

## Abstract

The objective of this work was to determine the inter-rater reliability of the ERIN method.

- ERIN is an observational method developed for non-expert personnel to assess the exposure to risk factors related to musculoskeletal disorders.
- Thirty-nine raters (physiotherapists) evaluated eight tasks from video recordings. Each task was evaluated simultaneously while the video was projected in a room.
- The results of this study indicate that the ERIN method has acceptable levels of inter-rater reliability.

**Keywords:** ERIN method · Inter-rater reliability · Observational methods · Posture · Risk assessment · Assessment tool

## Introduction

The prevention of musculoskeletal disorders (MSDs) has been an area of interest for ergonomics researchers and practitioners for several years [1].

Consequently, several methods/tools have been developed to assess exposure to risk factors related to MSDs [3–5].

Among the available methods, observational methods have been the most widely used by ergonomics practitioners [3–5].

Individual Risk Assessment (ERIN) method was developed taken into account the needs, limitations, and capabilities of non-expert personnel to assess exposure to MSD risk factors in real contexts considered [7, 8].

ERIN has gradually grown in Latin American countries and other regions of the world since its initial publication. However, few reliability studies of the ERIN have been reported [9, 10].

The objective of this work was to determine the inter-rater reliability of the ERIN method.

## Methodology

### ERIN method

- ERIN can be used to evaluate static and dynamic tasks [7, 8].
- For its use, the task must be observed during several work cycles, and the critical posture of the trunk, arm, wrist, and neck body segments must be evaluated, as well as the frequency of movement for each body segment.
- The work rhythm (a combination of work speed and effective duration of the task); the intensity of effort (a combination of perceived effort using the modified Borg scale and the frequency of effort); and self-assessment (perception of the stress referred by the worker on the task being performed) are also evaluated [7, 8].

### Video Tasks

- Eight video tasks from different economic sectors were selected. A brief description of the task was included at the beginning of each video.

### Raters

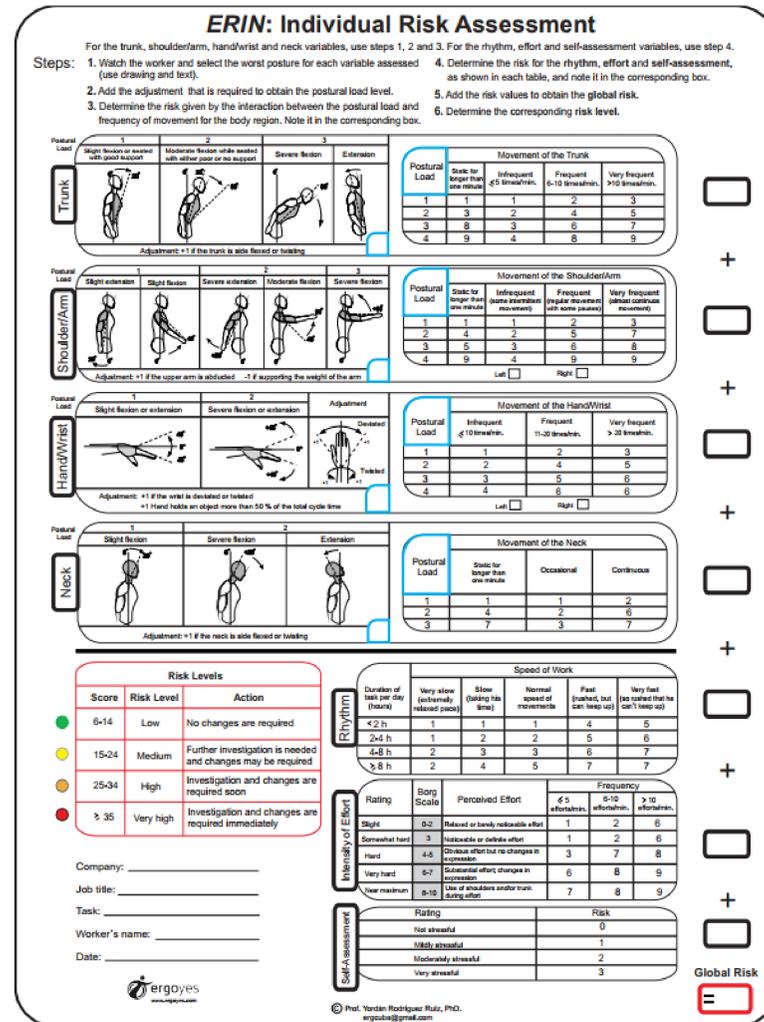
- Thirty-nine physiotherapists (31 women, 8 men) participated in this study.
- They had completed postgraduate studies lasting approximately one year: thirty-six in Occupational Safety and Health and three in Ergonomics.
- All physiotherapists had previous experience in ergonomic workplace assessment of more than three years.

### Training

- The 39 physiotherapists received a three-hour training in the use of the ERIN method. This training was led by an ergonomist.

### Task Assessment Procedures

- The evaluation of the eight selected video tasks was performed immediately after the training.
- All raters performed the assessments simultaneously in a room where the videos were projected.
- For the evaluation, they used the ERIN worksheet
- Raters were not allowed to exchange opinions and conversations with each other during the evaluations.



**ERIN: Individual Risk Assessment**

For the trunk, shoulder/arm, hand/wrist and neck variables, use steps 1, 2 and 3. For the rhythm, effort and self-assessment variables, use step 4.

Steps: 1. Watch the worker and select the worst posture for each variable assessed (use drawing and text). 2. Add the adjustment that is required to obtain the postural load level. 3. Determine the risk given by the interaction between the postural load and frequency of movement for the body region. Note it in the corresponding box. 4. Determine the risk for the rhythm, effort and self-assessment, as shown in each table, and note it in the corresponding box. 5. Add the risk values to obtain the global risk. 6. Determine the corresponding risk level.

**Trunk**

Postural Load: Slight flexion or seated with good support, Moderate flexion while seated with other post or no support, Severe flexion, Extension

Movement of the Trunk: Static for longer than one minute, Infrequent (5-10 times/min), Frequent (6-10 times/min), Very frequent (>10 times/min)

Adjustment: +1 if the trunk is side flexed or twisting

**Shoulder/Arm**

Postural Load: Slight extension, Slight flexion, Severe extension, Moderate flexion, Severe flexion

Movement of the Shoulder/Arm: Static for longer than one minute, Infrequent (5-10 times/min), Frequent (6-10 times/min), Very frequent (>10 times/min)

Adjustment: +1 if the upper arm is abducted, -1 if supporting the weight of the arm

**Hand/Wrist**

Postural Load: Slight flexion or extension, Severe flexion or extension, Adjusted

Movement of the Hand/Wrist: Static for longer than one minute, Infrequent (<10 times/min), Frequent (11-20 times/min), Very frequent (>20 times/min)

Adjustment: +1 if the wrist is deviated or twisted, +1 Hand holds an object more than 50% of the total cycle time

**Neck**

Postural Load: Slight flexion, Severe flexion, Extension

Movement of the Neck: Static for longer than one minute, Occasional, Continuous

Adjustment: +1 if the neck is side flexed or twisting

**Risk Levels**

Score	Risk Level	Action
6-14	Low	No changes are required
15-24	Medium	Further investigation is needed and changes may be required
25-34	High	Investigation and changes are required soon
> 35	Very high	Investigation and changes are required immediately

**Speed of Work**

Duration of task per day (hours)	Very slow (relaxed pace)	Slow (taking his time)	Normal speed of movements	Fast (frustrated, but can keep up)	Very fast (too fast that he can't keep up)
< 2 h	1	1	1	4	5
2-4 h	1	2	2	5	6
4-6 h	2	3	3	6	7
> 6 h	2	4	5	7	7

**Intensity of Effort**

Rating	Borg Scale	Perceived Effort	Frequency < 5 efforts/min	Frequency 6-10 efforts/min	Frequency > 10 efforts/min
Slight	0-2	Relaxed or barely noticeable effort	1	2	6
Somewhat hard	3	Noticeable or definite effort	1	2	6
Hard	4-6	Obvious effort but no changes in coordination	3	7	8
Very hard	6-7	Substantial effort; changes in coordination	6	8	9
Near maximum	8-10	Use of shoulders and/or trunk during effort	7	8	9

**Self-Assessment**

Rating	Risk
Not stressful	1
Mildly stressful	2
Moderately stressful	3
Very stressful	3

**Global Risk**

Fig. 1. ERIN method worksheet.

Worksheet available in the IEA congress app

## Results

- Sixteen categorical variables were analyzed. In eight, the agreement was moderate, the K values varied between 0.45 and 0.59, and in the other eight variables, the agreement was substantial; the K values varied between 0.61 and 0.80.
- When unifying the four ERIN risk levels into "No risk" (low and medium risk levels) and "Risk" (high and very high-risk levels), the agreement was almost perfect (K = 0.86).
- A good agreement was obtained for the total risk variable; the average value was ICC (2,1) = 0.62.

Table 2. Inter-rater agreement among physiotherapists (n = 39) from eight video tasks.

ERIN variables		Fleiss Kappa (K)*	Interpretation
Trunk	Posture	0.61	Substantial
	Frequency of movement	0.45	Moderate
	Adjust	0.65	Substantial
Shoulder/arm	Posture	0.61	Substantial
	Frequency of movement	0.54	Moderate
	Adjust	0.77	Substantial
Wrist	Posture	0.74	Substantial
	Frequency of movement	0.58	Moderate
	Adjust	0.80	Substantial
Neck	Posture	0.80	Substantial
	Frequency of movement	0.50	Moderate
	Adjust	0.69	Substantial
Intensity of effort	Intensity	0.50	Moderate
	Frequency of efforts	0.59	Moderate
Speed of work		0.59	Moderate
Risk levels (Low, Medium, High and Very High)		0.56	Moderate
No-Risk (Low-Medium)/Risk (High-Very High)		0.86	Almost perfect

\* (K) values interpretation: poor (< 0), slight (0.01–0.20), fair (0.21–0.40), moderate (0.41–0.60), substantial (0.61–0.80), and almost perfect (0.81–0.99).

## Conclusions

- The results of this study indicate that the ERIN method has acceptable levels of inter-rater reliability.
- Professionals interested in MSDs prevention can find in ERIN a valuable tool to consistently evaluate jobs/tasks and quickly identify which preventive actions can be applied.