

Leveraging VA and State Data to Examine Veterans' Injury: TBI, Opioids, and Guns

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Introduction

Poll Question #1

What is your affiliation with the VA CDA Program?

- Have not heard of the CDA program before
- Interested in applying for a CDA, but have not yet applied
- In the process of applying for a CDA
- Currently have a CDA
- Previously had a CDA
- Other

Poll Question #2

What is your primary training/discipline?

- Medicine
- Psychology
- Other clinical
- Epidemiology
- Sociology
- Other social science
- Other discipline not specified

Leading Causes of Death in the U.S.

1. Heart Disease
2. Malignant Neoplasms
3. Cerebrovascular Disease
4. Chronic Obstructive Pulmonary Disease
5. Unintentional Injury
6. Alzheimer's Disease
7. Diabetes Mellitus
8. Kidney Disease
9. Influenza and Pneumonia
10. Suicide

Leading Causes of Death in the U.S.

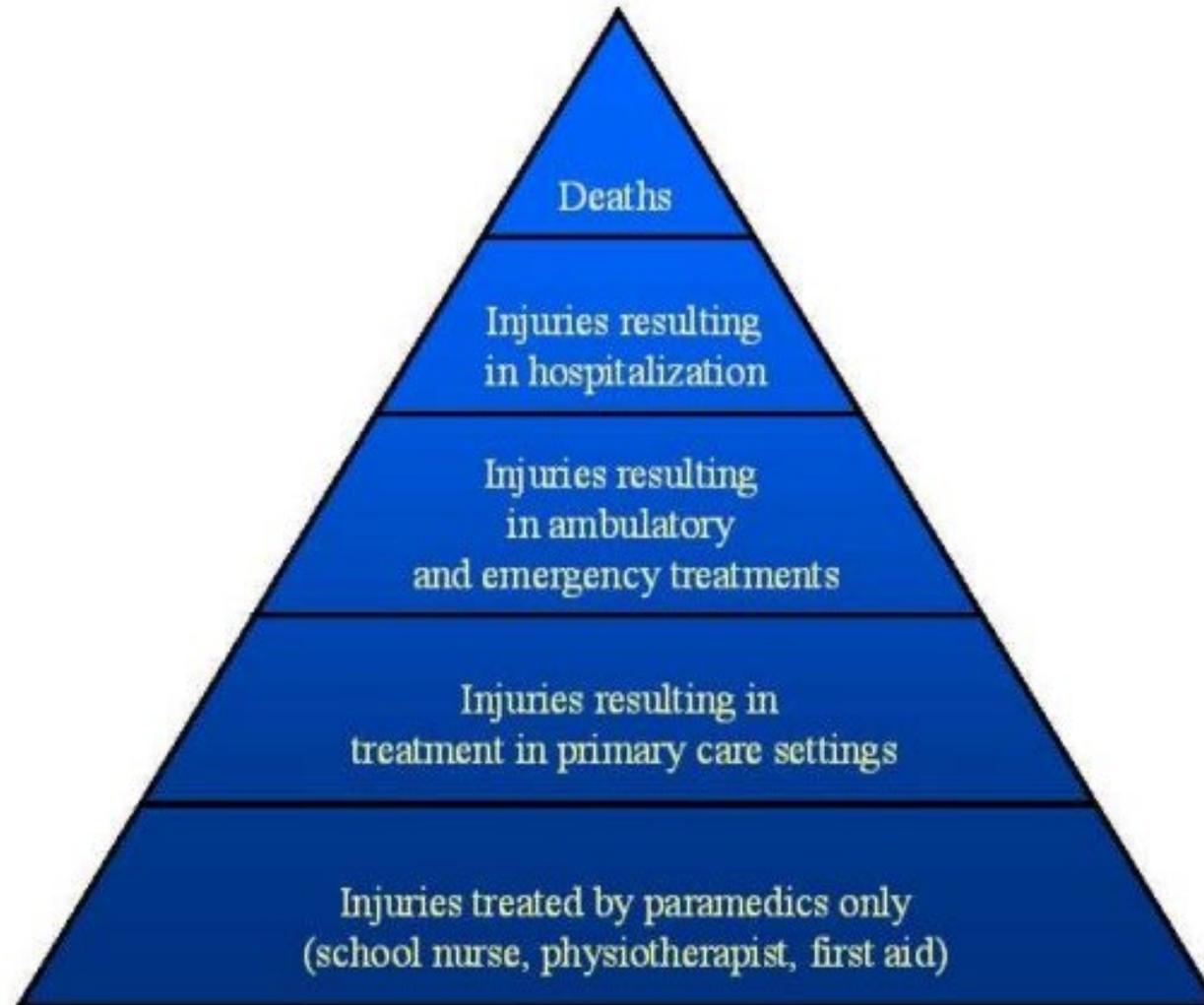
Ages 1 – 44 Years

1. Unintentional Injury
2. Malignant Neoplasms
3. Suicide
4. Heart Disease
5. Homicide
6. HIV
7. Liver Disease
8. Cerebrovascular Disease
9. Diabetes
10. Congenital

Ages 45+ Years

1. Heart Disease
2. Malignant Neoplasms
3. COPD
4. Cerebrovascular Disease
5. Alzheimer's Disease
6. Unintentional Injury
7. Diabetes Mellitus
8. Influenza and Pneumonia
9. Kidney Disease
10. Septicemia

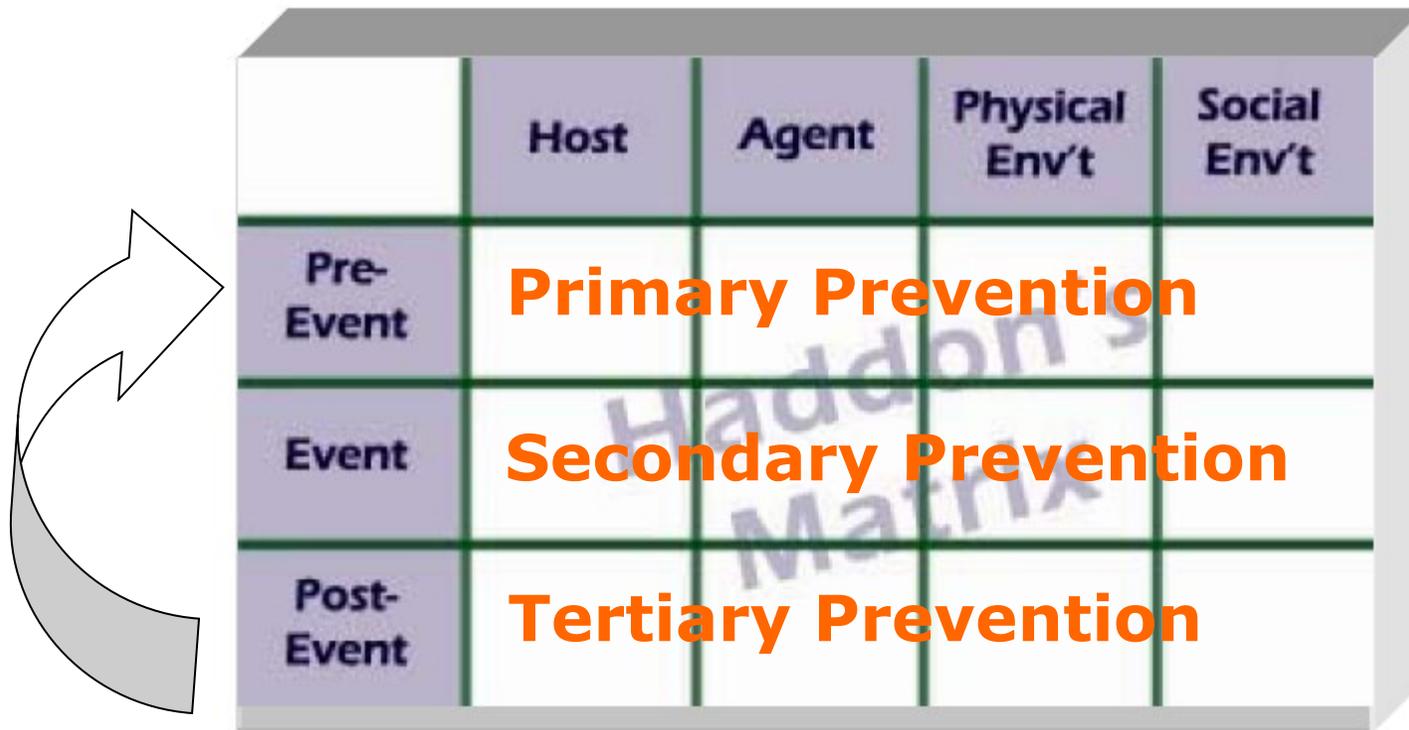
Injury-related Deaths vs. Inpatient and Outpatient Care



Injury Prevention & Control

Injuries are *not* Accidents!
(... *not even in combat*)

Injury Prevention & Control



Studying Veterans' Injuries

Traumatic Brain Injury

Traumatic Brain Injury in the War Zone

Susan Okie, M.D.

Related article, page 2121

An interview with Dr. Okie can be heard at www.nejm.org.

Sergeant David Emme, a supply officer with a U.S. Army Stryker Brigade, was stationed at a submachine gun on a truck rolling through northern Iraq last November, in a convoy transporting Iraqi volunteers to Mosul for military training. As they entered the town of Talafar, Emme noticed that the streets were unusually quiet: no children were outdoors running toward the vehicles demanding sweets. Emme got on the radio and warned others in the convoy: "Something might happen. They might have some plan for us." Moments later, as they slowed at a traffic circle, an improvised explosive device (IED) went off right next to Emme's truck, knocking him out.

Emme's version of what happened next is patched together, from his own memories and what others told him later. "I remember waking up and wondering who the hell I was, where the hell I was, and why can't I see or hear? My soldier was screaming for me to get out of the truck and I told him no, because it hurt too much. So he literally threw me out of the truck and guided me to a Stryker," a light-weight armored vehicle.

The blast wave and fragments from the explosion had blown out Emme's left eardrum, fractured his skull, injured his left eye, and caused a severe contusion in the left frontotemporal area of his brain. His fellow soldiers rushed him to the nearby military base, where he partially regained his vision



Sergeant David Emme.

Jonathan Ernst

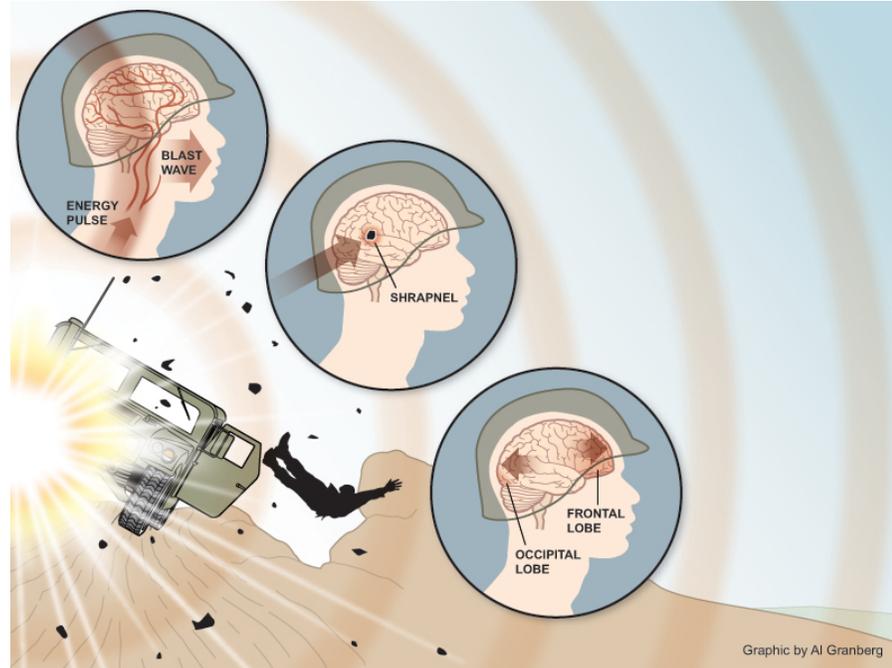
"The next time I come to, I'm at Walter Reed — like, 10 days later," he recalled.

Emme spent about six days in the intensive care unit, sometimes mistaking nurses for CIA agents or believing he was back in Baghdad. Then he was transferred to a room in ward 58, the neuroscience unit at Walter Reed Army Medical Center in Washington, D.C. At some point, he became alert enough to realize that he was having difficulty speaking.

"I called for the nurse. . . . I kept on just trying to say something, but I couldn't really say anything," Emme recalled. The nurse asked him questions and waited patiently for him to answer. Finally, she left to check on other patients. About a half hour later, she returned, and Emme managed

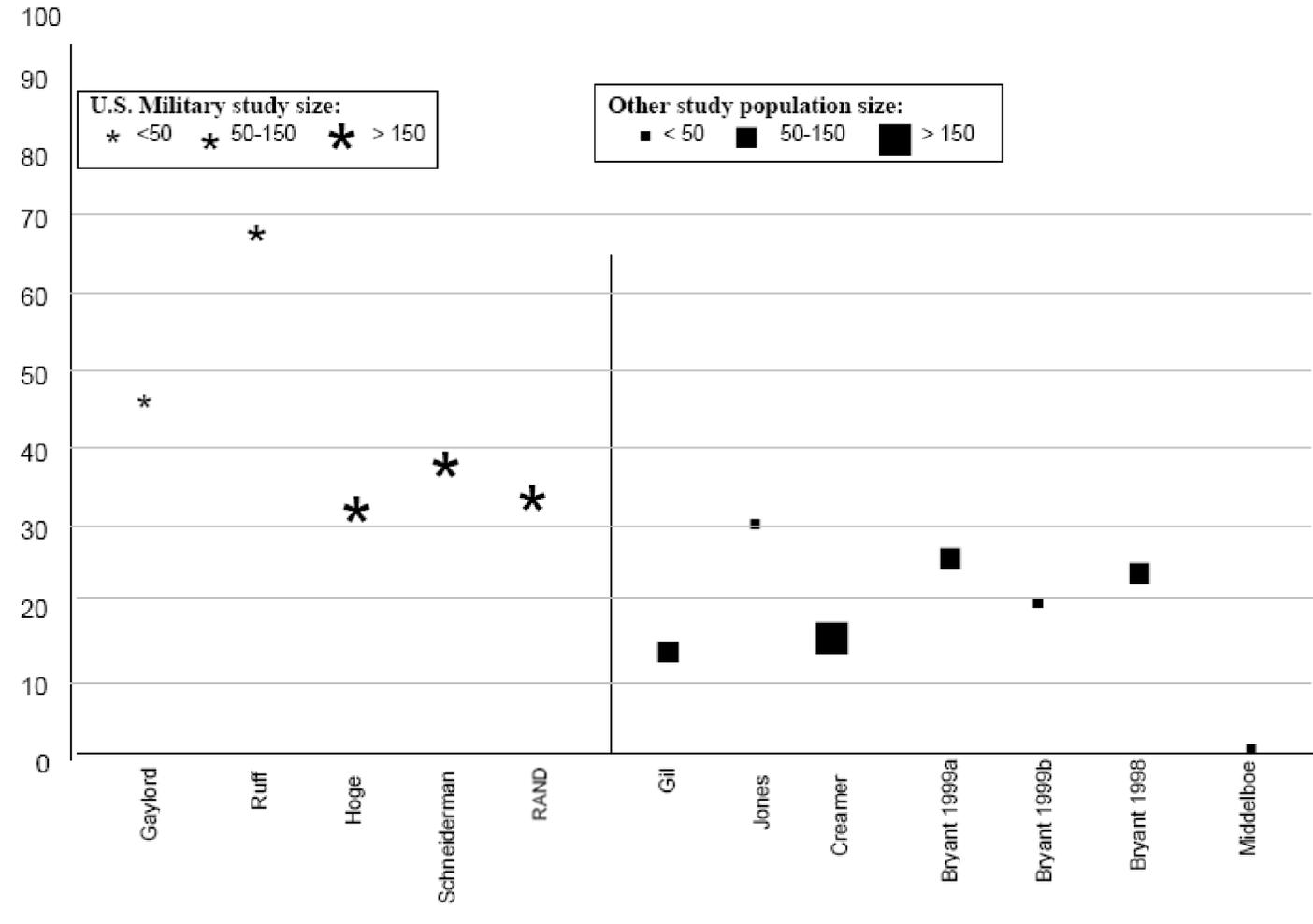
Source: Okie S., NEJM, 352(20): 2043-2047, 2005

Traumatic Brain Injury



- Estimated that about 20% of OEF/OIF/OND Veterans incurred TBI (Rand, 2008)

Traumatic Brain Injury and Posttraumatic Stress Disorder



Relative Risk of Psychiatric Diagnosis by TBI Screening Status in VISN 23 Veterans, 2009

Diagnoses	Negative Screen (n = 10,992)	Positive Screen (n = 2,278)	RR (95% CI)
	%	%	
Any	42.1	86.0	2.0 (1.99-2.10)*
Anxiety Disorders	13.5	28.0	2.1 (1.9-2.3)*
Adjustment Disorders/ Stress Reactions	13.5	27.0	2.0 (1.8-2.2)*
PTSD	18.6	62.5	3.4 (3.2-3.5)*
Depression	22.0	44.8	2.0 (1.9-2.2)*
Substance Use Disorders	8.9	20.9	2.3 (2.1-2.6)*
Psychoses	0.6	1.3	2.1 (1.3-3.1)*
Other	11.2	44.4	4.0 (3.7-4.2)*
2+ Diagnoses	25.7	66.8	2.6 (2.5-2.7)*

Relative Risk of Psychiatric Diagnosis by TBI Diagnosis in VISN 23 Veterans, 2009

Diagnoses	No TBI Diagnosis (n = 1,437)	TBI Diagnosed (n = 841)	RR (95% CI)
	%	%	
Any	83.1	91.0	1.1 (1.06-1.13)*
Anxiety Disorders	23.2	36.2	1.6 (1.4-1.8)*
Adjustment Disorders/ Stress Reactions	22.1	35.3	1.6 (1.4-1.8)*
PTSD	61.5	64.3	1.0 (0.98-1.12)
Depression	43.6	46.7	1.1 (0.98-1.18)
Substance Use Disorders	18.4	25.0	1.4 (1.2-1.6)*
Psychoses	1.0	1.9	2.0 (0.96-3.98)
Other	35.0	60.4	1.7 (1.6-1.9)*
2+ Diagnoses	62.2	74.7	1.2 (1.1-1.3)*

Using ICD-9-CM Diagnosis Codes to Examine TBI

	CDC series¹	VA Series²	VA-Plus Series³
	%	%	%
Accuracy/Concordance	67.7	75.3	75.0
Sensitivity	55.4	70.3	71.8
Specificity	85.4	82.4	79.5

1. ICD-9 codes included 800.xx-801.xx, 803.xx-804.xx, 850.xx-854.xx, and 959.01.

2. ICD-9 codes included those in the CDC series, plus 905.0, 907.0, 950.1-950.3, 310.2, V15.52, and 959.9.

3. ICD-9 codes included those in the VA series, plus 310.0, 310.1, 310.8, 310.9, 780.0x, 802.xx, 830.xx, 873.xx, 908.3, 910.xx, 920.xx, and 959.8.

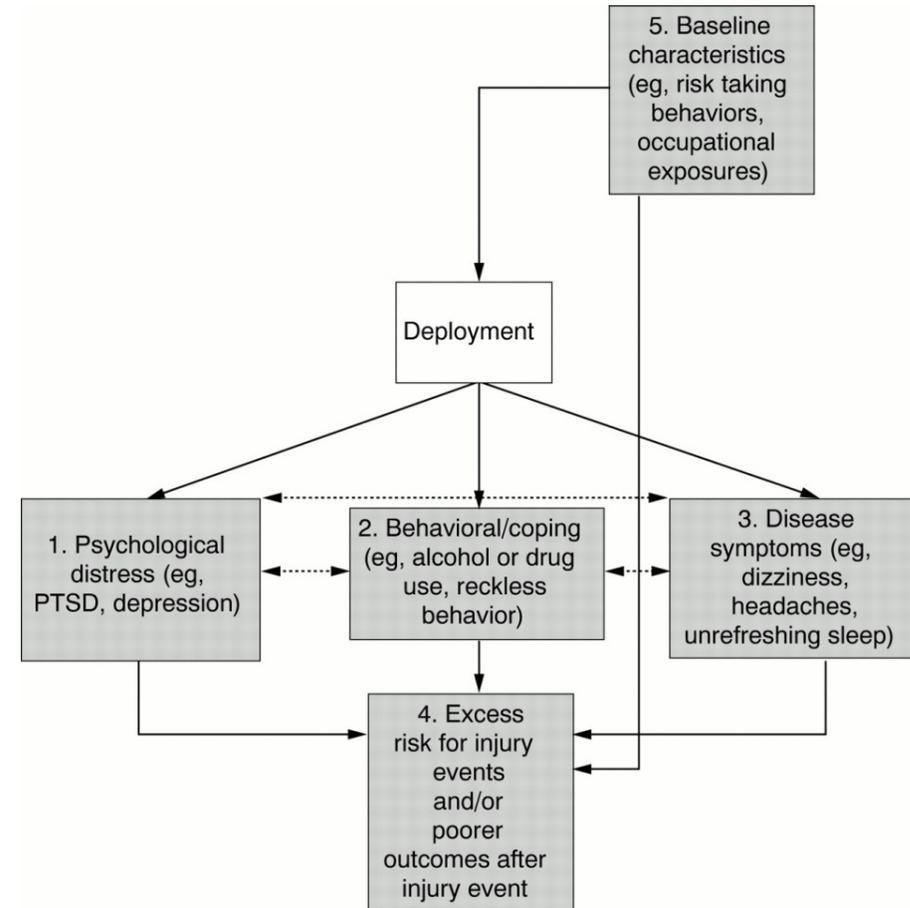
Ongoing TBI-related Research

- Implementation of PTM: **“Chronic Tinnitus among Veterans with and without TBI: Service Needs and Interests”** (RR&D SPiRE)
- TBI and Opioids: **“Effects of Opioid and Other Psychotropic Drug Exposures on Long-term Outcomes of TBI: Developing Measurement Best Practices”** (RR&D SPiRE)
- Epidemiology of TBI: **“Longitudinal Effects of Mild TBI and Other Military Exposures on Auditory Functioning in Recently-Discharged Veterans and Active Duty Service Members: CENC Study 1”** (DoD/VA CSR&D; CENC PI: Cifu; Study 1 PI: Walker)
- TBI and Community Care: **“Community Care Utilization among Post-9/11 Veterans with Traumatic Brain Injury”** (HSR&D IIR Application)

Preventing Veterans' Injuries

Increased Risk of Fatal Injury among Post-deployment Veterans

- Post-deployment Veterans have ~20% increased risk of fatal injury in the first 5 years after deployment
- Mostly *unintentional*
- Mostly motor vehicular



Source: Bell et al., Inj Prev, 2001

Public Health Model

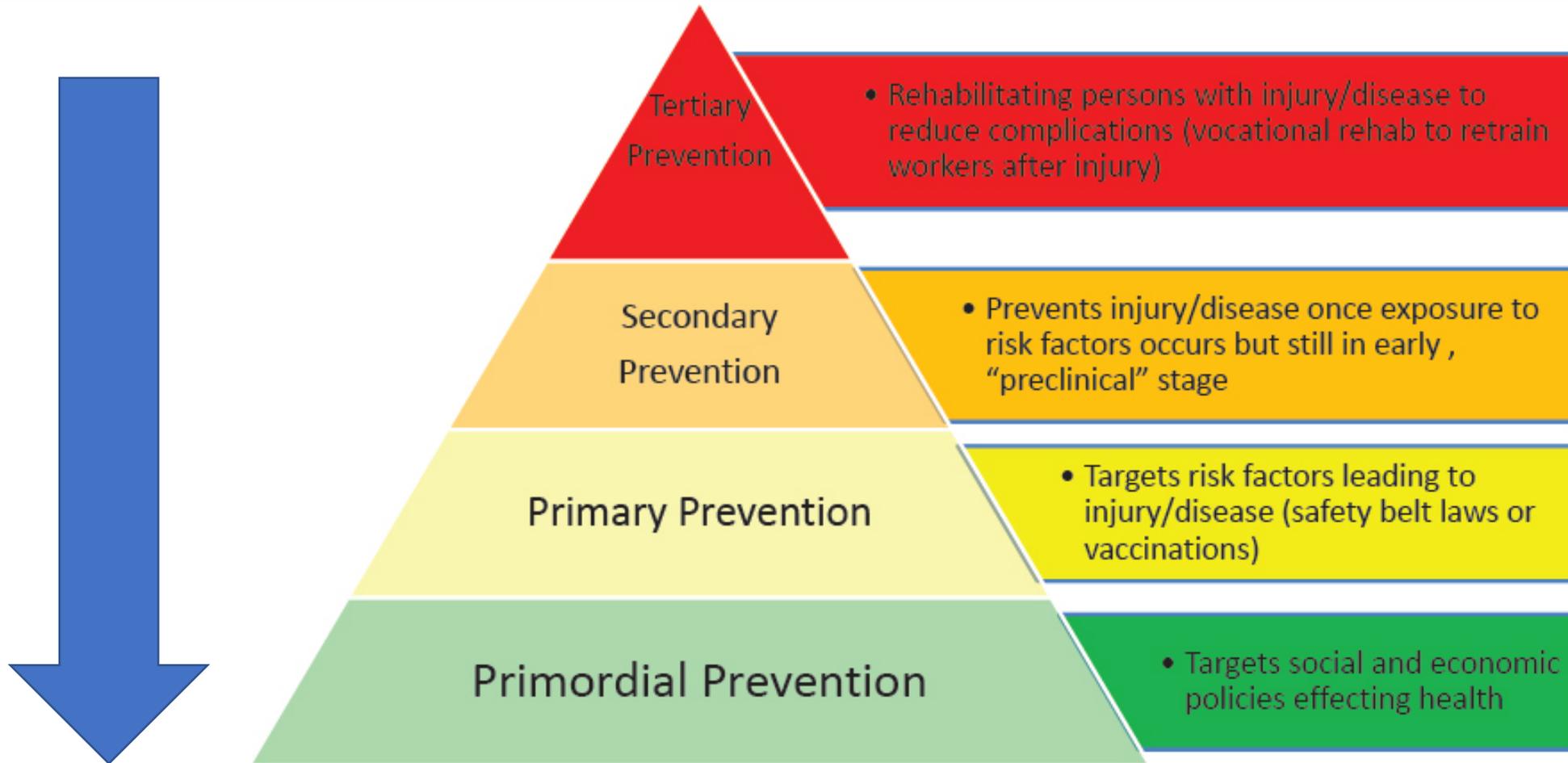


Image: Eisenman D. (2017) In National Academies Press, "Countering Violent Extremism through Public Health Practice: Proceedings of a Workshop."

Correlates of Post-deployment Injury among Veterans

VARIABLE	INJURED (n = 348)		NOT (n = 394)		BIVARIATE MODEL	MULTI-V MODEL
	n	(popn%)	n	(popn%)	OR (95% CI)	OR (95% CI)
<u>Screening Measures</u>						
PTSD screen						
Positive	169	(52.0)	120	(32.5)	2.2 (1.4-3.5)	2.1 (1.3-3.5)
Negative	179	(48.0)	274	(67.5)	Referent	Referent
Drug/Alcohol Screen						
Positive	139	(44.0)	119	(32.8)	1.6 (1.0-2.5)	1.5 (0.9-2.5)
Negative	209	(56.0)	275	(67.2)	Referent	Referent
<u>Self-reported Diagnoses</u>						
PTSD						
Yes, diagnosed	145	(42.1)	91	(24.1)	2.3 (1.4-3.6)	1.8 (1.1-3.1)
Not diagnosed	197	(57.9)	300	(75.9)	Referent	Referent

Source: Bell et al., Inj Prev, 2001

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Correlates of Post-deployment Injury among Veterans

VARIABLE	INJURED (n = 348)		NOT (n = 394)		BIVARIATE MODEL	MULTI-V MODEL
	n	(popn%)	n	(popn%)	OR (95% CI)	OR (95% CI)
<u>Self-reported Diagnoses</u>						
Traumatic brain injury						
Yes, diagnosed	18	(6.3)	12	(2.3)	2.8 (1.0-8.0)	1.5 (0.5-5.1)
Not diagnosed	328	(93.7)	379	(97.7)	Referent	Referent
Depression						
Yes, diagnosed	154	(40.9)	79	(18.6)	3.0 (1.9-4.9)	3.4 (1.7-6.6)
Not diagnosed	191	(59.1)	314	(81.4)	Referent	Referent
<u>Receipt of MH Therapy</u>						
Yes, currently	99	(28.0)	50	(13.0)	3.3 (1.8-5.8)	1.9 (0.8-4.5)
Yes, in the past	118	(30.4)	112	(23.9)	1.9 (1.2-3.2)	1.2 (0.6-2.4)
No	129	(41.6)	230	(63.1)	Referent	Referent

Source: Bell et al., Inj Prev, 2001

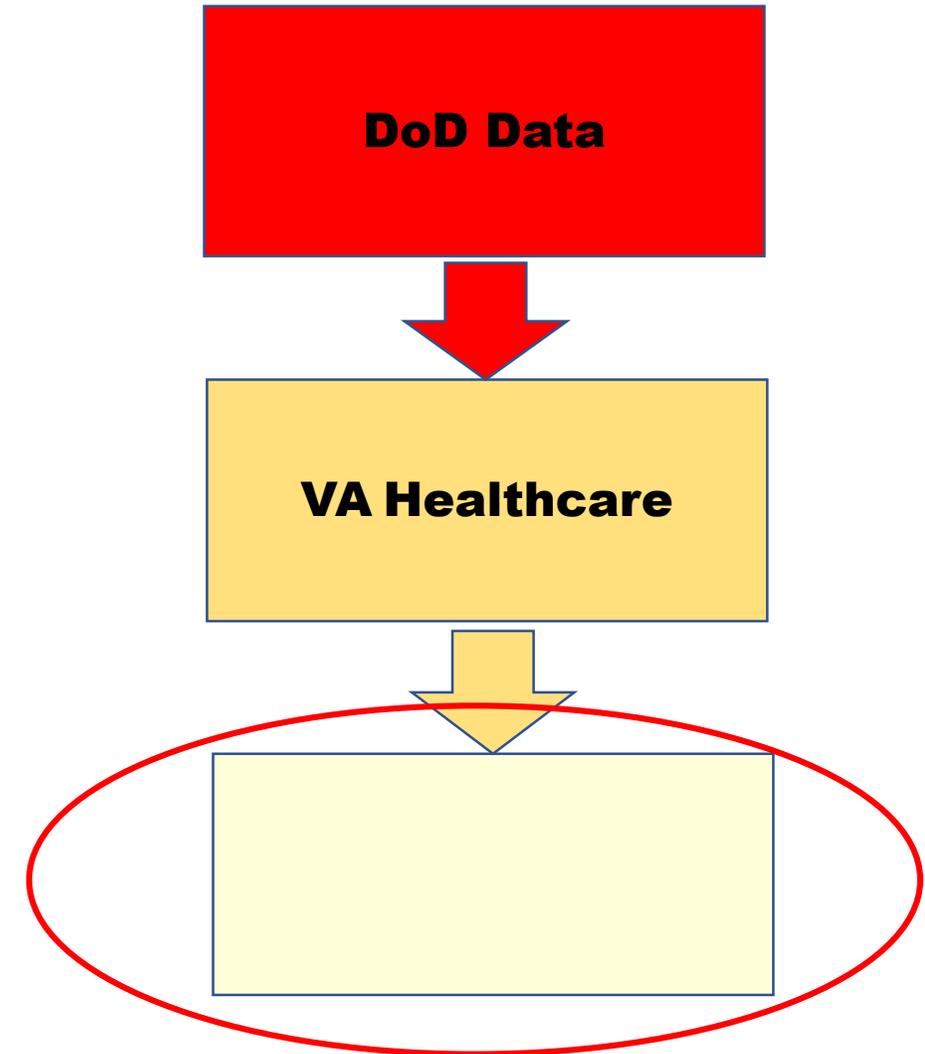
Association between TBI Diagnoses and Inpatient Stays for MVC

	Unadjusted Model	Adjusted Model
VARIABLE	HR (95% CI)	HR (95% CI)
TBI diagnosis	5.6 (4.5-6.9)	4.2 (3.3-5.3)

- Veteran VA users diagnosed with TBI in the first year after deployment were four times more likely to be hospitalized for MVC in 5 years' follow-up than those without TBI diagnoses

Public Health and Veterans

- How we can move farther upstream when we may only have VA data?
- If we could combine health data systems, we could make meaningful comparisons:
 - Veterans to non-Veterans
 - Veterans with certain characteristics (or VA users with certain characteristics) to those without



Public Health Data Systems

- Infectious disease surveillance
- Cancer registries
- Exposure registries
- Behavioral risk factors
- Ambulatory care
- Emergency care/syndromic surveillance
- Medical marijuana
- Medicaid/Medicare

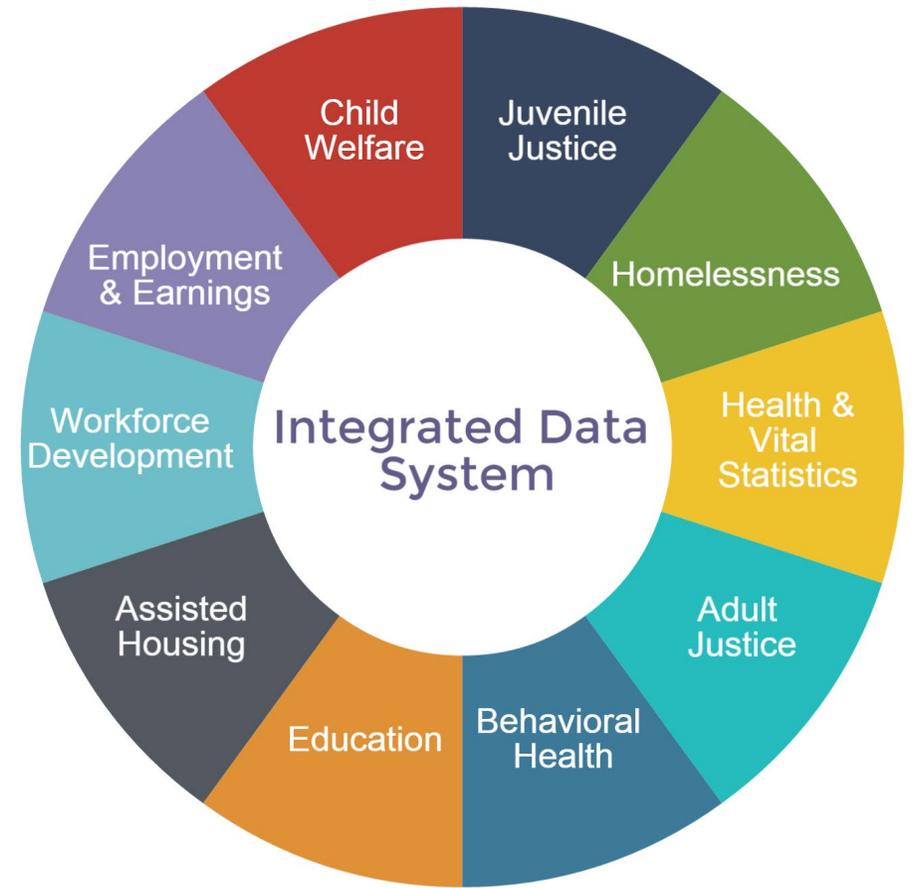


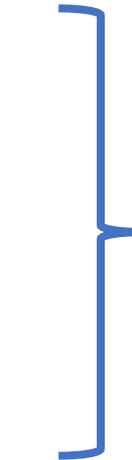
Image: University of Pennsylvania (2018) "Integrated Data Systems" <https://www.aisp.upenn.edu/integrated-data-systems>

Public Health Data Systems

- Vital records
- Violent death reporting system
- DMV/DOT
- Trauma registry
- Hospital discharge data
- Emergency services
- Prescription drug monitoring program (PDMP)



Fatal Outcomes



**Nonfatal
Outcomes/Risk
Factors**

Opioids and Guns as Sources of Veterans' (Preventable) Injuries

TRAUMA
ADDICT PAINKILLERS OPIOID
PTSD
PRESCRIPTION DRUG ADDICTION PHARMACEUTICALS DEATH
PAIN RELIEF OPIOID EPIDEMIC ADDICTIVE
MENTAL HEALTH DRUG ADDICT
OPIOID ABUSERS
DEPENDENCE CHILD ABUSE EMOTIONAL ABUSE
OPIOID ADDICTION PILLS OVERDOSE PAIN
IMPULSIVE BE

Image: <https://www.texasmedclinic.com/prescription-opioid-addiction/>

Veteran Opioid Prescribing and Overdose Risk

- Veterans who use VA healthcare have **twice the risk** of fatal drug overdose than non-Veterans.¹
- Large proportions of Veterans receive long-term opioid therapy (LTOT) for chronic pain.^{2,3}
- Among Veterans on LTOT, high proportions also receive BZDs.^{2,3}
- **Veterans receiving LTOT and/or BZD within VA may also receive opioid and/or BZD prescriptions from non-VA prescribers.**
- Post-9/11 Veterans frequently diagnosed with pain, receive high levels of opioids, and prevalent concurrent opioid/benzodiazepine use.^{3,4}

¹ Bohnert et al., Med Care 2011.

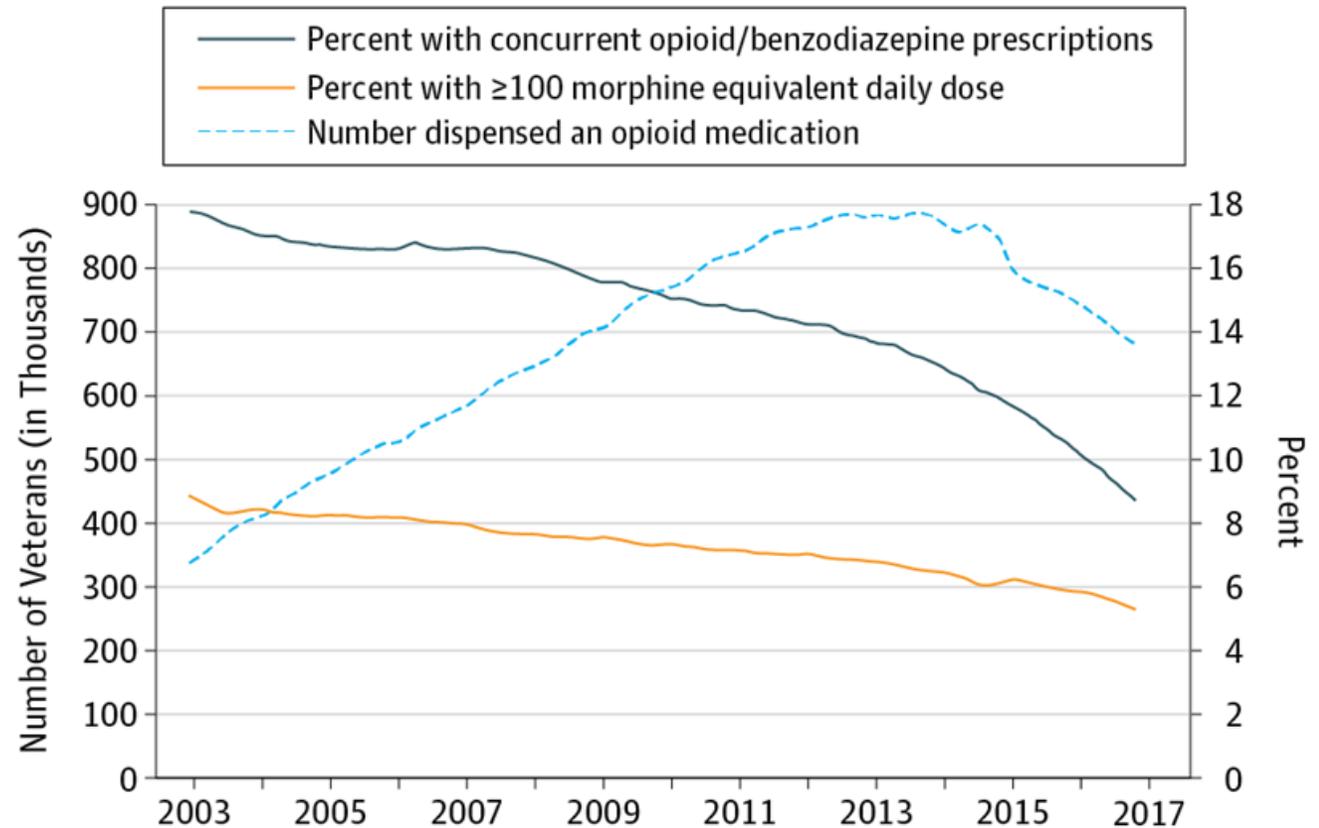
² Dobscha et al., Clin J Pain 2011.

³ Seal et al., JAMA 2012.

⁴ Macey et al., Pain Med 2011.

VA Opioid Safety Initiative

- Multifaceted approach to decrease unsafe opioid prescribing practices
- Nationally, between 2012 and 2014¹:
 - 16% reduction in the number of Veterans receiving MMEs >100
- Between 2012 and 2016²:
 - 25% reduction in Veterans receiving opioids; 36% reduction in Veterans receiving MMEs >100; 47% reduction in co-prescribed opioids/benzodiazepines



¹ Lin et al., Pain, 2017

² Gellad et al., JAMA, 2017

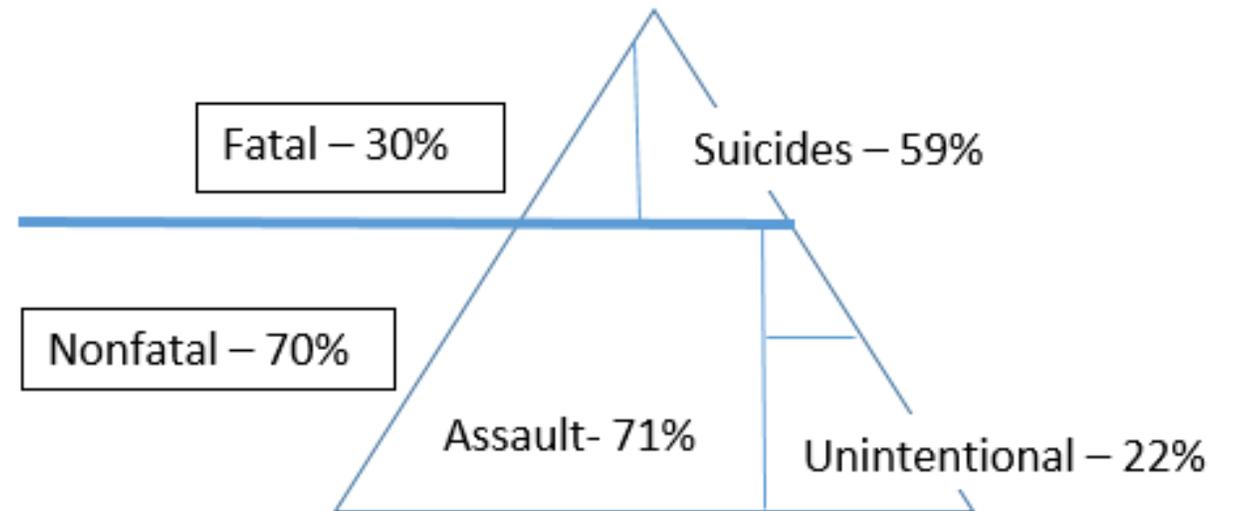
Research Questions

- What proportions of Veterans are receiving opioids, benzodiazepines, or other psychotropic medications from **both VA and non-VA healthcare providers**?
- Are there higher risk subgroups?
- How does the **Veterans Choice Program** (MISSION Act) affect VA/non-VA medication overlap?
- Are dual system users at greater risk of **adverse outcomes**?
 - Fatal or nonfatal overdose
 - Fatal or nonfatal other injuries
 - Treated inside or outside VA system of care
- Do Veterans whose opioids are **tapered or discontinued** instead receive non-VA opioids?

Gun Injuries in the U.S.

- Firearms are one of the most common causes of **fatal and nonfatal injuries** in the U.S.
- Fatalities comprised 30% of all gun injuries among US adults; 59% of fatal gun injuries were suicide
- Assaults comprised 71% of nonfatal injuries; and unintentional comprised 22%

Fatal and Nonfatal Firearm Injuries in the United States, 2001-2016



Data Source: Centers for Disease Control and Prevention, 2018

Research Questions

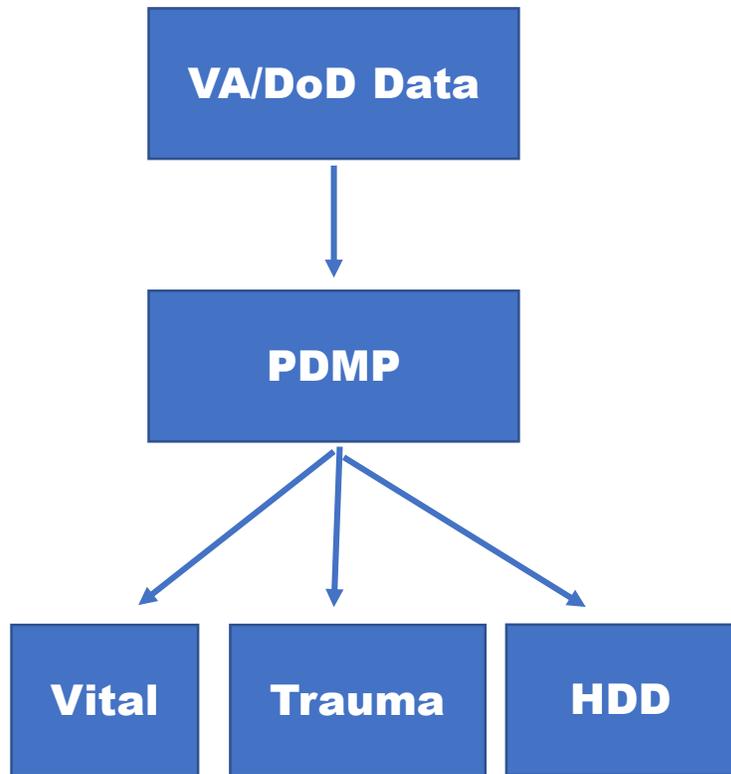
- **Why** do we have the gun violence problem?
- **What can we do about it?**

- What is the rate of gun injuries among Veterans relative to non-Veterans?
 - Fatal and nonfatal
 - Intentional and unintentional
- How have rates changed over time?
- What are risk factors for gun injuries?
- Among VA users, what upstream health factors might predict gun injuries
 - Does **mental health** predict risk?
 - Are there clinical touchpoints where risk could be addressed?

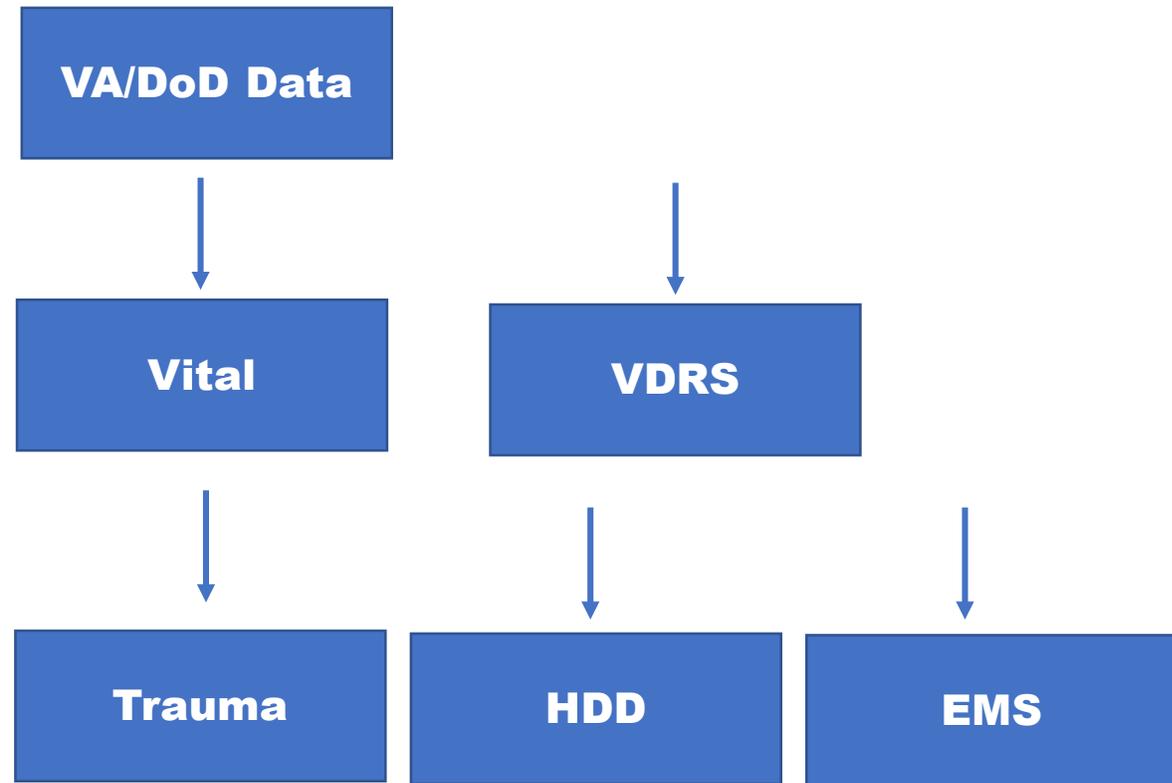
Methods

Linkage of VA to State Datasets

Opioids

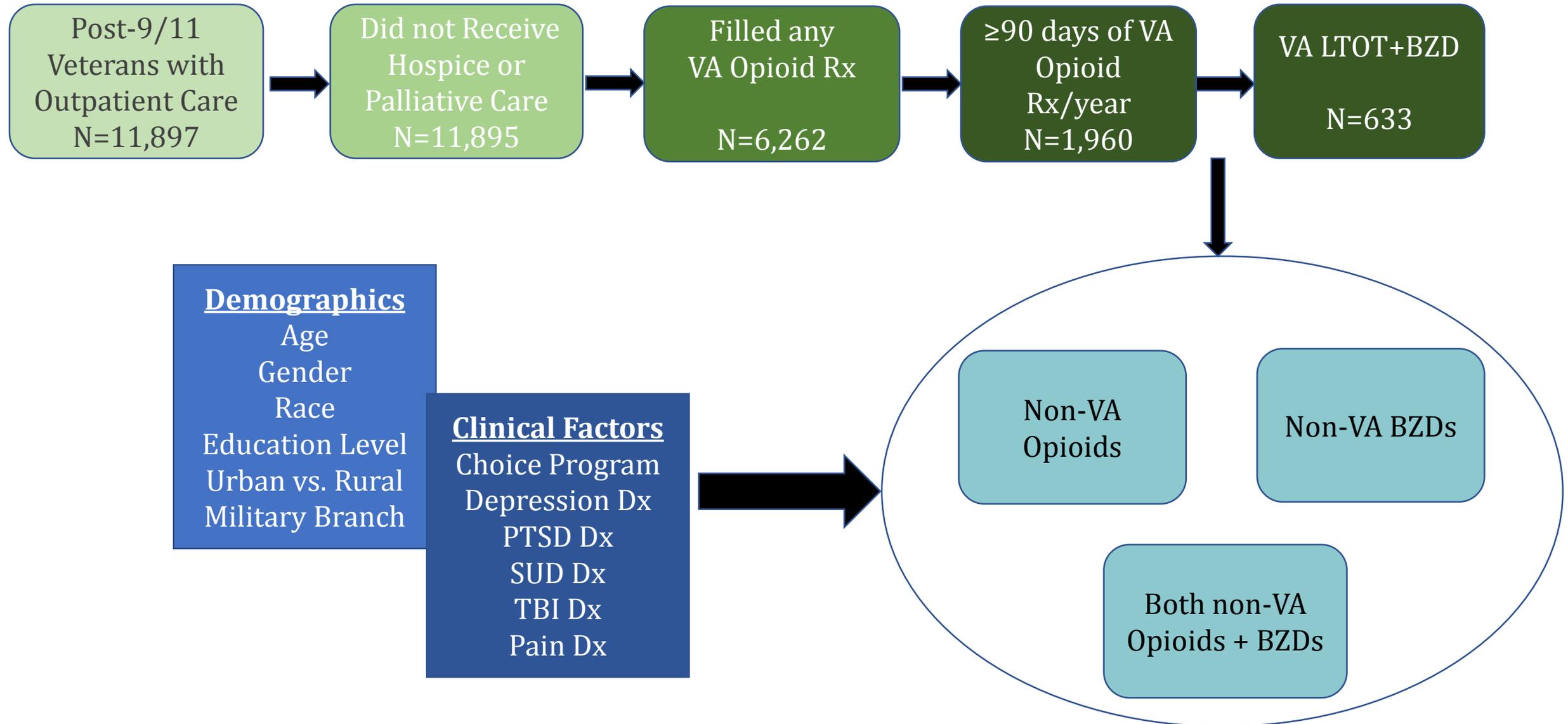


Gun Injuries



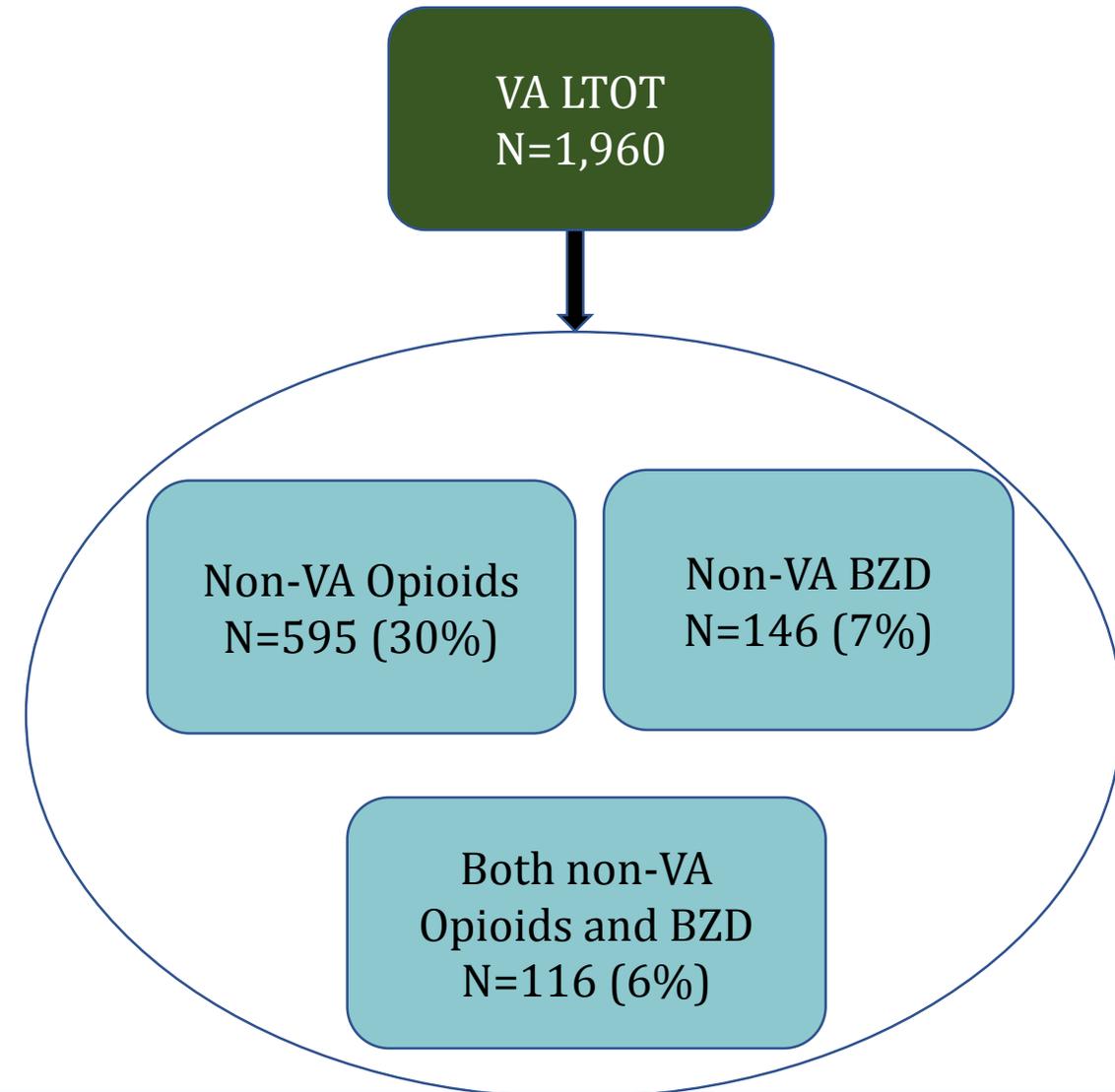
Results – Opioid Injuries

Study Population



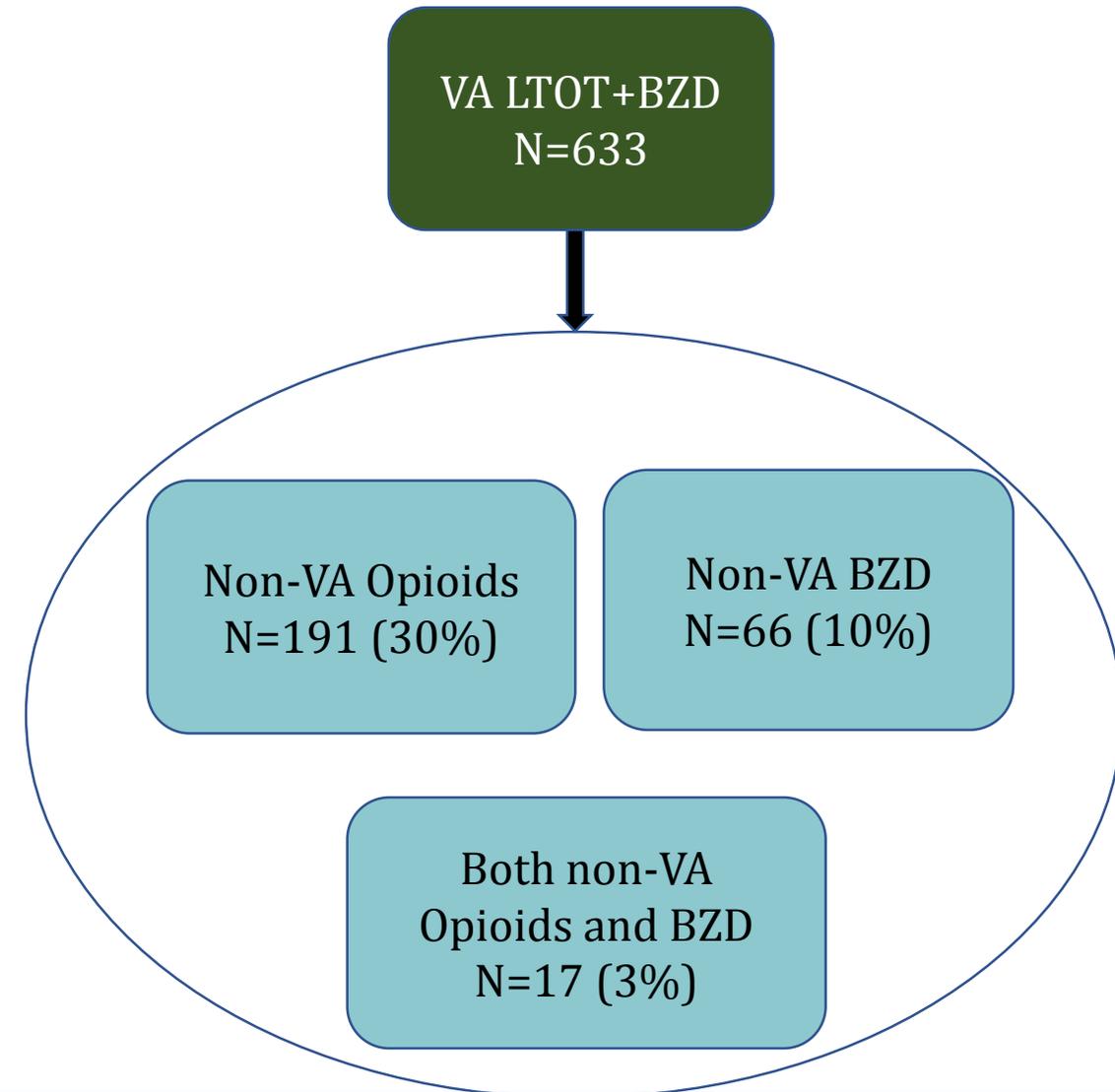
Prevalence of Concurrent VA/non-VA Prescriptions, 2011-2016

- Among 1,960 Veterans on VA LTOT:
 - **30%** had received concurrent non-VA opioids.
 - **7%** had received concurrent non-VA BZDs.
 - **6%** had received concurrent non-VA opioids and BZDs.

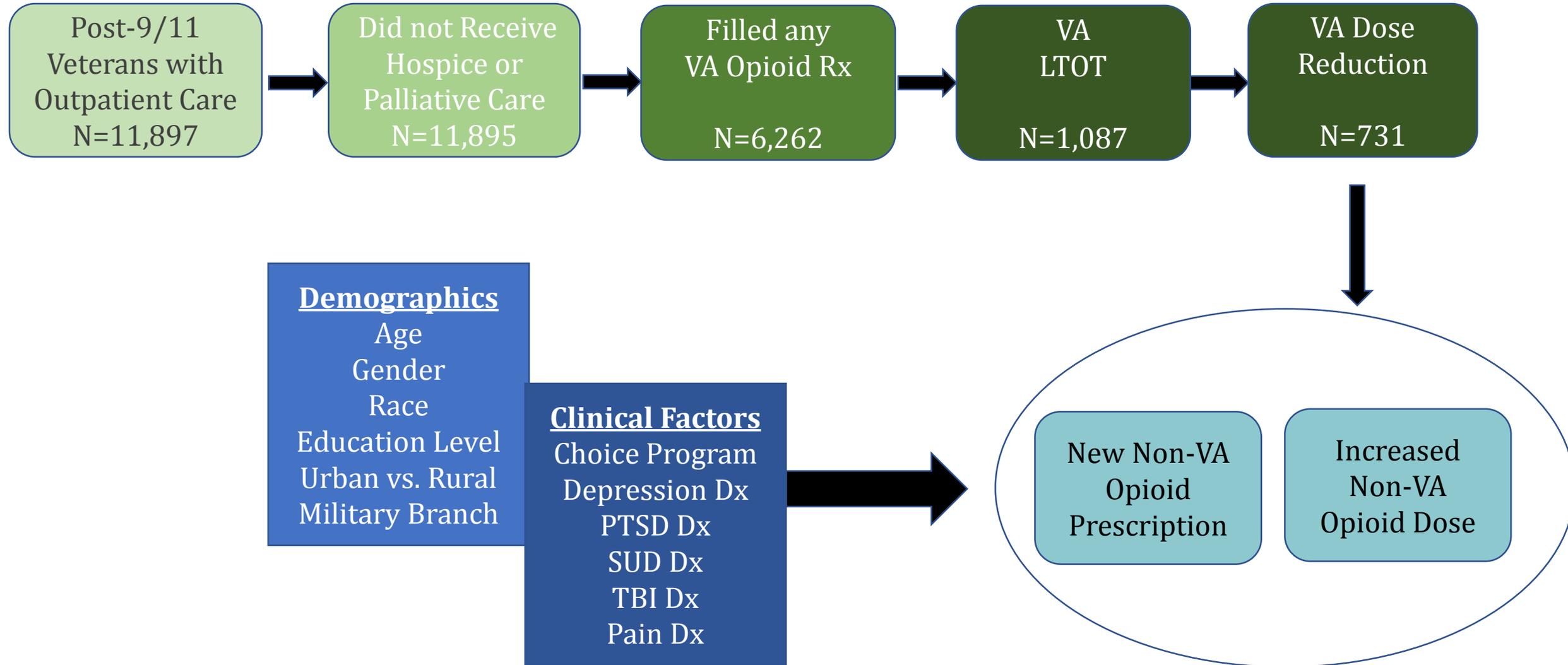


Prevalence of Concurrent VA/non-VA Prescriptions, 2011-2016

- Among 633 Veterans on VA LTOT+BZDs:
 - **30%** had received concurrent non-VA opioids.
 - **10%** had received concurrent non-VA BZDs.
 - **3%** had received concurrent non-VA opioids and BZDs.



Study Population



Prevalence of New Non-VA Opioid Prescriptions

- Among 731 Veterans with VA dose reduction:

	n	%
Received Non-VA Opioids	195	27%
<i>Year-Prior and Year-After (Ongoing)</i>	104	14%
<i>Year-After Only (New)</i>	91	12%
Did Not Receive Non-VA Opioids	536	73%
<i>Year-Prior Only</i>	106	15%
<i>Neither Year-Prior nor Year-After</i>	430	59%

Prevalence of Increased Non-VA Opioid Prescription Dose

- Among 731 Veterans with VA dose reduction:

	n	%
Non-VA Opioids	195	27%
<i>Increased dose</i>	167	23%

Results – Gun Injuries

Gun Injuries among Veterans and Non-Veterans

- 7,191 firearm events from 2007-2016 among Oregon adults
 - 104 (1.5%) Veterans – 21.4 events/10,000 population^a
 - 7,087 (98.5%) non-Veterans – 18.0 events/10,000 population^b

Characteristic	Veterans	Non-Veterans	Total
Male	103 (99%)	6,038 (85%)	6,141 (85%)
Age (mean, SD)	31.0 (7.4)	46.2 (19.1)	46.0 (19.1)
Fatalities	45 (43%)	4,924 (69%)	4,969 (69%)
Hospital stays	44 (42%)	1,596 (23%)	1,619 (23%)

^a Source: National Center for Veteran Analysis and Statistics, 2018

^b Source: American Community Survey, 2018

Gun Injuries among Veterans and Non-Veterans

- Intent of firearm event

Intent	Fatal (n=4,969)	
	Veterans (n=45)	Non-Veterans (n=4,924)
Unintentional	0 (0%)	51 (1.0%)
Intentional	45 (100%)	4,819 (98.0%)
Assault	3 (6.7%)	702 (14.3%)
Self-Inflicted	39 (86.7%)	4,021 (81.7%)
Legal Intervention	3 (6.7%)	96 (2.0%)
Undetermined	0 (0.0%)	54 (1.1%)

Intent	Nonfatal (n=2,222)	
	Veterans (n=59)	Non-Veterans (n=2,163)
Unintentional	32 (54.2%)	755 (34.9%)
Intentional	26 (44.1%)	1,296 (59.9%)
Assault	15 (25.4%)	930 (43.0%)
Self-Inflicted	7 (11.9%)	282 (13.0%)
Legal Intervention	4 (6.8%)	84 (3.9%)
Undetermined	1 (1.7%)	112 (5.2%)

Conclusions

13 Years In...

- Follow your passion
 - Veterans' well-being!
 - Health sciences
- Explore new areas
- Explore new collaborations
- Take some risks
- Mentorship is everything!

Acknowledgements

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Nina Sayer, PhD

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Daniel Storzbach, PhD

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So many others!

Sites

CCDOR, Minneapolis VA

CIVIC, Portland VA

NCRAR, Portland VA

Funders

VA HSR&D – CDA 08-025

VA RR&D and CSR&D

DoD and NIMH

Thank you!

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