Agromedicine Education and the Future Training of Rural Clinicians

The Southwest Center for Agricultural Health, Injury Prevention and Education

Vanessa Casanova, PhD, MS
Alan Cook, MD, MS, FACS
Melissa Fleegler, MD, FACEP
Jeffrey Levin, MD, DrPH, MPH

UTHealth
The University of Texas Health Science Center at Tyler

Objectives

1. Identify ways in which the Southwest Center for Agricultural Health, Injury Prevention, and Education (SW Ag Center) engages learners at multiple stages of their professional development in learning together;
2. Understand ways in which the SW Ag Center supports the challenging needs of residency programs and medical students in a rural context;
3. Recognize the benefit of Agromedicine and occupational/environmental health education for rural practitioners.

UTHealth
The University of Texas
Health Science Center at Tyler

“It needs to be recognized that work related to agriculture carries significant risk for injury and illness, and it is only relatively recently that these matters have been addressed in any significant way.”

Issues of Agricultural Safety and Health
Arthur L. Frank, Robert McKnight, Steven R. Kirkhorn, Paul Gunderson
Annual Review of Public Health 2004 25:1, 225-245

UTHealth
The University of Texas
Health Science Center at Tyler

National Institute for Occupational Safety and Health (NIOSH)

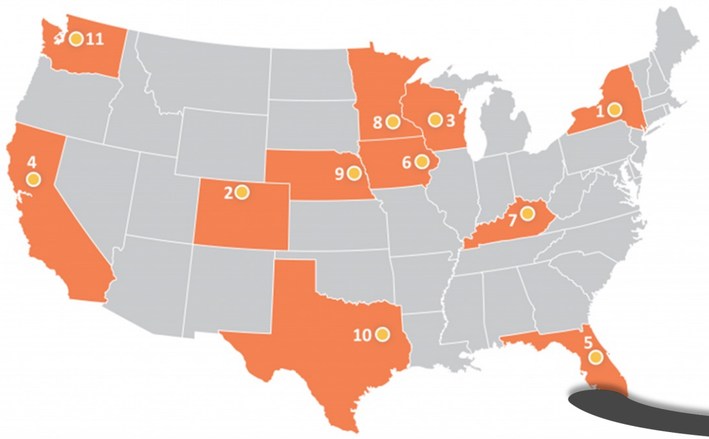
- 1990, NIOSH developed an extensive agricultural safety and health program to address high risks of injuries and illnesses experienced by workers and families in agriculture;
- NIOSH supports extramural research and prevention programs at university centers in 11 states;
- These programs conduct research on illnesses and injuries associated with agriculture, as well as pesticide exposure, pulmonary disease, musculoskeletal disorders, hearing loss, and stress.

UTHealth
The University of Texas
Health Science Center at Tyler

25 Years Strong

Southwest Center
FOR AGRICULTURAL HEALTH, INJURY PREVENTION, AND EDUCATION

NIOSH Centers for Agricultural Safety and Health



1. Bassett Healthcare
2. Colorado State University
3. National Farm Medicine Center
4. University of California, Davis
5. University of Florida, Gainesville
6. University of Iowa
7. University of Kentucky
8. University of Minnesota
9. University of Nebraska Medical Center
10. University of Texas Health Science Center, Tyler
11. University of Washington

DEPARTMENT OF HEALTH & HUMAN SERVICES · USA
CDC

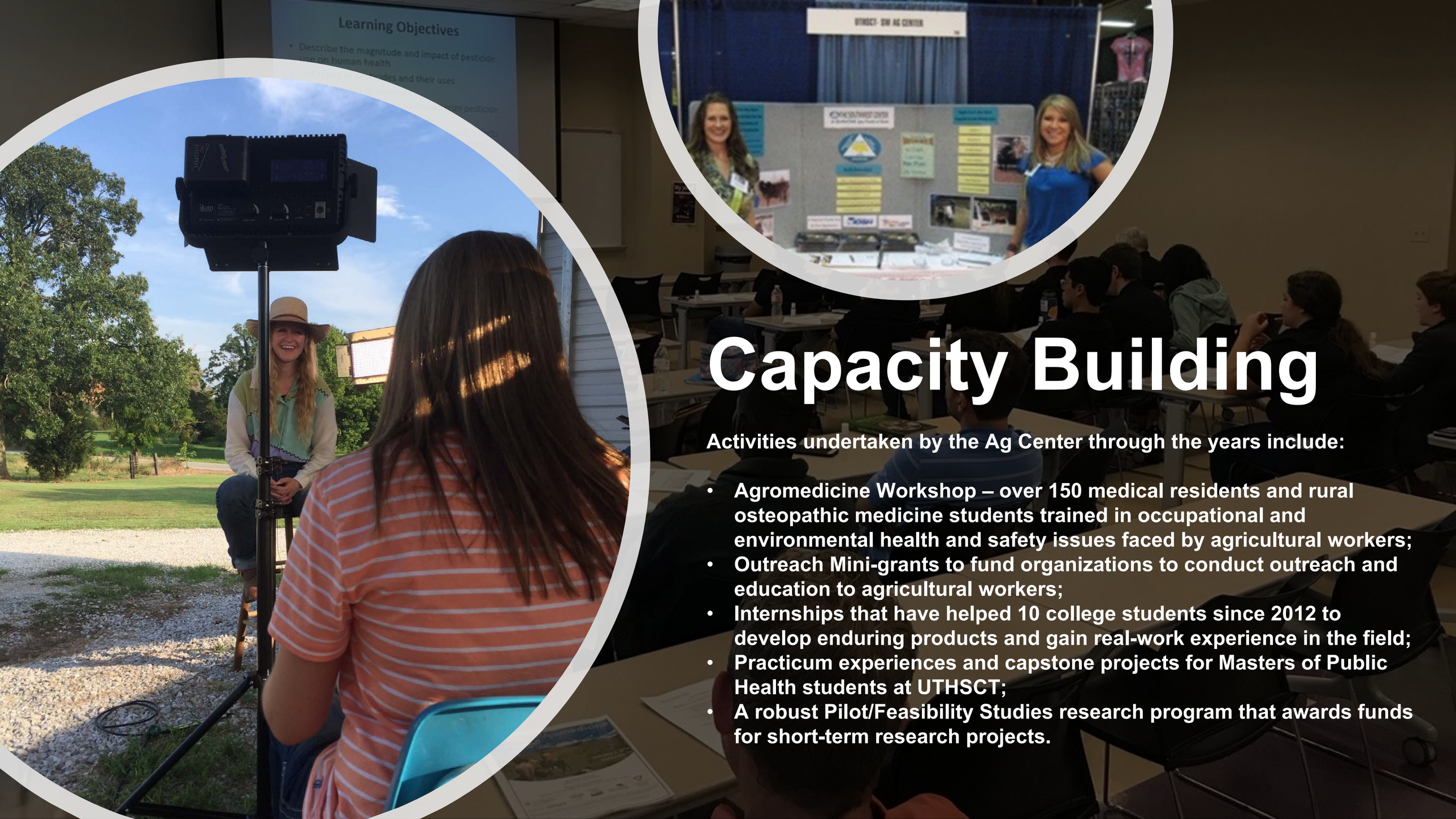
National Institute for Occupational Safety and Health
NIOSH

CDC/NIOSH Cooperative Agreement U54OH007541

Southwest Center for Agricultural Health, Injury Prevention, and Education

- Serves U.S. Public Health Region 6;
- Mission is to improve the safety and health of agricultural, forestry and commercial fishing workers;
- Mission is accomplished through an integrated program of research, intervention, translation, surveillance and outreach activities that engage and leverage a network of strategic partners;
- Supports the interests of a diverse worker population and a wide range of agricultural production in the region;
- Brings together an experienced leadership team of staff, Internal and External Advisors in an organizational structure that facilitates a cohesive, coordinated and synergistic operation.

UTHealth
The University of Texas
Health Science Center at Tyler



Capacity Building

Activities undertaken by the Ag Center through the years include:

- **Agromedicine Workshop – over 150 medical residents and rural osteopathic medicine students trained in occupational and environmental health and safety issues faced by agricultural workers;**
- **Outreach Mini-grants to fund organizations to conduct outreach and education to agricultural workers;**
- **Internships that have helped 10 college students since 2012 to develop enduring products and gain real-work experience in the field;**
- **Practicum experiences and capstone projects for Masters of Public Health students at UTHSCT;**
- **A robust Pilot/Feasibility Studies research program that awards funds for short-term research projects.**

Agricultural Injury Surveillance Using a Regional Trauma Registry

Alan Cook, MD, MS, FACS;
Rebecca Swindall, BS;
Yagnesh Desai, MD;
Vanessa Casanova, PhD;
Richard Fry, PhD, MSc,
Melissa Cloonan, MD;
Frederick Rogers, MD, MS, FACS;
Michael Horst, PhD, MPHS, MS;
Madison Morgan, BS;
Scott Norwood, MD, FACS, FCCM

This study was funded by the Southwest Center for Agricultural Health, Injury Prevention, and Education through Cooperative Agreement # U54-OH007541 from CDC/NIOSH.

BACKGROUND

- Agriculture-related occupational injury is a serious public health matter

- United States Bureau of Labor Statistics:
  - 2013: 11.7 cases per 100 full-time workers
    - 360 fatalities
  - 2018: 12.1 nonfatal cases per 100 full-time workers
    - 411 fatalities

BACKGROUND, cont’d

- Surveillance is the best tool for reducing injury among farmworkers but use is lacking

- RAND Corporation and the CDC and National Occupational Research Agenda (NORA)
  - Advocated using existing data sources for injury surveillance in agriculture

Regional Trauma Registry

- Verified trauma centers are mandated to maintain current registries of all injured patients arriving for treatment

- Required data elements
  - Mechanism and setting of the injury
  - All patient injuries
  - Hospital care rendered
  - Patient outcomes

- Optional data points: e.g., geographic location of injury (Zip Code)

Study Aims

- NORA for Agriculture, Forestry, and Fishing (AgFF) Objective AG-03:
  - Use the Northeast Texas Regional Trauma Registry (NTRTR) as a surveillance tool
  - Agricultural injuries requiring trauma center evaluation and treatment by

- Apply geospatial analysis to identify spatial associations with trauma incidents.

Methods

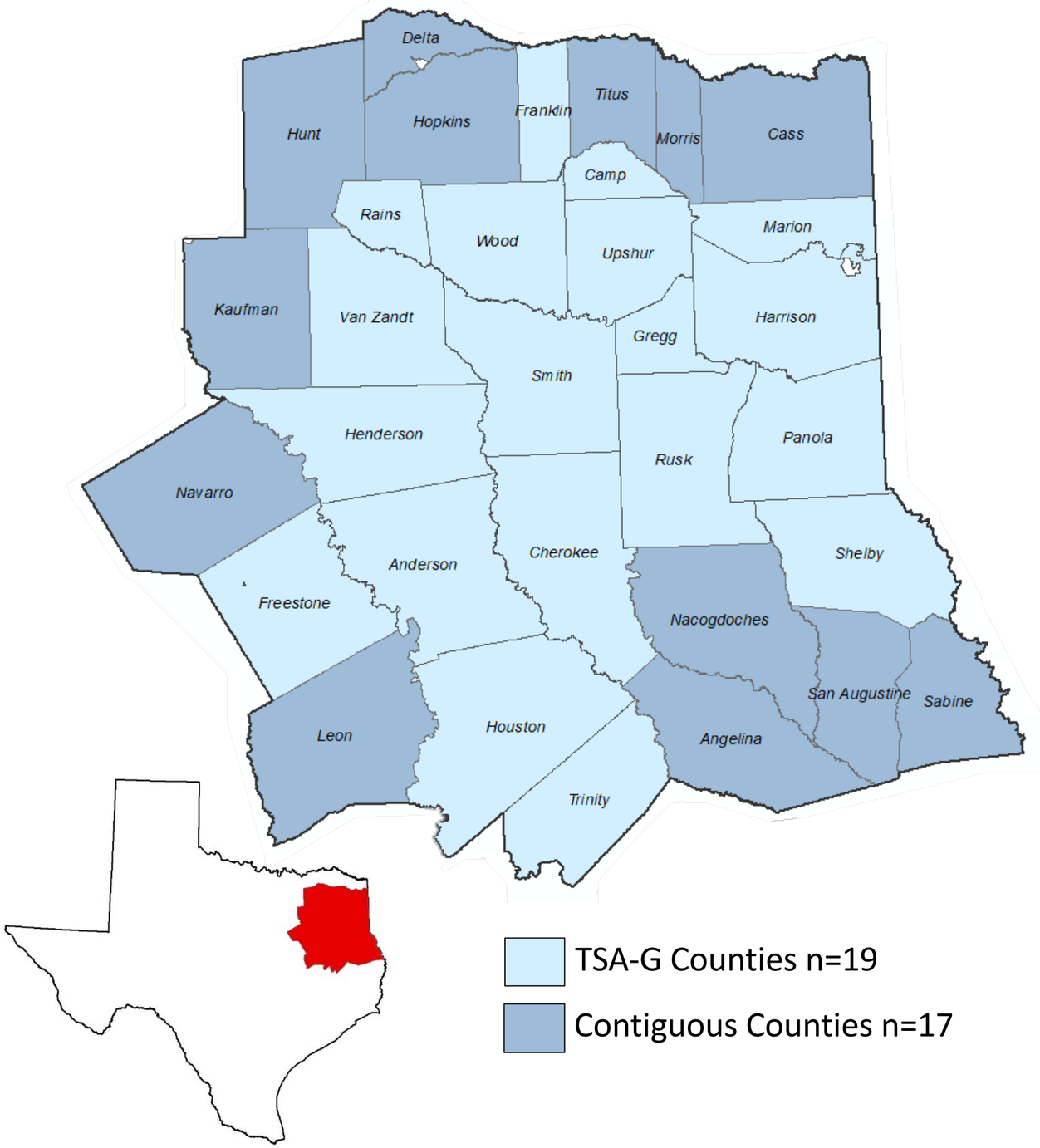
- Approved by the Institutional Review Board of UT Health East Texas
  - Case number 2020-025
- The NTRTR queried for agricultural injury for 2016-2017
- Case definition
  - ICD-10-CM External Causes of Morbidity codes, including Supplemental Factors Related to Causes of Morbidity (Y90-Y99)
    - Agricultural settings (e.g. farm, land under cultivation, outbuildings, Y92.79)
  - Free text fields in registry
- Location determined by Zip Code where incident occurred

Methods

- Patient-level data
  - Age
  - Sex
  - Race/Ethnicity
  - Comorbid chronic diseases
  - Mechanism of injury
    - Location
    - Date
  - Injuries
  - Intrahospital transport (Y/N)
    - Mode of transport
    - Sending hospital
  - Hospital length of stay
    - Incl. ICU length of stay
  - Hospital Charges
  - Lived/Died
  - Injury Severity
    - Trauma Mortality Prediction Model
    - Injury Severity Score

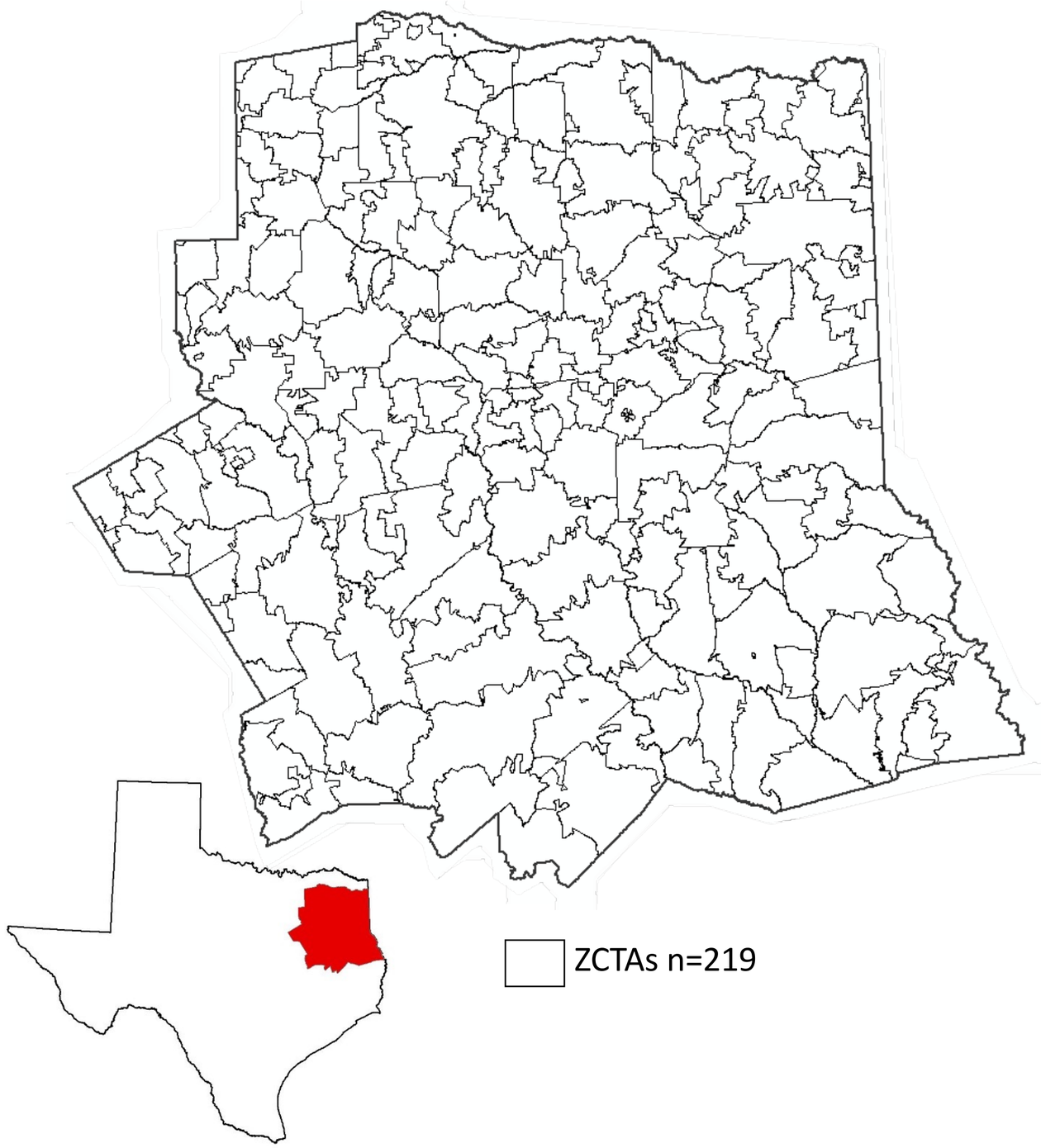
Methods

- Geographic Data
  - 32 contiguous counties
  - 23,581 square miles



Methods

- Geographic Data
  - 32 contiguous counties
  - 23,581 square miles
  - 219 Zip Code Tract Areas (ZCTAs)



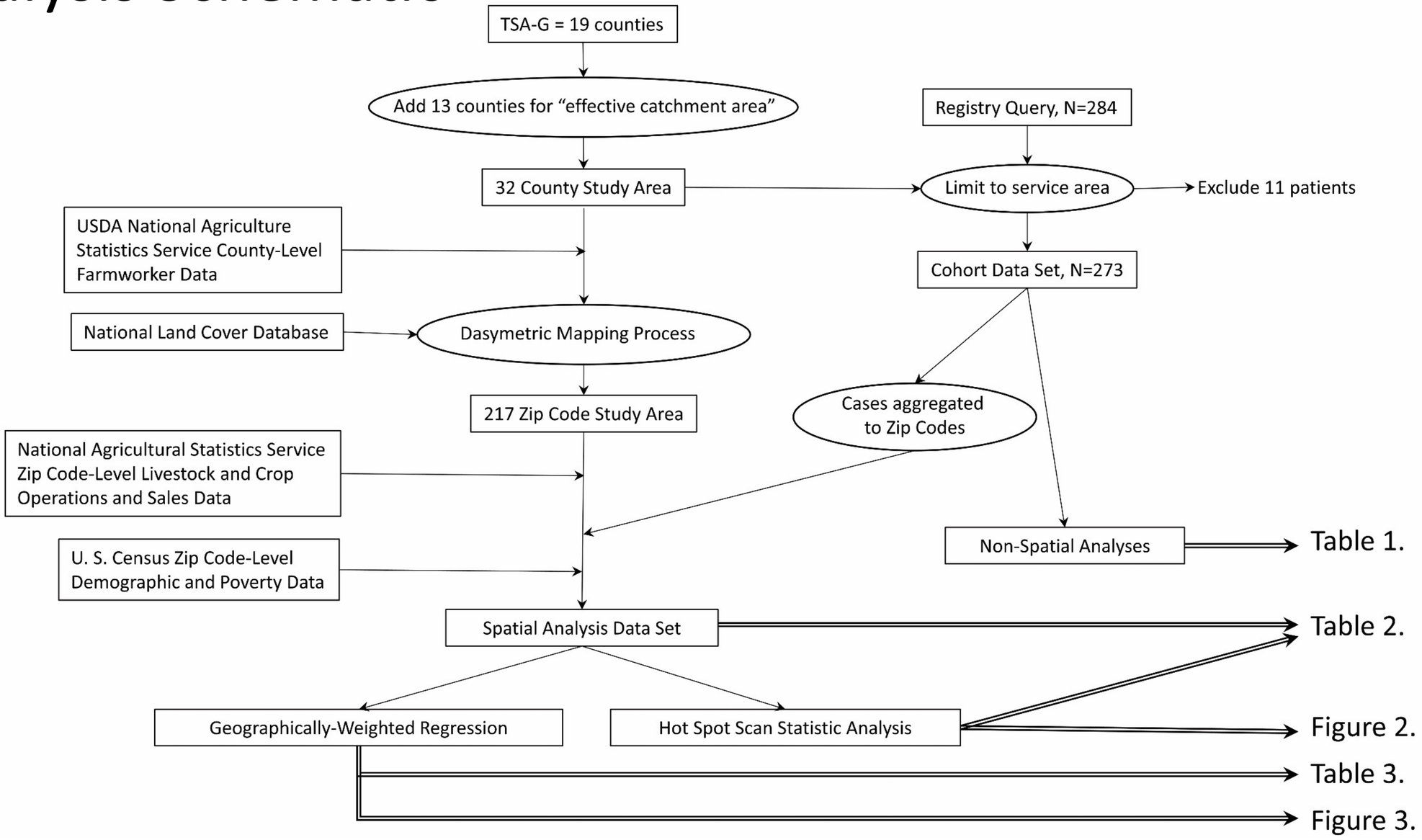
Ag Data

- USDA National Agricultural Statistics Service Quick Stats
  - Economic characteristics
    - Farm acreage
    - Livestock and crop production sales
  - Population-at-risk: Farmworkers
    - Migrant
    - Unpaid
    - Hired
    - Contract

Census Data

- Total population
- Percent rural population
- Percent population living in poverty
- Demographics
  - Age groups
    - Percent < 20 years-old
    - Percent 20 – 64
    - Percent 65 and older
  - Race/Ethnicity

Analysis Schematic



Spatial Analysis

- Exploratory Spatial Data Analysis for Spatial Autocorrelation
  - Global: Moran's Index
  - Local: Anselin's local indicators of spatial association
- Hot spot analysis
  - Kulldorff's spatial scan statistic for discrete Poisson probability model
- Multivariable spatial regression model
  - Multiscale geographically weighted regression
    - Fotheringham, et al.

Non-Spatial Analysis

- Contingency table of ZCTA characteristics x trauma event status (y/n)
- Rank sum test
- Kruskal-Wallis
- Chi-square
- Software
  - Stata MP, 16.1 (College Station, TX)
  - ArcMap, 10.8 (Redlands, CA)
  - GeoDa, 1.14.0 (Chicago, IL)
  - SaTScan, 9.6 (Boston, MA)
  - MGWR, 2.2 (Tempe, AZ)

Results

- 273 patients
  - Predominantly
    - Male

Characteristics of 273 Agricultural Trauma Patients	
Sex, n (%)	
Male	200 (73.5)
Female	72 (26.5)
Race/Ethnicity, n (%)	
White	218 (79.9)
Hispanic/Latino, Any Race	29 (10.6)
Black	20 (7.3)
Asian	1 (0.4)
Other/Unknown	5 (1.8)
Age, years, mean (sd)	47.5 (21.9)
min, max	2, 90
< 5	9 (3.3)
5 – 14	11 (4.0)
15 – 19	20 (7.4)
20 – 34	42 (15.4)
35 – 59	98 (36.0)
60 – 74	65 (23.9)
≥75	27 (9.9)
Mechanism of Injury, n (%)	
Animal Related	142 (52.0)
Farm Machinery Related	57 (20.9)
Fall	38 (13.9)
Motor Vehicle Crash, Incl. ATV	17 (6.2)
Struck By or Struck Against	15 (5.5)
Other Mechanism	4 (1.5)
Insurance Status, n (%)	
Private/Commercial	102 (37.4)
Medicaid/Medicare/Government	92 (33.7)
Uninsured	71 (26.0)
Other/Unknown	8 (2.9)
Died	6 (2.2)

Results

- 273 patients
  - Predominantly
    - Male
    - White

Characteristics of 273 Agricultural Trauma Patients	
Sex, n (%)	
Male	200 (73.5)
Female	72 (26.5)
Race/Ethnicity, n (%)	
White	218 (79.9)
Hispanic/Latino, Any Race	29 (10.6)
Black	20 (7.3)
Asian	1 (0.4)
Other/Unknown	5 (1.8)
Age, years, mean (sd)	47.5 (21.9)
min, max	2, 90
< 5	9 (3.3)
5 – 14	11 (4.0)
15 – 19	20 (7.4)
20 – 34	42 (15.4)
35 – 59	98 (36.0)
60 – 74	65 (23.9)
≥75	27 (9.9)
Mechanism of Injury, n (%)	
Animal Related	142 (52.0)
Farm Machinery Related	57 (20.9)
Fall	38 (13.9)
Motor Vehicle Crash, Incl. ATV	17 (6.2)
Struck By or Struck Against	15 (5.5)
Other Mechanism	4 (1.5)
Insurance Status, n (%)	
Private/Commercial	102 (37.4)
Medicaid/Medicare/Government	92 (33.7)
Uninsured	71 (26.0)
Other/Unknown	8 (2.9)
Died	6 (2.2)

Results

- 273 patients
  - Predominantly
    - Male
    - White
    - 35-74 years-old

Characteristics of 273 Agricultural Trauma Patients	
Sex, n (%)	
Male	200 (73.5)
Female	72 (26.5)
Race/Ethnicity, n (%)	
White	218 (79.9)
Hispanic/Latino, Any Race	29 (10.6)
Black	20 (7.3)
Asian	1 (0.4)
Other/Unknown	5 (1.8)
Age, years, mean (sd)	47.5 (21.9)
min, max	2, 90
< 5	9 (3.3)
5 – 14	11 (4.0)
15 – 19	20 (7.4)
20 – 34	42 (15.4)
35 – 59	98 (36.0)
60 – 74	65 (23.9)
≥75	27 (9.9)
Mechanism of Injury, n (%)	
Animal Related	142 (52.0)
Farm Machinery Related	57 (20.9)
Fall	38 (13.9)
Motor Vehicle Crash, Incl. ATV	17 (6.2)
Struck By or Struck Against	15 (5.5)
Other Mechanism	4 (1.5)
Insurance Status, n (%)	
Private/Commercial	102 (37.4)
Medicaid/Medicare/Government	92 (33.7)
Uninsured	71 (26.0)
Other/Unknown	8 (2.9)
Died	6 (2.2)

Results

- 273 patients
  - Predominantly
    - Male
    - White
    - 35-74 years-old
  - 26% Uninsured
  - 6 Deaths (2.2%)

Characteristics of 273 Agricultural Trauma Patients	
Sex, n (%)	
Male	200 (73.5)
Female	72 (26.5)
Race/Ethnicity, n (%)	
White	218 (79.9)
Hispanic/Latino, Any Race	29 (10.6)
Black	20 (7.3)
Asian	1 (0.4)
Other/Unknown	5 (1.8)
Age, years, mean (sd)	47.5 (21.9)
min, max	2, 90
< 5	9 (3.3)
5 – 14	11 (4.0)
15 – 19	20 (7.4)
20 – 34	42 (15.4)
35 – 59	98 (36.0)
60 – 74	65 (23.9)
≥75	27 (9.9)
Mechanism of Injury, n (%)	
Animal Related	142 (52.0)
Farm Machinery Related	57 (20.9)
Fall	38 (13.9)
Motor Vehicle Crash, Incl. ATV	17 (6.2)
Struck By or Struck Against	15 (5.5)
Other Mechanism	4 (1.5)
Insurance Status, n (%)	
Private/Commercial	102 (37.4)
Medicaid/Medicare/Government	92 (33.7)
Uninsured	71 (26.0)
Other/Unknown	8 (2.9)
Died	6 (2.2)

Results

- 273 patients
  - Predominantly
    - Male
    - White
    - 35-74 years-old
    - 26% Uninsured
    - 6 Deaths (2.2%)

- Mechanism of Injury
  - Animal Related

Characteristics of 273 Agricultural Trauma Patients	
Sex, n (%)	
Male	200 (73.5)
Female	72 (26.5)
Race/Ethnicity, n (%)	
White	218 (79.9)
Hispanic/Latino, Any Race	29 (10.6)
Black	20 (7.3)
Asian	1 (0.4)
Other/Unknown	5 (1.8)
Age, years, mean (sd)	47.5 (21.9)
min, max	2, 90
< 5	9 (3.3)
5 – 14	11 (4.0)
15 – 19	20 (7.4)
20 – 34	42 (15.4)
35 – 59	98 (36.0)
60 – 74	65 (23.9)
≥75	27 (9.9)
Mechanism of Injury, n (%)	
Animal Related	142 (52.0)
Farm Machinery Related	57 (20.9)
Fall	38 (13.9)
Motor Vehicle Crash, Incl. ATV	17 (6.2)
Struck By or Struck Against	15 (5.5)
Other Mechanism	4 (1.5)
Insurance Status, n (%)	
Private/Commercial	102 (37.4)
Medicaid/Medicare/Government	92 (33.7)
Uninsured	71 (26.0)
Other/Unknown	8 (2.9)
Died	6 (2.2)

Results

- Differences from pop’n
  - More males
  - More Whites
  - Older

Characteristics of 273 Agricultural Trauma Patients		Area Population, n=919,206
Sex, n (%)		
Male	200 (73.5)	456,843 (49.7)
Female	72 (26.5)	462,363 (50.3)
Race/Ethnicity, n (%)		
White	218 (79.9)	741,269 (70.9)
Hispanic/Latino, Any Race	29 (10.6)	142,961 (13.7)
Black	20 (7.3)	125,210 (12.0)
Asian	1 (0.4)	9,208 (0.9)
Other/Unknown	5 (1.8)	27,421 (3.0)
Age, years, mean (sd)	47.5 (21.9)	
min, max	2, 90	
< 5	9 (3.3)	57,502 (5.9)
5 – 14	11 (4.0)	180,555 (18.5)
15 – 19	20 (7.4)	62,021 (6.4)
20 – 34	42 (15.4)	171,861 (17.6)
35 – 59	98 (36.0)	286,113 (29.3)
60 – 74	65 (23.9)	148,413 (15.2)
≥75	27 (9.9)	70,243 (7.2)

Table 2. Comparison of 217 Zip Codes Tract Areas by trauma event status

	All ZCTAs	Events	No Events	
Number of ZCTAs[1]	217	94 (43.3)	123 (56.7)	--
Number of Farms[2]	32 (40)	39 (46)	26 (37)	†
Percent Livestock Operations	65.5 (8.7)	64.9 (6.7)	65.9 (10.6)	
Cumulative Farm Acreage[2, 3]	26.3 (36.7)	31.4 (35.6)	20.9 (32.0)	**
Production Sales[2, 4]				
Livestock	3.5 (5.7)	4.5 (5.7)	2.8 (5.0)	†
Crop	1.4 (2.1)	2.1 (2.2)	1.0 (1.9)	†
Total	5.2 (7.2)	6.6 (8.1)	3.8 (7.2)	†
Farm Labor Work Force[2]				
% Migrant	0.4 (0.9)	0.6 (0.7)	0.3 (0.8)	**
% Unpaid	65.0 (10.4)	64.2 (5.4)	65.2 (13.1)	
% Contract	6.8 (8.0)	5.5 (7.3)	7.8 (8.6)	
% Hired	26.4 (7.1)	27.8 (5.5)	26.0 (7.7)	†
Total	286 (395)	360.5 (471)	237 (359)	†
Workers per Acre	0.010 (0.007)	0.012 (0.014)	0.010 (0.007)	*
Total Population[2, 5]	3.8 (8.4)	6.6 (9.9)	2.7 (5.7)	†
Percent Rural Population[2]	100 (42.6)	91.7 (49.2)	100 (12.8)	**
Percent Population in Poverty[2]	16.7 (8.2)	16.3 (7.3)	17.1 (8.9)	
Population Age Groups, Years[2]				
% Less than 20	25.8 (7.0)	25.4 (5.8)	26.4 (8.2)	
20 to 64	55.3 (5.8)	54.6 (5.4)	56.0 (6.6)	
65 and older	18.1 (7.5)	18.6 (7.8)	17.7 (7.7)	
Race/Ethnicity[2]				
% White	84.5 (14.9)	83.2 (14.8)	85.4 (16.2)	
% Black	9.3 (14.2)	12.0 (13.0)	7.9 (14.7)	
% American Indian	0.2 (0.7)	0.3 (0.7)	0.1 (0.6)	*
% Asian	0.07 (0.6)	0.2 (0.9)	0 (0.4)	**
% Other Race	1.0 (3.0)	1.1 (2.1)	0.9 (3.9)	
% Hispanic/Latinx	10.3 (13.5)	11.9 (10.5)	9.3 (15.9)	

1. n (%)
2. Median (IQR)
3. 1,000 Acres
4. In $1 Million units
5. x 1,000 Population

* p <0.05
** p <0.01
† p<0.001

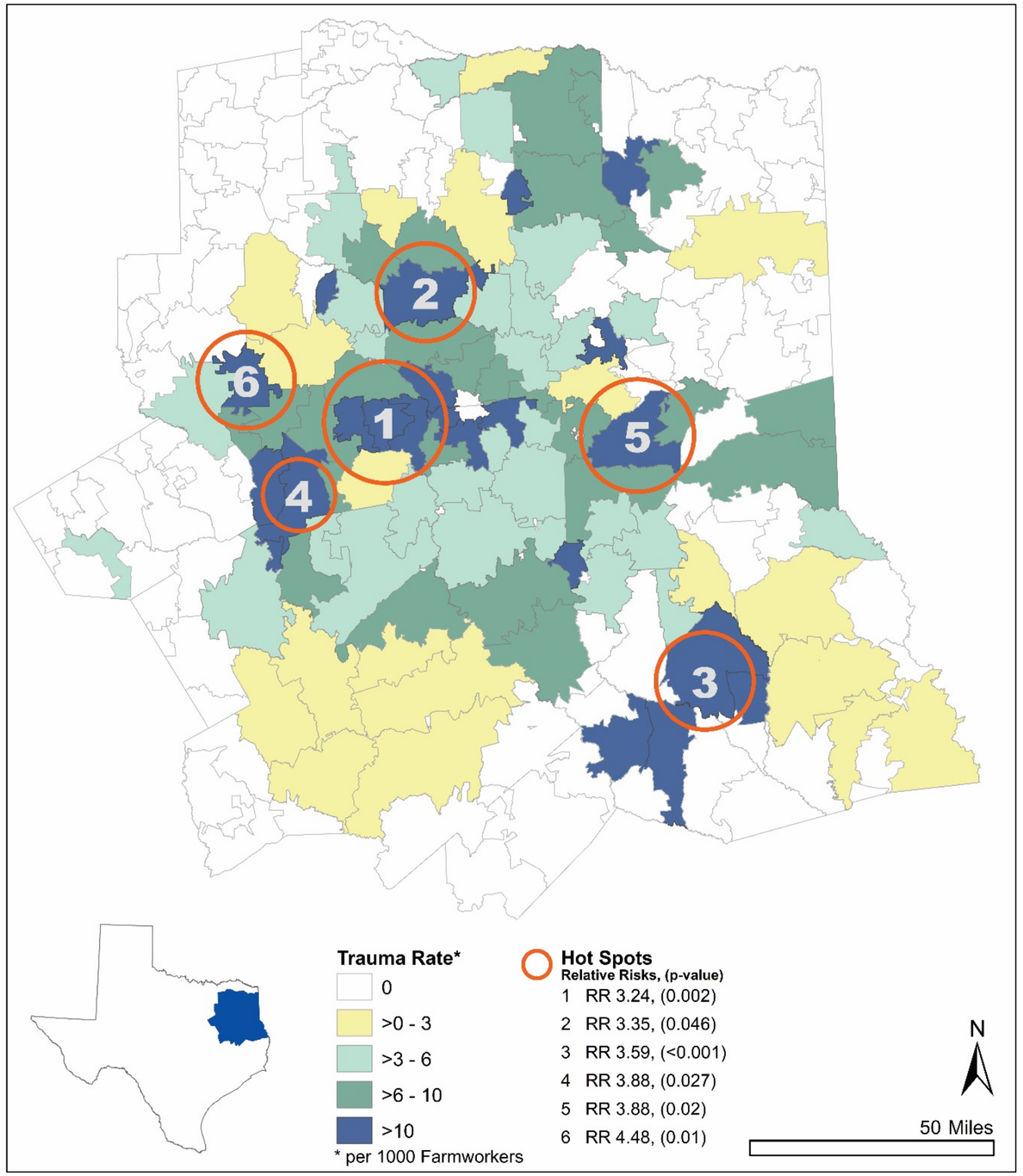
Table 2. Comparison of 217 Zip Codes Tract Areas by trauma hot spot status

	(+) Hot Spot	(-) Hot Spot	
Number of ZCTAs[1]	46 (21.2)	171 (78.8)	--
Number of Farms[2]	40.5 (54)	31 (39)	
Percent Livestock Operations	62.5 (7.5)	65.7 (8.3)	
Cumulative Farm Acreage[2, 3]	32.2 (41.7)	26.0 (35.4)	
Production Sales[2, 4]			
Livestock	3.9 (5.0)	3.4 (5.8)	
Crop	2.1 (1.8)	1.3 (2.2)	
Total	5.6 (6.2)	5.1 (7.4)	
Farm Labor Work Force[2]			
% Migrant	0.7 (0.6)	0.4 (0.9)	
% Unpaid	64.3 (9.6)	65.1 (10.3)	
% Contract	4.6 (3.5)	7.1 (7.9)	*
% Hired	28.6 (4.6)	26.1(8.4)	**
Total	375.5 (494)	281(390)	
Workers per Acre	0.012 (0.015)	0.010 (0.007)	
Total Population[2, 5]	6.7 (8.7)	3.5 (8.2)	*
Percent Rural Population[2]	63.5 (50.8)	100 (38.2)	**
Percent Population in Poverty[2]	12.3 (4.7)	17.3 (8.0)	**
Population Age Groups, Years[2]			
% Less than 20	26.1 (7.9)	25.7 (7.0)	
20 to 64	55.5 (8.2)	55.3 (5.8)	
65 and older	18.3 (8.2)	18.0 (7.5)	
Race/Ethnicity[2]			
% White	85.9 (13.0)	84.3 (15.3)	
% Black	7.7 (15.7)	9.4 (14.2)	
% American Indian	0.4 (1.0)	0.2 (0.7)	
% Asian	0.2 (0.9)	0.06 (0.6)	
% Other Race	0.6 (1.4)	1.0 (3.3)	
% Hispanic/Latinx	11.4 (11.2)	10.2 (13.9)	

1. n (%)
2. Median (IQR)
3. 1,000 Acres
4. In $1 Million units
5. x 1,000 Population

* p <0.05
** p <0.01
† p<0.001

Trauma rates per 1000 farmworkers and hot spots of agriculture worker traumatic injury events.



Exploratory Spatial Data Analysis

- Moran's Index 0.305, p=0.001

- Local Indicators of Spatial Association:

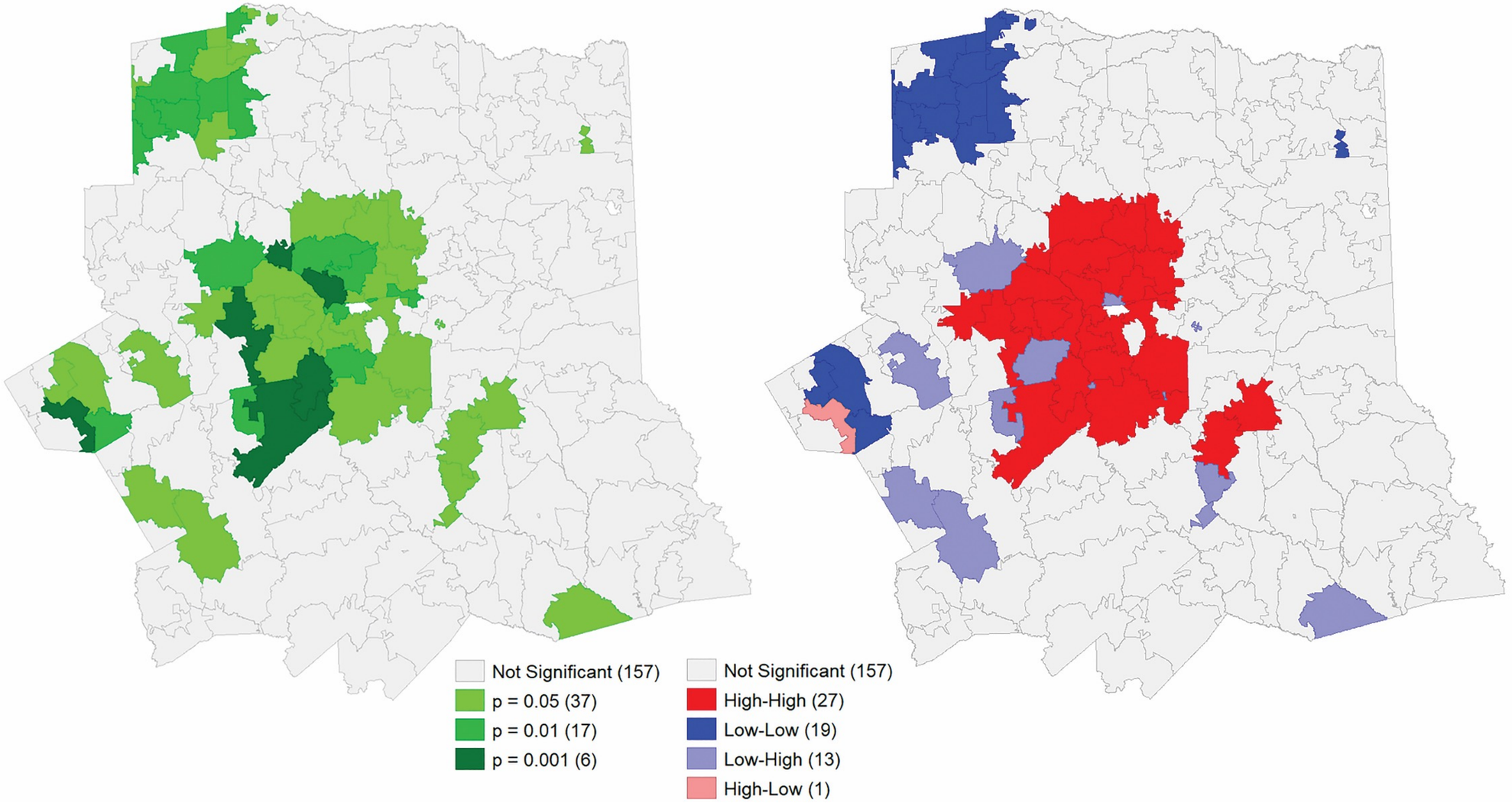


Table 3. MGWR model for traumas per 1,000 farmworkers

	Model β-Coefficients			P-Values					
Parameters	min	max	mean	min	max	mean	p <0.05, n (%)*	β>0, n (%)**	β<0, n (%)**
Total ZCTA Population	0.002	0.53	0.23	<0.001	0.99	0.18	136(63.6)	136 (100)	0
Percent Living in Poverty	-0.43	0.64	0.01	<0.001	>0.99	0.42	40(18.7)	32 (80.0)	8 (20.0)
Percent Black Residents	-0.95	0.51	0.10	<0.001	0.99	0.35	39(18.2)	30 (76.9)	9 (23.1)
Farms per Zip Code	-0.31	0.58	0.15	<0.001	0.98	0.34	45(21.0)	44 (97.8)	1 (2.2)
Workers per Acre	0.12	0.26	0.13	0.001	0.09	0.02	208(97.2)	208 (100)	0
Percent Livestock Operations	-0.47	0.40	-0.03	0.005	0.97	0.30	60(28.0)	13 (21.7)	47 (78.3)
Livestock Sales	-0.36	-0.10	-0.22	<0.001	0.24	0.05	133 (62.1)	0	133 (100)
Local Model Residuals	-1.54	2.89	0.003	--	--	--	--		
Local Model R-squared	0.20	0.77	0.45	--	--	--	--		

* Percent of all ZCTAs

** Percent of all ZCTAs where p<0.05

MGWR: Adjusted R^2 (Global) 0.42

Table 3. MGWR model for traumas per 1,000 farmworkers

Parameters	Model β-Coefficients			P-Values			p <0.05, n (%)*	β>0, n (%)**	β<0, n (%)**
	min	max	mean	min	max	mean			
Total ZCTA Population	0.002	0.53	0.23	<0.001	0.99	0.18	136(63.6)	136 (100)	0
Percent Living in Poverty	-0.43	0.64	0.01	<0.001	>0.99	0.42	40(18.7)	32 (80.0)	8 (20.0)
Percent Black Residents	-0.95	0.51	0.10	<0.001	0.99	0.35	39(18.2)	30 (76.9)	9 (23.1)
Farms per Zip Code	-0.31	0.58	0.15	<0.001	0.98	0.34	45(21.0)	44 (97.8)	1 (2.2)
Workers per Acre	0.12	0.26	0.13	0.001	0.09	0.02	208(97.2)	208 (100)	0
Percent Livestock Operations	-0.47	0.40	-0.03	0.005	0.97	0.30	60(28.0)	13 (21.7)	47 (78.3)
Livestock Sales	-0.36	-0.10	-0.22	<0.001	0.24	0.05	133 (62.1)	0	133 (100)
Local Model Residuals	-1.54	2.89	0.003	--	--	--	--		
Local Model R-squared	0.20	0.77	0.45	--	--	--	--		

* Percent of all ZCTAs

** Percent of all ZCTAs where p<0.05

MGWR: Adjusted R^2 (Global) 0.42

Table 3. MGWR model for traumas per 1,000 farmworkers

	Model β-Coefficients			P-Values					
Parameters	min	max	mean	min	max	mean	p <0.05, n (%)*	β>0, n (%)**	β<0, n (%)**
Total ZCTA Population	0.002	0.53	0.23	<0.001	0.99	0.18	136(63.6)	136 (100)	0
Percent Living in Poverty	-0.43	0.64	0.01	<0.001	>0.99	0.42	40(18.7)	32 (80.0)	8 (20.0)
Percent Black Residents	-0.95	0.51	0.10	<0.001	0.99	0.35	39(18.2)	30 (76.9)	9 (23.1)
Farms per Zip Code	-0.31	0.58	0.15	<0.001	0.98	0.34	45(21.0)	44 (97.8)	1 (2.2)
Workers per Acre	0.12	0.26	0.13	0.001	0.09	0.02	208(97.2)	208 (100)	0
Percent Livestock Operations	-0.47	0.40	-0.03	0.005	0.97	0.30	60(28.0)	13 (21.7)	47 (78.3)
Livestock Sales	-0.36	-0.10	-0.22	<0.001	0.24	0.05	133 (62.1)	0	133 (100)
Local Model Residuals	-1.54	2.89	0.003	--	--	--	--		
Local Model R-squared	0.20	0.77	0.45	--	--	--	--		

* Percent of all ZCTAs

** Percent of all ZCTAs where p<0.05

MGWR: Adjusted R^2 (Global) 0.42

Table 3. MGWR model for traumas per 1,000 farmworkers

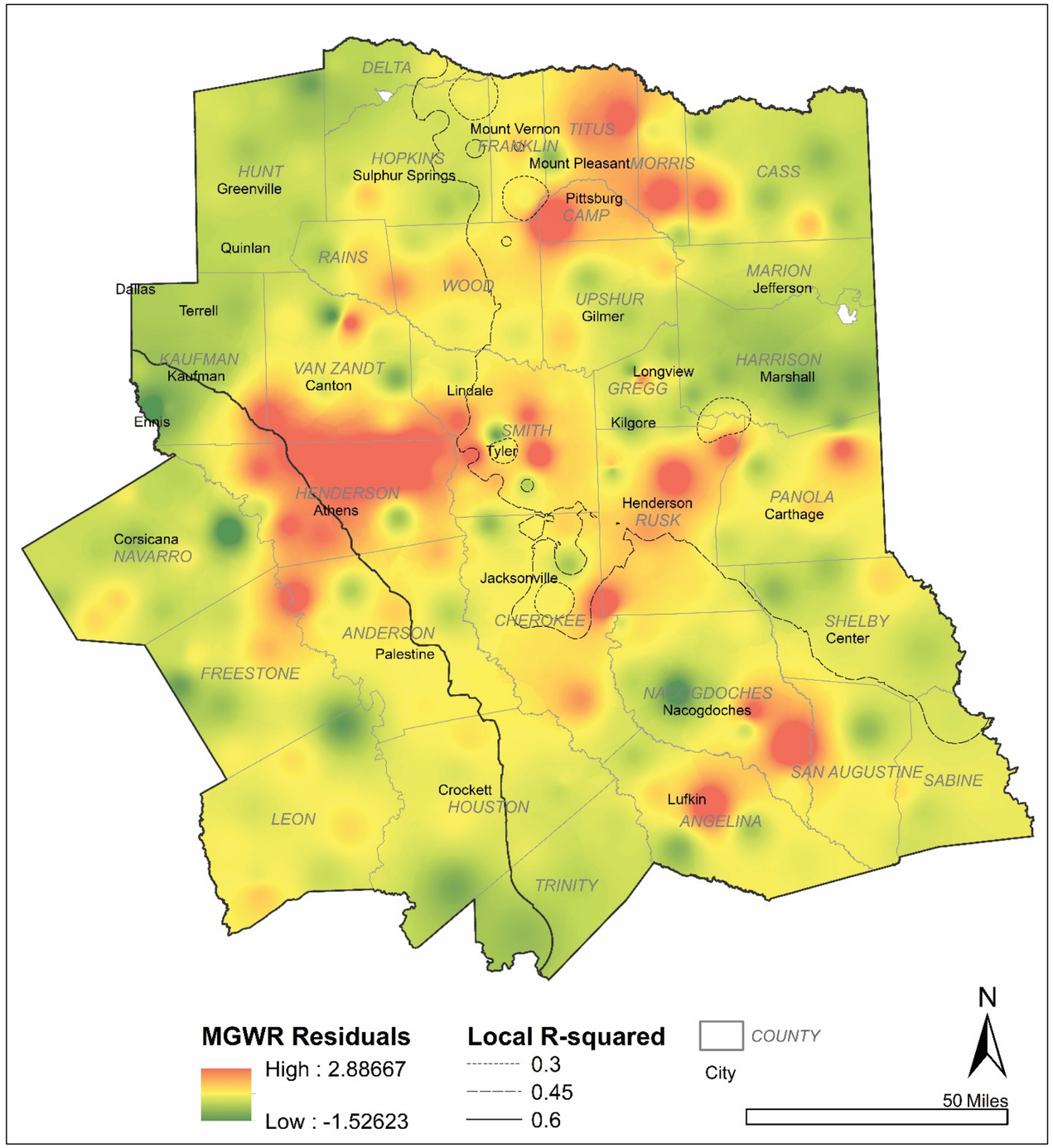
	Model β-Coefficients			P-Values					
Parameters	min	max	mean	min	max	mean	p <0.05, n (%)*	β>0, n (%)**	β<0, n (%)**
Total ZCTA Population	0.002	0.53	0.23	<0.001	0.99	0.18	136(63.6)	136 (100)	0
Percent Living in Poverty	-0.43	0.64	0.01	<0.001	>0.99	0.42	40(18.7)	32 (80.0)	8 (20.0)
Percent Black Residents	-0.95	0.51	0.10	<0.001	0.99	0.35	39(18.2)	30 (76.9)	9 (23.1)
Farms per Zip Code	-0.31	0.58	0.15	<0.001	0.98	0.34	45(21.0)	44 (97.8)	1 (2.2)
Workers per Acre	0.12	0.26	0.13	0.001	0.09	0.02	208(97.2)	208 (100)	0
Percent Livestock Operations	-0.47	0.40	-0.03	0.005	0.97	0.30	60(28.0)	13 (21.7)	47 (78.3)
Livestock Sales	-0.36	-0.10	-0.22	<0.001	0.24	0.05	133 (62.1)	0	133 (100)
Local Model Residuals	-1.54	2.89	0.003	--	--	--	--		
Local Model R-squared	0.20	0.77	0.45	--	--	--	--		

* Percent of all ZCTAs

** Percent of all ZCTAs where p<0.05

MGWR: Adjusted R^2 (Global) 0.42

MGWR model residuals



Conclusion

- Trauma registry data can provide valuable information for the surveillance of agricultural injuries in Northeast Texas
  - Combined with geospatial analysis

Conclusion

- Trauma registry data can provide valuable information for the surveillance of agricultural injuries in Northeast Texas
  - Combined with geospatial analysis

- Injury prevention initiatives should address risks associated with livestock and farm machinery

Conclusion

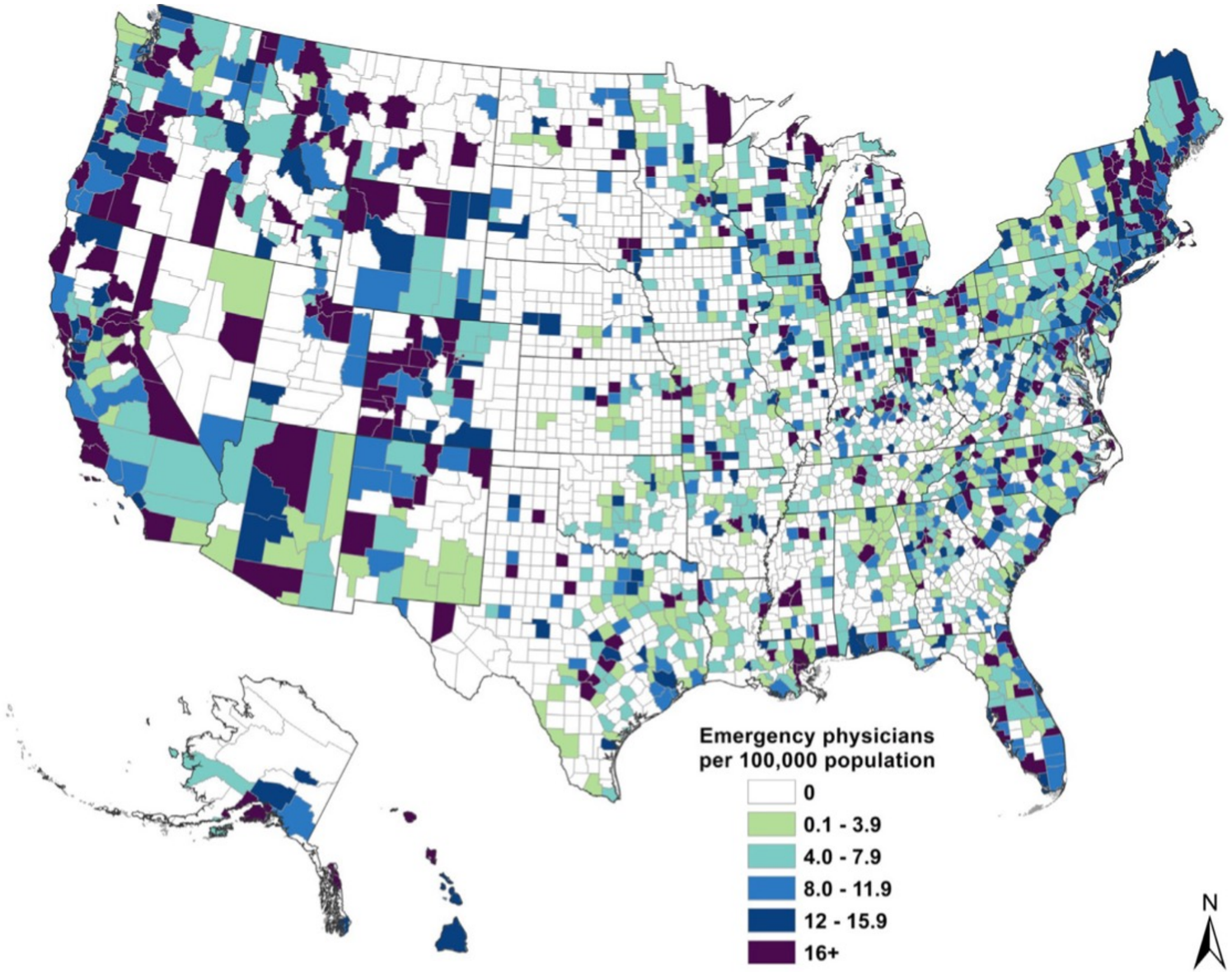
- Trauma registry data can provide valuable information for the surveillance of agricultural injuries in Northeast Texas
  - Combined with geospatial analysis

- Injury prevention initiatives should address risks associated with livestock and farm machinery

- Next step:
  - Data from the Census of Fatal Occupational Injuries
    - Deaths at the scene

Thank you!


Hospital Parking lot.
End of a shift.
Tumbleweed.
My car.



Bennett CL, Sullivan AF, Ginde AA, Rogers J, Espinola JA, Clay CE, Camargo CA Jr. National Study of the Emergency Physician Workforce, 2020. Ann Emerg Med. 2020 Dec;76(6):695-708. doi: 10.1016/j.annemergmed.2020.06.039. Epub 2020 Aug 1. PMID: 32747085.

National Challenges

US icon: Bence Bezeredy from the Noun Project

NM icon: Adnen Karedy from the Noun Project

Emergency Medicine Resident Community Experience

A PILOT FEASIBILITY STUDY

Funding for this research was supported by the Southwest Center for Agricultural Health, Injury Prevention, and Education through Cooperative Agreement # U54-OH007541 from CDC/NIOSH

Hypothesis

Residents' experiences with agricultural curricular and clinical content will influence their willingness to practice in underserved rural agricultural communities

Curriculum Development

Identify existing recommendations

Curriculum map

Academic Emergency Medicine
Official Journal of the Society for Academic Emergency Medicine

EDUCATIONAL ADVANCE

Rural Clinical Experiences for Emergency Medicine Residents: A Curriculum Template

Michael C. Wadman, MD, Ted R. Clark, MD, MPP, Douglas F. Kupas, MD, Marlow Macht, MD, MPH, Steve McLaughlin, MD, Terry Mize, PA-C, MMSc, Jennifer Casaletto, MD, and Robert L. Muelleman, MD

UNM RURAL EM CURRICULUM MAP

Adapted from: Wadman MC, Clark TR, Kupas DF, et al. Rural clinical experiences for emergency medicine residents: a curriculum template. *Acad Emerg Med.* 2012;19(11):1287-1293. doi:10.1111/acem.12007.

CATEGORY	TOPIC	READING	LECTURE
Orthopedics	**Fractures** ▪ Reductions ▪ Splinting ▪ Managing open fractures	• Tintinalli, Chapter 267	• Lecture: Wilderness Med/Orthopedic Injuries • Simulation: Ortho Procedures (2/19) • Small Groups 5/15/19: HO1 (Orthopedic reductions and splints) • F1, Case 79: Pelvic fracture, open ankle fracture
	Amputations ▪ Preparation of patient for transfer ▪ Amputation wound care ▪ Care of the amputated part ▪ Recognition of non-salvageable injuries	• Tintinalli, Chapters 43, 44, 266	• Ortho mini-cases

Resident Survey

- Attitudes and Experiences
- Knowledge and Gaps
- Perceptions of Rural Communities

Survey Themes

Make Rotations Available.

Options for core blocks, not just electives.

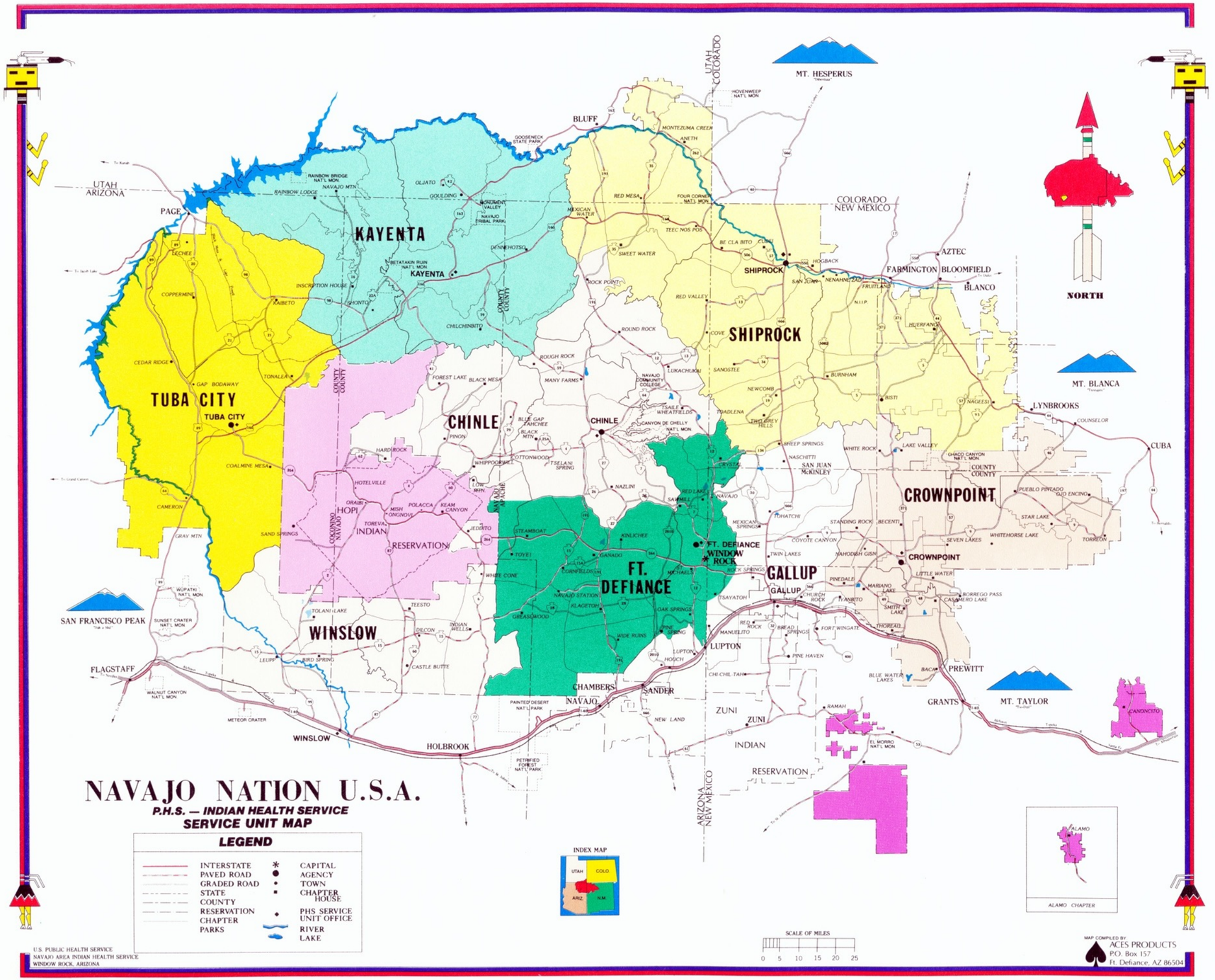
Minimize barriers.

Offer moonlighting.

Ag/Rural EM Rotation Implementation

Northern Navajo Medical Center

Shiprock, NM

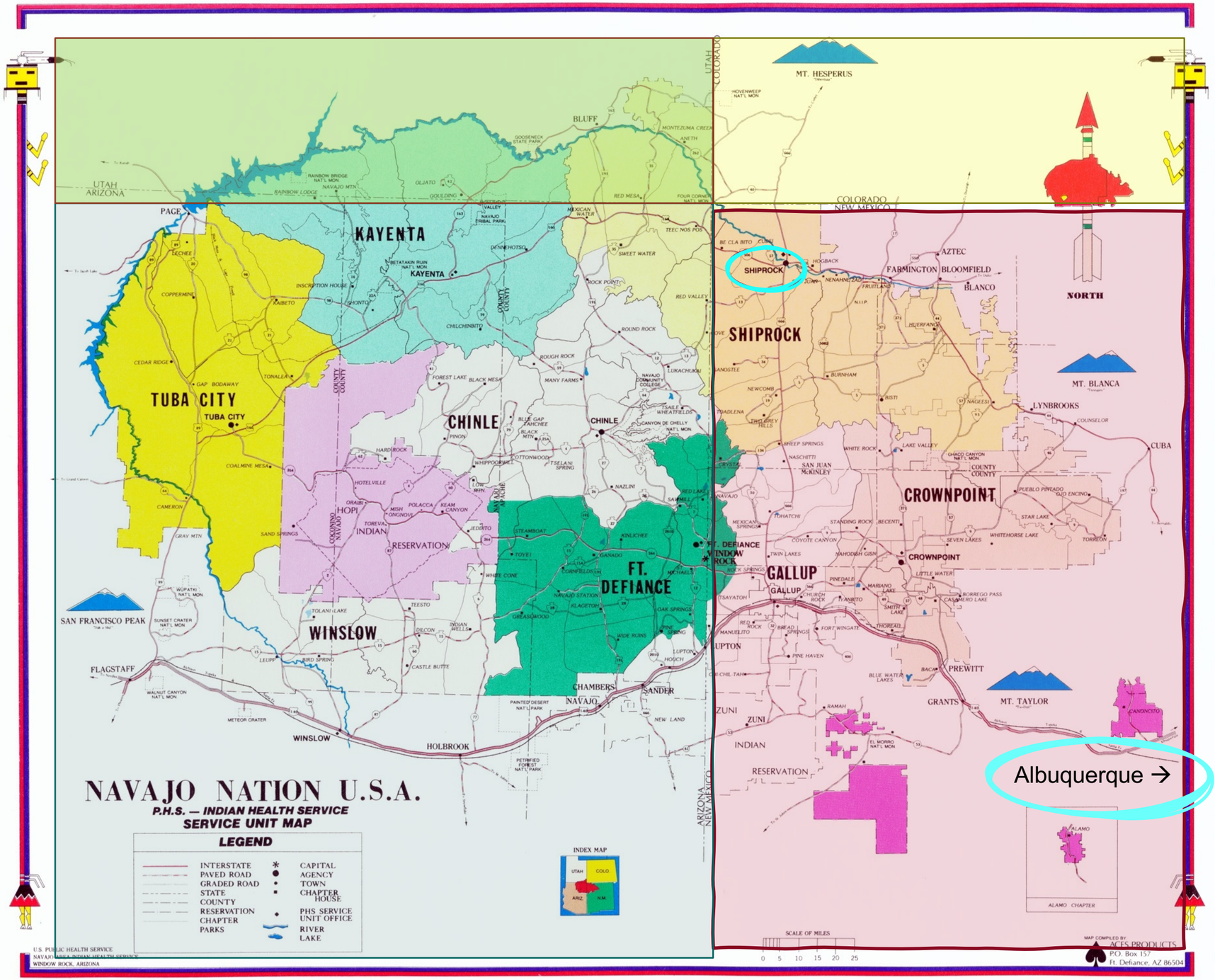


https://www.ihs.gov/navajo/

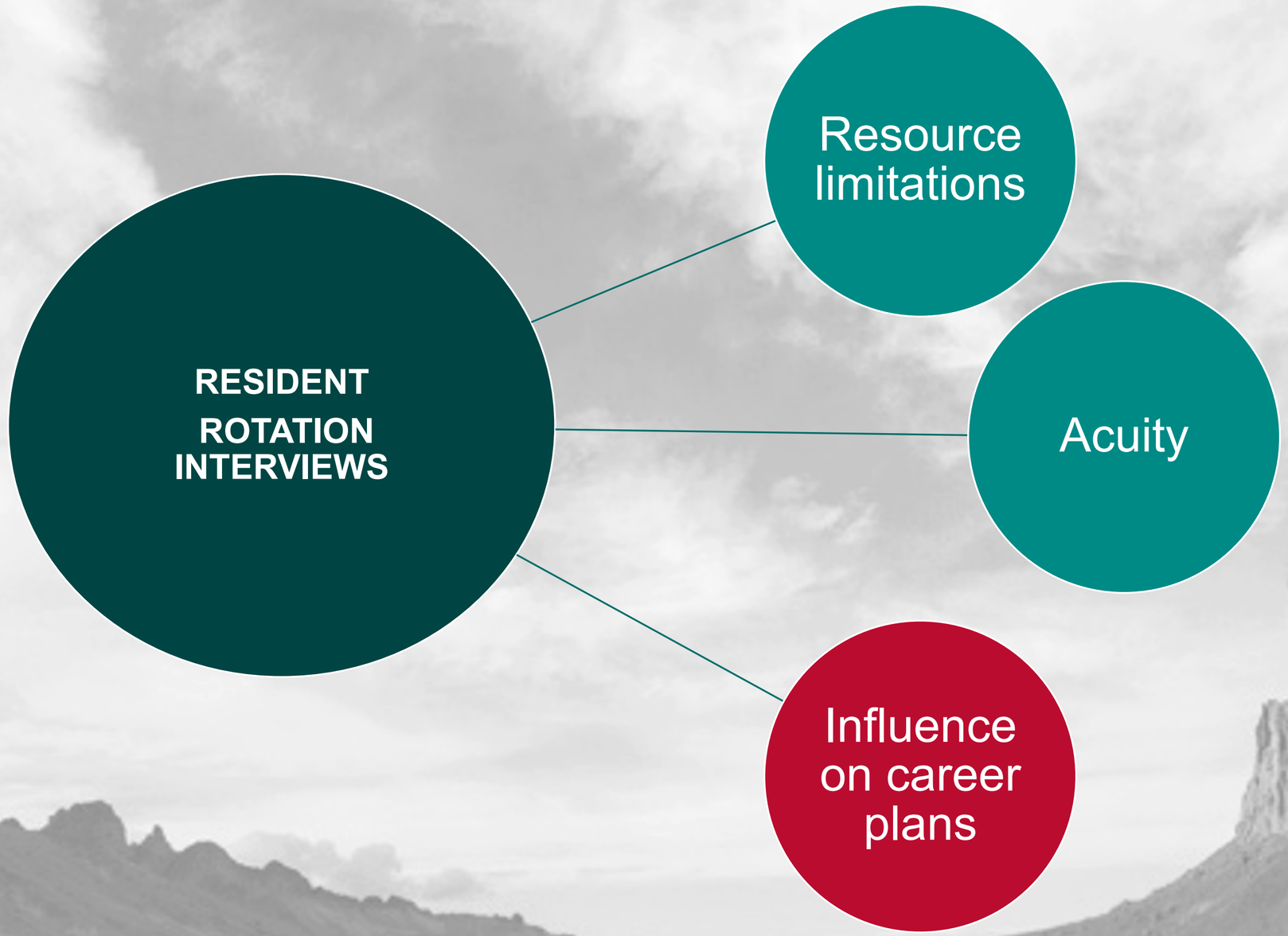
Ag/Rural EM Rotation Implementation

Northern Navajo Medical Center

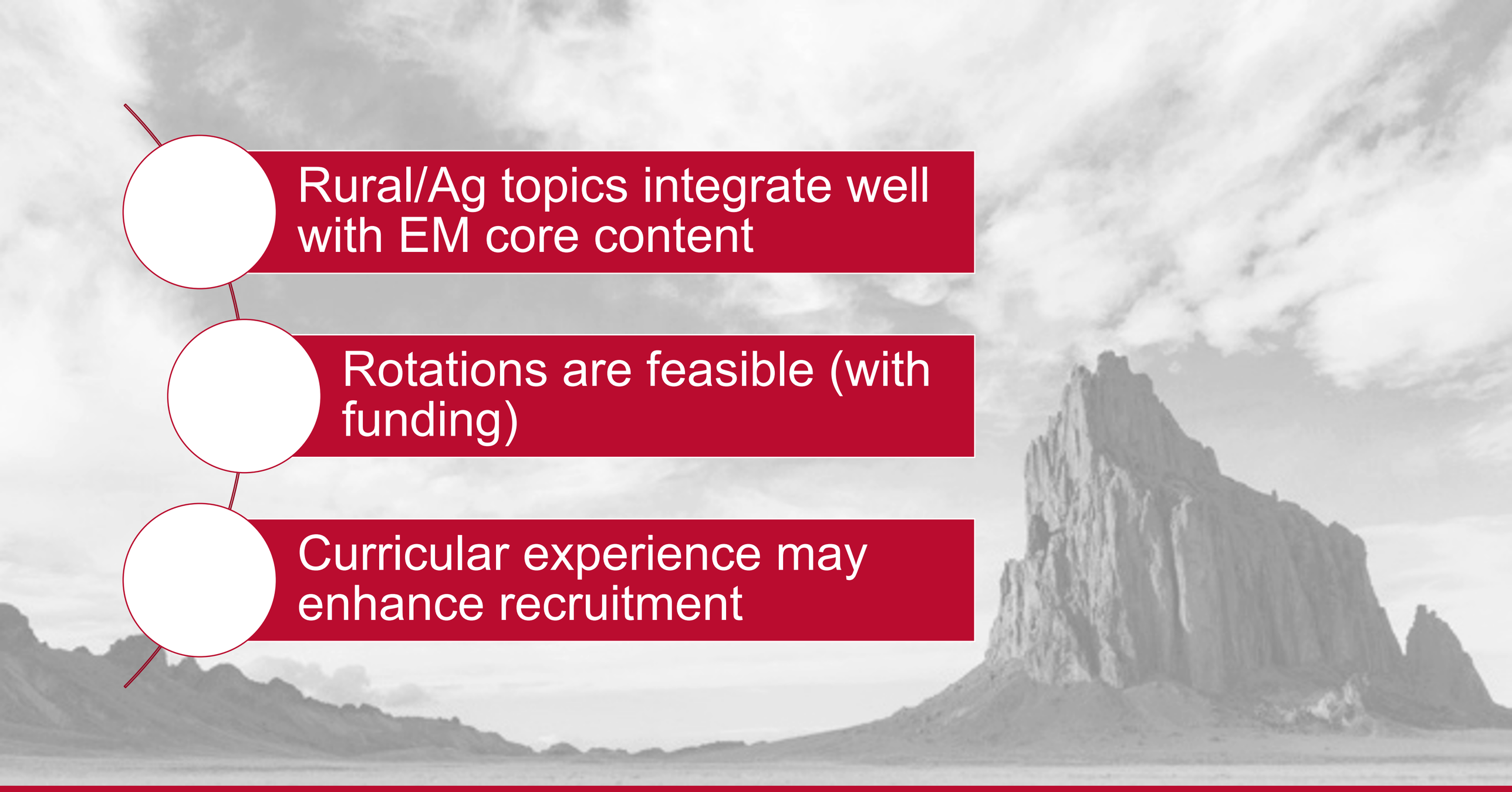
Shiprock, NM



https://www.ihs.gov/navajo/


RESIDENT
ROTATION
INTERVIEWS
Resource limitations
Acuity
Influence on career plans


MEDICAL DIRECTOR
ROTATION INTERVIEWS
Recruitment
Staffing
Information
Exchange


Rural/Ag topics integrate well with EM core content
Rotations are feasible (with funding)
Curricular experience may enhance recruitment

Building the Future

Current projects and areas for future research

- Rural-Academic Partnerships
- ACEP Rural Task Force
- Funding Innovation
- National Survey
- Rural Training Tracks
- Telemedicine supervision

UNM HEALTH SCIENCES

Contact information: mfleegler@salud.unm.edu

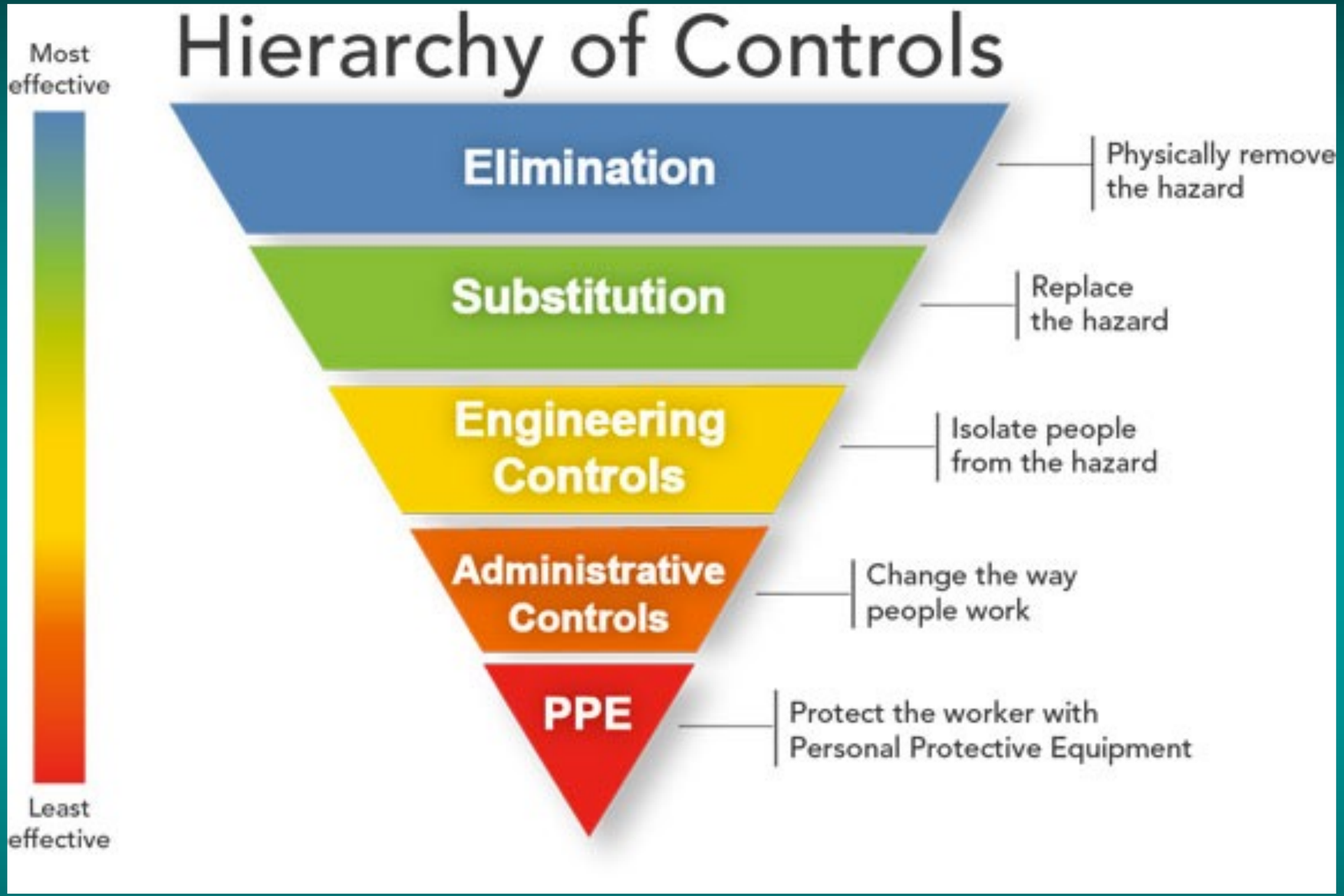
Relevance to Public Health

10 Essential Services

Public Health Core Functions

- Assessment
- Policy Development
- Assurance

Source: https://www.cdc.gov/stltpublichealth/publichealthservices/essentialhealthservices.html



Source:
https://www.cdc.gov/niosh/topics/hierarchy/images/hierarchycontrols.jpg

Summary of the Partnership With NIOSH

- The occupational medicine residency program at the University of Texas Health Science Center at Tyler (UTHSCT) has received support from NIOSH over the past 14 years through our competitive Training Project Grant (TPG).
- The aim of this grant has been to always engage our residents in rural occupational health considerations, up to and including service delivery, as well as research.

Successes and Accomplishments

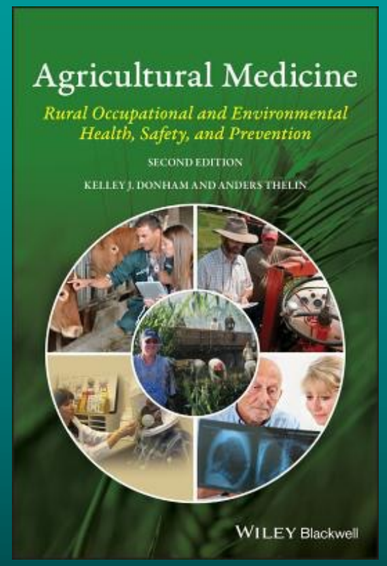
Several residents over the years have successfully focused on the specific occupational safety and health needs of rural working populations including agricultural, fishing, and forestry workers through projects that resulted in peer reviewed articles, pilot studies, and presentations at specialty society meetings.

Learning Methods for TPG

- Walkthroughs
- Rural rotation
- Collaboration with Ag Center
- Agromedicine workshop

Origins of the Agromedicine Workship

- Building Capacity Project at Iowa
- Uniformity of curriculum content and a textbook
- Engagement of multidisciplinary audiences

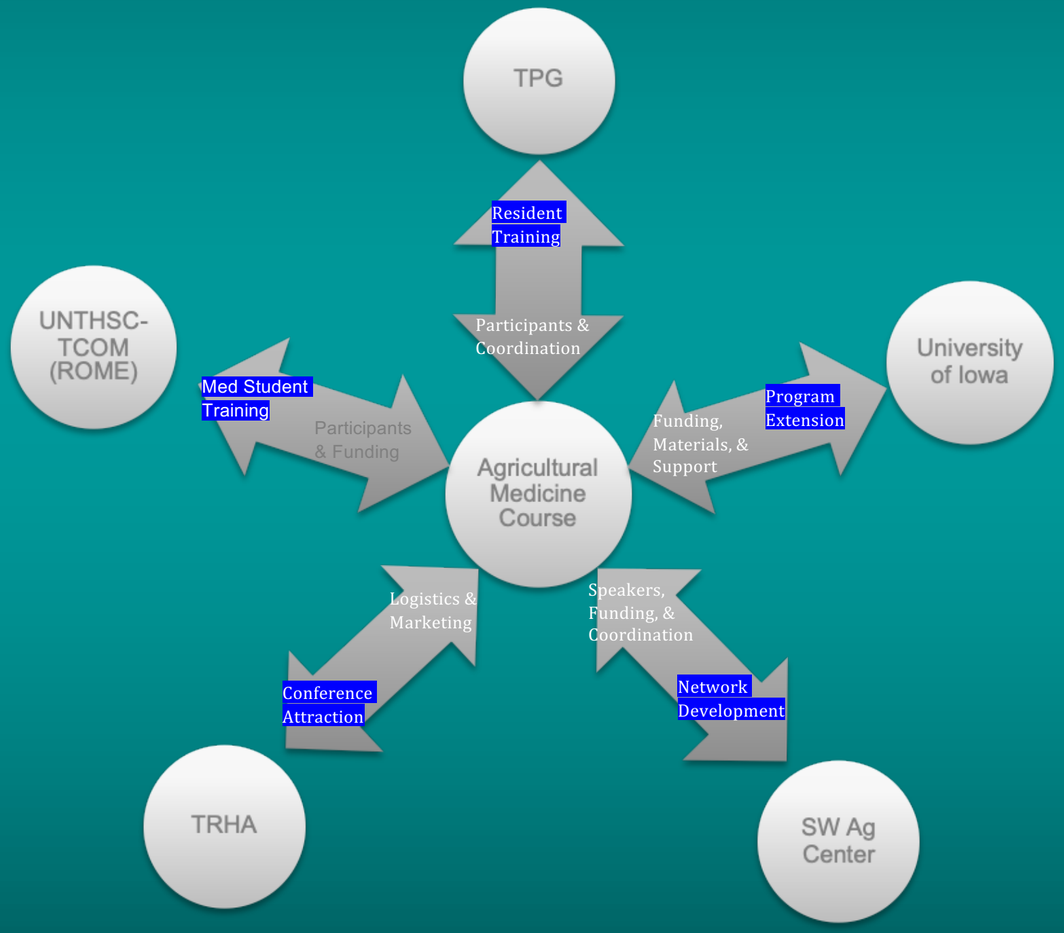


www.swagcenter.org

CHAPTER V
A BRIEF REPORT DESCRIBING THE UNION OF MEDICAL TRAINING AND AGRICULTURAL HEALTH

- Levin JL, Bowling J, Wickman AJ, Harris M. A brief report describing the union of medical training and agricultural health. Journal of agromedicine. 2016; 21(1): 123-126. [PubMed: 26479683]

Summary of the contributions of each of the agricultural medicine strategic partners.



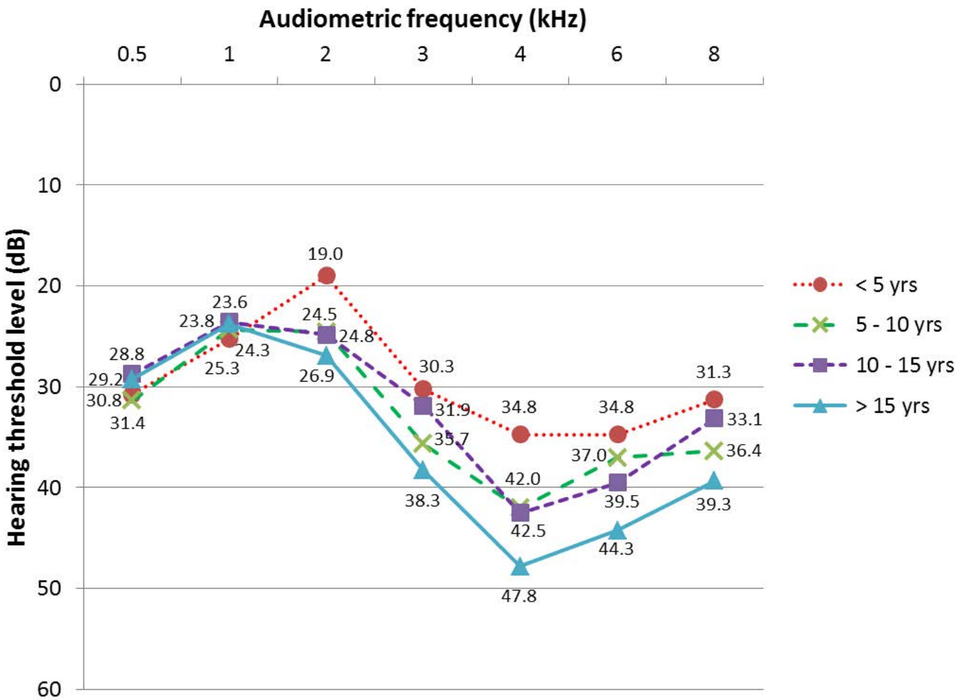
www.swagcenter.org

Examples of Resident Project Work

YEAR	RESIDENT'S NAME	PROJECT TITLE	DELIVERABLE
2007	Aman Dhillon & Lester Tarbutton	Environmental/Occupational Exposures and Parkinson's Disease in an East Texas Population	Published Article; Dhillon AS, Tarbutton GL, Levin JL, Plotkin GM, Lowry LK, Nalbone JT, Shepherd S: Pesticide/environmental exposures and Parkinson's Disease in East Texas. Journal of Agromedicine. 13:37-48, 2008. PubMed PMID: 19042691.
2008	Nicholas Bingham	Farmers and Ranchers Perceptions on Disability	Presented at TxCOEM Meeting
2011	Marek Greer	Developing an Emergency Preparedness Model for Cattle Producers and Community-Based Responders	Presented at TxCOEM Meeting
2014	William Curry	Hearing Loss and Noise Exposure Among Commercial Fisherman in the Gulf Coast	Presented at TxCOEM Meeting Published Article; Levin J, Curry W, Shepherd S, Nalbone J, Nonnenmann M. Hearing loss and noise exposure among commercial fishermen in the gulf coast. JOEM 58(3): 306-313, 2016. PubMed PMID: 26949882.
2017	Shaadi Khademi	Assessment of Sun-Safety Behaviors and Knowledge of Sun Protection and Skin Cancer in the Farmworker Population of South Texas	Presented at AOHC and TxCOEM
2019	Eric Meek	Public Health Through Mobile Gaming (Focused on Zika Virus Response Efforts)	A mobile application designed in conjunction with a Public Health County Presented at AOHC and TxCOEM
2020	Michael Wirsching	Improvement of Current Medical Surveillance of Coumaphos Exposure in Texas Animal Health Commission (TAHC) Fever Tick Eradicators	Presented at TxCOEM Meeting

CHAPTER III
HEARING LOSS AND NOISE EXPOSURE AMONG COMMERCIAL FISHERMEN IN THE GULF COAST

- Levin JL, Curry WF, 3rd, Shepherd S, Nalbone JT, Nonnenmann MW. Hearing loss and noise exposure among commercial fishermen in the gulf coast. J Occup Environ Med. 2016; 58(3): 306-313. [PubMed: 26949882]



Mean hearing threshold levels in the worse ear at all frequencies tested categorized by years of experience in the commercial fishing industry.


U.S.
COAST
GUARD

Questions and Discussion

Questions

Contact information:
Vanessa Casanova
Vanessa.Casanova@uthct.edu
903-877-1408
www.swagcenter.org

UTHealth
The University of Texas
Health Science Center at Tyler