Factors that increase the frequency of stressed, crippled, and dead pigs at a commercial abattoir

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Introduction

- More recent emphasis being placed on reducing pig losses during transport
- Decreasing the number of mortalities and non-ambulatory animals can increase profit
- In this dataset, significant emphasis has been placed on minimizing transport losses
  - Comparatively below average transport losses
- WHY do transport losses still occur?

Objectives

- Determine the effects of season, trailer attributes, personnel, and management on pig defects
- Ultimately, reduce the number of defects

Data description

- Retrospective study
- Number of loads = 11,451
- Number of pigs = 1,906,429
- Number of fatigued, injured, and dead pigs were counted on arrival at the plant and in the pen
- For each trailer load, weather data was collected at the plant
- The number of defects were divided by the total number of pigs per load to equal % basis.

Variables collected

- Season
  - time of year, week
- Personnel:
  - load crew, receiving crew, trailer driver
- Pig effects:
  - load time, average live weight, number of pigs per trailer/sq. ft., rest time before harvest
  - DENSITY = average live weight x number of pigs / meters squared trailer space

Variables collected

- Environmental effects:
  - temperature, relative humidity, dew point, barometric pressure, wind speed, wind direction
  - (HOBO weather station, Onset Computer Corporation, Bourne, MA)
  - THI (NOAA, 1976) = Temperature & Relative humidity
  - Weather data were collected every 15 minutes
  - Each trailer was assigned the closest weather data time logged
Pig Classifications

- **Fatigued** –
  - Non-ambulatory pigs
  - No visual signs of injury
  - Often exhibited open-mouthed breathing, blotchy red skin, and shaking

- **Injured** –
  - Non-ambulatory pigs
  - Obvious injury that prevents normal movement

- **Dead**

Statistical Methodology

- Statistical analysis was performed using PROC GLIMMIX of SAS (SAS Institute, Inc., Cary, NC)
- Link function was used to back-transform means
- Attempt to remove confounding variables e.g. distance and farm
- Treatment means refer to the geometric mean of the population ~ close to median

Model Parameters

<table>
<thead>
<tr>
<th>Fixed Effects</th>
<th>Covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week</td>
<td>Load time per pig (min/pig)</td>
</tr>
<tr>
<td>Pull</td>
<td>Hours of rest before harvest (hrs)</td>
</tr>
<tr>
<td>Farm</td>
<td>Temperature-humidity index (temperature (°C), relative humidity (%))</td>
</tr>
<tr>
<td>Load type – Split or Normal</td>
<td>Density of trailer (kg/m²)</td>
</tr>
<tr>
<td>Load crew</td>
<td>Wind direction</td>
</tr>
<tr>
<td>Driver of trailer</td>
<td>Wind gust (m/s)</td>
</tr>
<tr>
<td>Trailer</td>
<td>Wind speed (m/s)</td>
</tr>
<tr>
<td>Receiving Crew</td>
<td></td>
</tr>
<tr>
<td>Wind direction</td>
<td></td>
</tr>
<tr>
<td>Wind gust (m/s)</td>
<td></td>
</tr>
<tr>
<td>Wind speed (m/s)</td>
<td></td>
</tr>
</tbody>
</table>

Results

- **P < 0.0001 (F Value)**
  - Trailer Density (625.57)
  - Pull (116.36)
  - Rest time (38.14)
  - Load time per pig (23.80)
  - Load type (20.83)
  - Week (6.65)
  - Load Crew (7.63)
  - Farm (5.70)

- **P < 0.05 (F Value)**
  - THI (5.28)
  - THI quadratic (9.12)
  - Wind speed (4.34)
  - Wind direction (1.99)
  - Driver (1.37)

- **P > 0.05**
  - Trailer (P = 0.81) – was (P = 0.055) before adjusting for trailer space
  - Receiving Crew (P = 0.11)
  - Wait time at harvest facility (P = 0.24)

Defects (%) by load crew

- **0.20%**
Defects (%) by week of year

0.55% x 166 pigs/trailer = ~ 0.9 pig

Defects (%) by week of year (simple means)

Defects (%) by truck driver

0.82%
Realistic 0.40%

Trailer density - Pigs / 1000 marketed

Predicted defects (%) at different weights (lbs) and trailer density (ft²)

P < 0.0001

P < 0.0001
Defects (%) temperature-humidity index

THI = Temp (°C) – ((0.55 – (0.0055 x RH) x (Temp (°C) – 14.5)); NOAA (1976)

Conclusions

- Differences were found between load crews
  - Poorest load crew equaled 0.20% more defects per trailer load
- Differences between Truck Drivers
  - 0.82% difference
  - If best driver removed, difference equals 0.40% (few obs.)
- Differences were found between farms
  - Of the 37 farms, 0.63% diff between best/worst farm
  - If the best farm is removed (due to few observations, n=17), difference equals 0.53%
  - Problem farms may need additional training

Impact

- Large Integrator
  - 11,451 trailers
  - 166.5 pigs per trailer
  - 0.8% defects per trailer
  - = 15,917 defects per year
- Small pork operation, 0.8% defects
  - 50,000 pigs per year
  - = 400 pigs per year

Questions?

Photos courtesy of Dr. Matt Ritter, Elanco.