Assessment of Whole-Body Vibration and Work-Related Injury Burden Within a Public Works Department
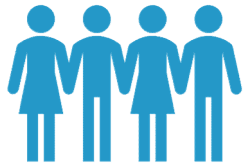
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PTOP PRESENTATION

NOHC CONFERENCE 2019

Oregon State University

Problem Statement

Work related musculoskeletal disorders are highly prevalent in the United States workforce.
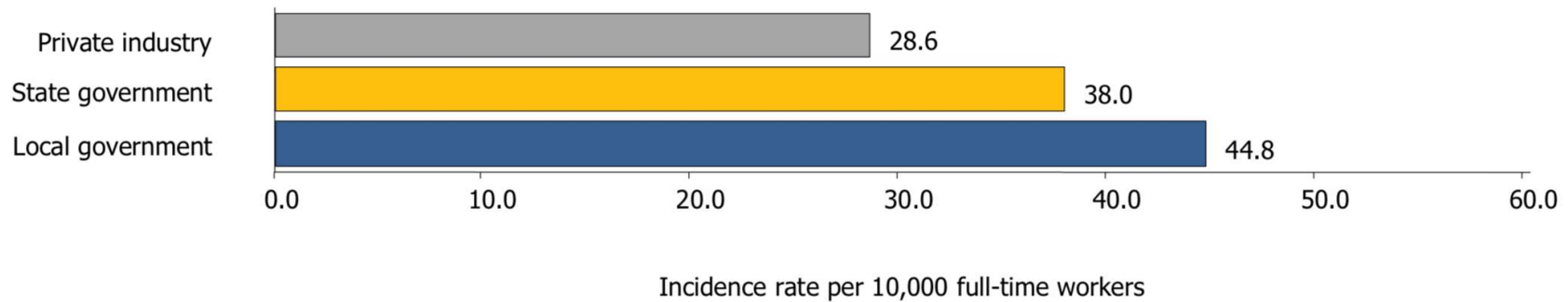
Back injuries account for the highest proportion of work-related musculoskeletal disorders.

Whole-body vibration is a leading risk factor for musculoskeletal disorders, especially low back pain.

Nonfatal occupational injury and illness incidence rates of musculoskeletal disorders with days away from work by ownership, 2017

Private industry	28.6
State government	38.0
Local government	44.8

Incidence rate per 10,000 full-time workers

Problem Statement

The total recordable cases incidence rate of injuries and illnesses has remained the highest among local government workplaces since 2008.

Study Aims

Systematically evaluate the burden of WMSDs within the City of Eugene Public Works department.

Objectively quantify WBV from three major vehicles routinely used at the City of Eugene Public Works department.

Provide recommendations of controls to reduce exposure and risk of injury from WBV.

Methods: Aim 1

Descriptive statistics were computed on claims between January 1, 2014 and March 31, 2019 under the workers compensation policy of the Department of Public Works, City of Eugene.
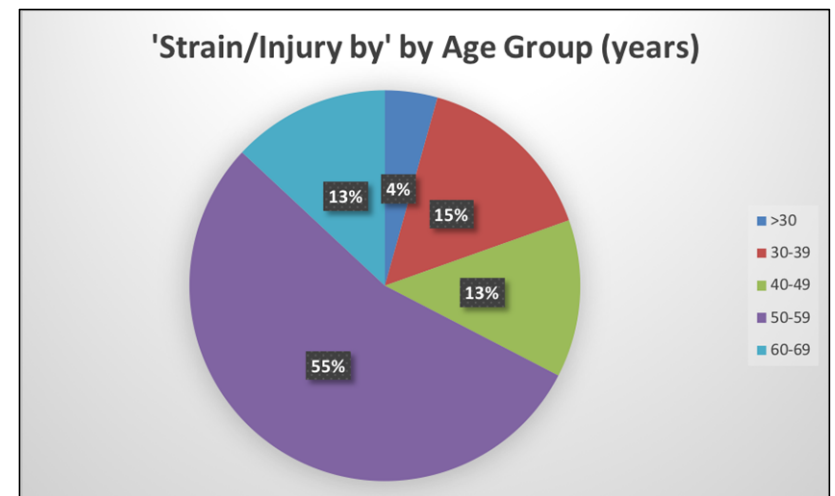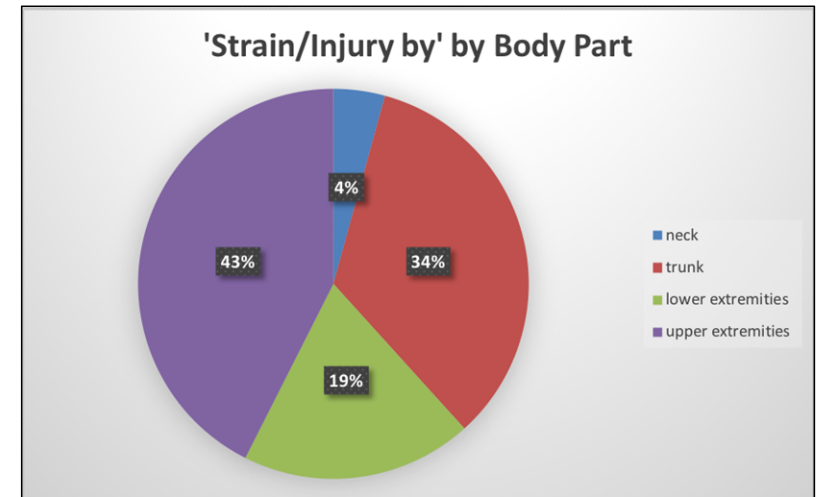
To assess leading indicators of the burden of work-related musculoskeletal disorders, a survey was administered to all Eugene Public Works employees.

Results: Claims Analysis

- An analysis was performed on "Strain or injury by" claims between January 1, 2014 and March 31, 2019 under the workers compensation policy of the Department of Public Works, City of Eugene.

Total cost	$335,210.32
Median cost	$1,570.17
Range of costs	$0.00 - $201,891.16

Age (years)	Total Median	Total Mean
>30	$2,099.31	$2,099.31
30-39	$1,226.72	$1,462
40-49	$825.82	$3,4613.48
50-59	$2,289.41	$3,994.7
60-69	$560.18	$1,961.21

'Strain/Injury by' by Body Part

neck 4%
trunk 34%
lower extremities 19%
upper extremities 43%

'Strain/Injury by' by Age Group (years)

>30 4%
30-39 15%
40-49 13%
50-59 55%
60-69 13%

Results: Survey

- 34% response rate (n=80, N=239)

- 76% of the participants reported a history of low back pain

- 13% reported more than 10 episodes of back pain within the past three months

- 65% lift loads greater than 30lbs at least once per day while at work

Oswestry Low Back Pain Disability Index Scores
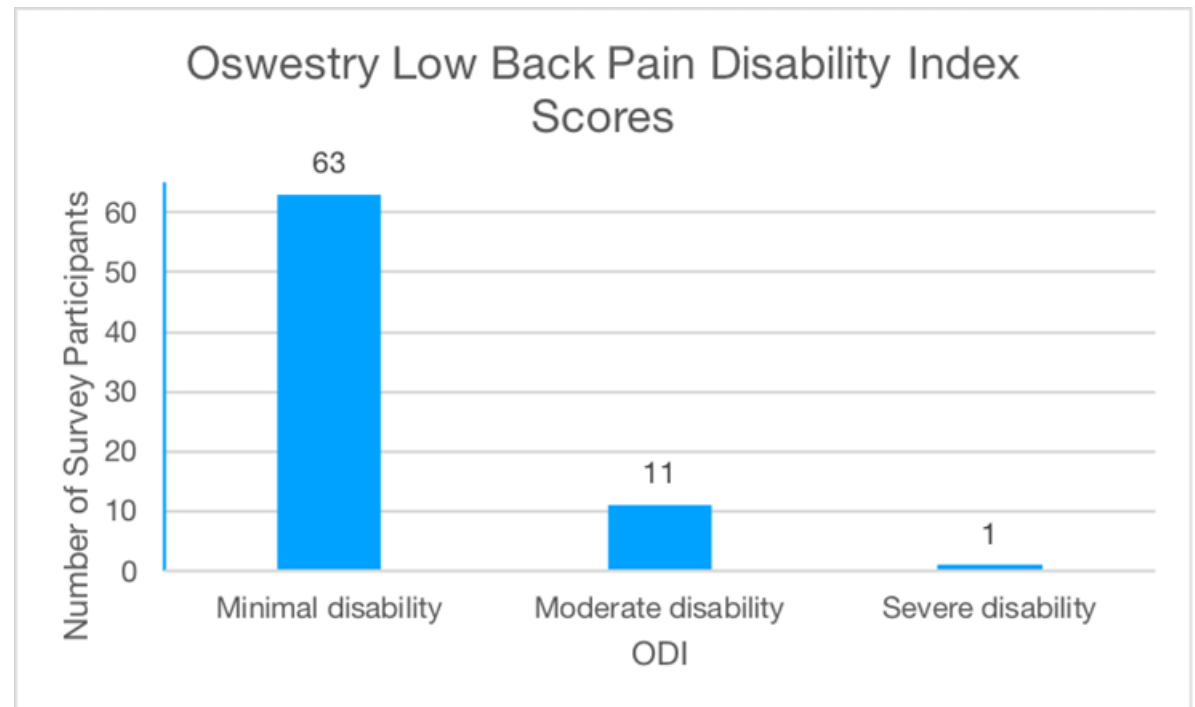
96.8% of minimally disabled (Mean ODI score: 7) employees drive vehicles while at work.
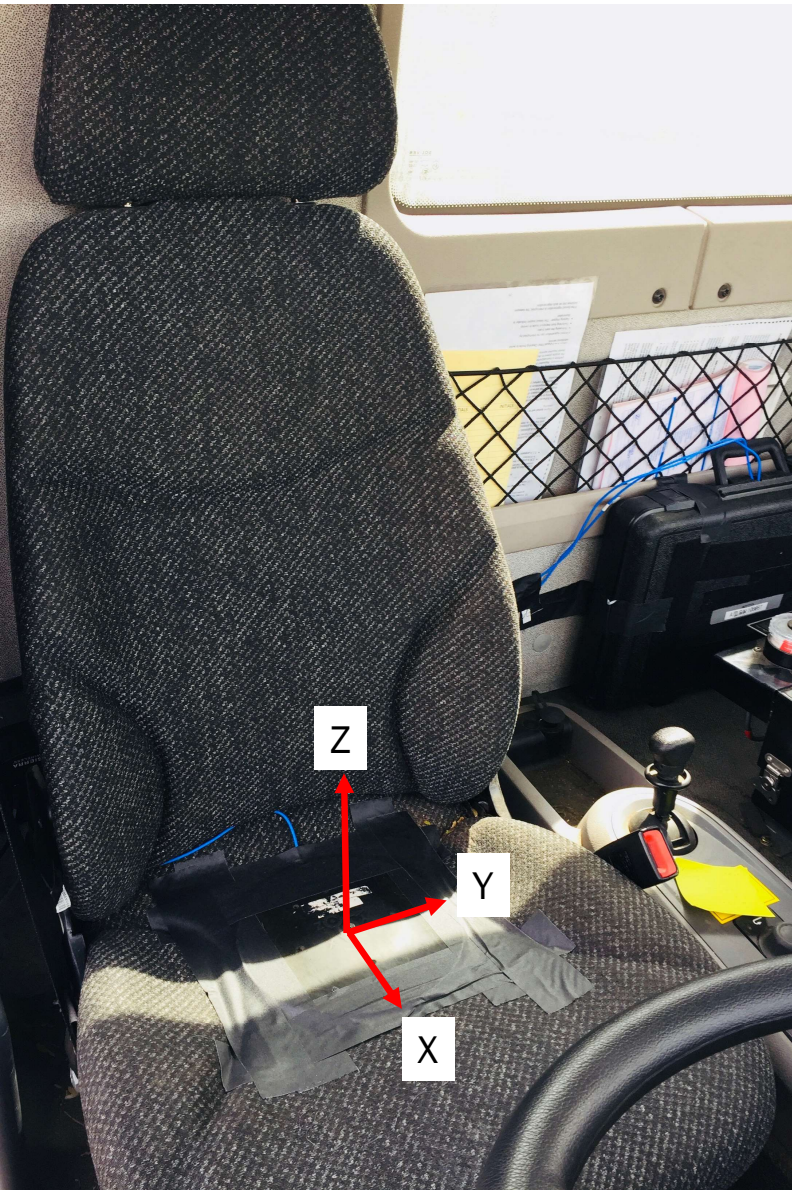
100% of moderately disabled (Mean ODI score: 33) employees drive vehicles while at work.

0% of severely disabled employees drive vehicles while at work.

Methods: Aim 2

- 5 drivers for each vehicle (mower, vacuum truck, street sweeper)

- Data collection ranged from 4 to 8 hours depending on the subject's schedule

Methods: Aim 2

- Whole-body vibration exposure was collected at 1,280 Hz using either a four or eight channel data recorder per ISO 2631-1 WBV standards.

- A rubber seat pad tri-axial accelerometer was mounted on the seat and the additional single axis (Z) accelerometer or tri-axial accelerometer was magnetically mounted on the vehicle floor directly under the driver seat.

- GPS coordinates of the vehicles were simultaneously recorded at 1 Hz using a GPS data logger.

Results: Whole-Body Vibration
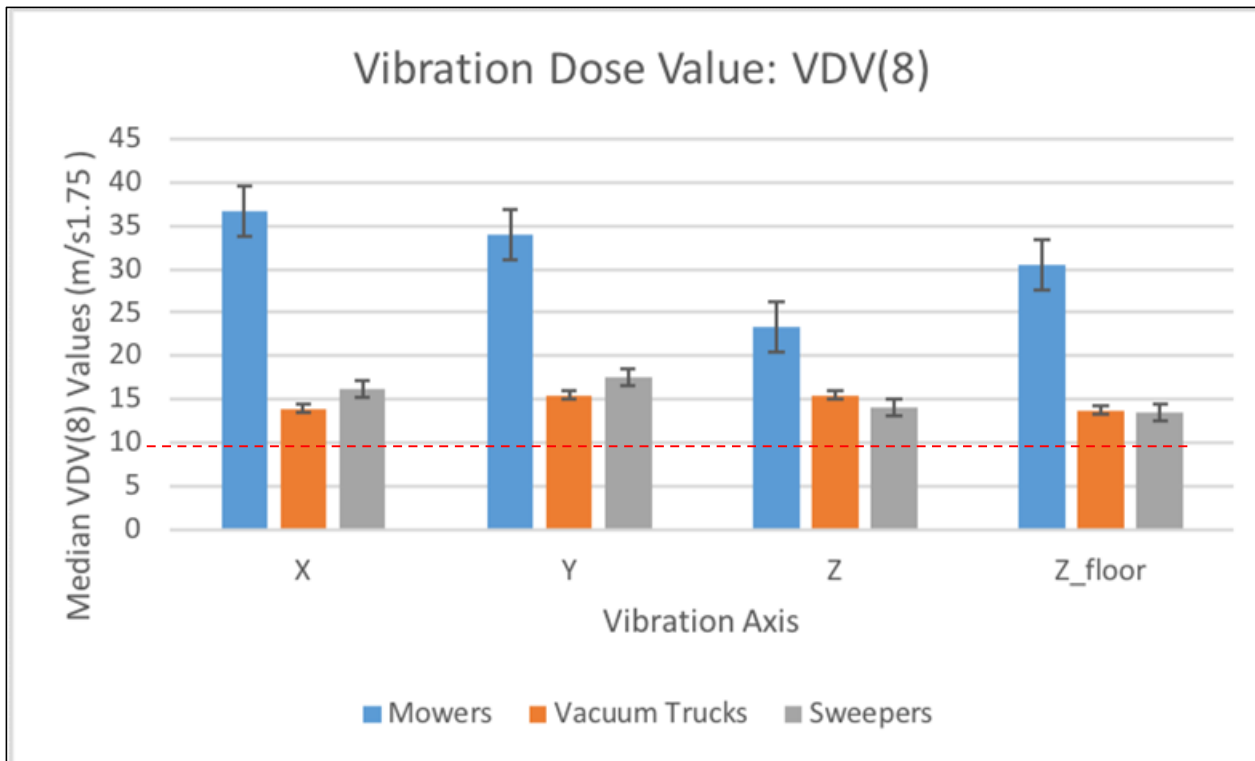

Average Weighted Vibration: A(8)
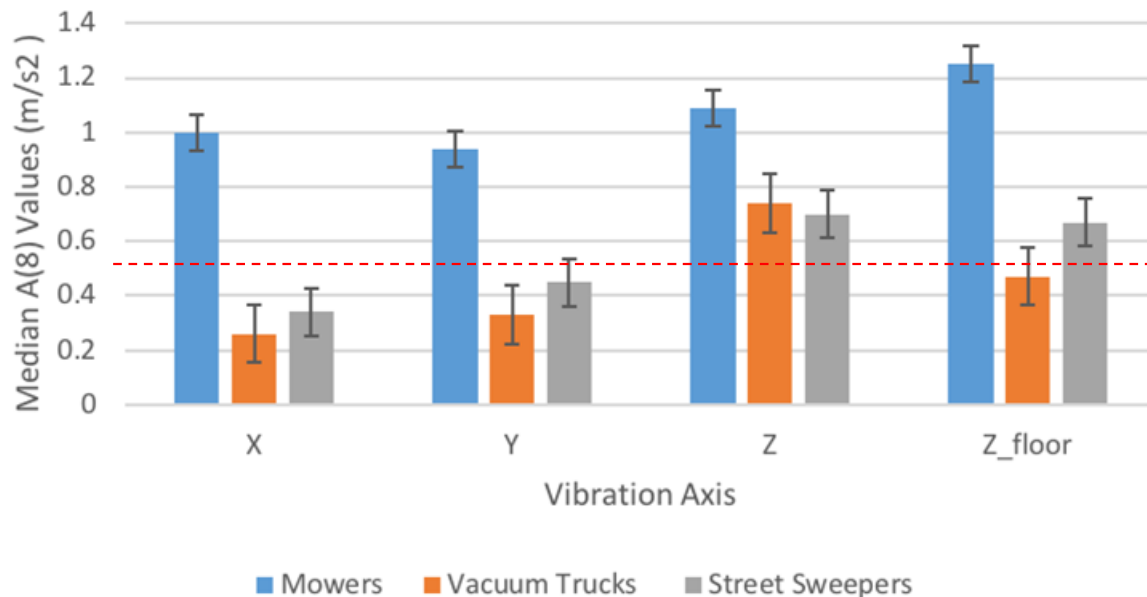
* Red dotted line indicates the daily action limit: A(8) = 0.5 m/s^2

Average Weighted Vibration: $A_W(8)$

- A_w measures exposure to continuous, typically lower amplitude cyclical vibration exposures.

- The Z axis was predominant for the vacuum trucks and sweepers. There was no predominant axis for the mowers.

- A(8) exposures in all three types of vehicles were above the daily action limits (0.5 m/s^2).

- Two mowers and one vacuum truck produced A(8) WBV exposures above the ISO and EU exposure limit (0.9 m/s^2, 1.15 m/s^2).

- Current seats in vacuum trucks and street sweepers do not appear to attenuate vibration exposures.

Results: Whole-Body Vibration

Vibration Dose Value: VDV(8)

- VDV measures the cumulative impact on the vehicle operator's body from the larger amplitude mechanical shocks, jolts, and peaks.

- VDV(8) exposures in all axes (X, Y, and Z) in all three types of vehicles were above the daily action limits ($9.1 \text{ m/s}^{1.75}$).

- Mower drivers were exposed to the highest level of impulsive exposures (i.e., VDV).

- Nine of the vehicles tested had VDV(8) WBV exposure above the ISO and EU exposure limit ($17 \text{ m/s}^{1.75}$, $21 \text{ m/s}^{1.75}$).

* Red dotted line indicates the daily action limit: VDV(8) = $9.1 \text{ m/s}^{1.75}$

Elimination

Substitution

Engineering Controls

Administrative Controls

PPE

➤ If an employee is suffering from a musculoskeletal disorder, assign modified or light duty work that eliminates the exposure completely.

➤ Proper aids for moving and lifting heavy loads should be incorporated in normal workday activities.
➤ Alternative seats that are more effective in reducing WBV exposures.

➤ Emphasize the importance of recognizing early signs of musculoskeletal disorders and seeking medical support right away.
➤ Provide annual training on safe lifting techniques.
➤ Schedule shorter driving times, especially for employees experiencing early symptoms of low back pain or musculoskeletal disorders.

Recommendations

Professional Development

Systematic process that strengthens how professionals obtain and retain knowledge, skills, and attitudes.

- Increased my **knowledge** of whole-body vibration exposures in the workplace.

- Expanded my data collection **skills** and experience.

- Further developed my professional **attitude:**
  - ✓ Remained flexible as the project took on its own timetable and experienced multiple delays.
  - ✓ Worked with people outside of academia and conformed to their schedule.
  - ✓ Admitted that I made a mistake and worked to remedy the issue.

"The greatest danger for most of us is not that our aim is too high and we miss it, but that our aim is too low and we reach it." - Michelangelo

Acknowledgments