

# CIÊNCIAS SOCIALMENTE APLICÁVEIS:

INTEGRANDO SABERES E  
ABRINDO CAMINHOS

JORGE JOSÉ MARTINS RODRIGUES  
MARIA AMÉLIA MARQUES

(Organizadores)

VOL IX



EDITORA  
ARTEMIS

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## APRESENTAÇÃO

O nono volume desta colecção segue a lógica dos livros anteriores. Procura apresentar ao leitor uma coletânea de artigos sobre problemáticas que são transversais ao campo das ciências sociais aplicadas.

Sendo discutível, na metodologia seguida na organização dos vários volumes procurou-se privilegiar artigos que abordassem novas tendências e/ou problemáticas transversais relevantes, adotassem metodologias mais holísticas e/ou modelos de investigação aplicada, apresentassem estudos de caso nacionais e/ou internacionais e procurassem ser reflexivos. Nesse contexto, o nono volume está organizado em quatro grandes eixos – Planeamento e informação, Turismo, Saúde e ergonomia, Direito.

Na construção da estrutura de cada eixo procurou-se seguir uma lógica em que cada artigo possa contribuir para uma melhor compreensão do artigo seguinte, gerando-se um fluxo de conhecimento acumulado que se pretende fluido e em espiral crescente.

Assim, o eixo Planeamento e informação, é constituído por um conjunto de quatro artigos. O planeamento dos territórios urbanos influencia a arquitectura das cidades e os seus equipamentos. Assim, o recurso aos sistemas de informação geográficos e cadastrais, enquanto sistemas geradores de informação e conhecimento, poderão ser bons preditores e auxiliares de gestão do risco, quer das cidades quer dos seus equipamentos.

O eixo Turismo junta um conjunto de sete artigos que, em comum, contribuem para otimizar os serviços e melhorar a imagem do turismo e do património cultural. A afectação ágil de recursos às actividades que mais deles necessitam, em cada momento, é um bom indicador de eficiência e de qualidade do serviço prestado. Esta flexibilidade permite redireccionar os diferentes imaginários e expectativas culturais e espaciais dos turistas, nas diferentes épocas do ano.

No eixo Saúde e ergonomia, composto por seis artigos, subjaz que uma política de avaliação de serviços de saúde necessita da medição dos seus efeitos, da comparação com outros indicadores e de incentivos. Este pressuposto contraria a falácia de quanto mais idade se tem mais se sabe sobre sexualidade e reprodução. Os riscos associados a tal ideia induzem à forte necessidade de formação contínua e treino de competências para a prevenção e promoção da saúde, onde se incluem os métodos ergonómicos, por forma a poupar energia.

O eixo Direito é composto por quatro artigos. Os normativos legais, em geral, obedecem a princípios éticos universais. Contudo, ainda há muitas lacunas a superar, nomeadamente quanto aos direitos femininos, com a ganância e a corrupção sempre à espreita.

Com a disponibilização deste livro e seus artigos esperamos que os mesmos gerem inquietude intelectual e curiosidade científica, procurando a satisfação de novas necessidades e descobertas, motor de todas as fontes de inovação.

Jorge Rodrigues, ISCAL/IPL, Portugal

Maria Amélia Marques, IPS/ESCE, Portugal

## SUMÁRIO

### PLANEAMENTO E INFORMAÇÃO

#### **CAPÍTULO 1..... 1**

IMPACTO EN EL ESPACIO PÚBLICO DE LAS EXTERNALIDADES PROVOCADAS POR LA DENSIFICACIÓN RESIDENCIAL EN ALTURA

M. Eugenia Pallarés Torres

Mirtha Pallarés Torres

Jing Chang Lou

 [https://doi.org/10.37572/EdArt\\_2905238281](https://doi.org/10.37572/EdArt_2905238281)

#### **CAPÍTULO 2..... 14**

EQUIPAMENTOS: GERADORES DE URBANIDADE E CONSTRUTORES DE CIDADE: UMA ANÁLISE AO PATRIMÓNIO ARQUITETÓNICO DA CIDADE DO PORTO ENTRE 1930 E 2020

Ricardo Martins

Gonçalo Miguel Furtado Cardoso Lopes

 [https://doi.org/10.37572/EdArt\\_2905238282](https://doi.org/10.37572/EdArt_2905238282)

#### **CAPÍTULO 3..... 34**

CHALLENGES IN BATHING WATERS DROWNING RISK MANAGEMENT – A CASE STUDY IN THE MADEIRA ISLAND

Paulo Falé

André Rodrigues

Carlos Hermenegildo

Johnny Reis

 [https://doi.org/10.37572/EdArt\\_2905238283](https://doi.org/10.37572/EdArt_2905238283)

#### **CAPÍTULO 4..... 52**

ORGANIZAÇÃO E REPRESENTAÇÃO DO CONHECIMENTO CORPORATIVO

Maurício Barcellos Almeida

Christiano Pereira Pessanha

 [https://doi.org/10.37572/EdArt\\_2905238284](https://doi.org/10.37572/EdArt_2905238284)



## TURISMO

### **CAPÍTULO 5..... 64**

ADECUADA ASIGNACIÓN DE LOS RECURSOS EN SISTEMAS DE SERVICIO BAJO ENFOQUE LEAN SERVICES: CASO DE ESTUDIO INDUSTRIA DE HOSPITALIDAD

Hernando Garzón Saenz

Andrés Redchuk

 [https://doi.org/10.37572/EdArt\\_2905238285](https://doi.org/10.37572/EdArt_2905238285)

### **CAPÍTULO 6..... 75**

MEGALITHIC TERM IN INDONESIAN CULTURE PROBLEM AND ALTERNATIVE FOR SOLUTION PROPOSED

Lutfi Yondri

 [https://doi.org/10.37572/EdArt\\_2905238286](https://doi.org/10.37572/EdArt_2905238286)

### **CAPÍTULO 7 ..... 86**

COORDINANDO INVESTIGACIONES INTERDISCIPLINARIAS: DE IMAGINARIOS A PRÁCTICAS

Mabel Silva

 [https://doi.org/10.37572/EdArt\\_2905238287](https://doi.org/10.37572/EdArt_2905238287)

### **CAPÍTULO 8..... 97**

SISTEMA FOTOVOLTAICO AISLADO, DISEÑO PARA UTILIZAR EN LA MACROPLAZA DEL MALECÓN VERACRUZ: CONTRIBUCIÓN DE TECNOLÓGIA VERACRUZ, A MICROEMPRESA MÓVIL O FIJA DE ARTESANÍAS

Miguel Ángel Quiroz García

José Luis Fernando Palomeque Loyo

Alma Genoveva Castro Valdés

Cesar Von Putilitz Balderas

Enrique Sánchez Hernández

Angel Miranda Juárez

Reyna Matías Correo

Martha Bibiana Arriaga López

 [https://doi.org/10.37572/EdArt\\_2905238288](https://doi.org/10.37572/EdArt_2905238288)

**CAPÍTULO 9.....107**

SOME PRELIMINARY NOTES ON TOURISM: AN ANALYSIS TO START THE DIALOGUE

Antonia del Rosario Sánchez Gonzales

Marco Antonio Bazalar Hoces

Víctor Marcelino López Lino

Raúl Eleazar Arias Sánchez

 [https://doi.org/10.37572/EdArt\\_2905238289](https://doi.org/10.37572/EdArt_2905238289)

**CAPÍTULO 10..... 116**

LA ECONOMÍA SOCIAL Y SOLIDARIA Y LAS NUEVAS ORQUESTAS DE TANGO: DE LA TRANSFORMACIÓN DE LA CULTURA A LA CULTURA TRANSFORMADORA

Walter Tejada

 [https://doi.org/10.37572/EdArt\\_29052382810](https://doi.org/10.37572/EdArt_29052382810)

**CAPÍTULO 11.....122**

TRANSFORMACIÓN DIGITAL DEL TURISMO EN MÉXICO, 2023

Giuseppe Francisco Falcone Treviño

Zaida Leticia Tinajero Mallozzi

Joel Luis Jiménez Galán

 [https://doi.org/10.37572/EdArt\\_29052382811](https://doi.org/10.37572/EdArt_29052382811)

**SAÚDE E ERGONOMIA**

**CAPÍTULO 12.....136**

INDICATORS FOR QUALITY MONITORING IN HEALTH AND PATIENT SAFETY

Cristina Maria Antunes Martins d´Arrábida

Nuno de Almeida Alves

 [https://doi.org/10.37572/EdArt\\_29052382812](https://doi.org/10.37572/EdArt_29052382812)

**CAPÍTULO 13.....152**

SEXUALIDAD Y REPRODUCCIÓN, DOMINIO AJENO? PROSPECTIVA DE UN ESTUDIO CON MUJERES MILLENNIALS MEXICANAS

Martha Gálvez Landeros

 [https://doi.org/10.37572/EdArt\\_29052382813](https://doi.org/10.37572/EdArt_29052382813)

**CAPÍTULO 14..... 161**

PREVENÇÃO DE RISCOS PSICOSSOCIAIS NO TRABALHO – DO ASSÉDIO E MOBBING À FORMAÇÃO HUMANA, EM VARIÁVEIS COMO STRESS, ANSIEDADE E DEPRESSÃO

Nádia Catarina Lima

 [https://doi.org/10.37572/EdArt\\_29052382814](https://doi.org/10.37572/EdArt_29052382814)

**CAPÍTULO 15..... 169**

POSTURAL RISK ASSESSMENT OF OFFICE STAFF IN A PUBLIC UNIVERSITY

Julio César Cano Gutierrez

Alejandra García Becerra

Claudia Camargo Wilson

Jesús Everardo Olguín Tiznado

Juan Andrés López Barrera

Lidia Yolanda Ramírez Ríos

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Abraham Aranda Avilés

 [https://doi.org/10.37572/EdArt\\_29052382815](https://doi.org/10.37572/EdArt_29052382815)

**CAPÍTULO 16..... 180**

CALENTADOR DE AGUA SOLAR DE BAJO COSTO CON CIRCULACIÓN FORZADA AUTÓNOMA

Nicolás Di Lalla

Alejandro Luis Hernández

Andrés Emanuel Diaz

 [https://doi.org/10.37572/EdArt\\_29052382816](https://doi.org/10.37572/EdArt_29052382816)

**CAPÍTULO 17..... 193**

IDENTIFICACIÓN DE LA PRESENCIA DE ESTUDIANTES DE GERONTOLOGÍA EN EL DESEMPEÑO DE LA PRÁCTICA PRIVADA

Jaqueline Guadalupe Guerrero Ceh

José Francisco Duarte Méndez

Elías Contreras Cordero

Claudia Beatriz Novelo Berzunza

Ana Mary Noh Delgado

José Luis Canto Ramírez

 [https://doi.org/10.37572/EdArt\\_29052382817](https://doi.org/10.37572/EdArt_29052382817)

## DIREITO

### **CAPÍTULO 18.....203**

LA RREVOCABILIDAD DE LA REMISIÓN A PROPOSITO DEL CÓDIGO DE RESPONSABILIDAD PENAL DEL ADOLESCENTE EN EL PERÙ

Alberto Pablo Soto Alfaro

 [https://doi.org/10.37572/EdArt\\_29052382818](https://doi.org/10.37572/EdArt_29052382818)

### **CAPÍTULO 19.....214**

GÉNERO Y DERECHO: ANÁLISIS DE LA JURISPRUDENCIA ECUATORIANA EN TORNO AL DERECHO DE LAS MUJERES A UNA VIDA LIBRE DE VIOLENCIA DURANTE EL PERÍODO 1998-2008

Catalina Mendoza Eskola

 [https://doi.org/10.37572/EdArt\\_29052382819](https://doi.org/10.37572/EdArt_29052382819)

### **CAPÍTULO 20.....234**

EL CONTEXTO DE VIOLENCIA EN MEXICO Y EL NUEVO MARCO INSTITUCIONAL PROPUESTO POR LA NUEVA ESCUELA MEXICANA, GENERANDO LA CULTURA DE LA PAZ

Jorge Alberto Vidal Urrutia

José Arturo Morales Juárez

 [https://doi.org/10.37572/EdArt\\_29052382820](https://doi.org/10.37572/EdArt_29052382820)

### **CAPÍTULO 21.....245**

*THE NAKED OPTION, DELTA BOYS AND BIG MEN: AN ANALYSIS OF CORRUPTION IN THE NIGER DELTA*

Óscar Ortega Montero

 [https://doi.org/10.37572/EdArt\\_29052382821](https://doi.org/10.37572/EdArt_29052382821)

### **SOBRE OS ORGANIZADORES .....256**

### **ÍNDICE REMISSIVO ..... 257**

# CAPÍTULO 15

## POSTURAL RISK ASSESSMENT OF OFFICE STAFF IN A PUBLIC UNIVERSITY

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**ABSTRACT:** The aim of this study was to carry out an ergonomic evaluation in order to propose recommendations to help in the correction and prevention of musculoskeletal disorders (MSD) due to the postural load of 12

secretaries of a public university. To fulfill this purpose, the ergonomic methods ROSA, REBA, OWAS and OCRA Check List were applied to analyze the anthropometric and postural measurements. From the results obtained with the ROSA method, it was identified that 6 secretaries present postural risks; with respect to the REBA method, 7 secretaries register a medium risk level; finally, with the OWAS and OCRA Check List methods, the results show the absence of postural risk in the secretaries. Based on the analysis of the results, recommendations for ergonomic improvement in the workstations are proposed.

**KEYWORDS:** Ergonomics. Postural stress. Musculoskeletal disorders. Secretaries. Offices.

## 1 INTRODUCTION

The International Labor Organization (ILO, 2013) mentions that occupational diseases cause a greater number of deaths than occupational accidents, and that of the 2.34 million annual work-related deaths, about 2 million are caused by these diseases, and also mentions that technological and social changes and economic conditions are increasing the danger and creating new risks, causing an increase in workers with musculoskeletal disorders (MSDs) and occupational diseases associated with it. MSDs of occupational origin, are alterations in muscles, joints, tendons, ligaments, nerves, bones and the circulatory system, whose origin lies in the work and its environment, causing cumulative disorders resulting from exposure to repetitive activity or forced postures for prolonged periods (EU-OSHA, 2017) being one of the most frequent work-related diseases associated with high costs due to increased absenteeism. Among the most common MSDs are back pain and carpal tunnel syndrome (CDC, 2016 and NIOSH, 2004). MSDs unlike other occupational injuries, may have their origin not in a single factor, but in several, which include physical or biomechanical, psychosocial and individual factors (Garcia et al. 2013), caused by inflexible and high intensity work cycles, repetitive movements performed at high speeds, high productivity rates, as well as the use of ergonomic equipment and inadequate office furniture (Da Silva et al, 2014 and Muñoz and Velasco, 2015).

Based on statistics from the Ministry of Labor and Social Welfare (STPS, 2013), in Mexico, dorsopathy diseases, carpal tunnel syndrome and shoulder injuries represented at the national level 18.7%, 19% and 25.7% during 2014, 2015 and 2016 respectively; while in Baja California, during the same period they represented 17%, 16.4% and 19.8%. On the other hand, disability rulings according to their nature of injury, during the same period, dorsopathy disease represented at national level 13.1%, 13.5% and 14.7%, and in Baja California 8%, 15.6% and 16%. These statistics show the magnitude of the problem at

the national and state levels. In addition, the data indicate that the great majority of back diseases of this type are considered to be general diseases, unrelated to work, since they have been ruled as disability and not as permanent disability or occupational risk.

Nowadays, in jobs, they adopt a sitting posture due to the growth in the number of people using a computer. This posture is a risk factor for several diseases, such as diabetes, cardiovascular diseases and MSDs (Do Espírito et al. 2017). For a long time, it has been thought that office workers do not perform any physical effort and that being eight hours in front of a computer can cause some physical disorder or discomfort. The above has been studied evidencing the opposite, due to pain in the back, arms, eyesight, wrists, and neck, among others (Méndez and Sánchez, 2016) caused by the incorrect positioning of the computer equipment used about the furniture and equipment that integrates the physical workspace (Miller and Suther, 1983). This is probably because in our country there is no regulation regarding the ergonomic requirements of the workstation and work environment in offices and the conditions in which the computer equipment should be operated to optimize the physical and psychological health of the worker, ensuring their safety and productivity (Prado et al. 2014).

Therefore, according to García et al. (2013) MSDs have a very important impact in the workplace. Therefore, the evaluation and measurement of risk factors for this type of injury are of great importance, which is why this study aims to propose recommendations to help in the correction and prevention of MSDs due to the postural load of 12 secretaries of a public university. For this purpose, the postural assessment methods mentioned by López et al. (2014) as the most widely used, the Ovako Working Analysis System (OWAS) (Karhu et al. 1977), Rapid Entire Body Assessment (REBA) (Hignett and McAtamney, 2000), Rapid Office Strain Assessment (ROSA) (Snonne et al. 2012) and Occupational Repetitive Action (OCRA) Check List (Occhipinti and Colombini, 2005) were used.

The present article is presented in three sections. The first describes the method used to generate the results; the second section mentions the final comments, composed of the summary of results, conclusions and recommendations; the last section lists the references used in the article.

## 2 METHOD DESCRIPTION

First, the secretaries were informed of the possibility of participating in the study, mentioning the need to record them for one hour and take the corresponding anthropometric measurements. Out of 16 secretaries, 75% (12) agreed to participate

in the study. The video recording was made during peak activity hours to identify the work cycles and postures in the development of the task. To evaluate the postural load and the risk of MSDs in the secretaries, it was necessary to determine the degree of physical demand required by the activity and whether the physiological, biomechanical and anthropometric conditions of the work area or of the task itself were adequate or could cause risks to the worker. The MSD risk due to the postural load of the secretaries was evaluated first using the ergonomic methods OWAS, OCRA Check List, and REBA. Finally, the workstation was evaluated using the ROSA method. All the ergonomic methods were evaluated using recordings of each secretary, considering only the movements and postures with views in lateral position for the postural evaluation methods, as well as the measures and reach of the work tools for the ROSA method.

The tasks were divided into work cycles which were finally standardized into document review, computer use and telephone use. Finally, the videos were analyzed to be able to execute the evaluation of the ergonomic methods, which in the case of the evaluation of postures were OWAS, OCRA and REBA, using the equipment and the support of the software available on the Ergonauts website of the Polytechnic University of Valencia and the ROSA method with the use of the software available on the Lead Ergonomics© website.

### **3 FINAL COMMENTS**

#### **3.1 SUMMARY OF RESULTS**

The work cycles were selected based on the job description and the task frequency. Finally, three cycles were determined: a) document review, which consists of reviewing documents whose activities refer to taking, reviewing, stamping and placing the document; b) use of the computer, which refers to capturing information on the computer, either by capturing a document or directly on the screen, the activities are: taking the document, capturing information and leaving the document; and c) use of the telephone, which refers to the task of picking up, answering/calling and hanging up. Fifty percent (6) of the secretaries performed all three cycles and the rest performed at least one. Figure 1 shows some postural examples of the secretaries performing the aforementioned cycles.



Figure 1. Work cycles a) document review, b) computer use, and c) telephone use.



### 3.2 OWAS METHOD

As shown in Table 1, 67% (8) of the secretaries in the use of the computer had a rating of 2 and 33% (4) had optimal values. In the case of telephone use, 71% (5 out of 7) require corrective and future actions and 29% (2) do not require action. The maximum values are mainly presented by poor back posture, such as bending and twisting the trunk or both. The codes for the posture of the arms in three of the secretaries present values 3 which corresponds to having one arm raised and the other low. Regarding the legs and the load lifted, there are no remarkable values since they are always seated and the loads do not reach 1 kg.

Table 1. Results of the risk level of the secretaries with the OWAS method assessment.

Secretary	Level of risk by cycle			Action required
	Document review	Computer use	Telephone use	
1	2	2	1	Corrective actions required in the near future
2	2	2	2	Corrective actions required in the near future
3	2	2	2	Corrective actions required in the near future
4	2	2	2	Corrective actions required in the near future
5	2	2	1	Corrective actions required in the near future
6	N/A	1	N/A	No action required
7	N/A	2	N/A	Corrective actions required in the near future

Secretary	Level of risk by cycle			Action required
	Document review	Computer use	Telephone use	
8	N/A	1	N/A	No action required
9	N/A	2	N/A	Corrective actions required in the near future
10	N/A	1	N/A	No action required
11	2	2	2	Corrective actions required in the near future
12	2	1	2	Corrective actions required in the near future

### 3.3 OCRA METHOD

The risk level for this method did not represent a significant risk, no case exceeds the Check List Index value  $\leq 5$  except for secretary 10, which exceeded 5, although for all secretaries no action is required. The maximum values are presented mainly in the secretaries who carry out a single cycle (computer use), also, due to the similarity in the duration in the workplace and the frequency of the task in the work cycles, the results were very similar, as shown in Table 2.

Table 2. Results of the level of risk of the secretaries with the OCRA Check List method evaluation.

Secretary	Level of risk by cycle			Action required	Risk level of the work position			Action required
	Document review	Computer use	Telephone use		Document review	Computer use	Telephone use	
1	3.4	3.4	3.4	Optimal risk - no action required	4	4	4	Optimal risk - no action required
2	3.4	3.4	3.4	Optimal risk - no action required	4	4	4	Optimal risk - no action required
3	3	3	3	Optimal risk - no action required	4	4	4	Optimal risk - no action required
4	3.4	3.4	3.4	Optimal risk - no action required	4	4	4	Optimal risk - no action required
5	2.5	5.5	2.5	Optimal risk - no action required	4	7	4	Optimal risk - no action required
6	N/A	3.5	N/A	Optimal risk - no action required	N/A	7	N/A	Optimal risk - no action required
7	N/A	6	N/A	Optimal risk - no action required	N/A	7	N/A	Optimal risk - no action required

Secretary	Level of risk by cycle			Action required	Risk level of the work position			Action required
	Document review	Computer use	Telephone use		Document review	Computer use	Telephone use	
8	N/A	3.5	N/A	Optimal risk - no action required	N/A	7	N/A	Optimal risk - no action required
9	N/A	3.7	N/A	Optimal risk - no action required	N/A	4	N/A	Optimal risk - no action required
10	N/A	5.1	N/A	Risk	N/A	5.5	N/A	Optimal risk - no action required
11	3	2.6	0	Optimal risk - no action required	4.5	4.5	4.5	Optimal risk - no action required
12	2.6	2	0	Optimal risk - no action required	4	4	4	Optimal risk - no action required

### 3.4 REBA METHOD

Table 3 shows the results obtained from the evaluation with the REBA method by groups. The 38% (4) of the secretaries evaluated presented medium risk, while the remaining 62% (8) presented a low risk level, it can be observed that both wrist and arm are the parts analyzed with the highest score, suggesting the presence of repetitive movements and a poor distribution in the work areas.

Table 3. Results of the risk level of the secretaries with the REBA assessment method.

GROUP		SECRETARY			
		SECRETARY 1	SECRETARY 2	SECRETARY 3	SECRETARY 4
GROUP A	Neck	1	3	1	1
	Backstroke	1	1	2	1
	Legs	2	3	2	1
GROUP B	Arm	2	3	3	2
	Forearm	1	1	1	1
	Wrist	2	2	2	1
GROUP		SECRETARY 5	SECRETARY 6	SECRETARY 7	SECRETARY 8
GROUP A	Neck	1	2	1	1
	Backstroke	1	3	1	1
	Legs	2	1	2	2
GROUP B	Arm	2	1	2	2
	Forearm	1	1	1	1
	Wrist	3	2	3	3

GROUP		SECRETARY 9	SECRETARY 10	SECRETARY 11	SECRETARY 12
GROUP A	Neck	3	1	2	2
	Backstroke	1	2	3	2
	Legs	2	2	1	2
GROUP B	Arm	2	2	3	2
	Forearm	1	1	1	1
	Wrist	2	2	2	3

### 3.5 ROSA METHOD

Table 4 shows the final results of the secretaries' evaluations using the ROSA method. Scores of 5 or more are considered to indicate the presence of a risk for the worker, and further evaluation is pertinent, so 50% (6) of the secretaries present such a situation. The scores obtained are due to poor adjustment of the chair and poor positioning of the monitor.

Table 4. Results of the risk level of the secretaries with the ROSA method assessment.

Results of the ROSA evaluation									
Secretary	Chair	Monitor and Telephone	Keyboard and mouse	Final	Secretary	Chair	Monitor and Telephone	Keyboard and mouse	Final
1	5	4	4	5	7	4	2	3	4
2	4	5	3	5	8	3	3	2	3
3	4	7	2	7	9	3	6	3	6
4	5	4	3	5	10	4	3	2	4
5	4	4	3	4	11	4	3	3	4
6	5	5	4	5	12	5	3	3	5

### 4 CONCLUSIONS

The results obtained from the postural evaluations of the secretaries, it can be concluded that the OCRA Check List and REBA methods showed a low level of risk in the three cycles, however, with the results obtained from the OWAS and ROSA methods, there is a level of postural risk, due to the position of the back in the three cycles, the torsion of the trunk and the flexion of the neck, mainly in the use of the telephone, and the extension of the neck in the use of the computer. On the other hand, it is considered that the ROSA and OWAS methods for this study were more sensitive to the tasks performed in the secretaries' work cycles with respect to the OCRA Check List and REBA methods; however, they allowed inquiring about the risks associated with the secretaries' postures in these cycles. It is necessary to take corrective actions in

the three cycles to facilitate and improve the secretaries' postures in document review, computer use and telephone use.

## 5 SUGGESTION

To reduce the level of MSD risk in secretaries for computer use, telephone use and document review, it is recommended to modify the reach of the telephone, the posture when using the keyboard and mouse, the height of the desk and the conditions of the chair. Specifically, for cycle a) and b), secretaries need to place in the workspace a paper-rest with an adequate inclination (approximately 70°) to prevent the head from leaning forward and consequently flexing the back; and for cycle c), place cordless telephones to prevent arm extension/flexion and the elevation of one of the arms to hold the telephone. Likewise, the generation of training programs for workers to adjust their work implements according to their physical characteristics and comfort needs, in order to avoid musculoskeletal problems due to the conditions of their work (Montreuil et al. 2006). Additionally, it is advisable that the recordings made to workers to identify work cycles and postural analysis are made in a way that guarantees the performance of the task as close as possible to reality, because workers are aware that they are being photographed or videotaped and therefore do not adopt natural postures (Liebregts et al. 2016). In addition, it would be convenient to carry out other evaluations based on a longer recording time of the secretaries' tasks at their workstation, starting from a duration in the observation of the tasks and work cycles of at least 8 hours, in order to validate that the selected work cycles occur in the same way throughout a workday.

Finally, it is advisable to carry out a previous study regarding the health conditions of the participants, such as the application of questionnaires to investigate MSD problems of the secretaries (Akodu et al. 2015), in addition to analyzing the relationship between the pain presented in the various parts at risk with respect to the results obtained by the RULA method, or to have a clinical history of the employees involved (Zegarra and Andara 2012), who consulted their medical information; or if possible, to prepare a clinical history, relying on specialists in traumatology and occupational health (Vigil et al. 2007).

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## ÍNDICE REMISSIVO

### A

Ansiedade 161, 162, 163, 164, 165, 166

Anthropocene 245, 254

Asignación de recursos 7, 64, 70, 71

### B

Bathing waters 34, 35, 36, 40, 41, 42, 43, 44, 45, 46, 48, 49, 50

Bioética 194

### C

Calentador de agua solar 180, 181, 182, 183, 184, 191

Calentamiento global 97

Cidade 14, 15, 17, 19, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33

Constitución 92, 214, 215, 216, 217, 221, 228, 229, 230, 231, 233, 240

Coordinando 86, 87, 92, 95, 96

Corporações 52, 53, 54, 55, 56, 57, 59, 60, 61

Corriente Directa CD 97

Corruption 245, 246, 247, 248, 251, 252, 253

Covid -19 64, 65, 66, 72, 71, 73

Cuidador formal 194

Culture 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 108, 234, 235, 247, 254, 255

### D

Densificación residencial 1, 2, 4, 5, 7, 12

Depressão 161, 162, 163, 164, 165, 166, 167

Derechos de las mujeres 214, 215, 216, 229, 230, 231, 232, 233

Desenvolvimento urbano 14, 15, 16, 18, 21, 23, 25, 27, 33

### E

Economía social 116, 117, 118, 119, 121, 128

Economic disparity 245

Economy 107, 114, 130, 138, 247

Energía solar 98, 100, 106, 181, 182, 192

Equipamento 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33

Ergonomics 170, 172, 178  
Escola 51, 120, 158, 206, 210, 226, 234, 235, 236, 237, 239, 241, 242, 243, 244  
Espaço público 1, 4, 5, 6, 7, 9, 10, 11, 12, 13, 120, 209, 217, 232  
Estudante de gerontologia 194  
Expression 75, 76, 81, 83, 113  
Externalidades urbanas 1

## F

Formação 15, 19, 161, 163, 164, 165, 166, 167, 168  
Formação contínua 194, 201

## G

Género 118, 152, 155, 156, 159, 160, 162, 165, 167, 196, 214, 215, 216, 217, 220, 221, 222, 224, 227, 229, 230, 231, 232, 233  
Geographic Information Systems 34, 41  
Gestão da informação e do conhecimento 52, 53

## H

Harassment 161, 162, 164, 165, 168  
History 76, 79, 107, 113, 177

## I

Imaginários 86, 87, 88, 89, 94, 117, 155  
Indicators 112, 115, 136, 137, 138, 139, 140, 149, 150  
Indonesian 75, 76, 77, 79, 83, 84  
Industria de la hospitalidad 64, 66, 67, 71  
Instituciones 65, 95, 152, 157, 158, 159, 196, 199, 205, 207, 208, 209, 210, 234, 235, 237, 239, 240  
Integración sociolaboral 116, 117  
Interpretación judicial 214, 231  
Investigaciones interdisciplinarias 86, 87, 96

## L

Lean Services 64, 65, 67, 74

## M

Megalithic 75, 76, 77, 78, 79, 80, 82, 83, 84

Mercantilism 107

México 95, 96, 101, 103, 115, 122, 123, 125, 130, 133, 134, 135, 152, 160, 169, 170, 193, 196, 202, 234, 235, 236, 239, 240, 241, 243, 244

Mobbing 161, 162, 163, 164, 165, 167, 168

Modelo de negocio 122, 127, 129, 130

Musculoskeletal disorders 169, 170, 177, 178

Músicos autogestionados 117

## N

Nueva 5, 6, 73, 74, 127, 131, 215, 217, 221, 231, 234, 235, 236, 239, 243, 244

## O

Offices 170, 171

Ontologia 52, 53, 54, 56, 58, 59, 61

Orquestas de tango 116, 117, 118

## P

P2P 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 134

Patient Safety 136, 137, 138

Patriarcado 152, 158

Políticas 6, 12, 73, 114, 116, 120, 121, 125, 136, 137, 154, 158, 159, 160, 161, 163, 165, 166, 198, 212, 214, 216, 217, 228, 229, 231, 232, 234, 235, 237, 240, 244

Postural stress 170

Práticas 86, 87, 88, 89, 92, 93, 94, 119, 152, 154, 156, 157, 195, 197, 215, 216

Progresividad 203, 211, 212

## Q

Quality in Health 136, 138, 139

## R

Radiación 97, 101, 104, 105, 183, 184, 188, 190

Relação 14, 15, 16, 18, 19, 21, 23, 25, 28, 29, 30, 55, 57, 58, 88, 162, 163

Remisión 203, 204, 205, 206, 207, 208, 209, 210, 211, 212

Resistance 141, 148, 245, 248

Revocabilidade 203

Riscos Psicossociais 161, 162, 163, 164, 165, 166, 167, 168

Risk management 34, 35, 36, 41, 43, 49, 50

Risk of drowning 34, 36, 41

## S

Secretaries 170, 171, 172, 173, 174, 175, 176, 177

Sentencia 214, 218, 219, 220, 221, 222, 223, 224, 226, 227, 228

Servicios 2, 7, 64, 65, 66, 67, 68, 70, 73, 74, 108, 119, 122, 123, 126, 129, 130, 131, 134, 195, 197, 210

Servucción 64, 65, 73

Sexualidad 152, 153, 154, 156, 160, 227

Sistemas de informação 52, 53, 54, 59, 61

Solar 12, 97, 98, 100, 101, 103, 104, 106, 180, 181, 182, 183, 184, 186, 188, 189, 190, 191, 192, 212, 213

Stress 161, 162, 163, 164, 165, 167, 168, 170

## T

Term 75, 76, 83, 251

Trabalho 18, 19, 53, 60, 61, 161, 162, 163, 164, 165, 166, 167, 168

Transformación digital 122, 133, 134, 135

Transnational corporations 245

Turismo 64, 66, 73, 74, 86, 107, 110, 111, 113, 114, 115, 122, 123, 124, 125, 127, 128, 129, 131, 132, 133, 134, 135

## V

Verticalización residencial 1, 6, 7

Violencia 156, 160, 162, 214, 215, 216, 217, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 237, 238, 239, 240, 243, 244

Violencia de género 214, 216, 220, 221, 222, 224, 227, 229, 230, 232, 233

## W

West 37, 45, 78, 80, 107, 248