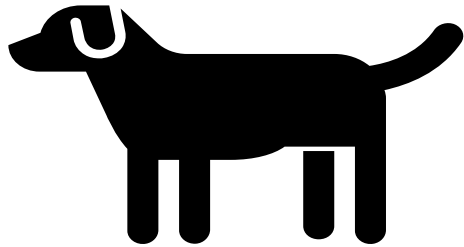


New Tricks for Old Dogs: Using Natural Animal Models and Comparative EMR Data to Fetch Solutions for Chronic Disease

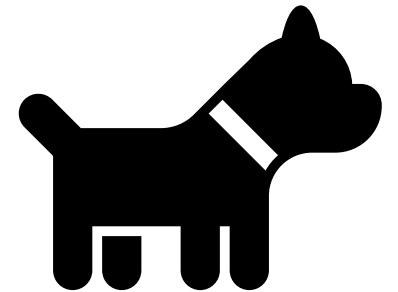


Tracy L. Webb, DVM, PhD, FNAP

Associate Professor

Colorado State University

August 13th, 2025

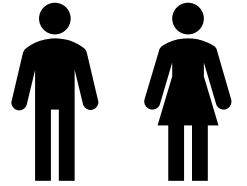


Disclosures

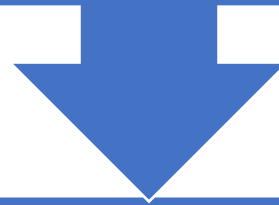
- No disclosures



Chronic Disease



Chronic disease = conditions that last >3 months (or a 1 year, depending on source) and require ongoing medical attention and/or limit activities of daily living



Chronic diseases account for most illness, disability, and death in the U.S. and are the leading drivers of health care costs.

90% of the \$4.9 trillion in annual health care costs are for chronic and mental health conditions.

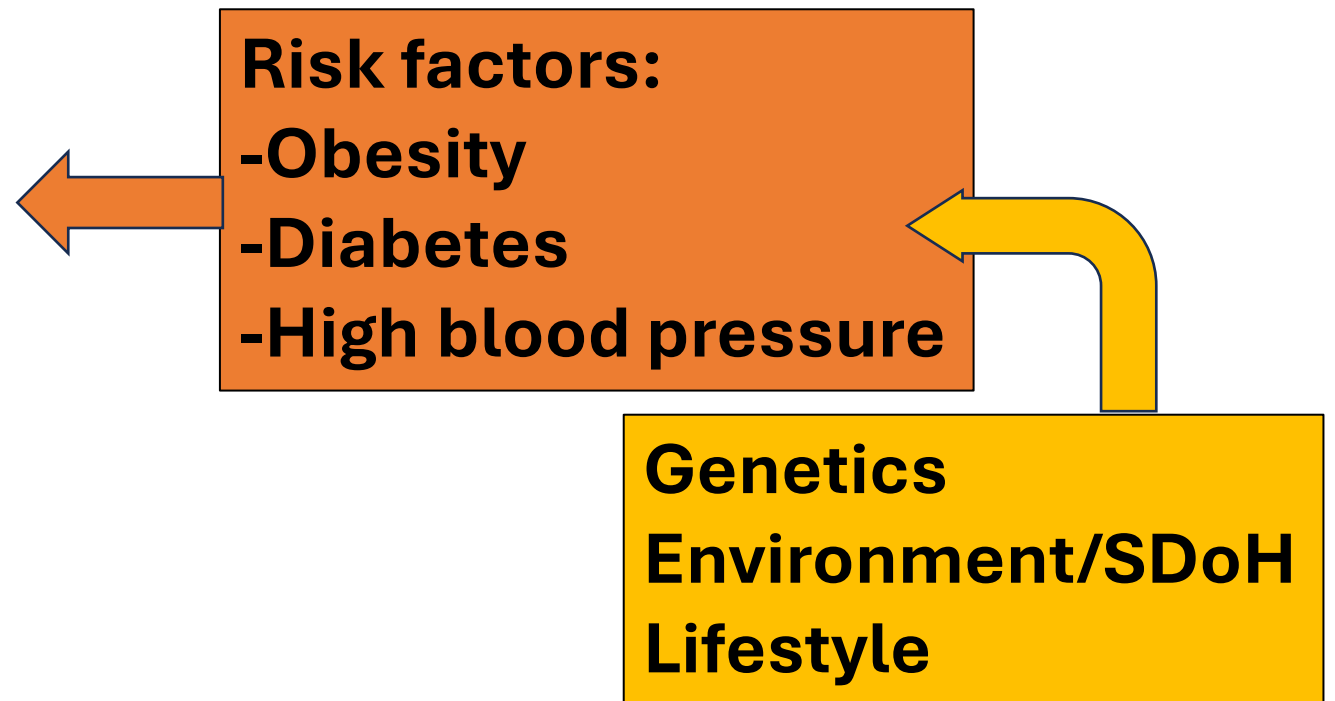
6/10 Americans have at least one chronic disease

4/10 have 2 or more chronic diseases

Chronic Diseases

- Most common chronic diseases in the U.S. = leading causes of death:

- Heart disease
- Stroke
- Cancer
- Emphysema
- Chronic kidney disease
- Alzheimer's disease

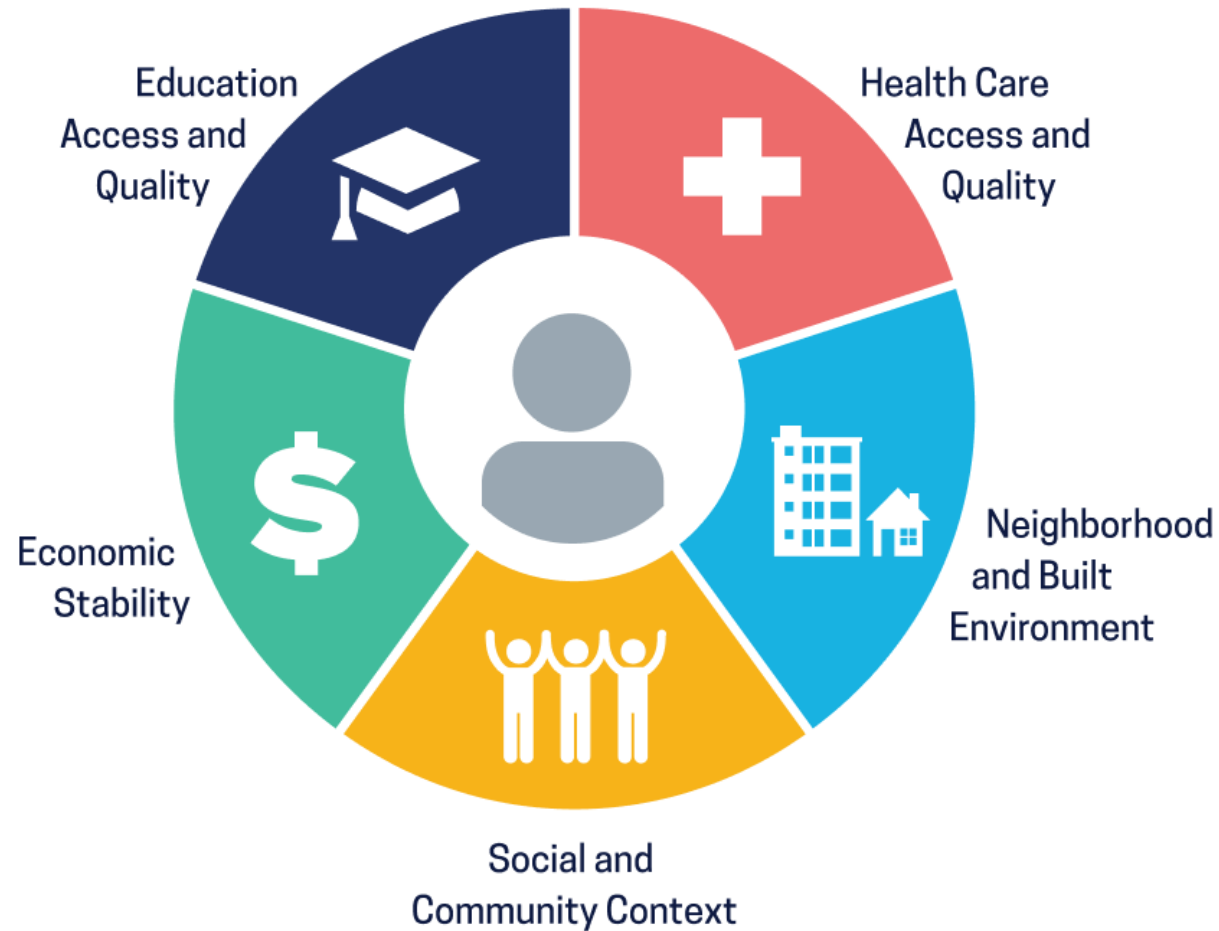


Chronic Disease

*“CDC's National Center for Chronic Disease Prevention and Health Promotion supports state, local, tribal, and territorial public health organizations to **reduce chronic disease risk factors**.*

*Funded programs **focus on addressing the social determinants of health**, so that everyone can have the same opportunity to live their healthiest life.”*

Social Determinants of Health



Healthy People 2030, U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. Retrieved [date graphic was accessed], from <https://health.gov/healthypeople/objectives-and-data/social-determinants-health>

SDoH Impacts

Significantly lower prevalence of asthma, arthritis, diabetes, hypertension, and obesity in affluent counties compares with least affluent ones. (Shaw KM, et al., 2013. *Prev Chronic Dis*. 2016;13:E119.)

People with <high school education had ~2x odds of having diabetes compared to those with a college degree. (Borrell LN, et al. *Am J Public Health*. 2006;96(9):1637–1642.)

Across large U.S. cities, rates of stroke and hypertension are concentrated in census tracts with a high proportion of Black residents, old homes with low market value, and people receiving government assistance. (Fitzpatrick KM, Willis D. *Int J Environ Res Public Health*. 2020;17(8):2961.)

SDoH Impacts

“Areas affected by a high prevalence of multiple chronic disease face a variety of socioeconomic and environmental barriers to achieving good health.”

”Many risk factors for chronic disease are likely beyond the individual’s control and require large-scale policy change.”

“Preventing and managing chronic disease will require combatting poverty and socioeconomic inequality.”

Pediatric Chronic Disease

RESEARCH ARTICLE · Volume 25, Issue 4, 102810, May-June, 2025 · [Open Access](#) [Download Full Issue](#)

Prevalence and Trends in Pediatric-Onset Chronic Conditions in the United States, 1999–2018

[Lauren E. Wisk, PhD](#) ^{a,b}  · [Niraj Sharma, MD, MPH](#) ^{c,d,e}

[Affiliations & Notes](#)  [Article Info](#) 

Publication History: Received July 3, 2024; Accepted February 24, 2025; Published online March 7, 2025

DOI: [10.1016/j.jaccp.2025.102810](https://doi.org/10.1016/j.jaccp.2025.102810)  Also available on [ScienceDirect](#) 

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- prevalence has risen to **nearly 30%** in the last 20 years
- nearly **1 in 3** young people estimated to be living with pediatric onset conditions that significantly affect their lives:
 - ADHD/ADD, autism, asthma, prediabetes, depression/anxiety
- Youth who are subject to socioeconomic vulnerability (e.g., less education, lower income, on public insurance, or unemployed) are more likely to live with a chronic condition



Solutions to Chronic Disease in U.S.

- Invest in “smart” disease prevention
- Boost health literacy
- Facilitate adoption of healthy diet and exercise
 - access
- Increase health services capacity and access
 - “In 2024, ~84 million people lived in areas with insufficient access to primary care.”
- Long-term, multidimensional plan





**>37%
of U.S.
households
own cats**

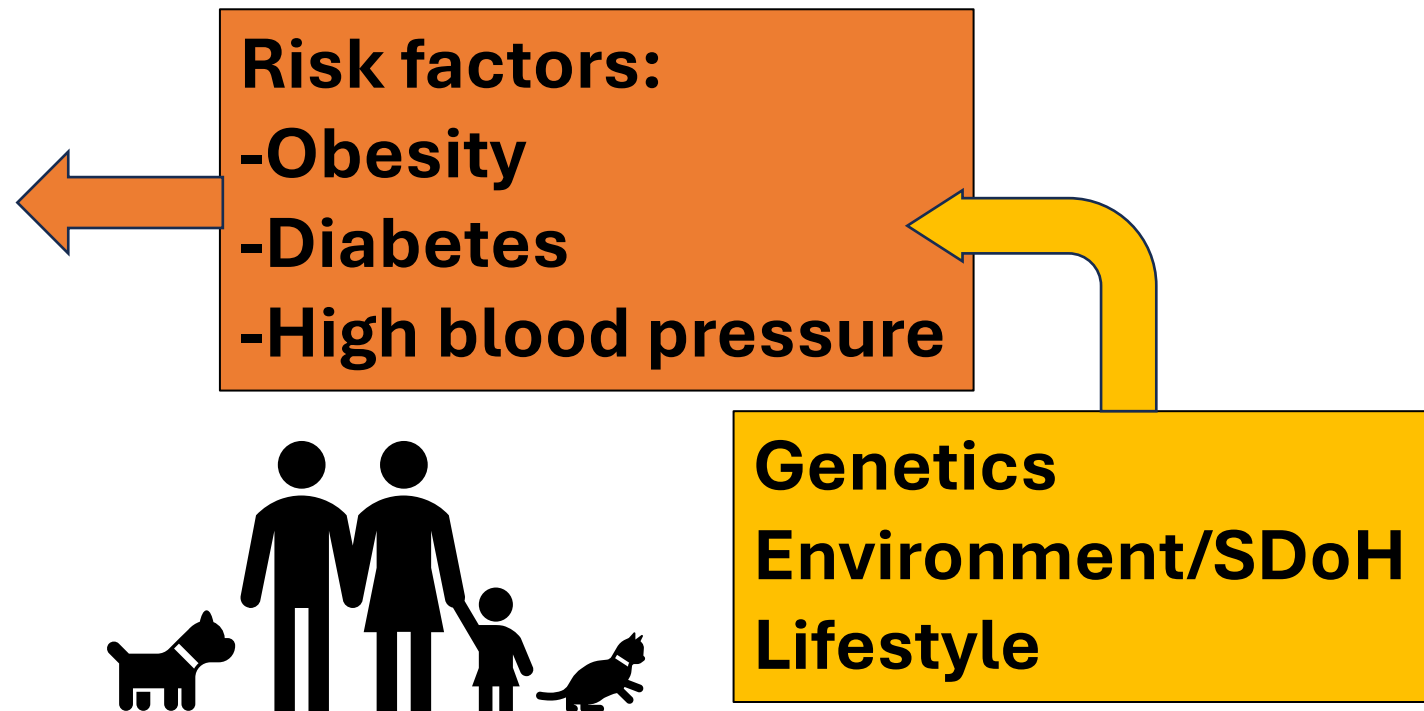


**>45%
of U.S.
households
own dogs**

Chronic Diseases

- Most common chronic diseases in the U.S. = leading causes of death:

- Heart disease
- Stroke
- Cancer
- Emphysema
- Chronic kidney disease
- Alzheimer's disease



International Cat Day (8 August)



nala_cat • Follow
New York, New York



realgrumpycat • Follow

People experiencing homelessness

- 2019 estimate: **~12% of unsheltered homeless adults owned pets.**
- Studies have shown that people experiencing homelessness report that their **pets provide a sense of responsibility and are a reason to live, reduce substance use, and motivated them to seek healthcare.**
 - **Pets are viewed as a stable source of social support, companionship and security.**

People experiencing homelessness

- While unhoused individuals with pets undoubtedly experience additional hardships as most support resources are not available to those living with a companion animal, **many will refuse assistance if it comes with a condition of giving up a beloved pet.**



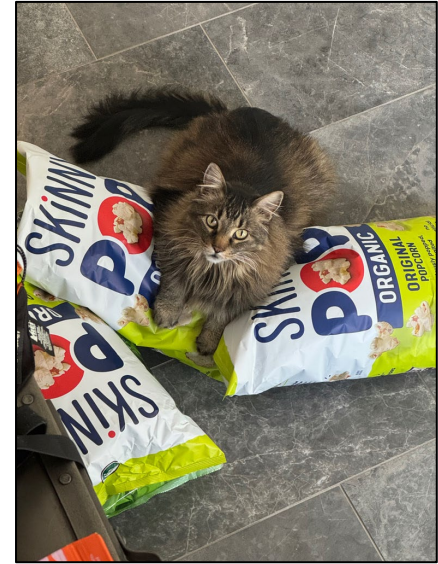
- 2017: **48%** of unhoused pet-owning individuals reported being turned away from a shelter because of pet policies.
- **22% of respondents indicated they avoided shelter because their pet was not allowed to be with them.**

People experiencing homelessness

- 2021—A Canada-based study found that animals owned by those experiencing homelessness and housing vulnerability are
- **generally in good health**
- **the characteristics and common clinical conditions seen in these pets are similar to those seen in traditionally housed pets**

Naturally-occurring Animal Disease Models

- occur during the natural course of life
- companion animals live in our environments
 - share our food
 - similar exposures
- vaccinated
- shorter life span but longer than rodents



Naturally-occurring Animal Disease Models

- Better reflect humans:
 - complex genetics
 - environmental variation
 - diverse diets and personal habits
 - physiological variation
 - comorbidities
- Spontaneous models yield higher translatability
 - complement laboratory animal studies
 - reduce failures in clinical trials



<https://catinfo.org>

**Especially with
chronic disease(s)**

FDA, NIH officials look to curb animal testing in drug development

 Regulatory News | 08 July 2025 | [Joanne S. Eglovitch](#)

During a joint workshop on Monday, officials from the US Food and Drug Administration (FDA) and National Institutes of Health (NIH) outlined efforts to reduce animal testing. FDA Commissioner Marty Makary opened the meeting stating the agency is committed to exploring non-animal models and stressed that reducing animal testing is one of the agency's biggest goals.

Makary said the topic “resonates with everybody,” and replacing animal testing with alternative models has can help expedite drug development, lower costs, and increase innovation.

“God did not make animals on planet Earth to abuse and torture, and so we have to respect animals, and this workshop is aimed at reducing animal testing in every way we can, while safeguarding the public with medications,” Makary added. Shortly after joining FDA, Makary [announced](#) a plan to “phase out” animal testing with new approach methodologies (NAMs), including computer simulation, artificial intelligence, lab-grown organoids, and organ-on-a-chip technologies. (RELATED: [FDA seeks to reduce animal testing requirements for mAbs, other drugs](#), *Regulatory Focus* 11 April 2025)



FDA Commissioner Marty Makary speaks at a workshop on reducing animal testing on 7 July 2025.

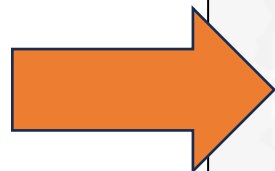
‘NAM’ = Natural Animal Models



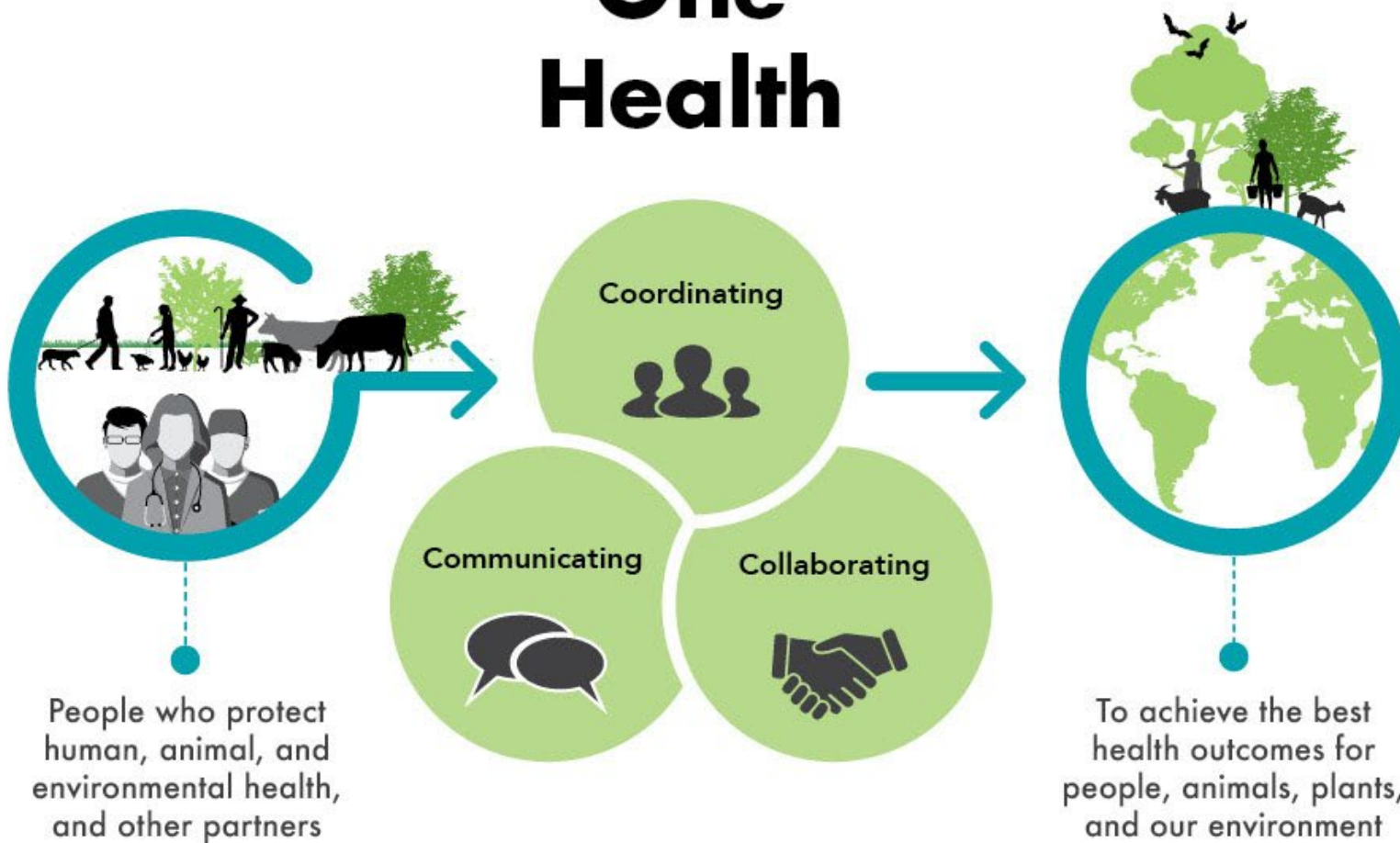
Colorado Clinical & Translational Sciences Institute

CCTSI Resources at CSU

- + BIOSTATISTICS
- + CLINICAL AND TRANSLATIONAL SCIENCE AWARD- ONE HEALTH ALLIANCE (COHA)
- + INNOVATION CORPS (I-CORPSTM)
- + NATURAL ANIMAL MODELS
- + LEADING AND TEAMING IN CLINICAL TRANSLATIONAL SCIENCE



One Health



When we protect **one**,
we help protect **all**.



00102186-C

SDoH affect animals

Social determinants of health and survival in humans and other animals

NOAH SNYDER-MACKLER , JOSEPH ROBERT BURGER, LAUREN GAYDOSH, DANIEL W. BELSKY , GRACE A. NOPPERT , FERNANDO A. CAMPOS ,
ALESSANDRO BARTOLOMUCCI , YANG CLAIRE YANG, ALLISON E. AIELLO, [...], AND JENNY TUNG  +4 authors [Authors Info & Affiliations](#)

SCIENCE • 22 May 2020 • Vol 368, Issue 6493 • DOI: 10.1126/science.aax9553

- health and lifespan in humans, highly social animals, are reduced with social adversity.
- humans are not the only animals that are social
- other social mammals are similarly influenced by isolation and adversity.
 - **measures of social integration, social support, and, to a lesser extent, social status independently predict life span in at least 4 different mammalian orders.**

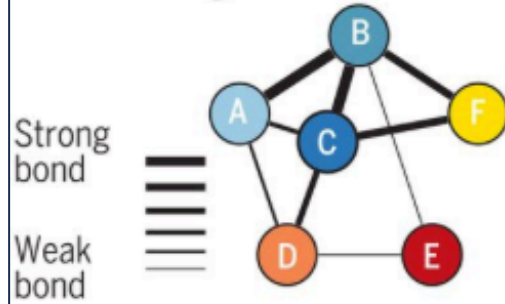
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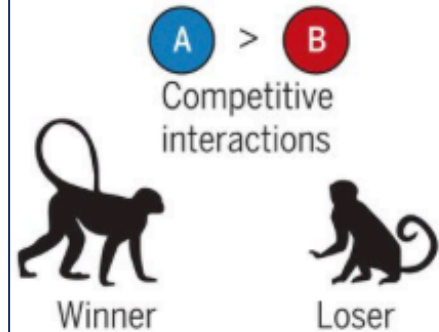
ALESSANDRO BARTOLOMUCCI , YANG CLAIRE YANG, ALLISON E. AIELLO, [...], AND JENNY TUNG  [+4 authors](#) [Authors Info & Affiliations](#)

SCIENCE • 22 May 2020 • Vol 368, Issue 6493 • DOI: 10.1126/science.aax9553

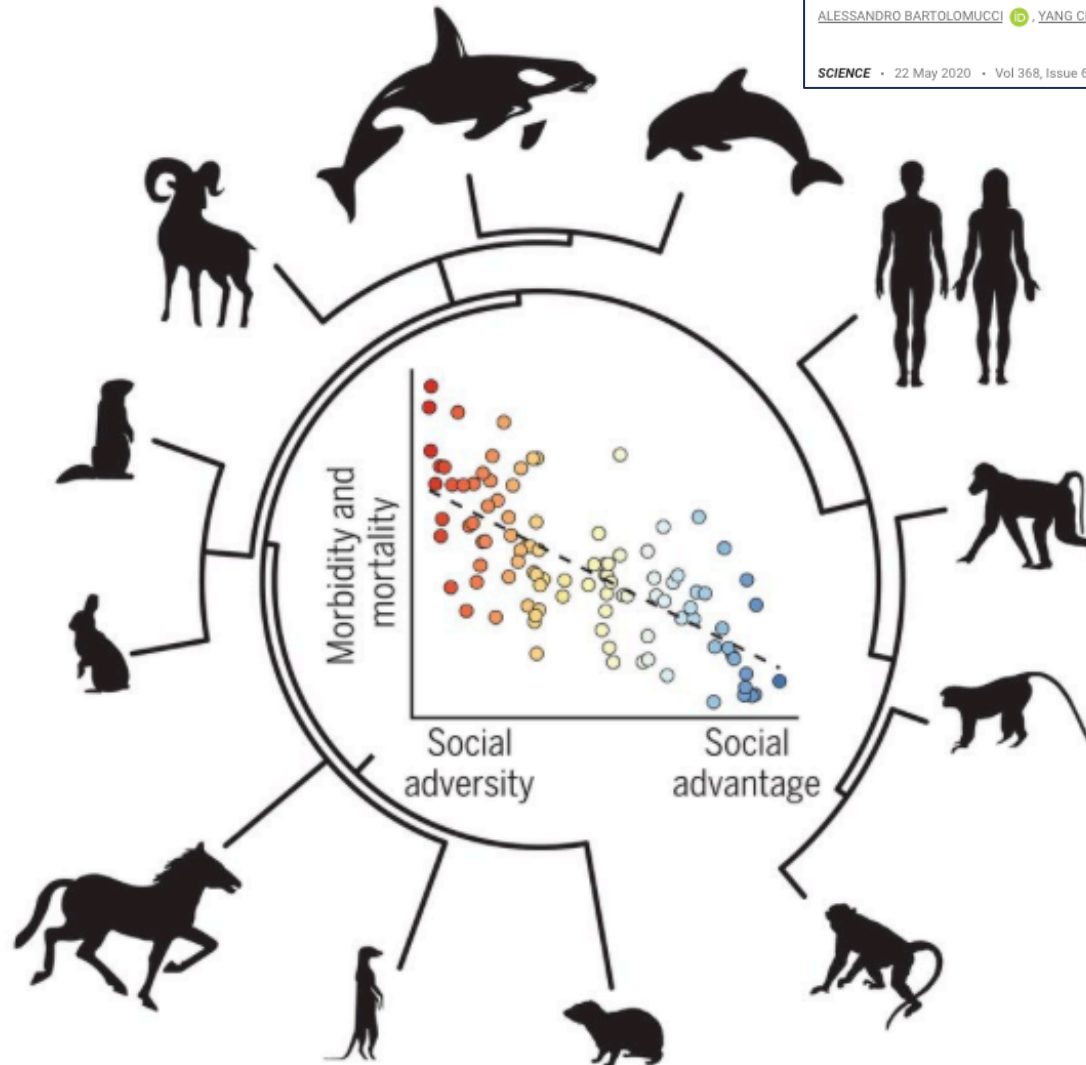
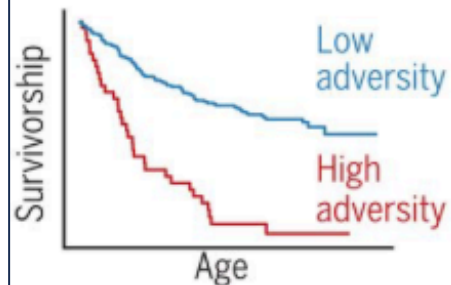
Social integration



Social status




Early life adversity



SDoH in Companion Dogs

- survey data collected on 21,410 dogs
- Factors capturing **financial and household adversity** were associated with **poorer health and lower physical mobility** in companion dogs
- Factors that captured **social support**, such as living with other dogs, were associated with **better health** when controlling for dog age and weight.

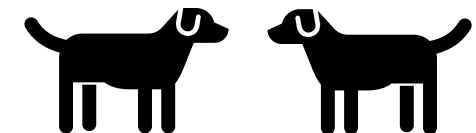
Social determinants of health and disease in companion dogs: a cohort study from the Dog Aging Project 

Brianah M McCoy , Layla Brassington , Kelly Jin , Greer A Dolby , Sandi Shrager , Devin Collins , Matthew Dunbar , Dog Aging Project Consortium , Audrey Ruple , Noah Snyder-Mackler ✉ [Author Notes](#)

Evolution, Medicine, and Public Health, Volume 11, Issue 1, 2023, Pages 187–201,

<https://doi.org/10.1093/emph/eoad011>

Published: 13 May 2023 [Article history](#) ▼



SDoH in Companion Dogs

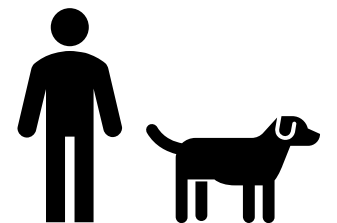
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Evolution, Medicine, and Public Health, Volume 11, Issue 1, 2023, Pages 187–201,
<https://doi.org/10.1093/emph/eoad011>

Published: 13 May 2023 [Article history](#) ▼

- effects of each environmental component were not equal:
 - **social support was 5× stronger than financial factors.**
- **Highlights:**
 - **the importance of income, stability, and owner's age** on owner-reported health outcomes in companion dogs
 - potential behavioral and/or environmental modifiers that can be used to **promote healthy aging across species.**



SDoH in Companion Dogs

Limitation:

- average household income was **well above** the U.S. median income (U.S. median: \$67,521 in 2020, DAP median: \$100,000–\$119,999)
- biases knowledge away from lower-earning households
 - underscores the **need to recruit a diverse set of human participants** to account for the variation of environmental exposures

Social determinants of health and disease in companion dogs: a cohort study from the Dog Aging Project 

Brianah M McCoy , Layla Brassington , Kelly Jin , Greer A Dolby , Sandi Shrager , Devin Collins , Matthew Dunbar , Dog Aging Project Consortium , Audrey Rupple , Noah Snyder-Mackler ✉ [Author Notes](#)

Evolution, Medicine, and Public Health, Volume 11, Issue 1, 2023, Pages 187–201,
<https://doi.org/10.1093/emph/eoad011>

Published: 13 May 2023 [Article history](#) ▼

Heart disease and Stroke




- #1 cause of human death in U.S.
 - >944,800 deaths/year = >1/3 deaths
 - Costs \$254 billion/year
 - \$168 billion in lost productivity

Heart Disease in Dogs

Research | [Open access](#) | Published: 29 December 2022

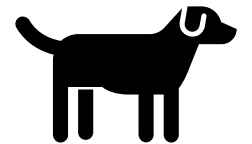
Morbidity and mortality in elderly dogs – a model for human aging

[Patricia Dias-Pereira](#) 

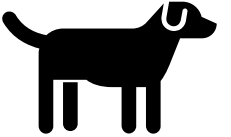
[BMC Veterinary Research](#) **18**, Article number: 457 (2022) | [Cite this article](#)

4856 Accesses | 14 Citations | 42 Altmetric | [Metrics](#)

- Cardiovascular is one of the organic systems most frequently exhibiting pathological changes
 - others = reproductive and urinary systems and mammary gland in females
- association between **increasing age** and increased risk of cardiovascular disease in dogs
- prevalence significantly **higher in males** than in females
 - sexual predisposition is maintained with aging.
 - incidence of cardiovascular disease is high in humans, **especially in men.**



Heart Disease in Dogs



- specific cardiovascular diseases are **different**:
- most cardiovascular morbidity and mortality in aging humans is related to vascular atherosclerotic and ischemic disease in the heart and brain
 - very rare event in dogs.
- age-related valvular disease (and consequent cardiac failure) is far more common in dogs than humans
- cause of species-related differences remains to be clarified



Cancer



- #2 cause of human death in U.S.
 - 1.7 million people diagnosed in U.S. per year
 - 2024: 10.3% of adults have been diagnosed with cancer
 - >600,000 die per year

Cancer in Dogs

Research | [Open access](#) | Published: 29 December 2022

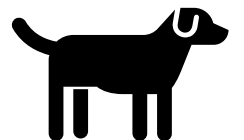
Morbidity and mortality in elderly dogs – a model for human aging

[Patrícia Dias-Pereira](#) 

[BMC Veterinary Research](#) **18**, Article number: 457 (2022) | [Cite this article](#)

4856 Accesses | 14 Citations | 42 Altmetric | [Metrics](#)

- main cause of death in geriatric dogs
 - accounted for ~50% of deaths
 - neoplasia, along with cardiovascular failure and old age, were responsible for > 80% of the deaths in the elderly canine population
- death due to neoplastic disease increases with age
- larger dogs died of neoplastic disease more frequently than smaller ones



Environmental Impact

> [Vet Comp Oncol.](#) 2022 Mar;20(1):246-255. doi: 10.1111/vco.12771. Epub 2021 Sep 16.

Risk of bladder cancer and lymphoma in dogs is associated with pollution indices by county of residence

Natalie Smith ¹, Kristofer Ross Luethcke ¹, Kaitlyn Craun ¹, Lauren Trepanier ¹

Affiliations + expand

PMID: 34480391 PMCID: [PMC9969847](#) DOI: [10.1111/vco.12771](#)

- human urothelial cell carcinoma (UCC) and non-Hodgkin lymphoma are considered environmental cancers in people
- Do dogs with UCC and lymphoma live in counties with higher tap water contaminants or higher levels of air pollution?

Environmental Impact

> [Vet Comp Oncol](#). 2022 Mar;20(1):246-255. doi: 10.1111/vco.12771. Epub 2021 Sep 16.

Risk of bladder cancer and lymphoma in dogs is associated with pollution indices by county of residence

[Natalie Smith](#)¹, [Kristofer Ross Luethcke](#)¹, [Kaitlyn Craun](#)¹, [Lauren Trepanier](#)¹

Affiliations + expand

PMID: 34480391 PMCID: [PMC9969847](#) DOI: [10.1111/vco.12771](#)

- **Tap water contaminants and airborne environmental pollutants may contribute to the risk of both urothelial carcinoma and lymphoma in dogs.**
 - Tap water total trihalomethanes (water disinfection by-products) were more than threefold higher in UCC case counties of residence compared to controls.
 - Higher proportion of dogs with UCC lived in counties exceeding EPA ozone limits compared to controls.
 - More boxers with lymphoma lived in counties exceeding EPA ozone limits compared to controls, with higher exposure risk estimates for airborne 1,3-butadiene and formaldehyde.
- If these findings reflect causal relationships, then it is possible that **tap water filtration units and more effective air pollution controls could decrease the overall incidence of these cancers in dogs.**




One Health Approach In Action



- Osteosarcoma:
 - People: 800-1000 cases/year
 - Dogs: >25,000 new cases diagnosed every year
 - <https://cvmb.ssource.colostate.edu/clinical-trial-for-pediatric-bone-cancer-underscores-one-cure-philosophy-at-csu/>
- 2021 National Academies of Science Workshop “**The Role of Companion Animals as Sentinels for Predicting Environmental Exposure Effects on Aging and Cancer Susceptibility in Humans**”
- 2022 - 60 Minutes “Comparative Oncology: Trial cancer treatments in dogs could also lead to breakthroughs for humans.”

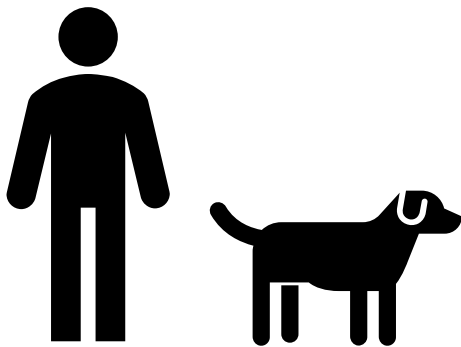
SHELTER ME

The Cancer Pioneers

5/15/2025 | 1h 27m 15s | 

Can dogs help cure cancer? Clinical trials of dogs with cancer being treated with immunotherapies are leading to new treatments for people. Leading scientists from world-renowned institutions such as the National Institutes of Health, the National Cancer Institute, and universities across the country provide a powerful reminder of the unbreakable bond between humans and animals.

05/15/2025

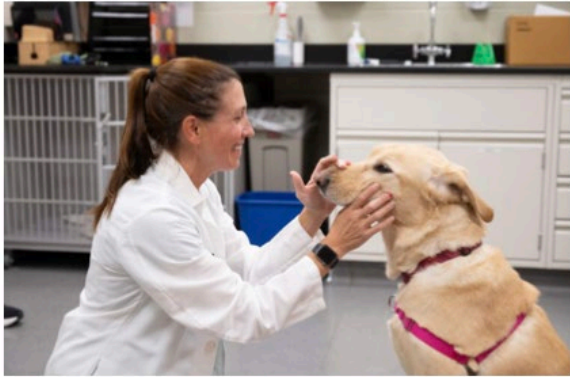


<https://www.pbs.org/video/the-cancer-pioneers-jemhoc/>

ShelterMe

— The Cancer Pioneers —

One Health Approach In Action



**Talking translational
medicine and canine
neurology with CSU's
Stephanie McGrath**



**A CSU-led study treating
canine trauma patients
might one day aid
soldiers on the
battlefield**

JOURNAL ARTICLE

LBSUN332 A Novel Drug To Modulate Auto-inflammation And Promote Glucose Control In Type 1 Diabetes Mellitus 

David Wagner , Gisela Vaitaitis , Dan Waid , Craig Webb , Tracy Webb

Journal of the Endocrine Society, Volume 6, Issue Supplement_1, November-December 2022, Page A296, <https://doi.org/10.1210/jendso/bvac150.611>

Published: 01 November 2022



Clinical and Translational Science Award
One Health Alliance



One Health Institute



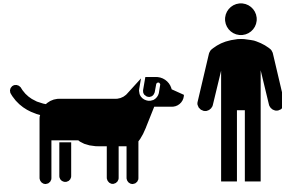
**C. WAYNE MCILWRAITH
TRANSLATIONAL MEDICINE INSTITUTE**

Diabetes



- >38 million Americans have diabetes
 - >15% of adults diagnosed with diabetes
- 98 million adults in U.S. have prediabetes
- \$413 billion in medical costs and lost productivity

Shared Risk?



> [BMJ](#). 2020 Dec 10:371:m4337. doi: 10.1136/bmj.m4337.

The shared risk of diabetes between dog and cat owners and their pets: register based cohort study

Rachel Ann Delicano ¹, Ulf Hammar ¹, Agneta Egenvall ², Carri Westgarth ³,
Mwenya Mubanga ⁴, Liisa Byberg ⁵, Tove Fall ¹, Beatrice Kennedy ⁶

Affiliations + expand

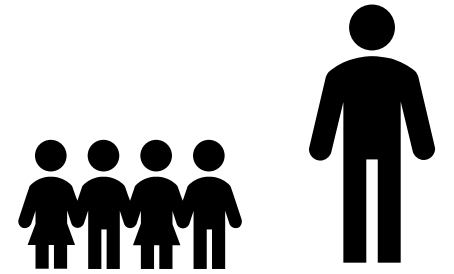
PMID: 33303475 PMCID: [PMC7726310](#) DOI: [10.1136/bmj.m4337](#)

- >200,000 owner-dog pairs
>120,000 owner-cat pairs
(1 January 2004 to 31 December 2006)
- Owners of a dog with diabetes were more likely to develop type 2 diabetes during follow-up than owners of a dog without diabetes.
 - **Dogs with diabetes could serve as a sentinel for shared diabetogenic health behaviors and environmental exposures.**
- (no association was found between type 2 diabetes in cat owners and diabetes in their cats)





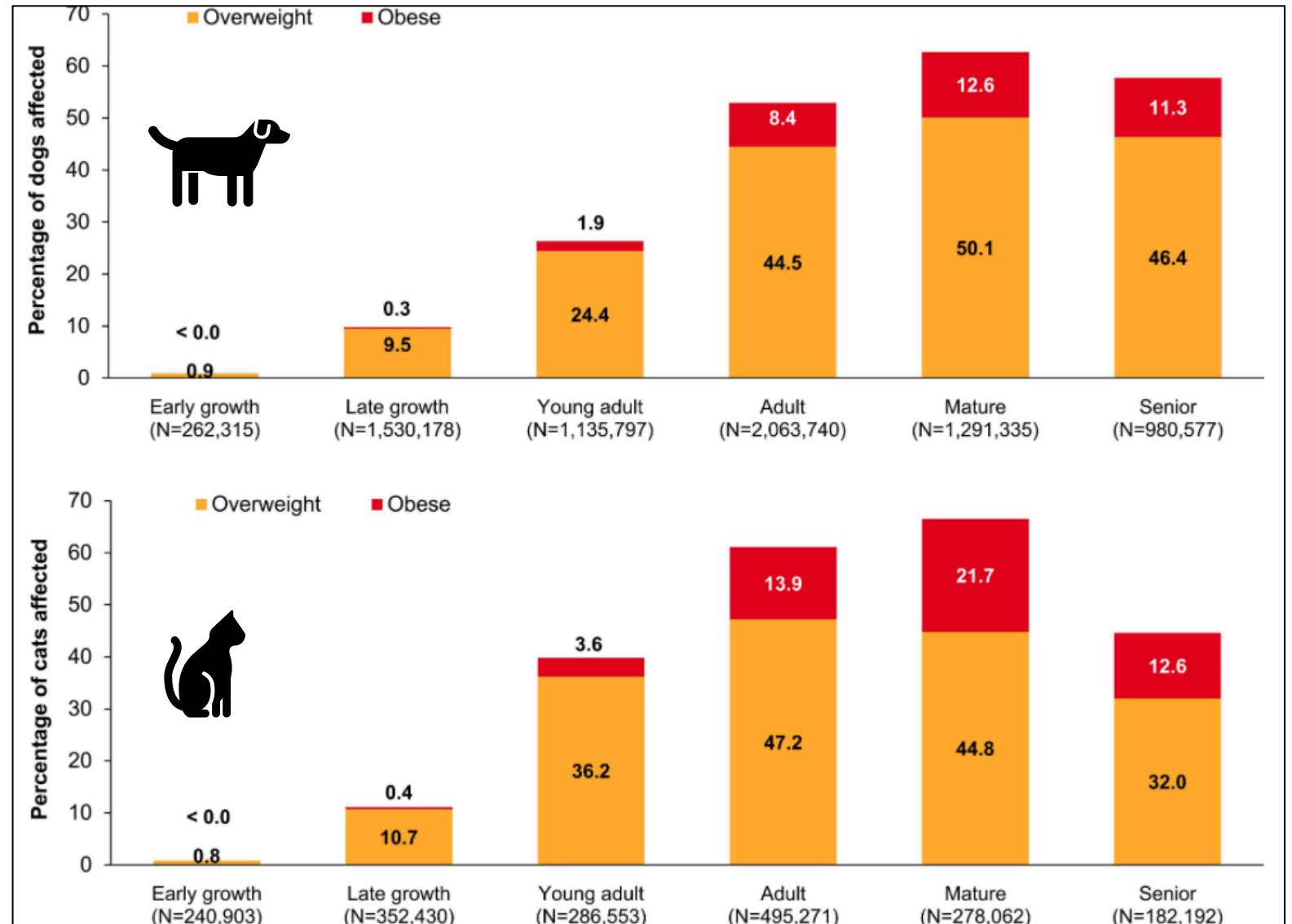
Obesity

- 20% of children
- 42% of adults
- >\$170 billion in health care costs per year



Obesity

- 20% of children 
- 42% of adults 



 Preventive Veterinary Medicine
Volume 235, February 2025, 106398

Overweight and obese body condition in ~4.9 million dogs and ~1.3 million cats seen at primary practices across the USA: Prevalences by life stage from early growth to senior

Mathieu Montoya^a, Franck Péron^a, Tabitha Hookey^a, JoAnn Morrison^b, Alexander J. German^c, Virginie Gaillard^a  , John Flanagan^a

Veterinary Medicine

- Large amount of medical data:
 - Approximately 270 million veterinary visits for dogs and 230 million for cats
 - Approximately 90 million dogs and 96 million cats in the United States
 - Average 3 visits/dog/year and 2.4 visits/cat/year
 - Approximately 1 billion human physician office visits per year
 - Average 3.21/person/year
- **shared diseases, environments, exposures, and treatments**



CU-CSU Data Linkage Pilot Project:

Goal: determine the feasibility of linking veterinary and human health records between UCDenver-Anschutz (UCD-AMC) and CSU-VHS for translational and comparative studies to improve patient outcomes.

- Determine overlap between people/households who receive healthcare locally and also bring their companion animals for treatment at the VTH.
- If the overlap is *significant*, determine how to undertake future studies that may look for similarities in diagnosis, therapies, etc., between people and their pets.

Process:

- multiple years
- many conversations
- two IRBs
- Data Use/Sharing Agreement

> [medRxiv](#) [Preprint]. 2025 Mar 26:2025.03.25.25324490. doi: 10.1101/2025.03.25.25324490.

The missing link: Electronic health record linkage across species offers opportunities for improving One Health

Kathleen R Mullen ¹, Nadia Saklou ², Adam Kiehl ³, Toan C Ong ⁴, G Joseph Strecker ³, Sabrina Toro ¹, Sue VandeWoude ⁵, Ian M Brooks ⁴, Tracy Webb ², Melissa A Haendel ¹

Affiliations + expand

PMID: 40196252 PMCID: [PMC11974984](#) DOI: [10.1101/2025.03.25.25324490](#)



Results:

Time span: 2019-2024

Number of owners: 41,081

Number of animal patients: 76,282

Cats: 13.0%

Dogs: 55.5%

Horses: 15.3%

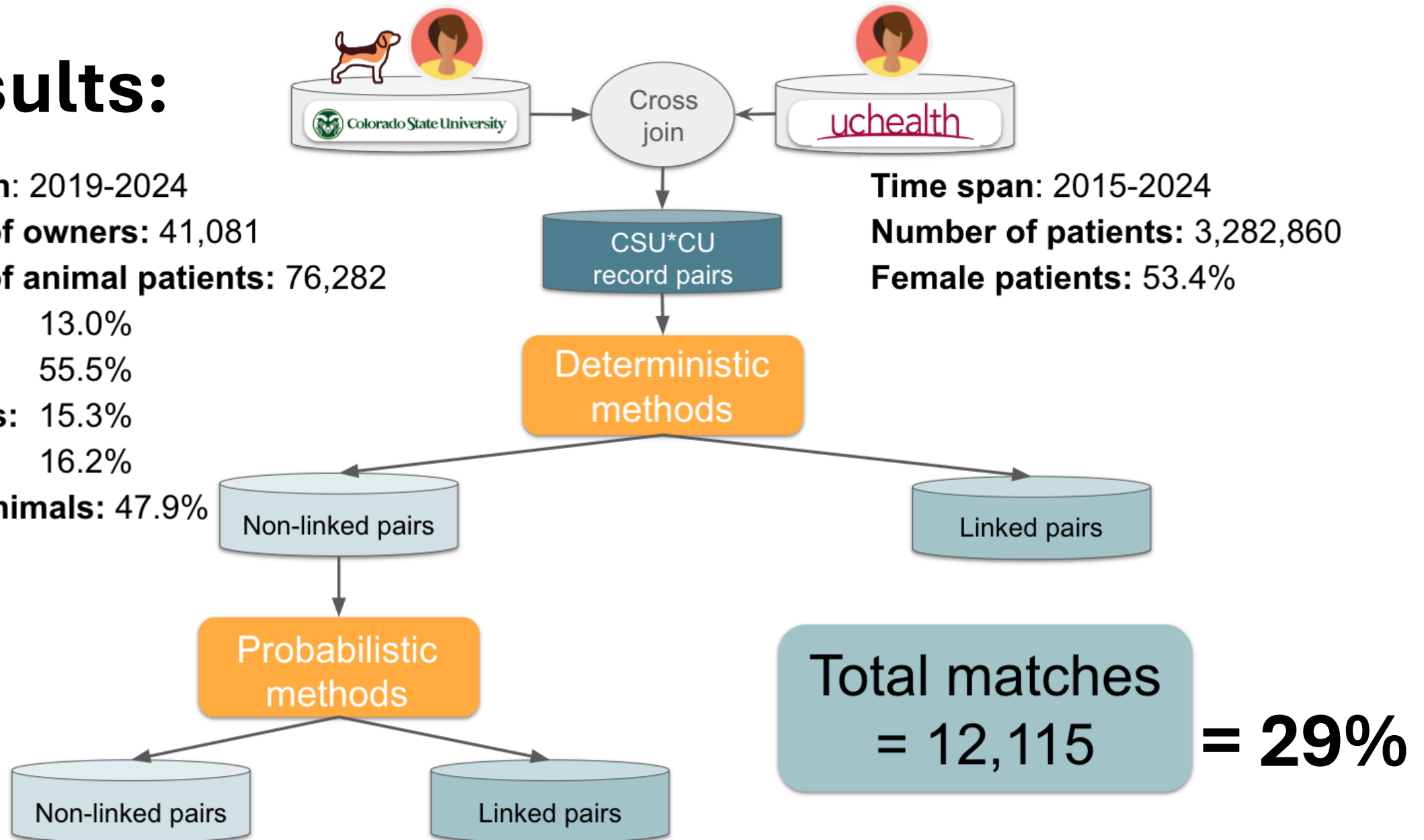
Other: 16.2%

Female animals: 47.9%

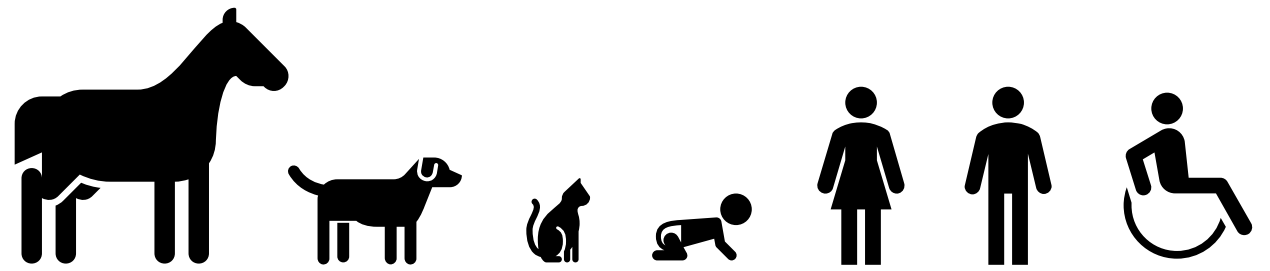
Time span: 2015-2024

Number of patients: 3,282,860


Female patients: 53.4%



Next Steps:



- Create pet-patient registry to evaluate shared health questions


 University of Colorado **Anschutz Medical Campus**

HOME

Andrey Soares, PhD
Associate Professor, Medicine-Internal Medicine

 **Tracy L. Webb, DVM, PhD**
Associate Professor
My Green Lab Ambassador
Office: (970) 297-4237
tracy.webb@colostate.edu

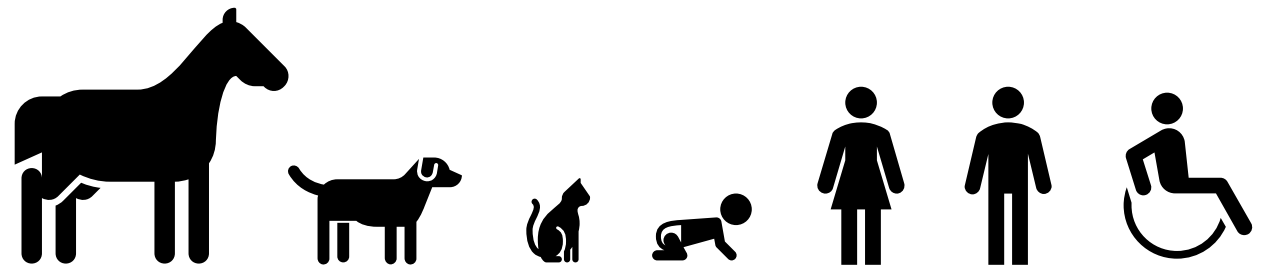


 **Adam Kiehl**
Health Data Scientist

 **Kathleen Mullen**

 **Nadia Saklou**

Next Steps:



- Create pet-patient registry to evaluate shared health questions

*example: leveraging companion animal and human EHR linkage to explore sex differences in **household** metabolic syndrome (MetS) co-occurrence*

- Incorporate Ontologies



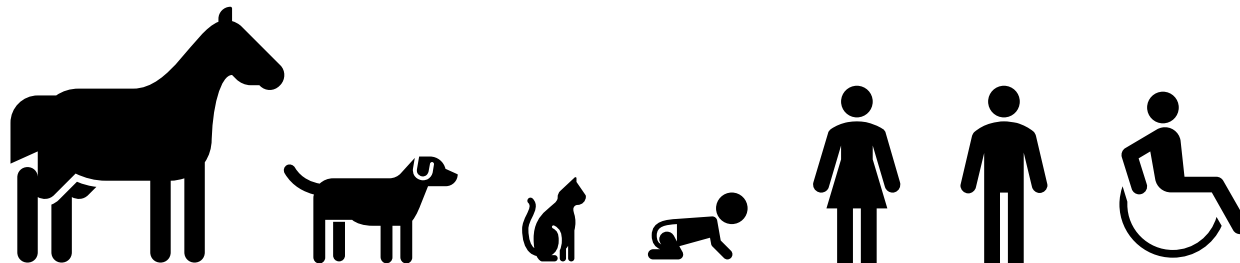
- Consider adding question about pet ownership to human medical records....

CU-CSU Pet-patient Registry

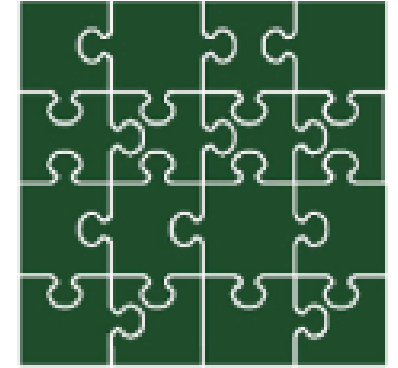
What question(s) would you want to answer using the registry?

Reach out with ideas:

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