to identify a final score of movement modes through video camera. It can be used in hospitals and at home.	It requires a video shot and hence may be expensive in terms of time. It analyses only manual movements and not those regarding bathrooms. It neglects all the other risk determinants (frequency, environment, work organization, etc.).	It can be used in an effectiveness check system.	
DINO (Johnson et. al. 2004)	Analysis of patient transfer manoeuvres	It assesses preparation, implementation and results with 16 items. Directly at workplace without movies.	Task analysis seems to be exhaustive. A final score of movement modes is identified. It can be used in hospitals and at home.	It neglects all the other risk determinants (frequency, environment, work organization, etc.)	It can be used in an effectiveness check system.	
Patient handling assessment (Radovanovic and Alexandre 2004)	Anthropometry, disability degree, furniture and environment	There is not one factor only, but all those that have been mentioned have the same impact.	Fast analysis with a score for 8 items. Assessment sum can identify crucial areas.	It must be carried out for each patient and at present it has been assessed only for two departments: Cardiology and Coronary Unit. It seems, however, oriented to assessing assistance rather than PMH risk.	Rough analysis of areas — departments more at risk	At time of publication of this Technical Report, it had been applied in only two wards.