

Measuring, and determining factors affecting performance of glycaemic alert dogs

Nicola Rooney, Claire Guest, Clara Wilson & Steve Morant



Type I diabetes

1.25 million people in USA are currently living with Type 1 diabetes

Hypoglycaemia is a common side effect

- distressing
- presents risk of serious neurological & cardiovascular consequences

Some patients lose the early warning signs.

Fear of hypoglycaemia is very common
especially night episodes,
common cause of death.



Patients “running their blood sugars high” with associated health risks.

Medical alert dogs



Glycaemia alert dogs reported to vastly improve quality of life in people with diabetes.

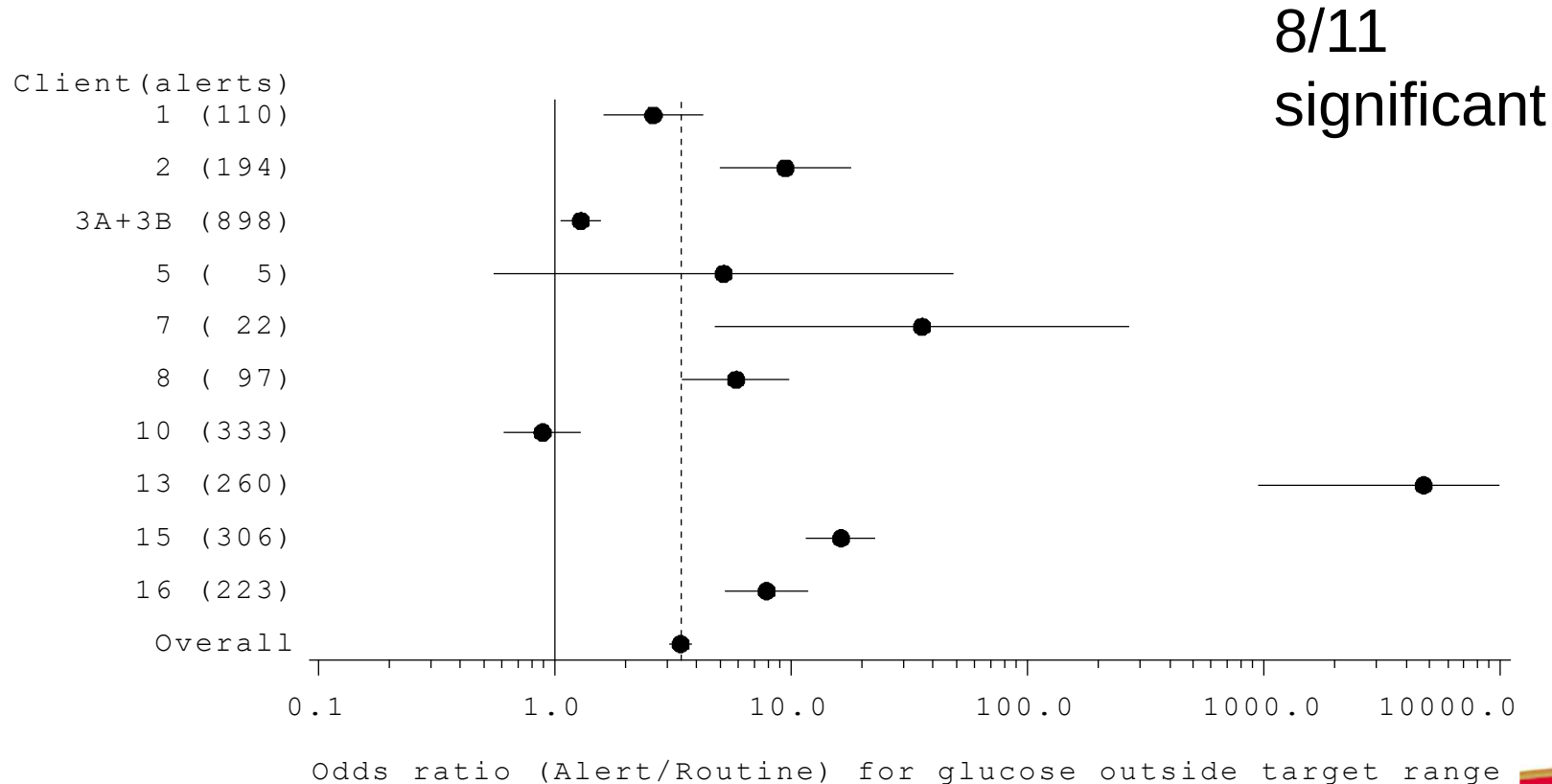
Imperative real efficacy is assessed



Changes post-dog allocation

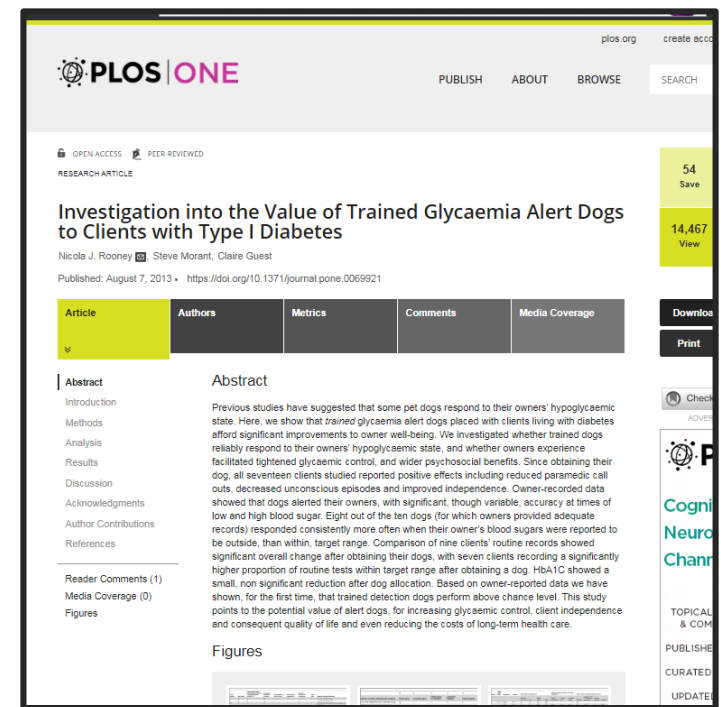
CLIENT	low blood sugar	unconscious episodes	paramedic call outs
1		NEVER SINCE GETTING DOG	
2			DECREASED SINCE DOG
3a			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

“Alerts” more likely to be outside the target range



Initial pilot study

- first published demonstration
 - trained dogs perform above chance,
 - dogs afford improvements to client well-being.
- points to the potential value for
 - increasing glycaemic control,
 - client independence, quality of life,
 - reducing the costs of long-term health care.



Rooney, Morant & Guest, (2013). *PLoS ONE*, 8:



Small sample

Medical
Detection Dogs



Largest study

30 dog-clients pairs

4197 OOR episodes



RESEARCH ARTICLE

How effective are trained dogs at alerting their owners to changes in blood glycaemic levels?: Variations in performance of glycaemia alert dogs

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Abstract

Aims

Domestic dogs are trained to a wide variety of roles including an increasing number of cal assistance tasks. Glycaemia alert dogs are reported to greatly improve the quality of owners living with Type 1 diabetes. Research into their value is currently sparse, or numbers of dogs and provides conflicting results. In this study we assess the reliability large number of trained glycaemic alert dogs at responding to hypo- and hyper-glycaemia (referred to as out-of-range, OOR) episodes, and explore factors associated with variations in their performance.

Methods

Routine owner records were used to assess the sensitivity and specificity of each of 2 dogs, trained by a single UK charity during almost 4000 out-of-range episodes. Sensitivity and positive predictive values are compared to demographic factors and instructors' of the dog, owner and partnership.

Results

Dogs varied in their performance, with median sensitivity to out-of-range episodes at 25th percentile = 50, 75th percentile = 95). To hypoglycaemic episodes the median sensitivity was 83% (66–94%) while to hyperglycaemic episodes it was 67% (17–91%). The positive predictive value (PPV) was 81% (66–94%), i.e. on average 81% of alerts occurred when glucose levels were out of target range. For four dogs, PPV was 100%. Individual characteristics of the dog, the partnership and the household were significantly associated with performance (e.g., whether the dog was previously a pet, when it was trained, whether its partner was an adult or child).



OPEN ACCESS

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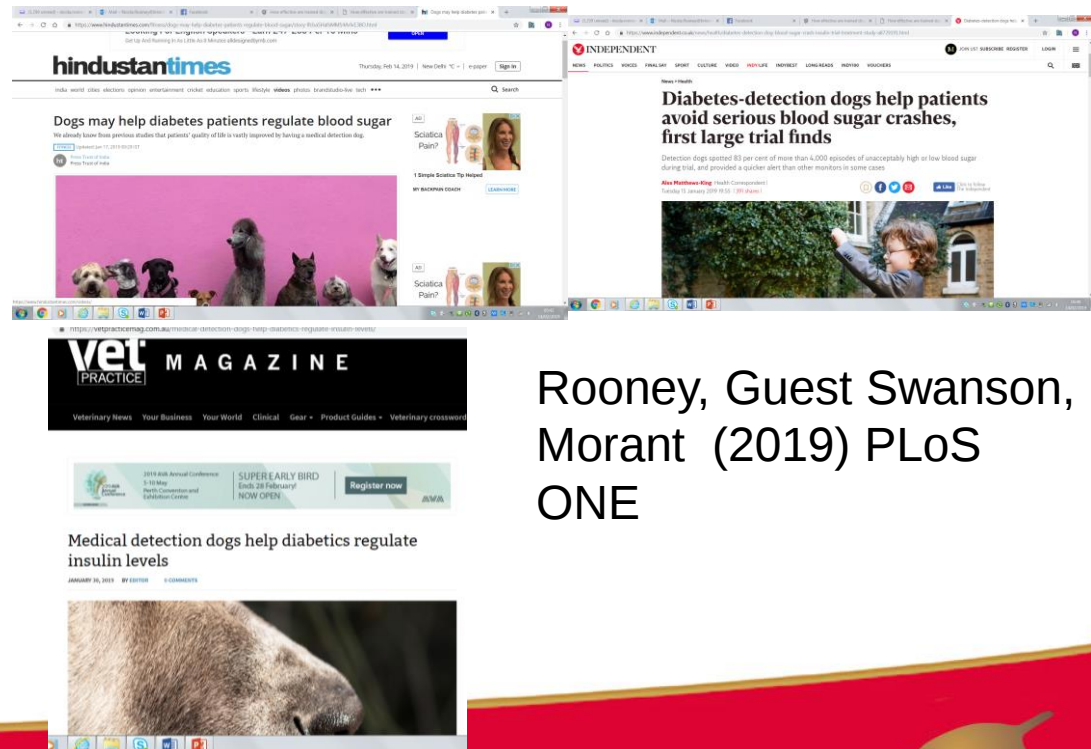
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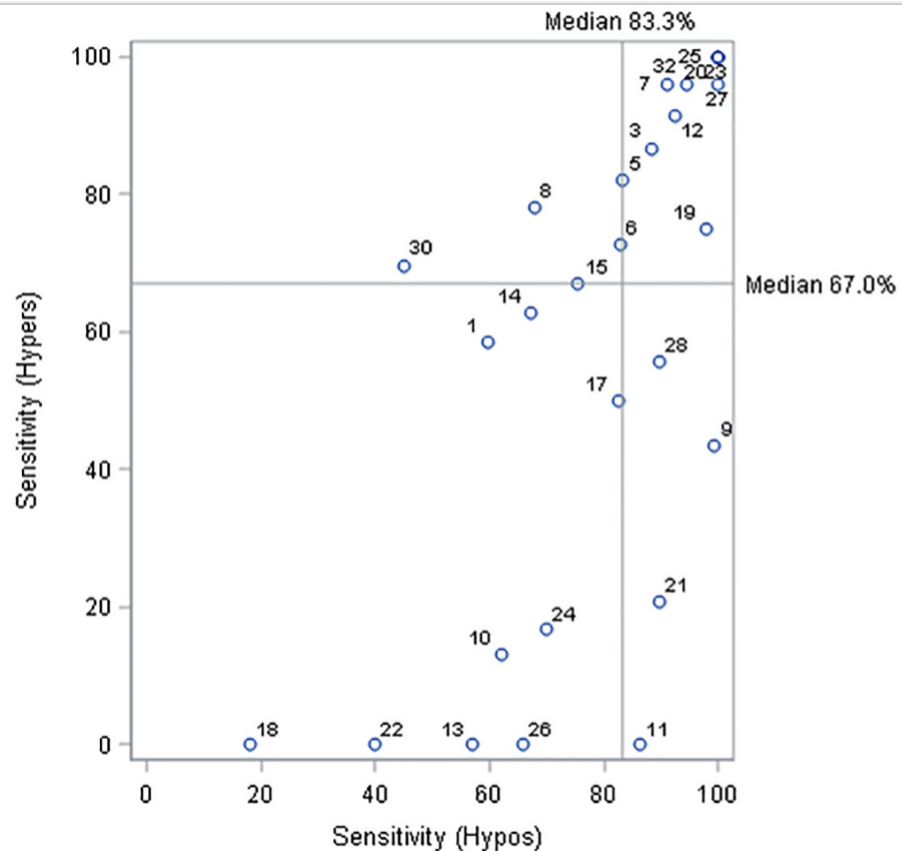


Rooney, Guest Swanson, Morant (2019) PLoS ONE

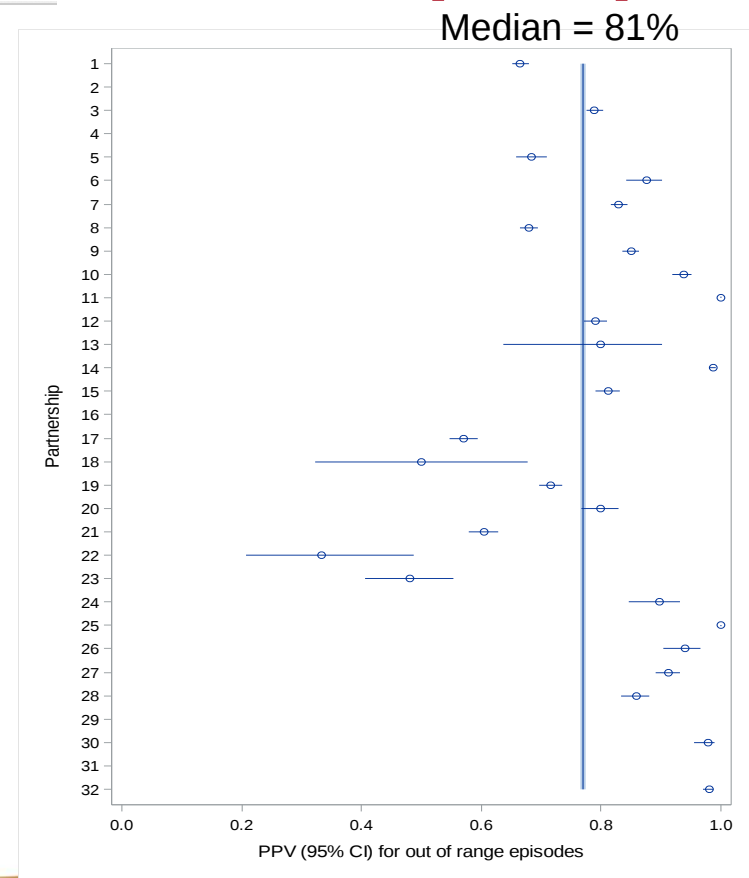
Medical
Detection Dogs



Sensitivity - % out of range episodes alerted to



Specificity – positive predictive value (PPV)



Owner-reported data



What is needed?

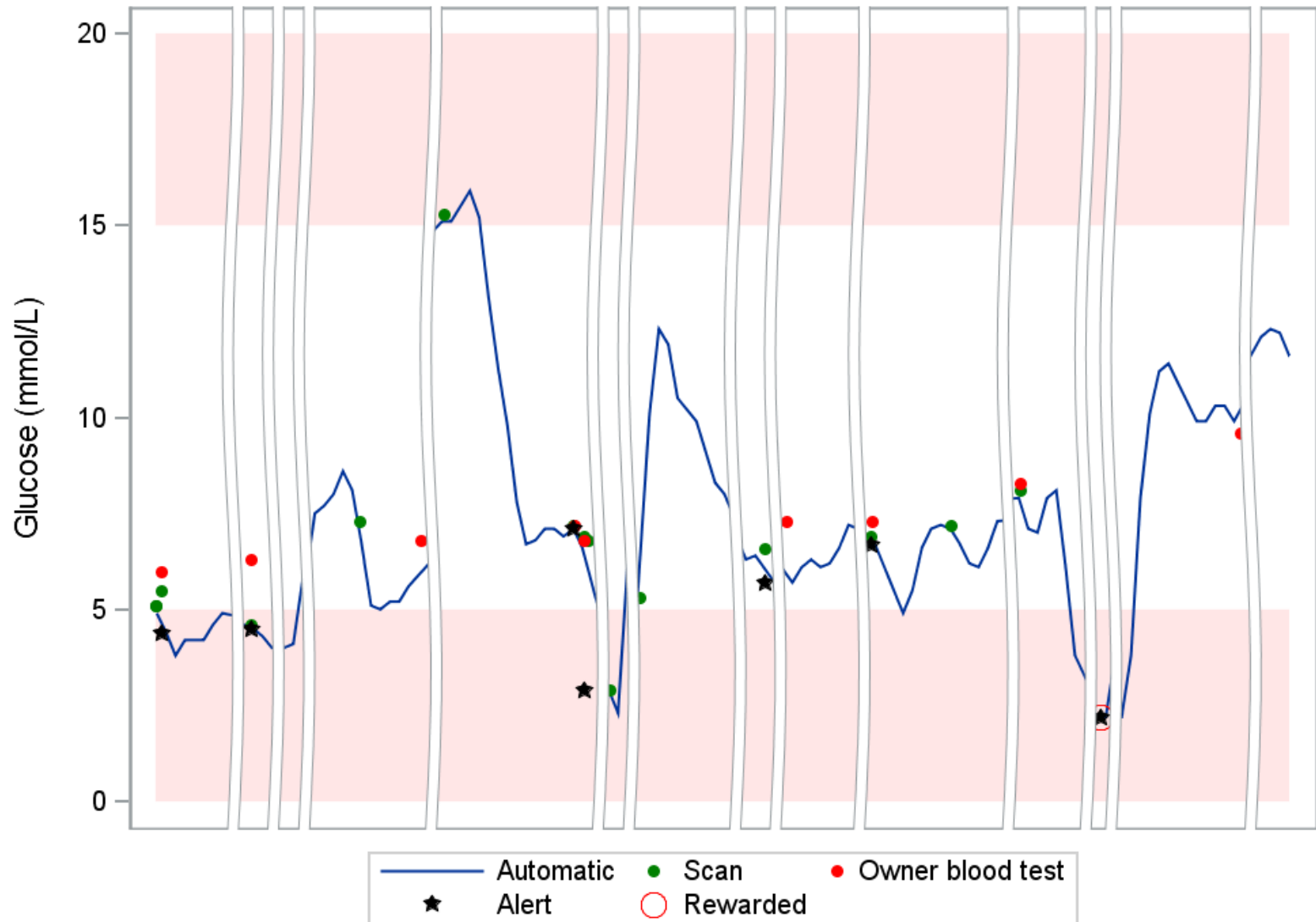
Owner-independent study



Continuous trace

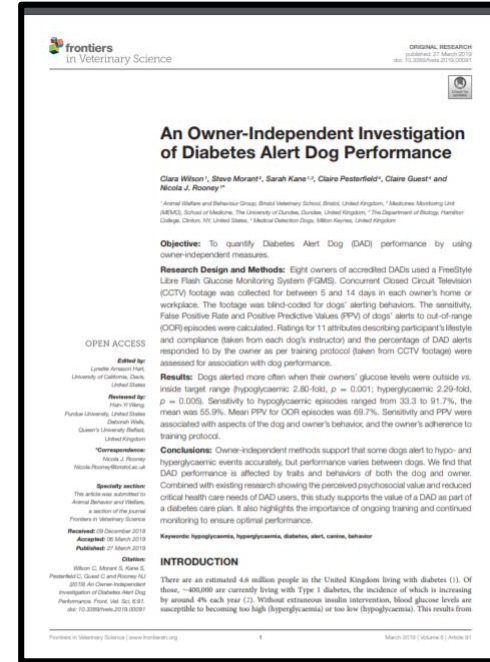
Sensitivity to OOR: 73.33%

Participant 5



Do dogs accurately alert their owners?

- Mean sensitivity to low blood glucose is 56%
 - (range 33.3% - 91.7%).
- Mean PPV is 70%
 - (range 45.2% - 92.9%).



Wilson, Morant, Guest Kane, Rooney
2019 *Frontiers in Veterinary Sciences*

Confirmed dogs perform role via owner-independent measures

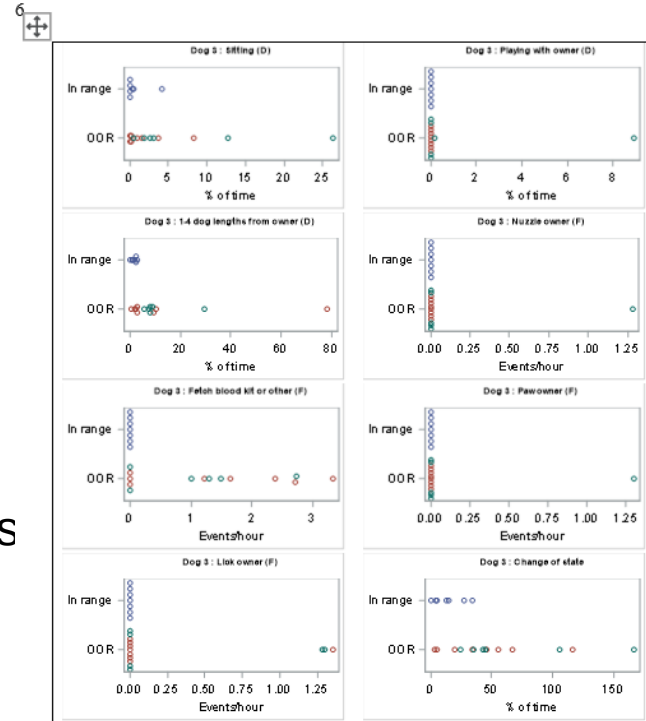
Differences between OOR and IR

When out of range greater variability in:

Playing with Owner,
Jump Up,
Sniff Owner,
Bark,
Paw Owner,
Lick Owner

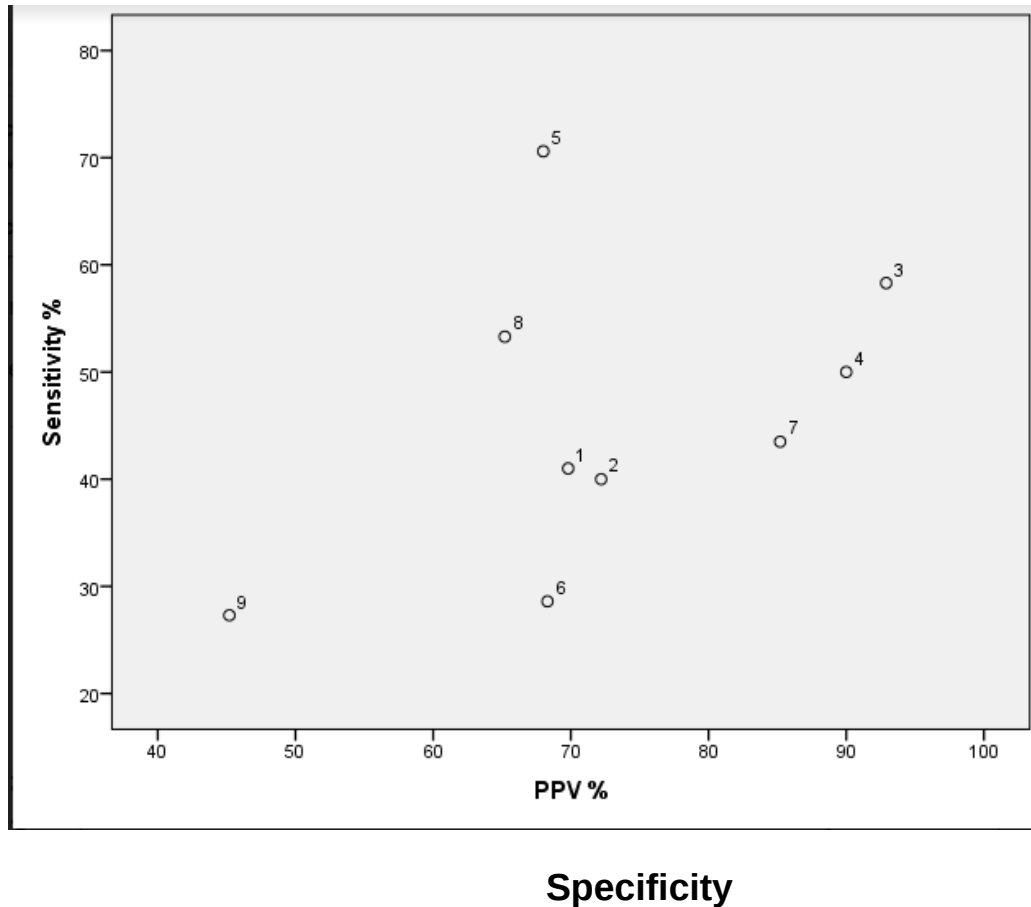
Individual dogs showed distinctive behaviours

Attention-seeking,
Locomotion/Standing,
Playing with Owner
Yawning
Licking Lips.



Wilson, Morant, Guest Kane, Rooney
submitted *Applied Animal Behaviour
Science*

Partnerships varied in performance



**Which factors
affect
performance?**

Which factors affect performance?

Features of household

Dogs in busy households

more likely to false alert

Partnered with a child

more likely to miss OOR episodes

less likely to false alert

Owner attitude and behaviour

Dogs missed fewer episodes if owners rated higher for:

Communication with Instructor

Willingness to Reward their Dogs

Confidence in the Dog's Ability



Which factors affect performance?

Features of dog

Missed fewer episodes if

more motivated/ enjoying task

higher strength of indication

more willing to try new behaviours and
“get it wrong”

What's next?



Can we predict differences in dogs prior to training?



Sharyn Bistre (PhD student)

Survey on the importance of different traits for medical detection dog performance

**Required*

Ideal Medical Detection Dog

In this section, a range of 40 different individual traits, potentially important for medical detection tasks, will be presented to you. Please indicate the level of each trait you think the IDEAL dog used for the discipline you work in would have. Please use the scale of 1 to 5: As high as possible (5), High (4), Intermediate (3), Low (2), As low as possible (1).

For example, if you consider that your ideal dog would never be distracted when working you should choose 1 (As low as possible) for 'Tendency to be distracted when working'.

A) Ideal levels of each trait *

	1. As low as possible	2. Low	3. Intermediate	4. High	5. As high as possible
Acuity of sense of smell - sharpness of nose	☐	☐	☐	☐	☐
Tendency to search by smell alone	☐	☐	☐	☐	☐
Tendency to investigate humans by sniffing	☐	☐	☐	☐	☐
Tendency to explore areas by sniffing	☐	☐	☐	☐	☐
Level of motivation when working	☐	☐	☐	☐	☐
Willingness to try new behaviours even if they are wrong	☐	☐	☐	☐	☐
Persistence	☐	☐	☐	☐	☐

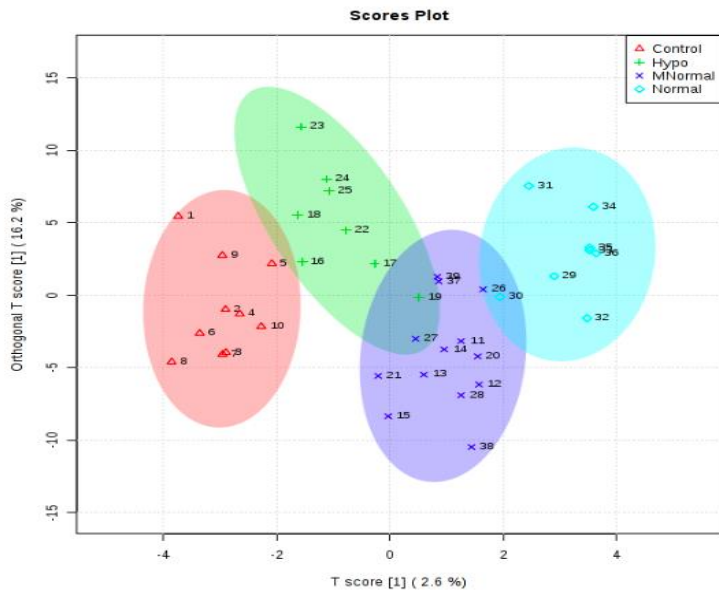
Important traits

- Reward preferences
- Human directed behaviour
- Willingness to try new behaviours

9. Boxes exploration 1. Please sit and hold your dog behind the start line facing forward. 2. When I say "READY" release your dog, they are free to search for treats hidden in boxes. 3. After your dog finds the treat or if I say "STOP" call them back, if they do not come, please take them back to the start point.	10. Unsolvable task 1. Please sit and hold your dog behind the start line facing forward. 2. When I say "READY" release your dog, they are free to try to take a treat out of a closed container. 3. Meanwhile, please remain in your seat quietly and ignore them if they try to get your attention.	11. Toy playing 1. Please play tug of war with your dog for one minute. 2. When I say "STOP", ask your dog to sit, lay down and stay. 3. Walk five steps backwards and hold the stay for 30 sec. 4. When asked, call your dog back and praise them.	12. Tennis ball 1. Please Sit and hold your dog behind the start line facing forward. 2. When I say "READY" release your dog, they are free to find a ball hidden under a can. 3. If your dog chooses the right can, I will throw them the ball, and you may release them. If they do not give up the ball, please take it back from them.	
13. Coat wearing 1. Please put the coat on your dog while I hold them. 2. We will then let them go, and they are free to explore for 30 sec. 3. please take off the coat afterwards.	14. Vet check up 1. Please hold your dog while I simulate a vet check up. 2. Please let me know beforehand if your dog does not like being handled.	15. Moving ball 1. Please sit and hold your dog behind the start line facing forward. 2. I will show your dog a ball. Release them when I place the ball on the floor. The ball will move and make a noise for around 30 sec. 3. Meanwhile, please remain in your seat quietly and ignore your dog if they try to get your attention.	16. Slippery surface 1. Please follow me into the next room. 2. Hold your dog's leash while I toss some treats on a slippery surface. 3. When I said "READY" release them so they can get the treats	17. Adaptation to resting area 1. Please take your dog back to their crate (resting area). 2. Toss some treats in the crate and put your dog inside. 3. We will leave them alone for five minutes while filming them. 4. Afterwards you may take them out if you wish.

How do they do it?

Thermal desorption gas-chromatography time-of-flight mass spectrometry (TD-GC-MS-TOF)



Differences in odour profiles with glycaemic state

5 compounds needed to detect hypoglycaemia,
(Wheatstone 2017).

What about dog-child partnerships?



Addison's crisis alert dog



PoTs syndrome



Postural Tachycardia Syndrome



Thank you for your attention!

