



Heidi A. Hanson

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Education: University of Utah

PhD in Sociology (Emphasis Population Health, Demography, and Life Course Epidemiology) | 2010 - 2013

Identified health trajectories using 18 years of population-wide health data, deconstructed national patterns of cancer risk using matrix factorization, developed new quantitative methods for decomposing genetic and environmental components of phenotypic heritability. Publications: *Age-Period-Cohort Analyses of Cancer Incidence among the Oldest Old*; *Reproductive History and Later Life Comorbidity Trajectories: A Medicare-linked cohort study from the Utah Population Database*; *Heritability of Post-Reproductive Longevity: Decomposing genetic and environmental components*.

MS in Sociology | 2010 - 2012

Utilized population level administrative records linked to genealogy and health data to study the relationship between early life exposures and later life health outcomes. Publication: *Early Origins of Longevity: Prenatal exposure to food shortage among early Utah Pioneers*

Certificate of Demography | 2007

Completed a project that utilized advanced survival analyses techniques to investigate the relationship between BRCA1/BRCA2 mutations and fertility outcomes. Publication: *Effects of BRCA1 and BRCA2 Mutations on Female Fertility*

Personal Statement

I am the Group Lead of the Biostatistics and Multiscale Systems Modeling Group in the Computing and Computational Sciences Directorate at Oak Ridge National Laboratory (ORNL). I hold adjunct appointments in the Department of Population Health Sciences and Surgery at the University of Utah and I am a Huntsman Cancer Institute (HCI) Investigator. My training and experience in the fields of demography, statistics, familial analyses, biomedical informatics, -omics, and life course epidemiology allow me to bring a unique set of expertise to building tools to identify populations at high risk for developing pancreatic cancer. Prior to joining ORNL, I was the Assistant Director of Research at the Utah Population Database (UPDB), affiliate faculty at the Scientific Computing and Imaging Institute (SCI) at the University of Utah, Scientific Advisory Board Member for the Utah Genome Project, Co-Director of the Surgical Population Analytic Research Core (SPARC), and the Co-Lead of the National Clinical and Translational Science Awards (NCATS) Lifespan Enterprise Committee's Life Course Visual Toolkit Working Group.

My research has utilized data science and large, population level datasets to: 1) investigate temporal patterns in cancer risk and aging; 2) explore familial clustering of disease; 3) examine environmental determinants of health; 4) show the importance of statistical model selection and rigorous methodology; 5) develop new techniques to investigate the role of the environment in heritability of longevity; and 6) develop new methods for identifying patterns of multi-phenotype clustering in families. My research emphases include understanding how environmental influences throughout the life course affect later life health and the health of future generations, genetic and environmental risk factors for cancer risk, and familial, community, and socioeconomic factors affecting health outcomes. I have 73 peer-reviewed publications investigating demographic, cancer, and aging related research using the Utah Population Database, SEER data, Environmental Protection Agency data, and air pollution exposure data. I have developed a new method for identifying familial multi-phenotype clusters that can be used by all UPDB investigators and is available for download via GitHub or R. I have also contributed to the development of SPECTRA, a method for identifying transcriptomic signatures of disease. Below I list select publications:

- a. **Hanson HA**, Leiser CL, O'Neil B, Martin C, Gupta S, Smith KR, Dechet C, Lowrance WT, Madsen MJ, Camp NJ (2020). Harnessing Population Pedigree Data and Machine Learning Methods to Identify Patterns of Familial

Bladder Cancer Risk. *Cancer Epidemiology Biomarkers & Prevention*. 2020;29(5):918-926. PMID: 32098890; PMCID: PMC7196496.

- b. **Hanson HA**, Leiser CL, Madsen MJ, Gardner J, Knight S, Cessna M, Sweeney C, Doherty JA, Smith KR, Bernard PS, Camp NJ (2020). Family Study Designs Informed by Tumor Heterogeneity and Multi-Cancer Pleiotropies: The Power of the Utah Population Database. *Cancer Epidemiology Biomarkers & Prevention*. 2020:cebp.0912.2019. PMID: 32098891. PMCID: PMC7168701.
- c. Ponnappalli SP, Bradley MW, Devine K, Bowen J, Coppens SE, Leraas KM, Milash BA, Li F, Luo H, Qiu S, Wu K, Yang H, Wittwer CT, Palmer CA, Jensen R, Gastier-Foster JM, **Hanson HA**, Barnholtz-Sloan JS, Alter A (2020). Retrospective Clinical Trial Experimentally Validates Glioblastoma Genome-Wide Pattern of DNA Copy-Number Alterations Predictor of Survival. *APL Bioengineering*. 2020: 4(026106).
- d. Grace K, Danvenport F, **Hanson HA**, Funk CC. Linking Climate Change and Health Outcomes: Examining the relationship between temperature, precipitation, and birth weight in Africa (2015). *Global Environmental Change*. 2015: 35(125).
- e. **Hanson HA**, Smith KR, Zimmer Z (2015). Reproductive History and Later Life Comorbidity Trajectories: A Medicare Linked Cohort Study from the Utah Population Database. *Demography*, 52(6):2021-49. PMCID: PMC4655204
- f. Leiser CL, Smith KR, VanDerslice JA, Glotzbach JP, Farrell TW, **Hanson HA** (2019). Evaluation of the Sex-and-Age-Specific Effects of PM2.5 on Hospital Readmission in the Presence of the Competing Risk of Mortality in the Medicare Population in Utah 1999-2009. *J Clin Med*. 2019;8(12):2114. PubMed PMID: 31810253. PMCID: 31810253.
- g. Martin C, Leiser CL, O'Neil B, Gupta S, Lowrance WT, Kohlmann W, Greenberg S, Pathak P, Smith KR, **Hanson HA** (2018). Familial Cancer Clustering in Urothelial Cancer: A Population-Based Case-Control Study. *J Natl Cancer Inst*, 110(5), 527-533. PMID: 29228305. PMCID: PMC5946951
- h. **Hanson HA**, Martin C, Oneil B, Leiser CL, Mayer EN, Smith KR, Lowrance WT (2019). The Relative Importance of Race Compared to Health Care and Social Factors in Predicting Prostate Cancer Mortality: A Random Forest Approach. *J Urology*. 202(6): 1209-1216. PubMed PMID: 31246547.
- i. Leiser CL, Taddie M, Hemmert R, Richards-Steed R, VanDerslice JA, Henry K, Ambrose J, O'Neil B, Smith KR, **Hanson HA** (2020). Spatial Clusters of Cancer Incidence: Analyzing 1940 Census Data Linked to 1966 – 2017 Cancer Records. *Cancer Causes Control*. 31 (7): 609-615. PMID: 32323050. PMCID: PMC7574665.
- j. **Hanson HA**, Leiser CL, Bandoli G, Pollock BH, Karagas MR, Armstrong D, Dozier A, Weiskopf NG, Monaghan M, Davis AM, Eckstrom E, Weng C, Tobin JT, Kaske F, Schleiss MR, Szilagyi P, Dykes C, Cooper D, Barkin SL (2020). Charting the Life Course: Emerging Opportunities to Advance Scientific Approaches Using Life Course Research. *J Clin Transl Sci*.
- k. **Hanson HA**, Horn KP, Rasmussen KM, Hoffman JM, Smith KR (2017). Is Cancer Protective against the Risk of Alzheimer Disease? Evidence from the Utah Population Database. *Journals of Gerontology*. PMID: 27101831
- l. De Havenon A, Delic A, Stulberg E, Shelbani N, Stoddard G, **Hanson HA**, Theilen L (2021). Association of Preeclampsia with Incident Stroke in Later Life Among Women in the Framingham Heart Study. *JAMA Network Open* 4(4); e215077.
- m. Waller RG*, **Hanson HA***, Madsen MJ, Avery B, Sborov D, Camp NJ (In Press). Transcriptome Spectra: Agnostic Expression Variables to Empower Genomic Epidemiology Studies. medRxiv.

Complete List of Peer-Reviewed Published Work on MyBibliography:

<https://www.ncbi.nlm.nih.gov/sites/myncbi/heidi.hanson.1/bibliography/47771529/public/?sort=date&direction=descending>

Including Conference Proceedings

<https://scholar.google.com/citations?user=u9ponk0AAAAJ&hl=en>

Positions and Honors

UNIVERSITY APPOINTMENTS

| | |
|-------------|--|
| 2014 – 2017 | Research Assistant Professor, Department of Family and Preventive Medicine, University of Utah |
| 2017 – 2021 | Tenure Track Assistant Professor, Department of Surgery, University of Utah |
| 2018 – 2021 | Assistant Director of Research, Utah Population Database, University of Utah |
| 2017 – 2021 | Co-Director, Surgical Population Analytic Research Core (SPARC), University of Utah |
| 2021 – | Adjunct Assistant Professor, Population Sciences and Surgery, University of Utah |

UNIVERSITY COMMUNITY ACTIVITIES

Programs, Centers & Institutes

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|-------------|--|
| 2019 – | Member, Center of Excellence for Exposure Health Informatics (CEEHI), University of Utah |
| 2019 – 2021 | Affiliate Faculty Member, Utah Center for Data Science, University of Utah |
| 2018 – 2021 | Affiliate Faculty Member, Scientific Computing and Imaging Institute, University of Utah |
| 2015 – | Associate Member, Cancer Control and Population Sciences Program, HCI |
| 2014 – 2021 | Member, University of Utah Center on Aging |

Other Experience and Professional Memberships

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|-------------|--|
| 2012 – 2020 | Member, Population Association of America |
| 2012 – 2018 | Member, Social Science History Association |
| 2013 – 2017 | Member, American Sociological Association |
| 2014 – 2018 | Member, Gerontological Society of America |
| 2015 – 2021 | Member, Genitourinary Malignancies Disease Oriented Team, Huntsman Cancer Institute |
| 2015 – 2021 | Member, Lifespan Domain Task Force, National Clinical and Translational Science Awards |
| 2017 – 2020 | Co-Chair, Early Life Exposures (ELE) working group, Lifespan Domain Task Force, National Clinical and Translational Science Awards |

Honors

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| 2012 | College of Social and Behavioral Science, Honor Roll Scholarship, University of Utah |
| 2015 | Vice President's Clinical and Translational Research Scholar, University of Utah |

Additional Information: Research Support

Completed Research Support

2018/7/6-2021/6/30

K07CA230150, National Institutes of Health

Subtyping Bladder Cancer: A Multi-omic, Exposure-informed, Genealogical Approach (MErGE)

Goal: To use dimension reduction techniques to perform an integrative multi-omic analysis of BCa expression and methylation combined with information on etiological factors associated with BCa risk to identify of subtypes of BCa that are epidemiologically and clinically relevant.

Role: PI

4/1/2020-5/1/2021

R01DK118405 (Kowaleski-Jones), NIH/NIDDK

Title: Family, Neighborhoods, and Intergenerational Transmission of Type II Diabetes Risk

Goal: Utilize a longitudinal approach to test the effects of dynamic family and neighborhood characteristics on T2DM risk. We will construct small-area measures of built-environment trajectories and examine how familial and neighborhood factors may independently and interactively influence T2DM risk.

Role: Co-I

07/01/2019-06/30/2021

R01HD099487 (Welt), NIH

Primary Ovarian Insufficiency: Etiology and Comorbid Disease

The proposal will determine the diseases that are inherited along with primary ovarian insufficiency (POI) in families and the gene mutations underlying POI and associated inherited disease. These studies will help identify causes of morbidity and early mortality in women who present with infertility in the form of POI.

Role: Co-I

09/08/2020 – 08/30/2021

R03CA238957 (Kirchhoff), NCI

Identifying the role of air pollution in the lung and heart health outcomes of testicular cancer survivors

Goal: Determine the role that ambient air pollution and co-exposure to cancer treatment has on the lung and heart outcomes of individuals with testicular cancer.

Role: Co-I

11/01/2020-10/31/2021

R03CA256263 (Kirchhoff), NCI

Identifying the role of short-term fine particulate matter air pollution in the heart and lung health outcomes of adolescent and young adult cancer survivors.

Role: Co-I

2016/07/01-2018/06/30

Childhood Cancer Research Grant

Anne Kirchhoff (PI)

St. Baldrick's Foundation

Effects of Air Pollution on Pulmonary Health in Childhood Cancer Survivors

Goal: This study will identify whether childhood cancer survivors face additional pulmonary health risks due to air pollution and help to inform efforts to prevent further morbidity in this population.

Role: Co-Investigator

2015/11/01-2017/7/31

1K12HD085852-01

Hanson, Heidi A (PI)

Phenomes, Families, Cancer and the Environment (PHFaCE): Using the phenome to better understand genetic and environmental risks of cancer in women. The purpose of my research project is to elucidate genetic and environmental mechanisms predisposing women to cancer by developing new algorithms to identify sex-specific familial and spatial patterns of cancer coaggregation. Uncovering underlying subtypes of cancer that have differential expressivity between sexes and across environments could identify at-risk families suitable for genetic testing or create predictive models that could be used to improve screening recommendations.

2011/05/01-2016/08/31

5R01 AG022095, NIA/NIH

Smith, Ken Robert (PI)

Early Life Conditions, Survival and Health: A Pedigree-Based Population Study

This study will identify associations between specific adverse early- and mid-life circumstances and later life-health and survival. The study will expand our understanding of the health effects of ELCS and will help guide the development of interventions for at-risk individuals to be introduced long before the onset of adverse adult health outcomes.

Role: OP

2015/04/01-2016/03/31

None, The University of Utah Consortium for Family and Health Research

Heidi Hanson (PI)

The Air of Heirs: Shared Environment, Shared Genes, and the Health Effects of Air Quality

There are significant correlations between air pollutants and adverse health effects such as cardiovascular and respiratory disease. An important indicator of disease risk is having a genetic or familial susceptibility to diseases that is associated with ambient air pollution exposure. This study will expand our understanding of the adverse health effects associated with ambient air pollution in individuals with a family history of cardiovascular and respiratory disease and help guide the development of recommendations tailored to these sensitive populations.

Role: PI

2015/02/15-2016/02/14

None, University of Utah Center on Aging

Heidi Hanson (PI)

The Airerly Study: Air Quality, Health and Mortality in the Medicare Population

We propose to study the predisposing factors for adverse health events, including mortality, during short-term periods of elevated ambient air pollution. This study will significantly improve our understanding of the heterogeneous effects of increased levels of ambient air pollution in the population over age 65.

Role: PI

2015/01/01-2016/01/01

Program for Air Quality, Health and Society, University of Utah

Carpenter, Jeannette (PI)

A Natural Experiment to Assess Prenatal Exposure to Air Pollution and Long-Term health and Reproductive Outcomes

The long-term effects of prenatal air pollution exposure can be studied in the context of the Utah Valley Geneva steel mill, which was closed from August 1986 to September 1987. The mill closure is a unique, natural experiment that allows us to: 1) study the long-term effects of prenatal air pollution exposure on health and reproductive outcomes, 2) control for potential confounders, and 3) identify individuals for future epigenetic studies in relation to the effects of air pollution

Role: Co-Investigator