

## Hazard Identification and Risk Assessment of Human Factors/Ergonomics (HF/E) While Working from Home

Revi Timora Salajar<sup>1</sup>, Agus Yulianto<sup>2</sup>

<sup>1</sup>(Widyaiswara of Center for The Development of Human Resources for Geology, Minerals and Coal - Ministry of Energy and Mineral Resources – Republic of Indonesia)

<sup>2</sup>(Widyaiswara of Center for The Development of Human Resources for Electricity, New Energy, Renewable Energy and Energy Conservation - Ministry of Energy and Mineral Resources – Republic of Indonesia)

**ABSTRACT :** The Covid-19 pandemic has caused an abrupt shift in the nature of work systems across the globe. Quarantine and restrictions on movement and gatherings have drastically increased the number of people who are working from their homes or other non-traditional workspaces. This has many advantages in terms of curbing the spread of COVID-19 and can also benefit workers who need more flexibility to balance work and family responsibilities during the pandemic. However, the rapid change in work conditions is impacting many who are not prepared to adopt this new and unfamiliar work mode. Attention to human factors/ ergonomics from micro perspective (individual workers) is essential to support and protect workers, to ensure worker wellbeing and performance, and to achieve the benefits of telework. Hazard identification and risk assessment of human factors/ ergonomics (HF/E) while working from home is carried out using semi-quantitative risk assessment method. Several control measures are taken to reduce risk in order to obtain the lowest possible and reasonable risk value. Without an HF/E setup, could be at risk of developing issues from minor strains to more serious repetitive strain injuries.

**KEYWORDS:** human factor, ergonomics, hazard identification, risk assessment, low back pain (LBP), working from home (WfH).

Date of Submission: 24-02-2021

Date of acceptance: 28-02-2021

### I. INTRODUCTION

Although nowadays various activities such as studying and working are done from home, or Work from Home (WfH), ergonomics is still important and cannot be ruled out. Ergonomics is closely related to comfort, safety, and health at work. According to International Ergonomics Association (IEA), Human Factors/ Ergonomics (HF/E) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimize human well-being and overall system performance. The goal of ergonomics is to reduce stress and eliminate injuries and disorders associated with the overuse of muscles, bad posture, and repeated task[1].

Due to the situation with Covid-19, people across the world are having to adjust to remote working. For some, this is an occasional part of their routine when they need flexibility around their usual schedule. However, many are having to make this adjustment without prior planning. Work from home means that you carry out your work activities in isolation from other people and without direct supervision. On the surface, working from home does not seem to present many risks to health and safety. In fact, reported by The Royal Society for The Prevention of Accidents (RoSPA), more accidents happen in the home than anywhere else. However, working in a familiar environment it does not mean that the health and safety risks should not be addressed.

As Indonesia, along with many other countries, face a lockdown, it is likely working from home will be a 'new normal' for a while. In fact, the current move to teleworking is in many cases being accomplished without adequate consideration of HF/E requirements. This will likely have future effects in terms of work-related injuries and other health problems. Many new teleworkers are being asked to work from home with little support for setting up a workstation, ensuring a safe work environment, or protecting their physical and psychological health and wellbeing. Therefore, hazard identification and risk assessment of HF/E while working from home is carried out to reduce the risk value to the smallest possible value and to a reasonable risk limit.

**II. RESEARCH METHODOLOGY**

There are several health risks while working from home such as shoulder/ neck strain, low back pain, carpal tunnel syndrome (CTS), fatigue, and stress[2]. Furthermore, when working in an office, muscle-skeletal disorders are the biggest risk for office workers, about 40-50%. The risk is worse predicted when working from home due to limited working facilities at home. Ergonomic work desks are rarely found at home, often working in a place with a position that is not good for health. Some of them are a bent body position, a bent wrist position, or a bent neck.

According to The Indonesian Ergonomics Association (IEA), there are three biggest hazards associated with working with a computer, for instance, non-ergonomic chairs, wrong work positions, and sitting for long periods of time. Therefore, we need to ensure that when working from home, potential hazards and risk are controlled by carrying out risk management. There are four stages in carrying out a risk management. A whole step is shown in Fig.1.



**Fig.1. A stage of Risk Management Process**

The initial stage in carrying out risk management is identifying potential hazards from the aspect of HF/E by using Hazard Identification Method (HAZID). Based on HAZID matrix, there are three scenarios such as effect, to/on, and cause[3].

The second stage is to assess the risk from known potential hazards by using Semi-quantitative Risk Assessment (SRA). SRA is the development of risk assessment using a model for certain events. The goal is to get the risk score. With this modelling, it will produce data accuracy based on initial information that is processed by considering the existing parameters. According to SRA method, the risk value is influenced by three parameters: likelihood, frequency, and severity. As shown in Table 1, all the parameters divided into five level.

**Table 1. Parameter of risk assessment**

	Likelihood (P)		Frequency (F)		Severity (S)
1	Certainly	10	Very often	20	Catastrophic
0.6	Significant chance	6	Often	10	Major
0.3	Possible	3	Sometimes	5	Moderate
0.1	Possible but unlikely	2	Rarely	2	Minor
0.05	Extremely unlikely	1	Almost never	1	Insignificant

The resulting risk score is categorized as low, moderate, high, or unacceptable risk. A risk score (R) is determined by the equation below:

$$R = P \times F \times S$$

Where:

R – Risk Score

P – Likelihood/ Probability

F – Frequency

S - Severity

Score of risk can vary from 0.05 to 20 or more. Process of SRA analysis is based on the description of each category level as shown in Table. 2.

Table 2. Risk Category

Risk Score	Risk Category	Description
>20	Unacceptable	It is necessary to stop the activity or immediately implement countermeasures aim at its minimization
>10	High risk	requires immediate corrective measures, warning and notification, and make an adjustment as a temporary control measure
3 – 10	Moderate	Countermeasures need not to implemented, low control, low repair
<3	Low risk	level of risk that is acceptable and tolerated

Based on risk score on the previous stage, the next stage is controlling the risks that may occur in order to minimize the risk score into the smallest and reasonable limit. According to The National Institute for Occupational Safety and Health (NIOSH), the hierarchy of risk-reducing measures is shown in Fig.2.



Fig. 2. Hierarchy of control

We should put the action to minimize potential risk by controlling hazard in accordance with the hierarchy of control. The order of risk control must be based on a hierarchical level. Furthermore, monitoring and evaluation are the final stage in maintaining risk control.

III. RESULT AND DISCUSSION

By using the HAZID method, three scenarios were identified, namely effects, to/ on, and cause. Scenarios of prevention could be proposed by determining various hazard-risks of its matrix as shown in Table.3.

Table 3. HAZID Matrix

Effect	To/ on	Cause
Muscular strain, carpal tunnel syndrome (CTP)	Excessive reach, bent wrist	Non ergonomic chair
Shoulder/ neck strain, low back pain	Shoulder, neck, human spine	Wrong work position
Fatigue, stress, saturation	Psychology	Sitting for long period of time
Eye damage	Eyes	Substandard illumination level

We used SRA method to determine the relative risk level [4]. It can be divided into four categories like “low risk”, “moderate risk”, “high risk”, and “unacceptable risk”. In this risk assessment, probability, frequency, and severity’ score calculated by determining its score of each parameter, subjective estimates may be used, as shown in Table. 4.

We estimated a score of each parameter with numerical values and interpretation of result from qualitative consideration. nevertheless, the disadvantage of this method caused by subjectivism in this risk assessment may still occur.

**Table 4. Typical worksheet of HAZID and Risk Assessment Matrix**

General Hazard	Risk Opportunity	Semi-quantitative Risk Assessment (SRA)				
		P	F	S	R	Category
Non ergonomic chair	Muscular strain	0.3	3	2	1.8	Low risk
	Carpal Tunnel Syndrome	0.3	3	5	4.5	Moderate
Wrong work position	Shoulder/ neck strain	0.6	3	2	3.6	Moderate
	Low back pain	0.6	3	5	9	Moderate
Sitting for a long period of time	Fatigue	0.6	6	2	7.2	Moderate
	Stress	0.3	2	1	0.6	Low risk
	saturation	0.6	6	5	18	High risk
Substandard illumination level	Eye damage	0.3	6	2	3.6	Moderate

As seen from Table. 4, the risk score lies in the range 0.6 to 18 and will reflect the difference in risk control of each its risk opportunities. Control risk arises when it is on moderate risk level or higher. Risk opportunities could be anticipated by controlling the risk, especially for risk that are moderate and high risk, as shown in Table 5.

**Table 5. Risk – Hierarchy of Control Matrix**

Risk opportunities	Hierarchy of control
<b>Carpal Tunnel Syndrome</b>	<ul style="list-style-type: none"> <li>Keeping your wrists straight when using tools/ typing</li> <li>Taking frequent rest breaks from repetitive activities</li> </ul>
<b>Shoulder/ neck strain</b>	<ul style="list-style-type: none"> <li>Avoid working while sitting on a bed or sofa for long periods of time.</li> <li>Stretching the muscle between work (back extension, neck forward, neck left and right, elbow pullover,</li> </ul>
<b>Low back pain</b>	<ul style="list-style-type: none"> <li>Avoid prolong sitting.</li> <li>Get regular exercise to keep your back muscles fit and flexible</li> </ul>
<b>Fatigue</b>	<ul style="list-style-type: none"> <li>Take a break for a while.</li> <li>Sleep well.</li> </ul>
<b>saturation</b>	<ul style="list-style-type: none"> <li>Avoid repetitive tasks that need to be done in the same posture all the time.</li> <li>Try something new.</li> <li>Take a break for a while</li> </ul>
<b>Eye damage</b>	<ul style="list-style-type: none"> <li>Use a lamp with capacity of 300 lux.</li> <li>Keep reading distance approximately 50 – 70 cm</li> </ul>

As seen on Table 5., controlling the risk may vary. It is important to follow hierarchical steps for all recommendation. One of the recommendations, “take a break for a while” may be used for all risk opportunities. We could apply the 25:25:25 method, resting 25 seconds looking at the object at a distance of 25 feet, after doing 25 minutes of work.

There are still some ergonomic aspects related with WFH that could not be ignored, include work station design, monotony and boredom, stress, lack of concentration [5]. There are any recommendations that possible to implemented. Change posture throughout the day is recommended. We should stand up and move around for 2 minutes, every 30 minutes [6].

#### IV. CONCLUSION

There are some key ergonomics principles to help ensure that you can work from home in a safe and productive manner and do not incur a sore neck or back due to poor working conditions. A failure to pay sufficient attention to ergonomics when working from home can be costly, resulting in physical discomfort and potentially even long-lasting damage to your body. The importance of ergonomics when working from home can perhaps be demonstrated by highlighting the consequences of ignoring ergonomic design.

It comes to how to work from home properly, certain smaller steps can also be adopted, in order to take care of your body and your overall well-being. These steps can complement ergonomic design principles, such as taking regular breaks and engaging in some basic stretching exercises over the course of your working day. By taking some basic steps to consider the effects of your working arrangements on your body and your well-being can potentially reduce injury and improve overall performance.

#### REFERENCES

- [1] S. Yasobant, "Ergo-HIRA: A conceptual model for fitness to work," *Indian J. Res.*, no. September, 2014.
- [2] Yassierli, T. Wijayanto, D. Hardiningtyas, O. Dianita, K. Muslim, and W. Kusmasari, *Panduan ergonomi "Working from Home."* Perhimpunan Ergonomi Indonesia, 2020.
- [3] F. Crawley, *A Guide to Hazard Identification Methods*, Second Edi. Elsevier Inc., 2020.
- [4] L.-D. RADU, "Qualitative, semi-quantitative and, quantitative methods for risk assessment: Case of the financial audit," *Analele Științifice ale Univ. »Alexandru Ioan Cuza« din Iași. Științe Econ.*, vol. 56, no. 1, pp. 643–657, 2009.
- [5] S. LP, "Ergonomics for Working from Home during COVID-19 Pandemic," *Ergon. Int. J.*, vol. 4, no. 4, pp. 1–4, 2020.
- [6] K. G. Davis, S. E. Kotowski, D. Daniel, T. Gerding, J. Naylor, and M. Syck, "The Home Office: Ergonomic Lessons From the 'New Normal,'" *Ergon. Des.*, vol. 28, no. 4, pp. 4–10, 2020.

Revi Timora Salajar, et. al. "Hazard Identification and Risk Assessment of Human Factors/Ergonomics (HF/E) While Working from Home." *American Journal of Engineering Research (AJER)*, vol. 10(2), 2021, pp. 140-144.