

Musculoskeletal Symptoms and Postural Analysis of Property Management Employees in a Residential Complex

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Abstract. Work-related musculoskeletal disorders (WRMSD) are disorders of the body experienced by employees affecting muscular, skeletal, and other tissues whose cause has been associated with the work environment. In property management, employees are distributed among its five main service aspects - administration, security, repair & maintenance, housekeeping, and landscaping. This study assessed the employees' musculoskeletal symptoms through CMDQ & CHDQ and the working posture through RULA & REBA in a property management of a residential complex in Metro Manila. A total of 100 employees participated in the studies, with 67 standing employees and 33 sedentary employees. The CMDQ results showed that WRMSDs are concentrated on the lower limbs (feet, legs, and knees) among standing employees. For sedentary employees, it is prevalent on the lower back, upper back, hips/buttocks, and neck. Since the sedentary employees involve fewer hand movements and lighter loads, the CHDQ results showed that WRMSDs in hand among sedentary employees (mainly from the administration group) is lower than those among the standing employees who often use heavy tools with more hand movements. The posture of the administration group, which makes up most of the sedentary employees, has a medium-risk level with borderline low-risk level. The posture risk of the other four employee groups, mostly standing employees, is medium to high.

Keywords: property management, physical ergonomics, musculoskeletal symptoms, working posture, RULA, REBA

1. Introduction

It is a common strategy for companies to know how to utilize effectively and invest in their resources for its growth and development. The most critical resource that has to be managed well is the company's employee [1].

The disorders of the body experienced by employees affecting muscular, skeletal, and other tissues whose cause has been associated with the work environment are referred to as the work-related musculoskeletal disorders (WRMSD), such as in cases of prolonged usage of computers among office workers [2].

There are five main aspects of services in a typical facility or property management team for residential properties: general management, security, repair & maintenance, cleaning, and leisure & landscape [3], with employees having distinct skills set in each aspect. WRMSD that has used to be mainly reported from the manufacturing industry is increasingly observed in the service industry, which includes the five aspects of facilities and property management [4].

Under the general management are the managers and administration staff who are office workers spending long working hours in front of a computer. This and sitting for a long time in a chair are linked with musculoskeletal system disorders of office workers [5]. There are related literatures establishing the

relationship of computer usage and other office activities to musculoskeletal disorders, such as recent studies in the Philippines with bank tellers [6] and call center workers [7].

WRMSD has been studied for other services industries as well in the Philippines, such as in garbage collection [8] and cleaners in educational institutions and commercial establishments [9].

This paper included each of the five employee groups of a property management team based on the five service aspects of Lai (2011), namely the (1) administration, (2) security, (3) repair & maintenance, (4) housekeeping, and (5) landscaping. Among the five employee groups, the administration is the only office employee. It includes managers, engineers, accountants, and front-office. The other four groups are involved in the tasks, as their name suggests. The security group is composed of security guards and one emergency medical technician (EMT). Repair & maintenance employees are skilled workers and technicians involved in minor building repair works and routine equipment checklist, operation, and maintenance. The housekeeping group handles the routine cleaning task, while the landscaping is responsible for the routine gardening and landscaping maintenance.

This study aims to assess the property management employees' posture while doing their designated tasks, and to evaluate the prevalence, severity, and work interference of musculoskeletal symptoms.

2. Methodology

2.1. Setting and participants

This study was conducted in a property management of a private residential complex in Metro Manila, Philippines comprising of high-rise residential buildings, open spaces, and common amenities. The study population consisted of office workers, engineers, and managers under the administration group who are in-house employees and performed general management of the building complex. Employees from third-party service contractors include receptionists, security guards, technicians, housekeeping personnel, and landscaping personnel.

2.2. Data gathering

To gather the data for this study on musculoskeletal symptoms, Google Forms was utilized to administer the questionnaire online. The questionnaires used in this study are the Cornell Musculoskeletal Discomfort Questionnaires (CMDQ) and Cornell Hand Discomfort Questionnaires (CHDQ) developed by Dr. Alan Hedge and ergonomics graduate students in Human Factors and Ergonomics Laboratory at Cornell University [10]. Using the CMDQ and CHDQ, musculoskeletal symptoms within the last work week of participants were evaluated, which includes the frequency and discomfort level, as well as the work interference due to discomfort.

For the posture analysis, the study used the Rapid Upper Limb Assessment (RULA) [11] and Rapid Entire Body Assessment (REBA) [12] as quick tools for the assessment of working postures by the participants. The longest posture sustained by participants while working that are within the scope of CCTV systems are identified, which mostly comes from the administration group working in the offices and the security guards and other personnel in the lobby. For other participants designated to areas with no CCTV monitoring, the researcher conducted personal identification of the posture of the participants while working. After identifying the working posture, the RULA and REBA are completed by the researcher. The results from RULA and REBA are used to evaluate the postural risk and discussion of the recommended ergonomic interventions.

Table 1: CMDQ & CHDQ score interpretation.

Score	Frequency
0	None
1.5	1-2 times last week
3.5	3-4 times last week
5	Once every day
10	Several times every day

Score	Discomfort Level
0	No Discomfort
1	Slightly uncomfortable
2	Moderately uncomfortable
3	Very uncomfortable
Score	Work Interference
1	Not at all
2	Slightly interfered
3	Substantially interfered

2.3. Statistical analysis

The data collected for the musculoskeletal analysis and postural analysis were interpreted using descriptive analysis. The study adopted the interpretation and scoring guidelines from the Cornell Musculoskeletal and Hand Discomfort Questionnaires and Cornell Hand Discomfort Questionnaires (CHDQ) [10] for musculoskeletal symptoms as shown in Table 1, and from the Rapid Upper Limb Assessment (RULA) [11] and Rapid Entire Body Assessment (REBA) [12] for the postural analysis as shown in Table 2.

Table 2: RULA & REBA score interpretation.

Score	Risk Level	Action
1	Negligible	None necessary
2 – 3	Low	May be necessary
4 – 7	Medium	Necessary
8 – 10	High	Necessary soon
11 – 15	Very high	Necessary now

3. Results

3.1. Socio-demographic results

The socio-demographic details of the one-hundred (100) respondents are shown in Table 3. A total count of 23 female employees and 77 male employees has participated in the study. The administration group has the highest participation comprising 29% of total respondents, followed by housekeeping (24%), repair & maintenance (21%), security (16%), and landscaping (10%). The age of female respondents ranges from 22 to 42 years old with a mean of 28.35 years (SD = 5.28), while the male respondents have a wider range of age from 20 to 63 years old with a mean of 34.22 years (SD = 8.48). The mean age of all participants is 32.87 years old.

Two-third of the total respondents is standing employee, and the remaining one-third is sedentary employee. The majority of male respondents are standing employees (78%), while, oppositely, the majority of female respondents are sedentary (70%). The total hours seating per workday of sedentary female employees ranges from 4 to 12 hours with a mean of 8.63 hours (SD = 2.16), while the male respondents have a smaller range from 4 to 10 hours with a mean of 5.06 hours (SD = 1.68). The total hours standing per workday of sedentary female employees range from 8 to 12 hours with a mean of 8.57 hours (SD = 1.51), while the male respondents have a smaller range from 6 to 12 hours with a mean of 8.48 hours (SD = 1.88).

3.2. CMDQ results

The collective data from the CMDQ survey is shown in Table 4 for sixty-seven (67) standing employees and Table 5 for thirty-three (33) sedentary employees. Scoring was based on the interpretation tabulated in Table 1, wherein the total score is the product of frequency, discomfort level, and work interference [10]. Among the body parts listed by standing employees, the feet have the highest total CMDQ score (111.5 for right, 107 for left), followed by the leg (94.5 right, 83 for left), and the knee (78.5 for both). For the sedentary

employees, the lower back has the highest total score of 280, followed by three body parts with a total score of more than 100, which are the upper back (198), hips/buttocks (177.5), and neck (149).

Table 3: Socio-demographic details of participants.

Variables	Female (n = 23)	Male (n = 77)	Total (n = 100)
Sample, n (%)			
Administration	14 (61%)	15 (19%)	29 (29%)
Housekeeping	5 (22%)	19 (25%)	24 (24%)
Landscaping	1 (4%)	9 (12%)	10 (10%)
R&M	0 (0%)	21 (27%)	21 (21%)
Security	3 (13%)	13 (17%)	16 (16%)
Age (Years)			
Range	22-42	20-63	20-63
Mean	28.35	34.22	32.87
Std. Deviation	5.28	8.48	8.22
Sedentary, total hrs. per work day			
Count, n (%)	16 (70%)	17 (22%)	33 (33%)
Range	4-12	4-10	4-12
Mean	8.63	5.06	6.79
Std. Deviation	2.16	1.68	2.62
Standing, total hrs. per work day			
Count, n (%)	7 (30%)	60 (78%)	67 (67%)
Range	8-12	6-12	6-12
Mean	8.57	8.48	8.49
Std. Deviation	1.51	1.88	1.84

Table 4: CMDQ for standing employees.

Body Part	CMDQ for Standing Employees			
	Frequenc y	Discomf ort	Interfere n ce	Tota l
Neck	28	17	78	33.5
Shoulder (R)	32	23	78	38.5
Shoulder (L)	29.5	19	77	33.5
Upper Back	23	18	80	38
Upper Arm (R)	21.5	17	75	23.5
Upper Arm (L)	19.5	17	75	18
Lower Back	30.5	20	80	36.5
Forearm (R)	13.5	15	73	13.5
Forearm (L)	17	15	73	17.5
Wrist (R)	18.5	16	76	40.5
Wrist (L)	18.5	19	76	48
Hips/Buttocs	12	18	76	18

Thigh (R)	22	17	76	46
Thigh (L)	20.5	17	75	43
Knee (R)	30	23	81	78.5
Knee (L)	28.5	22	79	78.5
Leg (R)	35	27	82	94.5
Leg (L)	35	26	81	83
Foot (R)	39.5	26	82	111.5
Foot (L)	38	25	81	107

*Note: (R) – Right, (L) – Left

Table 5: CMDQ for sedentary employees.

Body Part	CMDQ for Sedentary Employees			
	Frequenc y	Discomf ort	Interfere nce	Tota l
Neck	56	32	48	149
Shoulder (R)	34.5	24	39	93
Shoulder (L)	41.5	23	39	96
Upper Back	61.5	28	51	198
Upper Arm (R)	14.5	8	36	21
Upper Arm (L)	23	8	36	24.5
Lower Back	83.5	45	51	280
Forearm (R)	11	6	36	11
Forearm (L)	7.5	6	36	7.5
Wrist (R)	23	13	41	63.5
Wrist (L)	16	9	40	44.5
Hips/Buttocs	49.5	28	44	177.5
Thigh (R)	16	7	36	23
Thigh (L)	16	7	37	23
Knee (R)	19	8	36	17
Knee (L)	17.5	7	35	14
Leg (R)	18	15	38	48.5
Leg (L)	28	15	37	58.5

*Note: (R) – Right, (L) – Left

3.3. CHDQ results

The collective data from the CHDQ survey is shown in Table 6 for sixty-seven (67) standing employees and Table 7 for thirty-three (33) sedentary employees. Similar to CHDQ results, scoring was based on the interpretation tabulated in Table 1 [10]. For standing employees, Area F of both the right hand and the left hand has the highest total score of 137 and 109, respectively, followed by Area E (104 and 88) and Area A (80.5 and 72). For sedentary employees, the top four highest total scores are concentrated in the right hand, specifically in Area E (73), followed by Area A (67.5), Area F (57), and Area C (52).

Table 6: CHDQ for standing employees.

Part of Hand	CHDQ for Standing Employees			
	Frequency	Discomfort	Interference	Total
(L) Area A	40.5	13	78	80.5
(L) Area B	29	9	75	56
(L) Area C	30.5	10	75	60.5
(L) Area D	38.5	14	78	62
(L) Area E	47.5	12	77	104
(L) Area F	54	16	80	137
(R) Area A	37	14	77	72
(R) Area B	24	8	75	49
(R) Area C	25.5	10	76	52
(R) Area D	33.5	13	78	58.5
(R) Area E	37.5	12	78	88
(R) Area F	47.5	14	80	109

*Note: (R) – Right, (L) – Left; Area is shown in Figure 1

Table 7: CHDQ for sedentary employees.

Part of Hand	CHDQ for Sedentary Employees			
	Frequency	Discomfort	Interference	Total
(L) Area A	22.5	9	39	26.5
(L) Area B	9.5	6	37	17.5
(L) Area C	14.5	5	36	14.5
(L) Area D	18	8	37	39
(L) Area E	28	12	39	41
(L) Area F	24.5	10	39	34
(R) Area A	25.5	11	41	67.5
(R) Area B	14	7	39	19.5
(R) Area C	17.5	8	37	52
(R) Area D	19.5	8	38	36.5
(R) Area E	29	13	40	73
(R) Area F	24	14	42	57

*Note: (R) – Right, (L) – Left; Area is shown in Figure 1

3.4. RULA & REBA results

The RULA and REBA scores per employee group are shown in Table 8 and Table 9, respectively. The administration group has a range of score from 2 to 4 for both RULA & REBA, housekeeping has 3-6 and 3-7, respectively, 4-7 and 4-9 for landscaping, 2-7 and 2-9 for R&M, and 5-7 and 5-9 for security. For both RULA and REBA, the security group has the highest mean scores (6.27 and 7.67, respectively), followed by landscaping (6.00 to 6.80), R&M (5.81 and 6.43), housekeeping (4.50 and 4.63), and administration (3.24 and 3.45).

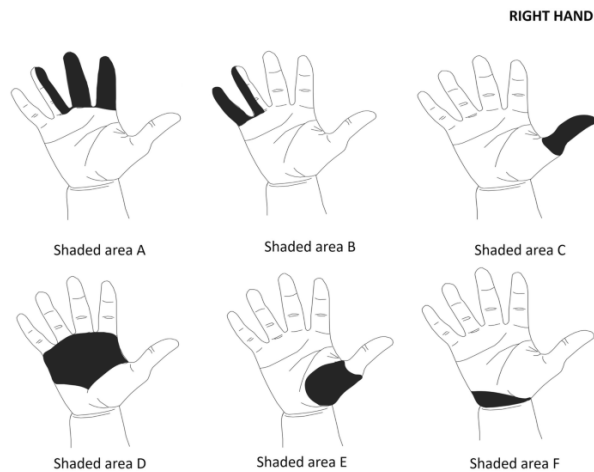


Fig. 1: Location of the area in CHDQ for right hand (typical to left hand)

Table 8: RULA score.

Employee Group	Range	Mean	Std. Dev.
Administration	2-4	3.24	0.83
Housekeeping	3-6	4.50	0.98
Landscaping	4-7	6.00	1.25
R&M	2-7	5.81	1.36
Security	5-7	6.27	0.70

Table 9: REBA score

Employee Group	Range	Mean	Std. Dev.
Administration	2-4	3.45	0.57
Housekeeping	3-7	4.63	1.44
Landscaping	4-9	6.80	2.35
R&M	2-9	6.43	2.04
Security	5-9	7.67	1.05

4. Discussion

The results from the RULA and REBA have shown that the five (5) employee groups have various postural risk levels based on the score interpretation in Table 2. The posture analysis of the administration group has a medium-risk level for RULA and REBA. It has the lowest scores among the employee groups, and the scores are almost borderline to the low-risk level category.

The following three groups, namely housekeeping, landscaping, and repair & maintenance, also have a medium risk level for RULA and REBA. Meanwhile, for the security group, the risk level is medium for RULA but high for REBA. These four employee groups composed mainly of standing employees except for one (1) repair & maintenance mostly seated in the control room as a building management system operator, and three (3) security personnel – two (2) security guards mostly seated in front of CCTV surveillance in the control room and one (1) security head or manager mostly seating in the security office. These standing employees on these four groups involve more body movement and muscle use in performing their tasks than in the administration group (who mainly use upper limbs only), which can explain these higher scores for RULA and REBA.

Among these four employee groups, housekeeping has the lowest RULA and REBA scores, as shown in Fig. 2. This is due to the nature of their work which is mainly routine janitorial services. Employees from the landscaping and repair & maintenance group perform more tasks with heavy movements and with the use of

power tools and machinery. Tasks in landscaping include watering, plant trimming using huge scissors and chainsaw, weeding, and grass cutting using mower and grass cutters. In repair & maintenance, there are different tasks that depend on the skillset of employees, namely painting, carpentry, masonry, welding, plumbing, machining, and various electrical & auxiliary works, including routine equipment checklist by technicians. These diverse tasks under R&M also involve many movements, muscle use for heavy loads and actions, and power tools such as hammer drill, chipping machine, grinder, and auger machine. These validated the high RULA and REBA scores and were consistent mostly with other similar studies for janitorial services [8], [9] and skilled workers or technicians [13], [14], and agriculture or landscaping [19], [20]

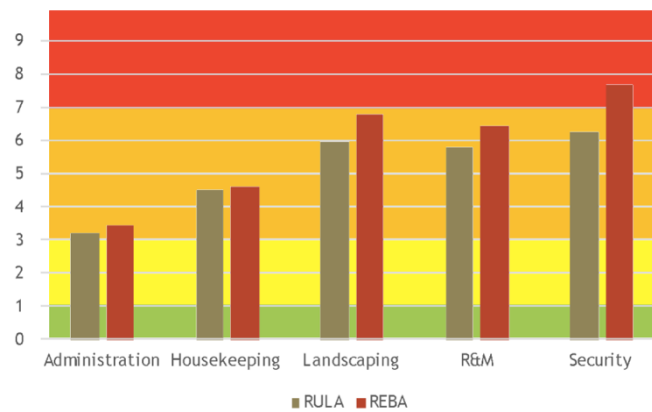


Fig. 2 : RULA & REBA mean total scores.

The security group, having the highest RULA & REBA score as shown in Figure 2, involves area roving and audits of emergency exit, door and windows, and other security systems. The routine checking of these security systems requires reaching elevated fixtures such as automatic door closers, emergency lights, and directional signage. The roving routine also involves checking busted ceiling lights and smoke detectors above and safe pathways below (e.g., tiles crack, obstructions, wet floor). Hence, frequent looking up and down is necessary. This neck movement for visual checking and upper limb for physical checking are significant contributors to the high total RULA and REBA scores. Another contribution of the high scores is the standing security employees in the lobby and backdoors bowing in the reception desks or podium tables to answer intercom phones and write for records and logs. Similar results were found in other research studies about security employees having high CMDQ results [15].

The results of CMDQ and CHDQ showed that despite the high frequency and discomfort levels among the participants, there are only a few work interference. The total scores per body part of the CMDQ and CHDQ are represented in Figure 3 and Figure 4, respectively, for standing and sedentary employees.

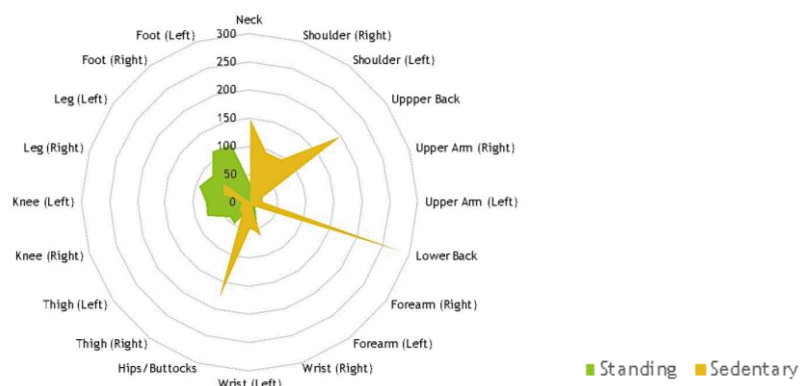


Fig. 3: Radar chart of CMDQ results

As shown in Figure 3, it is evident that the sedentary employees experienced more WRMSDs in the upper body. In contrast, for standing employees, it is more concentrated in the lower limbs. Specifically, the sedentary employees experienced high WRMSD in the lower back, upper back, hips/buttocks, and neck due to

prolonged posture, with few employees having poor seating posture. It is consistent with other similar studies wherein the lower back and upper back are prevalent among computer workstations [5]-[7], [16]. On the other hand, the standing employees experienced high WRMSD in feet, legs, and knees, which are expected for prolonged standing positions and frequent walking or heavy moving tasks.

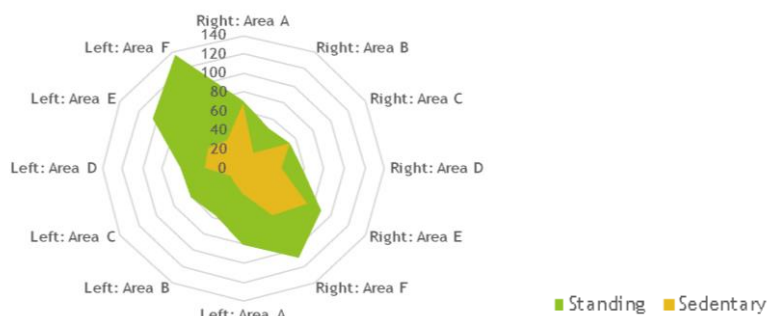


Fig. 4: Radar chart of CHDQ results.

Furthermore, since the sedentary employees use mainly office and computer-related tasks with fewer movements and lighter loads, the WRMSD in hand is lower, as shown in Figure 4, than those in the standing employees who use heavy tools and involve more hand movements. The WRMSDs among sedentary are concentrated in the right hand being the dominant hand in writing and other administrative tasks. Meanwhile, the WRMSDs among standing employees are prevalent in both hands as their tasks typically require both hands. For both sedentary and standing employees, the WRMSDs are concentrated in the area along the wrist to the base of the thumb (thenar eminence) and in the index & middle fingers. Similar results were found in other related studies, such as gardeners [17] and assembly workers [18].

With the discussed WRMSDs to several body parts among the employees, it is, therefore, advisable to conduct an ergonomic intervention with the aid of posture analysis through RULA & REBA. It is worth noting that the average hours per day of seating and standing are high, as shown in Table 3. Hence, shifting of nature of work can be considered to reduce the prolonged seating or standing.

The findings in this study show that risk in posture and the WRMSDs are prevalent among the property management employees working in a residential complex. However, the posture analysis using RULA and REBA was done with minimum experience and may not be accurately perfect. Nevertheless, it may be used to have a representation of the company's physical ergonomic and WRMSDs situation as the total number of participants is significantly high. Further studies still are recommended to be conducted, such as considering the body mass index (e.g., weight and height) and supplementing with other studies such as the cognitive ergonomics for computer workers [21], [22]. Studies that relate the findings of this study to work performance and productivity can also be done.

5. Conclusion

The work-related musculoskeletal disorders (WRMSDs) are prevalent among the property management employees with high severity on the lower back, upper back, hips/buttocks, and neck among sedentary employees (mainly from the administration group), and on feet, legs, and knees among standing employees (mainly from the other four groups). Figure 5 and Figure 6 show the approximate location of these top WRMSDs in the entire body and hands, respectively, for sedentary and standing employees. Among sedentary employees, hand WRMSDs are concentrated in the right hand. Meanwhile, WRMSDs in hand among standing employees are common for both hands and prevalent along the wrist to the base of the thumb (thenar eminence) and in the index & middle fingers. Despite the high prevalence and severity, the work interference, in general, is low.

The posture of the administration group, which makes up most of the sedentary employees, has a medium risk level, which means actions are necessary. However, the postural analysis mean scores are borderline to low risk, and actions can be focused more on those with poor working posture conditions, that is, awkward posture or sustained posture. Furthermore, the posture risk of the other four employee groups, mostly standing

employees, is medium except for the entire body posture analysis of the security group, which is high, requiring working posture intervention soon. Generally, the designated work in these four groups involves repetitive tasks. With this range of results, therefore, the nature of work (i.e., standing or sedentary) has an effect on the posture risks.

The findings of this study among the five employee groups of property management can help raise awareness on physical ergonomics and the prevalence of WRMSDs at workplaces and identify ergonomic interventions needed. The results would also benefit other organizations in terms of job design and work assignments and for future researchers who wish to conduct similar studies.

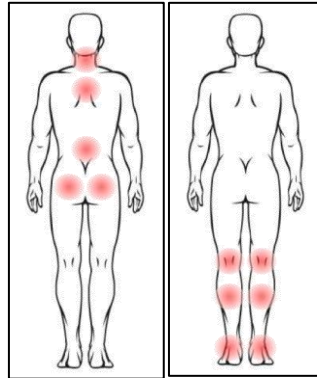


Fig. 5: Approximate location of top WRMSDs in the body for sedentary (left) and standing (right) employees.

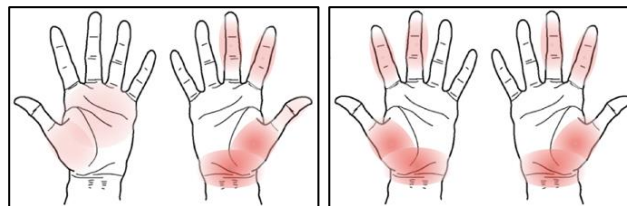


Fig. 6: Approximate location of top WRMSDs in hands for sedentary (left) and standing (right) employees.

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