



Washington State Janitorial Workload Study

Progress report to the Legislature

December 2022

Publication 102-124-2022

Acknowledgments

Special thanks to all the workers, employers, and community partners who participated in this research, including: Service Employee International Union Local Chapter 6 (SEIU6), Spokane Alliance, Entre Hermanos, El Centro de la Raza, and janitors around the state of Washington.

WA Janitorial Workload Study Staff Leadership

Caroline Smith, PhD MPH

Stephen Bao, PhD, CPE, CCPE

David Bonauto, MD MPH

Naomi Anderson, MPH

Michael Foley, MA

Wonil Lee, PhD

Ninica Howard, MSc, CPE

Jia-Hua (Jim) Lin, PhD, CPE

Patricia Pacheco, BA

Nanette Yragui, PhD

Additional L&I Staff

Elyette Martin

Christina Rappin

Amanda Robinson

Cathy Nevitt

Jacquie Goodwill

Table of Contents

Acknowledgments	2
Executive Summary	4
Introduction	5
Janitorial Study: Legislative Mandate.....	5
Background & Scope	5
Methodology	6
Study components.....	6
Progress Reports of Research Study Components.....	7
1. STATEWIDE SURVEY OF JANITORS	7
Workpace summary results.....	8
Next steps	9
Summary of Research Activity to Date.....	10
2. WORKLOAD ASSESSMENT	11
Work pace and the associated physical exposures of common cleaning tasks	12
3. WORKLOAD CALCULATOR DEVELOPMENT	15
Janitor Workload Calculator	15
4. EDUCATION AND TRAINING DOCUMENTS.....	18
5. STATEWIDE SURVEY OF JANITORIAL EMPLOYERS	18
6. INJURED WORKER INTERVIEWS	19
Methods	19
Summary of research activity to date.....	20
Conclusion	23
References.....	24

Executive Summary

This is the third progress report to the Washington State Legislature describing advances in the Washington State Janitorial Workload Study, as required in the 2021 operating budget. This research study is being conducted by the Department of Labor & Industries (L&I) Safety & Health Assessment & Research for Prevention (SHARP) to help correctly assign workload through the development of a “workload calculator” and other efforts to reduce work-related injuries among janitors.

This phase continues data collection through surveys while also developing educational materials. Previous components of the study and detailed methods are provided in the [January 2022](#) and [June 2020](#) reports to the legislature.

The majority of the analysis is ongoing, and brief progress reports on the status of all six (6) current study components are included in this report. These include:

1. **Statewide survey of janitors:** Analyses of the statewide survey of janitors continues and offers rich data to help understand their needs. Work is underway on multiple research topics on this portion of the janitorial research study. Survey data is being analyzed to better understand work pace correlation with physiological responses and trunk postures.
2. **Conduct an assessment of workload and workspace:** Study the workplace factors and the amount of time on each job to determine the risks and exposures to individual workers.
3. **Develop and test a workload calculator:** All data collected in this study will help develop a standalone calculator that can assist employers and labor groups in determining safe workloads when developing worksite contracts, or in-house cleaning schedules and assigning appropriate staffing levels. Draft examples of the calculator are included in this report.
4. **Education and training documents:** In formative work, research showed the diversity of the janitorial workforce needed cultural- and language-appropriate safety and health training resources. SHARP research staff are developing educational materials on health and safety hazards that will be appropriate for employers and workers, alike. All documents are available in the languages most frequently spoken by janitors, including English and Spanish, Amharic, Bosnian, Chinese, Russian, Somali, Tagalog, and Vietnamese. Published educational and training documents are available on the [study website](#).
5. **Statewide survey of janitorial employers:** An online, statewide postcard survey of janitorial firms was suspended in 2021, with too few responses. It began again in September 2022, with analyses expected in the next report.
6. **Injured worker interviews:** During COVID-19, interviews of injured workers were also suspended due to low response.

Introduction

Janitorial Study: Legislative Mandate

The Washington State Legislature provided the Department of Labor & Industries, Safety & Health Assessment & Research for Prevention (SHARP) Program funds initially in 2018 to conduct research to address the high injury rates of the janitorial workforce. The funding was continued in subsequent budgets. The research must:

- Quantify the physical demands of common janitorial work tasks.
- Assess the safety and health needs of janitorial workers.
- Identify potential risk factors associated with injuries among this workforce.
- Measure workload based on body strain per specific janitorial work tasks.

The department must conduct interviews with janitors and their employers to:

- Collect information on risk factors.
- Identify the tools, technologies and methodologies used to complete work.
- Understand the safety culture and climate of the industry.
- Issue [an initial report to the legislature on June 30, 2020](#).
- Determine usable support tools (the workload calculator) to reduce risk of injury.

A note on terms. Public sector cleaning workers are generally called “custodians,” while those in the private sector are called “janitors.” This report generally refers to all workers as “janitors.”

Background & Scope

Recent research demonstrates that janitorial work is considered labor intensive with a demanding pace, and high musculoskeletal and cardiovascular loads (Hagner and Hagberg, 1989; Seixas et al., 2013; Sjøgaard et al., 1996). The body parts most affected by this type of work are the back, legs, and arms (Seixas et al., 2013). The main factors that may influence these exposures are work procedures (tasks), the environment, tools/methods, individual factors, and organizational and psychosocial contexts.

Despite these risks, the number of janitors and cleaners (excluding maids and housekeeping cleaners) employed in Washington State increased by about 20% between 2013 and 2018 (BLS, 2020). An increase in workload was also found.

A study of union and non-union janitors found a reported increase of work intensity of 8.6% over a three year period (Seixas, 2013). In Minnesota, Green et al. (2019) conducted survey research to identify the relationship between workload and injury and found that an increase in self-reported workload was correlated with occupational injury.

These findings show the need to develop a method to calculate workload in a way that janitorial firms can determine safe workloads for janitors. The factors to include in those calculations include a combination of work assigned, tools, and work environment, itself.

Methodology

The research team uses a variety of methods to understand the physical workload of janitors and their capacity to perform such work, including:

- Janitor observations, for biomechanical and physiological workload estimates.
- Survey and interview data, on psychosocial and safety climate perceptions.
- Injured worker interviews, for more detail about workplace conditions.

Workplace factors and the amount of time on each job determines the risks and exposures on individual workers. A worker's physical and psychological capacity also determines proper workload for an individual worker. When workload factors exceed a worker's capacity, negative health outcomes are expected. All these factors must be considered in developing a tool to calculate proper workload among janitorial workers.

Study components

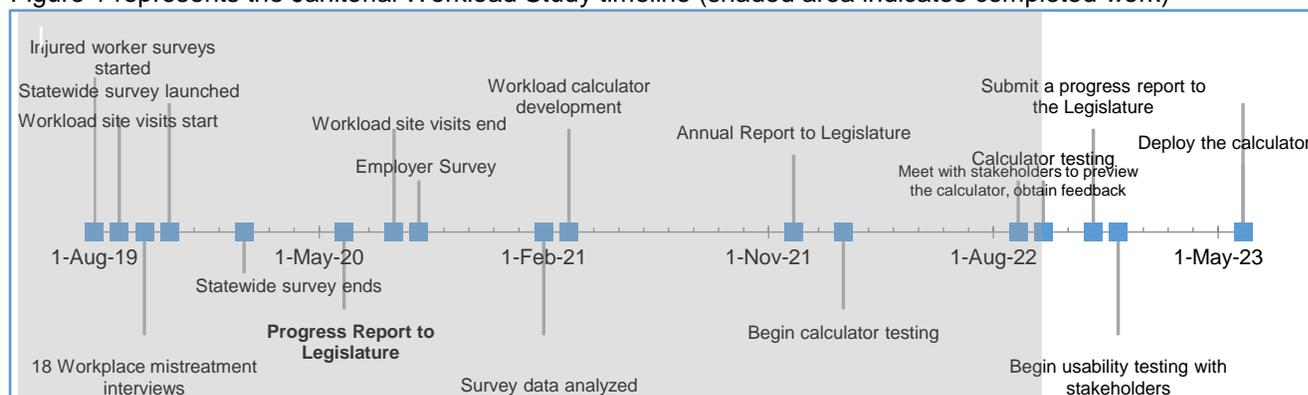
This study involves a multidisciplinary team of occupational health and safety researchers, and includes multiple phases and components. Initial data collection and analyses continued in the third year of the study. There are five main areas of work, including:

- **Statewide survey of Janitors:** Survey is complete and the initial analyses are completed. See the next section for details.
- **Statewide survey of janitorial employers:** The employer survey was relaunched in September 2022 due to low initial response rates.
- **Injured worker interviews:** Descriptive responses from injured worker interviews are provided in this report.
- **Workplace site visits:** Seventeen workplace site visits were completed, at five worksites. Detailed analyses will continue through early 2022. Preliminary results are provided in the Workload Assessment section of this report.
- **Workload calculator development and testing:** As the workplace site visit data is analyzed, along data from the statewide surveys, a draft workload calculator was developed to assist janitorial firms in designing workloads that do not exceed an average janitors' work limits. Factors involved in the calculation include physical exposures, tools and equipment used, and the workplace environment.

In addition, data analysis from site visits and statewide surveys continues. Additional educational training materials are listed in section four.

SHARP is also developing a beta version of the workload calculator to assign workload and reduce work-place injuries. As shown in Figure 1, development of the workload calculator began with site visits in 2019. Testing the function of the calculator will begin in early 2023 and it is expected to be deployed in mid-2023.

Figure 1 represents the Janitorial Workload Study timeline (shaded area indicates completed work)



Prior research from the study’s first phase shows the issues facing janitors at work. These include the need for safety and health training, workload, work pace, and equipment issues. Also facing janitors are levels of workplace mistreatment, bullying, and violence. In addition, that research included an economic scan of the janitorial industry in Washington State, and nationally. These formative research findings were included in the [June 2020 report to the legislature](#).

Progress Reports of Research Study Components

Janitorial work has high physical demands and chemical exposures, and janitors/custodians have a high rate of work-related injuries and illnesses – from musculoskeletal disorders, respiratory disease, and traumatic injuries – when compared to other occupations. The study’s research components explored both causes and interventions to mitigate risks for workers.

1. STATEWIDE SURVEY OF JANITORS

To reduce the burden of occupational injury and illness, information on what the tasks, workload, pace, and other exposures of janitors/custodians is needed. To gather this information, a statewide survey of janitors was conducted by a contracted survey research company. This will inform future study activities and guide the creation of injury/illness prevention materials, education/training materials, intervention activities, and outreach.

Methods and preliminary results are detailed in the [2021 report to the legislature](#). Researchers presented results of the survey to the Council of State and Territorial Epidemiologists (CSTE) in the summer of 2022, and as a panel at Human Factors and Ergonomics Society (HFES) in October of 2022.

Workpace summary results

Key highlights of the information learned in the survey is below:

Janitors, overwhelmingly, worked for janitorial companies (81.8%), followed by building owners (8.2%). Most janitors reported that their work is assigned by area (81.8%), rather than task. In this circumstance, janitors perform all the cleaning tasks in an assigned area. Less than half the janitors rotated between tasks or areas (46.2%)

Table 1. Job Characteristics of Participating Janitors

Employer Description	Percent
Work for a company that cleans buildings	81.8%
Work for a company that owns buildings	10.5%
Work as an independent contractor/freelance worker	5.3%
Other	1.8%
Work for a temporary agency	0.5%
Work Assignment Arrangement	
Perform only one cleaning task only per shift	11.6%
Perform all cleaning tasks in an assigned area	84.7%
Rotate between tasks or areas	46.2%

The cleaning tasks most commonly performed on a daily basis were: dusting (62.5%), cleaning restrooms (65.1%), sweeping floors (64.0%), mopping floors (58.4%) and vacuuming (56.3%). Only small proportions of janitors reported performing cleaning tasks on a monthly or longer basis. Though the durations of cleaning tasks varied greatly within cleaning tasks, the cleaning tasks with the longest mean durations were: manually stripping/buffing/waxing floors (134.4 minutes), shampooing carpets (126.2 minutes), cleaning floors and carpets using a ride-on machine (134.4 minutes). For janitors who perform these tasks, they are more commonly assigned only this one task in a shift, resulting in longer durations.

Table 2. Duration and Frequency of Cleaning Tasks

Cleaning Task	Average Duration (min)	Frequency		
		Daily	Weekly	Monthly or longer
Cleaning floors and carpets with ride-on machine	134.4	4.1%	2.5%	2.5%
Striping/buffing/waxing floors, manually	134.4	3.8%	3.7%	8.0%
Shampooing carpets	126.2	7.8%	6.1%	11.3%
Shampooing upholstery	120.5	2.4%	1.9%	3.7%
Cleaning restrooms	115.1	65.1%	15.6%	2.2%
Vacuuming	105.9	56.3%	19.1%	3.2%
Scrubbing floors, hand held machine	104.2	14.3%	10.8%	8.8%
Emptying and relining trash bins	98.4	66.0%	15.3%	1.3%
Dusting/dry mopping/sweeping floors	97.7	64.0%	18.5%	1.7%
Maintaining outdoor areas	95.4	11.0%	8.6%	3.8%
Dusting/wiping surfaces	95.4	62.5%	23.3%	2.7%
Cleaning kitchens/cafeterias/coffee stations	93.5	60.6%	17.4%	1.4%
Wet mopping floors, manually	93.3	58.4%	21.8%	2.2%
Cleaning windows	80.4	24.2%	19.1%	13.7%

Wiping/vacuuming furniture	80.3	29.0%	20.7%	7.0%
Rearranging/moving furniture	58.8	9.6%	10.0%	4.6%
Restocking/replacing supplies	58.0	40.2%	22.3%	10.2%
Transporting trash to dumpster/compactor	56.5	62.2%	13.7%	1.3%

With respect to physical demands, janitors reported experiencing physical difficulty in completing several cleaning tasks. These tasks included scrubbing floors with a hand-held machine (60.0%), stripping/buffing/waxing floors (59.0%), rearranging or moving furniture (46.9%), and shampooing carpets (48.4%).

Table 3. Physical Difficulty in Performing Cleaning Tasks (n=627). Percent responses reporting “Difficult” and “Very difficult”.

Cleaning Task	Percent
Scrubbing floors hand held machine	60.0%
Stripping/buffing/waxing floors, manual	59.0%
Shampooing carpets	48.4%
Rearranging/moving furniture	46.9%
Shampooing upholstery	43.1%
Wet mopping floors, manual	39.0%
Transporting trash to dumpster/compactor	38.0%
Cleaning restrooms	35.5%
Cleaning windows	34.2%
Vacuuming	34.0%
Dusting/mopping/sweeping floors	33.4%
Cleaning floors and carpets, ride-on machine	33.3%
Emptying/relining trash bins	28.5%
Maintaining outdoor areas	24.7%
Dusting/wiping surfaces	24.4%
Wiping/vacuuming furniture	20.8%
Cleaning kitchens/cafeterias/coffee stations	20.4%
Restocking/replacing supplies	16.6%

Next steps

Additional tasks to be addressed using janitorial worker responses to the statewide survey include:

- Finish analyzing janitorial cleaning tasks (above summary), and submit as a manuscript to a peer reviewed publication.
- Categorizing and analyzing chemical exposures to janitors.
- Analyzing occupational health and safety differences between union and non-union janitors.
- Assessing the correlation between personal protective equipment (PPE) availability, use and health outcomes.
- Analyzing relationships between safety climate and occupational safety and health.

Summary of Research Activity to Date

Multiple research reports that are anticipated to be published scientific manuscripts are in progress using the information provided by janitors in response to this survey. Two studies have been published. Detailed summaries of those are below. Copies of the journal articles are available upon request.

Published studies

Work-related injury burden, workers' compensation claim filing, and barriers: results from a statewide survey of janitors

Authors: Anderson, Naomi J., Caroline K. Smith, and Michael P. Foley.

Published in: *American journal of industrial medicine* 65, no. 3 (2022): 173-195.

[Abstract](#)

Background

Janitors are a low-wage, ethnically and linguistically diverse, hard-to-reach population of workers with a high burden of occupational injury and illness.

Methods

Data from an extensive multimodal (mail, phone, and web) survey of janitors in Washington State were analyzed to characterize their working conditions and occupational health experiences. The survey included questions on demographics, work organization and tasks, health and safety topics, and discrimination and harassment. The survey was administered in eight languages.

Results

There were 620 complete interviews received. The majority returned by mail (62.6%), and in English (85.8%). More than half were female (56.9%), and the mean age was 45 years. Twenty percent reported a health-care-provider diagnosed work-related injury/illness (WRII) in the past 12 months. Latino women and janitors had significantly higher relative risk of WRII. This was also associated with several work organization factors that may indicate poor working conditions, insufficient sleep, and possible depression. Half of injured janitors did not file workers' compensation (WC) claims.

Conclusions

Janitors reported a high percentage of WRII, which exceeded previously published estimates from Washington State. Women and Latino janitors had significantly increased risk of WRII, and janitors' working conditions may influence the unequal distribution of risk. WRII surveillance via workers' compensation or medical care usage in janitors and other low-wage occupations may reflect substantial underreporting. Characterizing the nature of janitors' work experience can help identify avenues for prevention, intervention, and policy changes to protect the health and safety of janitors.

The job demand-control-support model and work-related musculoskeletal complaints in daytime and nighttime janitors: The mediating effect of burnout.

Authors: Lee, Wonil, Nanette L. Yragui, Naomi J. Anderson, Ninica Howard, Jia-Hua Lin, and Stephen Bao.

Published in: *Applied Ergonomics* 105 (2022): 103836.

Highlights

- The relationships between job demand-control-support, burnout and musculoskeletal complaints were examined.
- Observed relationships differed between daytime and nighttime janitors.
- Burnout mediated the relationship between job demands and musculoskeletal complaints on both groups
- Findings highlight the importance of addressing burnout among janitors.

2. WORKLOAD ASSESSMENT

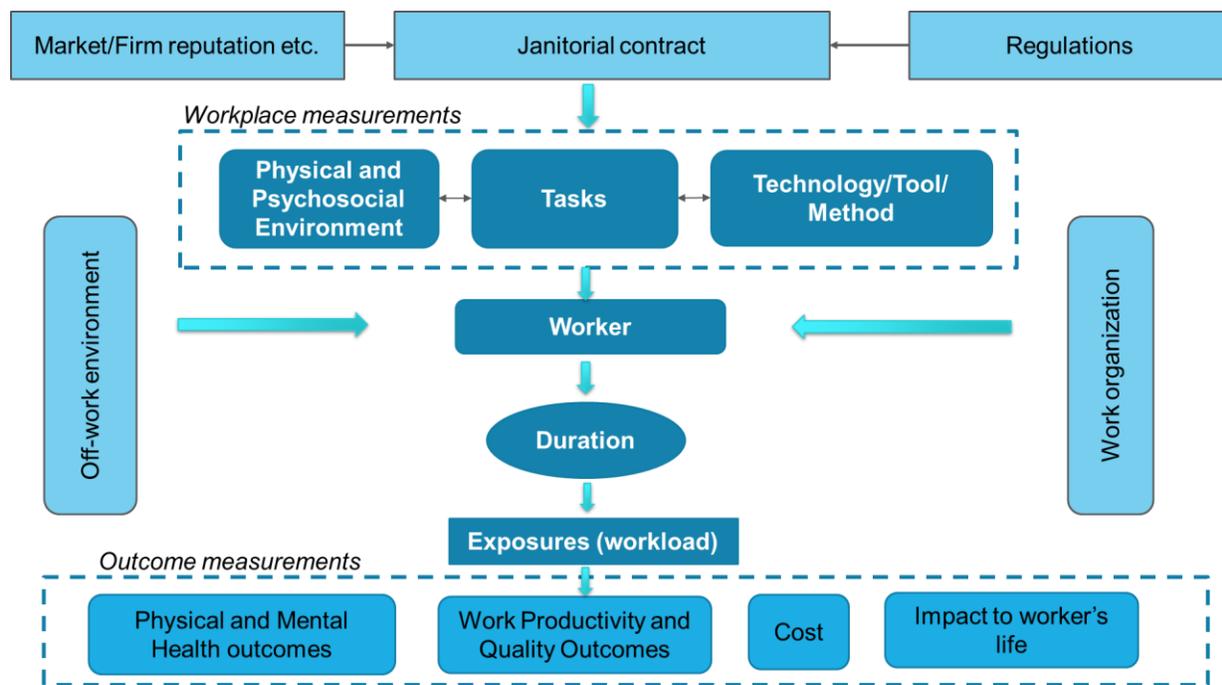
Janitorial work is labor intensive with a demanding work pace, and high musculoskeletal and cardiovascular workloads (Hagner and Hagberg, 1989; Seixas et al., 2013). Green et al. (2019) identified the relationship between workload and injury via survey, and found that as self-reported workload increased so too did occupational injury. Kumar and Kumar (2008) conclude that repetition, posture, and static muscle use are the major risk factors for janitors' musculoskeletal discomfort and disorders.

Workplace factors and the amount of time on each job determines the risks and exposures to individual workers. A worker's physical and psychological capacity also determines proper workload for an individual worker. When workload factors exceed a worker's capacity, expect negative health outcomes. All these factors must be considered in developing a tool to calculate proper workload among janitorial workers.

This conceptual model is illustrated in Figure 2, below. The 2020 report described the research activities that informed this year's work. There are three major sections:

- The first one is the workload assessment using workplace measurements, with a goal to identify the three elements enclosed in the top dotted rectangle.
- The second section models a method to understand work pace issues regarding how the work is organized and completed (work organization).
- The final section covers psychosocial factors – job demand, job control, social support, and burnout. These contribute to musculoskeletal issues and injury.

Figure 2. Workload Conceptual Model: Simplified and outlining areas currently being analyzed.



Work pace and the associated physical exposures of common cleaning tasks

The rate of work, or “work pace” is generally set by cleaning industry managers who assign tasks to be completed during a shift to janitors according to what must be cleaned. Prior research (Houtman et al., 1994; Seixas et al., 2013) demonstrated that fast work pace is associated with musculoskeletal pain or discomfort among janitors.

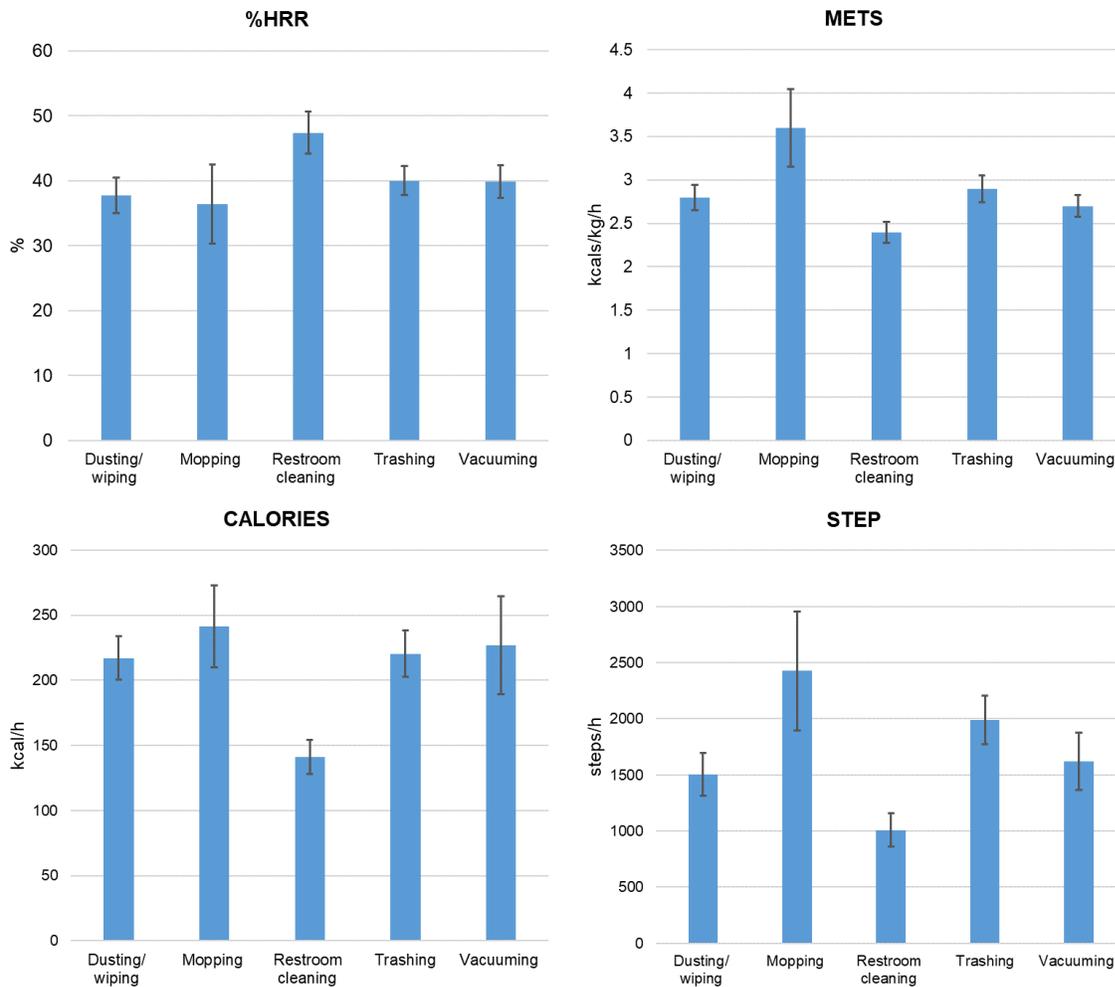
Physiological responses including heart rate, energy expenditure, steps, and trunk posture measurements have been used as indicators of the risk of high workload and work-related musculoskeletal disorders (WMSDs) in janitorial research (Balogh et al., 2004; Green et al., 2019; Hultman et al., 1984). This study aimed to measure these indicators when common cleaning tasks were performed, and examined the correlation among work pace, physiological responses, and trunk postures.

Data was gathered from site visits in 2019-2020. SHARP staff performed time studies using video recordings taken during the site visit and used blueprints and site notes to determine the area (in square feet), linear length (in feet), or the number of fixtures that janitors cleaned. The work pace as the ratio of the observed production rate to the [industry standard production rate \(ISSA, 2021\)](#) was then calculated. In the data analyses, the five most common tasks were identified as dusting/wiping, mopping, restroom cleaning, trashing, and vacuuming. The physiological responses and variables in the current study are listed in Table 4.

Table 4. Summary of measurements and analysis representing workload in janitorial tasks.

Physiological responses	<p><i>%HRR</i>: Percent heart rate reserve (%)</p> <p><i>METS</i>: Metabolic equivalents, activity level (kcal/kg/h)</p> <p><i>CALORIES</i>: Calories burned per hour, energy expenditure (kcal/h)</p> <p><i>STEP</i>: Number of steps per hour (steps/h)</p>
Trunk posture	<p><i>50%tile</i>: 50th percentile of trunk flexion posture (degrees)</p> <p><i>90%tile</i>: 90th percentile of trunk flexion posture (degrees)</p> <p><i>PCT20TO60</i>: Percentage of time with trunk flexion at 20° to 60° (%)</p> <p><i>PCTGE60</i>: Percentage of time with trunk flexion ≥ 60° (%)</p>
Work pace	<p>$\frac{\text{Observed production rate}}{\text{Standard production rate}}$</p>

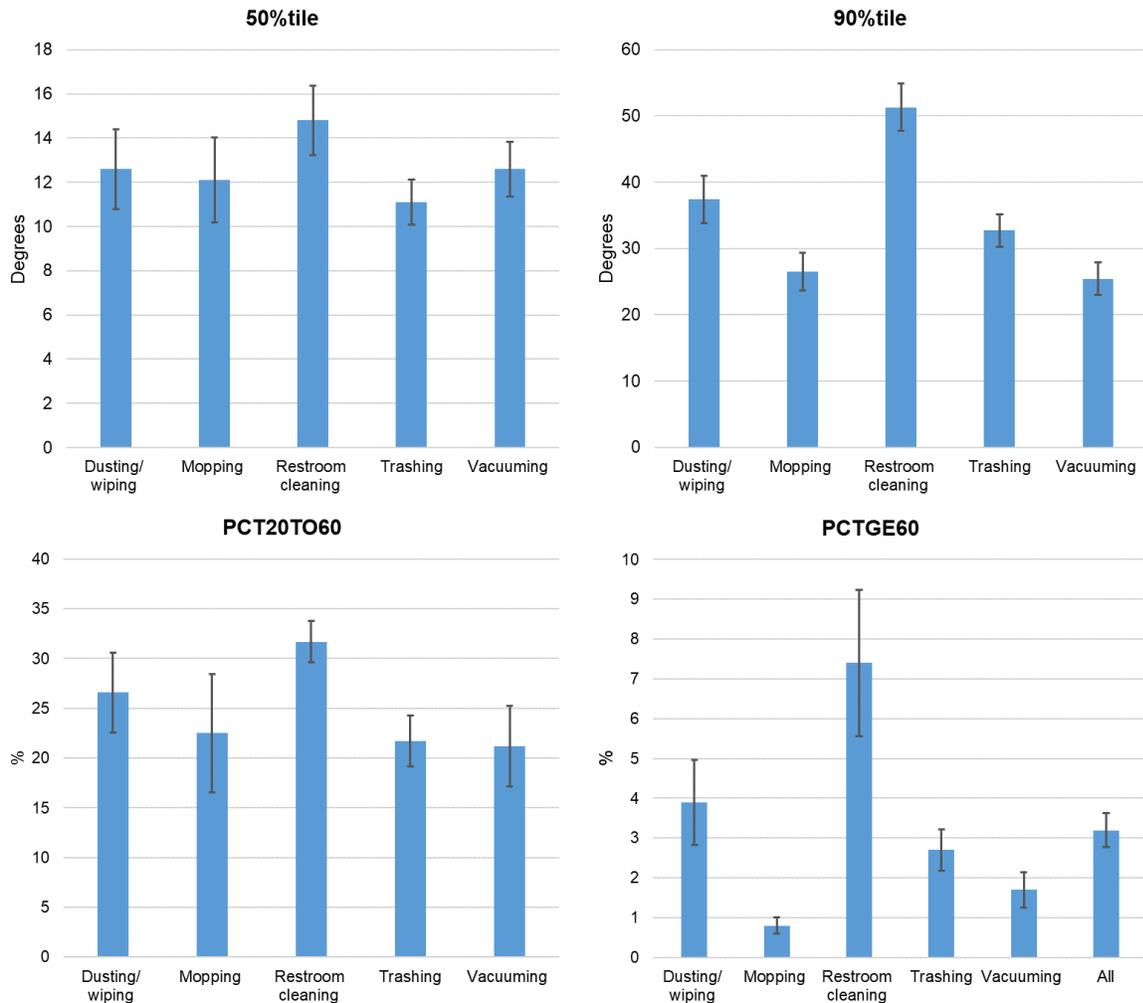
Figure 3. Mean and standard error of physiological responses measurements



The average level of %HRR was 40.1%, and restroom cleaning resulted in the highest level of %HRR (Figure 3). Average METS was 2.7 kcal/kg/h, and CALORIES was 213.4 kcal/h, respectively.

Mopping was the most demanding in terms of energy expenditure as quantified by METS and CALORIES. The average STEP for all tasks was 1704.5 steps/h. The highest step count occurred during mopping and the lowest level during restroom cleaning.

Figure 4. Mean and standard error of trunk posture measurements



We observed greater forward bending of the back angles (*50%tile*, *90%tile*) and exposure time to awkward postures (*PCT20TO60*, *PCTGE60*) during restroom cleaning compared to other tasks (Figure 4). The *90%tile* and *PCT20TO60* were the lowest for the vacuuming task, and *PCGE60* was the lowest for the mopping task.

Overall, when several tasks were considered, the body's physical responses increased as the work pace increased. This is considered a positive correlation, however it is not a positive (beneficial) result to the worker or their body. Again, using scientific terms, positive does not necessarily mean beneficial to the worker and their body. There were positive correlations between %HRR and work pace for restroom cleaning, trashing, and vacuuming.

SHARP staff observed positive trends between the activity level in METS and work pace during dusting/wiping, mopping, restroom cleaning, and trashing. CALORIES showed a positive correlation with work pace in restroom cleaning and trashing. Compared to other tasks, restroom cleaning showed the highest correlation among all the physiological response variables and work pace.

Restroom cleaning was the same (i.e., cleaning toilets, urinals, sinks, floors, etc.) regardless of the building. In contrast, dusting/wiping in this study constitutes a composite task of wiping different types of objects, which can vary by buildings. Objects such as furniture can vary by location, shape, and size. There were generally positive correlations between the number of steps (STEP) and the work pace for all tasks, except for vacuuming. This could be due to the characteristics where vacuuming was performed. In cubicle areas, moving furniture such as chairs is needed to access the space, and more twists and turns are unavoidable while the janitor navigates the crowded space

Positive correlations were also found between the trunk posture variables and work pace in dusting/wiping, mopping, trashing, and vacuuming. A high work pace could increase the exposure to severe trunk flexion during the observation period. The fast work pace led to more frequent and higher levels of awkward trunk posture based on a biomechanical model (Van Der Beek and Frings-Dresen, 1998).

In general, dusting/wiping and vacuuming tasks showed stronger relationships with postural loads regarding the degree of awkward posture (50%tile, 90%tile) and greater exposure time (PCT20TO60). However, in the mopping and trashing tasks, a stronger association in the exposure time variable (PCTGE60) and work pace was observed.

In conclusion, this study showed the potential associations between WMSD risks (assessed by physiological responses and trunk posture) and work pace in the five common cleaning tasks. Managers should consider the actual work pace deviations so that janitors can finish the assigned tasks in a shift minimizing or distributing WMSD risks. The study's limitations include small sample size (n=13) and that the International Sanitary Supply Association (ISSA, 2021) standard cleaning time data do not fully cover all possible variations in practice.

3. WORKLOAD CALCULATOR DEVELOPMENT

Janitor Workload Calculator

A workload calculator was developed to more accurately assign workload over a specific period of time in an effort to reduce work-related injuries among janitors.

The various workload measures calculated from the field data use workload data collected during site visits. These workload measures were then adjusted according to the standard work pace as documented in the industry standard cleaning times. The workload calculator is programmed to perform various calculations using the planned work pace (that is the work pace designed by the managers/supervisors).

For the commercial office building cleaning, the workload calculator has three applications (or user groups, Figure 5):

1. Managers/supervisors who want to design janitorial jobs (i.e. assign janitors with various tasks) in order to complete a janitorial contract.
2. Managers/supervisors who want to evaluate workloads for their janitors at a given contracted site.
3. EHS (Environmental health and safety) practitioners or workers or their representatives who want to conduct job evaluations for a specific janitorial job.

While it could prove to be a useful tool, there are limitations with this beta version. The workload calculator was developed based on the field data from commercial office building environment and is only applicable to that environment. However, the model allows for additional data to be added and to build a new calculator for another cleaning environment, such schools or hospitals. A calculator prototype is below. The final version of the workload calculator screens and reports may differ slightly, pending edits in the language or the arrangement and presentation of the report.

A reference guide will be developed clarifying that the calculator assumes the work is being done by an average “healthy” individual, and that all equipment and tools are in proper working order. However, it should be noted that these two important factors do not always occur in the reality of the industry. Calculator users must take these considerations into account when designing jobs for real world application.

Also, the calculator assesses jobs based on physical workload and activity, it does not address other work-related injury hazards such as psychosocial stress, work organization, chemical exposures, or workplace bullying/harassment. These were never intended to be included in the calculator. Additional safety program elements are expected to be used to help address those risks, in addition to the calculator.

Figure 5. Starting screen of the Janitors' Workload Calculator allows the users to select one of the purposes for using this calculator.

Janitors Workload Calculator

SHARP Program
Department of Labor and Industries, Olympia, WA
Version: prototype

This calculator is intended to address workload concerns among professional janitors in commercial office

This calculator can be used by:

1. Managers/supervisors who want to design janitorial jobs (i.e. assign janitors with various tasks) in order to complete a janitorial contract.
2. Managers/supervisors who want to evaluate workloads for their janitors at a give contract site.
3. EHS practitioners who want to conduct job evaluations for a specific janitorial worker.

Disclaimer: This calculator is based on field data collected among a number of work in several commercial office buildings in Washington State contracted by a participating janitorial firm. The available job tasks may be limited but can be expanded in the future whenever available.

I am a manager/supervisor and want to design a new janitorial job.

I am a manager/supervisor and want to evaluate the workload of an existing janitorial job.

I am an EHS practitioner and want to conduct a job risk evaluation for a janitor.

Application 1: Managers and supervisors can design a new janitorial job

If the user received a new contract for cleaning a commercial office building, they would know the scope of work and the location characteristics. These usually include the tasks that they are asked to perform (e.g. vacuuming, and restroom cleaning), and where these tasks need to be performed (e.g. carpet of the 2nd floor cubicles).

In the contract, many details should be included, such as the area square footage, number of restrooms and number of fixtures, and number of trash bins etc. The managers and supervisors should also have the knowledge in terms of tools they will use for their janitors to perform these tasks.

The contract may also specify the frequencies of cleaning (daily, weekly) and levels of cleaning etc. The job of the managers/supervisors is to design individual jobs that they will assign to the workers for the tasks included in the contract to be accomplished in the most efficient and safe way. This will include breaking tasks into smaller ones, assigning proper times to complete each of these smaller tasks, and combining several of these smaller tasks into a job, which will be assigned to one janitor.

The workload calculator can serve as a comprehensive tool to help the managers and supervisors with job design. They can enter their job related information through the data entry screen of the calculator (Figure 6).

With proper input of data, the workload calculator compares time and impacts to janitors with standard industry allocations. It can show:

- If the assigned tasks exceed the capacity of a janitor to perform the tasks within the given timeframe (work pace);
- If completion of the assigned tasks result in risk of developing work-related musculoskeletal disorders in individual body regions; and
- How overall workload may be adjusted to reduce work pace and risk of injury.

A detailed explanation of how to use the tool is included as Appendix A.

4. EDUCATION AND TRAINING DOCUMENTS

The diversity of the janitorial workforce and the need for cultural- and language-appropriate safety and health training resources for janitors in Washington was identified early in our formative work. The SHARP research staff has developed and will continue to refine resources for janitors and have them translated into multiple languages.

All documents are available in the languages most frequently spoken by janitors, including English and Spanish, as well as Amharic, Bosnian, Chinese, Russian, Somali, Tagalog, and Vietnamese. Published educational and training documents are available on the study website and include:

- Timely COVID-19 issues such as:
 - How to clean and disinfect
 - How to wear a homemade mask
 - Signs and symptoms of COVID
 - CDC guidelines
- Safety Leadership constructs
- Hazard identification symbols (OSHA Hazard Communication Standard Pictograms)

All published educational and training documents are available on the [study website](#).

5. STATEWIDE SURVEY OF JANITORIAL EMPLOYERS

In June of 2021 an online survey of janitorial firms was launched. This survey was designed to understand the economic, safety, and health needs, barriers, and challenges faced by janitorial firms in Washington State.

This information will assist the research project in developing safety and health educational material, and to identify areas where barriers and challenges exist, in an effort to find solutions to increase the safety of janitorial workers. The survey asked 1,850 businesses to complete 52 questions. However, only 25 responses were received. Results from this survey are in the prior progress report.

A new condensed survey (37 questions, fewer open ended) was deployed in early September 2022. Results from that survey will be included in the next progress report.

6. INJURED WORKER INTERVIEWS

A fundamental component of the Washington State Janitorial Workload Study is to hear from the workers, themselves. To do that, SHARP staff interviewed janitors with existing workers' compensation claims about their injury and work experiences. These interviews yield information that is not already in the workers' compensation administrative data – for example, workers offer more detail on the circumstances of the injury, such as safety climate, training, hazards present in their workplace, and what could have been done to prevent the injuries.

In-depth interviews are also valuable for workers to describe their experiences in their own words and can inform and generate prevention materials. Many workers with occupational injuries find it helpful to talk about their experiences, and feel proud of sharing their stories to help prevent future injuries.

Methods

Interviews are conducted by the research team on an on-going basis. Claims are extracted from Washington workers' compensation claim filings for the previous 30-60 days. For example, an August 28, 2019 extract identified 69 claims filed by workers in the selected Janitorial Risk Classes from July 1, 2019 through August 1, 2019 (injured January-July 2019). The risk classes included were "Janitorial Cleaning Services" and "Janitors." It excluded subclasses such as window washing services, residential janitors, pest control, portable cleaning & washing, and street/building decorating hanging of flags/bunting.

Selection criteria includes all claims filed and those where further information is required to understand injury cause. Claims are selected for interviews if the researchers believe there may be an opportunity to develop safety and health prevention materials based upon the circumstances of the injury.

An average of 68 new claims met these criteria, per month since the start of the research in 2019. Periodically, the team reviews the claims list and selects a percentage for potential interviews.

These janitors are first contacted via letter then a bilingual staff member contacts them by phone. Currently, letters and calls are conducted in English and Spanish. A language interpretation line is available for workers who prefer another language.

While injury description and claim information is used to inform prevention materials (by identifying a common hazard or exposure experience to focus on), personal identifiers are not used to protect worker privacy.

Summary of research activity to date

As of June 30, 2022, 22 interviews were completed, as responses were difficult to obtain. In 2023, if staffing resources permit, SHARP staff will resume interviews to increase the response rate. Descriptive information from injured worker interviews are listed, earlier, in Table 4. Due to low response rates, this data is not generalizable as it doesn't reflect a statistically representative sample size of the population. So, no summary is provided.

Table 6. Janitorial workload interviews with injured workers who filed a workers' compensation claim

Janitorial interviews N=22	
	Percent (%)
Average age in years	47 years old
Gender	
Male	30%
Female	70%
Race (22 responses)	
White	32%
Not White	64%
Hispanic/Latino (18 responses)	61%
Highest level of education completed	
Less than a high school degree	28%
High school degree or higher	72%
Years working as a janitor	
Less than a year	15%
1-5 years	55%
More than 5 years	30%
Injury type	
Slip trip and falls	42%
Musculoskeletal injuries	32%
Other	26%
Type of building worked in	
Commercial office	21%
Medical/hospital facility	21%
Residential facility	17%
Industrial facility	17%
Other type of facility	25%
What could have been done to prevent this injury?	
Limit heavy objects (trash/equipment)	21%
Better equipment/tools/supplies	16%
Reduce hazards at the workplace (e.g., uneven walking surfaces)	11%
Other	11%
Nothing that they know of	42%
Safety Climate questions (1=Strongly disagree, 5=Strongly agree)	Average score
My supervisor is committed to improving safety.	3.3
My supervisor places a strong emphasis on workplace safety.	3.5
Safety issues are openly discussed between my supervisor and my workgroup	3.4
My supervisor ensures employees have adequate safety training	3.3
My co-workers are committed to safety improvement	3.6
Unsafe conditions are promptly corrected in my work area	3.2
My supervisor encourages employees to become involved in safety matters	3.1
My supervisor praises safe work behavior	2.9
Workers compensation questions	

Overall, how would you rate your experience with the workers' compensation process?	
Very good	37%
Good	26%
Poor	32%
Very Poor	5%
How confusing is the process for filing a workers' compensation claim?	
Very Confusing	0%
Confusing	37%
Somewhat Confusing	26%
Not Confusing	37%

Conclusion

With a specific charge from the Washington State Legislature, the SHARP Program has developed a multi-tiered, systematic approach to understanding the physical and mental workload and workplace exposures that may put janitors at risk for injury. The SHARP program continues to analyze the data collected, using it to refine the workload calculator, and develop educational resources for janitors and employers.

Overall, the goal to develop, test, and release a workload calculator intended to keep janitorial workers safe and create a harmonized tool for janitorial companies to estimate reasonable work assignments to be completed during a worker's shift continues as planned. The beta version, outlined in this report, already demonstrates the value of the tool to address work pace and task-specific bodily impacts to workers. Barring any unexpected delays caused by the COVID-19 pandemic, the calculator will be in the testing phase in 2023. Results from that work will be detailed in the fourth report, scheduled for release in December 2023.

References

- Anderson, N. J., Bonauto, D.K., Adams, D. (2014). Prioritizing industries for occupational injury prevention and research in the Services Sector in Washington State, 2002–2010. *Journal of Occupational Medicine and Toxicology*. 9:37-51.
- Alamgir, H., Yu, S. (2008). Epidemiology of occupational injury among cleaners in the healthcare sector. *Occupational Medicine*. 58:393-399.
- Balogh, I., Ørbæk, P., Ohlsson, K., Nordander, C., Unge, J., Winkel, J., et al. (2004). Self-assessed and directly measured occupational physical activities—influence of musculoskeletal complaints, age and gender. *Appl. Ergon.*, 35(1), 49-56.
- BLS (Bureau of Labor Statistics) (2020). Occupational Employment Statistics. <https://www.bls.gov/oes/tables.htm>
- Chang, J.H., Wu, J.D., Liu, C.Y., Hsu, D.J. (2012). Prevalence of musculoskeletal disorders and ergonomic assessments of cleaners. *American Journal of Industrial Medicine*. 55:593-604.
- Charles, L.E., Loomis, D., Demissie, Z. (2009). Occupational hazards experienced by cleaning workers and janitors: A review of the epidemiologic literature. *Work*. 34:105-116.
- Garg, A., Moore, J. S., & Kapellusch, J. M. (2017a). The Composite Strain Index (COSI) and Cumulative Strain Index (CUSI): methodologies for quantifying biomechanical stressors for complex tasks and job rotation using the Revised Strain Index. *Ergonomics*, 60(8), 1033-1041. doi:10.1080/00140139.2016.1246675
- Garg, A., Moore, J. S., & Kapellusch, J. M. (2017b). The Revised Strain Index: an improved upper extremity exposure assessment model. *Ergonomics*, 60(7), 912-922. doi:10.1080/00140139.2016.1237678
- Gibson, M., & Potvin, J. R. (2017, June 1-2, 2017). Calculating the maximum acceptable effort for an isolated subtask while still accounting for the demands of all other subtasks. Paper presented at the *XXIXth Annual Occupational Ergonomics and Safety Conference*, Seattle, Washington, USA.
- Green, D. R., Gerberich, S. G., Kim, H., Ryan, A. D., McGovern, P. M., Church, T. R., ... & Arauz, R. F. (2019). Janitor workload and occupational injuries. *Am. J. Ind. Med.*, 62(3), 222-232.
- Green, D.R., Gerberich, S.G., Kim, H., et al. (2019). Janitor workload and occupational injuries. *Am J Ind Med*. 62(3):222-232. doi: 10.1002/ajim.22940.
- Green, D.R., Gerberich, S.G., Kim, H., et al. (2019). Occupational injury among Janitors: injury incidence, severity and associated risk factors. *J Occup Environ Med*. 61(2):153-161.

- Green, D.R., Gerberich, S.G., Kim, H., et al. (2019). Occupational injury among Janitors: injury incidence, severity and associated risk factors. *J Occup Environ Med.* 61(2):153-161.
- Hagner, I. M., & Hagberg, M. (1989). Evaluation of two floor-mopping work methods by measurement of load. *Ergonomics.*32(4):401-408.
- Houtman, I. L., Bongers, P. M., Smulders, P. G., & Kompier, M. A. (1994). Psychosocial stressors at work and musculoskeletal problems. *Scand. J. Work Environ. Health,* 139-145.
- ISSA (2021), *The Official ISSA Cleaning Times: The Cleaning Industry's Most Trusted Tasks, Tools, & Workloading Resource.* International Sanitary Supply Association Rosemont, IL
- Krause, N., Scherzer, T., Rugulies, R. (2005). Physical workload, work intensification, and prevalence of pain in low wage workers: Results from a participatory research project with hotel room cleaners in Las Vegas. *American Journal of Industrial Medicine.* 48:326-337.
- Lee, S.J., Nam, B., Harrison, R., Hong, O. (2014). Acute symptoms associated with chemical exposures and safe work practices among hospital and campus cleaning workers: A pilot study. *American Journal of Industrial Medicine.* 57:1216-1226.
- Lee, W. Yragui, N. L., Anderson, N. J., Howard, N., Lin, J.-H., and Bao, S. (2022B). Relationship among job demand-control-support, burnout, and work-related musculoskeletal complaints in commercial janitors. *Applied Ergonomics,* 105, 103836. DOI: 10.1016/j.apergo.2022.103836.
- Lee, W., Lin, J.-H., Howard, N., & Bao, S. (2022A). Methods for measuring physical workload among commercial cleaners: A scoping review. *International Journal of Industrial Ergonomics,* 90, 103319. DOI:10.1016/j.ergon.2022.103319.
- Leiter, M. P., Bakker, A. B., & Maslach, C. (Eds.). (2014). *Burnout at work: A psychological perspective.* Psychology Press.
- Lin, J.-H., Lee, W. Smith, C. K., Yragui, N. L., Foley, M. and Shin, G. (2022). Cleaning in the 21st Century: The musculoskeletal disorders associated with the centuries-old occupation. *Applied Ergonomics,* 105, 103839.
- Maslach, C., Schaufeli, W. B., & Leiter, M. P. (2001). Job burnout. *Annu. Rev. Psychol.,* 52(1), 397-422.
- Panikkar, B., Woodin, M.A., Brugge, D., Hyatt, R., Gute, D.M. (2014). Characterizing the low wage immigrant workforce: A comparative analysis of the health disparities among selected occupations in Somerville Massachusetts. *American Journal of Industrial Medicine.* 57:516-526.
- Potvin, J. R. (2012). Predicting maximum acceptable efforts for repetitive tasks: an equation based on duty cycle. *Hum Factors,* 54(2), 175-188. doi:10.1177/0018720811424269

- Schaufeli, W. B., & Bakker, A. B. (2004). Job demands, job resources, and their relationship with burnout and engagement: A multi-sample study. *J. Organiz. Behav.*, 25(3), 293-315.
- Seixas N, Domínguez C, Stover B, Simcox N. (2013, August). Janitors Workload and Health and Safety. Department of Environmental and Occupational Health Sciences, University of Washington.
- Seixas, N., Domínguez, C., Stover, B., Simcox, N. (2013). Janitors Workload and Health and Safety Department of Environmental and Occupational Health sciences, University of Washington
- Smith, C.K., Anderson, N.J. (2017). Work-related injuries among commercial janitors in Washington State, comparisons by gender. *Journal of Safety Research*. 62:199-207.
- Smith, M. J., & Carayon-Sainfort, P. (1989). A balance theory of job design for stress reduction. *International Journal of Industrial Ergonomics*, 4(1), 67-79.
- Søgaard, K., Fallentin, N., & Nielsen, J. (1996). Work load during floor cleaning. The effect of cleaning methods and work technique. *European Journal of Applied Physiology and Occupational Physiology*. 73(1-2):73-81.
- State of Washington. Washington State Fiscal Information. (2018). 2018 Supplemental (revised 2017-19 Biennium) Operating Budget. ESSB-6032. Available at: <http://fiscal.wa.gov/>.
- Swain, D. P., & Leutholtz, B. C. (1997). Heart rate reserve is equivalent to %VO₂ reserve, not to %VO₂max. *Med Sci Sports Exerc*, 29(3), 410-414. doi:10.1097/00005768-199703000-00018
- Swain, D. P., Leutholtz, B. C., King, M. E., Haas, L. A., & Branch, J. D. (1998). Relationship between % heart rate reserve and % VO₂ reserve in treadmill exercise. *Medicine & Science in Sports & Exercise*, 30(2), 318-321.
- The University of Michigan (Ed.) (2008). *3D static strength prediction program* (Version 6.0.0). Ann Arbor, Michigan: The University of Michigan, Center for Ergonomics.
- Van Der Beek, A. J., & Frings-Dresen, M. H. (1998). Assessment of mechanical exposure in ergonomic epidemiology. *Occup. Environ. Med.*, 55(5), 291-299.
- World Health Organization (WHO) (2019, May 28). Burn-out an "occupational phenomenon": International Classification of Diseases <https://www.who.int/news/item/28-05-2019-burn-out-an-occupational-phenomenon-international-classification-of-diseases>
- Wu, H. C., & Wang, M. J. (2002). Relationship between maximum acceptable work time and physical workload. *Ergonomics*, 45(4), 280-289. doi:10.1080/00140130210123499
- Zock, J. (2005). World at work: cleaners. *Occupational and Environmental Medicine*. 62:581-584.