



ANNUAL REPORT

AN UPDATE ON PROGRESS
MADE IN 2019

FOR ALL SAVSNET
STAKEHOLDERS

A YEAR OF EXCITING PROGRESS

Welcome to SAVSNET's first annual report. We have been going for 11 years now and we apologise it has taken us so long. This year we have published three new surveillance reports (with focus on tritrichomonas, bordetella and fleas) and four research papers. These have seen us using SAVSNET data to develop mathematical models that can also be used on human data, and undertaking our first observational study that suggests antibiotics do not improve outcome in acute diarrhoea.

No matter what you think of the UK political situation, SAVSNET remains outward looking. We received an award from the largest university in Spain (University Complutense Madrid) which also sees them starting to think about implementing SAVSNET in their country. We were lucky to receive an Erasmus scholar (Jose) from Gran Canaria who in three months has put together what we think will be the largest cancer registry for pets on the planet. We are also excited to report that we are now collaborating on a pilot in the USA, with new colleagues in Minnesota which has received national interest, being referenced in a presidential committee no less. Whilst these collaborations take up time, we believe that together we will be stronger than as isolated projects.

Talking of sustainability, our current major funding from BBSRC finishes early 2020. We have now secured funds from a variety of grants and commercial projects which sees the core team already funded till mid-2021. As well as developing some relatively simple projects for industry that bring in a regular income, we also secured a large interdisciplinary grant from Dogs Trust that has brought three new PhD students to Liverpool, Lancaster and Bristol / Animal Health Trust with the aim of speeding up actionable signals from SAVSNET data - we call this ambitious exciting project SAVSNET_Agile. As this year comes to an end, we recognise two major challenges. Firstly, completing the current BBSRC work so we can maximise on the deliverables from that funding. And secondly, publishing. Arguably this remains our major challenge and bottleneck with seven really excellent papers needing writing including our first interventional trial on antibiotic use. Finally, we were really delighted to win in May a team award for 'Societal Impact' at the 2019 BBSRC Innovator of the Year awards. A real recognition of the hard work of everyone over many years.

We remain extremely grateful to all our supporters, especially those funders and data providers in practice and laboratories who together help to realise a world where big data can improve animal and human health.



PROF. ALAN RADFORD
PRINCIPAL INVESTIGATOR

RESEARCH AND SURVEILLANCE

This year, five **peer reviewed papers** have been published which used SAVSNET data.

- Hale, A.C. et al (2019). A real-time spatio-temporal syndromic surveillance system with application to small companion animals. *Scientific Reports* 9, 17738.
 - Application of novel statistical tests to spot outbreaks (we call them anomalies) in data that is geographically uneven or patchy like SAVSNET.
- Singleton, DA. et al (2019). Pharmaceutical Prescription in Canine Acute Diarrhoea: A Longitudinal Electronic Health Record Analysis of First Opinion Veterinary Practices. *Frontiers in Veterinary Science*. 6, 218.
 - How vets use antibiotics in consultations for acute diarrhoea - and a first suggestion their use has no impact on clinical outcome
- Arguello-Casteleiro, M. et al (2019). Exploring semantic deep learning for building reliable and reusable one health knowledge from PubMed systematic reviews and veterinary clinical notes. *Journal of Biomedical Semantics* 10, 22.
 - First attempts to train computers to interpret veterinary clinical free text collected by SAVSNET



RESEARCH AND SURVEILLANCE

- O'Neill J. et al. (2019). Tick Parasitism Classification from Noisy Medical Records. Central Europe Workshop Proceedings. Available from: <http://ceur-ws.org/Vol-2429/paper5.pdf>.
 - Question - can computers spot the mention of ticks in clinical free text better than people? Answer - not yet!
- McIntyre KM. et al (2019) Fully Integrated Real-Time Detection, Diagnosis, and Control of Community Diarrheal Disease Clusters and Outbreaks (the INTEGRATE Project): Protocol for an Enhanced Surveillance System. JMIR Res Protoc 8(9).
 - A one health methodology to link human and animal gastrointestinal disease surveillance

Did you know that we also release infographics of our published work that can be shared freely?

Visit:

<https://www.liverpool.ac.uk/savsnet/publications/research-paper-summaries/>

RESEARCH USING SAVSNET DATA
CANINE ACUTE DIARRHOEA
USING CONSULT DATA TO DESCRIBE TREATMENT
Full paper published in Frontiers in Veterinary Science available [here](#)

1 **DIARRHOEA**
Acute canine diarrhoea is common, with antibiotics frequently being prescribed. There is increasing evidence that antibiotics are not an effective therapy.

2 **STUDY**
Electronic health records of 3,200 canine acute diarrhoea cases from April 2014 - January 2017. Monitored therapy and outcome.

3 **ANTIBIOTICS**
Systemic antibiotic therapy was common (50% of cases). There was no apparent association between antimicrobial therapy and clinical outcome.

4 **NUTRACEUTICALS**
However, dietary modification and gastrointestinal nutraceuticals were associated with improved clinical outcome.

5 **SEVERITY**
Antibiotics were most common in more severe cases of diarrhoea. Milder cases were more commonly prescribed gastroenteric nutraceuticals.

6 **CHOOSING TREATMENT**
This work supports the view that antimicrobials are unnecessary for many acute diarrhoea cases. You can use these findings when discussing treatment with owners.

Thank you to all practices supporting SAVSNET

RESEARCH AND SURVEILLANCE

**Veterinary
Record**

We have continued to publish quarterly surveillance reports in the Veterinary Record, collaborating with key opinion leaders to communicate the current status of a range of diseases.

- Singleton, DA. et al. (2019) Small animal disease surveillance 2019: respiratory disease, antibiotic prescription and canine infectious respiratory disease complex. Veterinary Record 184, 640-645.
- Singleton DA. et al. (2019). Small animal disease surveillance 2019: pruritus, pharmacosurveillance, skin tumours and flea infestations. Veterinary Record 185, 470-475.
This includes our first foray into a tumour registry which we believe to be the largest for pets in the world. This was presented by Skype as an oral presentation at an International Workshop on Animal Tumour registries in Brazil.
- Singleton DA. et al. (2019). Small animal disease surveillance: gastrointestinal disease, antibacterial prescription and Tritrichomonas foetus. Veterinary Record, 184, 211-216.

Interested in collaborating with us as a key opinion leader on a future surveillance report?

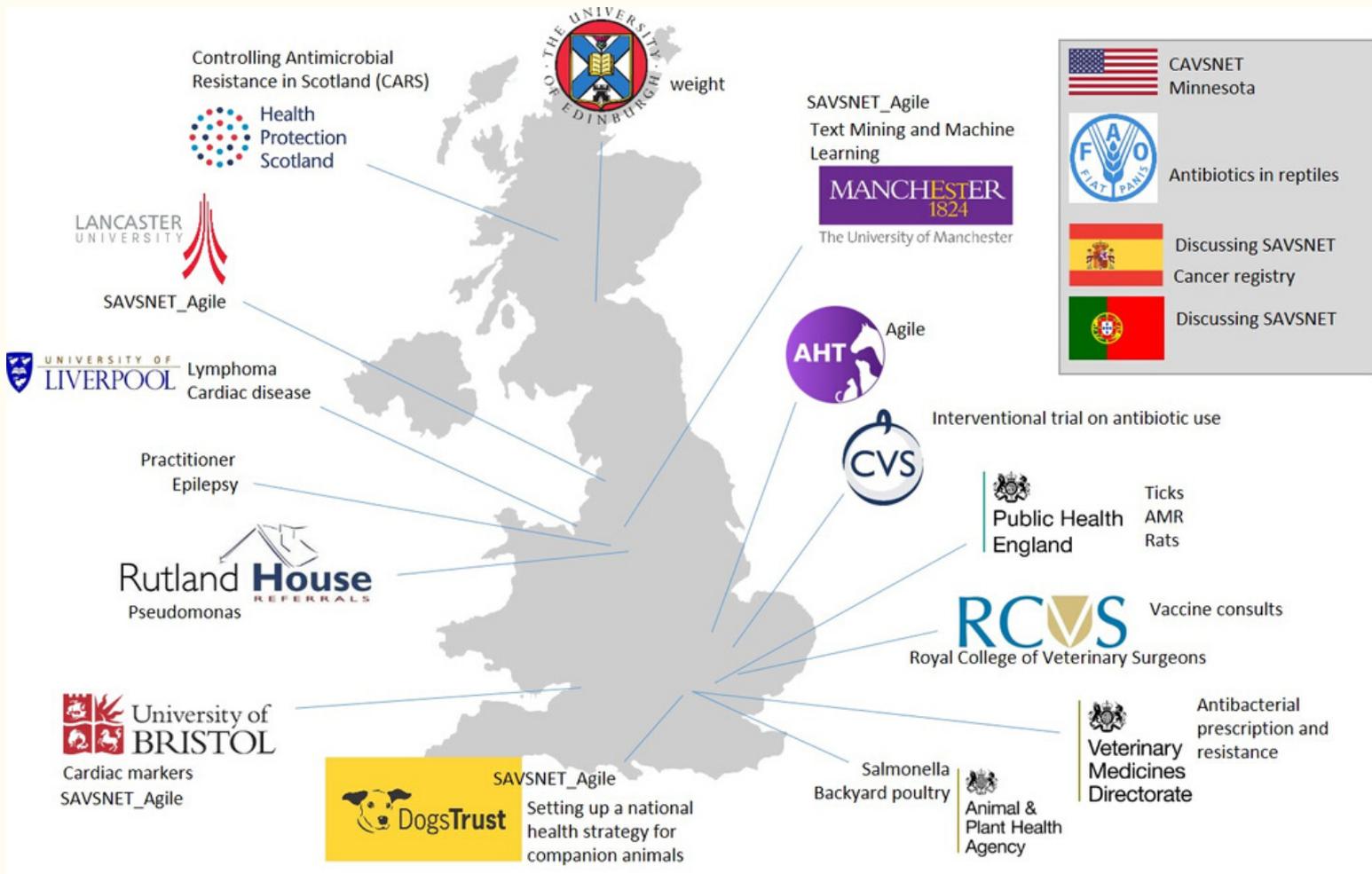
Get in touch and get involved!



COLLABORATION

From SAVSNET's inception, we knew that to get the best impact on animal health that these data deserve, we would need to make data available carefully to the widest possible network of researchers.

2019 has seen a range of new exciting collaborations. The map below shows some of our major external collaborations that are at various stages of consuming data or data summaries.



Looking for some data to sink your teeth into?

Researchers can apply for SAVSNET data access for their own projects.

Find out more:

www.liv.ac.uk/savsnet/using-savsnet-data-for-research/

COLLABORATION HIGHLIGHTS

Listed below are some highlights from our work with collaborators in 2019.

A project commissioned by the RCVS to evaluate what conditions are discovered in vaccine consults. This work is based on a pilot by a vet student Sam Richardson in 2018.



Partnership with the APHA through co-authorship on all future surveillance reports. This further cements our role as the provider of national surveillance for companion animals in the UK. Indeed we were asked by APHA to assess whether the recent acute haemorrhagic vomiting outbreak in dogs in Norway was also happening in the UK - we found no evidence.



Colleagues at University of Minnesota secured funding for a pilot of SAVSNET (named CAVSNET - Companion Animal Veterinary Surveillance Network). Emma Leof, the CAVNSNET Project Co-ordinator, will come to the UK in January 2020 for a two week visit.



With significant funding from the Horse Trust, Dr Gina Pinchbeck will supervise a PhD in 2020 to pilot an Equine Veterinary Surveillance Network in the UK. This will build on our existing links with labs and practices developed through SAVSNET.



SAVSNet-Agile is a new and exciting interdisciplinary project funded by Dogs Trust and brings together the University of Liverpool, University of Manchester, Lancaster University, University of Bristol and the Animal Health Trust. In a nutshell it aims to speed up SAVSNET from its current "thoughtful" research pace which sees our main peer reviewed outputs taking two years from genesis to publication, to producing rapid near real time actionable outputs. SAVSNet-Agile will link the large and expanding SAVSNET data resource to state-of-the-art informatics, statistics and genomic technologies, to develop a suite of near real time actionable health resources. These will be applied to key challenges in canine health and welfare, and facilitate the establishment of a national response protocol for emerging canine diseases.



We have also supported a variety of undergraduate projects including: rabbit teeth management (x2), heart murmurs, post op check, fleas (x2), overseas travel, vaccine consults, injection site sarcomas, chronic stomatitis, odontoclastic resorptive lesions, myxomatosis, anal gland disease and Cushing's disease (x2).



COLLABORATION HIGHLIGHTS

We have also supported a number of postgraduate research projects, listed below.

Cancer registry: (Jose Rodríguez Torres (Erasmus visiting scholar from Gran Canaria) got his Degree in Veterinary Medicine in 2004 from University of Las Palmas de Gran Canaria and has been working since then as an Official Vet for the Spanish Administration in the field of Border Inspections Controls. In 2016, he started a part time PhD on Tumour Epidemiology in Spanish dogs and cats and in 2018 he received an Erasmus scholarship and moved to Liverpool with his family (and his dog Ron) to spend three months with the SAVSNET team working with data on tumours in UK companion animals. The result of his time in Liverpool is what we believe to be the biggest dog and cat cancer registry (100,000) on the planet which he is writing up for the journal Scientific Data. He is also playing an active role in the newly created Global Initiative for Veterinary Cancer Surveillance (GIVCS), and at the first meeting, celebrated in October, Jose presented his findings both from Spain and from the UK.



Extracting medication names: Oluwatosin Dairo has completed a Masters in Computer Science at the University of Manchester. This research focused on evaluating commonly used medical text mining tools for identification of drugs used in SAVSNET consultation records.



Antibiotics in acute diarrhoea: Ivo Fins will submit his Masters thesis in 2020 on the use of antibiotics in acute diarrhoea, our first mixed methods study that includes analysing free text narratives to understand antibiotic use.



David Singleton successfully defended his PhD thesis on antimicrobial use and resistance in the UK before taking up the post of SAVSNET epidemiology postdoc (and getting married - what a year!)



Heather Davies continues her PhD funded by the Veterinary Medicines Directorate on adverse events.



UNDERGRAD RESEARCH EXPERIENCE



Sean Farrell spent six weeks with the SAVSNET team as part of research project over the summer.



What did you do on your placement with SAVSNET?

I studied Myxomatosis in UK pet rabbits. This is a nasty virus infection often caught from wild rabbits, and almost always fatal. I used SAVSNET data to work out how common infection is and what factors make rabbits more or less likely to get it, such as a rabbits age or gender, their location or the time of year.



What and where are you studying?

I am currently studying for a Biomedical Sciences BSc at the University of Kent in Canterbury.



What skills did you learn working with SAVSNET?

Although I came into my project with little statistical background, I left with an underlying understanding behind regression analysis and how to use programmes such as R to turn SAVSNET data into useful results. I was also able to learn how to present data clearly and professionally. Furthermore, SAVSNET improved my presentation skills where I gave talks for the SAVSNET research group as well as a pharmaceutical company. I have already been able to apply these skills within my degree.



What were the most important things you learnt working with SAVSNET?

That research is not an independent process, and that sharing of knowledge is key to the success of not only my own project but for the greater good of Science. As for myxomatosis, we confirmed its seasonality across the UK, and identified new risk factors for infection that formed the basis of future prevention advice to rabbit owners and their vets.



What do you want to do when you graduate?

Before my work at SAVSNET, the prospect of working in a data analytical / epidemiological laboratory environment seemed uninviting. Now however I find myself considering a postgraduate research degree in it. I also understand how big data and real-time surveillance is critical for the future of medicine – whether that be humans or rabbits!

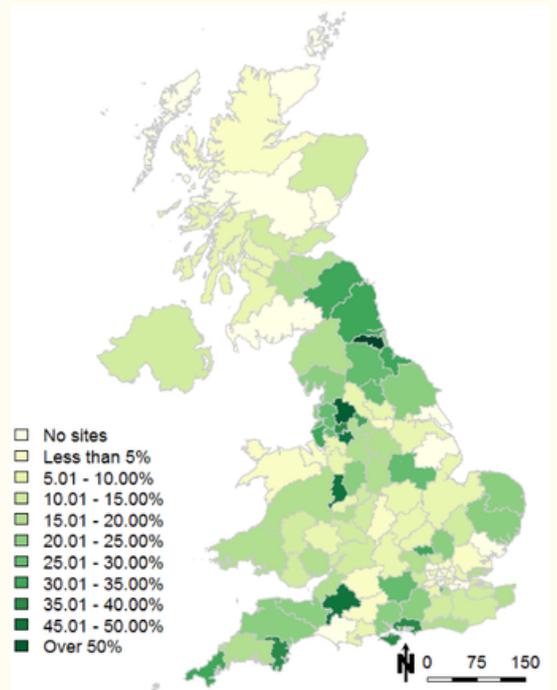


DATA PROVIDERS

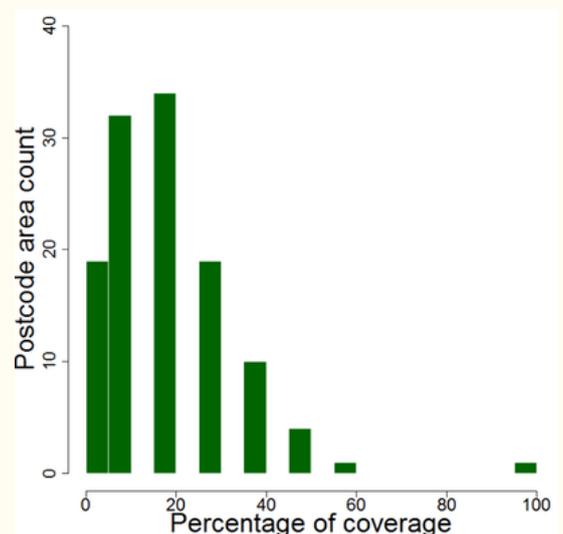
We are often asked about the representativeness of SAVSNET data. However, we believe that our geographical coverage is national, with only a small number of postcodes not represented.

In most areas of the UK, over 20% of practices contribute data to SAVSNET, and overall approximately 15% of UK practices are involved.

This gives us confidence that we have a good chance of identifying interesting patterns of disease across the whole country.



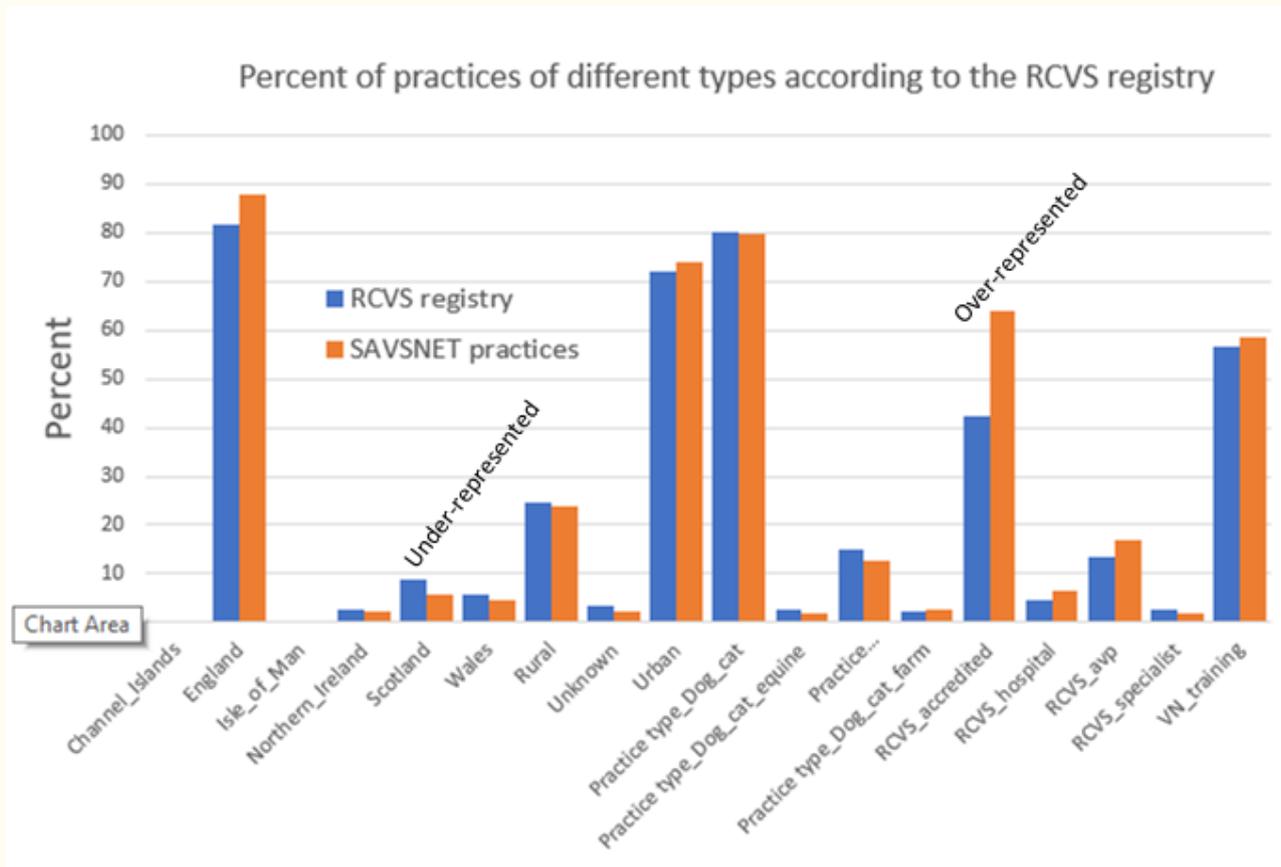
Proportion of RCVS-registered practices submitting data to SAVSNET (“coverage”)



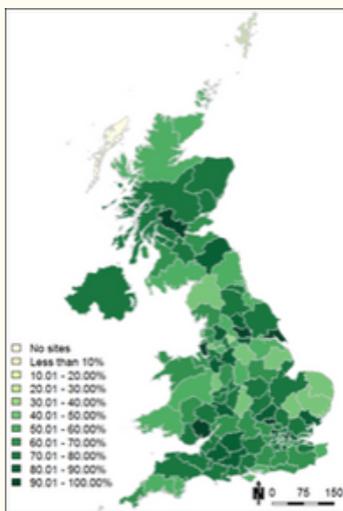
Percent 'coverage' for postcode areas

DATA PROVIDERS

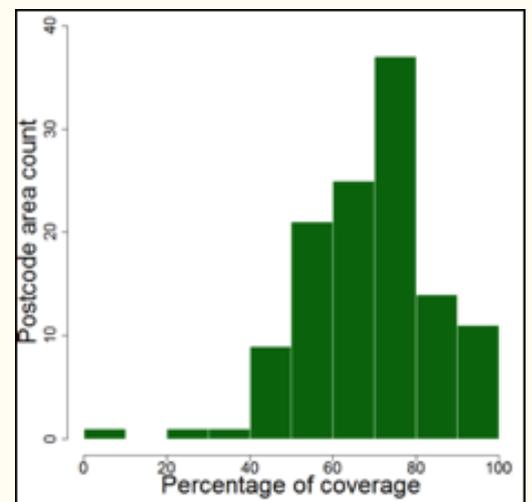
Practices participating in SAVSNET have a similar make up to those of the RCVS registry.



Laboratory data coverage is even broader, with our partner laboratories receiving data from over 50% of UK veterinary practices. The representativeness of the laboratory data is shown below.



Proportion of veterinary practice sites submitting samples as a percentage of total RCVS veterinary practice sites in each of the 127 UK postcode areas.



For the majority of postcode areas in the UK, we collect laboratory data from over 50% of practices.

THANK YOU TO OUR MAJOR SAVSNET DATA PROVIDERS



We currently receive data from **nine diagnostic laboratories** with a pipeline of laboratories planning to start contributing.

We receive daily data from **some 500 practice sites** across the UK, from CVS Group plc and independent veterinary practices.

We look forward to welcoming more practices and practice groups in the coming year.



SUSTAINABILITY

The SAVSNET team is supported by a range of short-term grants. We are particularly grateful to both BSAVA and BBSRC for their major support.

In 2019, we had some notable grant success which are listed below.

Radford et al (2019-2022). SAVSNet-Agile; responsive data intelligence for canine health. £509,702. Dogs Trust.

The aim of this interdisciplinary project is to speed up the rate at which data is analysed so that our outputs can be useful to individual animals with their vet and owner, as well as for controlling disease at a population level. You can see more about this project at our dedicated website - <https://www.liverpool.ac.uk/savsnet/savsnet-agile/>

Radford et al (2018-ongoing). Small animal disease surveillance and reporting. £30,000 per annum. Commercial.

Such income from supplying anonymised analysis of SAVSNET data to commercial companies is ring-fenced for SAVSNET sustainability.

Singleton et al (2019). Companion animal antibiotic resistance and surveillance modelling project. £16,500. Veterinary Medicines Directorate.

Nenadic et al (2018). Mining post-mortem examination reports for farm animals to enhance and support national disease surveillance. N8 Agri Food Programme. Project Resources & Seed Corn Funding £8,425

All surplus income is ring-fenced to support the ongoing work of the SAVSNET project. We aim to be here for a long time in the future.



SUSTAINABILITY

Singleton et al (2018). (£7,000). Commercial.
SAVSNET can offer a selection of services for commercial companies to meet their requirements.

Pinchbeck et al (2020-2022). An Equine Veterinary Research and Surveillance Network. £184k. Horse Trust.
We will be taking what we have learnt in SAVSNET and adapting it to the new environment of equine practice.

Pinchbeck et al (2019). An educational interventional trial. £14,500. BBSRC Impact accelerator.
Can benchmarking practices help them reevaluate their own antibiotic use?

Radford et al (2019). Innovator of the year team award for societal impact. BBSRC. £10,000 prize.



We won the 'Societal Impact' category at the 2019 BBSRC Innovator of the Year awards.



LINKS WITH UNIVERSITY OF MANCHESTER



We have a strong collaboration with the Health eResearch Centre (HeRC) at the University of Manchester, which was part of the Farr Institute (<https://farrinstitute.org/>). This has included two posts, a PhD project on veterinary text mining funded by the Farr Institute, and a 6-months collaborative project to further develop analytics capabilities to process free-text veterinary narrative.

Several workshops and conference panels promoted cooperation between medical and veterinary health informatics communities by show-casing text mining collaboration. We have also jointly supervised MSc students in Health data science, focusing on veterinary epidemiology.

Unfortunately, the Farr Institute was discontinued nationally in 2018, being replaced by Health Data Research UK (<https://www.hdr.uk/>). HDR-UK are currently in a development stage and are reluctant to formally include animal data as part of this new national initiative.



The link with the University of Manchester however remains strong and has resulted in the following outputs:

Arguello-Casteleiro et al (2019). Clinical Text De-identification in SAVSNET with NLM Scrubber. Poster at Healthcare Text Analytics Conference (Cardiff).

Arguello-Casteleiro, et al (2019). Extracting medications from veterinary clinical text: a case study within SAVSNET. Poster at Healthcare Text Analytics Conference (Cardiff).

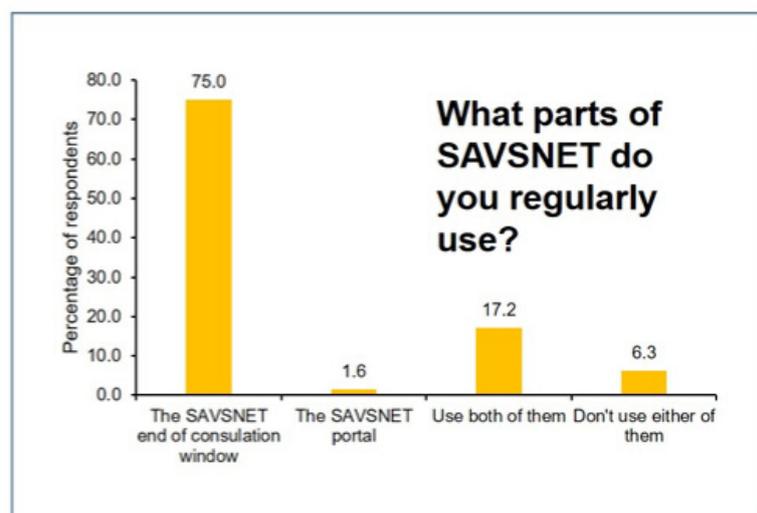
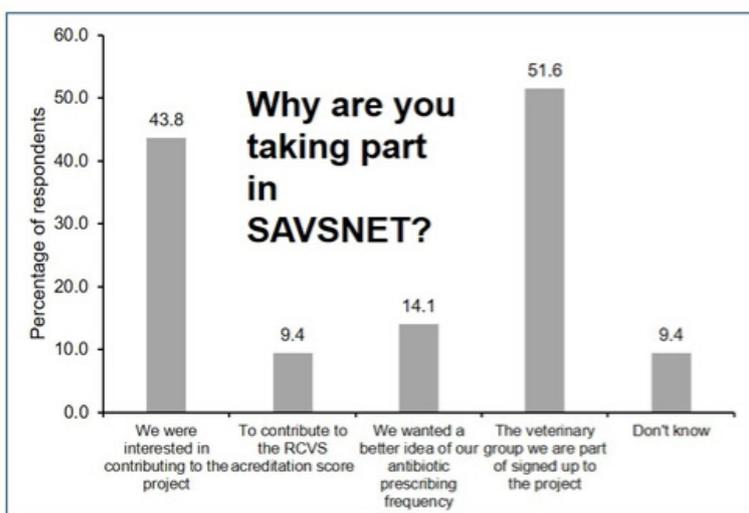
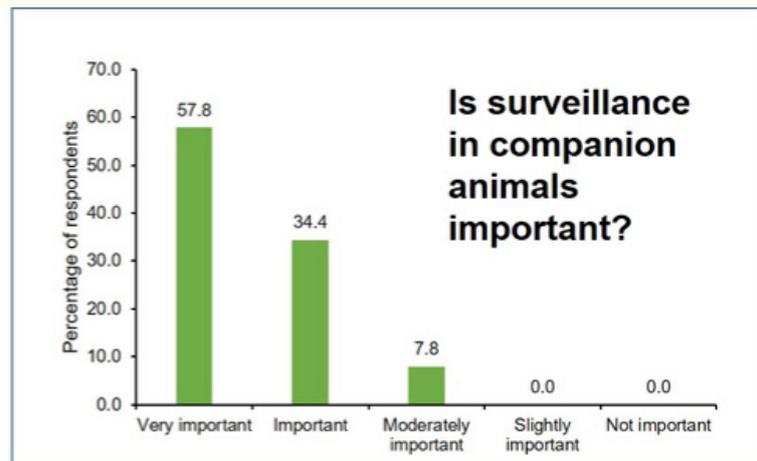
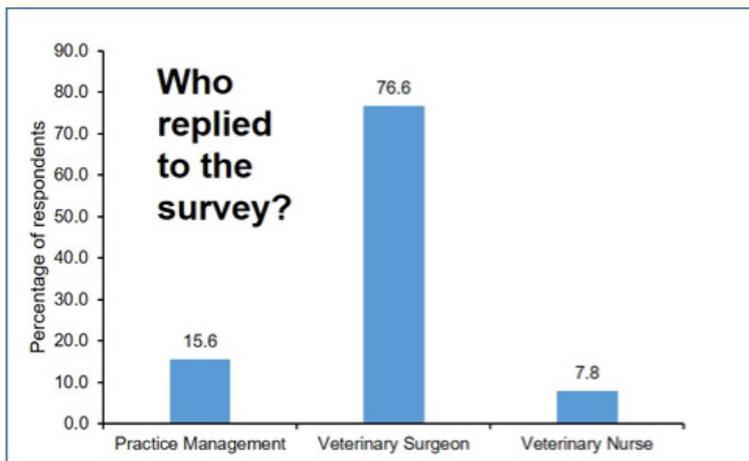
Arguello Casteleiro (2019). Exploring Semantic Deep Learning for Building Reliable and Reusable One Health Knowledge from PubMed Systematic Reviews and Vet Clinical Notes. *J Biomed Semantics*, 2019 10 (Suppl 1):22



FEEDBACK TO STAKEHOLDERS

We are extremely grateful to colleagues in veterinary practices and diagnostic laboratories who kindly send us data to use for research. 2019 saw us undertake our first broad survey for veterinary practitioners which was led by Dr Tessa Walsh, Impact Officer at University of Liverpool. We were particularly interested to find out how SAVSNET is used in practice and if the information presented to them in their SAVSNET portals had resulted in a change of practice within their businesses.

62 respondents replied to the survey and as thanks, we donated £320 to **vetlife**



FEEDBACK TO STAKEHOLDERS

10 veterinary practitioners said the portal had helped them better understand their antibiotic use

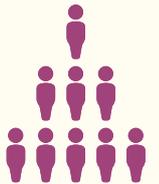


7 veterinary practitioners said the portal had either made them more aware of their antibiotic use or helped them reduce it.



Finally, practitioners made useful suggestions for how we could update the end-of-consult window to help with software issues and increase the relevancy of the questions and categories asked.

There were also some comments that the information in the portal is not necessarily being fed back to the vets at the front line in participating practices, rather staying with practice managers and directors.



Personalised practice data analysis from SAVSNET

All veterinary practices can benefit from SAVSNET, whether they are part of SAVSNET or not.



Practices not taking part in SAVSNET

Submit data through mySavsnet AMR and receive a personalised report on their antibiotic usage including benchmarking to anonymous peers.

For more info:

<https://www.liverpool.ac.uk/savsnet/my-savsnet-amr/>



Practices taking part in SAVSNET



Automatically receive the SAVSNET portal containing information on the practice's antibiotic use, clients, patients and disease trends. Also includes benchmarking to anonymous peers.

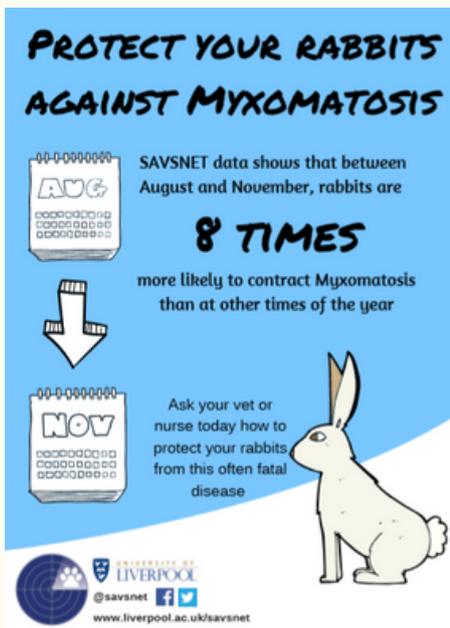
For more

info: <https://www.liverpool.ac.uk/savsnet/taking-part/information-for-veterinary-practices/savsnet-portal/>



PUBLICITY

We are working on improving our publicity outputs as we recognise that SAVSNET research is not just important to the veterinary profession, but pet owners and wider audiences too.



We designed a poster for participating practices to raise awareness of Myxomatosis after identifying the seasonality of the disease. The poster was also shared on our website and social media with relatively good exposure results. A paper is currently being prepared based on this work.

Professor Alan Radford was awarded the British Hispanic Chair at the Complutense University of Madrid (UCM), Spain, in recognition of the work of the SAVSNET team. Alan has visited the Complutense three times during this academic year giving a variety of lectures including courses for postgraduate students on surveillance and feline virology. At the last visit Alan addressed a professional meeting to explore the potential implementation of a system similar to SAVSNET in Spain.



Did you know that our website has 'Focus on Disease' pieces written by key opinion leaders?

This year we have added two new pieces on canine respiratory disease (Dr Jenny Stavisky at University of Nottingham) and fleas (Dr John McGarry at University of Liverpool).



PUBLICITY



In January, we worked with the Veterinary Poisons Information Service to prepare a letter raising awareness of the dangers of xylitol to dogs, which was published in the Veterinary Record and included some novel data analysis. The letter was a good trial for us of how we could prepare a publicity piece under a short timeframe. The letter can be accessed here:

<https://veterinaryrecord.bmj.com/content/184/5/157.1.long>



Follow us
@savsnet

Finally, we have also supported three health campaigns this year (shown below) through social media to help raise awareness.

Social media statistics indicate that these posts have been more successful than those used last year. Each campaign involved preparing 3-8 posts, some based on work we have done. Unfortunately, there is no way of knowing the background of those people who have engaged and shared for example, whether they are members of the public or in the veterinary profession.

World Zoonoses Day



Animal Pain Awareness Month



World Antibiotic Awareness Week



CLOSING STATEMENT

We are proud of all the good things we have achieved this year, recognised by the BBSRC through our little award and the growing interest that is being taken in veterinary data science around the world. We are excited about the new colleagues and collaborations coming next year through SAVSNET_Agile and EVSNET. These projects can be transformational if we can keep communication strong between all collaborators. We have received great support from the University of Liverpool (ethics, legal, business support).

We are extremely grateful to our many supporters in veterinary practices and diagnostic laboratories across the UK who trust us with the data this science is based on. We would also not be here without our wide range of legacy and current funders, particularly The Biotechnology and Biological Sciences Research Council (BBSRC), British Small Animal Veterinary Association (BSAVA) and Dogs Trust.



We are also extremely grateful to all our supporters and everyone who participates. Together we can best develop SAVSNET for the benefit of human and animal health.

THANKYOU

