

Analysis of the Body's Posture and the Risk of Musculoskeletal Disorder in Cleaning Service Workers Working at Height

Julianus Hutabarat^{1*}, Ida Bagus Suardika², Renny Septiari³, Diah Wilis Lestaring Basuki⁴
¹ Associate Professor, Industrial Engineering Department, National Institute of Technology, Malang, Indonesia

^{2,3,4} Industrial Engineering Department, National Institute of Technology, Malang, Indonesia

Article Info

Volume 83

Page Number: 6923 - 6927

Publication Issue:

May-June 2020

Abstract:

Cleaning service workers' job is the type of job that requires physical strength in carrying out their duties, especially if the work area is at height, which can cause the risk of Musculoskeletal Disorder. The purpose of this research is to analyze the body's posture of the workers and provide a recommendation for the level of risk of developing Musculoskeletal Disorder when working at height. This research was conducted using the Rapid Upper Limb Assessment (RULA) method, starting with an analysis of upper body posture including: Upper arm, forearm, wrist and hand rotation, then analyzing the body parts of the trunk and legs. The research results show that the body's posture while working at height has a score of seven (7), which means it has a high level of Musculoskeletal Disorder risk. The conclusion from this study is that working at specific height has a high level of Musculoskeletal Disorder risk, and the risk can be reduced by providing ergonomics assistive devices.

Article History

Article Received: 19 November 2019

Revised: 27 January 2020

Accepted: 24 February 2020

Publication: 18 May 2020

Keywords: RULA, Musculoskeletal Disorder, Cleaning service Workers, Working at Height

Introduction:

Cleaning Workers are workers who have the task of cleaning up all kinds of dirt. They not only clean dirt found on the floor such as trash, traces of food spills, traces of dirt attached on the floor or dust, but also the surface of walls, glass and window sills inside or outside a building. Whether we realize it or not, this job is really vital in various institutions as it is related to the hygiene of working environment. However, stakeholders do not pay attention on work safety issue that can cause musculoskeletal disorders in cleaning workers

Cleaning work not only requires physical work but also mental work. Physical work is related to the ability to do cleaning tasks, while mental work is related to carefulness and anxiety in using assistive devices, especially when working at height. This research will only focus on physical activity.

From the results of observations, especially for cleaning work outside the building at certain height, the activities include: preparing tools for cleaning, climbing stairs, cleaning glass, moving to other areas and tidying up the tools. There are 3 factors that can cause the body to experience musculoskeletal disorder (MacLeod 1995) including: Working Conditions (Physical, Repetition, Force, Awkward posture, Contact stress, Vibration, Extreme temperature), Work Organization (Stressful conditions) and Personal issue (Off-the-job activities, Physical conditions, other diseases). Based on the observation, the body posture when doing cleaning work is: body position tilts and bends with angle ranging from 20°-60°, neck bends at an angle of about 20°, cleaning is done repeatedly by sliding hand to the left and to the right with the upper arm angle > 90° raised for 10 minutes and the forearm at around 40°. This illustrates the condition of

awkward posture of the cleaning workers which is unergonomic, and if this is done continuously without any rest it can cause musculoskeletal disorder. Factors that need to be taken into account and have the potential for injury (Sutrio et al. 2011) include: body's posture, body's movement, and muscle activity, (Hutabarat. 2018). Research results for lifting activities of rice sacks from a milling company describe work position that is not ergonomic and has a high level of risk of musculoskeletal disorder.

To find out the work position and the level of risk of musculoskeletal disorder for cleaning workers who work at height, this study will be measured using RULA method

METHOD AND MATERIAL

The participants are cleaning workers who work at the National Institute of Technology Malang-East Java-Indonesia, with working hours starting from 7 am to 4 pm. A total of 30 participants selected are men who have no history of high blood pressure, heart disease and diabetes. Participant demographic description: mean age 35 years \pm 7.61; Weight Body average 64 Kg \pm 11.17; Average height 163 cm \pm 4.00; Body Mass Index (BMI) averaged 23.14 Kg/m² \pm 3.88.

Materials are the tools used to clean the glass, including: glass cleaner (denatured alcohol), used newspaper for cleaning the surface of the glass and cloth rags for cleaning the surface of the glass.

The equipments used include: a spray tube as a the container for denatured alcohol, a ladder as a means to ascend to the area to be cleaned, a rubber cape whose surface is from rubber and is used to clean the spray.

Cameras and videos are used to record and describe the activities of movement and body posture and also to record the time of each activity for an area of the glass surface. Rapid Upper Limb Assessment (RULA) is used to measure the level of musculoskeletal disorder (McAtamney & Corlett, 1993) including: neck, trunk, arms, forearms, wrists and legs.

This research was conducted by observing the activities of participants in carrying out cleaning work outside the building, especially cleaning the glass on a level of \geq 5 m. Activities from the beginning of work were observed, photographed and videotaped, which were started from preparing tools, installing stairs, climbing the stairs, cleaning process, then moving to other areas and tidying up the tools. In this study, only 2 (two) positions will be analyzed when conducting cleaning activities. Furthermore, the results of photos and videos are used as a basis for measuring the angle of participant's body posture while working using the Rapid Upper Limb Assessment (RULA) Method.

RESULTS AND DISCUSSION

Calculation of RULA Value at Work Position 1 (Figure 1 and Table 1 and 2).

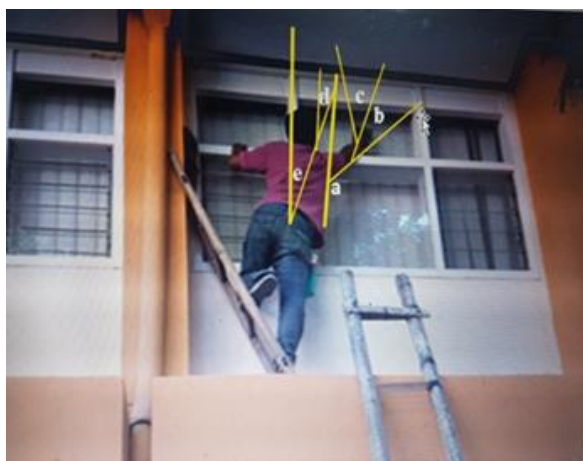
Calculation of Group C score:

In group A, there is a repetition of work which is more than 4 times, so the score of group A is added 1 point to make it 8. In group B due to static load, 1 point is added to the score of group B which results in 7 point. Thus, from the grand total results according to table C RULA, a total score of 7 is obtained. Based on the score, the risk level of glass cleaning activity at work position 1 is in the high risk category.

Calculation of RULA Value at Work Position 2 (Figure 2 and Table 3 and 4).

Calculation of group score C:

In group A there is a repetition of work for more than 4 times, so 1 point is added to the score of group A which results in 8. In group B because there is muscle with static load, the score of group B is added by 1 which results in 9. Thus, the grand total of the score is 7. Based on these scores, the level of risk of glass cleaning activity in working position 2 is high risk category.



The angle of
body posture Working
Position 1

- a = 130°
- b = 40°
- c = 35°
- d = 20°
- e = 30°

Figure 1: Body Posture in Working Position 1

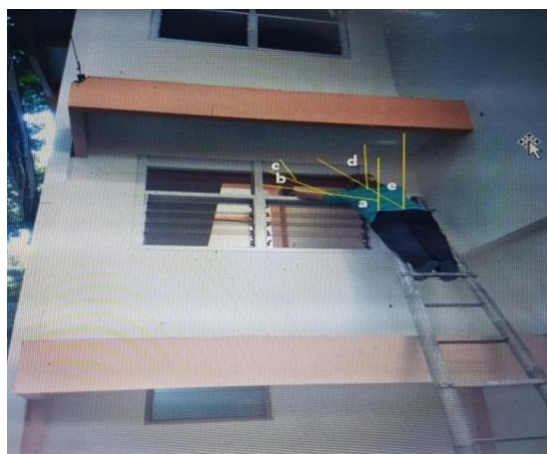
Table 1. Score of Group A for Working Position 1

Group A	Angle	Score	Adjustment	Total score
Upper arm	130°, bigger than 90°	4	Add 1 point because upper arm is bent	5
Forearm	40° lies between 40°-90°	1	Add 1 point because it crosses the center line	2
Wrist	35°, bigger than 15°	3	Add 1 point because it crosses the center line	4
Wrist round	The position is close to wrist round	2	-	2
The Score of Grup A in accordance with RULA table				7

Table 2. Score of Group B for Work Position 1

Group B	Angle	Score	Adjustment	Total Score
Neck	20°, lies between 10°- 20°	2	Add 1 point because neck is bent	3
Torso	30° lies between 20°-60°	3	Add 1 point because arm is bent	4
Foot imbalance	-	2	-	2
Score of Group B in accordance with RULA table				6

The angle of



bodypostureWorking

Position 2

a = 100°

b = 20°

c = 35°

d = 40°

e = 50°

Figure 2: Body Posture in Working Position 2

Table 3. Score of Group A for Working Position 2

Group A	Angle	Score	Adjustment	Total score
Upper arm	100°, bigger than 90°	4	Add 1 point because upper arm is bent	5
Forearm	20° lies between 0°-60°	1	Add 1 point because it crosses the center line	2
Wrist	35°, bigger than 15°	3	Add 1 point because it crosses the center line	4
Wrist round	The position is close to wrist round	2	-	2
Score of Group A in accordance with RULA table				7

Table 4. Score of Group B for Working Position 2

Group B	Angle	Score	Adjustment	Total Score
Neck	40°, bigger than 20°	4	Add 1 point because neck is bent	5
Torso	50° lies between 20°-60°	3	Add 1 point because arm is bent	4
Foot imbalance	-	2	-	2
Score of Group B in accordance with RULA table				8

From the observation, it can be concluded that body posture is not ergonomic and there is a high level of risk of musculoskeletal disorder as shown in Figure 1 and Figure 2. This can happen because ladder as the footrest has a narrow area so that

footwear is unbalanced and the partial foothold makes the leg muscle to become tighter to withstand the weight of the body. It is illustrated in RULA by giving an additional score of 2 for the level of risk of the disorder. It illustrates the lack of awareness and

understanding related to ergonomic working conditions (Ansari and Sheikh. 2014). This can lead to high risk of musculoskeletal disorder.

The position of the raised arm forms an angle of $> 90^\circ$ as shown in Figure 1 and Figure 2. This is also due to unsupportive and inflexible cleaning tools. In order to reach the area to be cleaned the workers have to lift the arm beyond the midline of the hand. This will make the hands tired quickly because the hands hang for > 5 minutes, so it can cause muscle spasms in hand. Working in an unergonomic position in working position heights variety (Djiono and Noya 2013) will have the potential of high risk level of musculoskeletal disorder.

The trunk forms an angle between $20^\circ - 60^\circ$ and the neck in a bent position forms an angle bigger than 20° . This is also due to the static stair where so as to reach the area that exceeds the reach of the hand, he must bend and lower his body, resulting in foot imbalance since his body only rests on one foot. If it lasts for a long time it will cause tension in the legs, neck and cause waist pain (Hayati et al, 2014). Low back pain is caused by unergonomic working positions both sitting and standing

CONCLUSION:

Glass cleaning work outside the building at a height is a job that has a high risk of developing musculoskeletal disorder due to the use of tools that are static, not flexible and have a narrow footrest. If the workers are forced to use equipment that is not supportive and not ergonomic, it will cause the posture to be uncomfortable. They tend to get tired quickly and may cause low back pain, muscle tension in the neck, arms and legs.

REFERENCES

1. Djiono, Y. K., dan Noya, S., Working Posture Analysis and Design using RULA (Rapid Upper Limb Assessment) Method In Production Process di PT. Indana Paint. *Jurnal Ilmiah Teknik Industri*, Vol. 12, No. 2, Desember 2013.
2. Hayati K.F., Kusuma I.F., Muhammad Hasan M., The Effect of Working Position on The Incidence of Low Back Pain in The Kampung

Sepatu Workers at District Miji-Prajurit Kulon-Mojokerto. *e-Jurnal Pustaka Kesehatan*, vol. 2 (no. 3), September 2014.

3. Hutabarat, Julianus, Work Posture Analysis by Using Rapid Upper Limb Assessment (RULA) and Rapid Entire Body Assessment (REBA) Methods (Case Study: Rice Milling In Malang – East Java of Indonesia). *IOP Conf. Series: Materials Science and Engineering* 469. 2019
4. MacLeod, D, The Ergonomics Edge: Improving Safety, Quality, and Productivity. Van Nostrand Reinhold, New York. 1995
5. McAtamney, L; and E.N. Corlett. 1993. RULA: A Survey Method for The Investigation of Work-Related Upper Limb Disorders. *Applied Ergonomics*. Vol. 24, No. 2, April 1993, pp. 91-99.
6. N. A. Ansari, and M. J. Sheikh , Evaluation of work Posture by RULA and REBA: A Case Study, *IOSR Journal of Mechanical and Civil Engineering*. Volume 11, Issue 4 Ver. III. Jul-Aug. 2014, pp. 18-23.
7. Sutrio, Oktri Mohammad Firdau, Analisis Pengukuran RULA dan REBA Petugas pada Pengangkatan Barang di Gudang dengan Menggunakan Software Ergo-intelligence (Studi kasus: Petugas Pembawa Barang di Toko Dewi Bandung), *Prosiding Seminar Nasional Ritektra*. 2011.