

# Risk assessment by M.M.C. in the occupationally exposed health care workers as by UNI ISO 11228-2:2009

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## Abstract

**Introduction:** diseases and musculoskeletal disorders for biomechanical overload (D.M.S.) are prevalent among health workers and are one of the main causes of sickness absence in many activities.

We want to present the obtained results after the measurement of the initial force, and the holding force for the action of pushing and pulling in manual handling of loads (M.M.C.) of equipment by health personnel.

**Materials and Methods:** the risk assessment by M.M.C. in the occupationally exposed health care workers, has only affected the action of pushing and pulling of equipment such as stretchers, medications carts barracks, wheelchairs, beds for patients. The measurement of Initial Forces and Retention Forces relating to the action of pushing and pulling, as by UNI ISO 11228-2:2009.

**Results:** in general, most of the equipments that have shown a synthetic risk index (I.S.R.)  $\leq 1$  devices were in good maintenance; on the contrary, most of the equipments that have shown a I.S.R.  $> 1$  were particularly obsolete equipment and in poor state of maintenance. Added to this is an incorrect way to use the equipment by staff.

**Discussion:** from the analysis of the results the importance of a protection and prevention service able to analyze and evaluate the risks in the hospital organization in order to achieve the right equipment to face harmful situations for the staff, is fundamental. Moreover a further investment for the information, vocational training and a specific reconsideration of working organization is essential.

**KEY WORD:** health personnel, moving and lifting patients, spinal injuries, staff workload.

## Introduction

Diseases and musculoskeletal disorders for biomechanical overload (DMS) are highly common among workers and they are one of the main causes for absence at working in many activities: about 25% of the workers of the European Union suffers from backache and 23% reports muscular pains; 62% of workers carry out recurring procedures with hand or arms for one-fourth of their scheduled time; 46% work in tiring or painful positions; 35% carries or moves heavy loads (1).

The chronic-degenerative illnesses of the backbone/ vertebral column and of the limbs, are usual among the most varied working communities of the industry, agriculture and tertiary sector, but as to the healthcare professionals they acquire a specific significance: as to economic and social outline they generate absence at work, medical treatment, changes in tasks, disability, in particular represent serious problems for those who deal with healthcare aspects (2).

Even if DMS have multiple causes (constitutional, registry, metabolic, endocrine and psychological), on many occasions mechanical and traumatic factors of professional nature can evoke them: when someone lifts, pushes or carries something, forces, which can originate an hostile effect on musculoskeletal system, can be produced.

This forces are normally felt by the person involved and are balanced by mechanical inner workings of the apparatus involved (3).

In Italy, according to some epidemiological surveys, at least five millions of workers carry out usual working activities which consist of manual movements of loads: among these workers, severe and chronic disorders and diseases of the back are widespread more than in any other working community (4). From a comparison among healthcare operators or not to the moving of the patient, the presence of pains in some body areas is undeniable. In particular 45% of the operators has backache in regard to not operators, 34% pains in their shoulders or neck in regard to 22%, 43% pains in their feet or legs in regard to 32% (5).

Between 2005-2009 DMS cases denounced at INAIL were 7926 in 2005, 9198 in 2006, 10427 in 2007, 12094 in 2008 and 16593 in 2009. In line with the test of Europe, this pathologies in Italy have become the most frequently denounced pathologies at INAIL; in 2009 the uphold of D.lgs 9<sup>th</sup> April 2008 and the addiction of the majority of DMS into the category of scheduled pathologies, has supported the emergence of the phenomenon and the improvement of the levels of the workers' security (6).

The most recurring injuries occur in the following percentage:

- effort injuries 2,4%
- Injuries from infections, parasitic agents and others 3,8%
- fractures 8,2%
- dislocation, distortion and lack of attention 32,9%
- wounds 13,3%
- bruise 25,6%
- others and not determined 14,6%.

INAIL database, among professional illnesses declared during the year 2012 and indemnified by 31st October 2013 related to "Industry and services management" reports 3014 notifications for "lumbar-disk hernia", 7242 notifications for "injuries by biomechanical overload of upper limbs", 447 notifications for "injuries by biomechanical overload of the knee" (7).

The consequences of DMS, from a social and economic point of view, are very hard for:

- the workers to whom health disorders cause personal sufferings and possible income reduction
- the employers who see their business efficiency reduced
- the country because they affect healthcare and social security costs.

The application and the examination of the rules in force as to health and security make DMS an avoidable risk (8).

Patients' hand-moving activities often require the use of strength, they can be recurring and prolonged and force the healthcare personnel to acquire incongruous and unsuitable postures (9). Among the many factors of the risk that can influence the upset of muscular and skeletal troubles for healthcare operators, it is useful to focus on the following ones: type and duration of activities inside the ward; number of operators available; patient's personal features (kind of disability, anthropometric parameters), operator's physical features (age, sex, anthropometric parametric, earlier pathologies, working seniority, ward and task seniority, professional experience, physical training), suitability and way to use supporting tools; features of areas and furniture; staff's vocational education, kind of clothes and shoes operators make use of (10).

The aim of this study is to evaluate the results by experiences related to hand moving loads activities on healthcare staff.

The rules of the title IV of D.lgs 9<sup>th</sup> April 2008 n.81 in accordance to close 2 of the title IV refers to the hand-moving activities of the loads that affect workers with risk of biomechanical overloads pathologies, as follows:

- manual handling of loads: the procedures of transport or support of a load by one or more workers, included the procedure to lift, to set down, to push, to pull, carry or move a load, which, for their features or in consequence of adverse ergonomic conditions, implicate risks of pathologies biomechanical overload, in particular disk-lumbar;
- pathologies by biomechanical overload: pathologies of the osteo-joint, muscular-tendon and nerve-vascular structures.

In addition to, in accordance to the same decree the employer judges, if possible during the planning stage, the condition of security and health connected to the job in issue taking into account the attached XXXIII, according to which the prevention of the risk of pathologies by biomechanical overload, in particular spine-lumbar, connected to the working activities of manual handling of the loads must take into account, in an in keeping way, the entirety of the elements of reference and of the individual factors of risk (11).

In 2009, the technical regulations of the series ISO 11228 (parts 1-2-3) were published in relation to the manual handling activities (lifting, moving, pulling, pushing, moving lightweight, loads at high frequency) are to be considered among those stated by the article 168, clause 3.

In particular, the goal of the UNI ISO 11228-2:2009 is that to give the limits recommended for the pulling and the pushing by whole body: it is a guideline to the evaluation of the factors of the risk considered important for the manual pushing and pulling, making possible the evaluation of the risks for the worker's health. The advice is applied to adult workers in good health and offers a reasonable protection to the majority of this working population and guidelines are based on applied studies on pushing-pulling tasks and on associated levels of musculoskeletal load, trouble/pain and resistance/weariness.

The procedure to evaluate the risk follows two methods: method 1 which gives a simple list of control of the risk of evaluation and psycho-physical perspective by which to evaluate a task quickly. The list of control focuses not only on the evaluation of the risk and of the threshold levels suggested, but also on the identification of the steps to reduce the level of risk and the method 2 which opts for an approach on three areas to define the level of risk (green, yellow and red).

The overall evolution determined by method 1 requires a classification of the risk on two levels: acceptable (green), unacceptable (red).

-Green zone (acceptable risk) - the risk of injury or wound is unimportant or at a low level for the whole population of the operators. No operation is required.

-Red zone (unacceptable risk) - an important risk of injury/illness exists.

It mustn't be neglected for the operators population. An instant action is required to reduce the risk (for example re-designing, working organization, workers' education and training).

Between these two areas, there's an intermediate yellow zone only in prevision of suitable revisions (12-14).

## Materials and methods

The risk assessment by manual handling of loads in the occupationally exposed health care workers of the hospital facilities PP.OO. of an important healthcare company in Campania was made between March and June 2014, taking into account only the actions related to pulling and pushing of tools such as medications carts barracks, beds for patients and stretchers and so on.

The measuring of the initial forces and of the forces of holding due to the action of pulling and pushing, as by UNI ISO 11228-2: 2009 was made by the use of an electronic device for forces, a digital dynamometer equipped with the following technical features:

- maximum endurance:  $\pm 0,2\%$  of the bottom scale
- measure frequency: 2000 Hz
- weight: 640 gr
- measure field: 500 N (50 kg)
- resolution: 0,10 N (1 kg)
- time conditions: temperature from 10 to 30°C, humidity from 15 to 80%.

The measurement of the pulling and pushing forces of an object on wheels or cogwheel (for example medications carts barracks) was made by uploading on the object the maximum weight which it could carry in normal conditions or in safety conditions.

## Results

On Table 1 results are reported, in its entirety and in details, the number and the kind of equipment undergone to the evaluation of the risk by MMC under the action of pulling and pushing (Table 1).

On 37 tools, 11 belongs to the stretcher category, 8 to wheelchairs category and 9 to bed category (4 old model beds 5 electrical beds). The tools have undergone to the evaluation of the MMC for the action of pushing but only 28 for the action of pulling.

The Figure 1a reports the number of tools with I.S.R.  $\leq 1$  (Acceptable Risk: Green zone) and with I.S.R.  $>1$  (Not Acceptable Risk: Red zone) for the action of pushing and pulling, in the same way, the Figure 1b reports the evaluations related to the actions of pushing and pulling.

The Figure 2 reports, both for the action of pulling and pushing of the stretcher, the percentages of acceptable risks (63,6%) and of unacceptable risk (36,4%). The values related to medications carts barracks

wheelchairs and beds have been tasted.

The values have always given mainly negative issues with a clear percentage of unacceptable risk (Figures 1a,b, 2).

## Discussion

The values achieved pave the way to some evaluations:

- in general, the majority of tools which have shown an  $ISR \leq 1$  (green zone) are devices not particularly dated back and in good conditions
- on the contrary, the majority of tools with an  $ISR > 1$  (red zone) are obsolete devices in very bad conditions. Added to this a wrong use of the tools by the healthcare professionals.

The analysis of the issues of the evaluation of ISR has underlined that for the action of pushing, the risk is not acceptable for the 48,6% of the examples ( $ISR > \text{red zone}$ ), on the contrary as to the action of pulling, the risk is not acceptable for the 57,1% of the examples ( $ISR > 1$  red zone): the importance of a Prevention and Protection Service, to analyze and evaluate the risk in hospital facilities, in order to get the suitable tools to face harmful situations for healthcare professionals, is essential. Nevertheless it is important to underline that, even if the culture of prevention is being to consolidate in healthcare professionals' ideas, a further investment on information, education and professional training is essential. It also depends on the working organization, the warranty of security and so every working situation must reflect on its deficiencies to carry out the best strategies able to achieve a more operating involvement of the staff in the process of security.

As to healthcare, the awareness of manual handling of loads is higher when the healthcare professionals are fully involved into the analysis and change of wrong behavior able to produce disorders.

**Table 1 - List and number of tools undergone to the survey.**

Typology of tools	Numbers of tools under evaluation of M.M.C	Numbers of tools undergone to the evaluation of M.M.C	
		Pushing action	Pulling action
Stretchers	11	11	11
Medications carts barracks	8	8	8
Wheelchair	9	9	0
Bed	9	9	9
<b>Total</b>	<b>37</b>	<b>37</b>	<b>28</b>

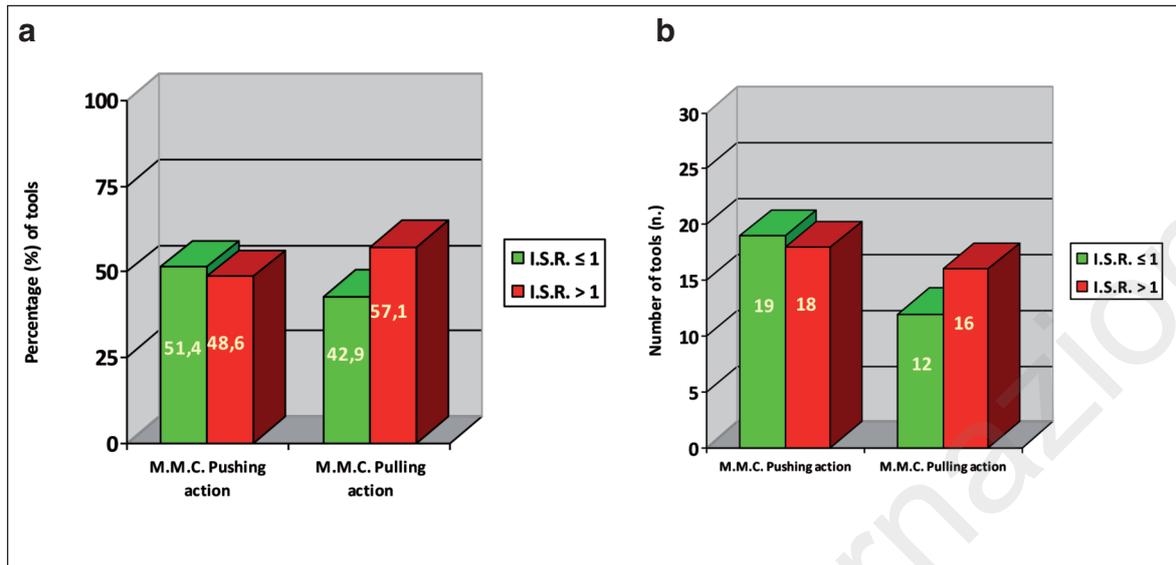


Figure 1 a, b - a) Number (n.) of tools with I.S.R. Acceptable ( $\leq 1$ ) and with I.S.R. not Acceptable ( $> 1$ ). b) Percentage (%) of tools with I.S.R. Acceptable ( $\leq 1$ ) and with I.S.R. not Acceptable ( $> 1$ ).

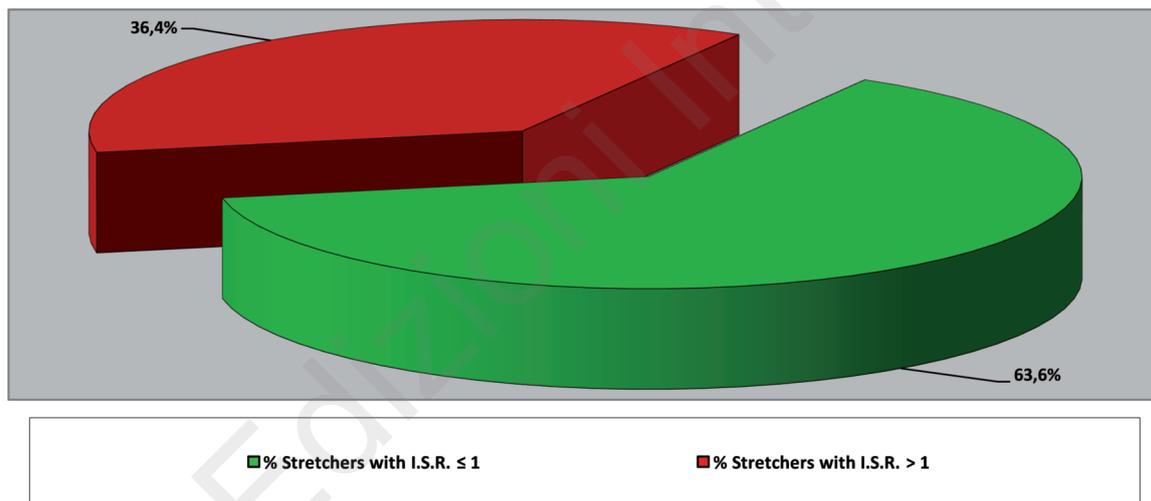


Figure 2 - Percentage (%) of stretchers with I.S.R. Acceptable ( $\leq 1$ ) and with I.S.R. not Acceptable ( $> 1$ ) under the action of pushing and pulling.

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