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Clinimetric properties of the Brazilian-Portuguese version of the Quick Exposure Check (QEC)

Propriedades clinimétricas da versão para o português-brasileiro do "Quick Exposure Check" (QEC)

Maria L. C. Comper[1,2], Leonardo O. P. Costa[1,3], Rosimeire S. Padula[1]

Abstract

Background: Most of the available instruments aimed to assess risk exposure associated with work-related musculoskeletal disorders were originally developed in English, which makes their use difficult in countries such as Brazil. **Objective:** To test the clinimetric properties of the Quick Exposure Check (QEC) instrument previously adapted into Brazilian-Portuguese. **Method:** The original version of the QEC was translated and cross-culturally adapted into Brazilian-Portuguese and tested with 107 workers in two sectors of a textile factory. The internal consistency and construct validity were tested using only baseline values from the participants while reproducibility (reliability and agreement) was evaluated in a test-retest design with a seven-day interval. **Results:** The adapted version presented appropriate levels of internal consistency (Cronbach's α=0.76); moderate intra-observer reliability (ICCs ranging from 0.41 to 0.60); moderate to substantial inter-observer reliability (ICCs ranging between 0.62 and 0.86). The standard error of the measurement (SEM) ranged from 8.3 to 11.2 points. Moderate levels of construct validity (Pearson's r=0.38) were observed. **Conclusions:** The Brazilian version of the QEC has appropriate clinimetric properties for measuring different levels of exposure to ergonomics risk factors and can now be used by Brazilian researchers and Occupational Health professionals.

Keywords: risk assessment; ergonomics; reproducibility, validity, physical therapy.

Resumo

Contextualização: A maior parte dos instrumentos utilizados para avaliação dos fatores de risco de desenvolvimento dos distúrbios musculoesqueléticos relacionados ao trabalho foram originalmente desenvolvidos em língua inglesa, dificultando seu uso em países cuja língua primária não é o inglês, como é o caso do Brasil. **Objetivo:** Testar as propriedades clinimétricas do instrumento *Quick Exposure Check* (QEC) para o português-brasileiro. **Método:** A versão original do QEC foi traduzida e adaptada transculturalmente para o português-brasileiro e testada em 107 trabalhadores de dois setores de produção de uma indústria têxtil. A consistência interna e a validade de construto foram testadas utilizando apenas valores basais dos participantes, enquanto a reprodutibilidade foi avaliada em um delineamento de teste e reteste, com intervalo de sete dias. **Resultados:** A versão adaptada apresentou níveis adequados de consistência interna (α Cronbach=0,76), confiabilidade intraobservador moderada (ICC entre 0,41 e 0,60) e confiabilidade interobservador variando de moderada a substancial (ICC entre 0,62 e 0,86). O erro-padrão da medida (EPM) variou de 8,3 a 11,2 pontos. Níveis moderados de validade de construto foram observados (r de Pearson=0,38). **Conclusão:** A versão do QEC para o português-brasileiro possui propriedades clinimétricas adequadas para mensuração de diferentes níveis de exposição aos fatores de risco ergonômicos, podendo ser utilizada por pesquisadores e profissionais da saúde e segurança ocupacional.

Palavras-chave: avaliação do risco; ergonomia; reprodutibilidade; validade, fisioterapia.

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Introduction

The significant number of workers affected by work-related musculoskeletal disorders (WRMSD) has encouraged studies evaluating exposure to occupational risk factors. This exposure can be measured by direct methods, observational methods and questionnaires[1-3]. Direct methods require complex and specialized instruments, such as videocinematography, dynamometry, electrogoniometry and electromyography. These methods are recommended as the gold standard for validation for observational methods and questionnaires that assesses postures and movements because it provides more precise and accurate measures[3-6].

Self-report outcome measures are used to analyze the perception of workers regarding to possible risk factors that they are exposed. The large variability in perception of exposures, which may be associated with low precision, appears to be a problem with these questionnaires[4]. Therefore, it is recommended that questionnaires should be preferably used in combination with other measurement methods[7-9]. Observational methods are used to evaluate physical workload in order to identify hazards at work and monitor the effects of ergonomic changes. It allows the assessment of a considerable number of employees and different occupational activities[2]. However, the scoring system of these methods varies largely from one instrument to the other. In addition the cut-off points to classify the risk exposure are theoretically driven, rather than based on epidemiological data, which makes them largely limited and hypothetical[3].

Over the last years, many observational methods have been developed[1,3]. A recent systematic review identified 30 observational instruments for simultaneously analysis of posture, repetitive movements and material handling, most of them with acceptable clinimetric properties[2]. Among these, the Quick Exposure Check (QEC) stands out as one of the most important. The QEC is an instrument that allows the evaluation of occupational biomechanics and, simultaneously, assesses the perception of workers regarding the task demands and work conditions (Appendix 1). The advantage of this instrument is the scoring system, since the calculation is based on the interaction between the observer's technical assessment and the worker's opinion[10].

Even though there is a variety instruments available for use by health and occupational safety professionals, most of them were originally developed in English, which means that related research is hampered in countries where English is not the primary language. When such instruments are used in non-English speaking countries, most often have been used in the form of a literal translation produced without appropriate methods[11,12] as well as without appropriate clinimetric testing[13].

Accordingly, the best strategy would be to cross-culturally adapt existent instruments and test the clinimetric properties of the adapted version in the target country prior to their use in countries like Brazil[14]. A proper testing of clinimetric properties will ensure that the adapted questionnaire can be used with the same confidence as the original questionnaire. In addition of being economical, this procedure facilitates comparisons between the results of the same questionnaire in different cultures[12,14,15]. The QEC was translated and cross-culturally adapted into Brazilian Portuguese and the detailed description of this procedure was published elsewhere[16]. This study, therefore, aimed to test the clinimetric properties of the Brazilian version of the Quick Exposure Check (QEC)[10].

Method

Study design

This study aimed to test the clinimetric properties (i.e. internal consistency, reliability, agreement, construct validity, ceiling and floor effects) of the Brazilian-Portuguese version of the QEC.

The QEC is an instrument that assesses the ergonomic risk factors, including physical, organizational and psychosocial factors. It consists of an overview page with the items and scoring sheet (Appendices 1 and 2). The assessment form includes sixteen items that are divided into two columns. The first column should be completed by the technical observer and includes the assessment of postures and movements performed by cervical spine (neck), lumbar spine, shoulders and arms, wrists and hands. The second column, that must be completed by the worker contains questions regarding amount of weight handled, the time necessary to complete the task in question, the level of hand force exerted, visual demands, vibration, driving of vehicles, work pacing and stress[10,17].

The scoring sheet is divided into sections that allow obtaining the total score and partial risk, divided into biomechanical risk by body area and other specific risk factors. The QEC exposure scores for biomechanical risk are based on combination of risk factors identified by the observer for each body area and by the worker's subjective responses (e.g.: posture versus force, duration versus force, and posture versus exposure duration), while the score for the other four specific risk factors are based solely in the worker's answers. The total score ranges from 46 to 269 points and can be classified into four categories of exposure to risk: low (46-84 points), moderate (106-138 points), high (168-198 points) and very high (187-242 points)[10,17].

Clinimetric properties testing

A convenience sample of 107 workers from the sewing and finishing sectors of a textile manufacturing plant was recruited. The workers from these sectors were over 18 years of age and had at least finished high school, which facilitated the reading and comprehension of the questionnaire. The selection of the tasks included in this study was based on different biomechanical demands such as those involving dynamic or static features, repetitive or non-repetitive features, a small or great amount of force, and a standing or sitting postures. Table 1 presents the socio-demographic characteristics of the sample.

The workers completed the Brazilian version of the Quick Exposure Check and the Job Factors Questionnaire[11] instruments. We used this questionnaire in order to test the construct validity of the QEC. The Job Factors Questionnaire obtains information on the workers' perceptions regarding fifteen ergonomics risk factors. These factors were rated on a Likert scale ranging from zero to ten, where zero means "no problems" and ten indicates "the largest possible problem". The score can also be divided into three categories, the first 0-1, which represents no problem, the second 2-5, which means minimal to moderate problem and 8-10 indicates the presence of a severe problem[11,18,19].

In order to quantify risks from the biomechanical postures and movements required in the respective work tasks, five physical therapists with previous experience in occupational health and safety (OHS) were trained as observers. Data collection occurred in the work sectors. Each worker was observed simultaneously by the five technical observers for a period of 15-20 minutes while performing their tasks. The results of this evaluation were scored in the first section of the instrument and in individual forms from each observer. Then, a single observer interviewed the workers about the questions regarding their opinions on the risk factors (items of the second section of the instrument) and all observers recorded these answers in their forms. These procedures were performed in two phases: at baseline, when 107 workers were interviewed and observed, and seven days after baseline, when 99 workers who had previously participated, were again observed and interviewed. In this phase, nine workers were absent from work for a variety of reasons including vacation, medical leave or firing. Thus, a total of 99 workers were included in the reproducibility tests.

All participants were informed about the objectives and procedures of the study and were invited to participate by signing an informed consent form that had been approved by the Universidade Cidade de São Paulo (UNICID), São Paulo, SP, Brazil ethics committee (# 1658/2010).

Table 1. Socio demographic characteristics (n=107).

Variable	
Gender	
Female	102 (95.3)
Male	5 (4.7)
Age (years)	27.6 (7.5)
Employment Time in the Company (months)	19.5 (24.7)
Time in the Same Function (months)	13.3 (17.7)
Task	
Silicone Application	4 (3.7)
Finishing	4 (3.7)
Sewing	20 (18.7)
Quality Control	5 (4.7)
Packing	12 (11.2)
Shaping/Pairing	12 (11.2)
Flaming	9 (8.4)
Machine Sewing	6 (5.6)
Marking	4 (3.7)
Turning	10 (9.3)
Reworking	10 (9.3)
Reviewing	7 (6.5)
Separation	4 (3.7)

Continuous data are mean (SD), categorical data are N (%).

Data analysis

Statistica Package for Social Sciences Software (version 17.0) was used in all analyses. The description of each statistical test and their interpretation for each clinimetric property is provided as it follows.

Internal consistency

Internal consistency assesses the homogeneity of the questionnaire's items by calculating the Cronbach's alpha index (α). Ideally α should range between 0.70 and 0.95. Values above 0.95 express redundancy of items, whereas values below 0.70 indicate that the items have low a correlation among themselves[13].

Reproducibility

Reproducibility checks the similarity of results through repeated measures in stable conditions[13]. The term reproducibility is an umbrella term for two clinimetric properties: reliability (relative measurement error) and agreement (absolute measurement error).

Reliability refers to the consistency of a measurement and free from error, when all related conditions are

constant[20]. There are several types of reliability that are considered depending on the type of study. In this study, we tested the intra and inter-observer reliability, both considering the combination of answers the observer and the worker, as proposed by the QEC. Intra-observer reliability examines the stability of data recorded by the same observer on two or more occasions, while inter-observer reliability determines the variation between two or more observers when using the same instrument to measure the same situation[21]. For the analysis of the intra and inter-observer-reliability, the Intraclass Correlation Coefficient (ICC) type 2,1 was used with the following classification proposed by Streiner and Norman (1995): <0.40 poor, 0.40 to 0.75 moderate, 0.75 to 0.90 strong; >0.90 excellent[22].

Agreement (absolute measurement error) expresses the variability of the scores in repeated measures and is calculated by the Standard Error of Measurement (SEM). SEM is expressed by the standard deviation of the differences of the test and retest divided by the square root of 2. SEM is always expressed in the units of the instrument, which eases the interpretation of the absolute measurement error[13].

Construct validity

Construct validity analyzes whether the instrument can measure the construct for which was developed. It includes the degree of correlation between an instrument and other measures that assess similar concepts (in the case of this study, the Job Factors questionnaire[11], in its numerical scale, was used). In this study, the construct validity was tested by comparing the results of the initial application of the Brazilian-Portuguese version of the QEC[16] and the Job Factors Questionnaire[11] using the Pearson's correlation coefficient (r).

The construct validity ranges from weak to good, being considered weak if r<0.30; moderate if 0.30≤r<0.60 and good if r≥0.60 (21)[18]. The level of significance was set at p<0.05.

Results

The internal consistency of the Brazilian version of the QEC was appropriate, with a Cronbach's α of 0.76. Reliability analysis considered the answers of the observers, the workers and the questionnaire scores. Since there was no statistically significant difference between the scores, the results of this study refer to a combination of the observer's and the worker's answers. Therefore, the results of intra and inter-observer reliability showed in Tables 2 and 3 refer to a combination of the observer's and the worker's answers.

Intra-observer reliability was considered moderate, with intraclass correlation coefficients ranging from 0.41 to 0.60 for the total score. This result was similar for most items scored by body area (cervical spine or neck, lumbar spine, shoulders and arms, wrists and hands) (Table 2).

The inter-observer reliability was higher than previously presented values. The ICCs ranged from 0.62 to 0.86, reaching moderate to substantial reliability by body area (Table 3). In addition, the results for agreement were also good with SEMs ranging from 8.3 to 11.2 points.

A moderate construct validity was observed between the results of the Brazilian version of the QEC and the Job Questionnaire (r=0.38).

Table 2. Intra-observer reliability of the Brazilian version of the Quick Exposure Check from 107 workers of 13 different tasks in a 7 days interval.

Body Area	Examiner 1 + workers	Examiner 2 + workers	Examiner 3 + workers	Examiner 4 + workers	Examiner 5 + workers
	$ICC_{2,1}$ (95% CI)	$ICC_{2,1}$ (95% CI)	$ICC_{2,1}$ (95% CI)	$ICC_{2,1}$ (95% CI)	$ICC_{2,1}$ (95% CI)
Cervical Spine (Neck)	0.46	0.16*	0.53	0.50	0.58
	(0.29 to 0.60)	(-0.04 to 0.34)	(0.37 to 0.66)	(0.34 to 0.64)	(0.43 to 0.69)
Lumbar Spine	0.45	0.42	0.53	0.40	0.57
	(0.27 to 0.59)	(0.24 to 0.57)	(0.38 to 0.66)	(0.22 to 0.55)	(0.42 to 0.69)
Shoulders and Arms	0.61	0.19*	0.40	0.52	0.43
	(0.47 to 0.72)	(0.01 to 0.36)	(0.22 to 0.55)	(0.36 to 0.65)	(0.26 to 0.58)
Wrist/Hand	0.35	0.49	0.42	0.45	0.46
	(0.16 to 0.52)	(0.30 to 0.64)	(0.22 to 0.59)	(0.24 to 0.60)	(0.26 to 0.62)
Total	0.60	0.41	0.51	0.53	0.50
	(0.46 to 0.71)	(0.20 to 0.58)	(0.34 to 0.64)	(0.32 to 0.68)	(0.33 to 0.64)

* P>0.05.

Table 3. Inter-observer reliability of the Brazilian version of the Quick Exposure Check from 107 workers of 13 different tasks by 5 observers.

Body Area	$ICC_{2,1}$ (95% CI)
Cervical Spine (Neck)	0.62
	0.54 to 0.70
Lumbar Spine	0.70
	(0.63 to 0.77)
Shoulders and Arms	0.73
	(0.66 to 0.80)
Wrists and Hands	0.82
	(0.77 to 0.86)
Total	0.86
	0.82 to 0.90

Discussion

The aim of this study was to test the clinimetric properties of the Quick Exposure Check (QEC)[10] instrument in Brazilian-Portuguese. The QEC is simple and quick to use, that it is applicable to a wide range of work tasks, and that its original development was based on the opinions of occupational health professionals about the available instruments and their preferences regarding the format and approach of a tool for analyzing occupational risk factors[23].

In some aspects the QEC is different from other tools used to assess occupational risk. It allows both evaluations of different risk factors such as posture, frequency of movement, hand force exertion, material handling, vibration, driving of vehicles and visual and psychosocial demands of the task, as well as considers both observers' technical evaluation and worker's opinion when calculating the risk score[10,23].

Regarding the clinimetric properties, this study demonstrated adequate levels of internal consistency and reproducibility. Internal consistency is a measure of homogeneity of the questionnaire's items. This property evaluates if a group of items that compose one test or instrument is measuring the same construct[13,22]. Reproducibility is a clinimetric property used to verify the similarity of results through repeated measures in stable conditions by evaluating the relative (reliability) and absolute (agreement) error of the instrument[13].

In this study, the relative measurement error was tested by the intra and inter-observer reliability, both considering the combination of answers the observer and the worker, as proposed by the QEC. Intra-observer reliability was considered moderate while the intra-observer reliability ranged from moderate to substantial. These results are consistent, at least partially, with the properties of the original version QEC, that demonstrated "fair to moderate" levels of inter and intra-observer reliability[10].

The fact that the inter-observer reliability was higher than those obtained by intra-observer reliability is an interesting finding. This shows that the variability among the observer' responses was low, even with different experience levels. This characteristic eases the use of this tool by professionals with different scope of knowledge[16].On the other hand, the intra-observer reliability is influenced by the experience acquired by the observers during test application and changes in worker´s opinions that increase the chances of contradictions between answers over time. Other factors, including the capacity of the workers to judge their work conditions, the formulation of the questions and the scale of options for answering could also explain this finding[7,9].

The absolute measurement error (agreement) expresses the variability of the scores (considering the combination of answers the observer and the worker) in repeated measures and was calculated by the Standard Error of Measurement (SEM)[13]. The results show that SEMs ranging from 8.3 to 11.2 points, on a scale of 196 points. The low SEM between observers confirms the low variability intra-observer, as described previously.

The construct validity analyzes the degree of correlation between an instrument and other measures that assess the same or similar concepts[13]. In this study, it was confirmed by the moderate correlation between the Brazilian version of the QEC and the Job Factors Questionnaire[11]. The Job Factors Questionnaire was considered the most appropriate instrument for this study, since like the QEC, assesses occupational risk factors and considers the perception of workers in its scores. In addition, it is considering one valid and reliable instrument available for use in Brazil[11].Nevertheless, it scores risk in a different manner (i.e. it does not evaluate biomechanical exposure by different body parts), which may be the reason for the observed moderate correlation.

It is noteworthy that the guidelines recommend that the validity (criterion validity) needs to be tested by comparing one instrument with a "gold standard"[16]. However, there is no "gold standard" for all risk factors evaluated by the observational methods. It is possible to assess the biomechanical risks, mainly the postures and movements, using direct measurement methods[5,6]. Unfortunately, these methods have not been used in the study, precluding the criterion validity test. The authors consider that this is a limitation and we strongly recommend future studies using direct measurement methods for comparison with the QEC.

The results of this study indicate that the QEC can contribute in a satisfactory way to the monitoring of work conditions regarding risk identification and classification. However, as with other related instruments, weak arguments are used to select the items used for risk exposure measurement. This

may be due to either a scarcity of longitudinal epidemiological studies or to biomechanical analysis carried out in laboratories with normal subjects.

The clinimetric properties observed for the Brazilian version of the QEC, although moderate, are similar to those found by other observational instruments[2]. Therefore, we stress the need to perfect existing instruments to improve their reproducibility and differentiate situations of higher occupational risk. Further studies should also be carried out with the Brazilian version of the QEC to verify its applicability in clinical practice.

Conclusion

The Brazilian Portuguese version of the QEC demonstrated practicality, applicability, and satisfactory results for clinimetric properties, which was consistent with the characteristics of the instrument and the conditions of application.

Although some of its clinimetric properties were considered as moderate, we conclude that this instrument can be used by occupational health researchers and professionals to measure different levels of exposure to occupational risk factors in Brazilian workers.

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Appendix 1. Assessment form of Brazilian Portuguese version of the Quick Exposure Check (QEC), completed by the observer (posture and movements) and worker (other ergonomic risk factors).

Nome do trabalhador: **Data:**

Avaliação do observador	**Avaliação do trabalhador**
Coluna A Ao executar a tarefa, a coluna está: *(selecione a situação mais crítica)* A1 ☐ Quase neutra? A2 ☐ Flexionada, em rotação ou inclinação lateral moderada? A3 ■ Flexionada, em rotação ou inclinação lateral excessiva? B Para tarefas realizadas na posição sentada ou em pé parada. A coluna permanece em uma posição estática a maior parte do tempo? Selecione APENAS UMA das duas opções a seguir: B1 ☐ Não B2 ■ Sim OU Para tarefas de levantar, puxar / empurrar e carregar (ex: movimentar uma carga). O movimento da coluna é: B3 ☐ Infrequente (cerca de 3 vezes por minuto ou menos)? B4 ☐ Frequente (cerca de 8 vezes por minuto)? B5 ■ Muito frequente (cerca de 12 ou mais vezes por minuto)? Ombro/braço C Quando a tarefa é realizada, as mãos estão: *(selecione a situação mais crítica)* C1 ☐ Estão na altura da cintura ou abaixo? C2 ☐ Quase na altura do tórax C3 ■ Estão na altura do ombro ou acima? D O movimento do ombro e braço é D1 ☐ Infrequente (algum movimento intermitente)? D2 ☐ Frequente (movimento regular com algumas pausas)? D3 ■ Muito frequente (movimento quase contínuo)? Punho/mão E A tarefa é realizada com *(selecione a situação mais crítica)* E1 ☐ Punho próximo à posição neutra? E2 ☐ Punho em desvio ou flexão/extensão? F Os padrões de movimentos similares são repetidos? F1 ☐ 10 vezes por minuto ou menos? F2 ☐ 11 a 20 vezes por minuto? F3 ■ Mais que 20 vezes por minuto? Pescoço G Ao executar a tarefa, a cabeça / pescoço está flexionada ou em rotação? G1 ☐ Não G2 ☐ Ocasionalmente G3 ■ Continuamente	Trabalhadores H O peso máximo transportado MANUALMENTE POR VOCÊ nesta tarefa é? H1 ☐ Leve (5 kg ou menos) H2 ☐ Moderado (6 a 10 kg) H3 ■ Pesado (11 a 20 kg) H4 ■ Muito pesado (maior que 20 kg) J Em média, quando tempo você gasta por dia nesta tarefa? J1 ☐ Menos que 2 horas J2 ☐ 2 a 4 horas J3 ■ Mais que 4 horas K Quando você realiza esta tarefa, o nível máximo de força executado por uma mão é K1 ☐ Baixo (menor que 1 kg) K2 ☐ Médio (1 a 4 kg) K3 ■ Alto (maior que 4 kg) L A demanda visual desta tarefa é L1 ☐ Baixa (quase não é necessário observar pequenos detalhes)? *L2 ☐ Alta (necessita visualizar pequenos detalhes)? * **Se for alta, por favor forneça detalhes no espaço reservado abaixo* M No trabalho você dirige um veículo por? M1 ☐ Menos que uma hora por dia ou nunca? M2 ☐ Entre 1 a 4 horas por dia? M3 ■ Mais que 4 horas por dia? N No trabalho, você usa ferramentas vibratórias por N1 ☐ Menos que uma hora por dia ou nunca? N2 ☐ Entre 1 a 4 horas por dia? N3 ■ Mais que 4 horas por dia? P Você tem dificuldade de manter o ritmo desse trabalho? P1 ☐ Nunca P2 ☐ Às vezes *P3 ■ Com freqüência **Se for com freqüência, por favor forneça detalhes no espaço reservado abaixo* Q Em geral, como você classifica seu trabalho Q1 ☐ Pouco estressante? Q2 ☐ Levemente estressante? *Q3 ■ Moderadamente estressante? *Q4 ■ Muito estressante? **Se for moderadamente ou muito estressante, por favor forneça detalhes no espaço reservado abaixo*

** Detalhamento adicional para L, P e Q, caso seja apropriado*
* L
* P
*Q

The development of the Quick Exposure Check (QEC) for assessing exposure to risk factors for work-related musculoskeletal disorders. David et al.[10].

Appendix 2. Scoring sheet of Brazilian-Portuguese version of the Quick Exposure Check (QEC).

Pontuação da exposição

Nome do trabalhador: **Data:**

Coluna

Postura da coluna (A) & Peso (H)

	A1	A2	A3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Pontuação 1

Postura da coluna (A) & Duração (J)

	A1	A2	A3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Pontuação 2

Duração (J) & Peso (H)

	J1	J2	J3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Pontuação 3

Aplique APENAS 4 se for uma tarefa estática OU 5 e 6 se houver manuseio de materiais

Postura estática (B) & Duração (J)

	B1	B2
J1	2	4
J2	4	6
J3	6	8

Pontuação 4

Frequência (B) & Peso (H)

	B3	B4	B5
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Pontuação 5

Frequência (B) e Duração (J)

	B3	B4	B5
J1			6
J2			8
J3			10

Pontuação 6

Pontuação total para a Coluna
Soma da pontuação de 1 a 4 OU soma da pontuação 1 a 3 mais 5 e 6

_____

Ombro/braço

Altura (C) & Peso (H)

	C1	C2	C3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Pontuação 1

Altura (C) & Duração (J)

	C1	C2	C3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Pontuação 2

Duração (J) & Peso (H)

	J1	J2	J3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Pontuação 3

Frequência (D) & Peso (H)

	D1	D2	D3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Pontuação 4

Frequência (D) & Duração (J)

	D1	D2	D3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Pontuação 5

Pontuação total para o Ombro/Braço
Soma da pontuação de 1 a 5

_____

Punho/mão

Movimento repetitivo (F) & Força (K)

	F1	F2	F3
K1	2	4	6
K2	4	6	8
K3	6	8	10

Pontuação 1

Movimento repetitivo (F) & Duração (J)

	F1	F2	F3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Pontuação 2

Duração (J) & Força (K)

	J1	J2	J3
K1	2	4	6
K2	4	6	8
K3	6	8	10

Pontuação 3

Postura do punho (E) & Força (K)

	E1	E2
K1	2	4
K2	4	6
K3	6	8

Pontuação 4

Postura do punho (E) & Duração (J)

	E1	E2
J1	2	4
J2	4	6
J3	6	8

Pontuação 5

Pontuação total para o Punho/Mão
Soma da pontuação de 1 a 5

_____

Pescoço

Postura do pescoço (G) & Duração (J)

	G1	G2	G3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Pontuação 1

Demanda visual & Duração (J)

	L1	GL2
J1	2	4
J2	4	6
J3	6	8

Pontuação 2

Pontuação total para o Pescoço
Soma da pontuação de 1 a 2

_____

Direção de automóveis

M1	M2	M3
1	4	9

Pontuação para direção

_____

Vibração

N1	N2	N3
1	4	9

Pontuação para vibração

_____

Ritmo de trabalho

P1	P2	P3
1	4	9

Pontuação para ritmo de trabalho

_____

Estresse

Q1	Q2	Q3	Q4
1	4	9	16

Pontuação para estresse

_____

The QEC exposure scores for biomechanical risk are based on combination of risk factors identified by the observer for each body area and by the worker's subjective responses. The columns refer to the observer's answer and the rows refer to the worker's answers, with the exception of neck, driving, vibration, work pace and stress scores, which considers the worker's subjective responses only.