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

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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

<table>
<thead>
<tr>
<th>Self-employed owner operator</th>
<th>Family farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Engage in various production activities (i.e., operating machinery/equipment, driving tractors)</td>
<td>- Represent more than 90% of US farms</td>
</tr>
<tr>
<td>- Predominantly non-Hispanic white</td>
<td>- Self-employed operators and families provide much of the labor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hired wage or salaried employees</th>
<th>Large and midsize farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Hired to carry out specific tasks. (i.e., fruit or vegetable picking)</td>
<td>- Represent 3% of US farms and yield 44% of annual production</td>
</tr>
<tr>
<td>- Hispanic and other migrant workers</td>
<td>- Employ hired wage or salaried workers</td>
</tr>
<tr>
<td></td>
<td>- Commodities – Dairy, beef and high-value crops like vegetables, nursery/greenhouse products, and fruits/tree nuts</td>
</tr>
</tbody>
</table>

U.S. forestry and logging workers

Approximately 14% US loggers are self-employed

- Cutting down trees
- Sorting and chipping
- Transporting woods

Use Chainsaw

Manually handle and transport

Mechanized logging

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

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

Fig 2. Vimek 404 harvester

Content source: Occupational Safety and Health Administration
U.S. fishing workers

About 42% US fishermen are self-employed

Owner-operated vessel types:

• Gillnetters
• Purse seiner
• Small trollers
• Crabbers

Tasks

<table>
<thead>
<tr>
<th>Owner or skipper</th>
<th>Deckhands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operate and navigate vessels</td>
<td>Set nets across the mouths of rivers or inlets</td>
</tr>
<tr>
<td>Vessel and equipment maintenance</td>
<td>Use pots and traps to catch fish or shellfish (i.e., lobsters and crabs)</td>
</tr>
<tr>
<td>Locate catch and catching fish</td>
<td>Use dredges to gather other shellfish like oysters and scallops</td>
</tr>
</tbody>
</table>

Fig 3. Deckhand handling Crab pots

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:

• (Number of annual injury-episode × 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, > college degree)

Work characteristics
- Job tenure (years)
- Weekly work hours
- More than one job
## Results

<table>
<thead>
<tr>
<th></th>
<th>Wage-salaried (n = 2318)</th>
<th>Self-employed (n = 1432)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male (%)</td>
<td>76</td>
<td>75</td>
</tr>
<tr>
<td>Age (mean ± SD)</td>
<td>40.9 ± 14.8</td>
<td>53.8 ± 14.8</td>
</tr>
<tr>
<td>White non-Hispanic (%)</td>
<td>52</td>
<td>95</td>
</tr>
<tr>
<td>No high school diploma (%)</td>
<td>41</td>
<td>12</td>
</tr>
<tr>
<td>Job tenure years (mean ± SD)</td>
<td>9.5 ± 14.8</td>
<td>22.7 ± 14.1</td>
</tr>
<tr>
<td>Weekly work hours (mean ± SD)</td>
<td>44.3 ± 18.6</td>
<td>49.1 ± 23.2</td>
</tr>
<tr>
<td>More than one job (%)</td>
<td>8</td>
<td>13</td>
</tr>
</tbody>
</table>
Results

Nonfatal injury rate per 100 AgFF worker FTEs

Injury rate by gender and worker type

- Wage-salaried
- Self-employed

US AgFF injury rate (BLS 2021)

- Male
- Female
# Results

<table>
<thead>
<tr>
<th>Variables</th>
<th>Unadjusted Odds ratio (95% CI)</th>
<th>Adjusted Odds ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class of worker</td>
<td></td>
<td></td>
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<tr>
<td>Wage-salaried</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>Self-employed</td>
<td>1.10 (0.54, 2.22)</td>
<td>0.99 (0.42, 2.34)</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th>Injury Source</th>
<th>Wage-salaried (%)</th>
<th>Self-employed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Being struck</td>
<td>22</td>
<td>15</td>
</tr>
<tr>
<td>Fall</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>Overexertion</td>
<td>28</td>
<td>9</td>
</tr>
<tr>
<td>Transportation</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Cut/piercing</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>Machinery</td>
<td>9</td>
<td>-</td>
</tr>
</tbody>
</table>
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.
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THANK YOU
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

<table>
<thead>
<tr>
<th>Descriptive analysis</th>
<th>Prevalence of self-employment</th>
<th>Sociodemographic</th>
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<tr>
<td></td>
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<td>Work characteristics</td>
</tr>
<tr>
<td>Annual injury episode rate/100 FTE worker</td>
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<td>Class of workers</td>
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<td></td>
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**Work-associated annual rate of injury episodes per 100 full-time equivalents (FTE):**

\[
\frac{\text{Number of annual injury-episode} \times 200,000}{\text{Number of hours worked by the AgFF worker groups}}
\]
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:

- Sociodemographic
- Work characteristics.

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 $p = 0.10$)
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<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>Female</td>
<td>0.50 (0.16, 1.53)</td>
<td>0.52 (0.16, 1.77)</td>
</tr>
<tr>
<td>Age groups (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-39 years</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>40-49 years</td>
<td>1.46 (0.67, 3.17)</td>
<td>1.29 (0.54, 3.10)</td>
</tr>
<tr>
<td>50-59 years</td>
<td>0.72 (0.23, 2.22)</td>
<td>0.78 (0.26, 2.36)</td>
</tr>
<tr>
<td>&gt;60 years</td>
<td>1.04 (0.33, 3.22)</td>
<td>1.02 (0.25, 4.08)</td>
</tr>
<tr>
<td>Educational attainment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some college or higher</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>0-12th grade (No diploma)</td>
<td>0.77 (0.29, 2.05)</td>
<td>0.80 (0.30, 2.14)</td>
</tr>
<tr>
<td>High school grad or GED</td>
<td>1.20 (0.52, 2.77)</td>
<td>1.25 (0.55, 2.87)</td>
</tr>
<tr>
<td>Current/longest job tenure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-4 years</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>5-9 years</td>
<td>1.02 (0.32, 3.20)</td>
<td>0.92 (0.29, 2.98)</td>
</tr>
<tr>
<td>&gt;10 years</td>
<td>0.87 (0.40, 1.90)</td>
<td>0.79 (0.35, 1.79)</td>
</tr>
<tr>
<td>Hours worked past week</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;35 hours</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>35-49 hours</td>
<td>0.74 (0.28, 1.93)</td>
<td>0.68 (0.24, 1.94)</td>
</tr>
<tr>
<td>&gt;50 hours</td>
<td>0.88 (0.35, 2.20)</td>
<td>0.74 (0.25, 2.16)</td>
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Bibliography


