U.S. Department of Veterans Affairs
Veterans Health Administration
Office of Research & Development

U.S. Department of Veterans Affairs
Veterans Health Administration
Office of Rural Health

Using Data & Information Systems in Partnered Research #7

An Evaluation of Firearm Injuries among Urban versus Rural Veterans: Data Validity and Early Findings

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CIVIC
Center to Improve Veteran Involvement in Care

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SCHOOL OF PUBLIC HEALTH

Using Data & Information Systems in Partnered Research Cyberseminar Series

Third Tuesday of the month | 12:00 – 1:00 PM ET

Presentations from the field focusing on VA data use in quality improvement and operations-research partnerships.

Topics

- Use of VA data and information systems in QUERI Projects and Partnered Evaluation Initiatives
- Operational data resources and QI-related data
- Challenges in using and managing multiple data sources
- VA resources to support data use
- Experiences working within operations/research partnerships

Visit HSR&D's VIReC Cyberseminar Archive to watch previous sessions:

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Poll #1: What is your **role** in research and/or quality improvement projects?

- Investigator, PI, Co-I
- Statistician, data manager, analyst, or programmer
- Project coordinator
- Other – please describe via the chat function

Poll #2: How many **years of experience** working with VA data?

- None – I'm brand new to this!
- One year or less
- More than 1, less than 3 years
- At least 3, less than 7 years
- At least 7, less than 10 years
- 10 years or more

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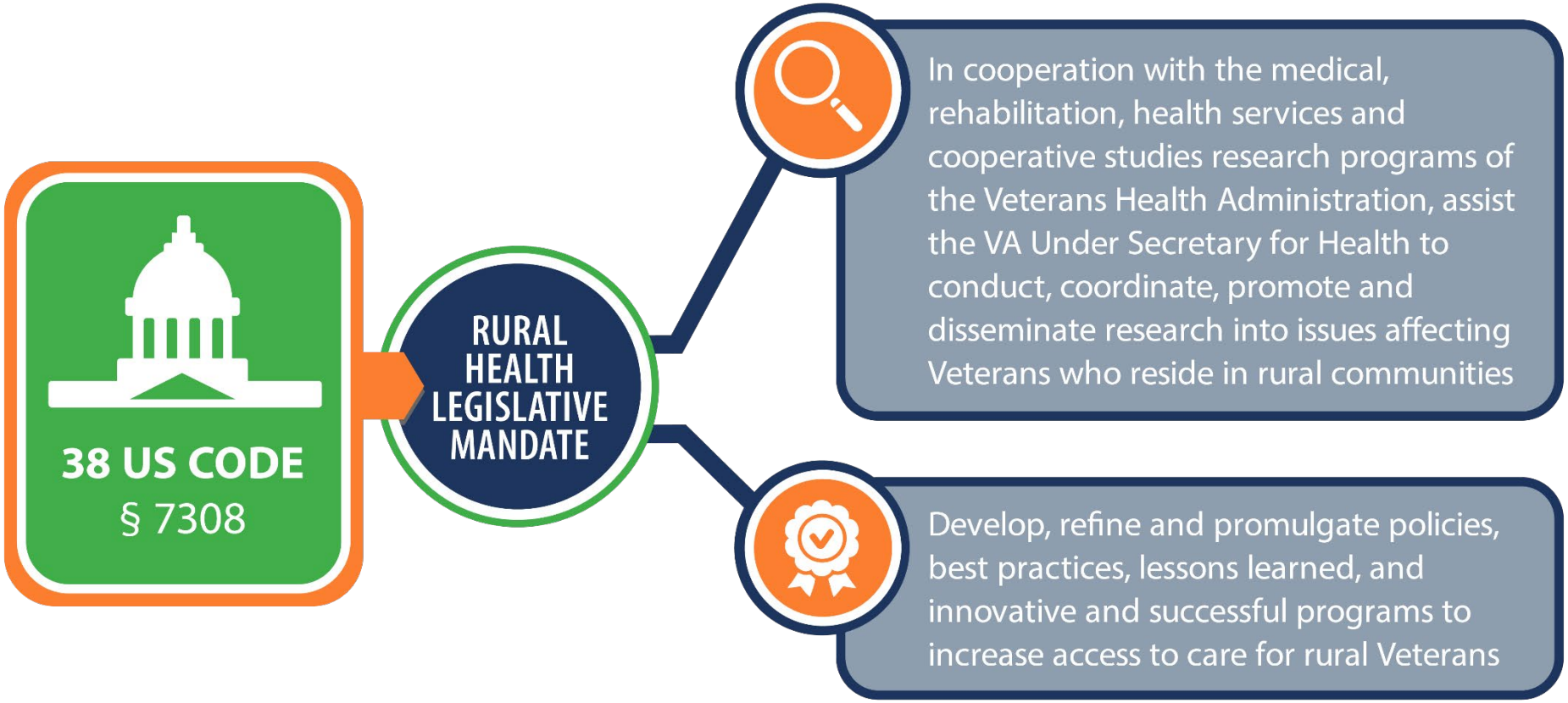
RURAL HEALTH LEGISLATIVE MANDATE



38 USC § 7308 AS AMENDED (JUNE 2012)

Rural Health Resource Centers – There are, in the Office, Veterans Rural Health Resource Centers (VRHRC) that serve as satellite offices for the Office. Their purposes are to:

Research

- To **improve the understanding of the Office of the challenges** faced by veterans living in rural areas
- To **identify disparities** in the availability of health care to veterans living in rural areas

Innovate

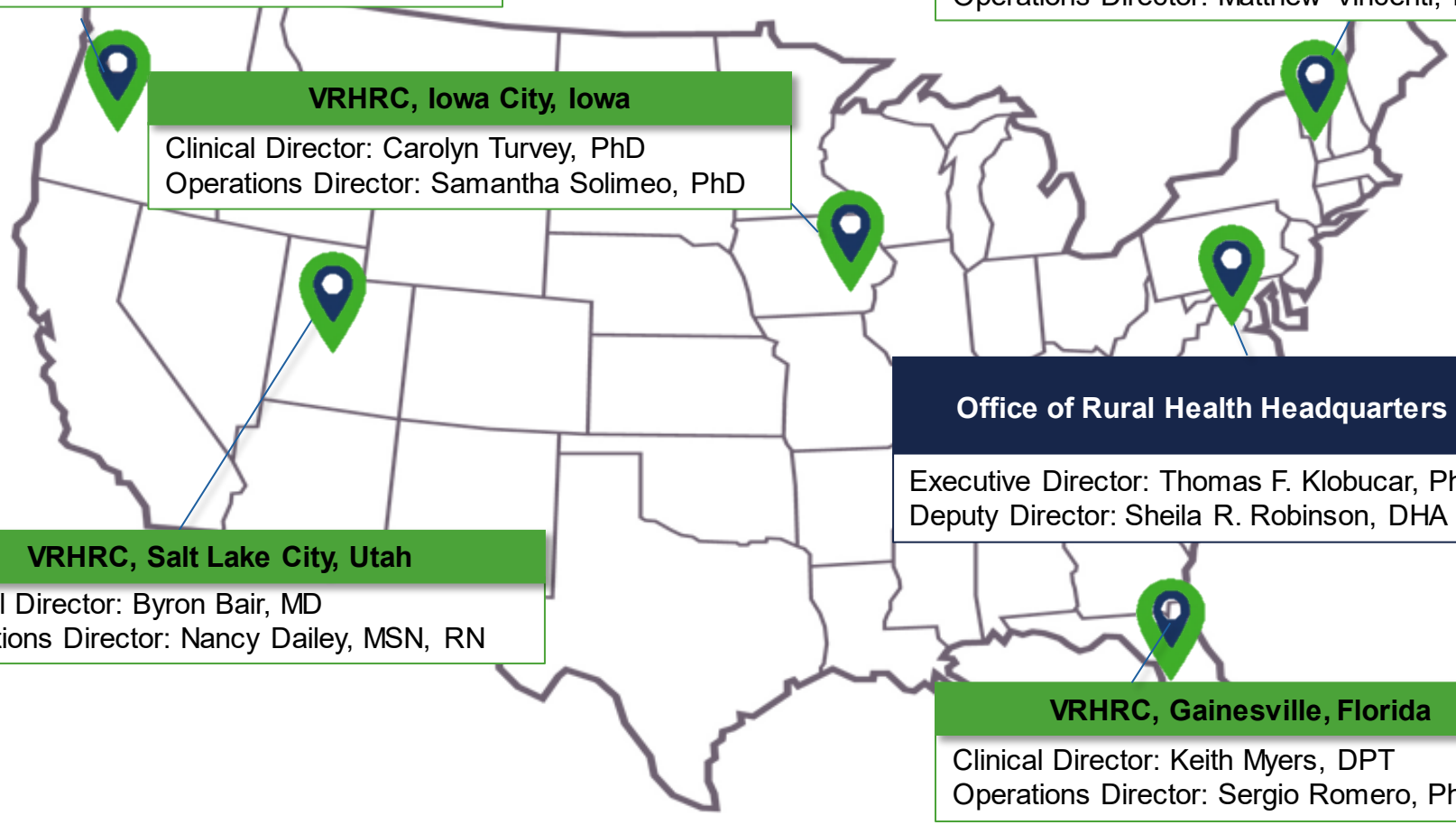
- To **formulate practices or programs to enhance the delivery of health care** to veterans living in rural areas

Disseminate

- To **develop special practices and products for the benefit of veterans** living in rural areas **and for implementation of such practices and products in the Department systemwide**.

*The 2018 appropriations act recognized resource center impact, *"…VA is encouraged to use some of these additional funds to increase the number of Rural Health Resource Centers as a means of increasing access to care for veterans in rural areas."*

ORH AND ITS SATELLITE VETERANS RURAL HEALTH RESOURCE CENTERS



VRHRC, Portland, Oregon

Clinical Director: Travis I. Lovejoy, PhD
Operations Director: Sarah Ono, PhD

VRHRC, Iowa City, Iowa

Clinical Director: Carolyn Turvey, PhD
Operations Director: Samantha Solimeo, PhD

VRHRC, Salt Lake City, Utah

Clinical Director: Byron Bair, MD
Operations Director: Nancy Dailey, MSN, RN

VRHRC, White River Junction, Vermont

Clinical Director: Bradley "Vince" Watts, MD
Operations Director: Matthew Vincenti, PhD

Office of Rural Health Headquarters

Executive Director: Thomas F. Klobucar, PhD
Deputy Director: Sheila R. Robinson, DHA

VRHRC, Gainesville, Florida

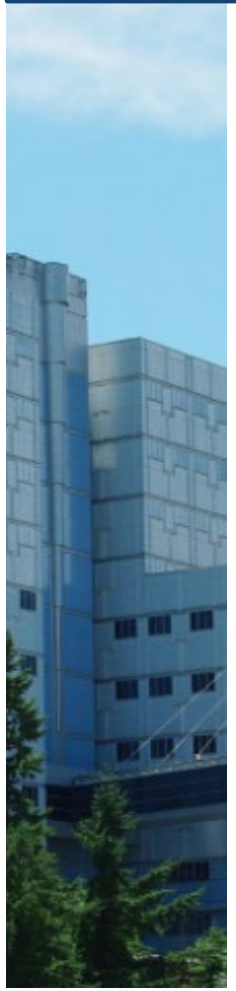
Clinical Director: Keith Myers, DPT
Operations Director: Sergio Romero, PhD

VETERANS RURAL HEALTH RESOURCE CENTER – PORTLAND, OREGON

- Increase rural Veterans' access to care
- Find innovative ways to combat the pain and opioid epidemics
- Prevent Veterans' suicide
- Address disparities in vulnerable populations

Firearm Injury Project

Acknowledgements



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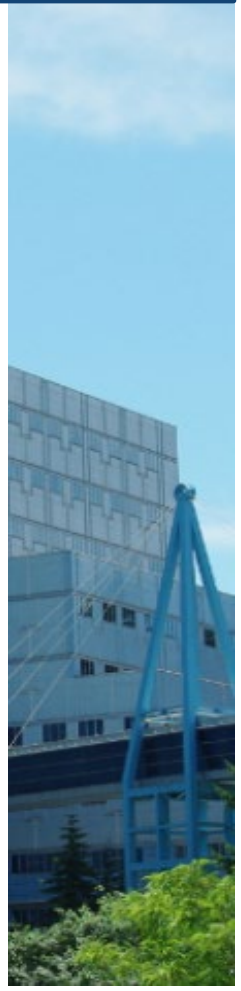
Department of Veterans Affairs Office of Rural Health, Veterans Rural Health Resource Center - Portland: *"Firearm Injuries among Rural Veterans in the US"* (OMAT #15528)



BACKGROUND

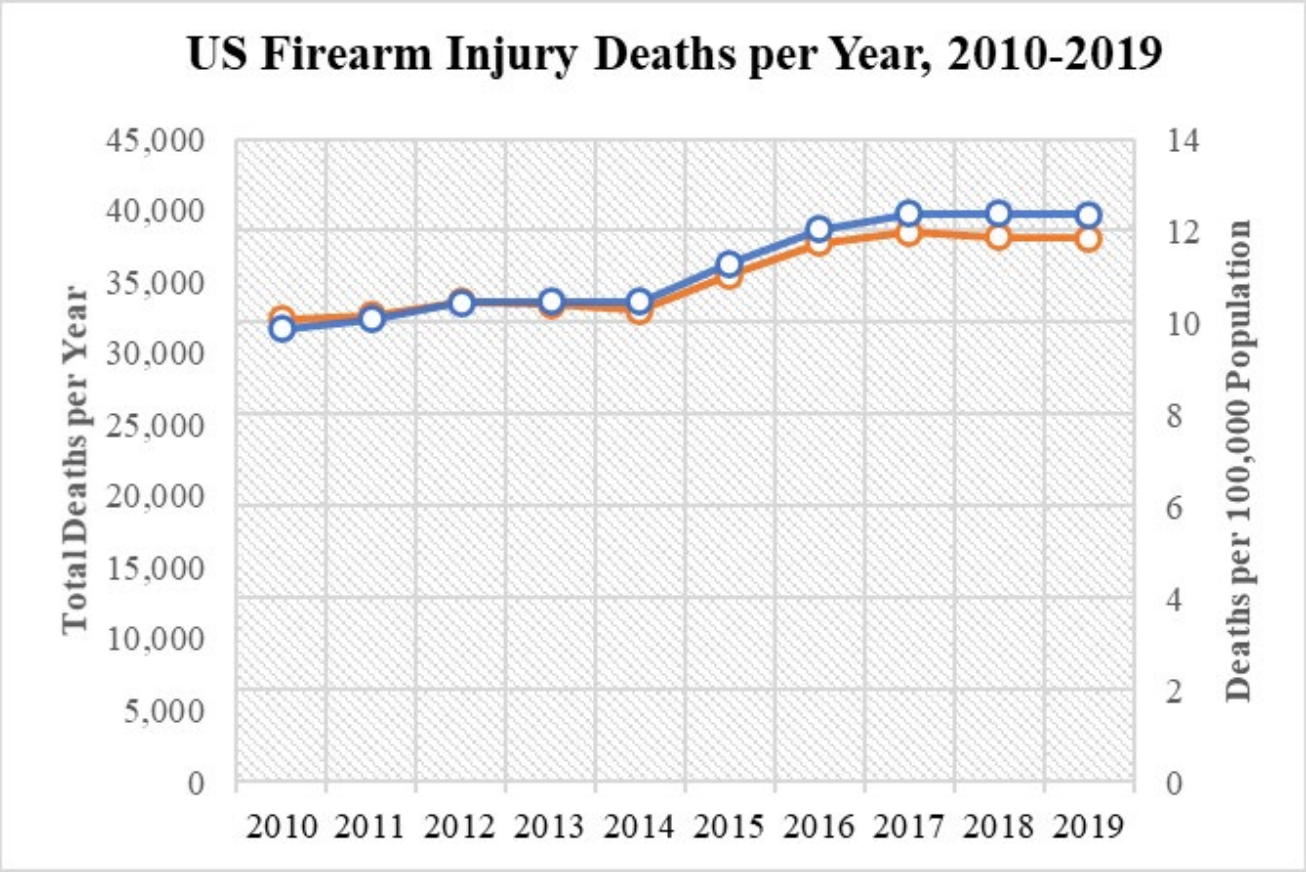
Firearm Injuries

- In the 10-year period from 2010 to 2019, there were an estimated 358,946 **firearm-related deaths** among US adults.

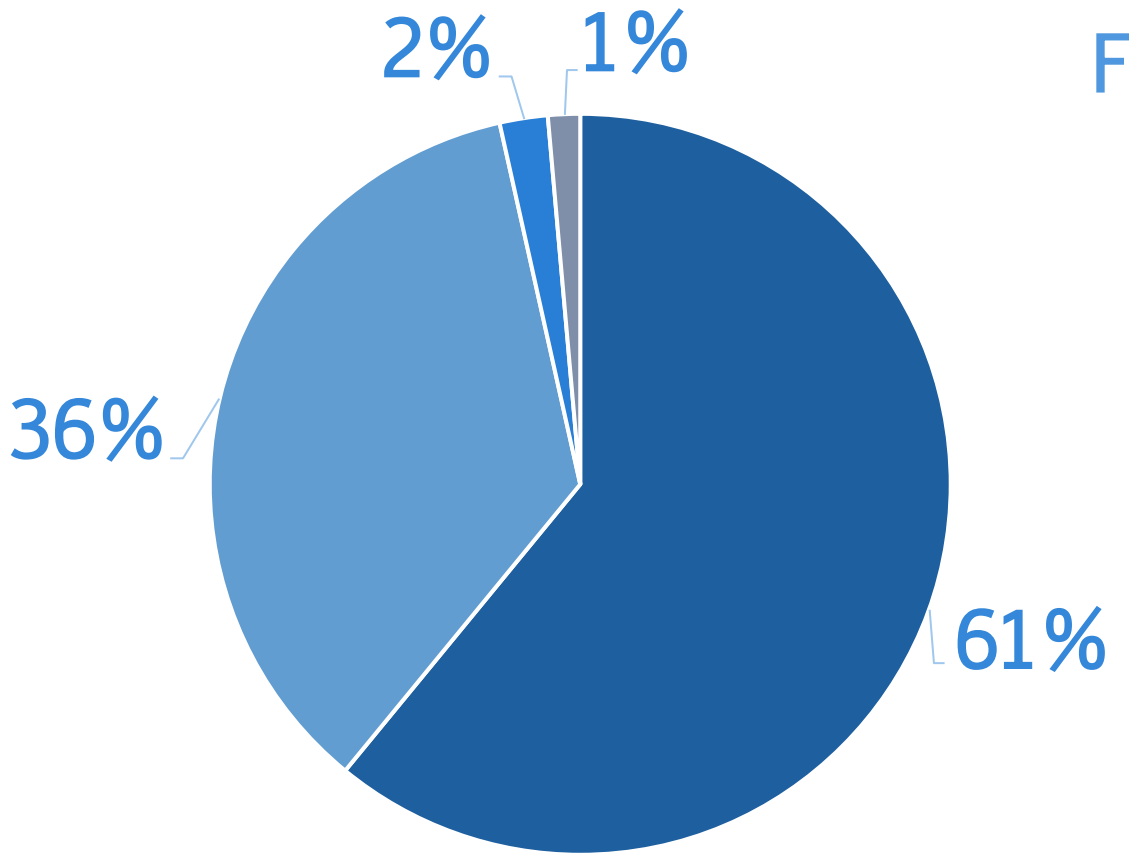
  Centers for Disease Control and Prevention. WISQARS, Fatal Injury Reports and Nonfatal Injury Reports, 1981-2019.

- There were **39,707 firearm deaths in 2019**– about 109 people dying per day.

  (WISQARS, 2021)



Fatal Firearm Injuries by Intent

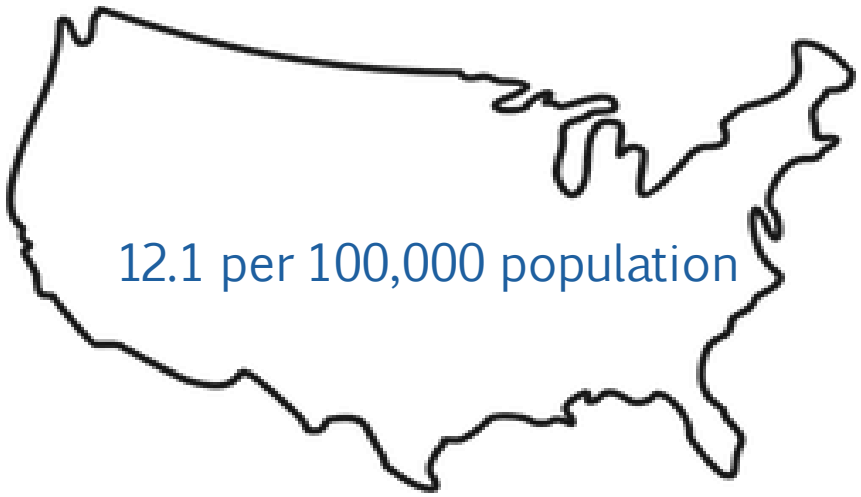


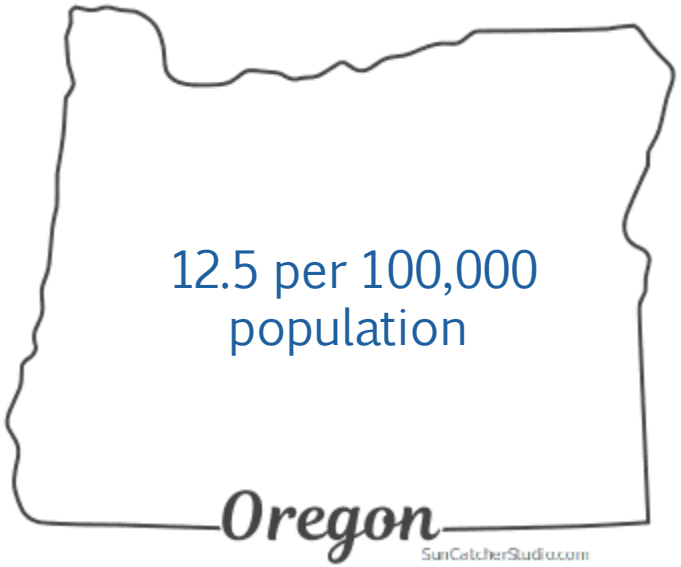
Firearm Deaths in the U.S., 2019

- Suicide
- Homicide
- Unintentional/Undetermined
- Legal Intervention

Source: CDC WISQARS, 2021

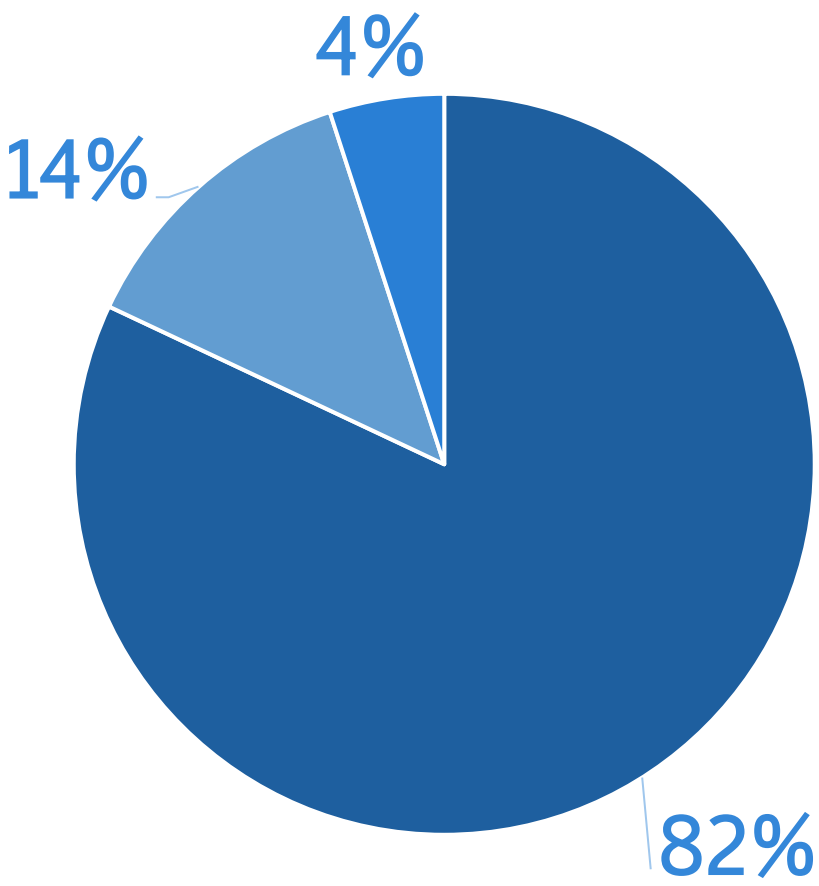
Fatal Firearm Injuries in US vs. Oregon





- In Oregon, ***566 people died*** from a firearm injury in 2019 (CDC WISQARS, 2020)

Oregon Fatalities by Intent



Firearm Deaths in Oregon, 2019

- Suicide
- Homicide
- Unintentional/Undetermined/ Legal Intervention

Source: CDC WISQARS

Rural Firearm-related Fatalities

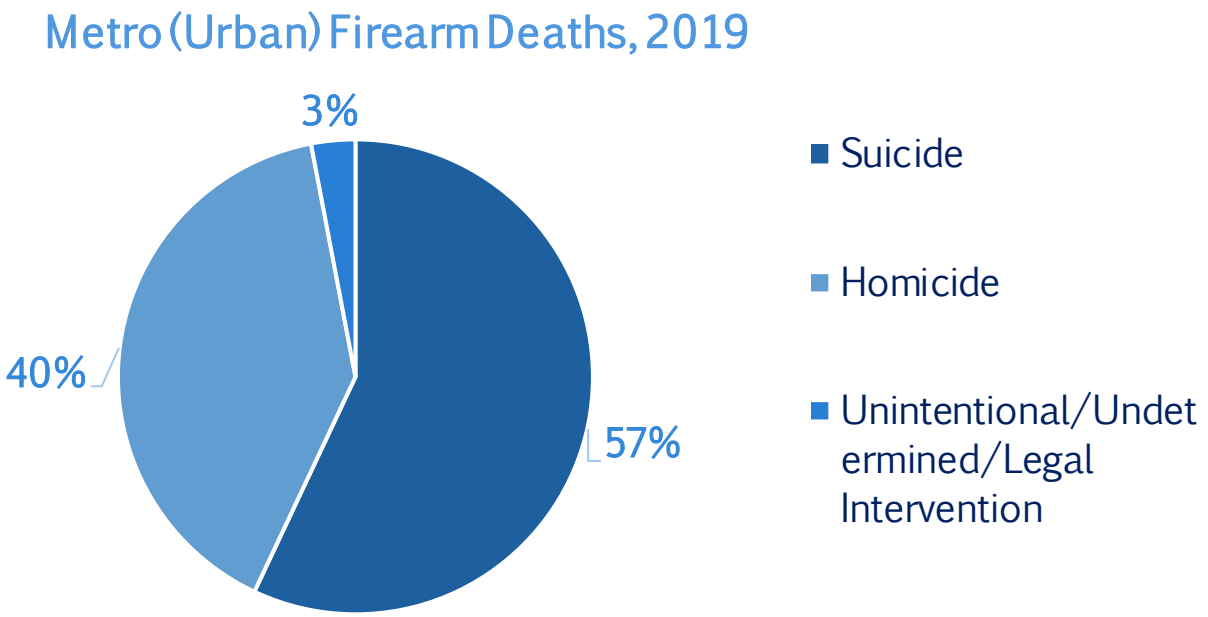
- In the 10-year period from 2010 to 2019, of the **358,946 firearm-related deaths**:
  - 292,373 were among US adults living in metro counties
  - 66,573 living in non-metro counties

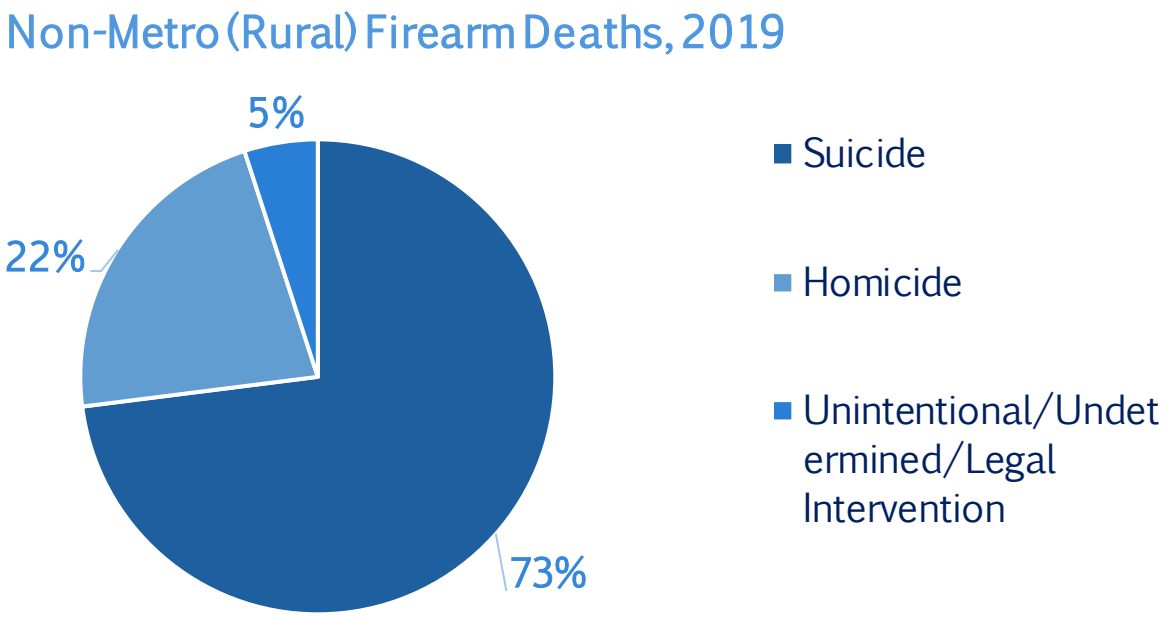
Rates of Fatal Firearm Injuries in the United States, 2010-2019, per 100,000

	Metro	Non-metro
All firearm deaths	10.5	14.0
Firearm suicide	6.2	10.2
Firearm homicide	4.2	3.2
Unintentional firearm death	0.1	0.4

(CDC WISQARS, 2020)

Urban vs Rural Fatalities by Intent

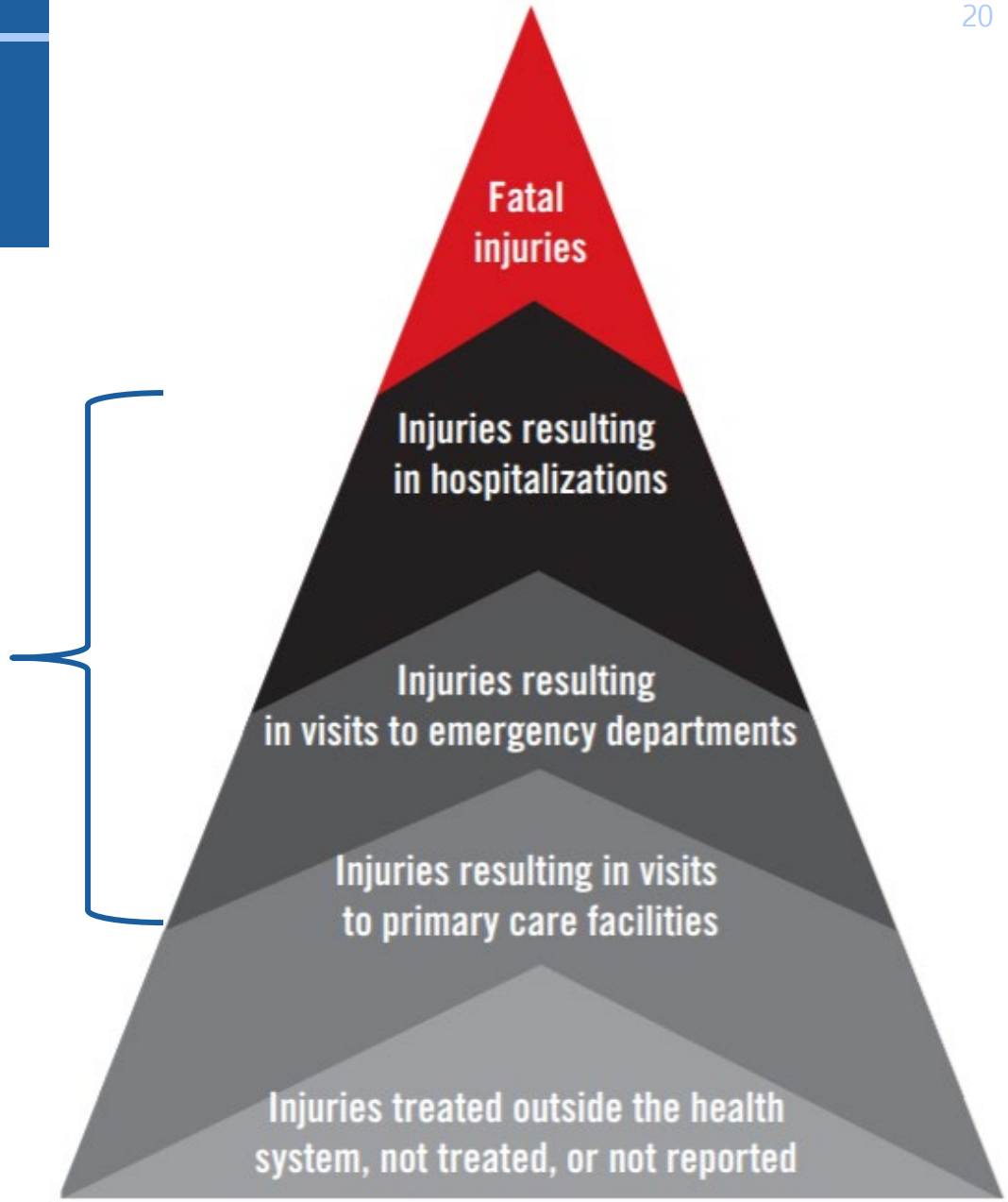




(CDC WISQARS, 2020)

Nonfatal Firearm Injuries

- There are more than twice as many **nonfatal** (than fatal) firearm injuries treated in EDs each year.

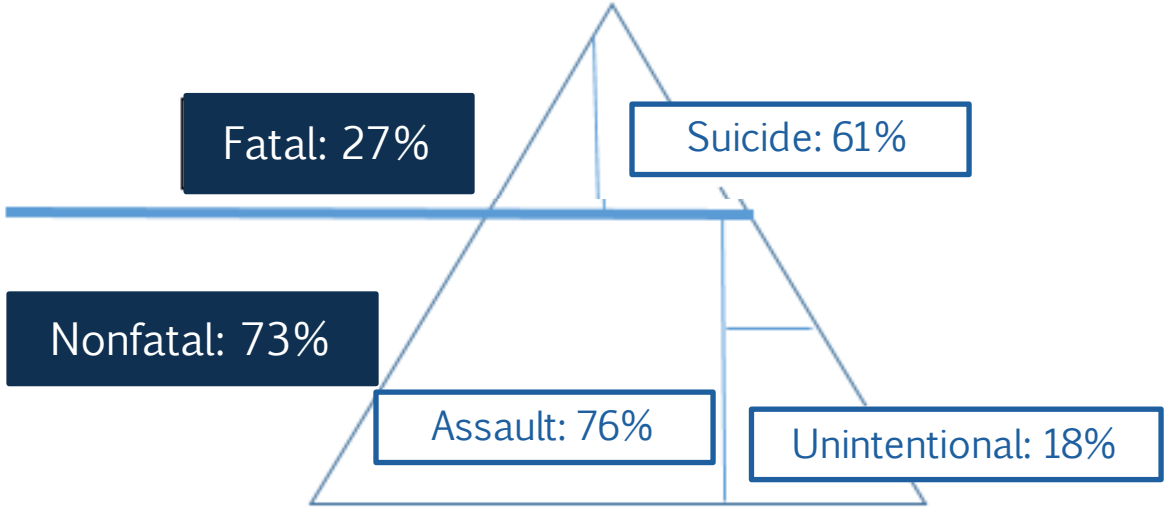


WHO, 2021

Nonfatal Firearm Injuries

- On average, each day, an estimated **2,688 Americans** are treated for a *nonfatal* injury with a firearm.

Fatal and Nonfatal Firearm Injuries in the United States, 2010-2019



CDC WISQARS, 2021

Veterans' Firearm Injuries

- Veterans had **26% increased risk of fatal injury** during the first 5-7 years deployment, and increased risk of **hospitalized injuries** after deployment.
  (Kang et al., 2001; Knapik et al., 2009; Gray et al., 1996; 2000)

- Veterans have more training with firearms than most US citizens, and a **higher prevalence of firearm ownership**.
  (General Social Survey, 2021; Cleveland et al., 2017)

Veterans' Firearm Injuries

- More than half of Veteran firearm owners owned **multiple firearm types**. The average number owned was **6** (95% CI: 4.2-7.9). (Cleveland et al., 2017)
- One third of Veteran firearm owners stored firearm **loaded and unlocked.** (Simonetti et al., 2018)
- Although some variation across studies, firearm ownership and storage practices were associated with **risky alcohol use**, and risk of **suicide.** (Smith et al., 2020; Goldberg et al., 2019; Simonetti et al., 2019)

Cleveland *et al. Injury Epidemiology* (2017) 4:33
DOI 10.1186/s40621-017-0130-y

Injury Epidemiology

American Journal of Preventive Medicine

RESEARCH ARTICLE

Suicide and

WILEY

RESEARCH ARTICLE

Understanding female veterans' experiences and perspectives of firearms

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Abstract

Objectives: Although firearms are the leading suicide means among female veterans, firearm research in this population remains limited. This study explored female veterans' firearm-related experiences and perspectives

Veteran Suicide

- Veterans are more likely to die from suicide, and **firearm suicide**, than non-Veterans.

Method of Suicide Among Veterans and Non-Veterans who Died from Suicide, 2018

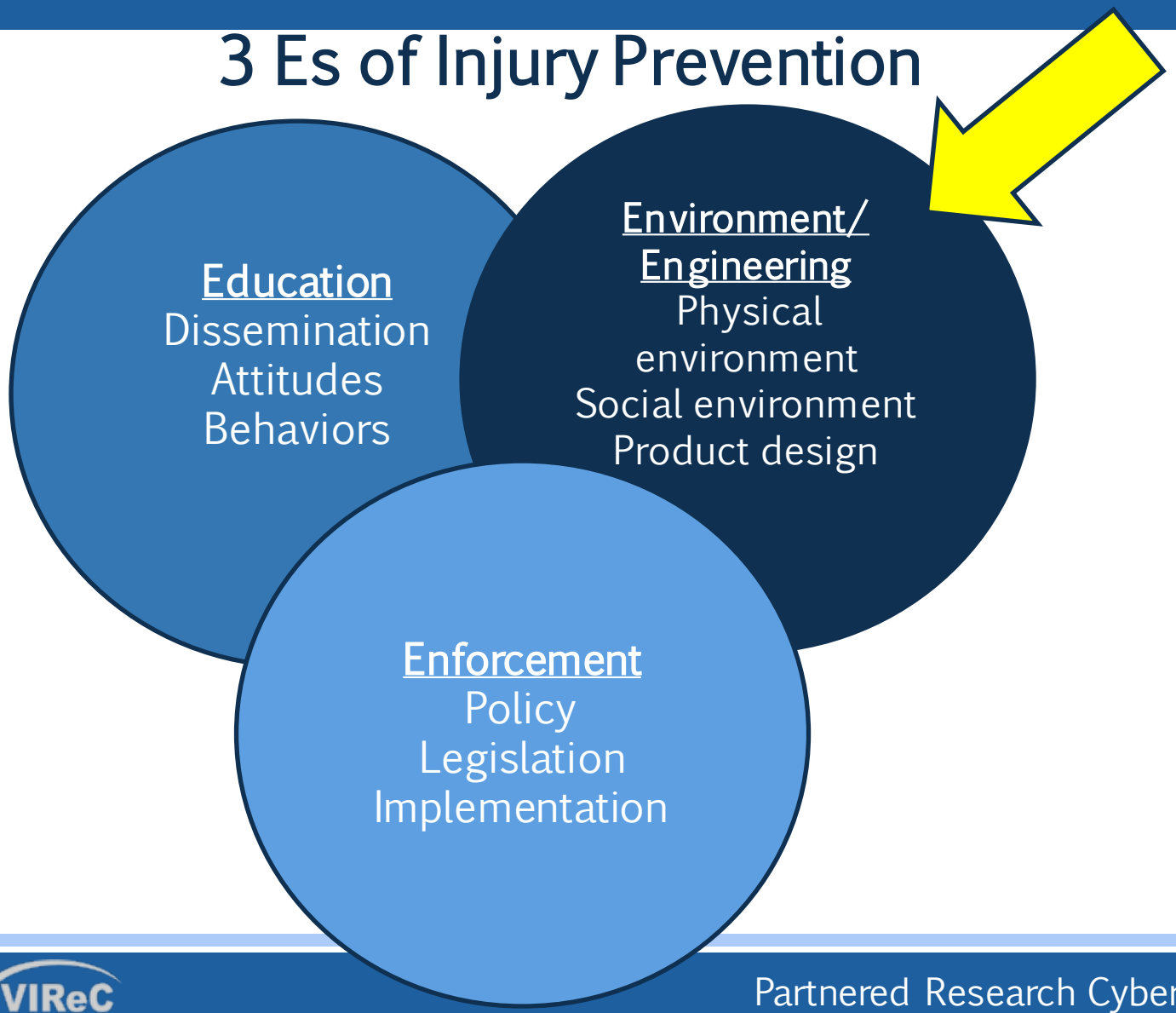
Method	% of non-Vet Suicide Deaths	% of Vet Suicide Deaths	% of Male Non-Veteran Suicide Deaths	% of Male Veteran Suicide Deaths	% of Female Non-Veteran Suicide Deaths	% of Female Veteran Suicide Deaths
Firearm	48.2	**68.2**	53.5	**69.4**	31.7	**41.9**
Poisoning	13.8	**9.5**	8.5	**8.5**	30.3	**31.6**
Suffocation	29.5	**17.1**	29.8	**16.9**	28.4	**20.3**
Other	8.5	**5.2**	8.2	**5.2**	9.6	**6.2**

Prevention of Veterans' Firearm Injuries

- Healthcare systems are initiating new efforts to address **firearm safety** with patients. (Simonetti & Brenner, 2020; Prater et al., 2021)
- VA programs are under development to improve communication with Veterans about means safety. (Valenstein et al., 2019; Dobscha et al., 2021; Newell et al., 2021; Fix & Linsky, 2021; Hoyt et al., 2021;
- *Suicide prevention is #1 priority!*

Prevention of Veterans' Firearm Injuries

3 Es of Injury Prevention



Haddon's Matrix/Strategies

Pre-event phase

1. Prevent the creation of the hazard
2. Reduce the amount of the hazard
3. Prevent the release of the hazard.

Event phase

4. Modify the rate or spatial distribution of the hazard
5. Separate in time or space the hazard from persons to be protected
6. Separate the hazard from persons to be protected by means of a mechanical barrier
7. Modify the hazard to reduce the potential for injury
8. Make what is to be protected more resistant to damage from the hazard

Post-event phase

9. Counter the damage that has already been done by the hazard
10. Stabilize, repair, and rehabilitate the damaged objects

Source: Roberts & Brasel, 2017

Prevention of Firearm Injuries among *Rural* Veterans

- >9 million Veterans use the VA healthcare system; 5.3 million rural/highly-rural.
- Knowledge gaps:
  - Veterans' nonfatal firearm injuries.
  - Differences in risk between those residing in urban versus rural regions.
    - Different access to healthcare, including trauma care.
    - Different experiences/cultures/relationships with firearms.
  - Differences in attitudes and beliefs about VA addressing firearm safety

Addressing the knowledge gaps…

- We are examining **firearm-related injuries** among Veterans receiving VA healthcare from 2010-present.
  - Firearm-related **deaths** from 2010-most recent data available
- We have compared Veterans in **US** to those in **Oregon** by **urban/rural residence** and **intent of injury**

METHODS

Step 1: Administrative Data Analysis

- Examining firearm injuries among all VA healthcare users, 2010-present
  - Current analyses based on 2010-2019
- Linking VA healthcare users to national mortality data repository
  - Current analyses based on 2010-2017
- Categorized Veterans' residence as **urban versus rural** based on RUCA coded zip codes

Step 2: Chart Review

- Identified firearm injury-related deaths, hospital stays, or outpatient encounters using **ICD cause-of-death or diagnosis codes** as used by the CDC.
- Conducting chart reviews to: 1) examine **circumstances** surrounding Veterans' firearm injuries, and 2) **evaluate the validity of using ICD codes** to identify true incident firearm injuries in VA encounters
  - Comparing chart review results to ICD-coded data by firearm injury (yes/no) and firearm injury intent (intentional [assault, self-harm], unintentional, legal intervention, undetermined)

RESULTS

Step 1: Administrative Data Results

- 9.0 million Veterans contributing 53.2 million Veteran-years.
- In Oregon, 144,091 Veterans contributing 898,846 Veteran-years.

Step 1: Administrative Data Results

- Nationally, on average, 23.6 Veterans per 100,000 Veteran-years had at least one firearm-related visit to a VA healthcare facility per year.

	Urban (n=33,016,353 Veteran-years)	Rural (n=20,185,967 Veteran-years)	Total US (n=53,202,320 Veteran-years)
Total Firearm Injuries	24.1	22.9	23.6
Intentional	9.3	7.5	8.6
Self-Inflicted	*3.7*	*4.3*	*3.9*
Assault	*5.5*	*3.1*	*4.6*
Unintentional	15.0	15.6	15.2
Undetermined	3.1	2.6	2.9

Step 1: Administrative Data Results

- Veterans in Oregon had a higher rate of firearm injuries than Veterans nationally.
  - 25.8 versus 23.6 per 100,000 Veteran-years.
- Rural Veterans had a higher rate than urban Veterans in Oregon, but not nationally.
  - Oregon: 29.3 versus 22.1 per 100,000 Veteran-years.
  - National: 22.9 versus 24.1 per 100,000 Veteran-years.

	Urban		Rural		Total US	
	US	Oregon	US	Oregon	US	Oregon
Total Firearm Injuries	24.1	22.1	22.9	29.3	23.6	25.8

Step 1: Administrative Data Results

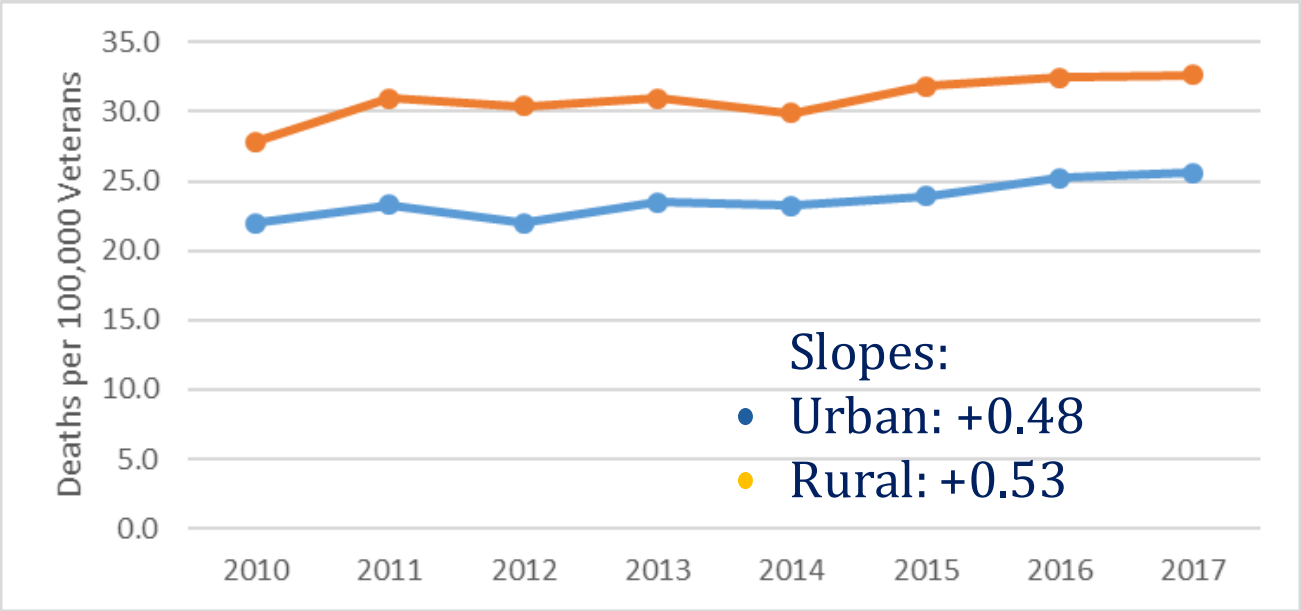
- Unintentional firearm injuries were treated more frequently, overall.
- Rates of unintentional injuries were substantially higher among rural than among urban Veterans in Oregon, but not nationally.
  - Oregon: 23.1 versus 15.6 per 100,000 Veteran-years.
  - National: 15.6 versus 15.0 per 100,000 Veteran-years.

	Urban		Rural		Total US	
	US	Oregon	US	Oregon	US	Oregon
Total Firearm Injuries	24.1	22.1	22.9	29.3	23.6	25.8
Intentional	9.3	7.2	7.5	6.2	8.6	6.7
Self-Inflicted	*3.7*	*4.3*	*4.3*	*4.1*	*3.9*	*4.1*
Assault	*5.5*	*3.1*	*3.1*	*1.7*	*4.6*	*2.1*
Unintentional	15.0	15.6	15.6	23.1	15.2	19.1
Undetermined	3.1	2.6	2.6	2.1	2.9	2.4

Step 1: Administrative Data Results

- 11,807 Veteran VA users died from firearm-related injuries (0.9% of all 1.2 million deaths), 2010-2017
- Nationally, on average, 26 per 100,000 Veteran VA users died each year from firearm-related injuries; rates were higher among rural-residing Veterans.

Rate of Firearm-related Deaths per 100,000 Veteran VA Users, 2010-2017



Step 1: Administrative Data Results

- In an analysis of death data, we found that Veterans with a previous firearm injury were **more likely to die from suicide** a year or more after their incident injury than Veterans without a treated firearm injury
  - **5.5%** of all Veterans treated for firearm injury vs. 1.1% of those who were not
    - OR = 5.1; 95% CI: 3.8-6.9
      - Rural Veterans: OR=5.6 (95% CI: 3.4-9.2)
      - Urban Veterans: OR = 3.8 (95% CI: 2.2-6.4)

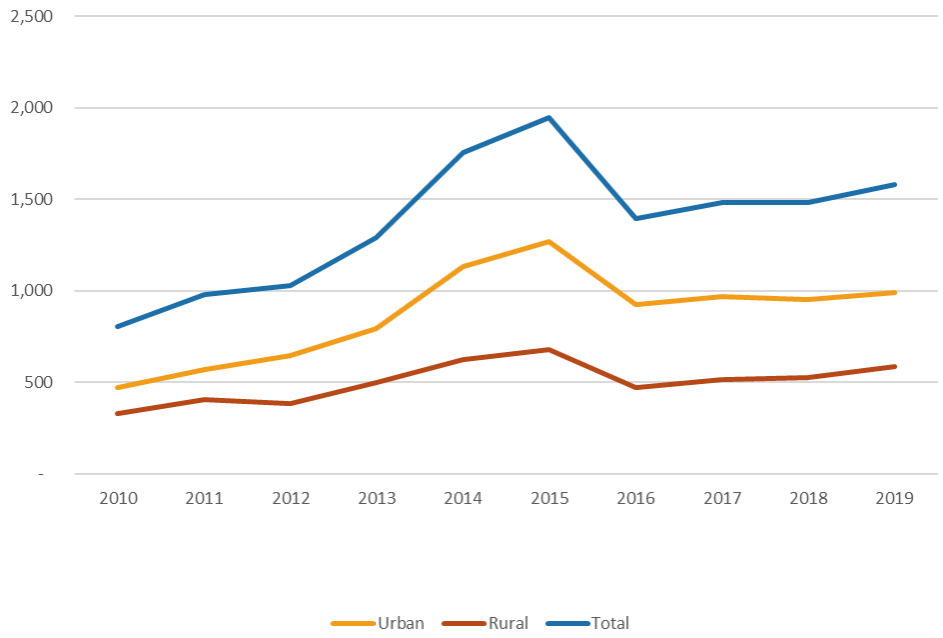
Step 2: Chart Review Results

- Reviewing EHR records of Veterans with ICD code for firearm injury

Number of unique Veterans with VA visits for a firearm injury, by year

Year	Urban	Rural	Total
2010	474 (5.4)	329 (6.6)	803
2011	571 (6.6)	407 (8.1)	978
2012	646 (7.4)	385 (7.7)	1,031
2013	792 (9.1)	497 (10.0)	1,289
2014	1,131 (13.0)	622 (12.4)	1,753
2015	1,267 (14.5)	680 (13.5)	1,947
2016	924 (10.6)	473 (9.4)	1,397
2017	969 (11.1)	515 (10.3)	1,484
2018	954 (10.9)	529 (10.5)	1,483
2019	989 (11.4)	589 (11.7)	1,578
Total	**8,717**	**5,026**	**13,743**

Number of Veterans with at least one firearm injury visit by calendar year.



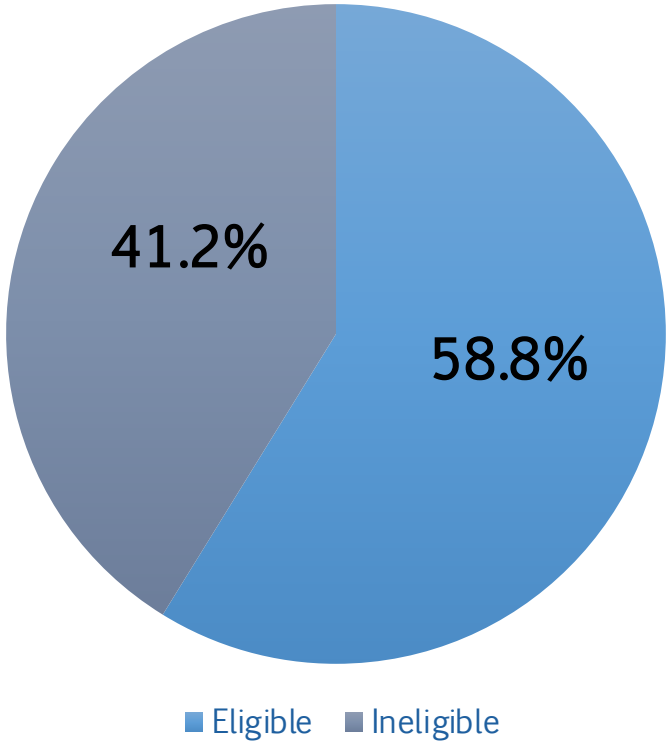
Step 2: Chart Review Results

- By ICD-coded firearm injury *intent*:

Number of unique Veterans with at least 1 firearm injury visit, by year						
	Urban			Rural		
Year	Intentional (n=3,323 visit-yrs)	Unintentional (n=5,516 visit-yrs)	Undetermined (n=1,124 visit-yrs)	Intentional (n=1,654 visit-yrs)	Unintentional (n=3,433 visit-yrs)	Undetermined (n=581 visit-yrs)
2010	281 (31.90)	163 (18.50)	78 (8.85)	167 (18.96)	140 (15.89)	52 (5.90)
2011	338 (30.02)	227 (20.16)	97 (8.61)	191 (16.96)	215 (19.09)	58 (5.15)
2012	363 (30.95)	284 (24.21)	87 (7.42)	181 (15.43)	204 (17.39)	54 (4.60)
2013	332 (22.51)	474 (32.14)	103 (6.98)	185 (12.54)	306 (20.75)	75 (5.08)
2014	301 (15.28)	867 (44.01)	108 (5.48)	146 (7.41)	492 (24.97)	56 (2.84)
2015	323 (14.77)	983 (44.98)	111 (5.08)	149 (6.81)	547 (25.01)	74 (3.38)
2016	353 (22.22)	598 (37.63)	105 (6.61)	138 (8.68)	345 (21.71)	50 (3.15)
2017	367 (21.61)	640 (37.69)	112 (6.60)	157 (9.25)	380 (22.38)	42 (2.47)
2018	322 (18.89)	652 (38.24)	145 (8.50)	165 (9.68)	377 (22.11)	44 (2.58)
2019	343 (18.77)	628 (34.37)	178 (9.74)	175 (9.58)	427 (23.37)	76 (4.16)

Step 2: Chart Review Results

- In Oregon, among 307 completed EHR reviews, only 180 **(59%)** met eligibility criteria:



Reason Ineligible	n	%
Injury occurred before 2010	109	35.5
Injury occurred during military service	59	19.2
No firearm injury occurred	45	14.7
Did not occur or treated in Oregon	*16*	*5.2*
Not powder gun injury	*10*	*6.0*

Step 2: Chart Review Results

- Most (76.5%) first treated at **non-VA** ED/trauma center
  - 19.8% first treated in VA ED or other setting
- 3 Veterans died en route to hospital (2 self-directed; 1 unintentional injury)
- 8 Veterans died while hospitalized (7 self-directed; 1 legal intervention)
- 90 (53.9%) Veterans admitted to the hospital
    - Lengths of stay: mean = 6.5 (median = 2) days

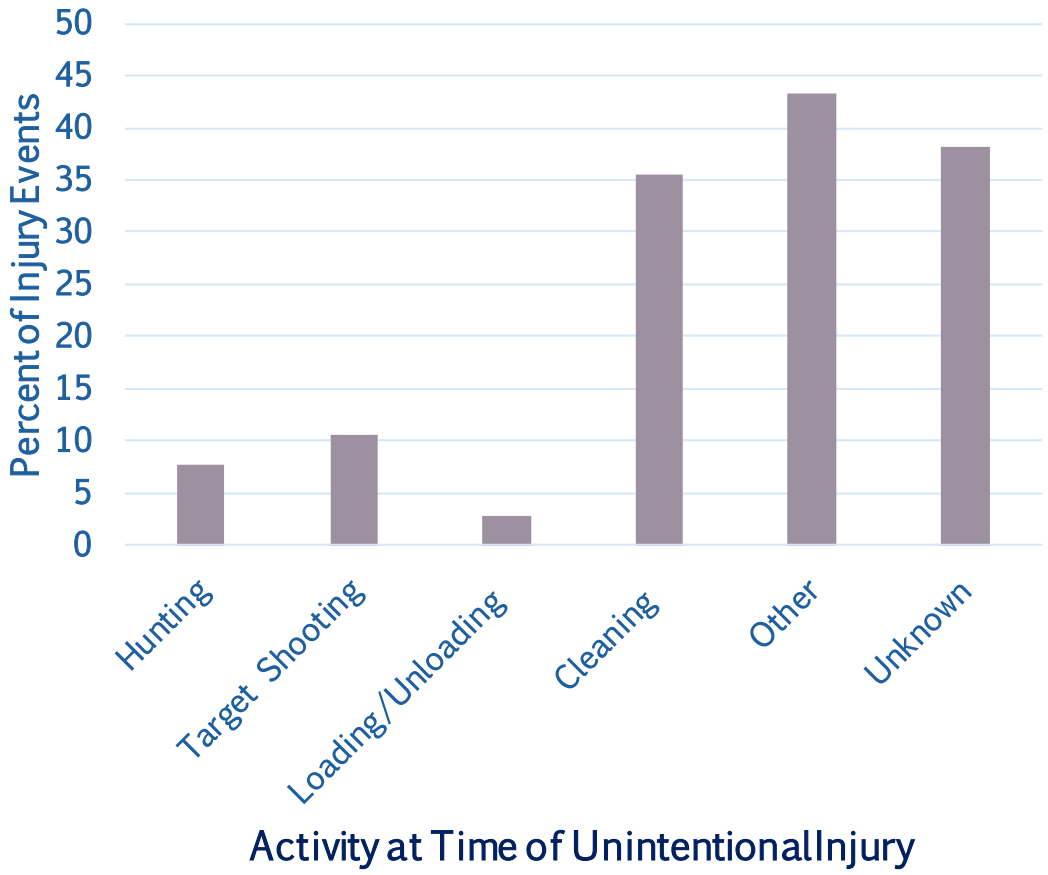
Step 2: Chart Review Results

- Overall, **x% concordance** between ICD codes and chart reviews by injury intent:

		EHR Chart Reviews (n=165)				
		Self-Inflicted	Assault	Unintentional	Legal Intervention	Undetermined/ Unknown
ICD codes	Self-Inflicted	7	0	0		0
	Assault	0	1	1		0
	Unintentional	6	9	51		3
	Legal Intervention					
	Undetermined	2	3	5		1
	Total	33 (20.3)	13 (8.0)	103 (63.2)	7 (4.3)	9 (5.4)

Step 2: Chart Review Results

- According to the EHR, 35.6% of coded unintentional injuries occurred when Veterans were cleaning their firearms.
- Included *unintentionally pulled the trigger, thought firearm was unloaded*, and *firearm malfunctioned*



Step 2: Chart Review Results

Veteran states he forgot to take his handgun out of his pocket when he got in the car. He then pulled the gun out and it accidentally discharged down into his lower abdomen/pelvic area while he was in a sitting position.

Unpacking, sleeping bag fell and firearm in the bag dropped and discharged, injuring Veteran in the thigh. Entrance and exit wounds – bullet lodged in Veteran's ceiling.

Cleaning wife's .22 caliber pistol. Discharged and injured Veteran in the arm.

Step 2: Chart Review Results

- 29 (17.6%) Veterans were referred to **mental health care** (20 self-directed; 1 unintentional)
- 19 (11.5%) EHRs documented **firearm safety intervention** at the time of or after injury treatment (11 self-directed; 8 unintentional)

Step 2: Chart Review Results

Intervention took place in hospital during follow-up visit to hospital shortly after incident. Gun safety

Patient's doctor had a co abo w

Discharge note states sister had taken poss of shotgun. Brother-in-law removed other rif pistol so house does not have firearms u patient's discharge. About 6 weeks after dis during outpatient appt VA social worker and isis safety plan.

VA provider and spouse discussed presence of firearms in home as part of Caregiver Program In-Home Assessment (about 2 weeks after injury, prior to patient being discharged from inpatient psychiatric program). Spouse/caregiver was recommended to search home for other weapons/firearms or knives.

ED provider counseled patient about gu ED (Info foun scanned r

VA provider and spouse di firearms in home as part c In-Home Assessment (a injury, prior to patient bei inpatient psychiatric program). Spouse/caregiver was recommended to sear home for other weapons/firearms or knives

VA Case Management note about 1 week after injury states that patient reported the firearm was separated

Psych Social Work completed safety evaluation prior to discharge (likely bedside) and confirmed with patient's mom that all firearms were removed from home by police.

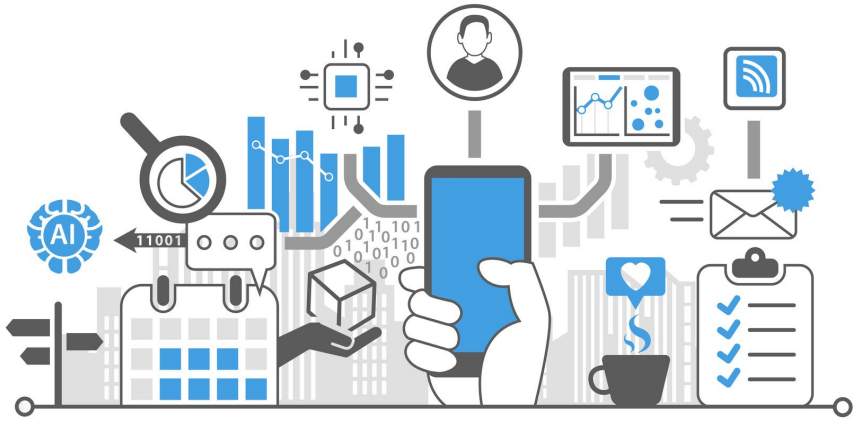
CONCLUSIONS

Take-homes

- Nationally, **rural Veterans** have higher rates of firearm-related deaths than urban Veterans
- In Oregon, rural Veterans seek VA healthcare for firearm injuries, and particularly for **unintentional firearm injuries**, at a higher rate than urban-residing Veterans.
- Firearm injury treatment strongly associated with subsequent **death by suicide**.
- Comprehensive (e.g., 3Es or Haddon's Strategies) firearm risk reduction programs are needed for implementation across both rural and urban VA settings.

Next-steps

- National chart reviews
- Improved firearm injury detection
- Site-specific risk reduction programs
  - Multiple partners
  - Community engagement
  - Experimental design
- DIPEx modules (www.healthexperiences.org)



Lethal Means Safety Counseling – Our research

- We will interview 100 Veterans and 80 health care provides at 10 sites across the country that have high rates of firearm injuries
- 8 will be in rural regions; 2 in urban areas
- Health care providers will be asked about their current firearm safety counseling practices, the difficulties they face when providing counseling, and ways to make it easier and more effective
- Veterans will be asked to share their perspectives about firearm safety counseling and ways to increase its acceptability and effectiveness

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Additional Resources

VIReC Options for Specific Questions

HSRData Listserv

- Community knowledge sharing
- ~1,400 VA data users
- Researchers, operations, data stewards, managers

– Subscribe by visiting https://vaww.virec.research.va.gov/Support/HSRData-L.htm (VA Intranet)

HelpDesk

- Individualized support

virec@va.gov

Quick links for VA data resources

Quick Guide: Resources for Using VA Data:
http://vaww.virec.research.va.gov/Toolkit/QG-Resources-for-Using-VA-Data.pdf (VA Intranet)

VIReC: http://vaww.virec.research.va.gov/Index.htm (VA Intranet)

Archived cyberseminar: *Meet VIReC: The Researcher's Guide to VA Data*
https://www.hsrd.research.va.gov/for_researchers/cyber_seminars/archives/video_archive.cfm?SessionID=3916&Seriesid=22

VIReC Cyberseminars (overview of series and link to archive):
http://www.virec.research.va.gov/Resources/Cyberseminars.asp

VHA Data Portal (data source and access information):
http://vaww.vhadataportal.med.va.gov/Home.aspx (VA Intranet)

Quality Enhancement Research Initiative (QUERI): https://www.queri.research.va.gov

QUERI Implementation Network Archived Cyberseminars:
_https://www.hsrd.research.va.gov/cyberseminars/catalog-archive.cfm?SeriesSortParam=y&SeriesIDz=83

Implementation Research Group (IRG) Archived Cyberseminars:
https://www.gotostage.com/channel/implementresearchgrpchristinekowalski

Center for Evaluation and Implementation Resources (CEIR): https://www.queri.research.va.gov/ceir/default.cfm