

# Examining nonfatal work injuries among self-employed and wage-salaried workers in the US agriculture, forestry, and fishing industry

**Solaiman Doza**

Ph.D. Candidate

Environmental and Occupational Health

College of Health



**Oregon State**  
University

# Background

# Agriculture, Forestry, and Fishing (AgFF) industry

## Agriculture, food, and related industries account for:

- 11% of U.S. employment
- 5.2% of U.S. gross domestic product (GDP)
- AgFF industry comprise high self-employment (*Pegula SM. 2004; ERS, USDA. 2020*)

## BLS 2021 data –

- AgFF industry – highest fatality (death) rate (19.5 per 100,000 FTE worker)
- AgFF industry – second-highest nonfatal injury and illness rate (180 per 10,000 FTE worker)

## Current gaps in injury surveillance

- Bureau of Labor Statistics (BLS) nonfatal injury surveillance does not track:
  - Self-employed
  - Small businesses (<10 employees)
- BLS underestimates nonfatal work injuries among agricultural workers (Leigh et al. 2014)

# U.S. agricultural workers

## Self-employed owner operator

- Engage in various production activities (i.e., operating machinery/equipment, driving tractors)
- Predominantly non-Hispanic white

## Hired wage or salaried employees

- Hired to carry out specific tasks. (i.e., fruit or vegetable picking)
- Hispanic and other migrant workers

## Family farms

- Represent more than 90% of US farms
- Self-employed operators and families provide much of the labor
- Specific commodities – 56% of total US poultry
- Limited work safety resources

## Large and midsize farms

- Represent 3% of US farms and yield 44% of annual production
- Employ hired wage or salaried workers
- Commodities – Dairy, beef and high-value crops like vegetables, nursery/greenhouse products, and fruits/tree nuts

# U.S. forestry and logging workers

Approximately 14% US loggers are self-employed

- Cutting down trees      Use Chainsaw
- Sorting and chipping      \_\_\_\_\_
- Transporting woods      Manually handle and transport

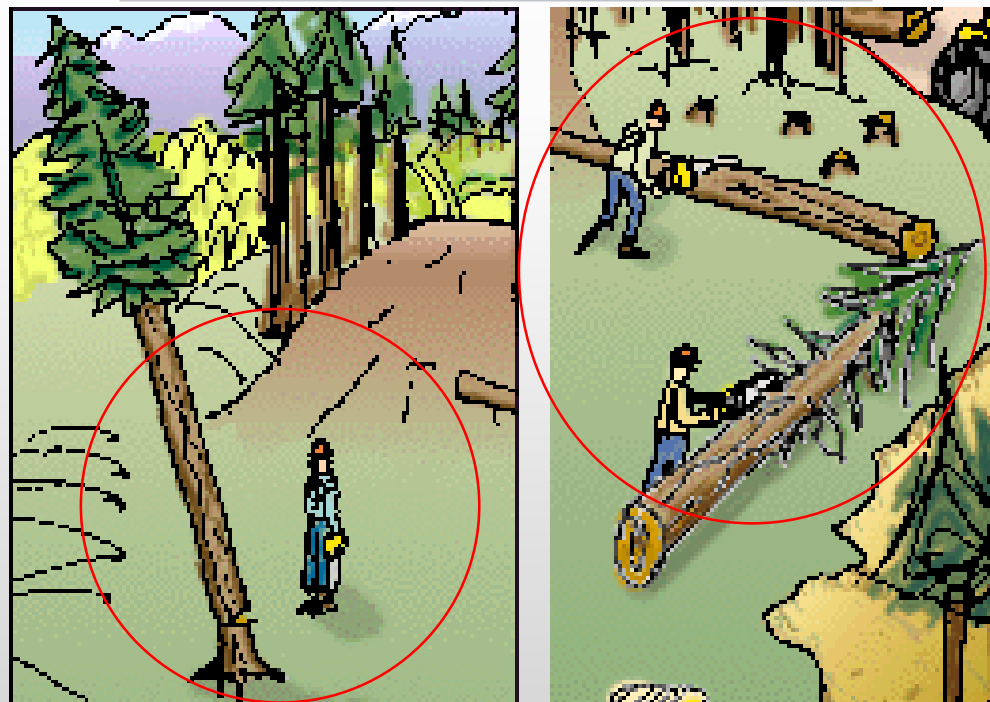


Fig 1. Manual logging operation – Felling trees, limbing and bucking (OSHA)

## Mechanized logging

- Large investment
- Trained operator
- Utilize harvester, forwarder etc.



Fig 2. Vimek 404 harvester

# U.S. fishing workers

About 42% US fishermen are self-employed

Owner-operated vessel types:

- Gillnetters
- Purse seiner
- Small trollers
- Crabbers



Fig 3. Deckhand handling Crab pots

Tasks	
Owner or skipper	Deckhands
Operate and navigate vessels	Set nets across the mouths of rivers or inlets
Vessel and equipment maintenance	Use pots and traps to catch fish or shellfish (i.e., lobsters and crabs)
Locate catch and catching fish	Use dredges to gather other



Fig 4. Deckhands unloading crabs



## Research Question

---

Do nonfatal injuries differ between self-employed and wage-salaried?

Aim a: Compare work-related injury rates between self-employed and wage-salaried AgFF workers

Aim b: Compare the injury nature, body part, and external causes between self-employed and wage-salaried AgFF workers



## Study sample and primary outcome

### Inclusion Criteria

- National Health Interview (NHIS) survey years 2004 to 2017 (14 years)
- All adult AgFF industry participants (>18 years):
  - “working for pay at a job or business,”
  - “with a job or business but not at work,”
  - or “working, but not for pay, at a family-owned job or business”.
- Self-employed and private industry workers
- State, local, and federal employees will be excluded

### Injury episode counts

- Participants reported up to 10 medically treated injury episodes during last 3 months
- Work-associated injuries – “Working at a paid job”

### Annual rate of injury per 100 full-time equivalent (FTE) worker:

- $(\text{Number of annual injury-episode} \times 200,000) /$   
Number of hours worked by the AgFF worker group





## Covariates (AgFF worker characteristics)

### Class of worker

- Self-employed
- Wage-salaried

### Sociodemographic

- Age (*years*)
- Gender (*male/female*)
- Race/ethnicity (*Hispanic/White/Black/All other race*)
- Education level (<high school, high school,  $\geq$  college degree)

### Work characteristics

- Job tenure (*years*)
- Weekly work hours
- More than one job



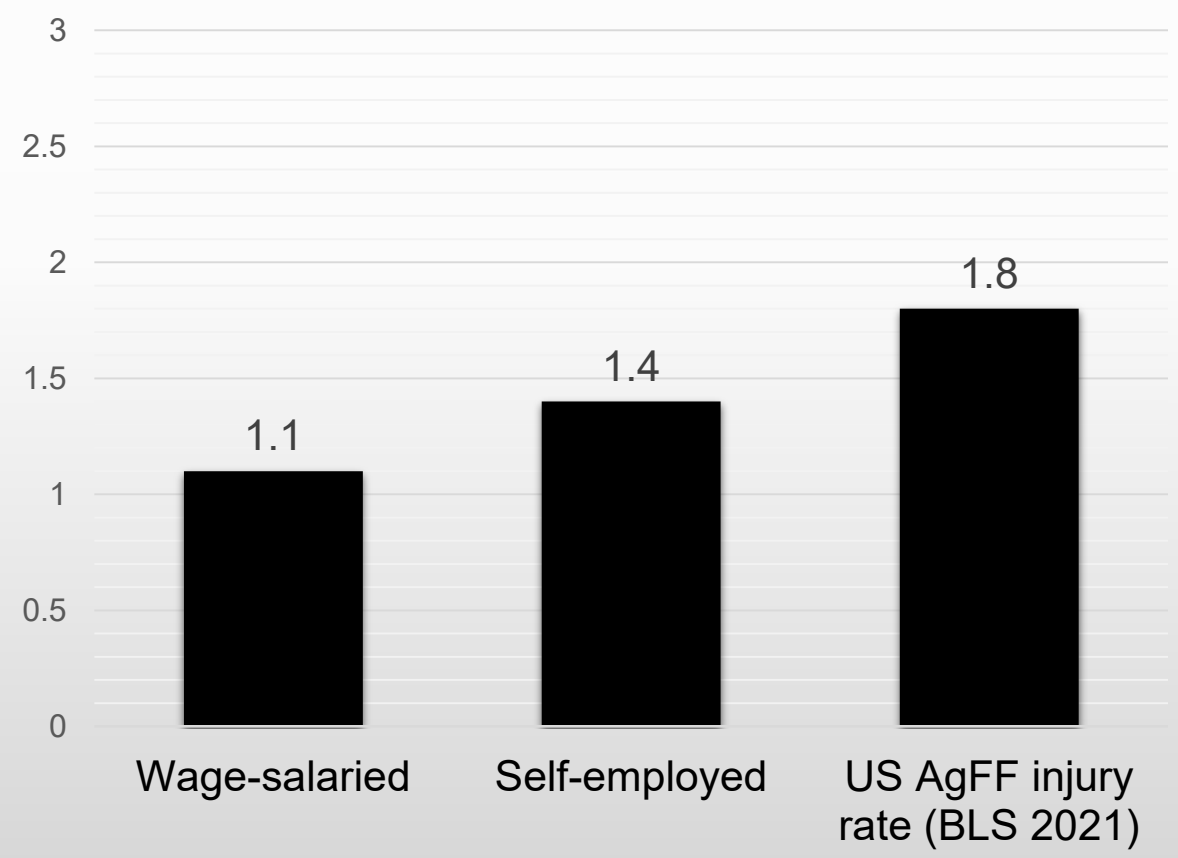
## Results

	Wage-salaried (n = 2318)	Self-employed (n = 1432)
Male (%)	76	75
Age (mean $\pm$ SD)	40.9 $\pm$ 14.8	53.8 $\pm$ 14.8
White non-Hispanic (%)	52	95
No high school diploma (%)	41	12
Job tenure years (mean $\pm$ SD)	9.5 $\pm$ 14.8	22.7 $\pm$ 14.1
Weekly work hours (mean $\pm$ SD)	44.3 $\pm$ 18.6	49.1 $\pm$ 23.2
More than one job (%)	8	13



# Results

### Nonfatal injury rate per 100 AgFF worker FTEs



### Injury rate by gender and worker type





## Results

Variables	Unadjusted Odds ratio (95% CI)	Adjusted Odds ratio (95% CI)
<b>Class of worker</b>		
<b>Wage-salaried</b>	<i>Ref</i>	<i>Ref</i>
<b>Self-employed</b>	1.10 (0.54, 2.22)	0.99 (0.42, 2.34)



## Results

Injury Source	Wage-salaried (%)	Self-employed (%)
Being struck	22	15
Fall	11	15
Overexertion	28	9
Transportation	4	16
Cut/piercing	3	16
Machinery	9	-



# Strengths & Limitations

## Strengths

- Nationally representative sample – population estimates
- Work injury reported by workers (vs. employer)
- Work-associated injury burden – self-employed AgFF workers
- Multiple survey years – large sample size

## Limitations

- Not representative of individual industries and occupations
- Unable to compare work activities & exposures – self-employed vs. wage-salaried workers
- Healthy worker effects and survival bias – underestimation of nonfatal injury prevalence
- Recall and reporting bias – self-reported data



## Key takeaway

---

- Self-employed US AgFF workers showed marginally higher injury rate and different injury source indicating their work exposure could be different from the wage-salaried.
- Work exposures of female self-employed AgFF workers need to be evaluated to mitigate their higher injury burden.
- Self-employed also had distinct sociodemographic characteristics:
  - Older
  - Non-Hispanic white
  - Higher educated
  - Longer job tenure
- Further exploration of the work exposures and injury characteristics are needed to determine the burden of self-employed AGFF workers.

# Acknowledgements

## Doctoral Committee

### *Co-major Advisors*

- Dr. Laurel Kincl
- Dr. Viktor Bovbjerg

### *Committee members*

- Dr. Molly Kile
- Dr. Adam Branscum
- Dr. Tala Navab-Daneshmand (GCR)

## RISC Study

- Amelia Vaughan
- Jasmine Nahorniak
- Samantha Case

## Family/Friend/Peer

- Nusrat Jahan Ritu (Spouse)
- Khalid Ibne Masood
- Hossain Ahmed Taufiq
- Stephanie Ann Foster
- Kwadwo Adu Boakye
- Hudson-Hanley, Barbara
- Yerram Divya Smitha Reddy
- Patil, Vaishali



**THANK YOU**



**Oregon State  
University**



## NHIS sample weights and design variables

NHIS utilizes a hierarchy of sampling –

- Household- and person-level base weights

Final sample weights =

- Base weights are adjusted for
  - Non-response
  - Ratio adjustment

Sample adult weight provided by NHIS

For pooled analysis, new weighting variable =

- Annual sample adult weight / total survey years (14 years)

Three design periods –

- 1995-2005
- 2006-2015
- 2016-2019

New design variable =

- Add multiples of 1000 to each design period



## Statistical Analysis

Descriptive  
analysis

Prevalence of self-employment

Sociodemographic

Work characteristics

Annual injury episode rate/100 FTE  
worker

Class of workers

Sociodemographic

Work characteristics

Injury characteristics

Class of workers

Sociodemographic

Work characteristics

*Work-associated annual rate of injury episodes per 100 full-time equivalents (FTE):*

$(\text{Number of annual injury-episode} \times 200,000) / \text{Number of hours worked by the AgFF worker groups}$

# Statistical Analysis (Modeling)

Exploratory Poisson regression models for each of the following

Class of workers	Injury episode counts
	Missed workdays,
	Number of nights in the hospital

Confounding and Effect modification	<ul style="list-style-type: none"> <li>• Sociodemographic</li> <li>• Work characteristics.</li> </ul>
-------------------------------------	---

Likelihood ratio test (LR) to compare

- Poisson vs. negative binomial models

Best-fitted model:

- Akaike information criterion (AIC)
- **Models with confounding terms**
  - Backward Selection method (pre-specified significance level  $p = 0.10$ )
- **Models with Effect modifiers**
  - Forward Selection with switching (pre-specified significance level  $p = 0.10$ )



## Results

Variables		Unadjusted Odds ratio (95% CI)	Adjusted Odds ratio (95% CI)
<b>Class of worker</b>	<i>Wage-salaried</i>	<i>Ref</i>	<i>Ref</i>
	<i>Self-employed</i>	1.10 (0.54, 2.22)	<b>0.99</b> (0.42, 2.34)
<b>Sex</b>	<i>Male</i>	<i>Ref</i>	<i>Ref</i>
	<i>Female</i>	0.50 (0.16, 1.53)	0.52 (0.16, 1.77)
<b>Age groups (years)</b>	<i>18-39 years</i>	<i>Ref</i>	<i>Ref</i>
	<i>40-49 years</i>	1.46 (0.67, 3.17)	1.29 (0.54, 3.10)
	<i>50-59 years</i>	0.72 (0.23, 2.22)	0.78 (0.26, 2.36)
	<i>&gt;60 years</i>	1.04 (0.33, 3.22)	1.02 (0.25, 4.08)
<b>Educational attainment</b>	<i>Some college or higher</i>	<i>Ref</i>	<i>Ref</i>
	<i>0-12th grade (No diploma)</i>	0.77 (0.29, 2.05)	0.80 (0.30, 2.14)
	<i>High school grad or GED</i>	1.20 (0.52, 2.77)	1.25 (0.55, 2.87)
<b>Current/longest job tenure (years)</b>	<i>0-4 years</i>	<i>Ref</i>	<i>Ref</i>
	<i>5-9 years</i>	1.02 (0.32, 3.20)	0.92 (0.29, 2.98)
	<i>≥10 years</i>	0.87 (0.40, 1.90)	0.79 (0.35, 1.79)
<b>Hours worked past week</b>	<i>&lt;35 hours</i>	<i>Ref</i>	<i>Ref</i>
	<i>35-49 hours</i>	0.74 (0.28, 1.93)	0.68 (0.24, 1.94)
	<i>&gt;50 hours</i>	0.88 (0.35, 2.20)	0.74 (0.25, 2.16)

# Bibliography

- Doza, S., Bovbjerg, V. E., Vaughan, A., Nahorniak, J. S., Case, S., & Kincl, L. D. (2021). Health-Related Exposures and Conditions among US Fishermen. *Journal of Agromedicine*, 0(0), 1–8. <https://doi.org/10.1080/1059924X.2021.1944416>
- Economic Research Service, USDA. (2020). *Ag and Food Statistics: Charting the Essentials*, February 2020 (Administrative Publication Number 083; p. 28).
- Janocha, J. (2012). Facts of the catch: Occupational injuries, illnesses, and fatalities to fishing workers, 2003–2009 : Beyond the Numbers: U.S. Bureau of Labor Statistics. *Beyond the Numbers: Workplace Injuries*, 1(9). <https://www.bls.gov/opub/btn/volume-1/facts-of-the-catch-occupational-injuries-illnesses-and-fatalities-to-fishing-workers-2003-2009.htm>
- Leigh, J. P., Du, J., & McCurdy, S. A. (2014). An estimate of the U.S. government's undercount of nonfatal occupational injuries and illnesses in agriculture. *Annals of Epidemiology*, 24(4), 254–259. <https://doi.org/10.1016/j.annepidem.2014.01.006>
- Pegula, S., & Keszy, L. (2014). Census of Fatal Occupational Injuries commemorates 20 years of occupational safety and health data: Beyond the Numbers: U.S. Bureau of Labor Statistics (Vol. 3; No. 23; Workplace Injuries). <https://www.bls.gov/opub/btn/volume-3/census-of-fatal-occupational-injuries-commemorates-20-years.htm>
- Pegula, S. M. (2004). Occupational fatalities: Self-employed workers and wage and salary workers. 11.