

## **Risk of Musculoskeletal Disorders (MSDs) Among Janitors During Most Frequent Occupational Tasks**

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**Abstract:** It is widely known that the average workday for a janitor can be physically demanding and draining. They typically repeat the same tasks on a daily basis and, within those tasks, repeat physically demanding motions for minutes to hours at a time. The objective of this study is to identify the top three most frequent tasks related to the janitorial occupation and conduct a risk assessment of musculoskeletal disorders (MSDs) on those tasks using ergonomic tools. A survey questionnaire was developed and distributed to identify the top three tasks performed by janitors. A cross-sectional study was conducted on 14 janitors during the execution of the tasks identified in the questionnaire. Risk assessments of musculoskeletal disorders were completed using the ergonomic risk assessment tools: Rapid Upper Limb Assessment (RULA), and Rapid Entire Body Assessment (REBA). The outcomes of the task were compared using one-way ANOVA with alpha level set at  $p < 0.05$  followed by a post-hoc analysis. Based on the survey questionnaire, the most frequent tasks completed by janitors are: floor mopping, cart pushing, and one-handed lifting. The summary of risk assessment scores are as follows: a) floor mopping (REBA:  $5.86 \pm 1.88$ , RULA:  $5.00 \pm 1.47$ ), b) pushing carts (REBA:  $5.81 \pm 2.11$ , RULA:  $5.71 \pm 1.33$ ), c) one-hand lifting (REBA:  $7.50 \pm 2.10$ , RULA:  $5.43 \pm 1.45$ ). There was a significant difference in REBA scores between certain tasks associated with janitorial services ( $F = 5.05$ ,  $P = 0.02$ ). The REBA scores of one-handed lifting are significantly higher than floor mopping ( $p = 0.04$ ) and pushing carts ( $p = 0.03$ ), whereas, there was no significant difference of REBA scores between floor mopping and pushing carts. There was also no significant difference in RULA scores between the identified tasks. The most frequent tasks associated with janitorial services are under categories of medium risk. One hand lifting task can put janitors under the highest risk of MSDs. Ergonomic interventions should be executed to lessen the observed risk of MSDs in the cleaning industry.

**Keywords:** Janitors, MSDs, RULA, REBA

### **1. INTRODUCTION**

It is widely known that the average workday for a janitor or housekeeper can be physically demanding and draining. Janitors and housekeepers can work anywhere ranging from schools, industrial shops, to hospitals. They typically repeat the same tasks on a daily basis and, within those tasks, repeat physically demanding motions for minutes to hours at a time. Some of the tasks may include mopping, sweeping, and scrubbing various surfaces. Their time is often spent bending, standing, or walking, while lifting heavy supplies at times which can cause strain in the arms, back, and legs. (U.S. BLS, 2019a) Ultimately, their jobs consist of static muscles loads and repetitive movements causing fatigue and leading to injury and various musculoskeletal disorders. (Krüger et al., 1997, Kumar et al., 2004)

It can be hard to understand how dangerous janitorial and housekeeping tasks are, but one must realize that most of those positions provide on the job training, and the more physically demanding the job, typically, the more training is required. However, those in the janitorial or housekeeping positions typically do not have to possess education beyond the high school level. They only receive short term on the job training at the very most, and ergonomic strategies are rarely taught or practiced in that field of work. (U.S. BLS, 2019a, Kumar et al., 2008) In addition, based on previous research, the average REBA scores for the janitorial and housekeeping jobs have been placed in the high risk category, and ultimately, the ergonomic workload of janitors and housekeepers held a positive relationship to injury. (Schwartz et al., 2019) OSHA also acknowledges the fact that workers exposed to risk factors such as lifting, bending, reaching, pushing, pulling, awkward working postures, and performing repetitive task increases workers' risks of injuries. (U.S. OSHA) When considering these details and the fact that these individuals are required to do static and repetitive muscle activities for, on average, 8 hours a day, it is easy to understand why janitors and cleaners were the third highest in ranking of occupational nonfatal injury rates. (U.S. BLS, 2017)

As of 2019, there were 3,740,000 people employed as janitors or housekeepers in the United States and 55% were over the age of 45. Janitors and housekeepers make up just over 2% of the entire employed population in the United States. (U.S. BLS, 2019b) Although they make up a small percentage of the employed population, and their daily tasks may seem on the less risky side, their physically demanding workload put them at a 2.7 times greater risk of days away from work than all other occupations. (U.S. BLS, 2016) The main reasons being repetitive motion (21%) and overexertion (19%), contributing to a 2.7 times higher rate than average of musculoskeletal disorders in the United States. (Schwartz et al., 2019, U.S. BLS, 2014) It is also known that musculoskeletal disorders are more common among older workers, so considering that over 50% of the janitorial and housekeeping workforce is of older age, it is extremely apparent that there must be ergonomic strategies incorporated into their daily routines. (Kumar et al., 2008) This will prevent further injuries, increase the workers' stamina and quality of life, in addition to saving companies money for the reduced injury rates and less time off due to injury. The objective of this study is to identify the top three most frequent tasks related to the janitorial occupation and conduct a risk assessment of musculoskeletal disorders (MSDs) on those tasks using ergonomic tools.

## 2. MATERIALS AND METHODS

This cross-sectional study was designed to identify the top three most frequent tasks related to the janitorial occupation and conduct a risk assessment of musculoskeletal disorders (MSDs) on those tasks using ergonomic tools. The study was reviewed and waived by Sam Houston State University (SHSU) Institutional Review Board (IRB).

A survey questionnaire was developed by the research team. The survey questionnaire consisted of questions asking to identify the top three most frequent janitorial tasks. The questionnaire was distributed to 60 janitors who agreed to participate in the study. The top three most frequent janitorial tasks were identified based on the survey results.

A sample of 14 janitors (7 males, 7 females) were recruited from small custodial services companies, located in Huntsville, TX, to participate in this study to complete risk assessments of musculoskeletal disorders related to the identified most frequent janitorial tasks. The participants were observed while performing the most frequent janitorial tasks. The risk assessments in this study were completed using the ergonomic tools: Rapid Upper Limb Assessment (RULA), and Rapid Entire Body Assessment (REBA).

REBA (Hignett et al., 2000) is a postural assessment tool which provides an observational analysis of the entire body. It provides scores for muscle activities caused by static, dynamic, rapid changing or unstable postures. REBA also gives an action level indicating the urgency for changing the working postures.

RULA (McAtamney et al., 1993) is a survey method developed for ergonomics assessments of workplaces where musculoskeletal disorders are prevalent. It is a simple tool to assess postural loads on the upper body. It also assesses posture movement and force associated with tasks. RULA uses a scoring system to generate an action list indicating the level of risks and ergonomic intervention required. The details of REBA and RULA action level and risk assessment are given in Table 1.

Table 1: CLASSIFICATION OF RISKS ACCORDING TO RULA AND REBA

REBA Score	Risk Level	Action Level	RULA Score	Risk Level	Action Level
1	Negligible	No change	1 - 2	Negligible	acceptable posture
2 - 3	Low	May be necessary	3 - 4	Low	change necessary
4 - 7	Medium	Change necessary	5 - 6	Medium	change soon
8 - 10	High	Change soon	7	High	change urgently
11 - 15	Very high	Change urgently			

Descriptive summary statistics were used to calculate all outcome measures. One-way analysis of variance (ANOVA) with alpha level set at  $p \leq 0.05$ , was utilized to analyze the data followed by a post-hoc analysis.

SPSS statistical software (IBM SPSS Statistics version 25, IBM, Armonk, New York, USA) was used for statistical analysis. An alpha value of  $p \leq 0.05$  was considered statistically significant for the comparisons.

### 3. RESULTS AND DISCUSSION

The present study investigated musculoskeletal disorders (MSDs) related to most frequent janitorial tasks and assessing them using ergonomic risk assessment tools RULA and REBA. Based on the survey questionnaire, the most frequent janitorial tasks identified by study participants were: floor mopping, cart pushing, and one-handed lifting. The risk assessment carried out by applying RULA and REBA (Table 2) showed a medium-high level of risk for the three tasks. None of the tasks reported a score equal to a negligible or low risk nor a very high risk level score that would require an immediate intervention.

TABLE 2: SUMMARY OF RULA AND REBA RISK ASSESSMENTS SCORES

Task	REBA	RULA
Floor Mopping	$5.86 \pm 1.88$	$5.00 \pm 1.47$
Pushing Carts	$5.81 \pm 2.11$	$5.71 \pm 1.33$
One-Hand Lifting	$7.50 \pm 2.10$	$5.43 \pm 1.45$

There was a significant difference in REBA scores between certain tasks associated with janitorial services ( $F = 5.05$ ,  $P = 0.02$ ). The REBA scores of one-handed lifting were significantly higher than floor mopping ( $p = 0.04$ ) and pushing carts ( $p = 0.03$ ), whereas, there was no significant difference of REBA scores between floor mopping and pushing carts. There was no significant difference in RULA scores between the identified tasks.

The most frequent tasks associated with janitorial services were under categories of medium risk. One hand lifting can put janitors under the highest risk of MSDs.

There were three main limitations of this study. The demographic characteristics were not collected in this pilot study. Also, the sample size of this study was small. Moreover, the ergonomic assessment tools used in this study, assess risk category of occupational posture only. Further research is needed to assess the biomechanical loads related to those most frequent janitorial tasks.

### 4. CONCLUSIONS

The ergonomic risk assessment has been carried out for three most frequent tasks associated with janitorial job in the cleaning sector by RULA and REBA. The study results have indicated janitors fall into the medium risk category according to REBA and RULA scores. It is due to the awkward postures adopted by workers in identified tasks. One hand lifting task such

as collecting trash cans put janitors under the highest risk of MSDs. A change in postures and performing tasks is recommended by incorporating ergonomic interventions, like engineering and administrative controls.

## 5. REFERENCES

- Bureau of Labor Statistics (BLS). (2014). Nonfatal Occupational Injuries and Illnesses Requiring Days Away from Work. U.S. Department of Labor. Retrieved from: [http://www.bls.gov/news.release/archives/osh2\\_12162014.pdf](http://www.bls.gov/news.release/archives/osh2_12162014.pdf)
- Bureau of Labor Statistics (BLS). (2016). Occupational Injuries and Illnesses Requiring Days Away from Work. U.S. Bureau of Labor Statistics (BLS) Economic News Release. Retrieved from: <https://www.bls.gov/news.release/osh2.htm>
- Bureau of Labor Statistics (BLS). (2017) Workplace injuries, illnesses, and fatalities by occupation. TED: The Economics Daily. Retrieved from: <https://www.bls.gov/opub/ted/2017/workplace-injuries-illnesses-and-fatalities-by-occupation.htm>
- Bureau of Labor Statistics (BLS). (2019a). Janitors and Building Cleaners. U.S. Department of Labor. Retrieved from: <https://www.bls.gov/ooh/building-and-grounds-cleaning/janitors-and-building-cleaners.htm>
- Hignett, S., and McAtamney, L. (2000). Rapid Entire Body Assessment (REBA), *Applied Ergonomics*, 31(2): 201-205
- Krüger, D., Louhevaara, V., Nielsen, J., and Schneider, T. (1997). Risk Assessment and Preventative Strategies in Cleaning Work, Wirtschaftsverlag NW, Bremerhaven, Germany, 1997.
- Kumar, R., and Kumar, S. (2008). Musculoskeletal risk factors in cleaning occupation—A literature review. *International Journal of Industrial Ergonomics*, 38(2), 158–170.
- Kumar, S., Amell, T., Narayan, Y., Prasad, N. (2004). Measurement of localized muscle fatigue in biceps brachii using objective and subjective measures. In: Kumar, S. (Ed.), *Muscle Strength*. Taylor and Francis, London, pp. 105–121.
- Bureau of Labor Statistics (BLS). (2019b). Labor force statistics derived from the Current population survey : a databook. U.S. Department of Labor. Retrieved from: <https://www.bls.gov/cps/cpsaat11b.htm>
- McAtamney L., Corlett, E. (1993). RULA: a survey method for the investigation of world-related upper limb disorders. *Applied Ergonomics*, 1993; 24(2):91-99.
- Schwartz, A., Gerberich, S. G., Kim, H., Ryan, A. D., Church, T. R., Albin, T. J., McGovern, P. M., Erdman, A. E., Green, D. R., & Arauz, R. F. (2019). Janitor ergonomics and injuries in the safe workload ergonomic exposure project (SWEEP) study. *Applied Ergonomics*, 81.
- U.S. Occupational Safety and Health Administration (OSHA), Department of Labor. Safety and Health Topics: Ergonomics. Retrieved from: <https://www.osha.gov/ergonomics>