

Cancer in Bernese Mountain Dogs - Applications of Liquid Biopsies

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Outline

Cancer in Bernese Mountain Dogs

Liquid biopsies

Cell-free DNA as a marker of health

DeepScan CFD test use in Bernese Mountain Dogs

Q & A

Cancer in Bernese Mountain Dogs

Bernese Mountain Dogs have an increased risk for many cancers

- Histiocytic sarcomas
- Lymphomas
- Osteosarcomas
- Others: Hemangiosarcomas, other sarcomas, mast cell tumours

Median life expectancy 7-9 years

Cancer is the most common cause of death

Cancer can also strike young and healthy-looking dogs

Early detection is challenging with traditional tools

Liquid biopsies

A liquid biopsy is a laboratory test done on a sample of bodily fluid

- 'Bodily fluid' = blood, urine, saliva
- 'Test' = DNA, RNA, proteins, metabolites

Complementary to imaging and histopathology

- Non-invasive, repeatable, affordable, fast, sensitive, specific

Emerging tool for

- Disease detection (especially cancer)
- Aid in diagnosis
- Treatment monitoring
- Relapse detection

Liquid biopsies in cancer

Liquid biopsy	Tissue biopsy (histopathology)	Imaging
Same day - 1 week	Often 1-2 weeks	Same day - 1 week
Non-invasive	Invasive	Non-invasive / sedation
50 - 500+ €	300 - 1000+ €	100 - 1000+ €
Tumour type, (location, grading)	Tumour type, grading	Tumour location, size, staging
Early detection, MRD, monitoring	Diagnosis for accessible tumours	Locating tumours

Cell-free DNA (cfDNA) as a health marker

Most liquid biopsy tests analyse cell-free DNA (cfDNA)

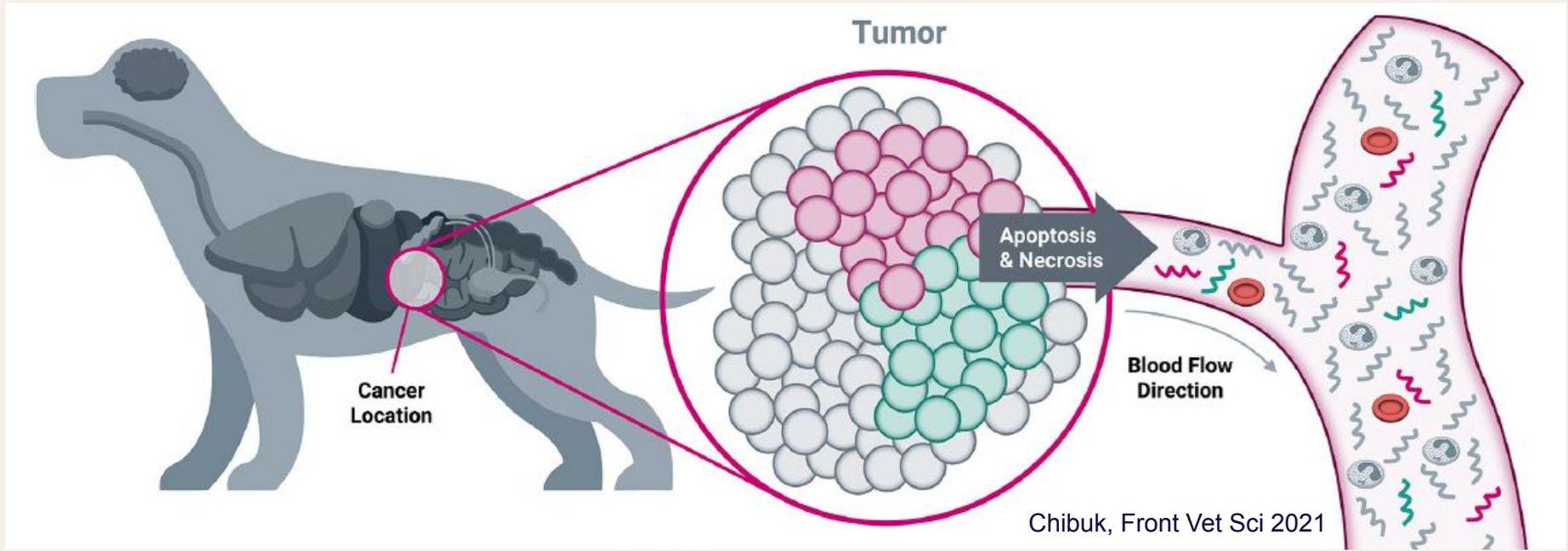
- Plasma, urine, saliva

cfDNA is DNA released by cells when they die. It is destroyed quickly outside cells

- Very low in healthy dogs
- Mildly increased level during growth & pregnancy
- Mildly increased level in many diseases
- Highest values in systemic cancers & internal bleeding

Think of cfDNA as a biomarker for cell death

cfDNA in cancer



DeepScan CFD test values



Green - Healthy dogs, eye & ear infections, UTIs

Yellow - Osteoarthritis, heart & kidney disease, IBD, mast cell tumours

Orange - Osteosarcoma, hemangiosarcoma

Red - Histiocytic sarcoma, lymphoma, internal bleeding, surgery

Note - Effect of tumour size, location, growth rate, stage.

DeepScan CFD test vs CRP test



CRP test is produced by the liver in response to immune system activation

- Good at detecting bacterial infections. Also elevated in some other diseases

CFD test is released by dying cells anywhere in the body

- Correlates well with disease severity and reacts quickly to health changes

Note - Both tests determine the current health status - not future risk for disease

DeepScan CFD test & BMDs

Total 284 samples from 132 Bernese Mountain Dogs

- Finland 95, France 33, Netherlands 2, Slovenia 2

Healthy follow up group

- 34 Bernese Mountain Dogs (total 400 dogs)
- Samples taken every 3 months

Cancer treatment monitoring group

- 5 Bernese Mountain Dogs (total 68 dogs)
- 2 Histiocytic sarcomas, 2 Lymphomas, 1 Mast cell tumour
- Samples taken before, during and after treatment

DeepScan CFD test in healthy dogs

Total 1600 samples from 400 healthy adult dogs in Finland. Breeds:

- Belgian Shepherd Dogs
- **Bernese Mountain Dogs (34)**
- Dobermans
- Golden Retrievers
- Flat-coated Retrievers
- German Shepherd Dogs
- Great Danes
- Irish Wolfhounds
- Staffordshire Bull Terriers

Blood samples taken every 3 months.

Elevated CFD test results lead to further tests (blood panels, imaging).

DeepScan CFD test in healthy dogs

Healthy male



7Y MI Bernese Mountain Dog

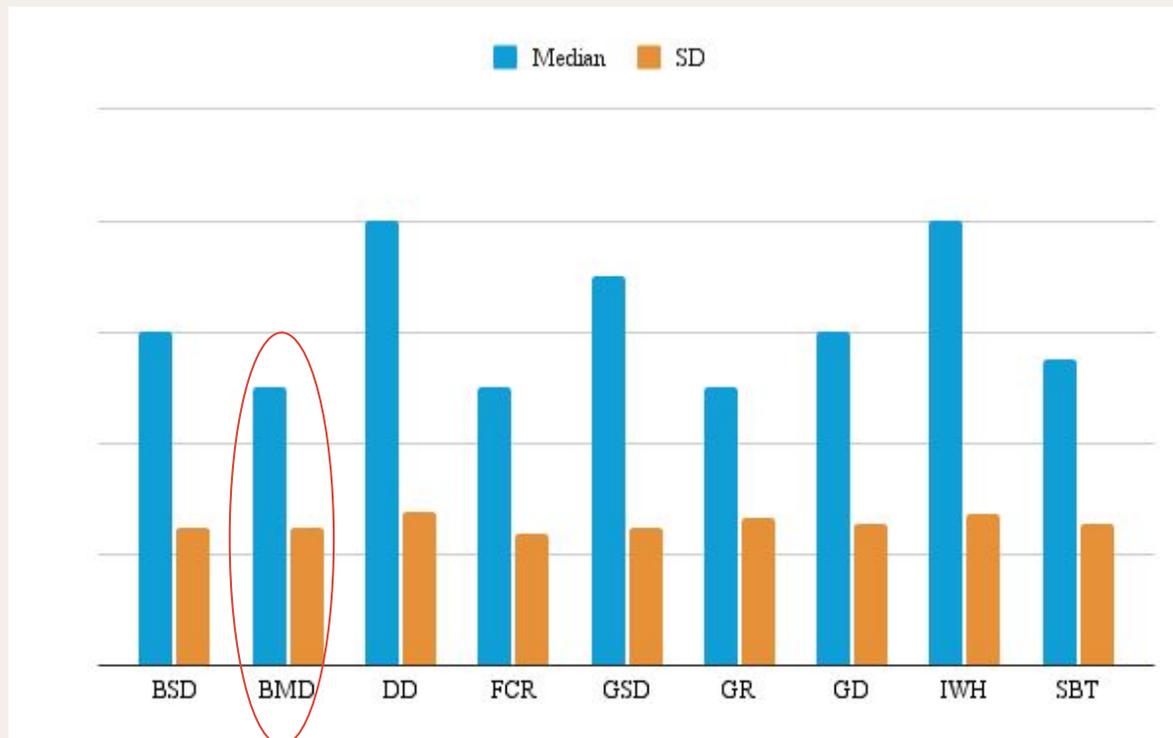
Healthy female



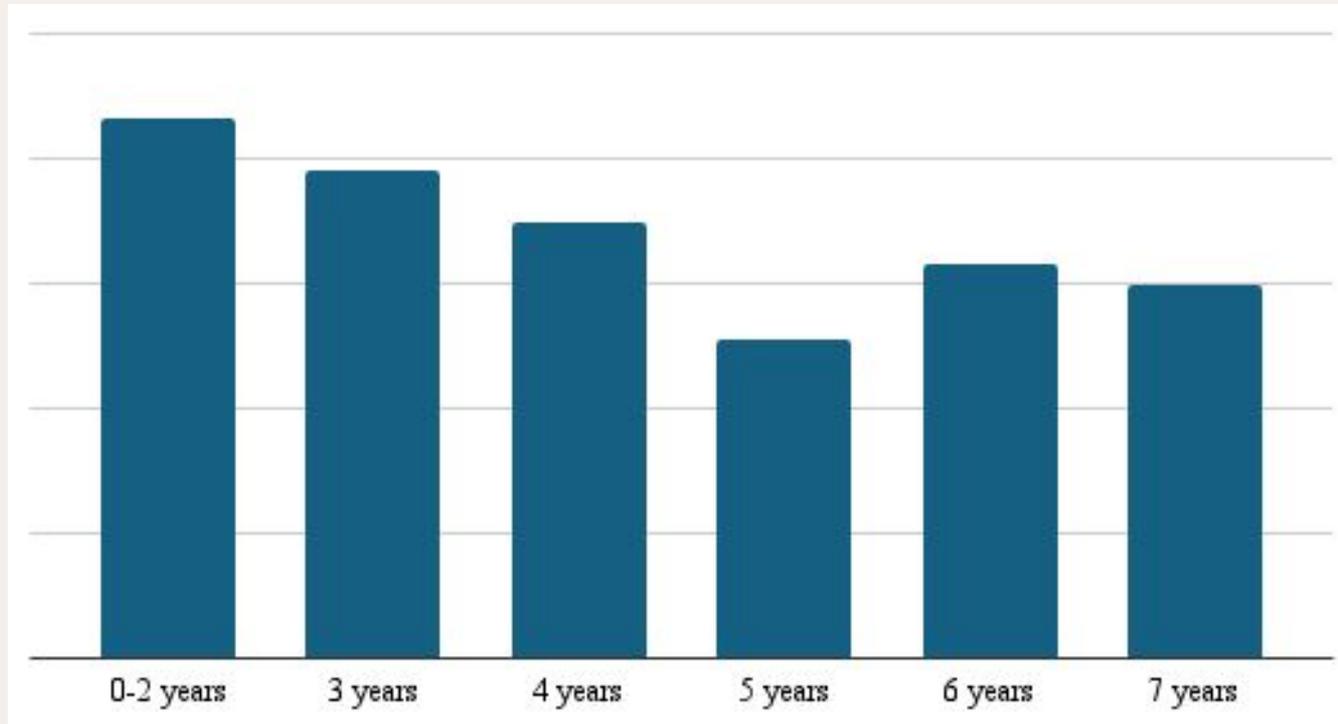
7Y FI Bernese Mountain Dog

DeepScan CFD test & breed effect

BSD Belgian Shepherd Dog
BMD Bernese Mountain Dog
DD Dobermann
FCR Flat-Coated Retriever
GSD German Shepherd Dog
GR Golden Retriever
GD Great Dane
IWH Irish Wolfhound
SBT Staffordshire Bull Terrier

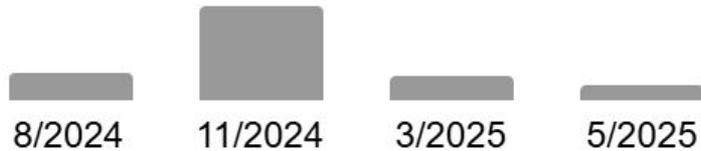


DeepScan CFD test & age effect



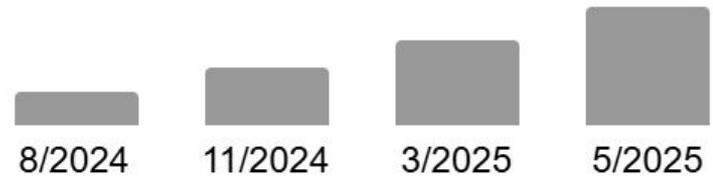
DeepScan CFD test & disease

Temporary increase - injury?



9Y MI Bernese Mountain Dog

Upward trend - cancer / organ damage?



4Y MI Bernese Mountain Dog

DeepScan CFD test & cancer treatment

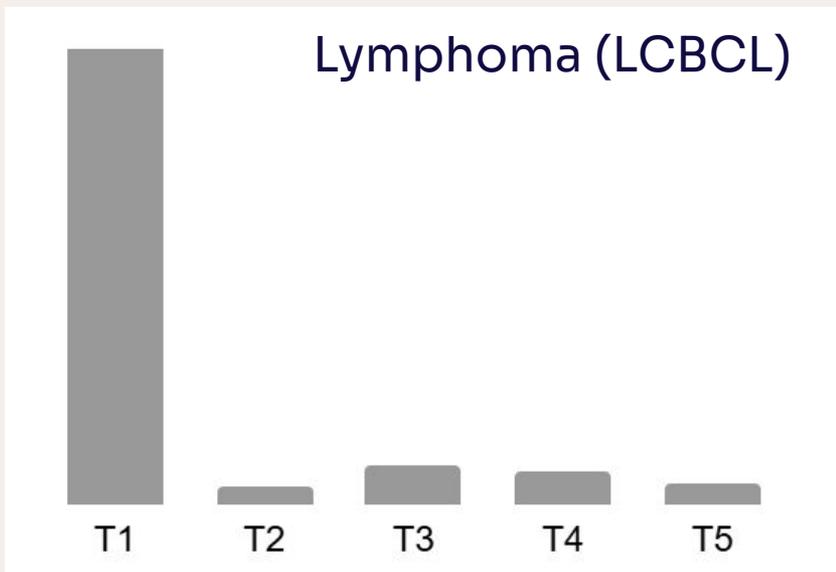
16 samples in 5 BMD (total 282 samples in 68 dogs)

- In Finland, Netherlands, France and Slovenia
- First sample taken before treatment begins
- Further samples taken before each treatment
- Follow up every 3-6 months after treatment ends to catch new tumours

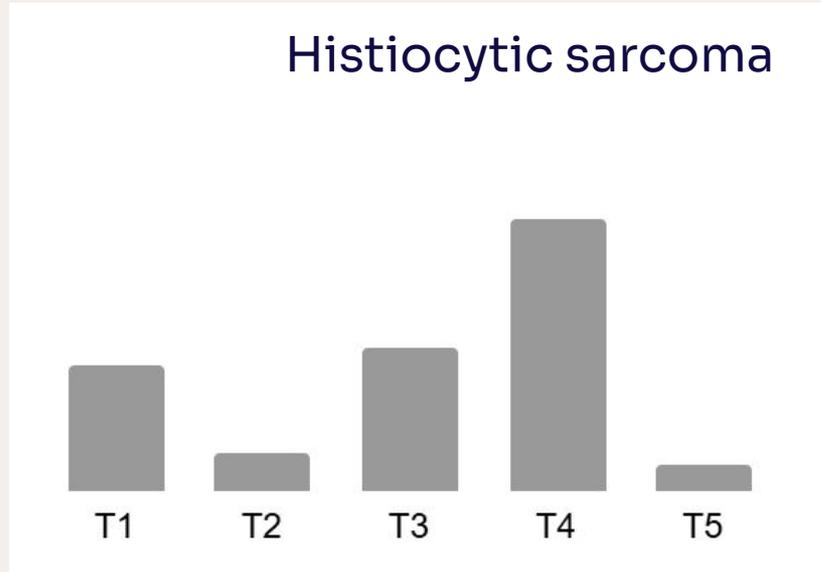
Results

- cfDNA level correlates with treatment success / cancer recurrence
- Question: How often & for how long to continue testing?

DeepScan CFD test & cancer treatment



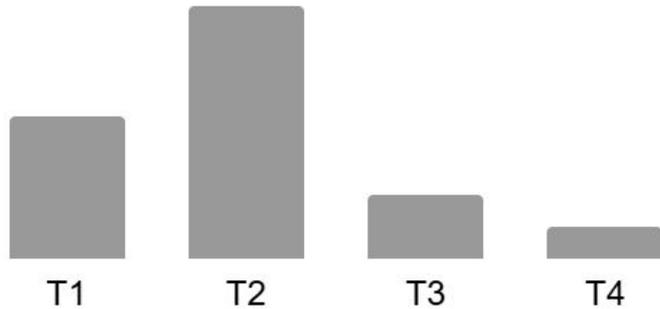
6Y FI Bernese Mountain Dog



6Y MI Bernese Mountain Dog

DeepScan CFD test & cancer treatment

Lymphoma (LCBCL)



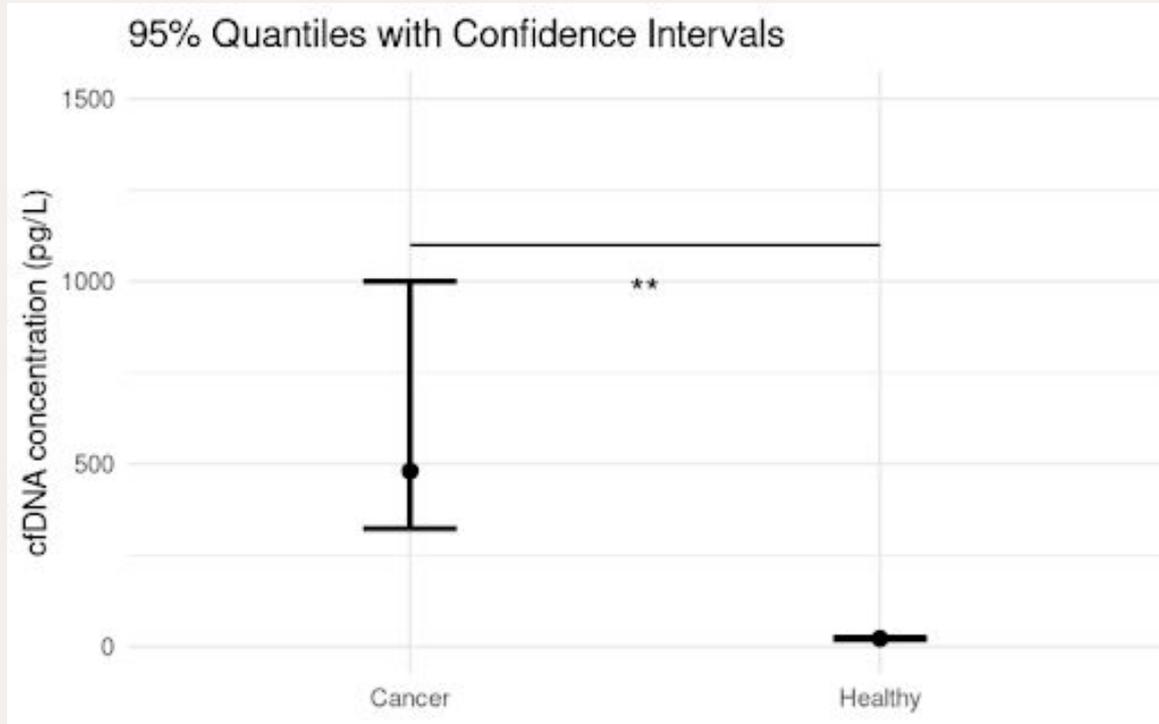
10Y FN Bernese Mountain Dog

Mast cell tumour



7Y FI Bernese Mountain Dog

DeepScan CFD test performance



DeepScan CFD test performance

Sensitivity	DeepScan CFD	Volition Nu.Q	IDEXX Cancer Dx*
Lymphoma	95%	77%	79%
Hemangiosarcoma	93%	82%	nd
Histiocytic sarcoma	96%	54%	nd
Melanoma	88%	43%	nd
Osteosarcoma	89%	35%	nd
Mast cell tumour	73%	19%	nd
Specificity	96%	97%	99%

DeepScan CFD test use cases

1. **As part of a regular health check**
2. **When suspecting a disease (complements CRP and other markers)**
3. **As a standalone test to monitor disease treatment success**

Notes

- **Results are breed- and age-dependent.**
- **Taking multiple tests 3-12 months apart gives a more reliable baseline than a single test**
- **DeepScan CFD test complements CRP and other blood biomarkers when making a diagnosis**

Challenges with current cfDNA tests

Tests cannot separate between cancer types reliably

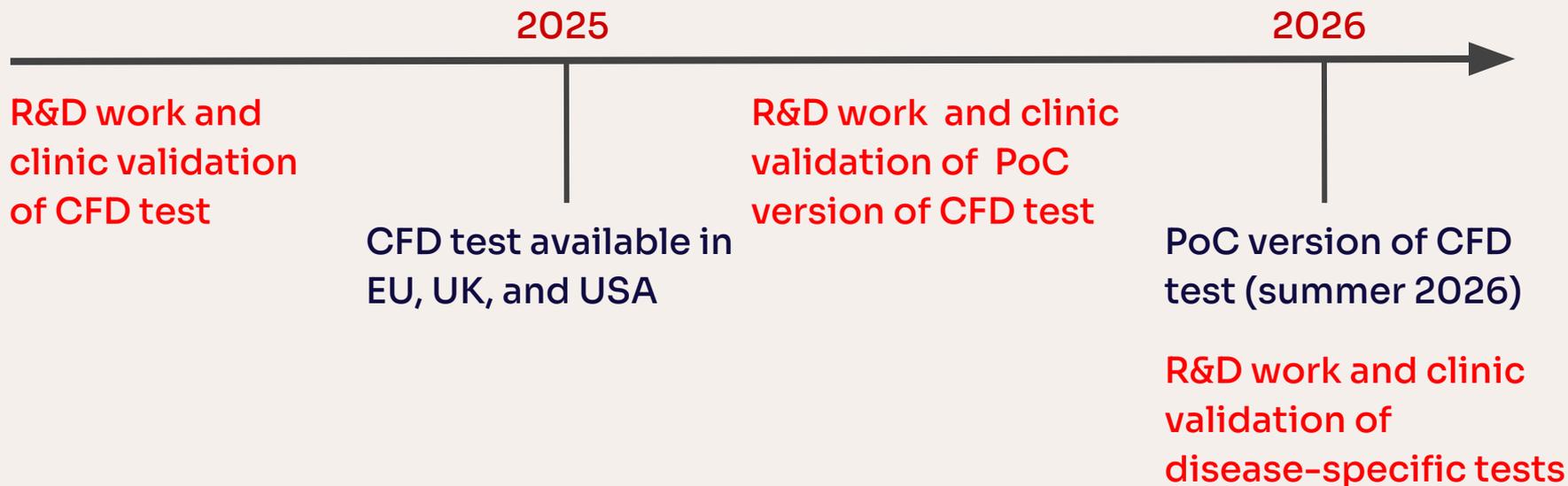
Tests miss cancers that do not have the mutation tested

In human medicine, sequencing of tumour + white blood cells is often used, but:

- Needs a lot of DNA (20 ml blood or several tissue samples)
- Is expensive (500 - 1000 € per test)
- Takes time (1 - 2 weeks per test)

DeepScan is working on a new 2-step approach with the best animal hospitals in Europe and USA.

DeepScan diagnostic test pipeline



Our goals

Develop diagnostic tests that extend and improve dogs' lives

- Detect diseases before visible signs
- Monitor treatment success and disease recurrence
- Detect organ damage caused by treatment

To do this, we are developing tests that are more sensitive and specific than existing ones. We will bring these tests to clinics to decrease waiting time, and minimise costs for the dog owner and the treating clinics.

We aim to determine the disease type and location using a small blood, urine, or saliva sample:

“This dog has visceral hemangiosarcoma in spleen”

“This dog has liver damage due to epilepsy treatment”

Thank you!

We are grateful for the support of Suomen Sveitsinpaimenkoirat ry and for all the dogs and humans who have taken part in our studies. We would not be here without you!

Special thanks to Dr Benoit Hedan and Prof Catherine Andre in Rennes, Prof Laura Barrett in Lyon, Dr Arno Roos in Nieuwegein, and Prof Natasa Tozon in Ljubljana for expert advice and characterisation of cancer samples.

We are looking for more research partners treating Bernese Mountain Dogs in the Switzerland - Germany - Austria region. If you know a clinic that may be interested, please call / email us.

Benoit's recent webinar can be found here:

<https://www.deepscandx.com/webinars>

Thank you!

Contact us if you are interested to hear more



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