**Transcript of the talk “VET Registry 30-Year Compendium of Scientific Research”**

 Presented by VET Registry Senior Epidemiologist Jack Goldberg, PhD on 05/17/2018

# **Slide 1**

[*Song* “*Born in the U.S.A.” by Bruce Springsteen plays*]

**Nick Smith**: So, welcome everybody. Today we have the opportunity, and sadly, the last opportunity, to hear professionally from Jack Goldberg who has been working with the VET Registry since its conception in 1982-83. Today is part of research week. We thought it would be an excellent opportunity for the VET Registry to have presented an overview of the accomplishments of the Vietnam-Era Twin Registry since it was started. Jack was there from the very beginning, and we thought it would be ideal if Jack was able to present the overview and give his take on the history of the VET Registry, and basically, its contributions to science. [*Directed to Jack*] And so, I think we have 50 minutes for your presentation?

So, Jack will get started with his presentation. We’ll have time for questions and answers afterwards. There are snacks and treats on this side [*gestures to snack table*], so please help yourself if you haven’t already done so. And let me introduce Jack Goldberg –

***Automated Voice:*** Someone has entered the conference.

[*Laughter*]

**Nick Smith:** [*Laughs*] Jack is entering the conference. [*Laughter and applause*]

**Jack Goldberg:** Thank you. Thank you much. It’s absolutely a pleasure and it’s been a delight to pull this together. The musical interlude that we had is Bruce Springsteen from his 1984 album and song, “Born in the U.S.A.”. And as the lyrics continue on, there is a lyric that is just so apropos that I’ve used for many decades now. A line that continues, “Had a brother at Khe Sahn, fighting off the Viet Cong. They’re still there, he’s all gone”. And this is a twin study, this just feels incredibly apropos.

[*Trips on wire*] I love tripping on the wires. [*Laughter*]

And so, it’s just so right on regarding that. Let’s see if we can move forward now, go ahead and do that. [*Switches to next slide, laughter*]

# **Slide 2**

**Jack Goldberg:** Okay, so here’s the title of the talk. It’s, “The Vietnam Era Twin Registry: A 30 Year Compendium of Scientific Research” –

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# **Slide 3**

**Jack Goldberg:** Okay, let’s just provide the background for this whole story. The VET Registry is an absolutely unique scientific resource. There are many large twin registries in the world, especially in the Nordic countries, and there are hundreds of studies on chronic disease and psychiatric conditions out of these Nordic countries. There is no other national twin registry in the United States. This is it.

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**Jack Goldberg:** And so, the presentation outline is, first, a history and development of the VET Registry with a few digressions. Many of you know the story, many of you know parts of the story. This is going to be the deep story. Unedited. Especially with digressions, you’ll be entertained. Then we’ll get into the meat of today’s talk, which is a completely new thing for me. Which is going to be some way of looking at the scientific productivity of the VET Registry. What is it we’ve produced over these many, many years? Over these decades? And really, I have an old colleague who was mentoring a young scientist – he said, “Scientific peer-reviewed publications: coin of the realm”. And it’s a fact that we –

***Automated Voice***: Someone has entered the conference.

**Jack Goldberg:** - do our science with these peer-reviewed scientific publications. So, I’m going to focus on that as our product. How many?

***Automated Voice***: Someone has entered the conference.

**Jack Goldberg:** And then the quality of these in terms of the number of citations, how often things are cited that we publish, and then something called the Journal Citation Report. We’ll come back to this later on when we get into that part of the talk. But let’s go into the history –

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**Jack Goldberg: -** and go into the way-back machine, and the concern about the health effects of Agent Orange was really what motivates the genesis of the VET Registry.

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**Jack Goldberg:** For those of you that don’t know, during the Vietnam War, especially the ’65-’71 period, there were spray missions all up and down the whole country of Vietnam. Where aerial spray, herbicides, insecticides occurred to deny cover for the enemy and to actually destroy rice paddies also. [*Referring to picture on slide*] We can see the extensive areas that were covered. Well, it turns out that this Agent Orange, which was one of the many different barrels of material that was sprayed -

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**Jack Goldberg:** - happened to be contaminated with a chemical called dioxin which is one of the most deadly chemicals known to man. This horrible thing. And added to this, after the war was over in ’75, Veterans came home and guys began to complain of all sorts of ailments and problems. And this led to an enormous furor nationwide about this issue.

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**Jack Goldberg:** [*Referring to picture on slide*] I just put up some of these cartoons of the era, and this was the type of thing that you saw. It’s called Agent Orange because the band on the drum, the 55-gallon drum, was in orange. There was Agent Yellow, and Purple, and whole different things, but it was Agent Orange that was contaminated. [*Referring to picture on slide*] And these were some of the many illnesses that people would complain about after they came back – the Veterans came back.

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**Jack Goldberg:** And the issue really was boiling up. [*Referring to picture on slide*] This was the kind of thing, again the political cartoons of the era, “’Agent Orange? We’re studying on it. What more do you want?’ – from the Veterans Administration”. It was really a very public issue.

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**Jack Goldberg:** So out of all this bubbling work, science went to work. We had to understand what kind of health problems were going on. Studies were launched by the Department of Defense, the VA, and the CDC was also involved. They’re all doing studies on the health of Veterans following service in Vietnam. Particularly, the damage done potentially by Agent Orange. The VA put out – there was something called the Agent Orange Project Office, back in the day. They put out an RFP at the time, a Request For Proposals, across the VA – anyone wanting to do studies on Agent Orange. Mostly, they expected a lot of bench science to come out of the VA enterprise. And out of St. Louis are a couple young guys named Seth Eisen and William True – Seth and Bill, of the St. Louis VA. And out of this response to the RFP they got this idea talking to some colleagues, especially one grand man in twin research, a man named Irvin Baxter. They got this idea of doing a co-twin control study.

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**Jack Goldberg:** And so, this idea they came up with that struck this moment of genius for them, was basically take 500 identical twin pairs, male-male monozygotic twin pairs, where one served in Vietnam and one did not serve, both guys had been in the military. Both were males, there weren’t very many females in the Vietnam era. And one brother served, one brother didn’t serve in Vietnam. And so, this idea bubbled up, a letter of intent was written, and they said, “Go ahead. Develop the Protocol. See what you can do to do this study”. And the VA gave them some money to get started. Now the thing is, you got to go back to 1983, Seth and Bill are really young guys. They really had not been – done a huge – they were sort of assistant professors, junior researchers at the time. Smart, but not a lot of experience in conducting such a massive study.

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**Jack Goldberg:** Okay. And so, what happened was, it was decided by VA Central Office that really, they needed infrastructure and support. And what they did was they said, “Seth and Bill, we’re going to move this study administratively from the Agent Orange Project Office, which has no infrastructure or validity, to the one place in the VA that can do large studies”. And that was the VA Cooperative Studies Program. And they gave it to the VA Cooperative Studies Program, and it was assigned to the Hines Clinical Trials Center because they were willing to take it on. And it was managed by William Henderson. Bill Henderson was the head of the Hines Center, and he said, “yeah, we’ll take it on”. And one of the earliest things that came out of the review of the letter of intent is they said that these guys are great in St. Louis, but they need biostatistical support and it would really be a great idea to hire an epidemiologist on this project. And the project was split to two parts: the clinical component of these 500 pairs, and then the other part of it was they had to figure out where to get these pairs. There was no twin registry that existed. It was this thought that you could build this sample, this pool of twins, that you might be able then to select your 500 from. And so, it was split into a registry component, build the registry, and then from that you would then select the twin pairs for the clinical examination component.

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**Jack Goldberg:** *Whoop!* So, we’re off and running, develop all this stuff, and then the next thing, this swirl of politics is going on. Agent Orange was an incredibly controversial issue at the time. And so, from 1984, after we’re developing our protocol, things are going on in VA, CDC is doing things, DOD. And next thing we know, *woo!* We’re not going to go forward. The VA is going to be cancelled, *and!* Notice the important last line here [*referring to picture on slide*], “but members of the research staff have been told to start looking for other positions” – [*overlapping*]

***Automated Voice:*** Someone has entered the conference.

**Jack Goldberg:** That’s me! [*Laughter*] I’m looking for other positions at this time, saying, “hold – what happened here?”. We’re not going to go into the details, but you know.

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**Jack Goldberg:** *But wait!* Thank goodness, Congress is there! So, the Washington Post in December, “Twins’ Study Saved”, so this twin study is going to go on now! And what happened as all the swirl through of it back in the era, it was decided that the clinical study of 500 twin pairs should not be done. And that was basically because CDC had established that it was not – you’re no longer able to assess based on self-report. It was not reliable to know whether someone was sprayed with Agent Orange. No one knew what they were being sprayed with. They were just being sprayed with stuff. And they spent several million dollars to develop an assay to assess whether people, long-term, had exposure to Agent Orange. And they developed that, and it turned out there wasn’t good correlation between people thinking they got sprayed with Agent Orange and actually what biology said. So, they said, “You’re likely not going to be able to find enough people exposed to Agent Orange if you do the twin study like that – the clinical study. But you can build the registry anyhow; we think it’s a good idea”. So, they said, “Go ahead. Build the registry. It’s probably a good thing to continue on that path”. And so that’s what happened, and they said -

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**Jack Goldberg: -** “Okay. Build the registry”. So how do you build a registry? Well, many of you know this story and have heard it before, and so we’ll go through it quickly. Basically, we looked around for computer files anywhere we could find them. The best place we could find was the Defense Manpower Data Center in the end. We knew it was incomplete because computerization was ongoing during the Vietnam War. Think of it, ’65-’75. Things are just evolving to data getting computerized, and so we used - [*overlapping*]

***Automated Voice:*** Someone has entered the conference.

**Jack Goldberg:** - a record linkage algorithm from the computer records we had, and used the same last name, different first name, same date of birth, military service between ’65 and ’75, and then the exact match in the first 5 digits of the Social Security Number.

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**Jack Goldberg:** From what we did out of that, we filtered these millions of records down to 15,000 people who might be twins. But we don’t know they’re twins; all we know is they match on – a pair of records match together: same last name, different first name, same date of birth, and first 5 digits. So, we got that. But we had to confirm that they were twins. And the only way you could confirm that they were twins was to look at the hardcopy records to look at the parent’s name which we knew was there, and then we could extract the military record information.

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**Jack Goldberg:** So off we went down back to St. Louis. [*Referring to picture on slide*] This is the National Personnel Records Center. It’s a blurry picture but that’s what it looks like. It’s a large building, and this is where all the military records from World War I, World War II, Korea, and Vietnam are stored. Hardcopy records, and this – when you go inside – is kind of what’s going on inside. Boxes and boxes. It’s a sea. So, when I went down to NPRC to see what were the records there, I was like, “oh my goodness”. [*Laughter*]

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**Jack Goldberg:** Seven shelf-mile of records represented the Vietnam Era. [*Referring to picture on slide*] Anyone know what this picture is?

**Female Audience Member:** Indiana Jones.

**Jack Goldberg:** Indiana Jones, right? That’s what it felt like looking around. So, we were going to have to go and pull hard records for the 15,000. Look at every record. Get mom, get dad’s name. Are they a match? And if they were, well, then we’d have a twin registry.

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**Jack Goldberg:** Miracle of all miracles, 7,500 twin pairs, roughly, were identified out of the 15. So, we had a 50% hit rate, which was pretty good. Still took, you know, several years of digging through those files, but we were able to identify. And then we collected, from the military record, a few variables that were of interest. Mostly on the DD214 discharge record.

# **Slide 20**

**Jack Goldberg:** Okay, big picture. Median age of birth, 1949 for the cohort; 92% white; and then their Vietnam distribution was nice, 21% both of the guys served time in Vietnam, 36% one served one didn’t serve, and 43% neither man served.

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**Jack Goldberg:** Okay. Now, some history. I’m going to do this in very sweeping, broad terms. First, it was at the Hines VA CSPCC, ’83-’90. The initial study that Seth and Bill – the piece of it that continued was called the Vietnam-Era Twin Study, CSP #256. What are we on now? 700 something? CSP 700 probably? So, it was 256, and it was managed by Bill Henderson during that era. And got that study done, built the Registry. Then, from ’91-2000, really it opened up. We said, “well, we want people to use this thing. We want people to use the twins to do science that they can”. There was enormously strong VA support, both locally with Bill Henderson and nationally in Central Office. Really terrific. We created an external advisory group, an oversight group to help us decide how to manage this resource that was potentially so valuable. We developed some rules on how investigators would be able to access the data in the Registry and the twins themselves to do new studies. And an active research portfolio developed by investigators from around the country, doing mail and telephone surveys, some first in-person exam was done in 1996 because the initial work was all mail and telephone, and then offsprings were – offspring were added by some investigators in 1998.

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**Jack Goldberg:** 2001 the Registry moved. The Registry moved for a lot of reasons, but in part it moved because the epidemiology centers, the ECs, didn’t exist back in 1983. All they had were the clinical trial centers. But the epidemiology centers had emerged. And as I saw this, being at Hines and sitting in the clinical trials center with an observational epidemiologic study, it felt like it was not a great fit. So, I managed to convince Bill Henderson, who convinced Ed Boyko, who convinced the people at Central Office to say, “you know, we can administratively just slide this resource within CSP over to an epidemiology center”. And indeed, the Registry moved with me in 2001 to the Seattle ERIC. Initially by Ed Boyko, and then managed by Nick Smith as it is today. And mail and telephone studies continue, in-person studies accelerate, and in 2002, we had first finally established the biorepository for the first time.

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**Jack Goldberg:** *Ah!* Some digressions [*Laughter*]. [*Referring to picture on slide*] You’re going to have to use a little bit of good vision, but you can look. Here in 1983, is the epidemiologist job description at Hines for the twin study. And you can see here, it says, “Attached is a position description for our epidemiologist position. Have a good trip to St. Louis. To Jack Goldberg – 5/9/83”. Now, this is a real trick. Does anyone know what these yellow slips were called back in the day? You’re all too young. These were referred to as “buck slips”. Remember, everything was paper back in the day. There was not – everything wasn’t on a computer. As in “passing the buck”, and so you’d pass these along. So, he wrote me a buck slip for this in ’83, and I had talked to Bill. He thought I was a good fit, but he thought I should go and meet with Seth and Bill down in St. Louis, and so, off I went to visit them to see whether or not this would be a good fit.

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**Jack Goldberg:** And here, I’ll show you just some of the earliest pictures. I don’t have the early days in the early ‘80s. I tried to ask Seth and Bill, but they didn’t have anything. 1989 – Seth in Rome hotel for the International Congress on Twin Studies which meets every 3 years in nice places. [*Referring to picture on slide*] And here’s Seth looking into the garbage pail thinking he’s thrown out his slides. This was in the era when you still had slides. [*Laughter*]

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**Jack Goldberg:** 1988 – This was the year when a large telephone survey was done by the VET Registry, initiated by NHLBI as an interagency agreement. [*Referring to picture on slide*] And this is the correspondence of a fellow named Richard Fabsitz, who was an old twin hand, and he provided money to support data collection. One of the first that was done after 256.

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**Jack Goldberg:** [*Referring to picture on slide*] And here, one of the big studies that was done in 1992 was the Harvard Drug Study, and this is the Harvard Drug Study team. That’s Bill True, Michael Lyons, it was really mainly his study with Ming Tsuang, another Harvard investigator, Seth Eisen, Nong Lin, and a non-gray-haired Jack Goldberg. [*Laughter*] Bald still.

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**Jack Goldberg:** One of our first clinical studies, in-person studies, was something called an Alcohol Vulnerability Study. [*Referring to picture on slide*] And Michael remembered this very well when I asked him who all these people were and when it was. And it was actually at the Harvard Library where this took place. It was the kick-off for that. And this is a fellow named Tom Doyle, myself, Bill Kremen – who has gone on to be one of our most active researchers in something called the VETSA study: the Vietnam-Era Twin Study of Aging, Bill True, Nong Lin, Seth, Mike Neale – a methodologist who- [*overlapping*]

**Voice on Loudspeaker:** Attention. Attention. May I have your attention please. Today we will be testing the Life Safety Systems and Code Red Systems in Buildings 100, 1, and outdoors. This is an equipment test only. There is no need to respond. Please disregard all automated Code Red messages. I say again, attention- [*Laughter*]

**Jack Goldberg:** Okay. [*Voice on Loudspeaker repeats message in background*] In the lower row is Rosemary Toomey – a neuropsychologist who works with Mike Lyons, and Krupa – a student at the time. Okay.

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**Jack Goldberg:** [*Referring to picture on slide*] And here is 2002, maybe the early days of something called the Vietnam-Era Twin Study of Aging. Seth, Jack, Bill, Michael, and Hong. And this is in Seth’s backyard, imbibing Diet Cokes. [*Laughter*]

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**Jack Goldberg:** Okay. Now we jump forward from that digression of some old pictures and things I was able to dig through, and we turn to the current day. And so, here we are at the current day. And, where are we? Well, here is our current mission statement for the Vietnam-Era Twin Registry, “To promote and advance high-quality scientific research in partnership with Vietnam-era Veteran twins and their families. To maintain a secure and current Registry database and biospecimen repository as a resource for future studies. And to treat the members and their families with respect and maintain their confidentiality”. So, if that’s our mission, especially the first one, high-quality scientific research and partnership, so how do we examine high-quality scientific research?

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**Jack Goldberg:** And as I said, the approach I took for the remainder of this talk is going to be kind of a bibliographic analysis of the work that has – the summative work that the VA Twin Registry has produced over these many decades. And so, the approach is, the method here, is going to search PubMed and Google Scholar for every peer-reviewed, scientific paper I could find. Not the abstracts. Peer-reviewed, scientific publications. I find that and then create a bibliographic database of everything that’s been published. I then categorized and went through each of these papers, quite briefly, and categorized each one as to which was the study team that sort of was leading that particular paper. These are the names: the Harvard Drug Study, the Vietnam-Era Twin Study of Aging, the Twin Heart Study, the Pitman/Gilbertson/Shin PTSD Studies, and the Jacob/Bucholz Offspring and Substance Use. These are not all of the investigations, but these are some of the big ones. And if I was going back, I’d probably add in more. And then, because we have these two parts to the Registry – we have the twin part and we have the offspring part – I thought being able to distinguish that would be good too. So, I just categorized it: twin or offspring. And then the data collection – whether the data collection for a particular paper involved self-report, whether it involved in-person, whether it involved some biologic measures, whether it involved some imaging technologies that became possible. And note what I’m doing; these are not mutually exclusive and exhaustive categories. They’re each one: yes, no. Because a lot of the papers use lots of different methods in there. For instance, a lot of the Twin Heart work is based upon whether PTSD is related to some biologic outcome. And so, you’re spanning different measures. So, a given study could have multiple kinds of measures. And then the topic: is it mental health, is it PTSD in particular – which is a big focus of the VET Registry, physical health, and substance use. Again, creating binary categories for each one. Mental health paper – yes or no. PTSD – yes or no.

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**Jack Goldberg:** Okay. And so, I then went and looked, did a little bit of looking at how things are done, and this type of approach, the easiest thing to do is simply count the number of citations to a VET Registry paper according to Google Scholar as of May 2018. How much has this body of work counted? And then I also used two measures that are fairly widely used. One is called an H-index, and the H-index is based on the set of the most cited papers and the number of citations that they have been cited in other publications. And the index can be applied to the productivity of a group of scientists. This is generated automatically by Google Scholar when you do a group of papers. And then, something called the Journal Citation Report. More commonly, we would refer to this as the Journal Impact Factor. So, it’s the characteristics of a journal, and saying, “well, is this a high-impact or low-impact journal?”. It gives it a score. The score is based on how frequently things are cited. It’s a measure reflecting the yearly average number of citations to recent articles published in that journal equal to the number of current year citations to all papers published in that journal during the previous two years. So, if you go out and look at any scientific journal, the splash page of that journal online, it’ll have the Journal Impact Factor because they want you to be impressed that you’re publishing in an important scientific journal. So, I recorded for [*claps between words for emphasis*] *every single paper*, the Journal Impact Factor. Now I couldn’t go back in time, because such a thing didn’t exist, so I simply used the 2016 rankings for the Journal Impact Factor. And a good way to anchor this for all of you is to look at some of the 2016 Journal Citation Report – Impact Factor – the *New England Journal* is the top, it has 72, a value of 72. *JAMA* has a value of 44. *JAMA Psychiatry*, which used to be the *Archives of the Journal of Psychiatry*, has a 15-score. *The American Journal of Epidemiology*, something many of us are very familiar with, has a value of 8. So there, I know that’s sort of a premier specialty journal in epidemiology, and that has a scale of 4.8. And then the place that Nick and I like to publish the most, *Twin Research*, has a 1.3, which is somewhat less than the others [*Laughter*] you can see. Basically, papers from *Twin Research* don’t get cited that much is what it says. So, it’s a good way to anchor it, looking at a few of these journals that I’m familiar with.

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**Jack Goldberg:** Away we go! And now, let’s see what we got! 304 papers have been published using VET Registry data since the starting of the Registry. To me, it’s a lot! 52 papers, I think (I may have lost how many because the numbers were moving around) 52 with a focus on PTSD. I would contend the VET Registry database is the single, most widely used database for PTSD scientific productivity of any in the world. I don’t think any other single resource has been used as extensively to examine characteristics about PTSD and its causes and its biology and psychology. Total number of citations to all VET Registry papers: 23,000 times that the VET Registry papers have been cited since the start. That’s a lot. The overall H-index for Registry papers is 81. This is a harder one to gauge. Basically, if you look at this, they say it’s hard to compare across disciplines, but say this is the biomedical arena. If you had 20-40, that’s usually regarded as pretty strong. An H of 40 would be regarded as a very substantial, full professor level. If you were doing it for an individual. This has an 81. The mean and median Impact Factor for the papers are 5 for a mean and a 3.4 for a median. And you can see, that these are not distributed very prettily. Those means and medians are a little bit different.

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**Jack Goldberg:** Let’s look at some pretty pictures. Okay? [*Referring to picture on slide*] So, here we can see the cumulative number of VET Registry publications. You see we start out slow there those first 10 years. But things really pick up because really after those first 10 years, we get these investigators now, getting their data back and they’re starting to generate lots and lots of papers. And that’s what happens. Lots of scientists coming out from ’99 on. It really takes a steep incline and has continued ongoing.

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**Jack Goldberg:** [*Referring to picture on slide*] And then if you look at this by some of these different groups, you can be pretty impressed. So, the Harvard Drug data have been used by far the most. And you can see cumulative studies. Again, these are not independent of one another. So, the Harvard Drug data is used across many different investigators in many different studies. But you can see lots of papers in Harvard Drug. Look at this here, that straight up line for the VETSA group. Extraordinarily productive group of investigators, lots of good science coming out of that. The Twin Heart Study, again, going up. Less activity from Pitman and Gilbertson and Shin, and Jacob and Bucholz. Somewhat less number of papers in that group, smaller groups.

# **Slide 35**

**Jack Goldberg:** [*Referring to picture on slide*] Twins and offspring. You see the vast majority of studies are twins. There’s relatively few studies relative to this that are –

# **Slide 36**

**Jack Goldberg:** - the offspring and mother. [*Referring to picture on slide*] Data type, again, mostly self-report. And then you can see the in-person, what’s happening here when the in-person studies are starting. Obviously, the biological studies and imaging studies and in-person are all in-person studies, and these have really, really taken off in the period 2005 moving forward.

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**Jack Goldberg:** [*Referring to picture on slide*] Publication focus over time. Again, mental health has been sort of the lifeblood of the Registry given the age of the guys when we first started studying them. That was the premier – the primary medical issue at the time. Mental health has continued to be a priority. PTSD, again, has continued. Substance use, with the Harvard Drug Study, being a lot of papers there. And physical health, more recent, again, that’s now – as the men have aged, that’s become a more important scientific issue -

# **Slide 38**

**Jack Goldberg:** - And more papers on that. [*Referring to picture on slide*] So we switch from that over to Registry citations. And here is the cumulative number of citations to VET Registry projects. Papers you can see all the way up here, *a little,* it’s flattening out there in more recent years.

# **Slide 39**

**Jack Goldberg:** [*Referring to picture on slide*] Ah! This is fun. To do a Top 10 List. So, what are the top 10 most cited papers from the VET Registry? Well, the most cited paper, by a lot, is from the Pitman/Gilbertson team on “Smaller hippocampal volume predicts pathologic vulnerability to psychological trauma”. This is a PTSD study, co-twin control type of design that Gilbertson published in *Nature neuroscience*, an important journal, an important piece of work. Then, the next set of studies – this is based on the original 256 data, that Bill True led this charge on this paper looking at the genetic liability to PTSD. It was really the first study in humans to show that there might be some genetic underpinnings to PTSD in 1993. And then, Harvard Drug Study here by Ming Tsuang on looking at the genetic influence on drug abuse. Really, again, had not been done. We’d been there for alcohol, but this was the first twin study to look at substance use. A more recent study by Mike Panizzon from the Vietnam-Era Twin Study on Aging group down in San Diego looking at genetics of cortical surface area, cortical fitness and imaging technology, nicotine and alcohol, doing a twin study analysis looking at – then the next study by Tsuang using the Harvard Drug data, pathological gambling and alcohol, do they go together? Heritability of adult and juvenile antisocial traits, again, this was from the Harvard Drug data. “Sexual orientation and suicidality: a co-twin control study in adult men”. And finally, genetic contributions to cigarette smoking, a heritability study using, I think, the Harvard Drug data.

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**Jack Goldberg:** And then also, let’s go now and ask, what are the 10 most highly rated journals for the VET Registry papers? Where are the important papers coming out? Based on JCR. And so, we had one in *JAMA*; we had one in *Science*; two in *American College of Cardiology*; one in *Circulation*; one in *Nature neuroscience*; *Internal Medicine*’s there, and you can see here [*Referring to chart on slide*], *JAMA Psychiatry*, which is pretty much the premier psychiatric journal, that’s where the bulk of our important contributions have occurred. Many, many papers in this premier psychiatric journal have appeared, 19 papers in total. And you can see the range of these scores, as we’ve said, it’s a very odd distribution.

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**Jack Goldberg:** [*Clicks but slide doesn’t change*] Really? [*Clicks 2 more times before slide changes*] Ah! Then I said, “okay, let’s take a look at who’s writing these papers”. Literally, you just see a sea of 300 papers; it’s hard to see. And what I did was not looked at first author or last author, there’s all sorts of ways of doing this. I just said, “any authorship position on this, who has authored a lot of papers?” and Dr. Lyons, Mike Lyons, has really led the charge there with 159 papers. This guy, Goldberg, has done a few. And Seth has done quite a few. Ming Tsuang. Hung has done a lot. Bill Kremen is charging forward with many, many papers on his VETSA study, along with Carol Franz, Bill True, and on down the list here [*referring to chart on slide*]. So, you can see that many authors have written many, many papers – been involved in these many papers.

# **Slide 42**

**Jack Goldberg:** Okay. Okay, so now this gets a little bit muddier when you start looking at these Journal Citation Impact Factor scores – no, excuse me, these are citations [*referring to chart on slide*]. These are simply the number of citations for individual papers. And so, I saw that – I crossed this by whether or not we’re looking at the study characteristic. So, when we look at twin papers, we see that on average, the twin papers have a mean of 79 citations for twin papers and we have a median of 40. Again, the means and medians are quite different here. Mother and offspring, my preference because of the crazy distribution here is to focus on the median as a better representation. 29 citations to the mother – somewhat less than the twin papers. And again, here, when we look at the kinds of data, mostly the heavy reference papers have involved self-report data. Somewhat less so for these other characteristics. That’s in part – the self-report studies cross a lot of different kinds of studies. Outcomes, you can see that PTSD is the most widely cited: 61. Fewer on physical health citations, and of course, the physical health papers are much more recent on many of those because they were based on examination protocols, many of them. And then here, we can see the average citations here by the study group: Harvard Drug and the Pitman group are very prominent, and then somewhat less for VETSA papers, and less for the Bucholz.

# **Slide 43**

**Jack Goldberg:** [*Speaking to himself*] Am I at the right place? Median citation… yeah! So, the journal citations. [*Referring to chart on slide*] This is the Journal Impact score that we have here. So, the Journal Impact score, again, we want to focus, I think, on the median here as a better representation of what’s going on. And so, twin studies have higher than the mother/offspring studies. Here, the imaging studies tend to be journals that have a higher impact on average than the self-report papers and some of the others. Mental health – when we look at this, we can see the physical health papers, on average, have been in journals that have a higher Journal Citation Reporting on average. And then, when we look across the different studies, we can see the Pitman/Gilbertson/Shin papers and the Twin Heart Study papers have been a little high and the Bucholz/Jacob study, somewhat, a little bit lower.

# **Slide 44**

**Jack Goldberg:** Okay, so that whirlwind tour there sort of blew up my mind a bit because I really was not that aware of what all had been done. Certainly had no idea that the papers had been cited that frequently. And so, in summary, what’s our productivity? The VET Registry, to me, is an amazing scientific resource. And this is borne out by looking at the citations and the productivity in the number of papers. There’s a large number of papers, very high-quality scientific journals. The VET Registry papers are widely cited. And the VET Registry work has led to fundamental new findings about PTSD, substance use disorders, aging, cognition, and heart disease. And that’s reflected, again, in these high-quality journals where the papers are found. So really there’s quite a sizable contribution to science that the Registry has made.

# **Slide 45**

**Jack Goldberg:** *But!*This is only the beginning! The best is yet to come. The Registry is thriving under Nick’s direction. Terrific support from Central Office. The twins are aging. As they age, sadly, as someone who is aging, that we get more stuff – illnesses. Eventually, they are not around. The data repository is now superbly curated. It’s maintained, it’s monitored, updated, it’s really in good shape. The biorepository with nearly 2,000 samples and growing. The whole genome sequencing now, which just got, you know, in the last year or so, we have about 1,700 and change samples on that. So, this is amazing. So, not only has the Registry produced a lot in the past and made important contributions to science, but that the future, the next 10 or 20 years is even going to be more important. And I think the Registry will be a resource that will be around for another 20 to 30 years and valuable. And with that, I want to – [*clicks several times but slide doesn’t change*] I want to press a button. Yeah, you have to – there’s only a few left.

# **Slide 46**

**Jack Goldberg:** So, I want to thank – special thanks for today’s talk – helping assemble this. Chris Forsberg did a lot of the analyses for this in very short order. Erin Acosta really pulled a lot of this together in short order also. And Shauna Biggs sort of shepherded everyone along to make sure that we got this done in time. So, really, thanks a lot for helping today.

# **Slide 47**

**Jack Goldberg:** And a grand thanks, really, go mostly to the VET Registry twins. [*“Glory Days” by Bruce Springsteen starts playing*] Because the VET Registry twins, without their participation – without their willing participation, there would be none of this. Everything would have gone in the toilet early on. These guys have been great, and as we meet with them in the focus groups, we love them.

# **Slide 48**

**Jack Goldberg:** [*Music continues playing*] And likewise, without the VA Cooperative Studies, there’s no study! [*Applause*]

# **Slide 49**

**Jack Goldberg:** [*Applause and music continue*] And the VET Registry directors, they’ve been fantastic! Bill, Ed, and Nick have been amazing. And I think that’s it.

# **Slide 50**

**Jack Goldberg:** [*Music continues*] Oh. [*Laughter*] And of course! All of you and the many others who have worked with me over the many years. [*Applause*] [*Referring to music playing*] It’s going to go off in a second. It’s going to go off in a few seconds [*Music plays louder then stops*. *Laughter, then applause*].

**AUDIO ENDS**