Dog Aging Project

A One Health Perspective on Healthy Aging

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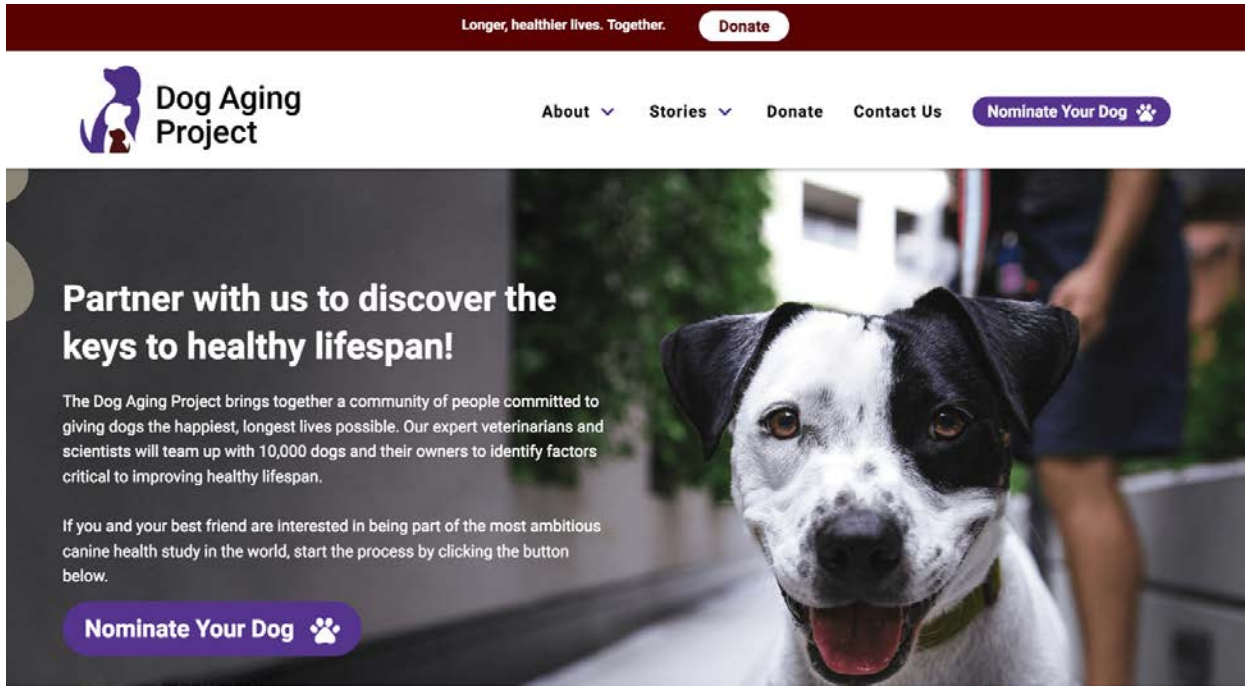
Dog Aging Project Team

Arizona State University
Broad Institute
Colorado State University
Cornell University
Fred Hutchinson Cancer Res Ctr
Iowa State University
North Carolina State University
Oregon State University
Princeton University
Purdue University
Seattle Children's Research Inst
Texas A&M University
University of Arizona
University of Georgia
University of Washington
Washington State University

The Dog Aging Project

dogagingproject.org

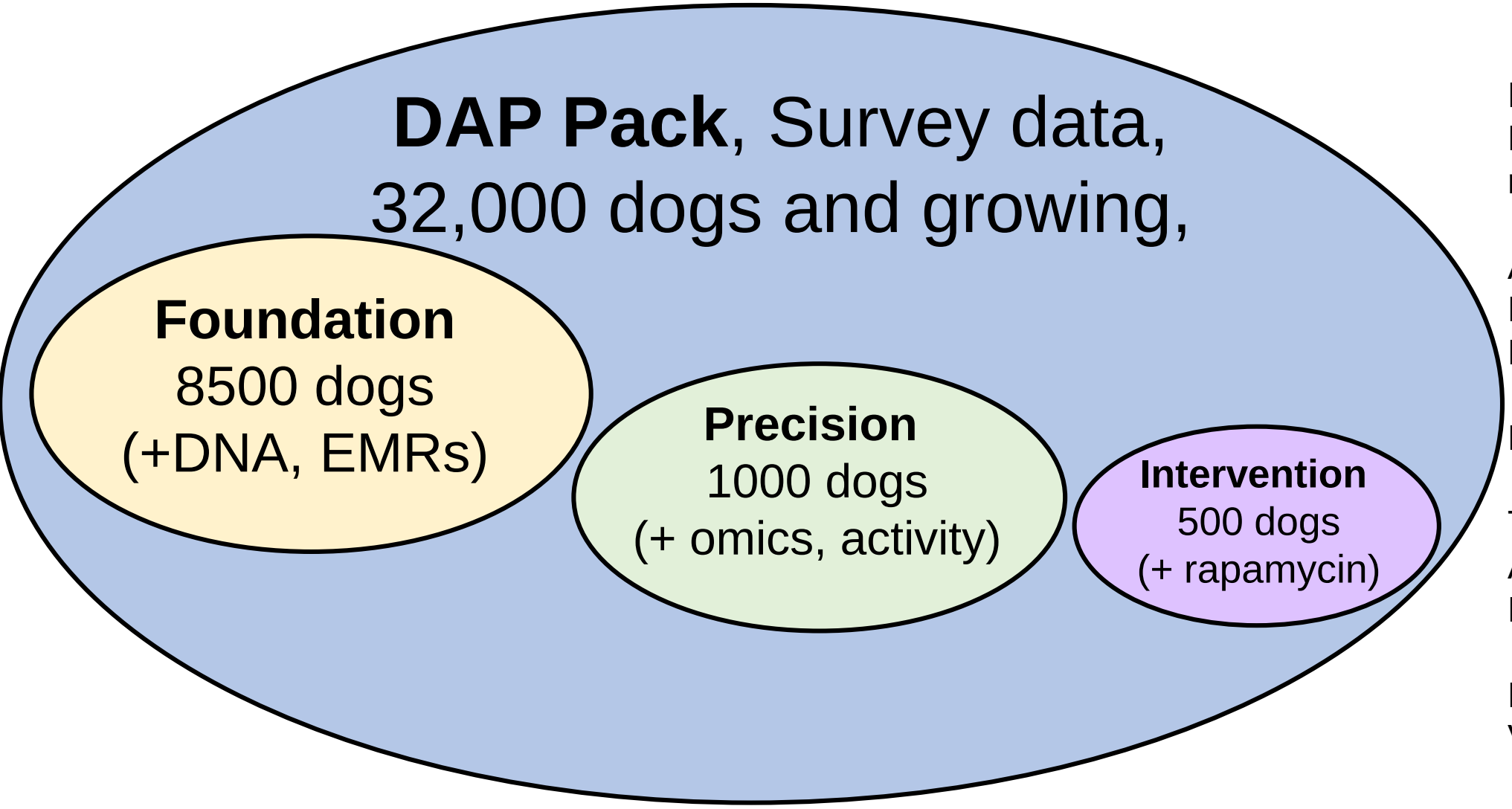


DAP is a long-term longitudinal study of the biological and environmental determinants of healthy aging.

<u>DAP is all dogs</u>

- all ages
- all sizes
- mixed breed and purebred
- every state in the US

Dog Aging Project dogs



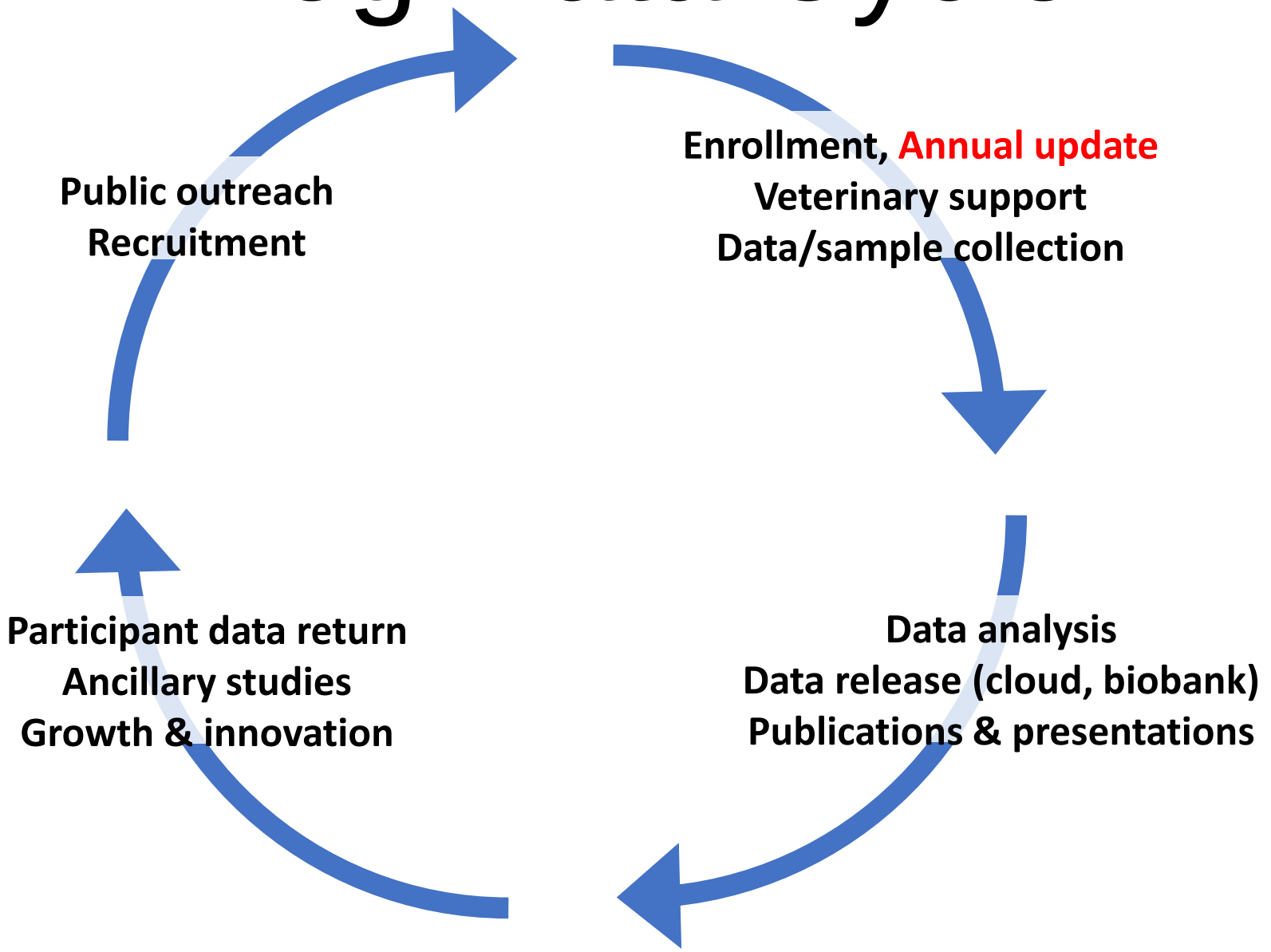
Health and Life Experience Survey + regular surveys

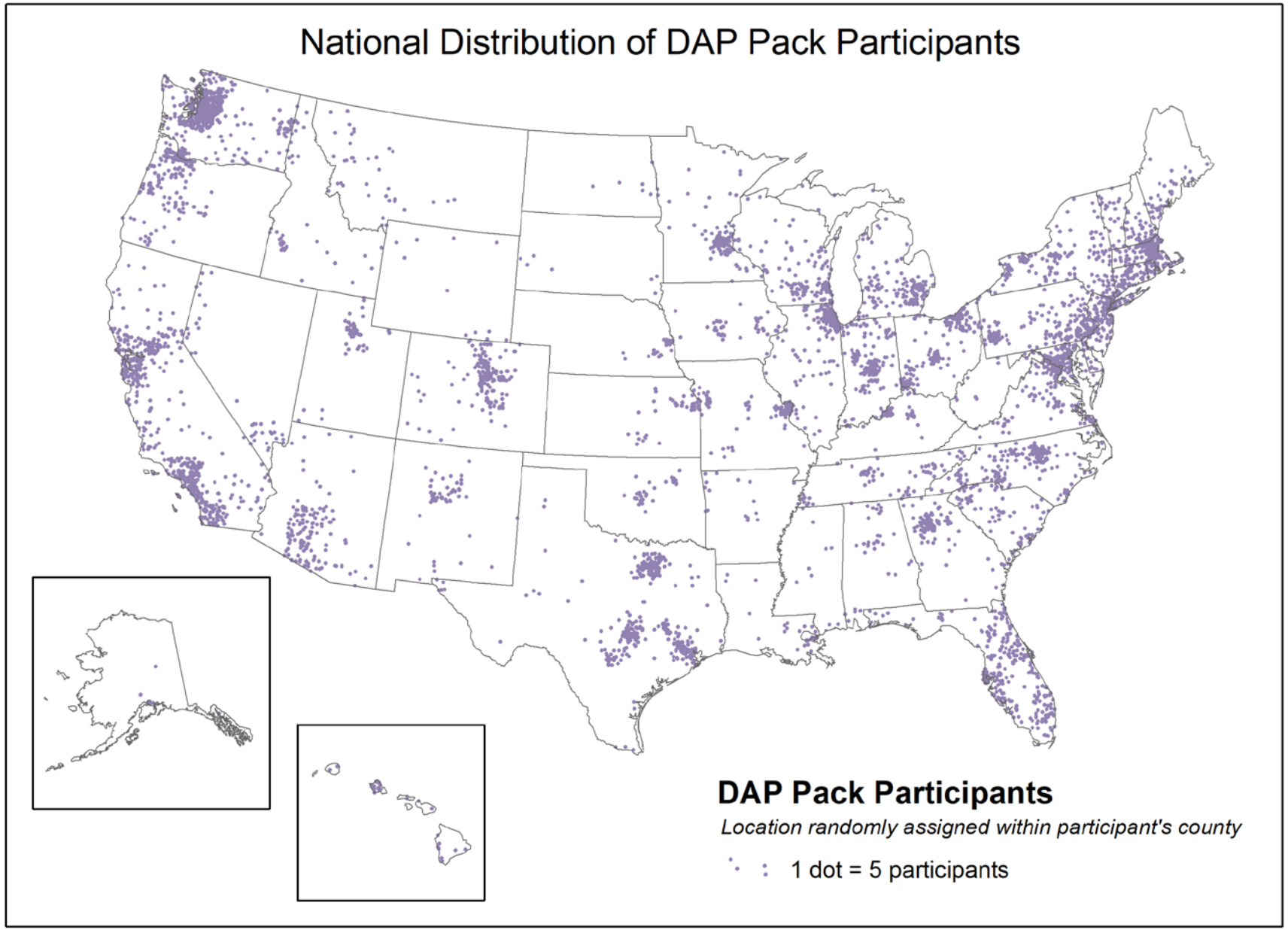
Annual vet check; EMR
Demography
Home and local environment
Behavior

Tissue/blood samples
Activity data
Necropsy/Pathology

Echocardiograms
Vet teaching hospitals

A Dog Data Cycle




National Distribution of DAP Pack Participants
DAP Pack Participants
Location randomly assigned within participant's county
1 dot = 5 participants

From genotype to phenotype

P = G + E

P2: G, GxE

P3: Sys Bio

P1: Aging

G Whole genome sequencing/
Breed info

E
Air, water, green space
Home environment
Social setting
Diet, exercise, health care
Age, size, sex

Clinical chemistry
Metabolome
Epigenome
Microbiome
Transcriptome
FACS

P
Age-specific disease
Frailty, Comorbidity
Mortality
Fecundity

P4: TRIAD

The TRIAD Trail—Test of Rapamycin in Aging Dogs

Health and Life Experience Survey
Current size: >32,000 dogs x 4973 questions

Race, Hispanic or Latino	
White alone, non-Hispanic	24716 (90%)
Two or more races, non-Hispanic	690 (3%)
White alone, Hispanic	655 (2%)
Asian alone, non-Hispanic	622 (2%)
Some other race alone, Hispanic	211 (<1%)
Black or African American alone, non-Hispanic	198 (<1%)
Some other race alone, non-Hispanic	196 (<1%)
Two or more races, Hispanic	150 (<1%)
American Indian and Alaska Native alone, non-Hispanic	45 (<1%)
Native Hawaiian and Other Pacific Islander alone, non-Hispanic	30 (<1%)
Asian alone, Hispanic	13 (<1%)
American Indian and Alaska Native alone, Hispanic	10 (<1%)
Black or African American alone, Hispanic	5 (<1%)
Native Hawaiian and Other Pacific Islander alone, Hispanic	1 (<1%)

Household Income	
Less than $20k	482 (2%)
$20k - $39.999k	1572 (6%)
$40k - $59.999k	2624 (10%)
$60k - $79.999k	3112 (11%)
$80k - $99.999k	3031 (11%)
$100k - $119.999k	3086 (11%)
$120k - $139.999k	2129 (8%)
$140k - $159.999k	1844 (7%)
$160k - $179.999k	1277 (5%)
$180k or more	5028 (18%)
Prefer not to answer	3357 (12%)

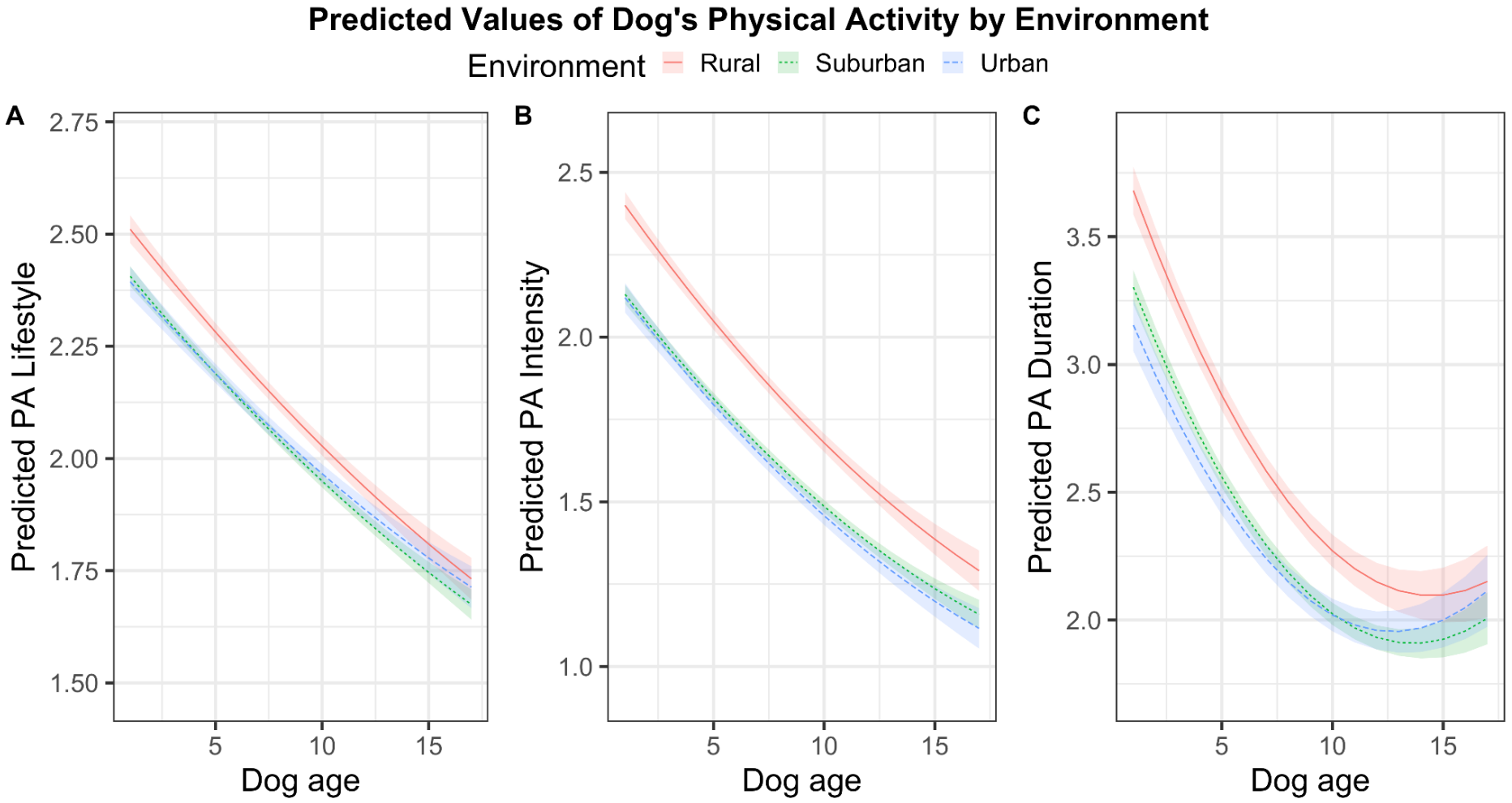
https://data.dogagingproject.org/

Health and Life Experience Survey
Current size: >32,000 dogs x 4973 questions

Characteristics	No. (%) of subjects (N=27542)
Breed	
Purebred	13619 (49%)
Mixed breed	13923 (51%)
Age category (years)	
Puppy (Under 1)	588 (2%)
Adolescent (1-2)	4619 (17%)
Young Adult (3-6)	8249 (30%)
Older Adult (7-10)	7669 (28%)
Senior (11-22)	6412 (23%)
Very Senior (23+)	5 (<1%)
Sex, Spayed or Neutered	
Female, Spayed	12974 (47%)
Male, Neutered	12445 (45%)
Male, un-Neutered	1369 (5%)
Female, un-Spayed	754 (3%)
Primary component of diet	
Commercial, dry	22888 (83%)
Commercial, canned	1133 (4%)
Home, cooked	1096 (4%)
Commercial, frozen raw	906 (3%)
Other	485 (2%)
Commercial, freeze-dried	382 (1%)
Home, raw	355 (1%)
Commercial, semi-dry	297 (1%)
Organic primary component	5495 (20%)
Grain-free primary component	11544 (42%)
Times per day being fed	
Once	2118 (8%)
Twice	20234 (73%)
Three or more	2131 (8%)
Free fed*	3059 (11%)

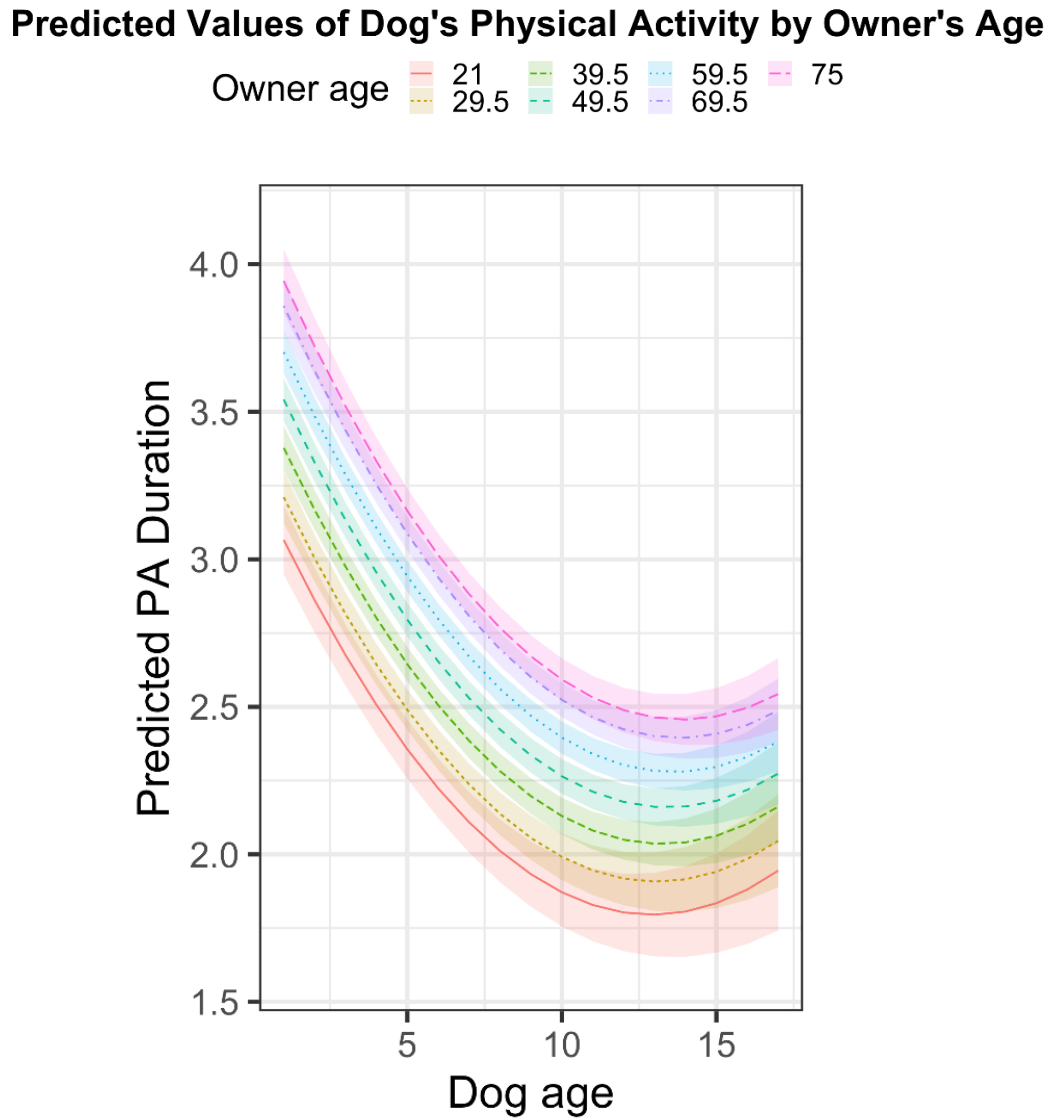
https://data.dogagingproject.org

Rural dogs are rated as more active



Lee and Collins *et al*. Unpublished

Dogs of older owners are rated as more active



Lee and Collins *et al*. Unpublished

Diet and Aging

Contents lists available at ScienceDirect

Ageing Research Reviews

journal homepage: www.elsevier.com/locate/arr

Review

Impact of intermittent fasting on health and disease processes

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The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

Dan L. Longo, M.D., *Editor*

Effects of Intermittent Fasting on Health, Aging, and Disease

Rafael de Cabo, Ph.D., and Mark P. Mattson, Ph.D.

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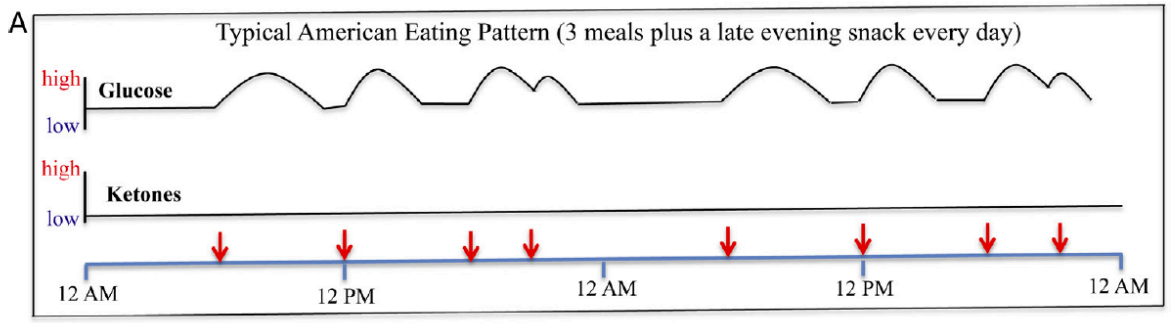


Diet and Aging

Cold Spring Harbor Laboratory

bioRxiv

THE PREPRINT SERVER FOR BIOLOGY

bioRxiv posts many COVID19-related papers. A reminder: they have not been formally peer-reviewed and should not guide health-related behavior or be reported in the press as conclusive.

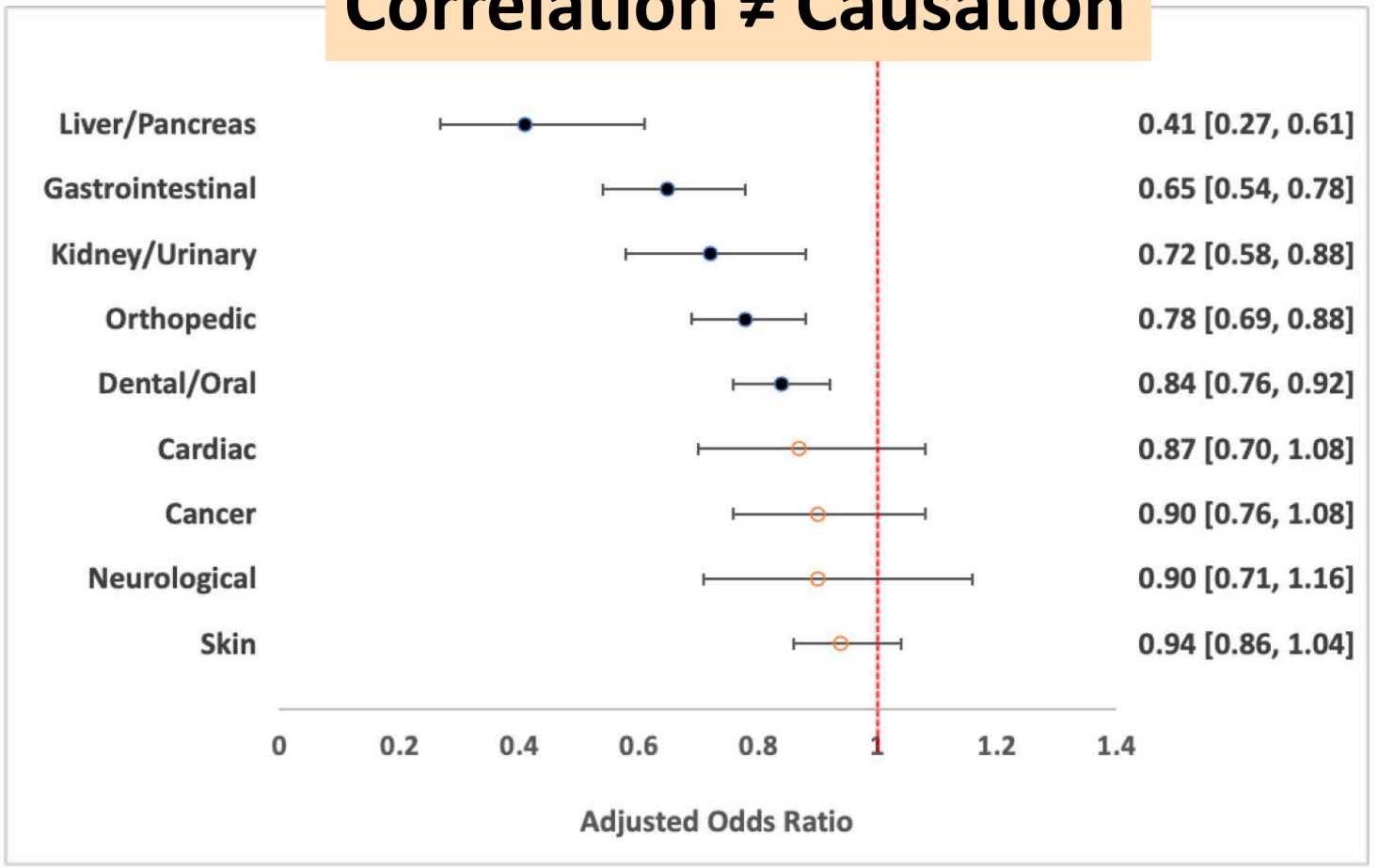
New Results

Follow this preprint

Once-daily feeding is associated with better cognitive function and health in companion dogs: Results from the Dog Aging Project

Emily E. Bray, Zihan Zheng, M. Katherine Tolbert, Brianah M. McCoy, Dog Aging Project Consortium, Matt Kaeberlein, Kathleen F. Kerr

Correlation ≠ Causation



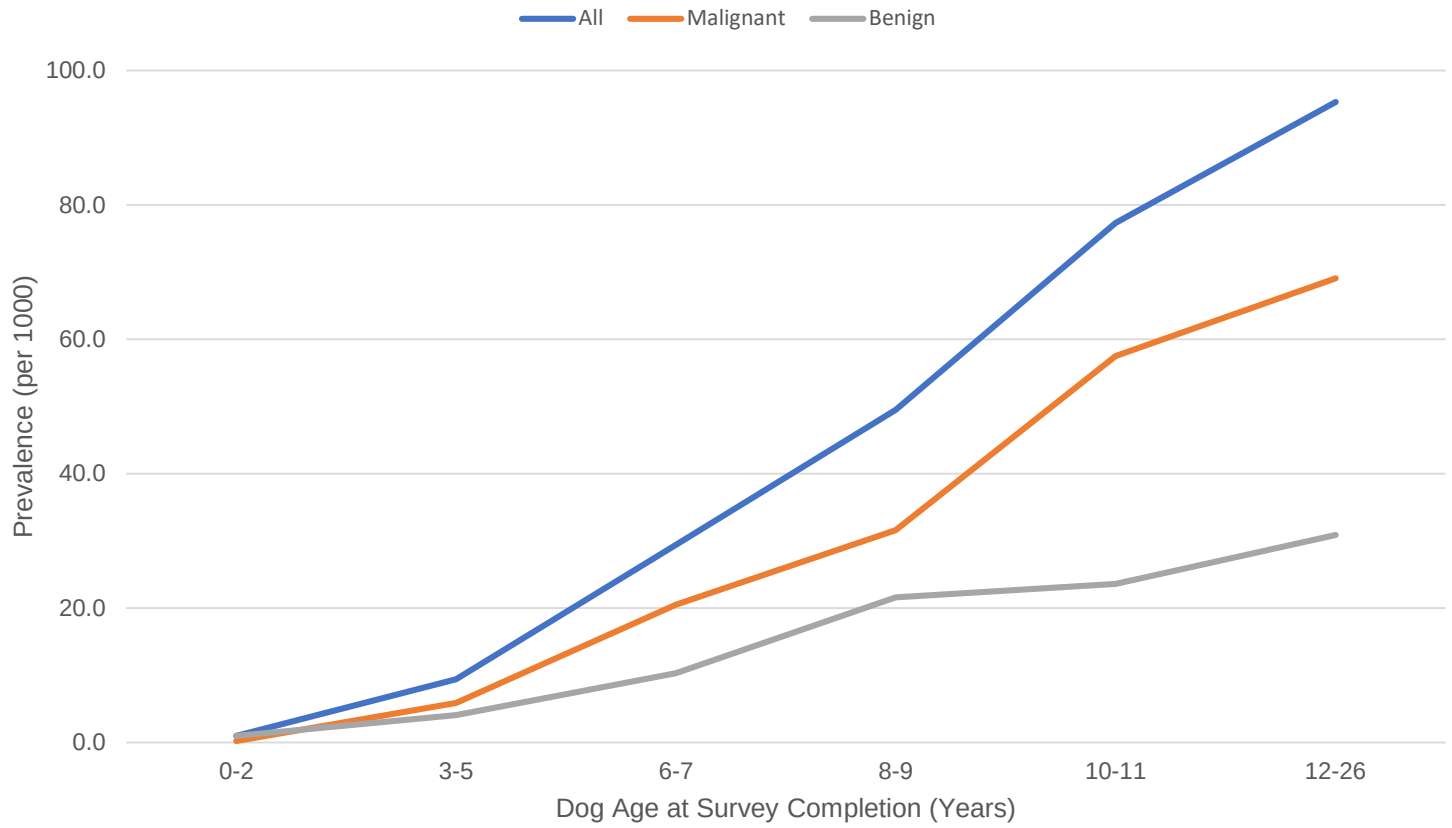
Subset of Dogs who have been diagnosed with cancer or tumors - types of cancer

Characteristics	No. (%) of subjects (N=1751)
Don't know	499 (28%)
Mast cell tumor	349 (20%)
Lipoma	217 (12%)
Other	141 (8%)
Soft tissue sarcoma	74 (4%)
Melanoma	62 (4%)
Carcinoma	57 (3%)
Lymphoma/lymphosarcoma	50 (3%)
Sarcoma	47 (3%)
Adenoma	43 (2%)
Adenocarcinoma	42 (2%)
Hemangiosarcoma	41 (2%)
Histiocytoma	38 (2%)
Basal cell tumor	35 (2%)
Osteosarcoma	30 (2%)
Epidermoid cyst	29 (2%)
Hemangioma	24 (1%)
Squamous cell carcinoma	21 (1%)
Papilloma	20 (1%)
Sebaceous adenoma	16 (<1%)
Fibrosarcoma	15 (<1%)
Plasmacytoma	15 (<1%)
Epulides	14 (<1%)
Peripheral nerve sheath tumor	12 (<1%)
Transitional cell carcinoma	10 (<1%)
Leukemia	6 (<1%)
Histiocytic sarcoma	5 (<1%)
Insulinoma	5 (<1%)
Chondrosarcoma	4 (<1%)
Cystadenoma	2 (<1%)
Leiomyoma	2 (<1%)
Meningioma	2 (<1%)
Leiomyosarcoma	1 (<1%)
Multiple myeloma	1 (<1%)
Thymoma	1 (<1%)
Rhabdomyosarcoma	0 (<1%)

Subset of Dogs who have been diagnosed with cancer or tumors - areas of body

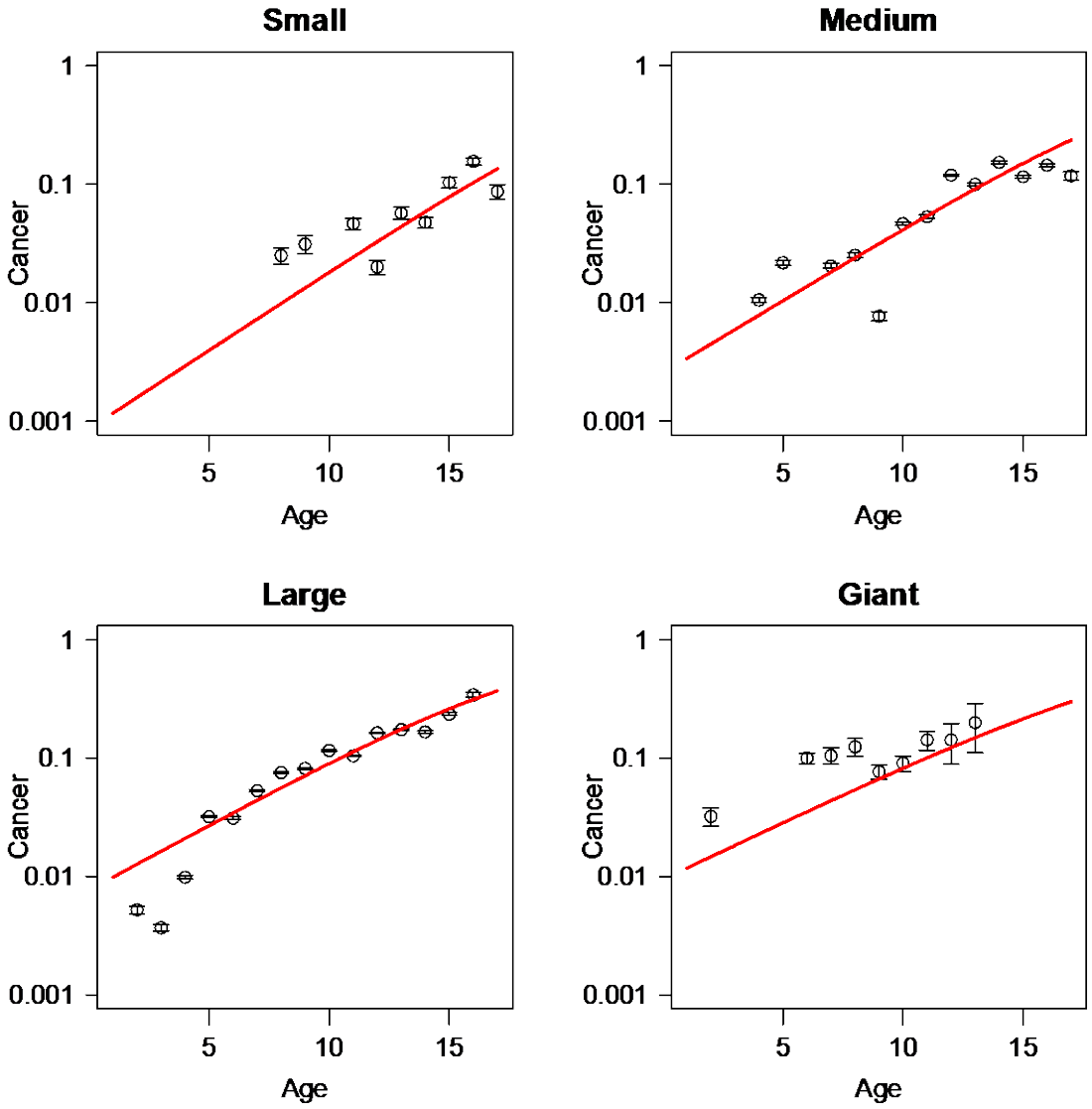
Characteristics	No. (%) of subjects (N=1751)
Skin of trunk, body, or head	502 (29%)
Muscle or other soft tissue	376 (21%)
Skin of limb or foot	254 (15%)
Other	128 (7%)
Oral (mouth) cavity	108 (6%)
Spleen	91 (5%)
Bone or Joint	83 (5%)
Mammary (breast) tissue	74 (4%)
Lymph nodes	71 (4%)
Liver	53 (3%)
Anal sac	49 (3%)
Eye	46 (3%)
Ear	45 (3%)
Lung	34 (2%)
Perianal area	29 (2%)
Don't know	28 (2%)
Gastrointestinal tract	26 (1%)
Adrenal gland	23 (1%)
Bladder or urethra	23 (1%)
Rectum	22 (1%)
Thyroid	19 (1%)
Nose or nasal passage	18 (1%)
Nerve sheath	18 (1%)
Blood	17 (<1%)
Brain	12 (<1%)
Kidney	12 (<1%)
Testicle	9 (<1%)
Venereal	9 (<1%)
Pancreas	8 (<1%)
Pituitary gland	7 (<1%)
Spinal cord	7 (<1%)
Cardiac (heart) tissue	6 (<1%)
Gallbladder or bile duc	5 (<1%)
Ovary or uterus	5 (<1%)
Prostate	4 (<1%)
Esophagus	1 (<1%)

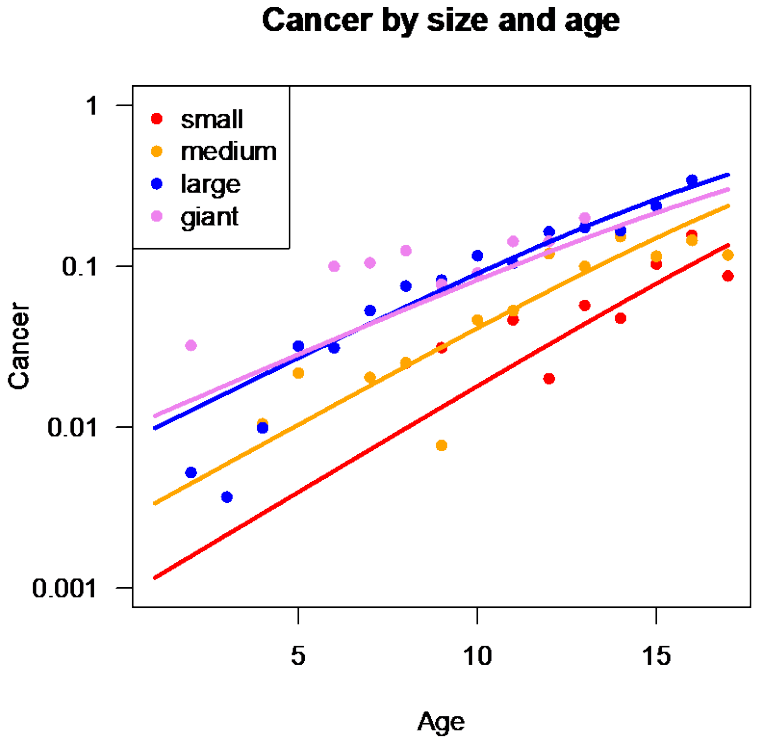
Cancer



Schwartz *et al*. In Review

Cancer (cumulative)





Secondary environmental measures

1. Tract-level sociodemographic and economic neighborhood variables
2. Tract-level air quality (O_3, CO, SO_2, NO_2, PM10, PM2.5)
3. County-level temperature and precipitation
4. Neighborhood walkability (Walkscore, tract-level density)

Outreach potential

- Partnerships with scientific community
  Open Data, Biobank specimens, Ancillary studies
- Partnerships with human longitudinal studies
  All of Us; Baltimore Longitudinal Study; Framingham
- Educational outreach
  Teaching labs at underserved institutions
- Interdisciplinary collaborations
  SES-related health, climate change, ethics, etc.

Acknowledgements

The DAP Consortium

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Manuel Moro
Felipe Sierra (ret.)

Animal Welfare Advisory Board
Lisa Moses (Chair)
Roberta Dev Anand
LaVonne Meunier
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Marylyn Ritchie

Data and Safety Monitoring Board

Cardiologists (TRIAD)

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