








Measurement of the ergonomic risk awareness in workers of moving companies in Lima, Peru

Monica Elisa Meneses-La-Riva, Dr.¹, Benjamin Di deus Ocupa-Meneses, BA¹, Josefina Amanda Suyo-Vega, Dr.¹, Víctor Hugo Fernández Bedoya, Dr.¹, Johanna de Jesús Stephanie Gago-Chávez, MsC.¹, Hitler Giovanni Ocupa-Cabrera, MsC.¹, and Giovanni Di Deus Ocupa-Meneses, BA¹

¹Grupo de Investigación Innovación Humanizadora, Universidad César Vallejo, Peru

*Corresponding author: mmenesesl@ucv.edu.pe

Abstract– *In the world, non-compliance with laws on occupational risk prevention is one of the factors that threatens labor quality. The objective of this study is to determine the perceived levels of ergonomic risk in workers of moving companies working in Lima, Peru. The research is of a basic type, with a quantitative, descriptive, non-experimental design and cross-sectional approach. The population consisted of a total of 70 workers who perform moving activities in Lima and who are hired by a moving company. The instrument used was the ergonomic risk awareness questionnaire consisting of 2 dimensions: geometric ergonomics risk awareness and temporary ergonomics risk awareness, with 17 items on a Likert scale. Results show that 100% of the workers present a medium level of ergonomic risk awareness. It was also observed that 100% of the workers present a medium level of geometric ergonomics risk awareness, while 65.71% of them present a low level of temporal ergonomics risk awareness and 34.29% a medium level. Finally, we recommend that managers of moving companies train their employees on ergonomics-related topics in order to increase awareness even more. We also encourage other researchers to carry out comparable investigations to further scholarly discussion on this novel topic.*

Keywords– *Ergonomic risk awareness, geometric ergonomics, temporal ergonomics, moving companies.*

I. INTRODUCTION

Currently, the lack of compliance with the law to address occupational risk prevention is a drawback that threatens the quality of working life [1]–[4]. This has caused that the majority of workers are exposed to suffer some type of injury and more with the inefficient supervision of the state to the companies. This has led to the fact that most workers do not have any type of health insurance, nor a life insurance policy in case of occupational accidents, illness, injury and/or death during the course of their work in developing countries such as Peru [5]–[8].

On the other hand, the Pan American Health Organization and the World Health Organization state that occupational health is related to the work of workers, who must enjoy and maintain a high degree of well-being in all aspects, physical, mental and social, through the practice of certain methods that allow them to take care of themselves such as risk control, use of ergonomics, among others [9].

Thus, the most important factors that favor occupational

health are the working conditions and the work environment, which are highly valued worldwide because they have the power to mitigate inequalities and favor the development of humanity, which in the future will exterminate extreme poverty. Large companies have occupational health services, in charge of advising on the improvement of working conditions and continuously examining their health status, likewise, it indicates that 85% of small companies do not have any type of occupational health coverage, in case of any labor emergency, which is established as the main agents of occupational morbidity [9].

Likewise, the International Labor Organization estimates that 6500 workers die every day due to occupational diseases; in the same way, 1000 workers die due to occupational accidents, indicating that 2.78 million workers die every year, likewise, every year non-fatal occupational injuries occur in the world, affecting an average of 374 million workers, which generates an excess in the annual GDP expenditure, as a consequence of poor occupational safety and health practices within companies. Ergonomic hazards can lead to excessive physical and psychological stresses, both concerning incorrect planning of the actions to be performed, incorrect ergonomic training affects the performance of employees and also the performance of the company. To prevent this, it is very important that companies adopt drastic preventive measures in order to reduce ergonomic risks [10], [11]. It is suggested that companies take into account the possible occupational health problems due to an inadequate distribution of the work environment where daily activities are performed, and also train workers in the use of resources to avoid inadequate working postures [12], [13].

In short, Peru is no stranger to these serious occupational health problems, because to date more than 20 thousand occupational accidents are registered every year [14]. According to the latest report of the Ministry of Labor and Employment Promotion indicates that about 20 876 occupational injuries were recorded and the national region with more cases of occupational accidents is Lima-Metropolitan, which accumulates a total of 14 931 reported cases [14]. Likewise, the occupational safety and health law which is Law N^o 29783, is so the state seeks the compliance of the norms, but, they are not strict with the compliance of it [15].

Digital Object Identifier: (only for full papers, inserted by LACCEI).

ISSN, ISBN: (to be inserted by LACCEI).

DO NOT REMOVE

On the other hand, SMEs are more exposed to their workers suffering from injuries and/or diseases that can threaten their lives. Hence the importance of seeking to analyze this issue of occupational ergonomic risks in order to analyze, identify and propose some alternatives for improvement for the benefit of workers [16]

The Regional Confederation of Business Organizations of Murcia pointed out that prevention-focused ergonomics and risk ergonomics are preventive techniques designed to adapt the conditions and organization of occupations to people, and their purpose is to study the ultimate role of workers in their jobs [17]. To perform these different functions, the field of ergonomics alternates into the following branches: Geometric Ergonomics, Temporal Ergonomics. Pointed out that prevention-focused ergonomics and risk ergonomics are preventive techniques designed to match the conditions and organization of occupations to people, and their purpose is to study the ultimate role of workers in their jobs. To perform these different functions, the field of ergonomics alternates in the following branches: Geometric ergonomics. Investigating workers in the work environment, paying individual attention to the size and particularities of the job, such as the worker's effort and posture. Temporal ergonomics. It is based on the study of time. We are not only interested in the importance of the workload, but also in the way it is distributed throughout the working day, rest time and working hours [17]

The study also aims to identify the main ergonomic risk factors through the multiple tasks performed by the workers of a moving company. In this way, to establish strategies that allow an adequate supervision with the purpose of avoiding the least affectation to the worker. Studies according to Arias [18], indicates that the operation within the work area, which does not require a large physical load, which is why these companies do not usually perform ergonomic risk research; on the contrary, if ergonomic research is conducted in these offices, ergonomic risks caused by misuse and incorrect design of workstations, future occupational diseases will be reduced and the risk of employees suffering from disability is high. The results obtained show that 55% of the workers who perform their activities in offices, manifest postural difficulties, also 7% of them caused victims for the same cause [18]. Likewise, workers in supermarkets, stevedores and others face a variety of occupational risks that may be related to occupational diseases [19].

On the other hand, health professionals, as a result of their work, are exposed to suffer from psychosocial stress problems, thus the importance that the hospital area is gradually examining periodically the health status of its medical staff, in order to identify deficiencies and increase safety in the health conditions of the staff [20]. In addition, Berrones [21], argues that labor situations that affect professionals such as precarious work where they work more than 60 hours a week and also do not have benefits such as: medical review, paid holidays, Christmas bonus among others. On the other hand, the analysis

of the job, according to the global average of the workers' statements, indicates that 72.02% of the workers have a perception of excellent and good for the total of the categories studied and only 8.11% consider themselves to be in bad conditions. However, when talking to the workers, it is possible to deduce that they are not aware of the work risks to which they are exposed. Other risks and demands do not seem to be known to them and, therefore, although they suffer and are affected by them, they do not identify them as a concern, and see them as something inherent to the work that cannot be modified [21].

At the national level, Infantes and Yampi refer that the problematic on the quality of life in the worker, it is necessary the training of the worker to reduce the physical load and implement ergonomics systems for an improvement in productivity [22]. For Bustos, by implementing ergonomics, the number of worker absenteeism has been reduced from 23 to 10. In addition, through the implementation, the employee turnover rate can be reduced from 11.26% to 6.32%, thus generating higher income, because the collaborators are more stable and allow to obtain higher performance than employers [23].

On the other hand, De La Cruz and Viza report that 70% of employers stated that sometimes that they took correct preventions announced by the company in a way to preserve their health. Likewise, workers recognize that from time to time such preventive measures are practiced [24].

Ergonomic risk is defined as risks related to the workplace where accidents, diseases and various injuries can be caused. Therefore, all latent risk factors should be evaluated and identified and may consider an influence on the worker's physical, mental and social well-being, in order to adopt the necessary measures that are able to control and avoid such risks [25]–[27]. In the same line, the ergonomic risk in the type of sedentary people are more affected by this action through long periods of time, recognizing 3 types of profiles: A) People with sedentary jobs, such as administrative types or those with long period in offices, mainly people who work in front of the computer, B) Housewives and retirees, who use long cycles of time to be lounging or watching TV and finally, C) Students, the population where they are more affected by diseases, which concerns the health field [28]

Geometric ergonomics is the relationship between the individual, metric circumstances and condition of their workspace, with a tendency to follow the geometric comfort limit through: Positional comfort, is the proper relationship between the body and the workspace, which is considered the outstanding anthropometric data, in which the design of the workspace and the principles that make it up, which the chairs, tools, as well as the appropriate positions, likewise, the kinetic-operational comfort, is the muscular displacement with respect to the coupling of the activity that analyzes and designs controls and instruments with respect to the performance of energy consumption, fatigue and effort, which are determined

by precision, flexibility, speed and muscular fatigue, therefore safety is directed to the care of the worker against the harmful elements of the machine [29].

Likewise, temporal ergonomics is the relationship of the worker's comfort with working times, such as, breaks, shifts and rhythms, having considered the type of organization it belongs to. It also studies work schedules, work duration, improving breaks and rests, determining the fatigue-rest relationship with respect to physical and psychological aspects [29], [30]. Next, temporary ergonomics considers that forced postures are working postures that cause one or different anatomical regions to move from a comfortable natural posture to a forced posture that causes excessive flexions or rotations resulting in the production of injuries due to overloading. Likewise, excess weight is considered a major risk factor, if it is heavy enough in relation to the amount of weight being lifted, it can lead to acute damage as a result of a single action [31].

It should be noted that excessive movement is defined as those continuous or repetitive movements prolonged during the work of the worker, involving the development of activities, as well as the realization of equipment and materials, being movements comprised by the complete displacement of the body of one of its segments in space [32].

Therefore, the set of activities performed between the conception of a job and its execution, it is essential to take preventive health actions to deduce the occupational risks. From the ergonomic perspective, the progress of the physical design of the workplace should be based on the adaptation of the work area to the kinetic demands, thus operationalizing the activity of people [33]–[35].

According to, Kumar presents the multivariate interaction theory, it shows that the disorders in the psychomotor system have a multifactorial type origin since it interacts with points of genes, morphological and psychosocial (own of the person) and biomechanical (coherent with the demand), even when it is assumed that the injuries of the psychomotor system are biomechanical by nature [36].

Feuerstein also argues that the theory of the multidimensional model contains the term "work method", which is intended to describe why workers exposed to identical tasks vary in the progression and exacerbation of signs in better limbs. The term "work method" was determined by the creator as a personal chief of knowledge, physiological reactivity and behaviors that possess site as work labors are done [37].

Finally, occupational health have been produced models just like: the control model, social support and demand, the imbalance model, effort and reward and among others. Whose purpose is to demonstrate the consequences of occupational risks such as: stress, depression, accidents, and cerebrovascular risks and among others [38].

II. METHODOLOGY

The present study is a quantitative, descriptive, non-experimental, cross-sectional design [39].

The population is made up of a total of 70 workers who perform moving activities. The inclusion criteria are: workers who perform moving activities in the company in Lima, workers who are hired and have been with any company for an average of more than 1 month, and workers who wish to participate voluntarily in the study. An ergonomics questionnaire was used, consisting of 2 dimensions: "geometric ergonomics" and "temporal ergonomics", with 17 items on a Likert scale.

The sum of the values obtained for each item made it possible to calculate the levels of each variable and dimension. Thus, for the variable "ergonomic risk awareness" the values calculated could be classified as low (20-47), medium (48-74) and high (75-102). As for the dimensions, the "geometric ergonomics risk awareness" was classified as low (13-30), medium (31-49) and high (50-67); and the "temporal ergonomics risk awareness" as low (7-16), medium (17-27) and high (28-39).

After data collection, they were processed and analyzed statistically, using the program Microsoft Excel 2021, by coding the responses acquired according to the established variable. The results were presented in tables with percentages and frequency. Throughout the research process, the ethical principles of research were complied with, requesting authorization for the execution of the study, as well as informed consent from each person included in the research.

III. RESULTS

It is observed in Table I that 100% of the workers present a medium level of "ergonomic risk awareness".

TABLE I
FREQUENCY DISTRIBUTION OF THE VARIABLE "ERGONOMIC RISK AWARENESS"

Level	Frequency	Percentage
Low	0	0.00%
Medium	70	100.00%
High	0	0.00%

It is observed in Table II that 100% of the workers present a medium level of "geometric ergonomics risk awareness".

TABLE II
FREQUENCY DISTRIBUTION OF THE VARIABLE "GEOMETRIC ERGONOMICS RISK AWARENESS"

	Frequency	Percentage
--	-----------	------------

Level		
Low	0	0.00%
Medium	70	100.00%
High	0	0.00%

Finally, it is observed in Table III that 34.29% of the workers present a medium level of "temporal ergonomics risk awareness", while 65.71% of them have it low.

TABLE III
FREQUENCY DISTRIBUTION OF THE VARIABLE "TEMPORAL ERGONOMICS RISK AWARENESS"

Level	Frequency	Percentage
Low	46	65.71%
Medium	24	34.29%
High	0	0.00%

IV. CONCLUSIONS AND DISCUSSION

Ergonomic risk awareness in the workers of a moving company, is of a medium level. These results agree with Villalobos, who found that supermarket workers face a variety of occupational risks that may be related to occupational diseases [40]. Likewise, Infantes and Yampi indicate that the performance of workers, is not directly related to the prevention of ergonomic risks, in view of the above, it is advisable to perform an ergonomic analysis [22].

Ergonomic risk awareness is related to work activities where accidents, diseases and various injuries can be caused. As well as the need to evaluate and identify these risks to avoid future occupational health problems, it is also important that the worker adopts preventive or protective measures to avoid ergonomic risks [41]. It should be noted that the physical and mental work demands, among others, must be recognized by the employer and the worker to assume preventive strategies or action plans to avoid injuries or health problems that reduce productivity and absenteeism due to health problems.

Regarding the geometric ergonomics risk awareness, workers in a moving company are at a medium level. Comparing with Arias, who found regular level and indicated that geometric ergonomics conveniently influences the productivity of the company of such offices, causing the incorrect use of the design of the work area [18].

In the same line, the risk of temporary ergonomics awareness in the workers of a moving company is reported that 65.7% of the surveyed workers perceive that they are at a medium level, while 34.3% mention that they are at a high level. These results differ with Berrones, who states that before the analysis of the workplace, an overall average of the workers' statements was obtained, indicating that 72.02% of the workers have a perception of excellent and good for the total of the categories studied and only 8.11% consider being in bad conditions [21].

It is important to point out that young workers who perform jobs with high demands of physical load generally have an absence of discomfort or symptomatology of musculoskeletal problems and it is likely that this absence mostly does not take into account the use of protective or safety measures, which puts them at high occupational risk [5]. In this same line De La Cruz and Viza indicates that sometimes correct preventions announced by the company are taken in a way to preserve their health [24].

In this sense, Bustos argues that with putting into practice the ergonomics system, it was possible to minimize work absences from 23 to 10 days. Likewise, by carrying out it was obtained to minimize the staff turnover rate from 11.26% to 6.32%, therefore, it provides greater income to the company, due to the fact that the stability of workers is obtained the maximum utilization required by the company which generates a competitive advantage [23].

Finally, workers have to be aware of the need to use personal protective equipment (PPE) or in the same way raise awareness for the corresponding use of safety equipment. In addition, in the work environment, it is important to implement strategies to train workers to adopt appropriate postures during the workday. Finally, the plan related to temporary ergonomics with respect to time planning to avoid physical efforts that may cause musculoskeletal problems.

It is concluded that ergonomic risks awareness is an issue that needs to be considered, analyzed and identified in order to assume a clear position to reduce the consequences not only on the worker's health but also on the productivity and performance of the collaborators within healthy work spaces.

V. RECOMMENDATIONS

We recommend that managers of moving companies train their employees on ergonomics-related topics, so that they can learn about the risks involved in their activities and how to reduce them.

Finally, we recommend other researchers to conduct studies on the same variable (ergonomic risk awareness) in similar populations in other contexts, in order to generate academic discussion that will further expand scientific knowledge on this topic.

REFERENCES

- [1] M. Segarra Cañamares, B. M. Villena Escribano, M. N. González García, A. Romero Barriuso, and A. Rodríguez Sáiz, "Occupational risk-prevention diagnosis: A study of construction SMEs in Spain," *Saf. Sci.*, vol. 92, pp. 104–115, Feb. 2017.
- [2] L. Boudra, Y. Lémonie, V. Grosstephan, and A. Nascimento, "The cultural-historical development of occupational accidents and diseases prevention in France: A scoping review," *Saf. Sci.*, vol. 159, p. 106016, Mar. 2023.
- [3] G. Papadopoulos, P. Georgiadou, C. Papazoglou, and K. Michaliou, "Occupational and public health and safety in a changing work environment: An integrated approach for risk assessment and prevention," *Saf. Sci.*, vol. 48, no. 8, pp. 943–949, Oct. 2010.
- [4] R. M. Morillas, J. C. Rubio-Romero, and A. Fuertes, "A comparative analysis of occupational health and safety risk prevention practices in Sweden and Spain," *J. Safety Res.*, vol. 47, pp. 57–65, Dec. 2013.
- [5] J. R. Díaz Dumont, S. L. Suarez Mansilla, N. Rubi, and E. M. Bizarro Huaman, "Accidentes laborales en el Perú: Análisis de la realidad a partir de datos estadísticos," *Rev. Venez. Gerenc.*, vol. 25, no. 89, pp. 312–329, Jan. 2020.
- [6] M. L. Salas *et al.*, "Working Conditions, Workplace Violence, and Psychological Distress in Andean Miners: A Cross-sectional Study Across Three Countries," *Ann. Glob. Heal.*, vol. 81, no. 4, p. 465, Dec. 2015.
- [7] I. Cruz and R. Huerta-Mercado, "Occupational Safety and Health in Peru," *Ann. Glob. Heal.*, vol. 81, no. 4, p. 568, Dec. 2015.
- [8] M. E. Meneses La Riva, J. A. Suyo Vega, J. L. A. Baldarrago Baldarrago, and V. H. Fernández Bedoya, "Looking for value in garbage: Intervention in domestic solid waste management," *Int. J. Sci. Technol. Res.*, vol. 8, no. 11, pp. 1762–1766, 2019.
- [9] World Health Organization, "Protecting workers' health," 2017. [Online]. Available: <https://www.who.int/news-room/fact-sheets/detail/protecting-workers-health>.
- [10] F. Yang *et al.*, "The prevalence and risk factors of work related musculoskeletal disorders among electronics manufacturing workers: a cross-sectional analytical study in China," *BMC Public Health*, vol. 23, no. 1, p. 10, Jan. 2023.
- [11] M. Hassani, P. Kabiesz, R. Hesampour, S. M. Ezbarami, and J. Bartnicka, "Prevalence of musculoskeletal disorders, working conditions, and related risk factors in the meat processing industry: Comparative analysis of Iran-Poland," *Work*, vol. 74, no. 1, pp. 309–325, Jan. 2023.
- [12] International Labour Organization, "Seguridad y salud en el trabajo: Surgen nuevos problemas de seguridad y salud a medida que el trabajo cambia," 2020. [Online]. Available: https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_686761/lang-es/index.htm.
- [13] International Labour Organization, "Seguridad y salud en el trabajo," 2017. [Online]. Available: <https://www.ilo.org/global/standards/subjects-covered-by-international-labour-standards/occupational-safety-and-health/lang-es/index.htm#:~:text=En la Constitución de la,accidentes resultantes de su trabajo>.
- [14] Ministerio de Trabajo, "Incidentes peligrosos y accidentes de trabajo," Lima, 2023.
- [15] Congreso de la República, "Ley de Seguridad y Salud en el Trabajo N° 29783," *El peruano*. El peruano, Lima, p. 13, 2011.
- [16] Ministerio de Trabajo y Promoción del Empleo, "Anuario Estadístico Sectorial," Lima, 2019.
- [17] Conferederación Regional de Organizaciones Empresariales de Murcia, "Prevención de riesgos ergonomicos," Murcia, 2014.
- [18] J. Arias Medina, "Analizar el impacto sobre la productividad por el incumplimiento de las normas básicas de ergonomía en un puesto de trabajo de un Call Center," Universidad de América, 2016.
- [19] C. Espín and R. Sánchez, "Evaluación de factores de riesgo ergonómico y su incidencia en la salud de los trabajadores,," *Rev. Boletín Redipe*, vol. 6, no. 6, pp. 153–160, 2017.
- [20] V. P. Bravo Carrasco and J. R. Espinoza Bustos, "Factores de Riesgo Ergonómico en Personal de Atención Hospitalaria en Chile," *Cienc. Trab.*, vol. 18, no. 57, pp. 150–153, Dec. 2016.
- [21] L. D. Berrones Sanz, "Choferes del autotransporte de carga en México: investigaciones sobre condiciones laborales y la cadena de suministro," *Rev. Transp. y Territ.*, vol. 17, no. 1, pp. 251–266, 2017.
- [22] N. J. Infantes Rodríguez and L. Y. Yampi Enciso, "Estudio ergonómico y propuesta de mejora de la productividad en el cambio de liners de una empresa especializada en mantenimiento de maquinaria y equipo, aplicando el software E - Lest," Universidad Católica San Pablo, 2018.
- [23] E. Bustos Peñaranda, "Diseño e implementación de Sistema Ergonómico para mejorar la productividad laboral de la Empresa Successful Call Center S.R.L. – 2017," Universidad César Vallejo, 2017.
- [24] Q. N. Jesus De la Cruz and G. Z. Viza Ticona, "Factores de riesgos ergonómicos que inciden en la salud de los trabajadores del área de producción de la Empresa Andes Yarn S.A.C., Arequipa – 2016," Universidad Nacional de San Agustín, 2017.
- [25] M. T. Gajbhiye, D. Banerjee, and S. Nandi, "Ergonomic Assessment of Collecting, Lifting, Throwing and Receiving Postures' of Indian Excavation Workers Using CATIA," in *Lecture Notes in Mechanical Engineering*, 2023, pp. 319–329.
- [26] A. T. Gabriel, S. Madaleno, F. Kanazawa, and C. Ollay, "Ergonomic Risk Assessment in an Energy, Mobility, and System Company," in *Studies in Systems, Decision and Control*, 2023, pp. 259–268.
- [27] T. Afonso, P. Carneiro, A. C. Alves, and S. Barros, "The Importance of Small Details in Ergonomic Risk: Influence of Casters' Characteristics on the Force Exerted in Pulling and Pushing Tasks," in *Studies in Systems, Decision and Control*, 2023, pp. 247–258.
- [28] C. Batalla García, J. Bautista Valhondo, and R. Alfaro Pozo, "Ergonomía y evaluación del riesgo ergonómico," Universitat Politècnica de Catalunya, 2015.
- [29] E. V. Labanda Herrera, "Evaluación y control de factores de riesgo ergonómico – geométricos, y su incidencia en el apareamiento de trastornos músculo – esqueléticos en el personal de las áreas conversión y paños húmedos de la Planta Industrial de Productos Familia Sancela del E,," Universidad Internacional SEK Ecuador, 2017.
- [30] L. T. Becerra-Medina, M. E. Meneses-La-Riva, M. T. Ruíz-Ruíz, A. Marcilla-Félix, V. H. Fernández-Bedoya, and J. A. Suyo-Vega, "Mental health impacts of nurses caring for patients with COVID-19 in Peru: fear of contagion, generalized anxiety, and physical-cognitive fatigue," *Front. Psychol.*, 2022.
- [31] M. E. Cabascango Flores, "Evaluación del nivel de riesgo ergonómico en trabajadores del área de clasificación en postcosecha en la florícola 'Florecal' 2019-2020," Universidad Técnica del Norte, 2021.
- [32] M. E. Quispe Cueva, "Estilos de afrontamiento y consecuencias de los riesgos ergonómicos en enfermeras. UCI – UCIM. Hospital nacional Carlos Alberto Seguin Escobedo Arequipa. 2019," Universidad Nacional de San Agustín, 2019.
- [33] M. I. Rivera Soto, "Diseño de puestos de trabajo cognitivo. Una metodología de impacto," Universidad de Córdova, 2013.
- [34] A. Naweed, L. Bowditch, J. Trigg, and C. Unsworth, "Injury by design: A thematic networks and system dynamics analysis of work-related musculoskeletal disorders in tram drivers," *Appl. Ergon.*, vol. 100, p. 103644, Apr. 2022.
- [35] I. Kačerová, J. Kubr, P. Hořejší, and J. Kleinová, "Ergonomic Design of a Workplace Using Virtual Reality and a Motion Capture Suit," *Appl. Sci.*, vol. 12, no. 4, p. 2150, Feb. 2022.
- [36] S. Kumar, "Theories of musculoskeletal injury causation," *Ergonomics*, vol. 44, no. 1, pp. 17–47, Jan. 2001.
- [37] G. D. Huang, M. Feuerstein, and S. L. Sauter, "Occupational stress

- and work-related upper extremity disorders: Concepts and models,” *Am. J. Ind. Med.*, vol. 41, no. 5, pp. 298–314, May 2002.
- [38] C. Garcia Lirios, J. Carreon Guillen, and J. Hernández Valdés, “Límites de los modelos de salud ocupacional. Estudio de adhesión al tratamiento del asma en trabajadores migrantes adultos mayores del estado México,” *Visión Gerenc.*, vol. 16, no. 1, pp. 103–118, 2017.
- [39] R. Hernández-Sampieri and C. P. Mendoza Torres, *Metodología de la investigación. Las rutas cuantitativa, cualitativa y mixta*. McGraw-Hill, 2018.
- [40] M. Villalobos Nieto, “Riesgos ergonómicos en los puestos de trabajo de un Supermercado del Estado Carabobo,” Universidad de Carabobo, 2015.
- [41] J. T. Flores Olivas, “Factores de riesgo ergonómicos que afectan la salud de los trabajadores en la empresa Industrias San Miguel S.A.C Huaura 2019-2020,” Universidad Nacional José Faustino Sánchez Carrión, 2020.