Cyberseminar Transcript

Date: September 10, 2019

Series: HSR&D Career Development Award Enhancement Initiative

Session: Learning VA and State Data to Examine Veterans’ Injury: TBI, Opioids, and Guns

Presenter: Kathleen Carlson, MS, PhD

**Rob:** And as we are just at the top of the hour now I’d like to introduce our presenter today, Kathleen Carlson, PhD, is an Epidemiologist and Health Services Researcher at the Portland VA Medical Center. Kathleen, can I turn things over to you?

**Dr. Kathleen Carlson:** You sure can.

**Rob:** There you go.

**Dr. Kathleen Carlson:** Thank you. Is that good?

**Rob:** Yes it is. Looks good.

**Dr. Kathleen Carlson:** Okay. Thank you, Rob. And thank you to those who joined today. Good morning on the west coast and good afternoon on the east coast. So as Rob was saying, I’m at the Portland VA Healthcare System. I’m with the Center to Improve Veteran Involvement in Care, or CIVIC, which is the HSR&D Center of Innovation out here. And I’m also an associate professor of Epidemiology with the Oregon Health and Science University and Portland State University Joint School of Public Health. And so I was honored to be asked to present for the CDA Cyberseminar today to be able to share some of my trajectory over time, over my 13 years with the VA now from a post-doctoral fellowship to a CDA award and then a few years of independent investigator-hood since my CDA. And part of what I wanted to share today was that this hasn’t been a straight trajectory but something that kind of weaves back and forth and, you know, is true to our mission of researching and studying healthcare, health systems, and health issues that are a high priority to Veterans but also staying true to my academic discipline and my interests in the field of injury and public health. Here we go. So I don’t necessarily focus on one topic but walk through my path of coming out of PhD school as an Injury Epidemiologist training in health services research at the VA, some of my research through my Career Development Award focusing on traumatic brain injury and learning health services research, but then doubling back to more of injury prevention approaches to research focusing on opioid related injuries and gun related injuries and kind of straddling those worlds of injury epidemiology and health services research. And I also share a little bit about my use of various data systems including state data systems to expand on what we can do relative to injury.

So I have a couple poll questions to get started with and first it would just be helpful to me to know what folks affiliation is with the VA through Development Award Program; maybe you haven’t heard of the CDA Program before and you’re just logging on due to the topic, maybe you’re in the process of applying for a CDA, maybe you haven’t yet replied, or applied, for a CDA or maybe you’re a previous or current CDA recipient, or maybe you know of the program but aren’t affiliated with it, or some other option I haven’t included here.

**Rob:** Dr. Carlson that poll is open and your attendees are making their choices now. We have about 50% voted and it usually levels off around 70% to 80% so I’ll give people a few more moments to make their decisions.

**Dr. Kathleen Carlson:** Okay. Great.

**Rob:** And things have leveled off so I’m going to go ahead and close the poll and share out the results. And I’ll let you know that 47% of your listening audience have not heard of the CDA program before. Sixteen percent say that they are interested in applying for a CDA but not yet applied. Zero percent are in the process. Zero percent are currently or previously a CDA. And 37% say other.

**Dr. Kathleen Carlson:** Okay.

**Rob:** And if you like, audience members, you could put what the other means to you in the questions and I’ll let Dr. Carlson know what that answer is later on. And now we’re back on your slides, Kathleen.

**Dr. Kathleen Carlson:** Okay. So just one other question and that is what is your primary training or discipline? And so I was curious to know if we had primarily a clinical audience here with us today or an epidemiology or sociology audience or some other discipline that I don’t have listed.

**Rob:** And that poll is up and running and people are making their choices. Nobody’s written in what other meant in the first poll yet. And this one’s going quite a bit faster than the last time. It looks like it’s just about at 80% so I’m going to go ahead and close and share out the results and let you know that 13% answered medicine. Seventeen percent psychology. Another 13% epidemiology. Nine percent sociology. And a whopping 48% say other.

**Dr. Kathleen Carlson:** Other. Oh what I wouldn’t give to know the other.

**Rob:** Yeah. Well one person said primary training is health, policy, health services research.

**Dr. Kathleen Carlson:** Yeah. Okay.

**Rob:** Another person says other equals statistics and that’s all we have for now.

**Dr. Kathleen Carlson:** Got it. Thanks to those of you that wrote that in, that’s helpful. So it’s just nice to know we have a variety of folks on the line with us today and, for those of you who haven’t heard of the CDA Program, I recommend that you check it out if you’re at an early career phase where you’d be interested in support in developing your career, particularly in the VA and as service to Veterans. So thank you for answering those questions.

Let me just lay the ground work for why it’s important to study injury through a public health lens and also a clinical lens. So year over year injury is of the top 10 leading causes of death in the U.S. We tend to break out injury into categories of unintentional injury versus intentional injury which is more your suicide and homicide and assaults or non-fatal injuries. But you can see here that unintentional injury is the fifth leading cause of death in the U.S. behind only the illnesses associated with age, or heart disease, cancer, stroke, and so on. And suicide is the 10th leading cause of death and homicide, surprisingly, is not very far behind that. It’s usually about 14th or 15th in line. And if you add up the numbers of deaths related to each of these causes and compile them together, injury overall will bump up into the third or fourth position, depending on the year that you’re doing this for. So injury is a major cause of mortality in the U.S.

And even more important is when you break this out by age group you can see that it’s far and above the leading cause of death for anyone under the years of 45, or under the age of 45 years. So this is, you know, I hopefully paint the picture for why injury is a major public health issue to be addressed and also one that we grapple with clinically, particularly in the VA where we have a relatively large cohort of recent Veterans that fall into this younger age category.

And of course the fatal injuries are only the tip of the iceberg, or what we call the injury pyramid here. So what this depicts is that for every fatal injury there’s magnitudes more non-fatal injuries that result in trauma or disability or lower functioning and quality of life. So for everyone injury related deaths there’s many, many more that result in hospitalizations. Even more that are treated in ambulatory care settings or emergency health department settings. More are treated in primary care and more are treated by paramedics alone. And even underneath this and base, I guess, is those injuries that are not treated in the healthcare system. And we know this to play a significant role in morbidity in the U.S., especially in the area of TBI and concussion where a lot of people are not treated or are not seen in the healthcare system for a concussion. But all of these injuries can contribute to disability which is also of importance to us here in the VA.

So one of the fundamental philosophies in the field of injury prevention and control is that injuries are not accidents. They’re actually predictable and quite preventable. And this pushes back against the long held misnomer or, I guess falsehood, that’s often times spread by special interest groups or maybe lobbyists or big businesses that injuries are acts of God and that they’re accidents and, therefore, unpredictable and unpreventable. And so you can see where this would play a role in our unwillingness, perhaps, to address injury through a public health lens if the general public thinks that injuries are just, you know, something that human beings live with. And instead, just like diseases, we can study their patterns and their risk factors and we can intervene to prevent the incidents of injury or the deleterious outcomes of injury.

And since being in the VA I’d like to add that injuries are not accidents even in combat.

So we know that there are ways to prevent injury in combat scenarios and also to reduce the effects of injury such as armor or other personal protective equipment that can reduce the transmission of injurious energies to the human host and, therefore, reduce the seriousness of injuries that might otherwise be incurred. So in talking about prevention, one of the tools that we use is called Haddon’s matrix. And this is named after one of the grandparents of this field of injury prevention and control, Bill Haddon. And what he did is he took the nodes or the components of the epidemiologic model; the host, the agent, the factor or vehicle which you don’t see here, and then the physical and social environment broken out in to two separate columns. And he split these out and then contrasted it with these different phases of an injury event; the pre-event phase, the event phase, and the post-event phase. And what this did was it opened up the possibility of different interventions that could be applied at any one of these cells to increase the resilient of the host, to decrease exposure to an agent, to modify the physical or the social environments so injuries don’t happen in the first place. And these can be identified in each of these phases which you might recognize as primary, secondary, or tertiary prevention. And course there’s a cyclical nature to this and this is relevant to us here in the VA where we may initially see Veteran patients who have incurred injuries and we rehabilitate or provide rehabilitation services to those Veterans but we also want to prevent them, perhaps if they’re physically vulnerable, to incurring new incident injuries. So there’s a cyclical nature to this and circling around back to that primary prevention row.

So speaking of the Veterans and talking about studying Veterans injuries in the VA, I’ll share a little bit of my past coming from a public health school and epidemiology PhD program in to the VA. So at the time I was graduating in 2006 the VA, or the U.S., was in the throes of these wars in Iraq and Afghanistan. And both the military and the VA Healthcare Systems were realizing that we had a large cohort of Iraq and Afghanistan combat Veterans who were returning with traumatic brain injury. And so this article that you see here written by Susan Okie is often times cited as the one article the coined the term signature injury referring to traumatic brain injury in Iraq and Afghanistan.

There was also a report published by the RAND Corporation in 2008 that screened returning Veterans for traumatic brain injury and produced this estimate that about 20% of Veterans had incurred one or more TBI’s during their deployment. So these were really, really large numbers and it was very important to the VA to understand the patterns of these injuries and the patterns of comorbidities that were occurring with these injuries and how best to improve our rehabilitation services for Veterans who were coming back with complaints of potentially TBI related sequella.

So for me this was fascinating and a challenge in terms of learning that tertiary prevention row, or that post event row, which I hadn’t yet focused on in my PhD program which was mostly focused on the primary and secondary prevention of injury. And also was compelling, of course, to be able to address injuries among Veterans who, you know, have served our country and are in need of research, or those trained in research, to apply our skills to help improve their outcomes. So that was compelling and also compelling was the possibility of learning more applied research approaches that often conducted in the context of health services research. So when I graduated from my PhD program I started a post-doctoral fellowship at the Minneapolis VA in the Health Services Research and Development Center of Excellence there called CCDOR, the Center for Chronic Disease Outcomes Research, it has a new name now but CCDOR at the time. And Dr. Nina Sayer, whose a psychologist and PTSD researcher, took me under her wing as a mentee. And Dr. Sayer had been awarded as PI of a new QUERI Center focused on polytrauma and blast related injuries that were incurred among this new generation of Veterans and that was called the Poly-trauma and Blast Related Injuries QUERI. So the QUERI researches including Dr. Sayer and others were examining patterns of comorbidity of these Veterans who had incurred traumatic brain injury, in particular mild TBI or concussion, and overlapping mental health conditions such as PTSD. So one of the first projects that I embarked on during my fellowship in CCDOR, and this was under the leadership of Dr. Tim Wilt who was leading the VA’s Evidence Synthesized Program at the Minneapolis site, was to lead an evidence review of all of the publications to date on the overlap between traumatic brain injury and post-traumatic stress disorder. And this evidence review was commissioned by the VA because we were interested in knowing if this overlap was theoretically possible and, if so, at what extent it occurred, in particular, to what extent it occurred among Veterans. So I’ll just point you to the middle three stars here that you see. And these stars represented three studies that we kind of honed in on as having quite consistent, surprisingly consistent, results for a published study. And these were epidemiologic studies published by Charles Hoge in the military, Aaron Schneiderman in the VA’s Office of Public Health, and the RAND Corporation which I previously cited. And these three studies used screening measures of TBI as well as PTSD and each of them reported that among Veterans or service members that screened positive for TBI, between 33% and 39% of them also screened positive for PTSD. So this was an interesting novel finding that in collaboration with Dr. Wilt and my friends and colleagues Shannon Kehle, Dr. Laura Meis, and Nancy Greer in Minneapolis. Also Nina Sayer and Steve Dobscha here at the Portland VA we published these results back in 2009. But this really left us interested in these measures of screening, or I guess measures of ascertaining, methods of ascertaining or measuring the occurrence of TBI and either diagnosable or symptoms of PTSD in these Veterans.

And so after this project I worked on a VA Administrative Data Project with Dr. Sayer where we were looking at the differences between mental health related diagnoses among Veterans who had screened positive for TBI versus those who had screened negative for TBI. And this was using data from VA’s VISN 23 in which the Minneapolis VA was situated. So basically you can see here that, I guess all up and down the board here, is that the prevalence of any mental health diagnosis was significantly higher among those who screened positive for TBI than it was for those who screened negative. And particularly so for diagnoses of PTSD where those who screened positive were almost 3-1/2 times, or had almost 3-1/2 times higher prevalence’s of PTSD diagnoses than those who screened negative.

But when we went on to separate those who screened positive for TBI into those who were confirmed and diagnosed with TBI versus who were not diagnosed with TBI we basically found very little difference in the prevalence of mental health diagnoses. So you can see here that the ratio, or the proportion of those who screened positive for TBI, is almost the same for those who were not diagnosed with TBI. Sorry I’m getting my vernacular mixed up here. But basically almost the same. And this was mostly true for some of the other mental health diagnoses where we saw those really high risk ratios from the previous slide kind of attenuated when we compared these in diagnosed individuals versus non-diagnosed individual. So this suggested to us that PTSD symptoms, and other mental health symptoms, were playing a role potentially in the positive screens for TBI but not necessarily more prevalence in terms of diagnoses among those who ended up being diagnosed with TBI. So these studies kind of were scientifically interesting and also of incredible importance to us in the VA because so many folks were using screening measures to understand the importance of TBI, or the prevalence of TBI, and also the overlap of mental health comorbidities in this cohort of Veterans.

So these studies form the basis of my Career Development Award application which focused on the prevalence of these comorbidities, TBI and PTSD, their overlap with other comorbid conditions such as headache or substance use disorders, and the functional outcomes then of Veterans who were experiencing these post-deployment health disorders. So I submitted by CDA application, focused on this. I had Dr. Nina Sayer stay on as my primary mentor and she served as a long term mentor for me, even to this day but especially when we were conducting this work together. Dr. Joan Griffin who was at CCDOR also at the time, she’s now at the Mayo Clinic in Rochester, Minnesota, she was also a mentor of mine on my CDA. And then Dr. David Cifu whose at the Richmond, Virginia VA and a physiatrist. He was the head of rehab medicine at the time and served as a medical mentor, a clinical mentor, in helping me understand the manifestation of TBI and these mental health disorders among patients that were seen in the VA and also how to translate some of these findings into clinically relevant communications.

So this slide here just gives a snapshot of some of my CDA work. One of which was important to, again, the measurements of TBI in the VA administrative data, or VA data that we were using. And I’ll just point you to the middle column here where I labeled it the VA Series. And this is the VA Series of ICD-9 codes that were being used as surveillance efforts to understand the prevalence of TBI diagnoses among post-deployment Veterans. And as you might think, we were also using this in our research examining TBI diagnoses in administrative data and to this day we still use ICD-9 codes to elucidate and measure TBI across our Veteran, VA user population. So basically what we found when we compared ICD-9 codes to a criterion standard which, in this case was a templated [sic] clinical interview, that the VA had disseminated widely called the comprehensive TBI evaluation. Where a trained clinician would interview Veterans and then determine whether or not their history and symptoms was consistent with a TBI diagnosis. And so we use that as a criterion standard and compared these series of ICD-9 codes against that standard and found that the concordance between the two was about 75%. So not great, not terrible, but not perfect. But good to understand the limitations of these methods that we were using. We also tried to use ICD-9 codes to distinguish between mild TBI and more severe pieces of TBI which we could ascertain from that criterion standards of comprehensive TBI evaluation. And when we did that, we found that there was basically no utility in using ICD codes to distinguish between different levels of TBI severity. And this is important because folks will try to use ICD codes to categorize Veterans as having incurred mild versus moderate or severe TBI. So we’re actually repeating this analysis right now using ICD-10 codes since myself and other researchers have moved on to using ICD-10 since the VA transitioned to this system in 2015. But to date, no one has looked at the validity of ICD-10 codes for TBI the way that we did here with the ICD-9 codes. So stayed tuned for the rebuilt of that project.

And just to give a snapshot of other ongoing TBI related research. I have a couple rehab research and development projects that involve traumatic brain injury. I also serve as a site PI for the Chronic Effects of Neuro Trauma Consortium, Longitudinal Epidemiology Study of TBI where we’re enrolling and tracking Veterans with and without a confirmed TBI history, hopefully, over their lifetimes to better understand the neurological outcomes of combat related TBI. And that’s a study, well CENC is PI’d by my CDA mentor Dr. David Cifu, and the Longitudinal Epi study is PI’d by William Walker whose an investigator and physiatrist at the Richmond VA. And then currently I have a HSR&D IIR application under review that focuses on looking at patterns of community care utilization among our post-9/11 Veterans who have been receiving services for traumatic brain injury in the VA. So now that we’ve expanded community care via the Mission Act, and previously the CHOICE Act, and we have a number of Veterans who may be using community care, this grant will focus on those patterns of dual utilization and try to find areas of improved communication or coordination between VA and our community partners in providing services for these Veterans.

So all that to say that it’s been rewarding and exciting and interesting to participate in such a wide variety of TBI related research that my fellowship and CDA award afforded me and also that the use of VA data afforded me. But I also always longed to kind of get back to the work of preventing injuries. So back to the primary and secondary injury prevention which is what I’m extraordinarily passionate about, especially in terms of public health and reducing injury across populations like our Veteran population. And what was driving me in this area was that there had been this body of research focusing on the risk of fatal injury among Veterans, or among combat Veterans in their years after deployment. And the systematic review published in, oh gosh, I think the mid-2000’s, 2005 or so, summarized all of this information, or summarized that post-deployment Veterans had about a 20% increased risk of fatal injury in about their first five years post-deployment. And interestingly, the body of work at that time showed that most of those injuries, fatal injuries, were unintentional in nature and many, many, many of them had to do with motor vehicle crashes which was interesting. And I think if this work were to be re-analyzed today we would probably see suicide playing a more prominent role than it did in this previous work but we would still see these unintentional injuries playing an important role. So on the right hand side of the slide here, I show a figure that was published by Nicki Bell back in 2001 in the Injury Prevention Journal where she was depicting some of the possible pathways that could be driving this excess risk for injury among combat Veterans. And she was hypothesizing that this could be driven through increased psychological distress after combat deployments through behavioral or coping mechanisms such as substance use after deployment. Or maybe even through increased or deployment related disease symptoms and she says here, dizziness or headaches which we commonly were referencing at that time as Gulf War Illness related symptoms. But I think you could swap that out now for maybe even TBI related symptoms that Veterans might be experiencing. And she hypothesized but it was untested at the time whether these different, various pathways were contributing to Veterans excess risk for injury.

So I thought this was compelling and quite interesting and, of course, we’re up here in the public health model working on tertiary prevention or rehabilitation services for Veterans who had incurred injuries but we should be or we’re also trying to push upstream to secondary prevention or primary prevention or what we’re now referring to as primordial prevention which covers the social determinants of health and injury.

So I started kind of circling back to this further upstream focus on Veterans injury and one of the first analyses that I did was a survey of Dr. Nina Sayers where she surveyed Iraq and Afghanistan Veterans. This was a national survey that was conducted. And she let me put a measure of incident post-deployment injury on her survey so that I could contrast that measure with some of these other post-deployment health measures that she had. And interestingly enough we see that the odds of post-deployment injury were greater for those who screened positive for PTSD and also those who self-reported that they had been diagnosed with PTSD.

We looked at it for those who reported that they were diagnosed with traumatic brain injury too and we see some elevated odds of injury among that group but what was interesting was this reported diagnosis of depression and its association with post-deployment injury. So this kind of pointed to the left hand and the middle pathway that Nicki Bell had suggested where it’s, you know, psychological distress or perhaps coping behaviors that are associated with this elevated risk for injury.

But another study that I did using VA administrative data was a time to event analysis where we identified Veterans who had been diagnosed with TBI in their first year post deployment and then followed them over time for five years as long as they stayed relatively frequent VA users. And identified those who were hospitalized for a motor vehicle crash within that five year follow up period. And what we were able to do was, even though the incidents of motor vehicle crash related hospitalizations is relatively low, we found that the hazard ratio is incredibly elevated for Veterans with a TBI diagnosis compared to those without. So this then also suggested that that right hand pathway of symptoms or outcomes of injury and ailments might also be driving this elevated risk of fatal and non-fatal injury among Veterans.

But these analyses were limited to, you know, the VA Healthcare data which may not reflect injuries treated outside the VA system of care or cross sectional survey data which doesn’t necessarily give you an idea of the temporality of risk factors in injury as an outcome. So I began thinking about how can we move farther upstream data wise when we may only have VA data or we may only have VA plus DoD data as is the case sometimes. But how could we incorporate, perhaps, non-VA Healthcare data or public health surveillance system data even to understand injuries they treated outside the VA system of care or other risk factors that maybe we couldn’t pick up in the DoD and VA Healthcare data. And if we had access and could combine our VA data with these other health data systems we could make some interesting comparisons, say comparing Veterans to non-Veterans or Veterans with certain characteristics or even VA users with certain characteristics to those without. And if you think about some of the other data systems that are out there, really the sky’s the limit as long as you can establish relationships with the data stewards or the owners of these data systems and get access to identifiable data where you can conduct linkages between these data systems and VA and DoD data.

In my case I was interested in public health or non-VA Healthcare Systems data in terms of injury. And so I was interested in accessing vital records data or violent death reporting system data which is maintained at the state level. And in these data systems we could identify fatal outcomes of Veterans. Or we then work with our Department of Motor Vehicles or Department of Transportation data looking at motor vehicle crashes or trauma registry data, hospital discharge data, emergency services data, and even our state’s prescription drug monitoring program data to try to hone in more on non-fatal outcomes treated outside the VA system of care or even, especially in case of the PDMP, some risk factors for injurious outcomes.

So this leads me to some of my more recent projects that are attempting to get more upstream into the primary and secondary prevention realms of injury prevention and control. And a couple projects that I’ve been working on have been related to Veterans risk of opioid related overdose and other injuries and their gun related injuries.

So let me just give a quick background on Veterans risk of opioid related injuries. So we’ve known from VA researchers, Amy Bonhert, Steve Dobscha here in Portland, Karen Seal and others, that Veterans are at increased risk of fatal drug overdose compared to non-Veterans and this has been primarily driven by prescription drugs and, especially, opioids. So we have a large proportion of VA users who are receiving long term opioid therapy for chronic pain. And even among them, we have high proportions who are also receiving benzodiazepines which is a sedative hypnotic but is contraindicated for those receiving opioids due to the combined suppressive effects on the respiratory system of these two medications. And so it’s also quite possible that Veterans who are receiving opioids and/or benzodiazepines within the VA could also be receiving opioids or benzo’s from outside the VA and maybe this is contributing to this observed elevated risk of fatal drug overdose among our Veterans. And also of relevance in post-deployment health we knew that a large proportion of post-9/11 Veterans were diagnosed with pain were receiving high levels of opioids and also concurrent benzodiazepines.

So in 2012, in 2013 the VA rolled out its opioid safety initiative which is a comprehensive approach to decreasing unsafe opioid prescribing across the VA. And you know, since the implementation of this program we’ve seen vast decreases in the overall number of Veterans who are receiving opioids or the number of Veterans who are receiving high doses of opioids and also the proportion that are receiving concurrent benzodiazepines. But there are many, many problems in the opioid epidemic that has yet to be addressed and a number of research questions that have yet to be answered.

So it’s important to me in the work that I propose and have embarked on, we wanted to know what the proportion was of Veterans who were receiving these medications from both inside and outside the VA and especially what proportion of these were overlapping in nature and if there were Veterans that were receiving medications from both VA and non-VA providers were there higher risks of sub-groups. For example, those who are using the Choice Program, now the MISSION ACT program, to receive VA paid community care services. Are they perhaps receiving non-VA prescribed medications at the same time as their VA medications. And then, additionally, are those who may be using dual systems to receive medications at greater risk of adverse outcomes including those fatal or non-fatal injuries including overdose and including those that may be picked up or treated outside the VA system of care so are otherwise not seen when we’re using VA data alone. And then also relevant to that chart I just showed on that last slide, this large number of Veterans whose opioids are either tapered or discontinued are they instead picking up non-VA medications to kind of make up the difference in the overall dose or number of prescriptions that are being received within the VA.

So hold onto that thought and I’ll just give a quick background on the questions of gun violence too which many probably don’t need an introduction to. But we know, of course that firearms are one of the most common causes of both fatal and non-fatal injuries in the U.S. So you can see kind of an injury pyramid here with the fatal injuries depicted at the top. And you can see that fatal injuries comprise about 30% of all gun injuries among U.S. adults and 2/3 of those are suicides. But then there’s also a large proportion of non-fatal gun related injuries, or 70% of all gun injuries, and about 70% of those are related to assaults and 22% are unintentional in nature. Okay so just a very basic overview of the epidemiology of gun related injury.

Some of the major questions, of course, is why do we have this gun violence problem and what can we do about it? But more specifically, and more pertinent to Veterans healthcare, is what is the rate of gun injuries among Veterans relative to non-Veterans? We know that Veterans have reported higher prevalence’s of carrying firearms or owning firearms and they also have had more training in the use of firearms. So how does this maybe relate to their risk of fatal and non-fatal gun related injury or their risk of intentional versus unintentional firearm related injury? Also how have rates of Veterans and non-Veterans injuries changed over time? What are the risk factors for injuries? Does mental health, for example, predict risk? Mental health is often times pointed to as a driving factor of gun violence. But most importantly for health services research within the VA are their clinical touch points where elevated risk could be addressed or risk factors, for example, could be addressed within the VA Healthcare System.

So as I was coming to the end of my Career Development Award and I was thinking about these more upstream injury prevention questions, and also thinking about expanding data sources from just VA or just surveys of Veterans to other sources of data that could be linked into VA data, I proposed a couple projects focused on opioids and gun injuries. And these had similar methods where we probabilistically linked VA and DoD data to multiple state datasets to answer questions relevant to opioid injuries or gun injuries. On the left hand side you can see for the opioid related project, which was ultimately funded by VA Health Services Research and Development through an IIR. And in this project we linked VA data to our states prescription drug monitoring program data to look at the overlap and the patterns of overlap between VA and non-VA prescriptions. And I’ll show some results from that in a couple of slides. And then more recently we’ve linked these data to our states vital records to look at fatal outcomes. Also to our trauma registry system and our hospital discharge data system to look at hospitalizations related to opioids that were not necessarily picked up in the VA. And we’re working on these analyses now. On the gun injury side, which was funded by an IMH as an R21, we’ve linked VA and DoD data to our vital records and to our violent death reporting system and then also linked to our trauma registry, our hospital discharge data, and to EMS related data to get, you know, an understanding of the landscape of Veterans and non-Veterans firearm related injuries in our state.

So just a snapshot of some of our results so far. Across the top here, you can see our cohorts of post-9/11 Veterans in the state of Oregon who used outpatient care at one of the VA Healthcare Systems in our state. About half way over you see the number that had filled any VA prescription for opioid. And we restricted that to who had used 90 or more days of opioids in a given year and that’s what we defined long term opioid therapy use in the sample, so that 1,960. And then of those about 1/3 that were co-prescribed benzodiazepines within the VA Healthcare System. And among those two groups each we were interested in the proportion that were also receiving non-VA opioids benzodiazepines or both from outside the VA Healthcare System and that’s what we picked up by linking to our states prescription drug monitoring program. And of course for those who did have any overlap we’re interested in some of the demographics or clinical factors that might predict or suggest increased risk or certain sub-groups of VA patients.

So what did we find among those 1,960 that were receiving long term opioid therapy from within the VA? We found that about 30% had received concurrent non-VA opioids. So this is overlapping prescriptions for opioids both inside and outside the VA. And smaller proportions had received benzodiazepines or both opioids and benzos. And among this potentially higher risk group of opioid and benzodiazepine co-prescribed patients in the VA we saw similar figures. About 30% who had received overlapping non-VA opioids, 10% who had received overlapping non-VA benzodiazepines, and a smaller number that had received both.

And then we had that question about, you know, we’ve seen this reduction in overall opioid prescribing or prescribed doses among Veterans in the VA Healthcare System whether a result of our opioid safety initiative or other major public health efforts going on in relation to the opioid epidemic. So you can see here that our number, in this figure, that we defined as receiving long term opioid therapy was just over 1,000 and of those, the majority or almost 75%, had undergone a dose reduction within the VA either an entire discontinuation or a reduction of their morphine mg equivalence that they were receiving from the VA. And so again we’re asking what proportion of those were receiving opioids from outside of the VA and, in this case, which proportion initiated new non-VA opioid prescriptions or increased the doses of non-VA opioid prescriptions or ongoing non-VA prescriptions. In other words, what proportion was kind of making up for the difference of the VA prescribing and, if we found those Veterans that were substituting non-VA opioid prescriptions, what were some of the demographic or clinical factors that might be driving that.

And so here you can see that among those 731 Veterans whose VA opioid doses were reduced 195, or 27%, received non-VA opioids in the year after their VA opioid dose reduction. So a large proportion had already been receiving non-VA opioids and were continuing to receive non-VA opioids after their VA dose reduction. But you can see here that 12% initiated new, non-VA opioid prescriptions after their VA dose reduction.

And on this next slide of those 195, or 27%, that either initiated new non-VA prescriptions or had ongoing non-VA prescriptions, the vast majority increased their non-VA dose after undergoing a VA dose reduction or discontinuation.

Okay so a snippet of what we’ve so far and our analysis of gun injuries among Veterans in the state of Oregon. In our linkage of various data systems between 2007 and 2016, in that 10 year period of time, we had about 7,200 firearm events among Oregon adults. 104 of those were among Veterans, or previous military service members, not necessarily VA users, but the vast majority were among non-Veterans. But when we looked at this as a rate per population, you can see that there is a slightly higher rate of firearm injuries among Veterans in Oregon than among non-Veterans. And down in the table there you can see some of the characteristics of those who incurred firearm injuries. And basically it really reflects differences in the Veteran population versus non-Veteran. So primarily male among injured Veterans, a lower age. But one interesting piece that kind of stood out to us was that the proportion of firearm related fatalities was lower among Veterans than it was among non-Veterans. And the proportion of hospital stays, so hopefully the non-fatal injuries that resulted in hospitalizations, but not necessarily death was higher among Veterans than it was among the non-Veterans. So this pointed to some potentially interesting patterns of differences in firearm related injuries between Veterans and non-Veterans at least in our state.

And here we look at it by the intent of the firearm events whether unintentional, intentional, or undetermined and broken out by fatal versus non-fatal injuries. So we get into smaller numbers here of the Veteran identified injuries. But basically you can see that in the fatal injury category far and away the most common intent of injury was self-inflicted. So these were your suicides and these are the vast majority of fatal firearm injuries among both Veterans and non-Veterans. But down here in the non-fatal injury category we see a higher proportion of unintentional injuries among Veterans than among the non-Veterans which is interesting. And this is made up for in a higher proportion of intentional injuries, non-fatal injuries among the non-Veterans compared to the Veterans. And this seems to be driven by assault related injuries. So probably again differences in demographic characteristics between these two groups but potentially also related to different levels of firearm exposure. You know for thinking about those unintentional injuries and what might be going on there and some of the narratives we examined in the trauma registry database, we saw Veterans that were injured when they were cleaning guns or practicing quick draw or recreationally shooting and then were injured. So perhaps a question of greater exposure to firearms among the Veterans and non-Veterans but we won’t know until we conduct further research in this area.

So in conclusion, and this is not necessarily my research conclusions, which you’ll find in published or forthcoming papers. But conclusion, you know, as a CDA Cyberseminar and my own path from a post-doctoral fellowship or going even further back from a PhD program in injury epidemiology to a post-doctoral fellowship in health services research and a CDA to being an investigator with the Health Services Research Group, what I’ve learned in my 13 years’ time here is that it’s really important to follow your passion and it’s possible. That’s it not straight trajectory from your doctoral program, I mean, your final training program throughout your research program. It can loop around and kind of go back and forth between your interests and between shifting priorities within the VA Healthcare System and your funders. But most important is that we’re focusing on our mission of improving Veterans health and well-being and also of improving our knowledge in the area of health sciences. And these are, you know, always underlying our research projects no matter what areas we’re focusing on. And for me, the ability and interest in exploring new areas of research and new collaborations, either in the Minneapolis HSR&D Center or the Portland Center which I moved to during my CDA period, has been really fruitful too and has brought me to new and interesting areas that I never could have imagined early on in my VA research career. Taking some risks, for me that meant taking that risk of trying to figure out the pathway of linking VA data to non-VA data which took me a long time to develop a method for doing that here in my state alone. But that risk has really paid off in unique findings and the ability to build on those findings in to new and interesting and worthwhile research trajectories. And of course, having awesome CDA mentors and awesome mentorship in general is everything here. So you know, I was fortunate enough to have wonderful CDA mentors who have stayed on as friends and mentors, and also mentors here at my center in Portland. And they’re all around, you know, whether you have time to meet independently or meet one-on-one with people in a direct formal mentoring relationship. Or just get nuggets of advice from folks or observe and model what folks do to navigate the VA Healthcare System successfully to also have a research career is really important.

And so, finally, I just want to thank, again, my VA mentors; Nina Sayer, Joan Griffin, and David Cifu. Also my mentors here in Portland; Daniel Storzbach and Jim Henry who really provided me a basis for conducting TBI and rehabilitation related research here in Portland. And Linda Ganzini and Steve Dobscha who are the leaders of our center, our Health Services Research Center, here in Portland. And of course, so, so many others who have buoyed my career and my research path. Again the sites, and I should have added here the Oregon Health Authority or the Public Health Division which has been a great supporter of our research primarily because, or in part I should say because, they’re so invested in Veterans health and are interested in working with the VA to serve Veterans and also has a strong and robust Injury in Violence Prevention Research Group that I’ve been able to partner with on a number of initiatives. And finally our funders, the most important in terms of the Cyberseminar being that CDA which was funded by HSR&D but also VA’s RR&D and CSR&D service which is funding some of my TBI work and the DoD and NIMH which is funding some of the new initiatives that I’m branching into.

So thank you so much to those of you who logged on today. I’m always available by email or phone or otherwise. You’ll know where to find me and I’d love to answer questions and talk about research strategies and trajectories and, of course, the Career Development Program through VA’s HSR&D.

**Rob:** Well thank you, Dr. Carlson, we do have a questions queued up. But let me take the opportunity to let people know if you would like to ask a question you can use the question section of the GoToWebinar dashboard, it’s that white piece of software that came up when you joined the webinar. I’ll read your questions to Dr. Carlson as soon as they come in. As for the two that we have queued up, I’ll just launch right in. What resources did you use to weave the VA and non-VA data e.g., vital records together? How did you approach analysis?

**Dr. Kathleen Carlson:** That would probably be a really long winded question but the upshot, or long winded answer to that question, but the upshot in terms of weaving those together, was being able to gain the trust of the stewards of the non-VA data so that we could move their data onto a VA data system, in our case a VA laptop. So that our VA data, which was identifiable, could stay protected on the VA IT system and that made all the difference in terms of getting permissions from the VA to link to non-VA data sources. And for our state, they were interested primarily in keeping their data onsite physically until it was linked to VA data and then de-identified. And so what we’ve been able to do is spend time over at the state with our VA laptops and with the VA data on our VA laptop and then moving the non-VA data onto the VA laptop but within the healthcare, or within the state’s health department’s building, and working with them on that data linkage and then de-identifying the data before we come back to the VA and run our analyses. And so it’s a lengthy process. I became a vetted researcher at our state health department and we have a partner there who became a vetted researcher through the without compensation at a WOC process at the VA. So as you can imagine, it’s a heavy investment of their time to support this research but that’s what’s made this possible. And then in terms of analysis that’s still ongoing and it’s been, especially in the area of prescriptions and linking VA to non-VA prescriptions, it’s been sometimes a feeling of drowning in data and how to we make the most sense of these multiple layers of data. And that’s been where working with my brilliant colleague and biostatistician and probabilistic linkage expert, Larry Cook, from the University of Utah have made all the difference in the world. So anyone whose interested in that can reach out to me offline and I’m happy to share what I know or put you in touch with people who know more.

**Rob:** Thank you. I think you may have touched on this one, in your previous answer but, how did you initiate your relationship with your state public health authority?

**Dr. Kathleen Carlson:** Oh yeah this goes back a lot of years actually to when I first moved to Oregon. And because I see myself as a public healther [sic] and an epidemiologist, it was one of the first groups that I connected with through professional organizations based in our state like our state’s Public Health Association and our state’s epidemiology and biostatistics groups. And so I met folks that were in the Injury and Violence Prevention Program at our state health department. And I started serving on committees for them long before we ever proposed a link data. And so I knew them for a lot of years and worked together on various projects. We co-mentored a couple master students that were [inaudible 57:06] data. And so I think for me and, you know, maybe this doesn’t necessarily have to be the case for anyone that’s trying to do this, but the building of trust was critical to being able to do this. And I understand that it’s time prohibitive and that it was just kind of a natural history and evolution of my time in Portland and my natural interests and relationships that made this happen. But I do think that anytime that you’re making two separate identifiable data systems touch, there’s going to have to be an established level of trust between both of the systems, or between both parties or both organizations, that are involved in that linkage. So I would add that to my previous answer that that relationship was natural for me and it occurred over many years’ time which is probably the best case scenario but maybe could be shortened for others who are thinking about data linkages in the future.

**Rob:** Thank you. That was the final question we have at this time. We really are just about out of time so my suggestion would be if you have any closing comments now is your opportunity.

**Dr. Kathleen Carlson:** Oh well, as you can see, I tend to be long winded and excited and passionate about the field of injury and about VA Health Services Research and how to address Veterans injuries using multiple data systems. But I can see how this extends to a large number of other topics that are of importance to Veterans and VA Healthcare. So I’m happy to work with anyone or talk to anyone whose also interested in some of these methods or some of the framing of injury prevention through the public health perspective and just basically share what I can with anyone whose interested. So thank you, Rob, and to our Cyberseminar leadership for giving me this opportunity to share some of my path.

**Rob:** Wonderful. Thank you, Dr. Carlson. And if anybody needs to get in touch with Dr. Carlson her email address is displayed on the screen currently. Attendees when I close the webinar momentarily you’ll be presented with a short survey. Please take a moment to go ahead and provide answers to that. It’s not very long but we do rely on your answers to continue to bring you high quality Cyberseminars such as this one. Once again, thank you Dr. Carlson, for your work in general and for preparing and presenting today. And with that, I’ll just wish everyone a good day.