

*2019 Western Agriculture Safety and Health Conference
Cultivating Collaborations*



Analyses of Agricultural Injury Data from Administrative Databases

ERIKA SCOTT, PHD

NORTHEAST CENTER FOR OCCUPATIONAL HEALTH AND SAFETY

AGRICULTURE | FORESTRY | FISHING

Purpose, Uses, Users



- ▶ Create a passive surveillance system that uses existing administrative data
 - ▶ Pre-hospital Care Reports (PCR)
 - ▶ Hospital Data
- ▶ Develop a method to identify cases by taking advantage of free text
- ▶ Ideally system will employ machine learning to enhance speed and reduce cost
- ▶ Users include NEC, stakeholders, trainers, etc.

Case Definition



- ▶ TRAUMATIC INJURY is defined as energy transferred to an individual a) from an AFF source [e.g. bull, skidder, or gaff hook], b) while in an AFF location, or c) while doing an AFF activity, which is severe enough to require medical attention. Excluded are injury events that occur on an AFF site involving sources not associated with AFF activity at any time [e.g. skateboard or barbecue grill].

Funding Source



- ▶ Component of the NEC Center Grant, Extramural funding from NIOSH
- ▶ Approximately \$115,000 per year, 2016-2021



Surveillance Staff

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Katherine Franck, BA
Research Assistant



Liane Hirabayashi, MA
Sr. Research Coordinator



Paul Jenkins, PhD
Co-Investigator



Nicole Krupa, BS
Data Analyst



Erika Scott, PhD
Principal Investigator

Collaborators

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Stuart M. Shieber, PhD
Harvard University
James O. Welch, Jr. and
Virginia B. Welch Professor
of Computer Science

*Computer scientist whose
primary research area is
computational linguistics,
the study of natural
language from the
standpoint of computer
science.*



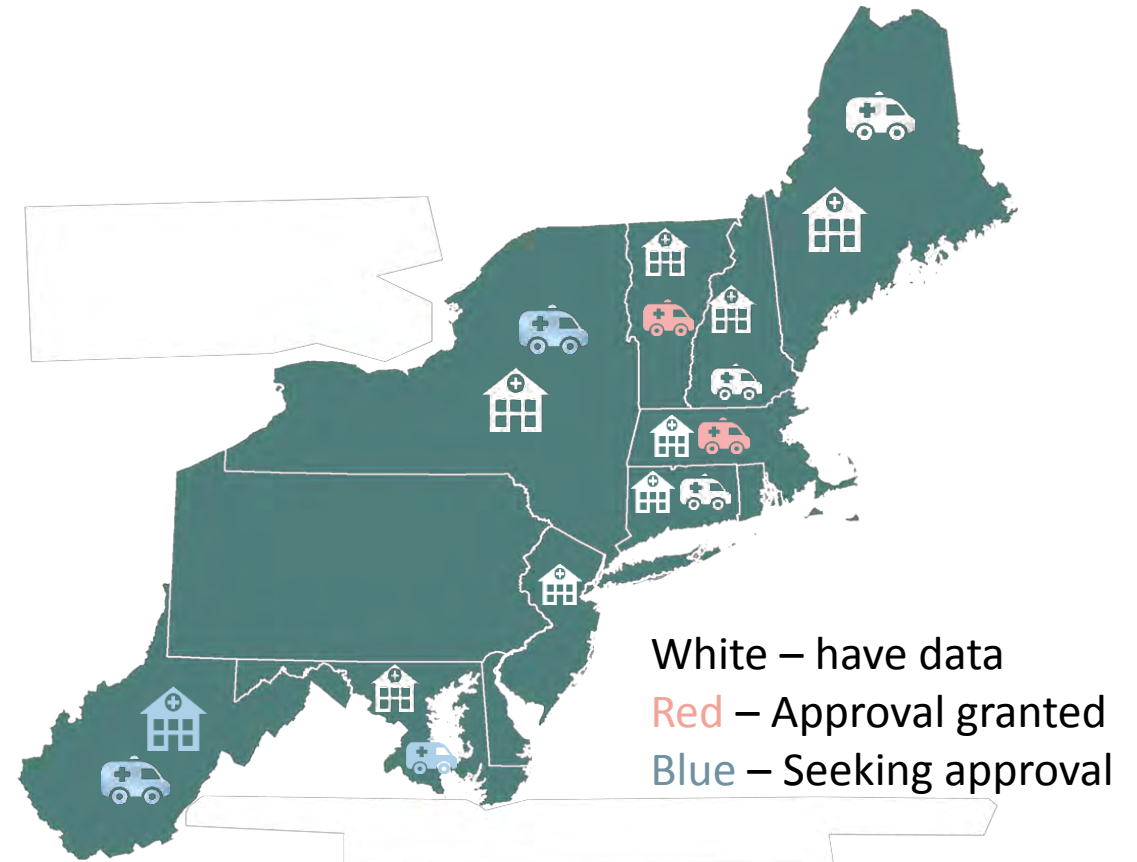
Alex Levenstein, BS
Python Coder

*Python, Web Scraping,
Process Automation
Descriptive and
Predictive Modelling,
SciPy, Pandas, NLTK,
SciKit Learn, ipython
Notebook, StatsModels*

Population Under Surveillance

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- The Agriculture, Forestry, Fishing and Hunting sector comprises establishments primarily engaged in growing crops, raising animals, harvesting timber, and harvesting fish and other animals from a farm, ranch, or their natural habitats.



Time Period



- ▶ Data
 - ▶ ePCR data 2008 →
 - ▶ Hospital data 2008 →
- ▶ 2006-2011
 - ▶ Explored PCR (paper) as a source for ag injury in NY
- ▶ 2011-2016
 - ▶ Explored ePCRs for ag/logging in NE

Data Acquisition



- ▶ Individual data use agreements with each state's entity
 - ▶ Bureau of Emergency Medical Services
 - ▶ Department of Health
- ▶ Institutional Review Board Review
 - ▶ Mary Imogene Bassett Hospital
 - ▶ Each Entity/State

Data Collection

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- ▶ Once access is approved, data transferred through online secure file transfer or by password protected CD
- ▶ Data read into SAS 9.3 (Cary, NC)
- ▶ Coding team identifies and codes cases
 - ▶ Coder A & B (dual coding)
 - ▶ Lead Coder/Team Review

Refining our Keyword Search

Space[keyword]space

- ▶ Python and the Natural Language Toolkit (NLTK)
 - ▶ Stemming
 - ▶ Lemmatization
- ▶ Bringing in expertise in Computational Linguistics
 - ▶ Computer scientist
 - ▶ Python contract coder



Word	Stem
ANIMAL	anim
ARCH	arch
BARN	barn
BLADE	blade
BULL	bull
CABLE	cabl
CART	cart
CHAIN	chain
CHICKEN	chicken
COW	cow
FARM	farm
FEED	feed
FENCE	fenc
HAY	hay
HITCH	hitch
HORSE	hors
LIMBING	limb
LOG	log
PEN	pen
PIG	pig
PLOW	plow
PTO	pto
RAM	ram
STALL	stall
TRACTOR	tractor
TREE	tree
WAGON	wagon
WINCH	winch
WOODS	wood
HOG	hog
PENS	pen

Classification Schemes

- ▶ Case Determination
- ▶ Farm and Agricultural Injury Classification Code (FAIC)
- ▶ Occupational Injury and Illness Classification System (OIICS)
 - ▶ Crosswalk between ICD10CM codes and OIICS for AFF injuries

The Whole Enchilada: Completed OIICS-Coded Records

Completed OIICS-Coded Records

RBDB ID: [REDACTED] DEDB ID: [REDACTED] AFF CD: I: true case, Agriculture

OIICS Codes

Nature of Injury: 111 - Fractures
Body Part Injured: 513 - Lower leg(s)
Primary Source of Injury: 3222 - Skid steer loaders, mini loaders
Secondary Source of Injury: 0 - Blank
Injury Event/Exposure: 2731 - Jack-knifed or overturned, nonroadway

Geographic Information from PCR

PCR ID: [REDACTED] Agency ID: [REDACTED] Date: [REDACTED] Zip Code: [REDACTED]
State: [REDACTED] County: [REDACTED] Town: [REDACTED]
Location Type: Farm Destination Zip Code: [REDACTED]

Victim Information from PCR

Age: 63 Gender: Male Ethnicity: Not Applicable
Race: Not Applicable Mechanism of Injury: Other Injury
Primary Method of Payment: Workers Compensation Work-Related? Yes

Additional Codes

Intentionality: 1 - Unintentional injury Severity: 1 - Non-fatal
FAIC Code: 1 - Farm Production Work
NORA Location: 9 - Other Farmstead Area, Unspecified
If Other, Specify: [REDACTED]
Activity at Time of Incident: 14 - Unknown
If Other, Specify: [REDACTED]

Narrative from PCR

Example of Farming Free Text Narrative

...A 39 Y/O MALE C/C LEFT FOOT INJURY. **PT FOOT TRAPPED IN A CORN CHOPPER.** ARRIVED ON SCENE PT SELF EXTRICATE FOOT. FOUND PT SITTING ON THE CORN CHOPPER. PT STATED - C/P - SOB, - DIZZY - NAUSEA, - VOMIT, - H/A, S- LEFT FOOT INJURY, A- SEE ABOVE, M- SEE ABOVE, L- BREAKFAST, E- **WAS OUT SIDE CHOPPING CORN, WENT TO KICK A PIECE OF WOOD OUT OF THE WAY AND THE CORN CHOPPER GRABBED HIS FOOT AND PULLED IT IN,** ||O- - DCAPBTLs ON ALL EXT WITH THE EXCEPTION OF SWELLING AND DEFORMITY TO THE LEFT FOOT, ANKLE STILL INTACT...



Example of Logging Free Text Narrative

Dispatched for a **pt stuck and trapped by a falling tree**. Arrived to find **pt freed by co-workers**. Pt stated a dead tree (poss 16' diameter), 100 ft away, fell unexpectedly striking him from the L shoulder down the left side. Later he added there was a head strike but no pain or bleeding resulted. He described initial near-LOC. Alert by our arrival, he was cold, having sat in the snow for 20 min. (?) with CC: extreme L shoulder 10/10 and L arm pain 10/10--self-splinted along his L side, hip and leg pain... |Pt was immobilized with board and collar, covered in blankets and **extricated from the hill on a tracked 4-wheeler 'pickup' bed**, with rescuers holding and walking alongside to minimize the pt's movement...



E916 - Struck by falling object

81240 - Fx lower humerus NOS-cl

8054 - Fx lumbar vertebra-close

80709 - Fx mult ribs NOS-closed

86504 - Spleen disruption-closed

9110 - Abrasion trunk

8082 - Fracture of pubis-closed

80841 - Fracture of ilium-closed

81002 - Fx clavicle shaft-closed

86121 - Lung contusion-closed

Example of Fishing Free Text Narrative

...Report from referring medic: 38 yo male who was out **on a lobster boat using a fishing knife**. His had **slipped on the handle running down the blade cutting his index, middle, and ring finger on the right hand**. Reported by patient to be **to the bone**, no amputation of any parts. Bleeding controlled with difficulty using bandages, pressure, and elevation. Patient was met at town dock by EMS who added bandages, started an IV, and gave 100mcg of fentanyl. Patient has no medical history and no allergies...



8832 - Open wnd finger w tendon	E0000 - Civilian activity-income
E8498 - Accident in place NEC	3051 - Tobacco use disorder
8830 - Open wound of finger	E9203 - Knife/sword/dagger acc

Data Preparation

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State Incident ID	[KW]	[KW]	[KWetc.]	[Stem]	[Stem]	[Stemetc.]	Special Case Search	CD	Industry	OIICS source 1	OIICS source 2	OIICS Type of Event
XX 123456	0 or 1*	0 or 1*	0 or 1*	0 or 1*	0 or 1*	0 or 1*	0,1,2,3,4,5	0, 1, 2, or 3†	Ag,Fi,Fo			
XY 123456	0 or 1*	0 or 1*	0 or 1*	0 or 1*	0 or 1*	0 or 1*	0,1,2,3,4,5	0, 1, 2, or 3†	Ag,Fi,Fo			

* Where 0 = not present, 1 = 1 not present

† Where 0 = not a case, 1 = 1 true traumatic/acute, true AFF, 2 = true traumatic/acute, suspected AFF, 3 = suspected traumatic/acute, true AFF

Special Case Search

0 - keyword

1 – Farm box only

2 – E-code only

3 – Farm Box and E-code

4 – has one of the –ing keywords (bucking, raking, planting) only

5 – has the embedded wedge word only (would not include any unembedded wedge records)

Data Analyses



- ▶ Completed coding a 'gold standard' dataset (approximately 50K records)
- ▶ Using that dataset for building/training our algorithms
 - ▶ Bayesian
 - ▶ Additional machine learning algorithms
- ▶ Testing fit on more recent data, as well



Challenges of Using Free Text

- ▶ Identifying all cases of interest
- ▶ Spelling errors
- ▶ Spacing issues
- ▶ Semantics
- ▶ Time consuming
 - ▶ To establish the gold standard dataset

Key Findings

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- ▶ Identification of previously unfound cases (about 2/3 of AFF cases from PCR's)
- ▶ Occupational information
- ▶ Pre and post injury details
- ▶ Not limited by existing variables
- ▶ Data from free text can put hospital data in context
- ▶ Not limited to occupational injury
 - ▶ Opioids

Future Plans



- ▶ Refining algorithm to ID AFF cases in PCR data
- ▶ Testing if free text search algorithm can be optimized for other health data, e.g. EMR free text
- ▶ Adapting algorithm for regional data analyses
- ▶ Can we not only ID cases, but assign OIICS codes?

Reports on Findings

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- ▶ Scott E, Hirabayashi L, Krupa N, Jenkins P. Emergency Medical Services Pre-Hospital Care Reports as a Data Source for Logging Injury Surveillance. *J Agromedicine*. 2019 Apr;24(2):133-137. doi: 10.1080/1059924X.2019.1572558. Epub 2019 Feb 11.
- ▶ Scott E, Bell E, Krupa N, Hirabayashi L, Jenkins P. Data processing and case identification in an agricultural and logging morbidity surveillance study: Trends over time. *Am J Ind Med*. 2017 Sep;60(9):811-820. doi: 10.1002/ajim.22751.

Contact Information



Erika Scott, PhD

Northeast Center for Occupational Health and Safety
in Agriculture, Forestry, Fishing

Mary Imogene Bassett Hospital | Cooperstown, NY

Erika.scott@bassett.org

(800) 343-7527