

Brett Kinsler, DC, interviews J. David Cassidy, DC, DrMedSc, PhD.

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KINSLER Representing the responsible voice in chiropractic, this is *On The Other Hand*. I'm your podcast host Dr Brett Kinsler. You can contact me by going to my landing page <http://www.kinslerpress.com> That's also the place where you can get more information about this podcast, see the show notes, post comments about episodes, or get new episodes. You can also read my blog or see what other projects we're working on <http://www.kinslerpress.com>

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KINSLER For the last few years it's been almost impossible to enter a conversation about any association between chiropractic manipulation and stroke without someone bringing up a huge study that was published in *Spine*. For evidence based chiropractors, that study turned what we thought we knew on its ear, and for medical skeptics, it was viewed as a misinterpretation of data, a biased piece of research. Well, I can tell you that no single study has been cited more often in all of the episodes of *On The Other Hand* than David Cassidy's 'Risk of Vertebrobasilar Stroke and Chiropractic Care' study that was published in *Spine*. I've read quite a bit of discussion on this paper, both in the journals and informally on the internet, and I wanted to get some perspective. So I turn now to the head author, Dr J David Cassidy in Toronto, Ontario. Dr Cassidy, welcome to *On The Other Hand*.

CASSIDY Ah, thank you.

KINSLER Now, without a complete recitation of your CV, give me an idea of what your educational background is.

CASSIDY I started out as a chiropractor, and I practiced as a chiropractor full-time for several years in a small town in western Canada, in Saskatoon, Saskatchewan, and when I was there I was also the first chiropractor to be part of a university hospital back pain clinic - and so I would spend half a day seeing patients in a private clinic and the other half of the day at outpatient clinics at that hospital, and I got drawn more and more into research working in the hospital. There was an orthopaedic surgeon there, Professor Kirkcaldy-Willis, who had written a book about treating back problems, and he got me more and more interested in research and I ended up doing degrees - undergraduate degree in anatomy, and then graduated - a masters degree in surgery and doctoral degree in pathology. And then I got drawn out of pathology and into public health and epidemiology. So I did a second doctoral degree in injury epidemiology at Karolinska Institute, which is in Stockholm Sweden, and now I'm a senior scientist at the Toronto Western Hospital which is a teaching hospital with the University of Toronto, and I'm a Professor of Epidemiology and Clinical Epidemiology at the University of Toronto.

KINSLER Do you still identify yourself as being a chiropractor? Do you feel that you've moved on from that, or are you a chiropractor turned epidemiologist? I mean, how do you see yourself?

CASSIDY Well, probably the answer to that would be both. In my day to day work, I work really as an epidemiologist and I - for example, I do work now in brain injury and I'm starting to some work in spinal cord injury. Have done a lot of work in musculoskeletal injuries and occupational health issues, and certainly my background as a chiropractor helped me a lot in understanding musculoskeletal injuries, and I've done a lot of work in that area now, but my day to day job now is as a scientist and as a professor at a university. I don't see patients any more.

KINSLER You have over 200 published papers and a lot of your work is focused on the spine. A good portion of that has actually been cervical spine injuries and whiplash. Was your chiropractic background what drove this passion into spine research, or was there something else that influenced that?

CASSIDY Well, I think that the interest in spine research, of course, started with being a chiropractor and seeing patients with spine problems. But I think my interest in research developed when I was working at the Royal University Hospital in Saskatoon with Professor Kirkcaldy-Willis because he developed a very well known academic centre for a small centre like Saskatoon, and we were publishing papers, doing studies, writing textbooks, writing chapters in other peoples' textbooks, so it was a very exciting time and it was focused on back problems, neck pain, back pain, and I got more and more drawn into research and more and more drawn away from clinical practice, but I did practice at least part-time for up to 20 years before I finally had to stop practice because I became so busy as a researcher I didn't have time any more to see patients and after 20 years I thought I had a pretty good clinical background.

KINSLER Let's talk about one of those research papers that I'm sure kept you pretty busy, and continued to keep you busy beyond its publication. You co-authored an article in *Spine* in 2009 entitled 'Risk of Vertebrobasilar Stroke in Chiropractic Care: Results of a Population-Based Case Control and Case Crossover Study', and in this study it demonstrated that patients suffering from headache and neck pain were no more likely to suffer a stroke following a visit to a chiropractor than they were following a visit to a family medical physician. Tell me about that study.

CASSIDY Well, to start out, I'll just correct you on a little detail. It was published in 2008, actually, in the journal *Spine* as part of a whole issue that was dedicated to the findings of the Decade of the Bone and Joint Task Force on Neck Pain, and last decade was the decade of the bone and joint and there were initiatives around the world looking at musculoskeletal problems. So back in 1999, 98-99, a group of us got together and wrote grants to raise money to have a task force which would study the problem of neck pain and whiplash and neck injuries, and some of their associated disorders, and look at the world literature and then publish a patient care guideline. And we did that, and as you mentioned it was published in *Spine* in 2008 and it had several - I think there were 20-some odd chapters to it. Most of it was just systematic review where we looked at the world literature on different issues such as the epidemiology of neck pain and whiplash, the prognosis for people with neck pain and whiplash, the best treatments for patients with neck pain and whiplash and their associated disorders. But we also saw some gaps in the research and we did five original research studies, and one of them was this study on stroke and chiropractors. And the reason we did that was because the experts on the panel, and these were - this was a multi-disciplinary panel made up of clinical scientists from all around the world. There were orthopaedic surgeons, neurosurgeons, neurologists, physical therapists, chiropractors, all sorts of backgrounds - and we saw a gap in

chiropractic care - was very popular and being utilised by a lot of people and expanding throughout the world, but there wasn't much information on the risks of chiropractic care to the neck and there was a lot of concern about it because there'd been a lot of press around several cases where it was alleged that individuals suffered a stroke after seeing a chiropractor. And we looked at the past literature and there were a couple of studies, one from my university, the University of Toronto, and another one from the U.S., and there were a couple of other studies, but those were the two main studies and we wondered if we could improve on those studies and extend them a bit and learn more about this phenomenon.

KINSLER And how did you improve on those studies?

CASSIDY Well, two aspects. The first is that our study is the biggest study. We studied everyone in Ontario over a nine-year period, and that represents over 109 million person years of at risk, and so that's pretty big. Prior to that the biggest study which had used the same database was here in Ontario - was a study done by a lady named Deanna Rothwell, and she published that in the journal *Stroke* in 2001 and she used the same databases that we used - and used a traditional case control methodology - and she looked at five years whereas we looked at nine years so our study had more power, we were able to find more cases. So that's the first thing we did, was we had a bigger study, and because this is such a rare event you need a big study. The second thing we did was we extended the traditional case control study methodology which is a methodology that's been used throughout - for many years in epidemiology to study the risk of rare events or events that take a long time to develop. So, for example, the first case control study ever published was on the risk of car crash and people that were drinking, and this was done many years ago, and then an even more famous case control study was a study that looked at smoking as a risk factor for lung cancer. So this methodology's been used quite a bit. So the past two studies that have been done, the one in the U.S., and the one that was done here in Ontario back in 2001, they used this traditional case control study where you gather as many cases that you can find and then you get usually age and sex matched controls and you look back in time and see if their exposures are different. So, in the case of chiropractic, you would get as many strokes as you could get and then match these cases of strokes to controls who are of the same age and the same sex and then go back in time just before the stroke and see if the stroke cases had more chiropractic visits than the control cases.

KINSLER You said this type of stroke was very rare. How rare was it?

CASSIDY Well this particular type of stroke that we're interested in is vertebral stroke and it's very rare. I mean it occurs in older people, and it's not that rare in older people, but in - we're really interested in this because the case reports that have come out in the past linking chiropractic to this type of stroke had really described cases that were young, people that were young and got these strokes, and that's why I think it garnered a lot of attention because a stroke, of course, is a very severe neurological problem, which can lead to death in some cases, and if it happens in a younger person it draws a lot of attention. Stroke is a fairly common cause for death in older people, but not in younger people so these cross studies that I'd mentioned, these past case controlled studies, had really seen - had seen an association for a link between chiropractic care and this particular type of stroke, posterior stroke, from vertebral artery dissection likely, affecting the posterior part of the brain, and so we - sort of focused a bit on younger people. This type of stroke is very, very rare. And it's so rare that we don't really have great figures on it. The only good study comes from the Mayo Clinic and this showed that - this was published back in 2006 -

and it showed that this type of dissection-related stroke occurs in about one person per 100,000.

KINSLER Did that correlate well with your results?

CASSIDY We actually weren't focused on incidence. We were focused on risk. And there are differences there. The Mayo Clinic has an entire reporting system so every case that presents to a hospital is examined and put into a database. In Ontario, we don't have a clinical database like that. What we have is an administrative database. It's similar, but there are subtle differences. So, because we have universal healthcare in Ontario, everybody in Ontario when they present to a hospital their ICD, their international Classification for Disease code's entered into a national database called CIHI, Canadian institute of health information, and researchers can access those databases to look at various types of health problems. In the case control study it's possible to calculate an incidence rate from a case controlled study, but we didn't focus on that. We focused on looking at the risk and whether this association between chiropractors and this type of stroke - if we could replicate that using this new methodology called case crossover which is a variant of the case controlled study, and briefly what that does is instead of matching - matching cases or patients to separate controls, that is separate people who are in controls - the case cross over methodology matches people to themselves. It's a big advancement in risk factor epidemiology because when you're studying things like stroke from administrative databases there are no codes that indicate the person smokes, there's no code that indicates that they're overweight, there's no code that indicates that they're inactive, so the sort of risk factors that these stroke risk factors - you can't draw them out of these databases, so if you're comparing cases to separate controls it's likely that there's some confounding because the cases are going to have more risk factors for stroke. When you do a case crossover study you're comparing cases and you're looking at the period right before they had their stroke - what happened to them - and then you look at separate periods in their past that go beyond in their past, beyond a short time period right after the stroke, and this type of methodology has been used, for example, recently to study the risk of car crash while using a cell phone - and you can understand why it was used there because if you use controls, separate people, you can't control for the way that they drive, you can't control for, you know, how angry they get when they drive, or how aggressive they are, but when you compare them to themselves you're able to do that. So this methodology has been made in that - and in studying other things like exercise causing acute myocardial infarction and heart attack, it's been used to look at the risk of deep vein thrombosis when you go on long range aeroplane rides, and things like that. So it's been used quite successfully and we wanted to apply it in this case because we thought that it would give better control for confounding. And then the final thing that we did is we not only looked at what we call the hazard period or the risk period right before the stroke at chiropractic services, we also looked at family doctor services. And the reason we did that is because we knew that this particular type of dissection-related stroke often present as neck pain and headache before the person has a full blown stroke, and the reason this happens is because they have damage in the carotid or vertebral artery and this causes neck pain or headache before they get the stroke and of course we know that people will, if they have severe neck pain and headache, they'll seek out care from both family physicians and chiropractors. So this is another way that we extended the other studies is that we replicated what they did with the case control methodology with separate controls then we did this case crossover methodology which has better control for confounding and we also included an analysis looking at family practitioner services right before the stroke.

KINSLER So there are a lot of complicated layers to this...

CASSIDY There are, and it's a complicated issue when you're studying rare events. And this study took quite a while to design, and I think it's a fairly well designed study, and it does extend findings because we found that we replicated the findings of the past studies in that we found an association between chiropractic care and subsequent stroke, but we also saw the same associations between physician care and this type of stroke. And when we looked at all visits to physicians and chiropractors prior to this type of stroke we also then did a sub-analysis where we looked at just visits that were coded neck pain and headache related visits, and the risk estimates went way up in both groups. So this indicated to us, first of all because there was no difference between risk estimates between chiropractors and physicians, that really there was no additional risk that we could see for chiropractic care, and because the estimates in both groups went up when we limited the analysis to people with neck pain and headaches, this tends to support the hypothesis that these patients are actually in the prodrome of this type of stroke and they're seeking care from chiropractors and GPs and then they're going on to have the stroke.

KINSLER That's a pretty controversial conclusion. Would you say there's been a lot of criticism of this study?

CASSIDY Wherever there are special interests there's always criticism, and epidemiologists are used to that. I think it's controversial because there are lawsuits against chiropractors for this type of stroke and, of course, when you involve the courts and lawyers it becomes controversial.

KINSLER Do you think there are valid criticisms of the study?

CASSIDY There's no perfect scientific study

KINSLER Sure.

CASSIDY So our study has strengths and limitations. The main strength is the large source population. We had 103 of these type of strokes over a nine-year period in a population of 12-13 million people, which is over 109 million person years, so you need a big, big source population to study this.

KINSLER Some people would say that large source population may have also been a distraction. You know, the fact that you had people included from all age groups knowing that the risk of, or the rate of stroke in elderly population is spontaneously higher and they were mixed into the results.

CASSIDY No. When we did our analyses we stratified by age so we did what the other main studies that had found this association did - we looked at people up to age 45 and over age 45, and the reason that's done is because the real interest is in strokes in younger people under the age of 45 and the cross study had shown that strong association between chiropractic care and people under 45 years of age and we found that also. We also looked at older people and we found no association between chiropractic care and these types of strokes in older people and that's because I think this type of stroke is a different type of stroke in an older person. It's the same anatomically or pathologically the same stroke, but the causes are different. For example, when we looked at the older people they had more cardiovascular risk factors and that's why people have focused on this issue, because these strokes are rare, but they're occurring in young, healthy people and that always draws a lot of attention. But getting back to the strengths and limitations - well one strength is the large source population. Now another

big strength of this study is that the - we had accurate and independent measures of exposures. In other words, the visit to a chiropractor's and physicians were drawn from a different database than the outcome which is the stroke. And because of our case crossover design, we have very good control of confounding. One of the limitations in our study is the potential misclassification of stroke in the CIHI data so, in fact, we did a series of sensitivity analyses where we actually introduced bias into the - or misclassification into the - different levels of misclassification into the estimates and it doesn't change the results because this misclassification would be true for the GP results and the chiropractic results because, again, the ascertainment of the stroke was done independently of the ascertainment of the exposures and this is an important principle when you do case control studies

KINSLER So the fact that the data was coming from discharge notes, which are unreliable, you're saying that that would not really have affected the data because it would have affected the medical doctor, the GP data, equally as it affected the chiropractor data?

CASSIDY Yeah. The misclassification becomes important when it's differential. So if it was different for the chiropractic cases than it was for the GP cases that would be important, but in this case it's not. And the other thing is that this type of data, health administrative data, is used all over the world to study all sorts of problems. It does have problems of accuracy, but even diagnoses done in hospitals have problems with accuracy so there's no doubt there's misclassification in these databases. I do want to underline, though, because people focus on this who don't like the study, that, you know, there's error in the coding - and there is error in the coding I'm not saying there isn't - but the people that code in hospitals in Ontario and across Canada are very highly trained and what they do is they go to the discharge summary, which is dictated by the physician in charge of the case, and in the discharge summary the physician lists off the main reasons why that person is in hospital. So even though there is likely to be some misclassification, the reliability of these coders has been carefully studied and they're very good at doing it, their reliability is quite good. But, of course, if there are errors in the discharge summary, they wouldn't know about that. So much has been made about the misclassification of the stroke diagnoses, but we don't believe that that's a big enough bias or issue to bias our study

KINSLER You mention that certain aspects of the study are misinterpreted. Do you think it's being misinterpreted on both sides?

CASSIDY Well, I don't know because, I mean, I don't think I hear all the criticism. There's no doubt that this study is being used in courts - in court cases - and I know it was used in Connecticut, for example, to look at the issue of informed consent because I was asked to go there. And, of course, people who want to limit chiropractic care, or are suing chiropractors, are going to focus on this study because this study raises a pretty strong argument that there's no additional risk - so there's no doubt they're going to criticise it. As far as scientific criticism, we've had a couple of letters to the editor which is the way scientific criticism happens and there - I mean, we answered the queries there was nothing raised that in our mind biased the study, and I think by and - and you have to realise, too, that the study was peer reviewed twice before it was published. It was peer reviewed by an international task force, and then it was peer reviewed by the Editorial Board of *Spine*. So we think it's a pretty solid study. The main criticisms I've heard are around the ICD coding, but there are literally thousands and thousands of studies published every year using ICD coding, so it's not something that would bias the study.

KINSLER Would you have changed anything about the study's construction now in hindsight?

CASSIDY No, and there's not much more we could do because this is a very difficult issue to study. It's a very rare event. You're not going to get a really good clinical study on this because you'd have to have millions of people in it and that's not possible. You know, for example, people have asked why you didn't examine the patients. Well, to, you know, examine these patients first of all we didn't have permission to contact them. When researchers use health administrative data it has to be de-identified and our ethics board wouldn't allow us to contact them. And the other thing is, it would be very hard to contact these cases over nine years - that had happened up to nine years ago in various parts of Ontario. which is a big land mass, and, you know, 12-13 million people. It would be very expensive.

KINSLER Because you used the OHIP data - the Health and Insurance Plan data - there are some patients who've had strokes that won't necessarily show up. Patients who weren't hospitalised, for example, or just people where it was a transient cerebral ischemia, stroke patients that were in long term care facilities, and those who weren't covered by the plan. Would have including that data have a significant influence on the results, if you were able to obtain that data?

CASSIDY Well, yeah, all those issues you raise, they're all slightly different, so let's go through them one by one. What was the first one?

KINSLER Non-hospitalised stroke cases.

CASSIDY Well, of course, if someone's not - that would be a very, very minor stroke if it wasn't hospitalised. I'm not - it's possible, and I think people who have very mild transient ischaemic attacks aren't always hospitalised, so we did study more, you know, substantial strokes that resulted in hospitalisation. So our results are limited to important strokes.

KINSLER And what about those in long term care facilities?

CASSIDY Well, we excluded anybody in a long term care facility.

KINSLER Right...

CASSIDY ...because we know that they are at higher risk for stroke so before we formed our cohort we excluded those people - and it's not a lot of people, a small number of people relative to the population.

KINSLER But you did it because you're looking for the lower risk type of...

CASSIDY No, we did it because to do this type of study first of all you have to start out with incident strokes, and by that I mean new strokes, so we included in the cohort where we selected the cases people that were in long term care facilities. Some of them would have been in there for prior stroke, and certainly the people that are in long term care facilities are at greater risk for strokes, and they're not seeing chiropractors because they're in a long term care facility, so we excluded them.

KINSLER And what about people who aren't covered by the Ontario Health Insurance?

CASSIDY Well, again, that's a universal program so it covers, I think, 99% of Ontarians. The people that aren't covered are people that are paid through the Federal Government for their health care and that's a small number. That would include the Royal Canadian Mounted Police, and also people in the Canadian Armed Forces, and also some native Canadian people who live on First Nations Reserves. But that's really a small number, relatively speaking, and we couldn't include them because they're not in these databases.

KINSLER You spoke about appearing at the Connecticut informed consent hearings in 2010, and one of the questions you were asked at the time discussed your previous experience with causing a stroke in a patient with cervical manipulation. Tell me the background on that.

CASSIDY Well, when I was practicing in Saskatoon I had a pretty busy practice and a patient had one of these types of strokes after seeing me and at the time I was pretty convinced because of the temporality - in other words you give a treatment then a person has a stroke - that I was the cause. So I came to this study pretty convinced that - in other words I wouldn't be surprised that there was this association between chiropractors and stroke. But I think that that's - as time went on, and I became more trained as an epidemiologist, I started to understand that case reports, although important in raising issues, cannot determine causality and there are some conditions where the condition is present before the treatment is given but the treatment is blamed for the condition and we call that 'confounding by indication' and this is a good example of that. So that, you know, patients - some, very rarely because it's not a very common phenomenon - but occasionally a patient with a headache then neck pain will present to a chiropractor, the chiropractor will treat them, or they'll go to a family doctor and the family doctor may do nothing, he may give them a prescription, but he might not even touch them and they'll even have a stroke. Does - and my view on it has changed because now I've seen what we call an analytic study which has a control group and if chiropractors were causing this type of stroke the risk estimates associated with chiropractors would be much higher than the risk estimates associated with family practitioner care, and they weren't.

KINSLER I think it's important to note that in your result you did say that you haven't ruled out neck manipulation as a possible cause of some vertebrobasilar artery strokes. Why would you state that in your conclusion?

CASSIDY Well, because it is possible that some family physicians are causing some strokes. We can't say for certain that they're not. For example, the prevailing thinking in the past has been that if someone has a dissection developing in the vertebral artery as it transverses up through the foramina in the cervical spine, that even if they turn their neck, that can disturb a clot and throw off an embolus which goes up into the brain and causes a stroke. And, in fact, there are case reports of people having this type of stroke after being at an air show and looking up in the sky. There's also a case report of someone having this type of stroke after having their hair washed at a beauty parlour. So the thinking was that any type of neck movement could participate this cascade of events that would lead to an embolus and a stroke. So it is possible that a family doctor might, if some one comes in and says I have a headache and my neck's very sore, he might ask them to turn their neck to the right, turn their neck to the left, look up as high as you can put your chin down, in other words put the neck through a range of motion. For sure chiropractors do that, but I'm not convinced that a lot of family physicians do that, but some do, so it's possible that some of these strokes are occurring because family physicians are moving the neck and poking around at the neck. But I think that's rather unlikely but I can't totally rule it out a...

KINSLER ...So you're pretty convinced, though, that the stroke that you thought you had caused, that you were probably mistaken and that it was just a temporal fallacy?

CASSIDY Yes, but the thing about a scientist, and I want to underline this, is that if someone comes out with a better designed study, and shows in a better designed study, that this association is causal, I would then change my mind, but I think our study shows a lot of - I think what it does is it raises a very strong hypothesis that there is no additional risk. So that's my position right now, but in science things can change and another study might come out and show the risk, but I think right now the evidence, at least in my mind as an epidemiologist, is that there's no associated risk, that there's no additional risk to seeing with the chiropractic care.

KINSLER And that's you, as the best available evidence right now?

CASSIDY Yes, that's looking at a study with a control group and not single cases because, again, there's lots of examples in medicine where single cases are published and everyone's convinced that that treatment is risky or helpful and then later on a better study is done that shows that it's not.

KINSLER To what extent can clinicians assess for risk factors and screen for potential strokes in neck pain patients who present?

CASSIDY I know of no clinical screening tests that can pick these up – a dissection in the neck - and so there is no test, and I don't think there's any way of screening. I think the good news is that this is such a rare event that most practitioners would not see this ever their practice.

KINSLER What about critics who say you know you have to look at the risk/benefit ratio, and the benefit of spinal manipulation of the neck is zero, therefore it's not even worth any slight risk if you can't assess for it? How do you feel about the benefit of spinal manipulation according to the literature?

CASSIDY Well, first of all I would completely agree that if there's no benefit to a treatment then why would you apply it? So if there was no benefit to chiropractic care for neck pain, then I would see no point in providing that type of care.

KINSLER So there's the question, is there a benefit to chiropractic care in neck pain?

CASSIDY Well, if you look in the Decade of the Bone and Joint Task Force, which studied the world literature on treatment, there's a chapter on intervention written by Dr Erica Wirtz – check, and it surveys all the past studies on the treatment of neck pain and it does recommend that chiropractic care is an option to help people with neck pain. So there is a benefit according to the scientific literature, but if there wasn't then I wouldn't see the point in applying it.

KINSLER Is it standard questioning in Emergency Departments to ask a stroke patient if they've recently seen a chiropractor?

CASSIDY I don't know if it's standard, but we did publish another study where we looked at - and it's in the same issue of the Decade of the Bone and Joint Task Force document - and what we did there was we looked at the number of these types of strokes over a long period of time, 30 years I think it was, in the province of Saskatchewan, and we looked at that because an interesting thing

happened there - a young woman died after seeing a chiropractor and there was a coroner's inquest and it was in the newspapers so it was - there was a lot of publicity around it, very negative publicity for chiropractors. We looked at the number of these cases diagnosed over that period of time and after that inquest we saw a big spike in the number of these types of strokes diagnosed and we saw a big decrease in chiropractic utilisation and what that indicated to us - this was an ecologic study - what that indicated to us is that neurologists and physicians became much more aware of this type of stroke and were looking more carefully for it, and maybe even over estimating it, or over diagnosing it, and on the other side chiropractic utilisation dropped really, really low - and we could do that because all chiropractic visits again were captured in the Saskatchewan health administrative database, so here we see the opposite happening. If this increase is really - and it was being caused by chiropractors, you wouldn't expect to see a big decrease in chiropractic care with a big increase in these strokes. The other thing we saw was, after a while, the number of these strokes diagnosed fell off and went back to about the same, and the number of chiropractic utilisations went up again over time.

KINSLER So you think there's some errors in common knowledge of...

CASSIDY Well, I just think you just have to be careful because there, you know, this can happen - it's called a detection bias, where physicians become more aware of an issue and they look more carefully for it - and getting back to your question about emerg doctors, I think if neurologists in particular, if they go down to emerg and they see someone with a young person with this type of stroke I think many of them would say "have you seen a chiropractor?" and, of course, if the person says "yes" they might say "well it's possible that's what caused your stroke", and that can lead to a whole chain of events that might end up with a lawsuit - and that may happen. That's speculation on my part, but I think that that's possible.

KINSLER Do you think at this point that's an inappropriate question to ask?

CASSIDY I think from a causal point of view I don't see the point right now. I don't think it's going to - I don't think it's a risk factor. So it may be a marker. It may indicate that the person had neck pain and headache, and this type of stroke was developing, but I don't think the chiropractic care is in the causal pathway.

KINSLER Dr Cassidy, from Toronto, Ontario, I appreciate you spending the time with us. I appreciate the research you've produced and your willingness to talk about it.

CASSIDY Well, thank you very much. Pleased to talk to you.

KINSLER POSTSCRIPT: If you hear any informal discussions on the topic you develop the feeling the Cassidy study is misused. You might have this feeling whether you agree with chiropractors or with the anti-chiropractic skeptics who are frequently involved in these arguments. When I asked Dr Cassidy about this he said he really doesn't know if his work is being misused, he says he doesn't follow the online debates much at all. He cautioned me, of course, that most special interest groups tend to latch on to, or attack, studies that either agree or disagree with their entrenched beliefs. There are people who will listen to this podcast and say "see, I told you that chiropractor is biased and it comes through", and there are people who will listen and say "see, this

epidemiologist/pathologist agrees that there's no evidence of increased risk with chiropractic". Sometimes it's all in the interpretation. There's an old Chinese proverb called 'Three Men Make A Tiger'. It's a story about a high-ranking Chinese official who was about to leave on a trip and he asked the King whether he would hypothetically believe one civilian's report that a tiger was roaming the markets in the capital city. "No," said the King, "I would not believe that at all. That's absurd to have a tiger roaming the markets." The official asked the King what he would think if two people reported that there was a tiger in the market in the capital city the King said, "Well, I would begin to wonder maybe if it were true." And then the official said "Well, what if three people all claimed to have seen a tiger in the market?" And the King replied, "Well then, I would believe it." Well, the official reminded the King that the idea of a live tiger in the crowded market place was absurd and just because numerous people repeated it, it seems real, but that still doesn't make it true. In other words, just because three men said there was a tiger doesn't make a tiger. There's a lot of common knowledge in medicine about causation between chiropractic and stroke, but that common knowledge actually appears to be incorrect and if a physician asks a patient have they been to a chiropractor recently, the answer may be irrelevant now there are plenty of good reasons to find out if a patient has had chiropractic care. Before attempting, say, a more invasive treatment method you want to make sure that the patient has tried things that are less invasive and safe before delving further, but asking about chiropractic treatment preceding a stroke doesn't make a tiger.