Fitting the Work to the Worker:

Impact of the Participatory Ergonomics Approach to Reducing Discomfort Among Custodial Workers

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Background

- Over 2 million people work in building cleaning in the US (US BLS, 2015).
- In 2010, janitors and cleaners in the US suffered over 46,000 workplace injuries and had the 16th highest injury rate for all occupations (US BLS, 2012 as cited in Seixas 2013).
- Muscle fatigue and discomfort are risk factors for work-related musculoskeletal disorders and can predict future pain and injury (Hamberg-van Reenen 2008).
- Many custodial tools have not changed in the past 100 years.

Aims

- Analyze custodial tasks and demographic characteristics as potential risk factors for discomfort to identify where ergonomic recommendations may be of benefit.
- Assess discomfort severity levels for custodial tasks and locations on the body where tasks cause high levels of discomfort before and after the ergonomic recommendations.

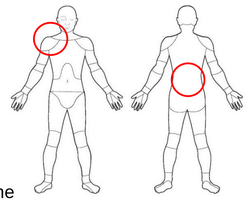
Methods

Study Design:

- This study of UW custodial workers used pre- and post-modification surveys to assess discomfort for 16 custodial tasks.

Data Collection:

- Pre-modification surveys were given in early fall at three locations on the UW-Seattle campus to any UW custodian over 18 years old with no minimum work history.
- Ergonomic recommendations including trainings and tool modifications were implemented the following spring.
- Post-modification surveys were given in summer to assess the effect of the ergonomic recommendations and modified tools.
- In the surveys, if a task caused discomfort, participants selected the affected body part on an anatomic figure and rated discomfort severity level on a scale of 1-7 with 5-7 ranked as high severity.



Participatory Ergonomics:

- Custodians, managers and health and safety personnel met to develop task modifications using new tools and ergonomic training for four tasks (see Figure 2a): vacuum backpack, cleaning toilets, picking up garbage from the floor, and scraping floors.
- Participation in surveys and ergonomic recommendations, including trainings and modified tool use, was voluntary and distributed by availability.

Analysis: Used Ordinal Logistic Regression to analyze survey data for overall discomfort and multiple task discomfort models.

Table 1. Demographics of Population

	Pre-Modification Survey (n=133)		Post-Modification Survey (n=106)	
	n	(%)	n	(%)
Ages				
<40 years	10	(8)	9	(9)
40-49 years	29	(23)	21	(22)
50-59 years	51	(40)	42	(43)
60+ years	37	(29)	25	(26)
Missing	6	--	9	--
Sex				
Female	76	(62)	55	(58)
Male	47	(38)	40	(42)
Missing	10	--	11	--
Years Worked				
0-5 years	26	(21)	27	(28)
6-10 years	24	(19)	18	(19)
11-15 years	26	(21)	19	(20)
16-20 years	29	(23)	15	(15)
21+ years	20	(16)	17	(18)
Missing	8	--	10	--
BMI				
Underweight (<18.5)	2	(2)	7	(7)
Normal (18.5-25)	38	(32)	35	(38)
Overweight (25-30)	65	(54)	36	(38)
Obese (30+)	14	(12)	16	(17)
Missing	14	--	12	--

	Pre-Modification Survey (n=133)		Post-Modification Survey (n=106)	
	n	(%)	n	(%)
Height				
Short (≤ 5'5 M/5'0 F)	27	(27)	29	(37)
Average	38	(39)	23	(30)
Tall (≥ 5'9 M/5'3 F)	33	(34)	26	(33)
Missing	35	--	28	--
Primary Language				
English	77	(62)	60	(66)
Other	48	(38)	31	(34)
Missing	8	--	15	--
Primary Handedness				
Right	113	(90)	79	(89)
Left/Both	13	(10)	10	(11)
Missing	7	--	17	--
Attended Training				
None	--	--	2	(2)
Some Trainings	--	--	36	(35)
All Trainings	--	--	66	(63)
Missing	--	--	2	--
Taken Survey Before				
No	125	(96)	33	(33)
Yes	5	(4)	68	(67)
Missing	3	--	5	--

Results

Table 2. Training Participation and Receipt of Modified Tools

	Vacuum Backpack		Cleaning Toilets		Picking Up Garbage from Floor		Scraping Floor	
	n	(%)	n	(%)	n	(%)	n	(%)
UW Custodians (n = 218)								
Attended Training	189	(86)	185	(85)	185	(85)	185	(85)
Study Participants (n=106)								
Attended Training								
Yes	96	(95)	93	(91)	83	(86)	97	(88)
No	5	(5)	9	(9)	13	(14)	11	(12)
Missing	5	--	4	--	10	--	16	--
Received New Tool								
Yes	58	(85)	55	(90)	17	(25)	9	(15)
No	10	1(5)	6	(10)	51	(75)	51	(85)
Missing	38	--	45	--	38	--	46	--

Figure 1. Proportion of Study Participants Who Use Modified Tools/Methods

Figure 2. High Severity Discomfort Among Participants Who Reported Any Level of Discomfort

a. Percentage of Participants Reporting High Severity Discomfort for Modified Tasks

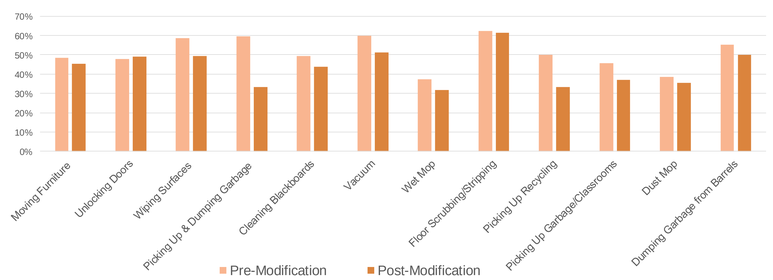
Modification: Systematically tightening harness straps personalizes backpack fit

Modification: Long handled toilet brush reduces bending over

Modification: Long trash grabber reduces picking up trash by hand

Modification: Long-handled scraper reduces kneeling and bending

b. Percentage of Participants Reporting High Severity Discomfort for Unmodified Tasks* (Totals Only)



* Tasks were not explicitly part of the ergonomic training or tool modification recommendations

Table 3. Odds of Multiple Task Discomfort & Overall Discomfort Severity

	Multiple Task Discomfort				Overall Discomfort Severity			
	Pre-Modification		Post-Modification		Pre-Modification		Post-Modification	
	OR*	95% CI	OR**	95% CI	OR*	95% CI	OR**	95% CI
Female vs. Male	**3.28**	**(1.17-9.21)**	2.30	(0.67-7.86)	0.93	(0.25-3.54)	3.26	(0.72-14.72)
Age Range (compared to <40 years)								
40-49 years	1.43	(0.29-7.03)	**0.09**	**(0.01-0.89)**	1.14	(0.22-5.78)	0.99	(0.08-11.71)
50-59 years	0.80	(0.17-3.73)	**0.07**	**(0.01-0.75)**	0.24	(0.30-1.89)	0.3	(0.20-4.42)
60+ years	1.04	(0.20-5.47)	**0.06**	**(0-0.86)**	0.23	(0.26-1.98)	1.08	(0.08-14.12)
Job Years (compared to 0-5 years)								
6-10 years	4.46	(0.92-21.57)	3.47	(0.85-14.17)	**9.84**	**(1.23-78.61)**	0.32	(0.04-2.79)
11-15 years	0.65	(1.16-2.65)	4.94	(0.94-26.13)	**6.15**	**(1.14-33.20)**	0.15	(0.01-4.22)
16-20 years	1.70	(0.39-7.45)	5.47	(0.38-79.06)	6.04	(0.98-37.27)	0.39	(0.02-7.21)
21+ years	3.87	(0.80-18.78)	3.00	(0.58-15.61)	3.45	(0.48-24.85)	0.41	(0.02-10.36)
Attended Training								
Some Training	--	--	**0.03**	**(0-0.32)**	--	--	34.92	(0.34-3627)
All Trainings	--	--	**0.03**	**(0-0.45)**	--	--	26.64	(0.51-1398)
Non-English vs. English Speakers	1.91	(0.73-4.99)	3.4	(0.92-12.56)	**3.56**	**(1.12-11.33)**	0.73	(0.51-1398)

*Adjusted for BMI, age range, height and language.
**Adjusted for BMI, age range, height and language, and training
Note: Bold type ORs are significant at p<0.05

Conclusion

- Total reports of high severity discomfort decreased for most tasks, including all four modified tasks, after the ergonomic modifications were recommended.
- Tasks where custodians consistently received training and new tools (Vacuum Backpack and Cleaning Toilets) showed the greatest decrease in back pain. Vacuum Backpack also had the greatest decrease in shoulder pain post-modification.
- Females were more likely to report discomfort than males in the pre-modification survey.
- Custodians with increasing age reported less discomfort after the ergonomic training were completed and tool modifications were recommended.
- An increasing number of years worked was associated with a increasing overall discomfort severity after 6-10 and 11-15 years worked suggesting a cumulative trauma source of discomfort. The association between years worked and overall discomfort severity was no longer present after modifications were recommended.
- Attendance of trainings was associated with a reduction in multiple task discomfort but not with overall discomfort severity.
- Custodians who did not speak English as their primary language had higher overall discomfort severity prior to the modifications. Language lost significance post-modification.

Limitations

- Anonymous surveys inhibited direct comparisons by individual between the two surveys.
- Only 16% of pre-modification surveys and 5% of the post-modification surveys were completed as intended.
- Baseline chronic pain may have biased discomfort reporting.
- Seasonal workload of custodians may have impacted reporting differences between surveys.
- There was differential emphasis by managers on employees to take the surveys.
- Modified tools were not uniformly distributed, and custodian receipt of tools was not within the control of the project team. The adoption of modified tool use was voluntary.

Implications

- Participatory ergonomics efforts between custodians, managers, and health and safety professionals may help reduce the burden of musculoskeletal disorders in this high-risk occupation.
- Surveying workers may be useful in identifying tasks causing discomfort and anatomic localization of discomfort may help modify tasks.
- Future studies might prefer alternate forms of data collection to help overcome language barriers and anonymity concerns of employees.
- Future studies might address the repetitive nature and force aspects of this work.

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