



# Work-Related Musculoskeletal Disorders (WMSDs) in Washington State Agriculture

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## A Summary of Research Study Findings

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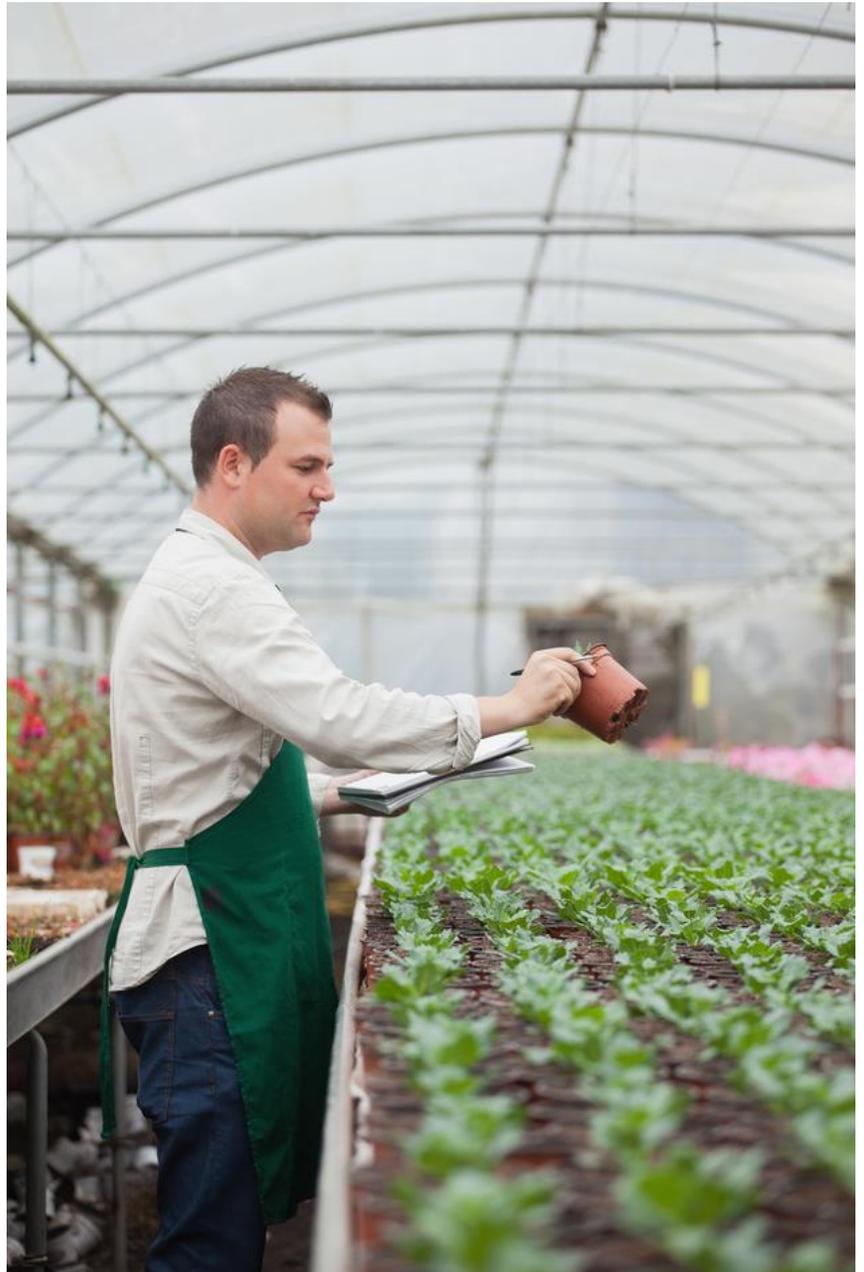
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### Why do we study sprains and strains and overexertions?

The Agriculture sector in Washington State includes a range of industries. Workers in these environments face a multitude of occupational safety hazards that may lead to serious injuries, from fractures and dislocations to contusions and lacerations.

However, the most common and most costly types of injuries agriculture workers incur are soft-tissue sprains and strains, generally referred to collectively as work-related musculoskeletal disorders (WMSDs). These injuries can result from years of accumulated stress on muscles, tendons, ligaments, and nerves. Common risk factors for WMSDs include repetitive motions, awkward body postures, forceful hand exertions, and heavy or frequent manual material handling.

In 2010 the Safety and Health Assessment and Research for Prevention (SHARP) Program, began a five-year study exploring the physical and organizational factors that may contribute to WMSDs in several major industries of the Agriculture sector. Through interviews with company managers, employee representatives, and injured workers, our researchers gained insight into the organizational climate, the nature of existing safety programs, and the context within which WMSDs occur. During site visits to Agriculture operations, SHARP researchers assessed physical risk factors for hundreds of jobs using a combination of well-researched evaluation instruments. This report draws on the data collected and summarizes the results of the analyses performed.



### What are the injury trends in Agriculture?

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According to Washington State workers' compensation claims data from 2002-2010, Agriculture ranks among the top high-risk industry sectors in its compensable claims rate of WMSD injuries (for claims that involved more than 3 days away from work).

However, two Agriculture industry groups rank in the top 25 when ranking industry groups within all industry sectors by compensable claims incidence rate – Aquaculture, and Poultry and Egg Production.

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Logging and Fruit & Tree Nut Farming have the two highest numbers of lost work days among all Agriculture groups.



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Within Agriculture, the top five industry groups by claims rate are:

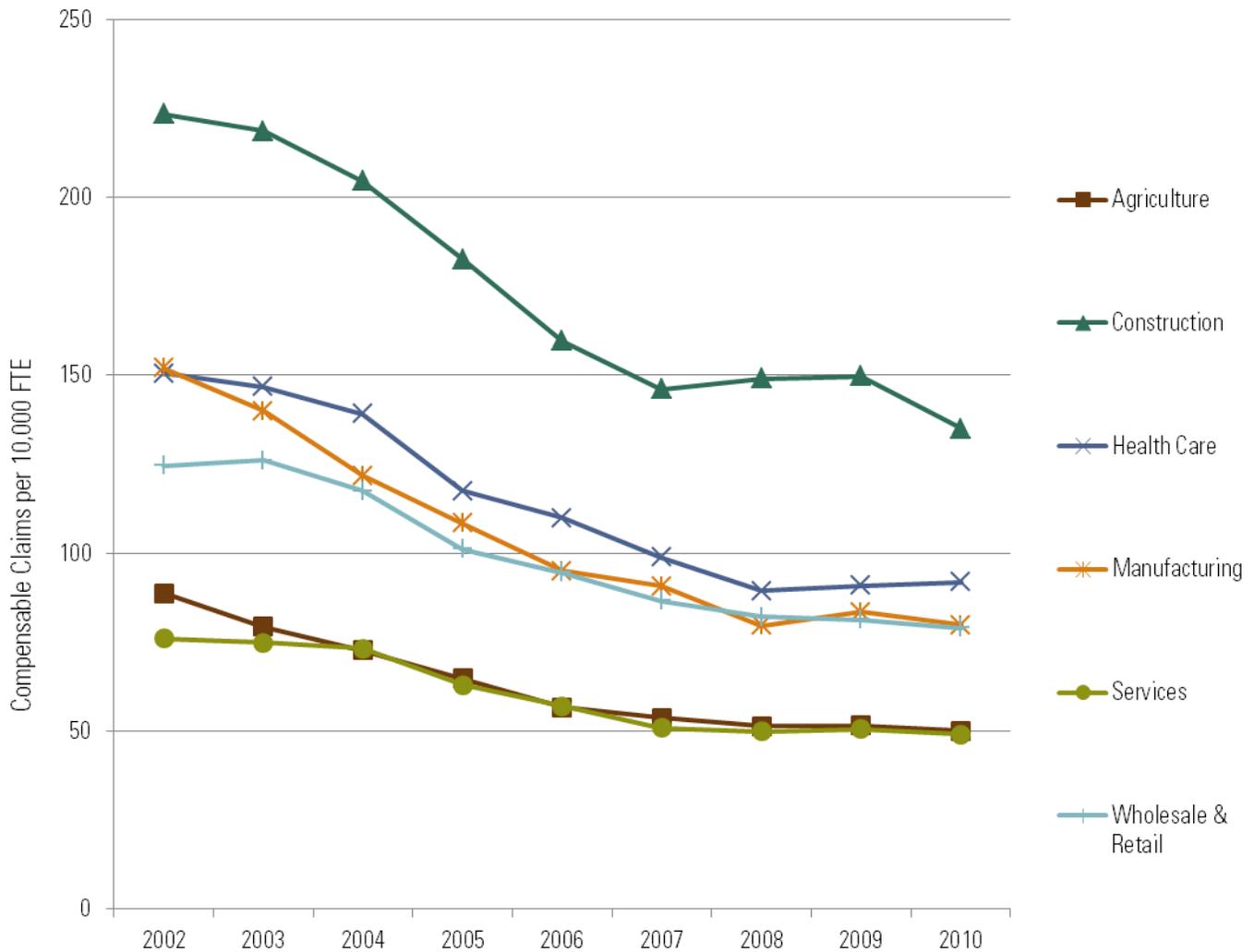
1. Aquaculture
2. Poultry and Egg Production
3. Fishing
4. Logging
5. Greenhouse, Nursery, and Floriculture Production

Logging and Fruit & Tree Nut Farming have the highest number of lost work days among all Agriculture groups (219,391 and 201,442 lost days, respectively). When ranked by non-medical costs, Logging is the highest industry group (\$45,269,091).

Injuries of the back are the most commonly reported WMSD injury, compared to other body areas.

# How does Agriculture compare to other industry sectors in Washington State?

Washington State, Compensable WMSD Claims Rates, 2002-2010<sup>1 2</sup>



<sup>1</sup> Compensable Claim = a claim that involved more than 3 days away from work

<sup>2</sup> FTE = full time equivalent, an employee working 2000 hours/year

## Which industry groups in Agriculture have high WMSD claims rates?

### Top 25 Study Industry Groups by Claims Rate, 2002-2010\*

Industry Sector	Industry Group Description	Incidence Rate Per 100 FTE**
Services	Waste Collection	2.92
Health Care	Residential Mental Retardation, Mental Health and Substance Abuse Facilities	2.76
Health Care	Psychiatric and Substance Abuse Hospitals	2.64
Wholesale & Retail Trade	Beer, Wine, and Liquor Stores	2.41
Health Care	Other Ambulatory Health Care Services	2.40
Wholesale & Retail Trade	Vending Machine Operators	2.31
Construction	Foundation, Structure, and Building Exterior Contractors	2.15
Manufacturing	Other Furniture Related Product Manufacturing	2.12
Services	Spectator Sports	1.98
Health Care	Nursing Care Facilities	1.98
Manufacturing	Dairy Product Manufacturing	1.96
Wholesale & Retail Trade	Beer, Wine, and Distilled Alcoholic Beverage Merchant Wholesalers	1.86
Health Care	Community Care Facilities for the Elderly	1.81
Construction	Building Finishing Contractors	1.81
Construction	Residential Building Construction	1.73
Agriculture	Aquaculture	1.71
Wholesale & Retail Trade	Grocery and Related Product Merchant Wholesalers	1.68
Manufacturing	Clay Product and Refractory Manufacturing	1.65
Health Care	General Medical and Surgical Hospitals	1.65
Agriculture	Poultry and Egg Production	1.64
Wholesale & Retail Trade	Grocery Stores	1.64
Wholesale & Retail Trade	Department Stores	1.60
Manufacturing	Sawmills and Wood Preservation	1.59
Manufacturing	Electric Lighting Equipment Manufacturing	1.59
Health Care	Other Residential Care Facilities	1.58

\*Washington State, all compensable WMSD claims. This table lists only those industry groups included in the present study, such that the Transportation & Utilities industry group has been omitted. Very small industry groups (those with 50 companies or fewer) have also been excluded.

\*\*FTE = full time equivalent, an employee working 2000 hours/year

## What is the burden of WMSDs in Agriculture?

### Cost and Lost Days in Agriculture (Industry Groups by Rate Rank), 2002-2010\*

Industry Group	Non-Medical Costs	Lost Work Days**	Incidence Rate Per 100 FTE***	Rate Rank
All Industries	\$3,881,386,921	28,354,928	0.89	--
All Agriculture	\$113,826,060	988,071	0.63	--
Aquaculture	\$2,241,071	23,449	1.71	1
Poultry and Egg Production	\$1,054,212	3,793	1.64	2
Fishing	\$1,698,695	24,522	1.14	3
Logging	\$45,269,091	219,391	1.08	4
Greenhouse, Nursery, and Floriculture Production	\$6,392,730	98,889	0.83	5
Support Activities for Forestry	\$2,803,227	24,915	0.70	6
Support Activities for Crop Production	\$14,179,290	151,277	0.64	7
Cattle Ranching and Farming	\$5,567,023	56,861	0.58	8
Vegetable and Melon Farming	\$6,556,307	55,301	0.54	9
Oilseed and Grain Farming	\$2,279,403	23,047	0.52	10
Other Crop Farming	\$5,289,658	65,547	0.49	11
Fruit and Tree Nut Farming	\$16,346,863	201,442	0.41	12

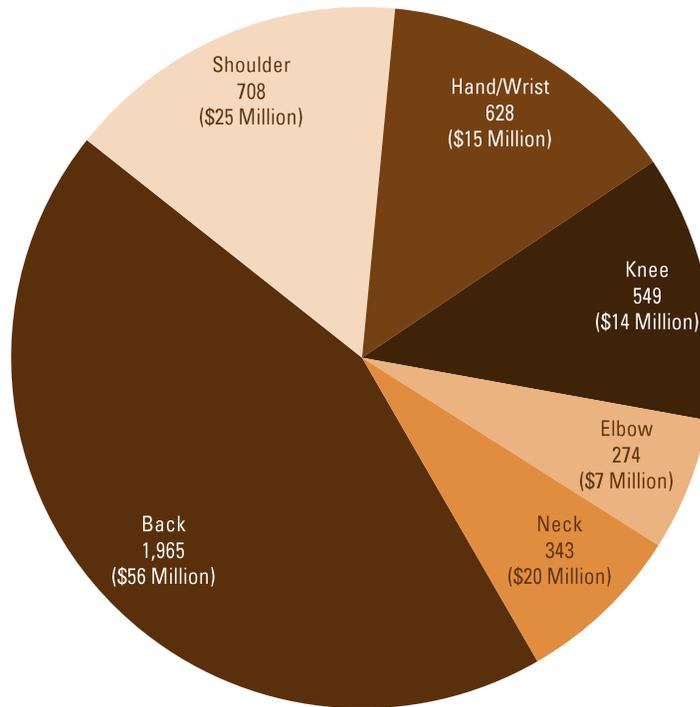
\*Washington State, All Compensable WMSD Claims

\*\*Lost work days included total time loss for state fund claims only; does not include self-insured employers.

\*\*\*FTE = full time equivalent, an employee working 2000 hours/year

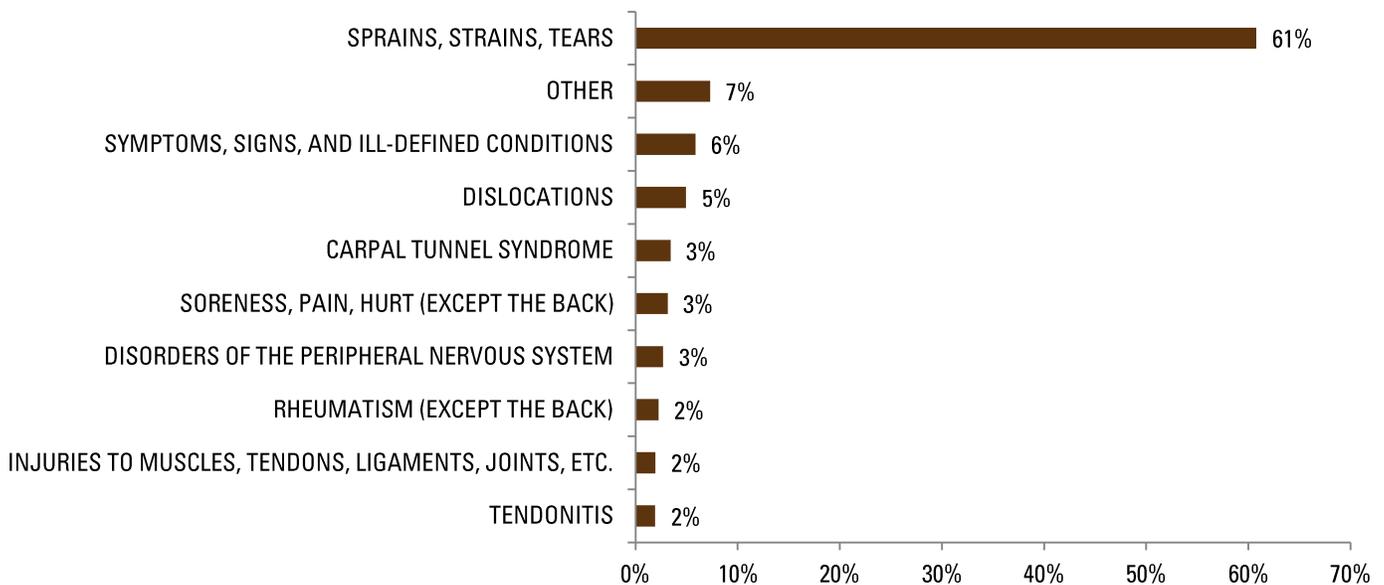
# What kind of WMSD injuries are occurring in Agriculture?

## WMSD Claims & Non-Medical Costs in Agriculture by Body Area, 2002-2010<sup>3</sup>



Number of Claims (and Non-Medical Costs)

## WMSD Claims in Agriculture – Top 10 “Nature of Injury” Categories, 2002-2010<sup>4</sup>



<sup>3</sup> Washington State, All Compensable WMSD Claims. A claim may include more than one body area. WMSD claims with uncategorized body area have been excluded.

<sup>4</sup> Washington State, All Compensable WMSD Claims. Excluded categories include remaining 6% of claims.

## What are the physical risks in Agriculture?

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### Focus Industry Groups:

- ▶ **Fruit and Tree Nut Farming**
- ▶ **Greenhouse, Nursery, and Floriculture Production**
- ▶ **Support Activities for Crop Production**

### Methods

To assess the physical risk factors in the Agriculture sector, SHARP researchers visited 16 companies; 8 in the “Fruit and Tree Nut Farming” industry, 4 in the “Greenhouse, Nursery, and Floriculture Production” industry and 4 companies in the “Support Activities for Crop Production” industry. At each site, we assessed risk factors specific to 4 body parts; the back, the shoulder, the hand and wrist, and the knee. We evaluated 457 jobs for WMSD risk factors. Based on the exposure to these risk factors, we then determined the magnitude of risk of injury as either low, moderate, high, or very high.

The physical risk factors that were evaluated are those that have been associated with WMSDs. These risk factors are:

- Awkward postures
- Lifting
- Pushing, pulling, carrying
- High hand forces
- Highly repetitive motions
- Repeated impacts of the hand or knee
- Vibration (whole body, hand)

### Results

The charts in the following pages display some of the notable findings from our analyses.

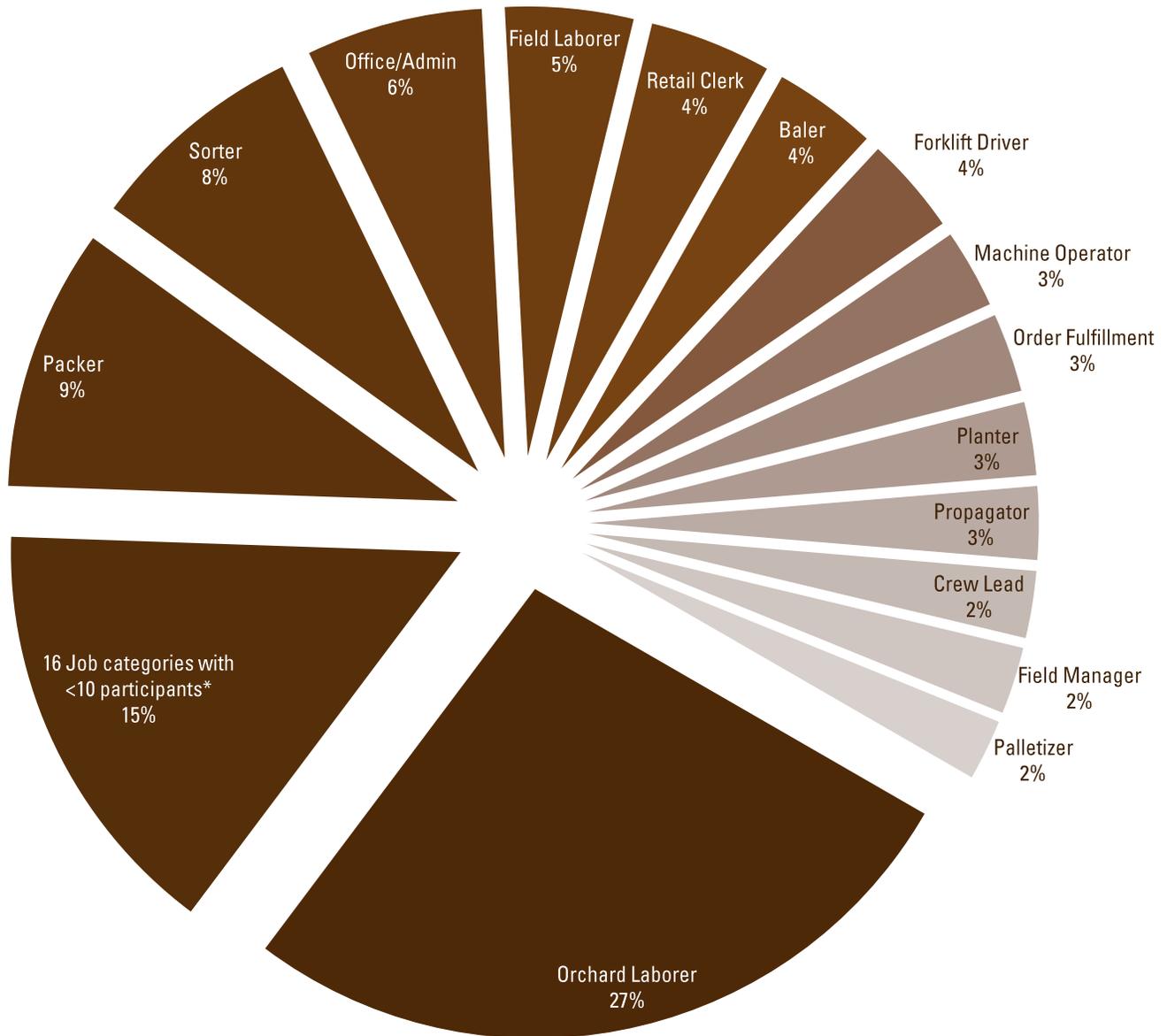
- Job Categories Assessed
- Level of Risk of Injury from Working with Elevated Shoulder Postures
- Level of Risk of Injury from Static Back Postures
- Level of Risk of Injury from Awkward Neck Postures
- Level of Risk of Injury from Forceful Pinch Gripping
- Level of Risk of Injury from Manual Material Handling Activities (Lifting, Carrying, Pushing, Pulling)
- Level of Risk of Injury from Repetitious Hand Movements

The charts that follow illustrate the level of risk (very high, high, moderate, low) posed by exposure to each risk factor. The level of risk is determined by these factors:

- The duration of exposure to the risk factor (How long?)
- The frequency of exposure to the risk factor (How often?)
- The intensity of the exposure to the risk factor (How much?)

## Job Categories Assessed

We observed jobs in a large number of categories (31 in total) in the Agriculture Sector.



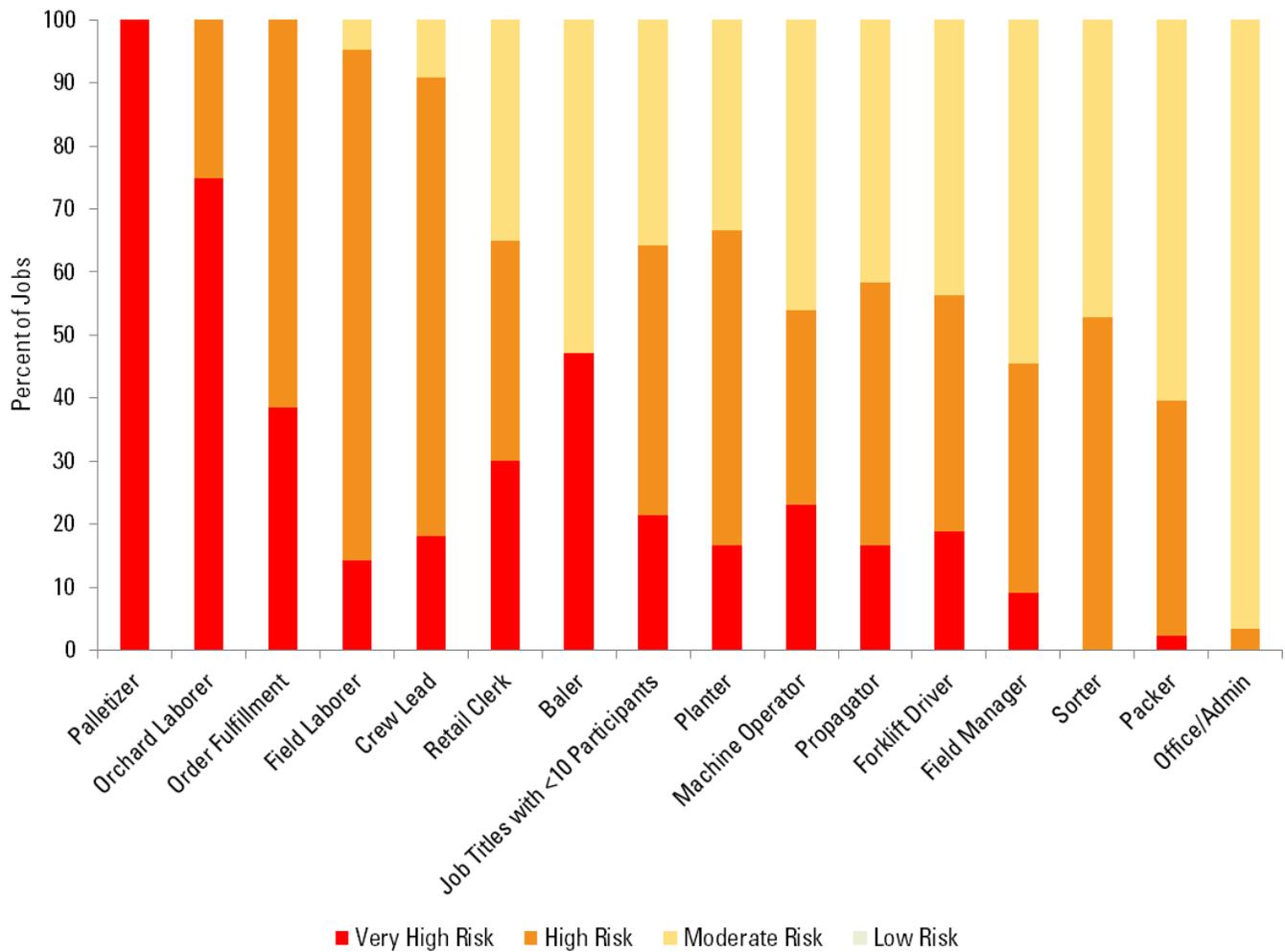
Percent of Workers

\*Job categories with <10 participants: Box Hanger; Chemical Applicator; Clean Up; Irrigation; Line Helper; Pallet Tagger; Refrigeration; Storage Cellar; Fruit Checker; Maintenance; Mechanic; Quality Control; Shipper/Receiver; Supervisor/Manager; Tractor Driver; Truck Driver

# Level of Risk of Injury from Working with Elevated Shoulder Postures

Working with the hands above shoulder height is a common hazard among the Agriculture jobs observed.

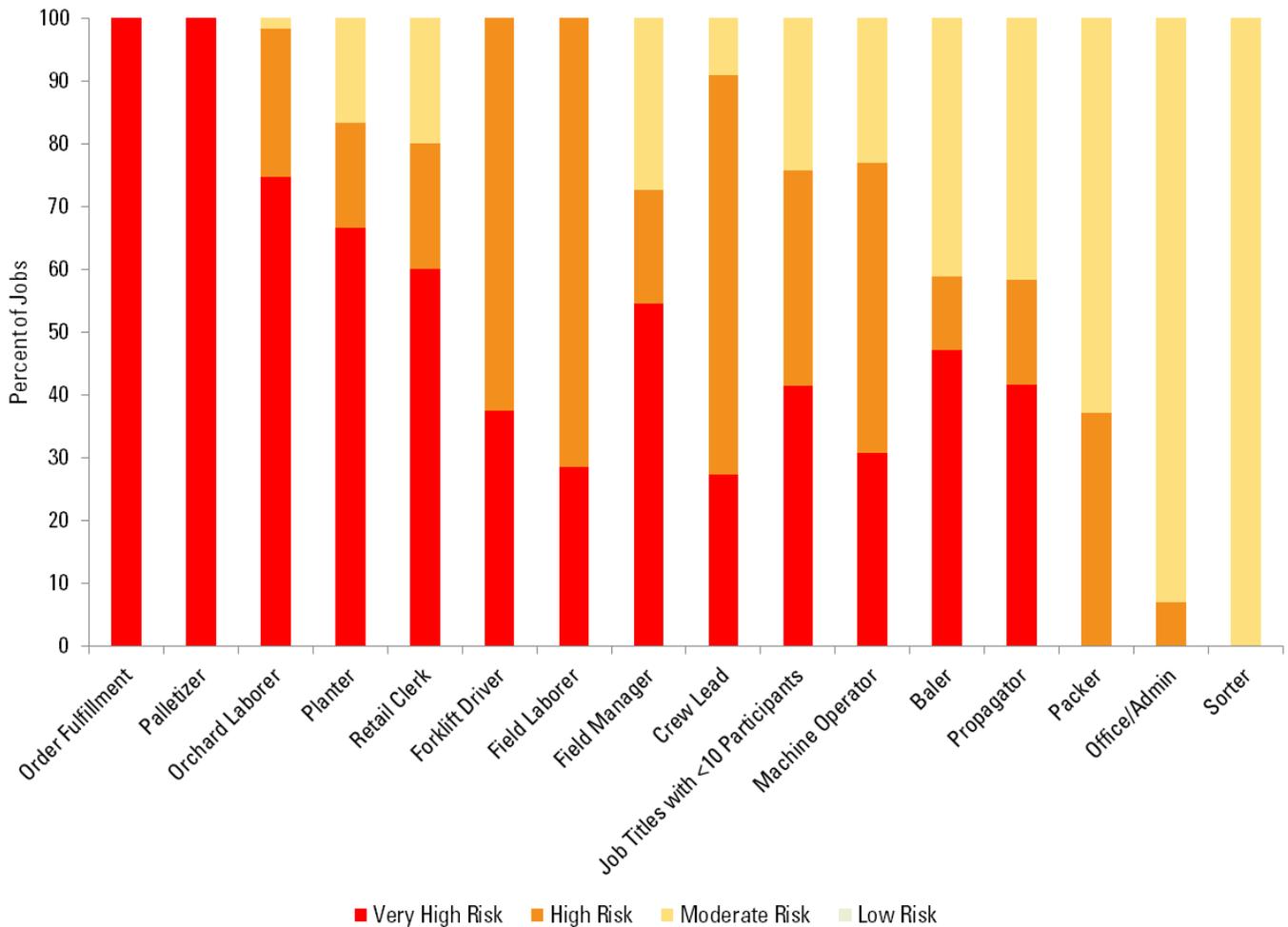
No participants observed had shoulder postures that posed less than a moderate risk, while palletizers and orchard laborers had the highest risk of shoulder injury from awkward postures.



## Level of Risk of Injury from Static Back Postures

**Surprisingly, a high and very high risk of injury from static back postures is characteristic of the Agriculture jobs observed.**

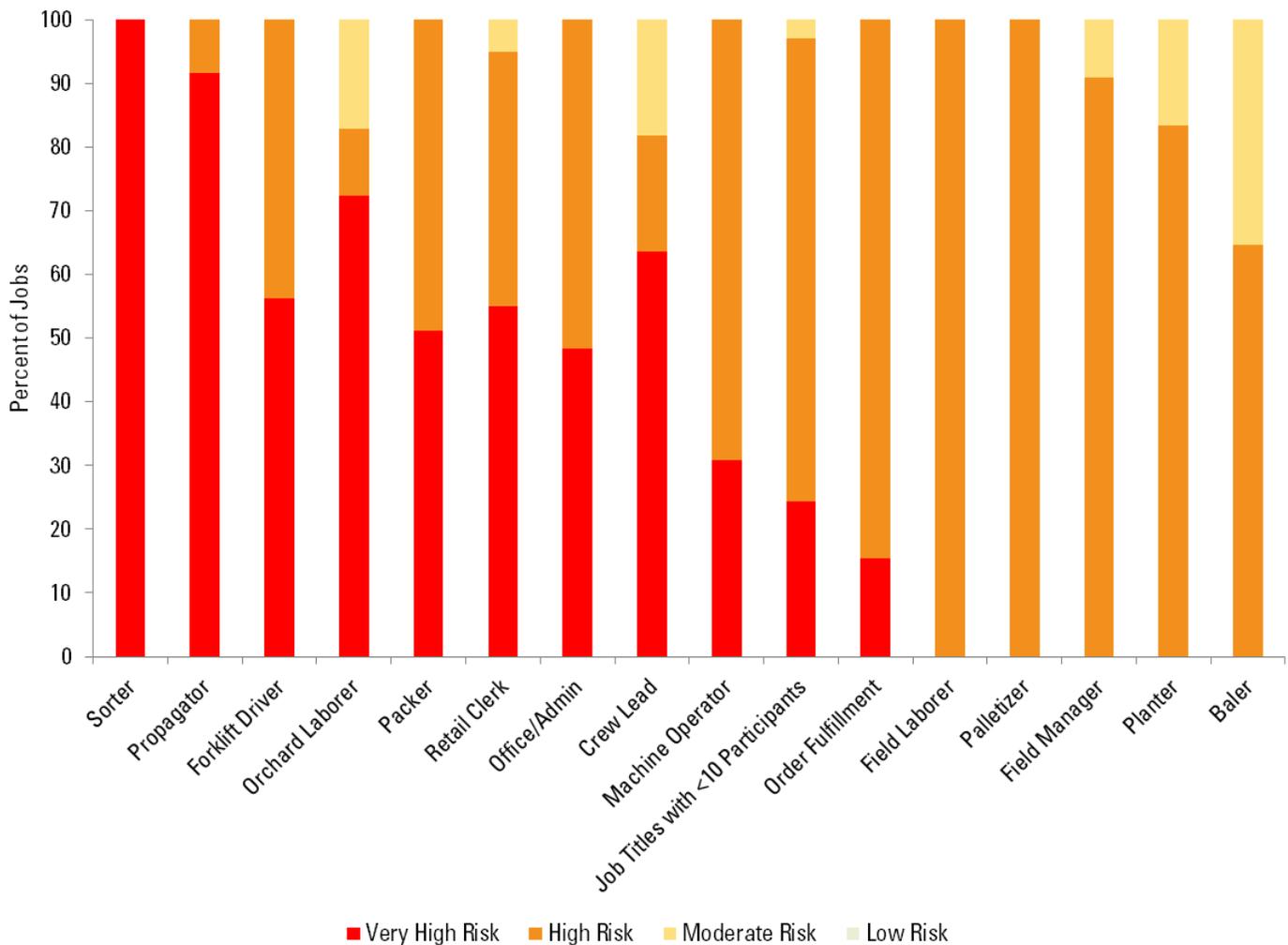
**No participants observed had static back postures that posed less than a moderate risk, suggesting very little variation in back postures while performing the job activities.**



## Level of Risk of Injury from Awkward Neck Postures

**Awkward neck postures (flexion, extension, twisting) are a common hazard among Agriculture jobs observed.**

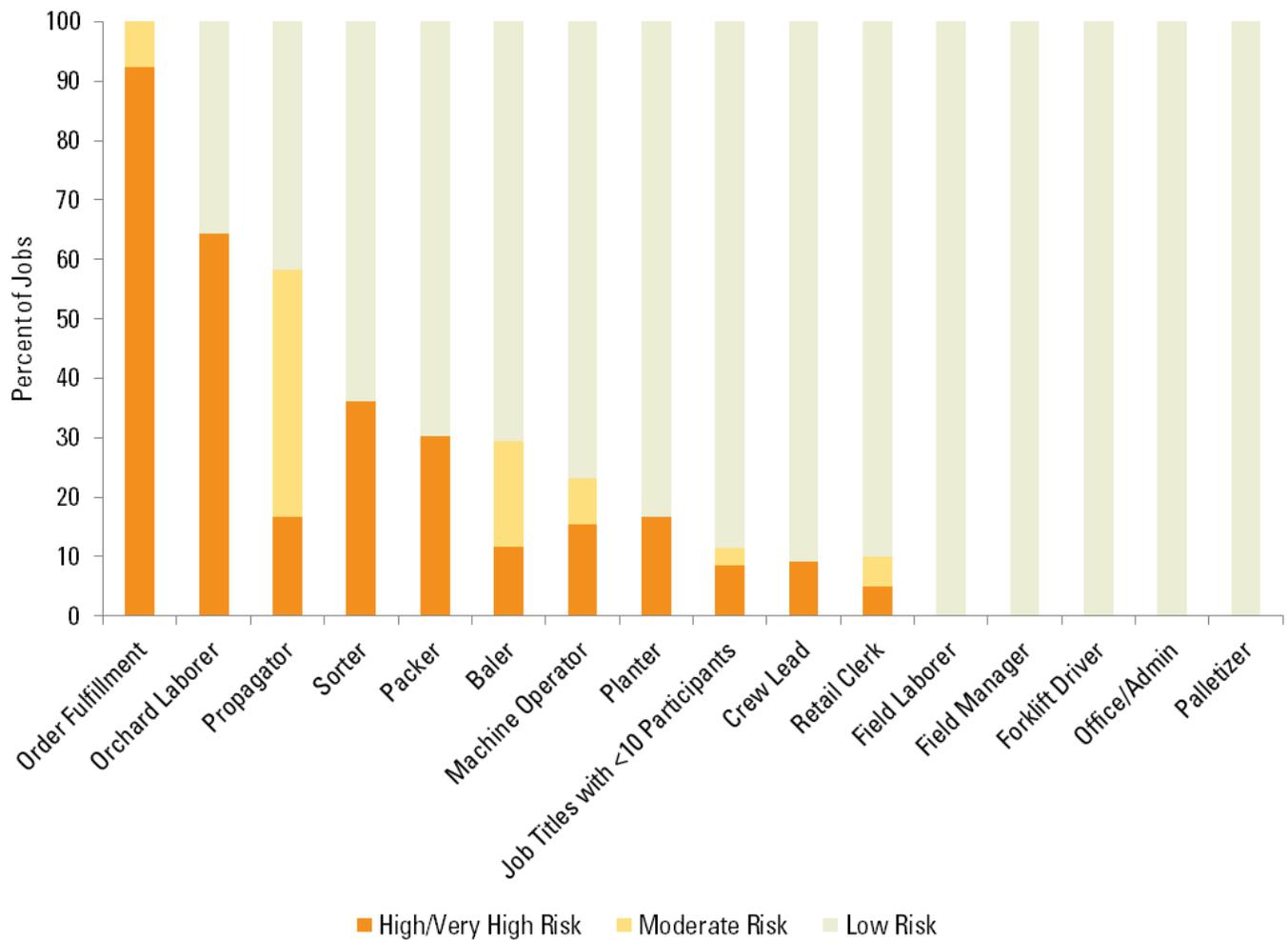
**No participants observed had neck postures that posed less than a moderate risk, while almost all the sorters and propagators had neck postures that posed a very high risk of injury.**



## Level of Risk of Injury from Forceful Pinch Gripping

Although pinch gripping was observed in many of the jobs, by the definition of our assessment tools the force of pinch gripping was not high enough to pose a high risk of injury for most jobs.

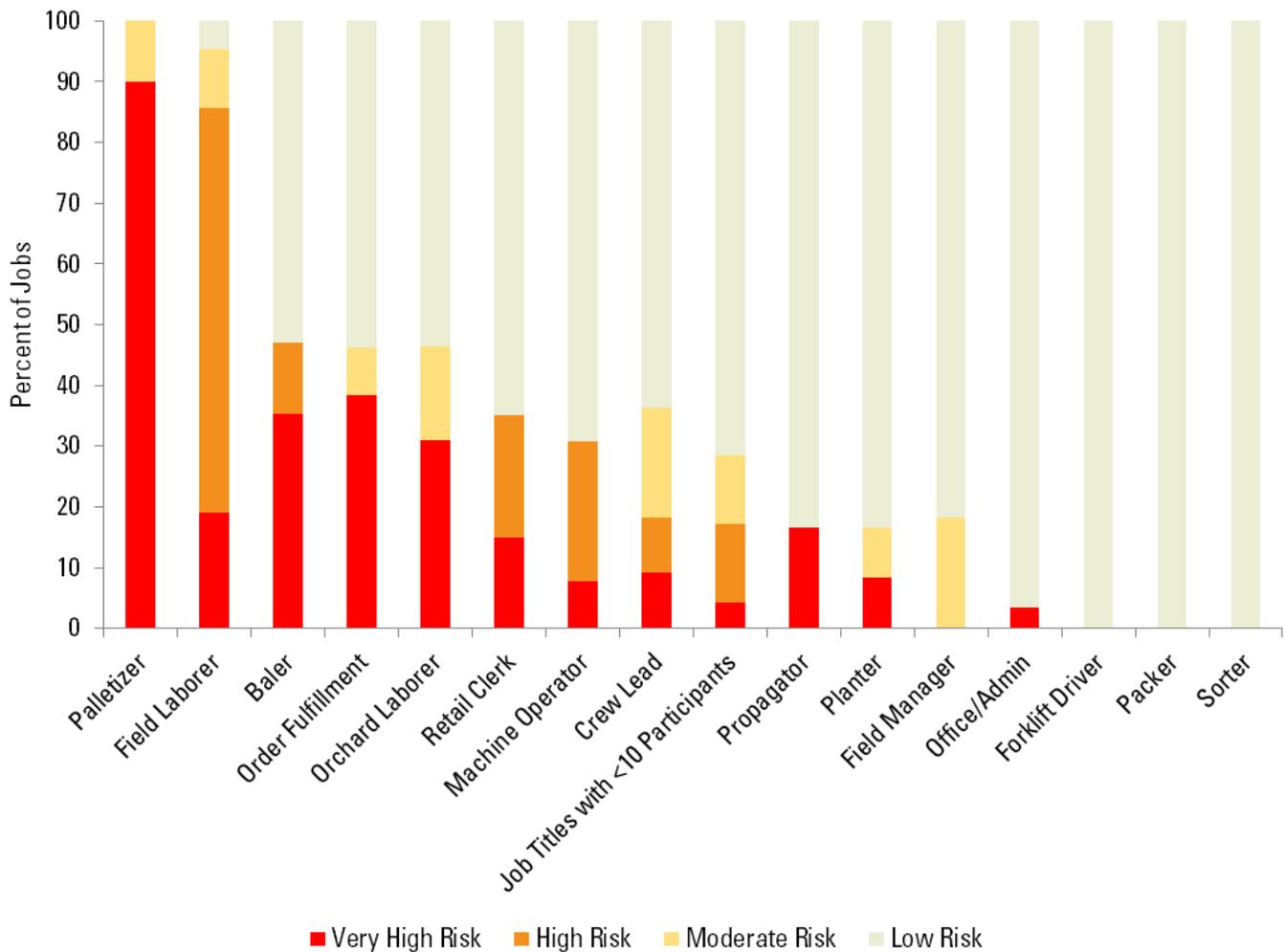
Order Fulfillment and Orchard Laborer are the only job categories in which the tools identified a majority of workers at high risk from pinch gripping.



# Level of Risk of Injury from Manual Material Handling Activities (Lifting, Carrying, Pushing, Pulling)

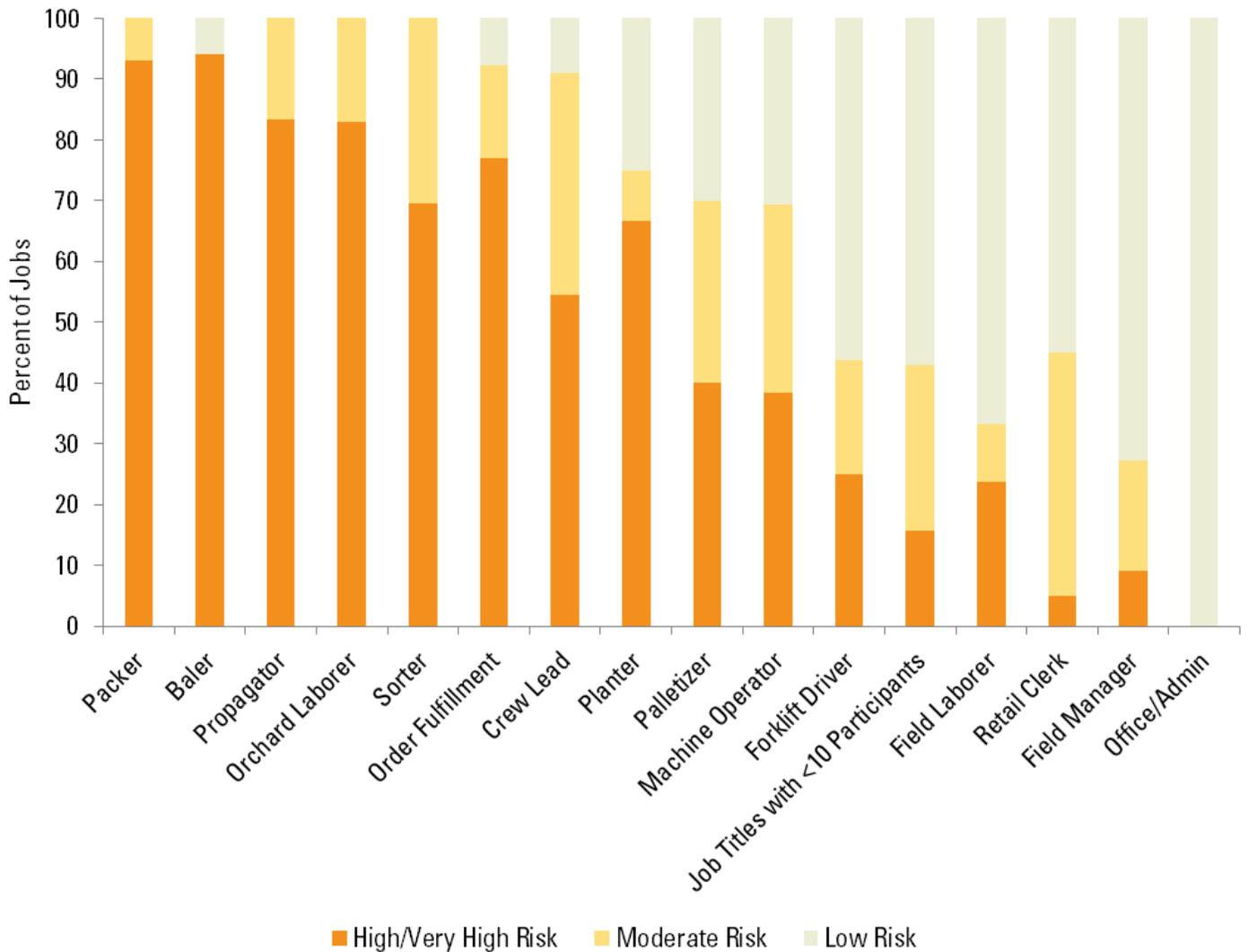
**Most Agriculture jobs observed had a low risk of injury from manual material handling activities, as determined by our assessment tool.**

**Palletizers and Field Laborers faced the highest risk of injury.**



## Level of Risk of Injury from Repetitious Hand Movements

The jobs with the highest risk of hand/wrist injury from repetitious motions were those whose pace was machine-controlled (Packer, Order Fulfillment, and Baler) and those with very little variation in job tasks (Propagator and Orchard Laborer).



## Discussion

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Among the companies in the Agriculture sector involved in our study, there were a large number of job categories assessed (31), indicating a wide variety of work performed in this industry sector. The risk factors that most frequently posed a high or very high risk of injury from the jobs observed were Awkward Neck Postures, Static Back Postures and Awkward Shoulder Postures. Repeated Impact of the Hand or Knee, a risk factor associated with WMSDs, was *not* observed among the jobs assessed in this study. However, several assessed risk factors produced interesting results:

- Prolonged Standing was common among the jobs in the Agriculture industry – 68% of the jobs required standing for more than 6 hours per day.
- In only 3% of the jobs did Pace of Work pose a high or very high risk of injury. In 29% of the jobs, pace posed a moderate risk of injury.
- A high or very high risk of injury from Prolonged Stress levels, a psychosocial work factor associated with WMSDs, occurred in 21% of the Agriculture jobs observed.

Exposure to a single risk factor can pose a high risk, but exposure to a combination of risk factors increases the risk of injury. Risk factor combinations that have been associated with increased WMSD risk include awkward back postures with frequent/heavy lifting, working overhead while handling heavy objects, and awkward wrist postures with forceful hand exertions.

Although the design of our study did not allow us to determine if risk factors occurred simultaneously, it was possible to identify where these risk factors occurred in the same job. Additionally, if the duration of exposure to each of these risk factors were for longer periods, then the likelihood that these risk factors occurred at the same time was high. The following risk combinations were found among the jobs in the Agriculture Industry:

- The combination of the forward bending of the back more than 45° and manually handling weight more than 25 lbs. was seen in those workers fulfilling orders at plant nurseries.
- The combination of working with the elbows above shoulder level for more than 4 hours per day and manually handling weights more than 25 lbs. was seen in laborers working in tree orchards.

This study identified physical risk factors specific to the Agriculture sector using commonly used evaluation tools. However, the exposure assessment tools did not capture exposure to potential risk factors that may increase the risk of WMSDs to the lower extremities (back, knee, and foot). These risk factors included climbing up and down ladders (with or without loads) and large equipment, and walking on uneven surfaces. Additionally, orchard laborers carried picked fruit in bags harnessed to their chests; this is not characterized as a “typical” carry because the weight is supported by the torso and not the hands. These characteristics contribute to the physical workload of the job but are not commonly quantified.

## Physical Job Evaluation Checklist for Agriculture

In an effort to help increase general awareness of physical factors that contribute to work-related musculoskeletal disorders and injuries (WMSDs), such as sprains and strains, SHARP researchers developed a Physical Job Evaluation Checklist tailored specifically for work performed in the Agriculture sector. This checklist can quickly assess levels of risk of injury for the back, shoulder, hand/wrist, and knee in a given job.

The Physical Job Evaluation Checklist was developed from observations of the more common jobs performed in plant nurseries, fruit orchards, fruit packing facilities and other agriculture support services. The evaluation of WMSD risk is based on those observations. The checklist is comprised of questions about WMSD risk factors that were observed and assessed to pose more than a minimal risk.

While the checklist was developed using observations from several Agriculture industries, other industries in this sector may have similar job activities and may benefit from the use of the Physical Job Evaluation Checklist.

This checklist is **not** intended to predict injury. Instead, the purpose of the Physical Job Evaluation Checklist is:

- 1) To help identify aspects of the job that pose a risk for the back, shoulder, hand/wrist and knee injury
- 2) To help prioritize injury prevention efforts by identifying the jobs or the aspects of the job that pose the greatest risk of injury

Download the checklist (click here)

<http://www.lni.wa.gov/Safety/Research/Wmsd/WMSD2010.asp>

# Start With the Basics: General Principles for Preventing Musculoskeletal Injuries and Disorders

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The physical risk factors in a workplace that can contribute to the development of musculoskeletal injuries and disorders can be both numerous and complicated. However, there are several basic principles and “best practices” that should be considered when attempting to eliminate or reduce these physical risk factors. If you have jobs that have more than one of these risk factors occurring at the same time (combination exposures), these should be your first priority for improvement. Finally, workers should be involved in brainstorming solutions if physical risk factors are found.

## Awkward Postures:

Avoid holding the body in the same position for long periods of time (static postures).

- Try to move from that posture, even if for a short period of time.
- Use a machine to do the task.
- Keep the body moving (dynamic movements)--vary the levels or distance in which the work is performed, as long as extreme postures are not adopted.

Avoid working with the limbs far from the torso.

- Bring the work closer to the worker.

Avoid hand tools or the orientation of objects that cause the wrist to bend upwards (extension) or downwards (flexion) or to the side (wrist deviation).

- Use jigs or work surfaces that can orient the object into a position that keeps the wrist straight.
- Use tools with the handles bent in a position that will keep the wrists straight while performing the work.

Avoid working with the back bent forward (back flexion) for long periods of time.

- Raise the work to at least waist level.
- Alternate with work that is performed standing up straight.

## High Hand Forces:

When grasping an object with any kind of force, avoid using a pinch grip (grasping with the tips of the fingers) especially with the wrist bent. A power grip (holding the object with the fingers wrapped around it) can generate more force.

- Use a tool such as a vise or a jig to hold the object that requires a pinch grip.

## Repetitive Motions:

Avoid having to perform quick motions repeatedly over an extended period of time.

- See if it is possible to use a machine instead.
- Alternate the performance of repetitive tasks with less repetitive ones.

## Heavy, Awkward and Frequent Lifting:

- Avoid lifting objects that:
  - can't be lifted close to the body,
  - require twisting during the lift,
  - are too big or of a shape that doesn't allow a good hold by the hands,
  - require the start and end of the lift to be below knee level or above shoulder level, if the object is heavy.
- Use a machine to do the lifting.
- Arrange space so that heavier objects are kept between knee and shoulder height.
- Store less used, lighter, smaller objects below knee level or above shoulder level if there are no other alternatives.

## What other factors could be involved in sprains, strains, and overexertions?

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### Important WMSD risks described by injured Agriculture workers

Over the course of our research we conducted many physical exposures assessments of jobs at companies throughout Washington State. Risk factors were evaluated using a set of established tools designed to assess aspects of the work such as posture, force, and repetition. However, we also conducted interviews with workers from the Agriculture sector that had filed workers' compensation claims for sprains, strains, and other WMSDs. These interviews helped shed light on factors, other than the physical, our tools could not measure but may contribute to, or exacerbate, WMSD injuries. The following are excerpts taken from these interviews that illustrate several commonly mentioned problems.

#### Problems with Equipment

Injured workers in Agriculture industries commonly discussed problems with equipment in relation to their injuries, including poorly designed equipment, chronic break-down of old or poorly maintained equipment, and the absence of a tool or piece of equipment that would reduce the physical requirements.

##### **Farm Laborer, back injury:**

*About noon we'd shut down every day and start nailing those darn planter boxes back together. ... Those things rot and fall apart because they're pretty much beaten to death. About half the day we'd be repairing the darn things. ... Big hammers and 16-penny nails. Yep, just a pile of material. You got to stand them on end, flip them over, nail them back together. They got posts that are lag-bolted in through the corners. It's real hazardous in there. ... They're just on the floor. They stand maybe a foot tall. So there's a lot of bending, stooping, nailing, bashing, pushing, pulling. ... A nail gun would have helped immensely. With my arms and they got us beating these 16-penny nails back into these things as fast as you could. A simple nail gun and nobody would have to do that.*

##### **Fruit Packing Sanitation Supervisor, shoulder injury:**

*We had a pit that debris would flush into through the water rinsing systems. ... One night we were cleaning the pits and I was pulling the pump out because there was nobody there to do it... Standing there doing a hands over fist, proper lifting procedure, using my legs and my shoulders and my arms, and my arm popped. ... The pump is heavy. ... I just reached down with my right arm to do the next pull and my right arm popped. ... I believe that if hoists had been utilized then the manual lifting would have been nullified. Hoists would have been a very simple process. A basic L-arm up the side of the pit with electric motor cable, just like you have on the front of your truck for a winch. But they didn't have those on any of the pits. They didn't actually think of the cleaning aspects when these pits were designed. ... Had they been designed by people who knew what the end work was going to be, there would have been measures brought in to mind when they designed the pit for the removal of the debris after it had been collected.*

## Work Pace, Client Demands, & Staffing

Many workers pointed to the fast pace of line work as contributing to their injuries. Some explained how other factors, like client demands and limited staffing levels, further fuel an increase in work pace. Yet, it is this extreme pace that workers consistently identified as a major cause of injury.

### **Fruit Packing Forklift Driver, back injury:**

*Slow down, take better precautions. But there are production requirements that need to be met. We have to turn around product very quickly the same day. There's no safety because of the intense pace that's required.*

### **Fruit Packing Segregator, shoulder injury:**

*It's a production line. There's apples cranking out of there every day. We fill big orders. It was pretty rough. ... I was stacking up the boxes and stuff like that, and that's when it happened. I was putting one up and I felt it. ... They could have either hired more people or slowed the machine down. At the same time, they can't because we meet demands for places like [large food retailers] and all this other stuff. We got apples going out all across the globe. These people, they do business with folks in China and Japan and all that. ... Here's the thing. It kills me every time. ... These people pay their segregators \$9.82 an hour. OK. \$9.82 an hour to go through that type of hell. The attrition rate there is just beyond ridiculous.*

## Hazardous Processes & Placement

Some workers described work practices that created a situation requiring awkward maneuvering. A common explanation described the placement of materials either too high or too far apart to be reached without strain.

### **Fruit Packing Repack, back injury:**

*When they bring in the pallets, they're usually like three to four boxes taller than we are, most of the time. You kind of have to jump up and grab the box and pull it to the edge so it can slide down, so you can grab it. Probably about like the second time, I was pulling a box off and I picked it up over my head. And when I came down and turned, my back just kind of did the snap, crackle, pop thing. Pretty much from the weight of the box. ... It would have just been nicer if the boxes had been stacked a little bit lower. ... It seems like they expect you to be seven foot tall. If I remember right, I think they would stack them ten to twelve high. Sometimes we'd get pallets in where the tops were leaning over because they were so tall.*

## Manager/Supervisor Priorities

Some workers described their experiences with managers and supervisors who prioritized production over safety and displayed a lack of support when workers raised safety concerns.

### **Fruit Packing Packer, shoulder injury:**

*I was packing five- and eight-pound bags of apples. The truth is, [the conveyor belt] was too fast. And they had me working by myself, and they didn't want me to miss filling any of the bags. ... You had to be—one bag after another, stretch out your hand to grab a box, and, like that, I just felt I messed up the little bone in my shoulder. I think the principle things are, they are not careful with us. They set up the machinery too fast. Sometimes it's throwing the fruit and even then they don't turn down the speed. There are many things that happen there. I think that first of all, [the employers] need to be more considerate of the workers. I'm not saying to make the workplace lax or that we not work. But they should have less—well, they don't care if something bad happens to you. They place importance on production demands above worker safety.*

# Industry Prevention Strategies

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## Lessons learned from Agriculture insiders

We also conducted 61 interviews with management and non-management representatives from companies in the Agriculture sector throughout the State to help us gain additional insights into strategies for preventing WMSDs. Companies in this industry are using a variety of preventive strategies including engineering controls (eliminating exposure) and administrative controls (reducing the exposure to risk factors or the severity of risk). Commonly described prevention efforts included using equipment and machinery to do the most strenuous or repetitive work, as well as changing work processes. In some orchards, new technologies are being adopted that help to reduce the physical requirements of the jobs.

### Introduction of Equipment & Machinery

**Apple Orchard Safety Manager:**

*We've installed devices on the packing line that use air pressure to lift boxes and move them along a conveyor. This reduces the workers' need to do as much heavy lifting.*

**Apple Orchard Office Manager:**

*In the cider pressing room, they used to have to carry apples. Now we have this brush bed that rolls them at the right height. It saves everyone's back.*

**Grape Vineyard Safety Director:**

*Pneumatic [air-powered] pruners, versus hand-held pruners that you'd use in your yard—they're hard on your hands. So we have a tractor with an air compressor, and that pressurized air does the flexing for them. They hold the pruners, and just with a light squeeze of the hand, it closes all the way for them. It's faster and reduces hand stress.*

### Job Rotation

**Nursery Safety Officer:**

*For pruners, it's repetitive. So we have them do pruning half a day, then do half a day doing something else.*

**Potato Packing Production Manager:**

*We rotate stackers every 30 minutes.*

**Fruit Packing Safety Manager:**

*For the bagging position, it now rotates out every hour, or before if needed.*

## **Modifications to the Physical Environment**

### **Apple Orchard General Manager:**

*We modified the orchards. There are lots of trellises that used to have a ground wire that people had to step over while bending down to get under other wires. We removed the ground wires so now they don't have to step over them. Also, we used to have to use 12-foot ladders to reach the upper branches. We brought all the limbs down so they're all accessible with 10-foot ladders instead.*

### **Apple Orchard General Manager:**

*We are replanting with smaller trees that, over time, will reduce the need for large ladders.*

### **Apple Orchard Manager:**

*We have started removing the plastic sheeting—the mulch—that we put down earlier in the season. ...Also, we will take down wires to make it easier to get ladders safely positioned to reduce reach distances.*

### **Potato Packing Maintenance Supervisor:**

*We provide ergo mats for the sorters so they are more comfortable.*

### **Fruit Packing HR Manager:**

*We raised the conveyor belts to reduce the impact of lifting.*

## Additional Resources

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### WMSDs

- Work-Related Musculoskeletal Disorders of the Back, Upper Extremity, and Knee in Washington State, 2002-2010
  - Report Summary: [http://www.lni.wa.gov/Safety/Research/Files/WMSD\\_TR\\_EXP\\_Summary2.pdf](http://www.lni.wa.gov/Safety/Research/Files/WMSD_TR_EXP_Summary2.pdf)
  - Full Report: [http://www.lni.wa.gov/Safety/Research/Files/WMSD\\_TechReport2015.pdf](http://www.lni.wa.gov/Safety/Research/Files/WMSD_TechReport2015.pdf)
- Perceptions of risk from workers in high risk industries with work related musculoskeletal disorders  
<http://iospress.metapress.com/content/e3553913x0503461/>
- Job Organization and Worker Health  
<http://www.tandfonline.com/doi/full/10.1080/00140139.2015.1065347>

### L&I Programs

- SHARP Program  
<http://www.lni.wa.gov/Safety/Research/default.asp>
- Sprains & Strains Prevention Resources  
<http://www.lni.wa.gov/safety/SprainsStrains/>
- DOSH Consultations  
<http://www.lni.wa.gov/Safety/Consultation/default.asp>