Research Focus: How long will this dog live? Going beyond average life expectancy, Dan O'Neill

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Sally Everitt:

Hello, and welcome to this Research Focus podcast from RCVS Knowledge. During these podcasts, we'll be covering all aspects of veterinary clinical research from getting involved in research in practice, to discussing published papers and evidence, with particular emphasis on how we can integrate them into our clinical practice.

Sally Everitt:

Hello, my name is Sally Everitt. And today I'm delighted to be talking to Dan O'Neill, who many of you will know from his work involved with VetCompass, and with the Brachycephalic Working Group. Dan is Associate Professor of Companion Animal Epidemiology at the Royal Veterinary College. And today we're going be talking about some research which has recently been published in Nature Communications entitled, Life Tables of Annual Life Expectancy and Mortality for Companion Dogs in the United Kingdom. Welcome Dan. Before we start, can I just ask you to explain a little about what life expectancy is, and how overall life expectancy differs from a life table?

Dan O'Neill:

Thanks Sally. It's a wonderful opportunity to be here and chat with you. Thank you very much. I loved your introduction by the way, talking about getting involved in research and then talking about papers, because that's exactly my life journey. Moving veterinary practice and then starting to actually do research as well as reading it. Life tables are fabulous. The overall lifespan kind of describes if we started with a large number of animals, how long on average they would live. But it's going from time zero to the average age of death. Life tables are a much more precise way of looking at lifespan. Where instead of starting the clock running at time zero for all animals, the life table allows you to start say with an animal that's already six years of age, and then to work out how long it will live from that point onwards. And that often gives you a very different estimate of lifespan towards the overall average.

Sally Everitt:

Excellent. In your paper you make a difference between a cohort and a current life table. Could you just very briefly give an overview of what that means, because I think it is important for people?

Dan O'Neill:

Yeah. It's hugely important. And this comes down to methodology. So a cohort literally means a group of animals that you follow over time. And the cohort life tables are where we start with a whole series of animals, let's say 30,000 dogs that are all born on a set date. We know they were born on that date. We were there on the moment they were born and we follow them all through to the point of their death. Now in an ideal world, that's what we would always do. It's complete cohort study. The reality is it's almost impossible to do.

Dan O'Neill:

So what tends to be done instead is to either do a cross sectional approach, which is where we start with a whole series of animals that have died and then we know their date of birth. So then we're generating death data, but not necessarily having to follow them for 10 or 12 or 13 years. And that then becomes a cross sectional cohort, not quite as reliable because there will be animals that were born, lived and died. That didn't quite make it into my study. So it's not quite as representative, but it's much more achievable. So when the study we're doing here is like a hypothetical cohort or a cross section approach, not quite as reliable, but much more achievable and still gives us huge information on lifespan.

Sally Everitt:

Thank you. That's really helpful, because I think in veterinary practice we're quite used to the idea of life expectancy. But as you say, we are taking that from the average life span of an animal. And this is a much more nuanced way of looking at it. So can I start just by asking a little bit about the background to this research, how you got involved in this particular topic?

Dan O'Neill:

So it's a really good question. So the further background is that I was a practitioner. I was in practice for 20 years. And increasingly towards the end of my 20 years, I became more and more frustrated with the lack of evidence from much of what we do and say in practice. So even when clients would come and ask which breed to get and which breed would live the longest, I would always give an answer because that's what we do as vets. Clients ask questions, we answer questions. We believe our answers, but it doesn't mean our answers are correct or true. There's a huge gap between an evidence based answer and a belief based answer. And I got to the point when I thought, actually, most of what I'm saying is belief based. So I moved from treating animals one by one in my own practice in Kent, to working at the Royal Veterinary College doing a PhD to set up VetCompass.

Dan O'Neill:

And the idea there is to collect clinical records, anonymize clinical records from veterinary practices right across the UK. And VetCompass is set up. It's now running. We have 30% of all UK vet practices feeding in information, 20 million animals in the database. And that means it's all of us, the veterinary profession, the vets, the nurses, the receptionists, everyone who is chipping in contributing this data. And that's the deep background. So then those data are then used to help me or the equivalent of me still back in practice with a solid, robust, reliable, evidence based, based on primary care records. So the idea with this particular study was to look at life expectancy, but it's just one of... Last week, we had a skin fold dermatitis paper came out. That's the 106th VetCompass peer review publication since I started my PhD in 2010, the first paper was 2012.

Dan O'Neill:

So it's just another... It's almost like a jigsaw. We're just producing each paper as a separate piece of a jigsaw feeding into this overall picture. The aim with this one was to build on a previous overall life expectancy paper. Part of my PhD in 2014, I published an overall longevity study. And then that's useful, but it's telling you the average life expectancy per a breed. It's very useful, but this one was taking it a stage further. And it meant that we could now predict the life expectancy from each point in an animal's life. And a lot of owners are introduced to an animal not at birth, but maybe at rehoming when the animal is two or three or four. I'm thinking especially of dogs like Greyhounds at rescue centers, dogs at some wonderful charities. So this is really important to get a distinction between the overall average lifespan, and then lifespan from specific points in time.

Sally Everitt:

I can see this also being useful for any pet owner when you are discussing perhaps treatments with them. Being to talk about how long that dog is likely to live based on where it already is, can help both the vet and owner make their clinical decisions in practice.

Dan O'Neill:

Such a wonderful welfare point, Sally. And that's exactly where we're trying to go with all the VetCompass evidence, is trying to produce evidence that helps in the real world, that helps veterinary professionals, nurses, and vets, and it helps clients. So a client that is faced with a difficult decision at a certain point in an animal's life, by being able to go to a life table and predict on average how long should be expected in that animal's life, that helps them to make their decision as to whether it's justified to put an animal through let's say, a painful surgery that might have a certain length of time of recovery. And that recovery could be involving pain for the animals. It just means we can make a much more evidence based welfare judgment. And the whole idea is that by shining light onto issues, by bringing more information into issues, we take the guesswork out of it. And it's easing the cognitive load for vets and for owners that are making tough decisions.

Sally Everitt:

And as you said, making it all more evidence based. That leads us on really nicely to perhaps just talking a little bit more about the methodology for this study. It's obviously based on VetCompass data, but presumably you didn't look at 20 million dogs records to do this. So perhaps you could just give us a little bit about how you selected your data.

Dan O'Neill:

Yeah, it's kind of fascinating. When I was in college, I graduated in 1987, we had an epidemiology module. Everyone hated it. It was just horrible. It was boring. It was numbers. But epidemiology has come on and now with the modern vet students I do lots of these research projects at the Royal Veterinary College with vet students, and actually most of them really enjoy it. It's much more easy to understand and we have tools to do it. So for this particular study the epidemiology was that we started with a denominator, an underlying population of dogs that were alive in a single year, in 2016. So we worked on this dogs, there was 900,000 dogs, so just short of a million. And then we followed those dogs over time to pick up all dogs that died. So we knew they existed at a certain point in time, and we followed them over time.

Dan O'Neill:

So we picked up all the dogs that died. That was just over 30,000 in the sample that we worked through, so that was our core data set of deceased animals. For each of those dogs we had a breed, we had the date of birth, we had the date of death, we had what they died of, we had are male, female, whether they were measured their body weight. And so we could then take those factors into account in the analysis. So essentially we had a huge data set, 30,000 deaths with all this ancillary information for the analysis.

Sally Everitt:

Fantastic. And so what were the main findings from this analysis?

Dan O'Neill:

Well, you could actually even go back before the actual statistical results. So one of the first main findings is that veterinary clinical data is hugely useful for research. And that's an absolutely key finding because really up until the times of big data and VetCompass type studies, these data just sat on veterinary clinical records, either paper records or electronic clinical records. And kind of was a huge opportunity missed, so that's one big finding. The second big finding was that interestingly, when we looked at the overall life expectancy of dogs from the previous study, which was six, seven years ago, the life expectancy's gone down. Which on the face of it seems odd because we might think that dogs are getting healthier and veterinary care is getting better, but there's a possible reason for that.

Dan O'Neill:

The overall life expectancy in this study was at 11.2 years, so that means that we have a summary value that we can say for dogs in their life expectancy, 11.2 years. And that's useful. But what that does mean is we've crunched 30,000 deaths into one number. And some people love that because now I've got all this complexity, and I have a single number and that's great. That's wonderful. The reality is it's kind of comfortable, but there's way more complexity in all of this. And dogs currently are literally the most diverse mammalian species on this planet. And that's where the issue is here. It's the diversity. So the next big finding was that even though we had a standard average... I hate that word from an epidemiological sense, but an average and life expectancy it varied widely across the breeds. And that's the big finding.

Sally Everitt:

Most people in practice will be aware that there are significant differences between breeds. But again, your work has showed a lot more detail within that. It's a bit more subtle than just size and some breeds are particularly long lived. So excellent.

Dan O'Neill:

Yeah. And that's exactly it. So in practice you kind of get it, you get used to which animals die early and which animals die late. The nice thing with big dataset is that actually you have some figures to back it up, because all of us have our own cognitive biases. And we see what we tend to expect to see, and stuff that we don't expect to see we either don't notice it or we discount it. It's just what we do as humans. So within this study we could divvy the dogs up in certain ways. So we might look at male versus female and we might say, "Wow, okay. 11.2 years overall. But how does that work out for male versus female? Does one live longer than the other?"

Dan O'Neill:

And the study showed that female dogs lived on average 11.4 years, whereas males lived on average 11.1 years. So it's 0.3 of a year, it's a quarter of a year, might not seem like a huge pile. But if you are that owner of a dog really struggling as it gets toward the end of its life, if magically somebody was able to say, "I could make you a dog live another three months." Most owners would take that. So these are important factors.

Sally Everitt:

I think you've got some data in there about the difference in neutering, because neutering is a big topic at the moment. And about how it affects or having gone from a neutering or advising we neuter everything early, that's become a rather more nuanced discussion as well, as to how it affects health. But again, perhaps some overall data on the effect of neutering on average may be useful here, because although you can't predict cancer on individual breed, it could give us some help on those decisions and discussions with owners.

Dan O'Neill:

Again, a really good question. And I suspect you've done it on purpose in your question. Even when you're saying effects, that word as somebody who's come from practice, where I assume something causes something, you end up going into the epidemiological world and you realize, we can say that-

Sally Everitt:

It's correlational.

Dan O'Neill:

It's correlation. Exactly.

Sally Everitt:

Not causation.

Dan O'Neill:

Yeah. On purpose to set up that question. So when we say effects, we're almost implying causation. And I've learned over time that if we have a characteristic variable that is permanent within the dog... I'm actually quite comfortable using the word effect just as you have there, Sally. So if I'm talking male versus female, I know those dogs always were male or always were female. So I'm quite comfortable with that. When we have what's called a time varying variable, so something which varies throughout life, you have to be much more careful. So dogs end up starting life as being entire, and then at some point in their life journey they become neutered, and then at some point they die. So it may well be that... And certainly the results were showing that neutered dogs lived longer or died at a later age than entire dogs. But you also have to take into account that by living longer, you had more time to become neutered.

Sally Everitt:

Neutered. Yeah, absolutely.

Dan O'Neill:

It may well be it's longer lived dogs are leading to being and been neutered, not neutering is leading. And this is the issue, and it's one of... There's a lot of research on neutering. Most of it in an ideal world, we should almost be doing cohort studies where we do start with the dogs at age zero, and then we could very confidently answer the neuter question. At the moment, we are seeing results that seem to shine a positive light on neuter in terms of longevity. But the jury is still out as to whether it's the neutering genuinely that causes that. Which is why it's such a great question that you did up there.

Sally Everitt:

Thank you. The other thing that I thought was really interesting that you discussed a little bit in your research, is this point at which life expectancy reaches 1.5 years, which I thought was really interesting. I wonder if you'd like to just say something about that.

Dan O'Neill:

Yeah. So there is different ways of trying to unpick the data to tell us something. So one way is to look at the overall life expectancy. And we can come back to that in a minute if you're interested, and break that down say by breed for example, and compare breeds. Another way is to look at the life tables, but each... And we have them in the paper, but each breed has its own pattern and those patterns can be quite unique. So when you're trying to compare breeds, another metric is to say, right, what we will do is we will find the age at which you are almost into the final section of life for most animals.

Dan O'Neill:

So it's not quite the average life expectancy, is not the maximum life expectancy. It's where you're getting very close to the end, and that's at final group when you're into that almost end stage of life. When we did that and we have it in the paper, it shows a wonderful and helpful clear pattern across the breeds showing the differences between breeds and the age that they get to that final pattern. With French Bulldogs and English Bulldogs being at one end, and then other breeds such as Jack Russells, Yorkshire Terriers, crossbreeds overall being at the other end.

Sally Everitt:

Yeah. And that raises the issue of French Bulldogs, because well, I think everybody would understand that some breeds are shorter lived than others. And brachycephalic dogs have a whole range of health issues. The one thing that did stand out for me in this study was just how short the life expectancy of the French Bulldogs turned out to be. Would you like to say something about that, because I think there are a few reasons why that might be happening in this particular study?

Dan O'Neill:

Correct. Great question as well. And some of those reasons are genuine biological ones and some of them are methodological. So essentially there's a couple of concepts. So, when I left practice, I was interested in dogs as a species and my PhD was about pure breeds versus crossbreed dogs. And it took me a little while for the penny to drop that actually that's a false division. That we have pure breeds and crossbreeds, but the pure breeds are made up of breeds and those breeds are very distinct. And I'm now coming very close to the viewpoint when I would propose that we move from calling them dog breeds to dog species. And that we have as many species as there are breeds. So, species in the wild are groups of animals that breed with each other and they produce animals that look like themselves, but don't breed with other species.

Dan O'Neill:

When we look at dog breeds, that's exactly what happens with them. Not because of nature or because genetics means they can't breed with each other, but because that's what humans do. We don't allow them to breed with each other. And if that does happen, the thing that's born is a different creature. It's no longer part of what we call currently a breed. So, you could argue it's now outside the current species and we just retain the original breed as being part of the species. When we look at breeds, almost now getting to the point of calling them species, these results showed huge differences. Absolutely huge. And this is another reason why I'm moving to thinking these different breeds are different species. They are so different in their patterns of disease, I've done breed studies on Greyhounds, and Border Terriers, Bulldogs, French Bulldogs, Pugs, et cetera. Every single one of them has a different pattern of disease.

Dan O'Neill:

Greyhounds for example, 39% of them had dental disease. Yeah. It's just standout no other breed has a disease pattern like that. When we look at Bulldogs, the top diseases are skin fold dermatitis, cherry eye. There was no other breed that has those sort of top disorders. So each breed is almost a unique distinct species in terms of its lifespan, in terms of its health profile and in terms of its physique, because that's what we've done. We've created these different species. In this study, when we looked at overall life expectancy, 11.2 was the average, the middle, but the French Bulldog was way down at one end at 4.5 years, horrifically different. There was then a cluster of breeds, English Bulldog 7.4 years, Pugs 7.7, American Bulldog 7.8. So these are all severe brachycephalic dogs, but with lifespans that are 30%, maybe 40% shorter than the average.

Dan O'Neill:

Now, I suspect the French Bulldog it obviously does have a very short life span. All the other studies say the same thing. But I suspect that the very low level here is also an artifact of the study design in that the French bulldog is rapidly becoming popular in the UK. That means we're introducing lots and lots of young French Bulldogs into the overall population. Therefore, if a French Bulldog is to die on average, it's going to be a young dog because they just aren't that many relatively older dogs. And I have a feeling when their popularity will flatten out, that their average life expectancy will be pretty much the same as the Bulldog and the Pug. It'll probably be seven and a half years. So that result is artificially low. What it does say very clearly is that extreme brachycephaly is associated with severely shortened life. And that's a very distinct message.

Sally Everitt:

So we have to think, yes, there are breed species differences here or artificially imposed species differences here, but we also have to remember a little bit about the demographics of the cohort we're looking at. So when a particular breed becomes suddenly very popular, that's going to skew the demographics within the population.

Dan O'Neill:

That's such a great point, because that's exactly where I was coming to with this as well. So in other words, we're describing the current population. And my opening comment to you was that when I did my PhD study and I was looking at longevity, or maybe five, six, seven years ago, the typical average longevity of dogs in the UK was longer than it is now. What has also happened in the intervening time is that the breed profile has changed exactly as you have just said. And certain breeds have fallen out of favor, breeds like Labrador Retrievers which were at the top, and certain breeds have come to

dominate. These are the severe brachycephalic breeds. So the UK has become a country that has fallen in love with French Bulldogs, Pugs and English Bulldogs. And because those dogs have shorter lifespans, whether that's good or bad we can talk about, that is bringing down the average. So in other words, the average just reflects the animals that currently exist. Very good point.

Sally Everitt:

Which leads us on very nicely, it's a wonderful piece of research. I was absolutely fascinated by it, but all research has limitations. So what would you say are the main limitations of this study?

Dan O'Neill:

So in this study, even though I'm talking about big dataset, and VetCompass, and 30,000 vets, and it's probably one of the biggest groups of dataset on dogs longevity ever recorded, one of the limitations is it's not big enough to my mind. We need more, we need 60,000, 90,000, 120,000. So, within this study we were able to focus in on 18 breeds that are common enough, that we had large enough dataset that we could report them individually. But in the UK, there's 220 breeds recognised roughly by the Kennel Club. In VetCompass, we have a much more extensive breed list. It's over 800 breeds. In my world, the VetCompass world, I count the designer breeds, Cockapoo, Labradoodles, they're breeds. Owners buy them, they're recognised on the street, they're a breed. They might not be a registered recognised pedigree breed, but they're a breed.

Dan O'Neill:

So, the first thing is we need more numbers, more dataset. And that just comes down to time and researcher time and we will do that, so that's a limitation. We had the limitation earlier that this it's really a hypothetical cohort or a cross sectional design. It would be lovely to follow from birth. I'm not sure that will ever be possible, so we may well just have to live with that limitation. But the main limitation is methodological from that, it's the size of the study and then trying to interpret some of the time varying variables like neutering. And actually one of... I think we've kind of overcome it with a lot of the press release, but another big limitation of science is dissemination. A lot of science is published, really excellent work goes into publishing it, analyzing it, and then it goes into a top journal and then other researchers read it.

Dan O'Neill:

And that's the typical academic circle. Where VetCompass tries to break that mold is that our target audience isn't just academics or veterinary professionals, they're key but it's actually owners. Owners choose which dogs to buy, owners choose how to care for their dogs, owners choose when they spot their dogs are sick, owners choose when to come to a veterinary surgeon, owners choose whether to take up the vet's advice, owners choose whether to come back for revisits. So the target audience is owners, we're trying to bring them into an overall veterinary care decision making more and more. And that we've tried to overcome here by doing a press release. We have an infographic, so a visual pictorial representation of the paper that's free to download from the VetCompass website, and it works really well on social media. So veterinary practices could just take that and put it on their social media.

Sally Everitt:

I think that leads it really nicely to sort of my partly last question, which is how do you see these life tables being used?

Dan O'Neill:

Yeah, it's a really good question because when it comes to science, there's basic science. So that's science for the sake of science, science for the sake of knowledge. We're just trying to scratch that little cerebral itch we have to learn a little bit more. And then there's applied science, the question you've just asked Sally, which is brilliant. So that means taking the science and saying, well, how can I use this to change the world. Many different ways, so say for example, if you are somebody planning to rehome a dog, or if you're a charity that does rehoming. Using the old style approach, so using the heuristic that dogs on average live 11.2 years, if I'm rehoming a seven year old dog, I might then say, well, that dog on average is going to live 11.2 minus seven. So 4.2 years. By having the life tables, we know that we can do much better than that.

Dan O'Neill:

We know that dog has already lived till seven, therefore it's already overcome many opportunities to die. And on average it will live a lot longer than 11.2 years. And we can go to the life table, we can read across from its current age and we can predict what age that dog will live until. So as the owner taking home that dog you now know better about the expectations, your responsibility, how long you're going to have that dog. And also it gives you some reassurance that this dog isn't going to just die at 11.2. And from the rehoming center, it's actually a much more positive message. Also, the life table and paper allows us to take into account whether it's male or female, and take into account it's breed. So rather than the simple heuristic of 11.2 for all dogs... And as I've said, I no longer believe really that there is a dog as such.

Dan O'Neill:

I think there is as many species as there are breeds. We can go to each breed or species and using inverted cameras, and read for each one. So it's all about precision of the results so that the overall and life table is sensible in that way. Life tables are also a measure of summary health. So it means that we can take these life tables and we can... In humans for example, this is what they do. They do this in the UK, they do a census every three years. In the US it's every year. It's used as a summary metric of our overall health. And if the general population is getting more unhealthy, so COVID might have driven this, obesity could be driving it, we're going to die earlier on average. So it means we can use this as a welfare summary for each breed.

Dan O'Neill:

And we can look at the lifespan and we can say, well, on average a Bulldog lives 7.4 years. Dogs on average live 11.2, therefore this is strong evidence that the cumulative effect of all the issues within English Bulldogs is shortening its lifespan by X amount. And the flip is that animals that die early then we can say, if they didn't have all those issues they would've lived until next time. So a breed that's dying at 7.4 years that on average if it didn't have all the limitations of that breed, would live until 11.2. We can talk about the burden of disease on that breed and the expected life last. So it means we now have a measure of the degree of urgency we should apply to breeds that have shorter lives, that we think should have longer lives.

Sally Everitt:

Excellent. So that sounds... I was going to ask about further research, but this sounds like a sort of ongoing and constant to be updated piece of work that has enormous potential for the future to look at not only perhaps at more breeds, but also to follow breeds over time and see how the healths of the

breeds is improving. I wish you very good luck and thank you very much for taking the time to talk to us this afternoon.

Dan O'Neill:

Thank you very much, Sally. It's been an absolute pleasure to chat with you, and obviously all these papers are open access. They're free to access on the VetCompass website and it's already in infographics. And again, if your listeners are working in veterinary practice, veterinary nurses, vets, receptionist, thank you very much for contributing to VetCompass. I much appreciate it.

Sally Everitt:

Thank you again, Dan. And we will also provide links to the published paper and the infographic on the VetCompass website after this podcast. And I would recommend that anyone who looks at this also looks at the supplementary material, because that actually includes the life tables by different breed. If you have enjoyed this podcast and would like to find out more about veterinary clinical research and evidence in practice, please have a look at the evidence and library sections on our website. For more podcasts from our RCVS Knowledge, find us on your favorite podcast platform.

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