Latin Questionnaire: a threshold strategy for anamnestic screening of occupational musculoskeletal disorders through specific reference groups

Questionário Latino: estratégia de limiar para o diagnóstico anamnésico de distúrbios musculoesqueléticos relacionados com o trabalho através de grupos de referência específicos

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ABSTRACT | Introduction: Health surveillance programs conducted for both individual workers and working populations as a whole are managed by occupational health physicians and focus on disorders and diseases caused by biomechanical overload, primarily for preventive purposes. Objectives: The purpose of the paper is to update an anamnestic protocol for studying musculoskeletal disorders after more than 40 years experience of its application. The updated version has been re-named the Latin Questionnaire. The protocol enables preliminary epidemiological evaluation, by comparing results of exposed populations to those from a reference population, thanks to the introduction of a severity threshold, a concept lacking in similar questionnaires. Methods: The Latin Questionnaire is based on symptoms of discomfort, pain, and paresthesia. Each symptom is described in terms of location, duration, number of episodes, irradiation, and treatment. The model covers present symptoms during the previous 12 months and is designed to identify positive anamnestic cases (when positive according to the threshold), cases with minor disorders, and negative cases for conditions involving the spine and upper and lower limbs. Results: The updated anamnestic model was validated again through the collaborative effort involving 37 physicians from 14 Latin countries. To enable comparisons with exposed populations, an updated reference population (4,000 unexposed workers) is presented, evaluating the percentages of subjects positive according to thresholds for spine and upper and lower limbs and the incidence of acute lower back pain, broken down by gender and age groups. Examples of application of the questionnaire are also presented. Conclusions: The Latin Questionnaire, which has also been implemented in digital form (free download), allows selection of significant anamnestic cases compared to cases with minor disorders. This strategy is indispensable for correctly conducting preliminary epidemiological studies. Example applications confirm the presence of significant differences between the percentages of subjects with positive thresholds in exposed compared to reference groups, with surpluses proportional to their levels of biomechanical overload. Keywords | health surveillance; survey and questionnaires; musculoskeletal diseases; epidemiology; reference parameters.

RESUMO | Introdução: Programas de vigilância sanitária realizados tanto em trabalhadores individuais quanto na população economicamente ativa em geral são gerenciados por médicos de saúde do trabalho e se concentram em distúrbios e doenças causados por sobrecarga biomecânica, principalmente com fins preventivos. Objetivos: O estudo visa atualizar, após mais de 40 anos de experiência de aplicação, um protocolo de anamnese para o estudo de distúrbios musculoesqueléticos, re-intitulado Questionário Latino. Este questionário possibilita avaliação epidemiológica preliminar, comparando os resultados da população exposta com os da população de referência, graças à introdução de limiar de gravidade, conceito ausente em questionários semelhantes. Métodos: O Questionário Latino se baseia nos seguintes sintomas: desconforto, dor e parestesia. Cada sintoma é descrito considerando a localização, duração, o número de episódios, a irradiiação e o tratamento. O modelo, que abrange sintomas atuais e os 12 meses anteriores, destina-se a reconhecer casos de anamnese positiva (quando positiva de acordo com o limiar), casos com distúrbios leves e casos negativos para condições que envolvem a coluna vertebral e membros superiores e inferiores. Resultados: O modelo de anamnese atualizado foi novamente validado através da cooperação de 37 médicos de 14 países latinos. Para permitir comparações com a população exposta, propôs-se uma população de referência atualizada de 4.000 trabalhadores não expostos, avaliando a proporção de limiar positivo para a coluna vertebral e membros superiores e inferiores, distribuídos por sexo e faixa etária, além da incidência de lombalgia aguda. São apresentados exemplos de aplicação. Conclusões: O Questionário Latino, implementado também em formato digital (download gratuito), permite selecionar casos de anamnese relevantes em comparação com casos de distúrbios leves. Essa estratégia é indispensável para realizar estudos epidemiológicos preliminares corretamente. Os exemplos ilustrativos confirmam a presença de diferenças significativas entre a proporção de limiar positivo nos grupos expostos em comparação aos grupos de referência, com excedentes proporcionais aos níveis de sobrecarga biomecânica.

Palavras-chave | vigilância sanitária; inquéritos e questionários; doenças musculoesqueléticas; epidemiologia; parâmetros de referência.
INTRODUCTION

Health surveillance programs conducted for both individual workers and working populations as a whole are managed by occupational health physicians and focus on disorders and diseases caused by biomechanical overload, primarily for preventive purposes. Periodic health surveillance can be organized on three levels – level 1: programs are generalized, addressing all exposed workers and aiming to reveal “anamnestic cases”; level 2: clinical examination of subjects who test positive in the anamnestic examination; level 3: instrumental exams (X-rays, ultrasonography, electromyography [EMG] etc.) to determine diagnoses.

The most common work-related musculoskeletal disorders (WMSDs) involve the spine and upper limbs,1-6 while disorders affecting the lower limbs involve the hips and knees.7-9 The relationship with occupational biomechanical risk factors is less clear for the foot and ankle: the only risk factor cited by several authors is frequent use of pedals.

In order to facilitate the work of the occupational health physician conducting the clinical examinations to be carried out on exposed workers, the authors have developed a number of health surveillance models over the years, including a questionnaire.1-6

The purpose of this paper is to present an updated version of the questionnaire, renamed the Latin Questionnaire, to be used in the first level of health surveillance. The questionnaire has been improved on the basis of more than 40 years of application experience and re-validated with contributions from 37 physicians from 14 Latin countries. Its main aim is to offer a global anamnestic investigation of musculoskeletal disorders for the spine and upper and lower limbs, with a very useful filtering tool (severity threshold) for deciding which workers need the subsequent steps in the health surveillance process (clinical and instrumental testing). It constitutes a preliminary epidemiological investigation tool for recording the initial collective impact (already in the anamnestic phase) on the health of workers exposed to occupational biomechanical overload versus unexposed workers.

The main differentiating factor this questionnaire offers compared to other anamnestic models is the introduction of a severity threshold.

The Nordic Questionnaire10 is the most widely used questionnaire, describing musculoskeletal disorders that have occurred in the previous 12 months, but it does not explicitly include a severity threshold. Here, problems only arise when the results are processed collectively, for the purpose of epidemiological studies, given the extremely widespread nature of WMSDs, even in the unexposed reference populations (and moreover with differences by gender and age). In a substantial review11 of 256 studies administering the Nordic Questionnaire,10 the prevalence of musculoskeletal symptoms in the different occupationally exposed groups appears extremely high, on average between 60 and 90%.

Unfortunately, few statistical comparative studies between exposed and non-exposed subjects are available in the literature, adopting the aforementioned questionnaire.11 These studies rarely indicate significant differences in musculoskeletal disorders between exposed and unexposed subjects12 creating difficulties in interpreting the risk-damage relation.

The Latin Questionnaire, offering a threshold severity level, makes it possible to better standardize the results, classifying the workers analyzed as “positive anamnestic cases”, “minor disorder cases”, or definitively “negative cases”.

The initial version of this questionnaire,1-6 developed by the authors, was largely applied not only for studying exposed populations13,14 but also for populations not exposed to biomechanical overload, to respond to the need to define a relative reference group.1-4,15 This paper will present the updated questionnaire, its new validation, and the new relative reference group of more than 4,000 subjects, obtained from several different investigations.16,17

METHODS

This section is entirely dedicated to presentation of the Latin Questionnaire.


UPDATE PROCEDURE, GENERAL STRUCTURE, AND CONTENTS

The procedure to update the questionnaire involved: addition of a section dedicated to the lower limbs; addition of information about the level of biomechanical overload risk exposure, deriving from repetitive movements for the upper limbs, from manual lifting of loads for the spine, and from biomechanical overload for the lower limbs; and optimization of the layout and related coding to make compilation and interpretation easier.

The update did not affect the threshold levels, which were maintained as in the previous version.1-6 Here, we will be focusing on the anamnestic interview scheme proposed for the Latin Questionnaire for screening for WMSDs, primarily relating to the previous 12 months.

The questionnaire is divided into five main sections:

1 - Personal details: the main information concerning the worker and his/her position in the company (Annex 1A, section a).

2 - Upper limbs (Annex 1A, section b; Annex 1B, sections c and d);

3 - Spine (Annex 1C, section e; section f);

4 - Lower limbs (Annex 1D, section g; section h);

5 - Summary of musculoskeletal disorders, positive at the threshold (Annex 1D, section i).

The anamnestic questionnaire is designed to generate an accurate patient history, guided by anatomical illustrations and closed questions to help the healthcare operator compiling it to quickly collect the necessary information (by placing an “X” in the boxes provided).

Data collection is also facilitated by the fact that virtually the same scheme and criteria (described below) are used for all of the anatomical segments analyzed.

METHOD OF QUESTIONNAIRE ADMINISTRATION

These are the steps to be followed for collecting anamnestic data, for each of the sections considered in the questionnaire: a) show the subject the picture illustrating the anatomical site; b) ask the subject where problems have occurred in the last 12 months; and c) ask for more information only about anatomic areas reported as positive for general presence of any disorders (mark others as “negative”).

Once the guided questions focusing on each anatomical area addressed have been answered, it will be possible to define whether: a) the subject is a positive anamnestic case for that particular segment and side (i.e. is positive for the anamnestic threshold); b) the subject is a minor disorder case having not exceeded the threshold; or c) the subject is negative.

Only after obtaining this information, ask the subject with positive threshold or minor disorders: a) how many years the disorders have been present; b) if they have caused the subject to take sick leave; and c) whether the subject knows they suffer from any previously diagnosed diseases.

SPECIFIC CONTENTS

The specific content of each of the five sections mentioned above will now be illustrated.

Section 1 - Personal details (Annex 1A, section a)

Certain basic personal information is requested, such as name, date of birth (age), gender, company name, department, and length of employment. The date of completion and name of the person administering the questionnaire are also important.

Section 2 - Upper limb disorders

The recent anamnestic history section includes symptoms that have appeared over the previous 12 months, broken down by joint and divided into two categories: pain (Annex 1A, section b) and paresthesia (Annex 1B, section c). Presence of pain must be reported separately for each joint of the upper limb, as well as any radiating pain, and whether the pain appears while moving the joint, lifting weights, or also at rest. For the hand, the location of the pain should be indicated on the picture. Pain or paresthesia lasting only a few minutes is not considered for the purposes of determining an anamnestic case (a typical example
would be hand pain upon waking due to incorrect sleeping position).

The following information must also be included for each upper limb joint: past treatment; clinical tests/instrumental exams performed; and months or years since onset of the condition.

The second group of symptoms (Annex 1B, section c) includes paraesthesia (pins and needles, tingling, numbness), and whether the symptoms occur during the day or at night.

Each health condition is investigated through a set of standard questions, including the number of episodes of pain or paraesthesia that have occurred over the last 12 months, and their duration.

The duration and frequency of pain and paraesthesia that classify workers as anamnestic-positive cases (1-6), are based on the following criteria: presence of pain or paraesthesia lasting at least one week in the last 12 months, or at least one episode of pain or paraesthesia per month in the past 12 months.

This definition of an anamnestic-positive case is useful in epidemiological research and studies relating risk to occupational injury. Whilst they might not qualify as a precise clinical-diagnostic parameter, the above criteria may provide useful guidance for both individual and collective management.

In the section concerning the past medical history (ailments and illnesses before the last 12 months), subjects are asked if, having reported disorders in the last 12 months, they are aware of any previously diagnosed musculoskeletal pathologies (Annex 1B, section C3). In order to confirm such existing disorders, the subject is asked to produce the results of the relevant instrumental examinations documenting the pathology reported.

The part concerning the upper limbs ends with two sections: Annex 1B, section C4, which includes remarks on possible future treatments to be recommended to the subject, and Annex 1B, section d, which indicates the level of exposure to biomechanical overload, if known.

**Section 3 - Spinal disorders**

The anamnestic investigation model includes a part focusing on the spine, divided into 3 sections, cervical (Annex 1C, section E1), dorsal (Annex 1C, section E2), and lumbosacral (Annex 1C, section E3), using the same rationale for determining the type and duration of disorders.

Here the subject is asked to report any painful episodes and/or discomfort that have occurred over the previous 12 months.

A disorder is considered to be “positive” (over the positive threshold), when it meets the following criteria over the last 12 months: a) the discomfort, pain, or paraesthesia has been almost continuous; or b) the pain was episodic but significant in terms of frequency and duration. The most representative values are 3-4 episodes lasting 3-10 days; or six episodes lasting 2 days; or two episodes lasting 30 days. Other proportional combinations can be used.

If the pain is not defined as per situation a) or b) above, but is not entirely absent, then it is classified as a minor disorder.

The presence of a positive threshold must be defined separately for each of the three segments of the spine.

To simplify interpretation of the results, the conditions determining the presence of a positive threshold are identified with capital letters (Annex 1C, sections E1, E2, E3).

It is actually the use of a preset anamnestic threshold and a standardized data collection method for such disorders that makes it possible to compare the results with data derived from reference populations unexposed to biomechanical overload.

For the lower back, acute lumbar pain (Annex 1C, section E4) is reported separately. Acute lumbar pain is defined as “presence of intense lower back pain, with or without irradiation, that has caused immobility for at least 2 days, or 1 with medication”. When a worker reports more than three or four episodes of acute lumbago in the last 12 months, it is probably not true acute lumbago but may indicate a positive threshold for the lumbar spine.

In the section concerning the past medical history (ailments and illnesses before the last 12 months), subjects are asked if, having reported disorders in the last 12 months, they are aware of any previously diagnosed spine musculoskeletal pathologies (Annex 1C, section E5), such as, for example, a herniated disk. In this case, the subject is also asked to produce the results of the
relevant instrumental examinations, confirming the reported pathology.

The spinal anamnesis ends with two sections completed by the compiler, with remarks on possible future treatments to be recommended to the subject (Annex 1C, section E6), or for reporting the results for exposure level to biomechanical overload, when known (Annex 1C, section f).

Section 4 – Lower limbs disorders

The structure of this recently-added section (Annex 1D, section g), comprises questions about pain affecting the hips, knees, and feet. The definition of a positive threshold uses similar criteria to those adopted for the upper limbs, given that these disorders derive primarily from the inflammation of tendons and joints.

Section 5 – Summary of musculoskeletal disorders, with positive threshold in the last 12 months

The last part of the anamnestic questionnaire (Annex 1D, section h) includes body maps, which are useful for providing a visual summary of the anamnestic examination and the joints found to be positive at the various specific anamnestic thresholds.

LATIN QUESTIONNAIRE SOFTWARE TOOLS

The Latin Questionnaire is also supplied as a “simple tool” (software free to download from www.epmresearch.org/a57_free-software-n-english.html) to allow healthcare personnel, also without a specific expertise, to conduct preliminary epidemiological studies, processing the collective results of health surveillance activities, already at the first, purely anamnestic level.

The healthcare personnel in charge of filling in the anamnestic form presented here are required to enter basic, clearly specified, information into the software, such as personal details, positive thresholds, minor disorders, acute lumbago (at least one episode in the last 12 months), and disorders diagnosed previously. The software already includes the prevalence of musculoskeletal disorders in unexposed subjects. After uploading the data for a group of workers, histograms comparing the data for exposed and unexposed workers and their statistical significance are plotted automatically.

RESULTS

In this section, firstly the results of the validation of the updated questionnaire are reported, then the clinical data for the new reference groups, and finally examples of collective evaluation for two working populations exposed to biomechanical overload of the upper limbs.

VALIDATION TESTING OF THE ANAMNESTIC QUESTIONNAIRE

Considering the updates introduced, it seemed appropriate to proceed with re-validation of this updated model of the questionnaire. The inter-rater and intra-rater reproducibility of the questionnaire were tested by examining agreement between the results obtained by administering the questionnaire to 99 persons (n=42 in the 15-35 age group, n= 49 in the 35-55 age group, and n=8 in the 55-65 age group).

Each questionnaire was administered: a) by the same observer, in two sessions 2-3 weeks apart; and b) once more by a different observer.

37 medical doctors from 14 Latin countries participated in the study.

Inter-rater and intra-rater reliability were tested with the Kappa statistical methodology, according to Landis. The validation reported here concerns the results of the questionnaire with regard to the most salient data: anamnestic thresholds, minor disorders and acute lower back pain in the last 12 months (Table 1, part a) for intra-rater and part b) for inter-rater). The validation indicates that the updated questionnaire possesses good intra-rater and inter-rater reproducibility. The results obtained are not due to chance given the high Z-value.

REFERENCE GROUPS, OCCURRENCE OF MUSCULOSKELETAL DISORDERS IN WORKING POPULATIONS NOT EXPOSED TO BIOMECHANICAL OVERLOAD

The main purpose of computing and analyzing collective data is to detect significative higher percentages of anamnestic-positive cases in the study group, compared to a reference population of workers, with negligible or no occupational exposure.
to biomechanical overload. The reference population data are essential to enable preliminary epidemiological evaluations, even with anamnestic findings alone.

The data concerning the reference groups will be reported according to the following steps:

**Step 1 - General presentation of the updated reference groups**

The occurrence of musculoskeletal disorders in the general adult population not exposed to biomechanical overload represents the threshold beyond which higher percentages of disorders reported in exposed groups can be attributed to the specific working conditions, on which preventative actions should focus.

Considering the update of the questionnaire and possible ageing of the data resulting from studies prior to 2000,\(^1\)\(^6\) it seemed appropriate to update the reference groups with data derived from more recent clinical studies (Table 2). Study number 1 with 1,387 employees (data from L. Bossi’s thesis in Occupational Medicine, 2008, University of Milan), number 2 with 2,015 employees,\(^1\)\(^6\) and number 3 with 1,046 employees.\(^1\)\(^7\) The results obtained with the new reference groups were, however, very similar to the older data.

**Step 2 - Reference data for spine**

In Figure 1 (part a), histograms illustrate the percentages of subjects with anamnestic positive

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**Table 1. Statistical results of intra-rater (Table 1 a) and inter-rater (Table 1 b) reliability tests (99 subjects)**

| Salient questionnaire data                | Intra observer reproducibility test (part a) | Inter observer reproducibility test (part b) |
|-------------------------------------------|---------------------------------------------|---------------------------------------------|
|                                           | k (%) | z         | k (%) | z         |
| All anamnestic positive thresholds        | 79    | 32.36     | 58    | 17.01     |
| Upper limb positive threshold             | 84    | 30.88     | 59    | 13.73     |
| Lower limb positive threshold             | 61    | 8.00      | 54    | 6.52      |
| Spine positive threshold                  | 80    | 14.49     | 56    | 7.29      |
| Acute lumbago                             | 91    | 13.63     | 70    | 5.78      |
| All anamnestic minor disorders            | 75    | 28.04     | 61    | 16.50     |
| Upper limb minor disorders                | 78    | 17.95     | 45    | 6.18      |
| Lower limb minor disorders                | 69    | 12.08     | 41    | 4.98      |
| Spinal minor disorders                    | 73    | 15.82     | 54    | 9.04      |

**Table 2. Updated reference groups for workers not exposed to biomechanical overload, analyzed by gender and age**

| Age groups | Group No. 1\(^{st}\) 2008 | Group No. 2\(^{nd}\) 2010 | Group No. 3\(^{rd}\) 2018 |
|------------|---------------------------|---------------------------|---------------------------|
| Lumbar spine (n) | Cervical spine, upper limbs (n) | Spine, upper limbs, knees (n) |
| Male 15-25    | 25                        | 31                        | 57                        |
| 26-35         | 269                       | 417                       | 110                       |
| 36-45         | 219                       | 399                       | 140                       |
| 46-55         | 146                       | 197                       | 88                        |
| > 55          | 47                        | 76                        | 42                        |
| Total         | 706                       | 1,120                     | 431                       |
| Female 15-25  | 28                        | 48                        | 87                        |
| 26-35         | 236                       | 373                       | 187                       |
| 36-45         | 224                       | 252                       | 140                       |
| 46-55         | 174                       | 205                       | 135                       |
| > 55          | 19                        | 17                        | 66                        |
| Total         | 681                       | 895                       | 615                       |
| Male + female | 15-25                     | 53                        | 79                        | 144                       |
| 26-35         | 505                       | 790                       | 321                       |
| 36-45         | 443                       | 651                       | 250                       |
| 46-55         | 320                       | 402                       | 223                       |
| > 55          | 66                        | 93                        | 108                       |
| Total         | 1,387                     | 2,015                     | 1,046                     |
Part a) Anamnestic-positive thresholds for spine, LS hernia and acute lumbago (%) in reference groups

- **a)** % positive threshold for cervical spine in not exposed groups, by age and gender
- **b)** % of positive threshold for lumbar spine in not exposed groups, by age and gender
- **c)** % positive threshold for dorsal spine in not exposed groups, by age and gender
- **d)** % acute lumbago and lumbo-sacral (LS) hernia/protrusion in not exposed groups, by age and gender

Part b) Anamnestic-positive thresholds for upper and lower limbs in reference groups

- **a)** % positive threshold for shoulder in not exposed groups, by age and gender
- **b)** % of positive threshold for elbow in not exposed groups, by age and gender
- **c)** % positive threshold for wrist/hand in groups of not exposed groups, by age and gender
- **d)** % positive threshold for nocturnal paraesthesia in not exposed groups, by age and gender
- **e)** % positive threshold for different upper limb area in comparison, in not exposed groups, by gender
- **f)** % positive threshold for knee in groups of not exposed groups, by age and gender

**Figure 1.** Assessment of anamnestic-positive thresholds (%) in reference groups for spine (part a) and upper and lower limbs (part b).
thresholds (separately for cervical, dorsal, and lumbosacral disorders), and the incidence of acute lower back pain in groups of workers with negligible or no occupational exposure, broken down by gender and five age groups.

To facilitate epidemiological evaluation of the trends for disorders at various ages, the five age groups shown in Figure 1, were merged into three age groups (Table 3, part a) where the third group (age > 55) is maintained separate, since the prevalence of anamnestic-positive cases is seen to be significantly higher.

Observing the results, it is clear that the percentages of positive thresholds for cervical and lumbo-sacral spine are very low for the first two age groups, then rise exponentially in the last group, especially for women, among whom they even exceed 30%. On the other hand, the percentages of acute lower back pain and lumbosacral disk hernia remain low.

**Step 3 – Reference data for upper limbs and knees**

In Figure 1 (part b), histograms illustrate the percentages of anamnestic positive thresholds (separately for shoulder, elbow, wrist/hand, nocturnal paraesthesia, and knees) for groups of workers not exposed to biomechanical overload, broken down by gender and five age groups.

Table 3 (part b) summarizes the results obtained from an analysis of the distribution of positive thresholds for the upper limbs and knees, now broken down by three age groups. Data are still being collected.

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**Table 3. Spine, upper and lower limbs: positive thresholds (anamnestic cases) for reference groups broken down by age and gender**

| Part a) Positive thresholds for the cervical, dorsal, and LS spine (anamnestic cases), acute lower back pain, and LS herniation (%) | M | F | M | F | M | F |
|---|---|---|---|---|---|---|
| Cervical | Dorsal | LS |
| 15-35 | 8.6 | 22.0 | 21 | 3.3 | 42 | 12.4 |
| 36-55 | 15.5 | 32.5 | 40 | 7.3 | 106 | 21.5 |
| > 55 | 14.4 | 26.5 | 24 | 13.6 | 143 | 43.9 |
| Total for gender | 12.5 | 27.4 | 30 | 6.2 | 81 | 18.8 |

| Part b) Upper and lower limbs: positive pain thresholds (anamnestic cases) (%) | M | F | M | F | M | F |
|---|---|---|---|---|---|---|
| Shoulder | Elbow | Wrist/hand |
| 15-35 | 2.3 | 4.2 | 0.9 | 0.2 | 0.7 | 3.3 |
| 36-55 | 45 | 94 | 17 | 2.2 | 19 | 46 |
| > 55 | 59 | 181 | 13 | 0.0 | 13 | 0.0 |
| Total for gender | 37 | 75 | 13 | 12 | 13 | 39 |

| Nocturnal paraesthesia | Knees |
|---|---|
| 15-35 | 0.4 | 31 | 8.4 | 6.6 |
| 36-55 | 0.7 | 10.9 | 11 | 13.5 |
| > 55 | 0.0 | 176 | 190 | 19.7 |
| Total for gender | 0.6 | 74 | 8.9 | 11.1 |

F = female; LS = lumbosacral; M = male.
on positive thresholds for the pelvis and feet, also in reference groups.

**Step 4 – Diagnostic data for musculoskeletal pathologies: correspondence between positive threshold and pathologies already known to the workers in the reference group.**

A good correspondence was observed between the percentages of positive thresholds for traits determined by the questionnaire and the percentages of WMSDs diagnosed (based on instrumental examinations), for the subjects in the reference groups reporting diagnoses at the time of administration of the anamnestic questionnaire. A lower correlation was found only for nocturnal paraesthesia cases that proved to have little correspondence with presence of carpal tunnel syndrome as diagnosed using EMG. The reason is however known, since very few of the respondents, who were found to have a positive threshold for nocturnal paraesthesia, requested further clinical investigations for these disorders, not considering them worthy of further clinical investigation.

The percentages of positive thresholds for the upper limbs are quite low for all areas compared to those for the spine. On the other hand, shoulder disorders and nocturnal paraesthesia increase exponentially with age, tending to reach 20% for women. Surprisingly, the same pattern occurs for positive knee thresholds cases.

**EXAMPLES OF APPLICATION OF THE THRESHOLD QUESTIONNAIRE FOR PRELIMINARY EPIDEMIOLOCAL STUDIES, COMPARING RESULTS FOR EXPOSED POPULATIONS WITH THE REFERENCE GROUPS**

There are two ways of administering the anamnestic questionnaire, and each approach requires the data to be gathered differently: a) method 1– the healthcare professional administers the anamnestic questionnaire to workers before a clinical examination; or b) method 2 – the questionnaire is administered to groups of up to 10-15 exposed workers, under supervision by a trained healthcare professional or nurse. This method may be employed as a means of sharing information.

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| a) % positive pain thresholds for upper limbs in a group of supermarket cashiers (100, female) versus non-exposed females | b) % positive pain thresholds for upper limbs in a group of workers in a pork processing plant (310, male) versus non-exposed males |
| --- | --- |
| ![Graph a) % positive pain thresholds for upper limbs in a group of supermarket cashiers (100, female) versus non-exposed females](image1) | ![Graph b) % positive pain thresholds for upper limbs in a group of workers in a pork processing plant (310, male) versus non-exposed males](image2) |

**Figure 2.** Percentage of anamnestic-positive cases in two groups of exposed workers compared with reference groups for shoulder, elbow, wrist/hand, and upper limb nocturnal paraesthesia (noct.paraes.).
with workers and offers an excellent opportunity to explain the disorders (e.g. what causes them and how they can be prevented). Method 1 was used to obtain the data presented below.

Many applications of the model were conducted, but, due to editorial limitations only two examples are presented (Figure 2).

The examples presented here illustrate data from two groups of workers, the first consisting of 100 female supermarket cashiers and the second of 310 male subjects, employed in a pork processing plant. Given that these two groups had the same age distribution both among themselves and with respect to the reference groups, the percentages of anamnestic thresholds are referred to as a single age group. The data are for the percentage of cases with a positive threshold for the shoulder, elbow, wrist/hand, and nocturnal paraesthesia. In Figure 3, histograms illustrate the percentages of cases with a positive anamnestic threshold among the exposed workers, compared to the percentages of cases in the reference population. The two groups of exposed workers (supermarket cashiers and workers in a pork processing plant) feature a different degree of exposure to biomechanical overload of the upper limbs, both qualitatively and quantitatively.

The numbers of cases over the anamnestic threshold were high and the differences to the data from unexposed workers were statistically significant for the shoulder, elbow, wrist/hand (p < 0.001 according to the X² test). The difference in nocturnal paraesthesia was not statistically significant for these cashiers working in the specific supermarket that was investigated.

Even the few data presented indicate the importance of complementing the clinical screening of workers with a collective evaluation of results, comparing the percentages of positive thresholds observed in exposed and reference groups, separately for each different working area. This is important because, even in the absence of a risk assessment or in the presence of incorrectly performed assessments, the significant excess of the positive thresholds detected through the questionnaire compared to those of the reference groups demonstrates presence of risk for the anatomical area for which the excess is detected.

Ideally it would be advisable to compare the data for exposed subjects with data from unexposed people obtained in the same territory and period in which the epidemiological study is conducted: however, we are all aware of the costs and difficulties of creating more specific reference groups each time. So, rather than disregarding inferential studies, it is better to use the reference groups data provided here, recently obtained from numerous working populations.

Although the results of comparisons should be treated cautiously, when the differences between exposed and unexposed groups are large, exposure to biomechanical overload can be considered evident.

**DISCUSSION AND CONCLUSIONS**

The original model of the questionnaire was updated and optimized based on more than 40 years experience of its application and was re-named the Latin Questionnaire.

The updated anamnestic questionnaire model presented here differs from other models proposed in the literature mainly because it employs a positive threshold, which enables a predetermined level of severity to be used to select anamnestically significant cases, compared to cases with minor disorders. This strategy, even after only collecting anamnestic data, is indispensable for conducting preliminary epidemiological studies, thanks to the possibility of comparing well-selected collective data on an exposed working population with those of reference populations not exposed to biomechanical overload.

The Latin Questionnaire is also available in the form of a simple tool (software available to download free: www.epmresearch.org/a57_free-software-n-english.html)

Re-validation of the model was performed by 37 physicians in 14 Latin countries by administering the questionnaire to 99 people and indicated that the updated questionnaire possesses good levels of reproducibility in terms of both intra-rater and inter-rater reliability.

Considering that the questionnaire had been updated and the possibility that the previously
published data on reference groups, resulting from studies published prior to the year 2000, could have become out of date, the not exposed working population was updated on the basis of over 4,000 new cases. The results for the new reference groups were found to be very close to the previous results and are reported in this paper.

Example applications of the model confirm that when the level of exposure to biomechanical overload is high, the percentage of cases passing the anamnestic threshold are proportionally much higher in exposed than in unexposed workers.

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Author contributions

DC was responsible for study conceptualization, data curation, formal analysis, and methodology. She worked on project administration and obtaining resources. She produced dedicated software for validation of the study methodology. She was responsible for writing - original draft of the text. OM worked on developing the methodology proposed. She made fundamental contributions to investigation and data curation from the reference groups and was involved in supervision of the final test. NB made fundamental contributions to investigation and data curation from the reference groups. He did statistical and epidemiological validation studies on the results of the proposed methodology. He contributed to production of the dedicated software and was involved in supervision of the final test. EO did statistical and epidemiological validation studies on the results of the proposed methodology and was involved in supervision of the final test. MVP worked on data curation and investigation, testing the new methodology and the dedicated software, and was involved in supervision of the final test. AH played an important role in obtaining resources and was responsible for project administration and supervision of the final test. RF and ES worked on data curation and investigation, testing the new methodology and the dedicated software and were involved in supervision of the final test. All authors have read and approved the final version submitted and take public responsibility for all aspects of the work.
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