



Kara A. Keeton, MPH

Supervising Health Scientist

Summary of Experience

Kara Keeton is an epidemiologist with 10 years of experience applying epidemiological concepts and methods to explore human health risks from environmental, occupational, and consumer product exposures. She earned a BA in Biology and Anthropology and an MPH with a focus in Epidemiology. Ms. Keeton has focused her consulting experience in occupational and environmental epidemiology, behavioral science, and human health risk assessments. Her experience includes investigating the health effects of exposure to a variety of compounds, including asbestos, talcum powder, ethylene oxide, ethylene glycol ethers, lead and other heavy metals, glyphosate, and diacetyl. Additionally, Ms. Keeton has evaluated human health risk associated with the use of consumer products, including electronic nicotine delivery systems, pesticides, and personal care products. She has expertise in implementing rigorous systematic literature review and meta-analysis methods, including the development of search strategies, protocols, screening, data extraction, quality control, in order to synthesize evidence between exposures of interest and behavioral outcomes and/or human health effects. Recently, her research has involved methods for characterization of electronic nicotine delivery system use, including topography and pharmacokinetic, human factors, label comprehension, and product perception and intention studies. Additionally, her recent research interests have focused on evaluating nationally representative surveys methods related to tobacco, nicotine, and cannabis use, as well as the development of surveys to measure tobacco product perceptions and intentions.

Education

Bachelor of Sciences (B.A.), Anthropology and Biology, 2012, University of Louisville

Master of Public Health (M.P.H.), Epidemiology, 2014, University of Louisville

Project Experience

Quantitative Exposure Assessment

Contributed to the design and implementation of a simulation study to characterize asbestos exposures to asbestos during the use of the application of cosmetic talc body powder spiked with known concentrations of tremolite.

Contributed to the design and implementation of a simulation study to evaluate inhalation and dermal exposures to glyphosate during heavy residential consumer application of Roundup®.

Contributed to the design and implementation of a simulation study to characterize potential exposures to diacetyl in a small coffee shop during the preparation and consumption of unflavored coffee to determine if exposures exceed recommended occupational exposure limits.

Occupational and Environmental Epidemiology

Analyzed cancer registry data to evaluate whether there was an elevated incidence of various cancers in a population surrounding a medical sterilization plant using ethylene oxide.

Performed a systematic literature review and meta-analysis of occupational exposures to ethylene oxide and the risk of lymphohematopoietic and breast cancers. Pooled risk estimates were calculated and stratified by type of cancer, occupational groups, types of cancers within occupational groups, and decade of publication.

Performed systematic literature reviews and synthesized literature on the relationship between childhood and adult lead exposures and various health effects and behavioral outcomes.

Assessed and compared U.S. pleural mesothelioma incidence rates and trends in men and women residing in urban versus rural areas using the National Cancer Institute's (NCI's) Surveillance Epidemiology and End Results (SEER) database and NCI's Joinpoint Regression software.

Conducted a quasi-experimental design using logistic and Poisson regression to determine the impact of potential exposures to crude 4-methylcyclohexanemethanol (MCHM) by potentially exposed pregnant women had on adverse birth outcomes.

Performed a systematic literature review and meta-analysis of non-occupational environmental and household exposures to asbestos and the risk of mesothelioma. Pooled mesothelioma risk estimates were calculated and stratified for type of non-occupational asbestos exposure and/or predominant fiber type.

Consumer Product Use

Led and contributed to multi-interdisciplinary research teams to evaluate electronic nicotine delivery systems (ENDS), including pharmacokinetic, human factors, and label comprehension studies, as well as tobacco product perception and intention surveys, which have been subject to multiple premarket tobacco applications (PMTA) of open- and closed system devices, e-liquids, and oral nicotine products for the FDA Center of Tobacco Products.

Conducted a critical state-of-the-science evaluation of e-cigarettes or electronic nicotine delivery systems (ENDS) with respect to abuse liability and topography, short- and long-term health effects, biomarkers of exposure and harm, product use behaviors and patterns (e.g., initiation, switching, cessation, and current use frequency), product perception and intentions, and population modeling.

Managed analysis and evaluation of all nationally representative survey data with ENDS data to estimate the prevalence on various measures of ENDS use (e.g., ever use, current use, and frequency of use). This analysis was used to compare the prevalence for each measure of use across nationally representative surveys as well as determine how different denominator definitions influenced reported prevalence of ENDS use.

Developed a survey to evaluate product perceptions and intentions to use ENDS by device and nicotine type in relation to comparator tobacco products.

Professional Experience

Supervising Health Scientist, Valeo Sciences LLC, August 2023 – present

Apply epidemiological methods to explore human health risks from a range of human exposure settings, including occupational, consumer, environmental, and medical. Serves as a project lead on several multi-disciplinary research teams involving epidemiology, behavioral science, risk assessment, exposure science, and toxicology to address complex questions about human health and safety.

Senior Supervising Health Scientist, Stantec (ChemRisk) (Formerly Cardno ChemRisk and ChemRisk), October 2014 – July 2023

Provided consulting services specializing in areas of general epidemiology, environmental and occupational epidemiology, behavioral science, and human health risk assessments involving occupational, environmental, and consumer product settings. Evaluated health effects of exposures to a variety of compounds, including asbestos, talcum powder, ethylene oxide, ethylene glycol ethers, heavy metals, and pesticides.

Public Health Intern, T-MARC Tanzania, 2013

Analyzed HIV/AIDS prevalence trends using national representative survey data and HIV test results from the Tanzania HIV/AIDS and Malaria Indicator Survey. Additionally, developed survey instruments and data collection tools for behavior change communication program funded by the United States Agency for International Development (USAID).

Research Assistant, Department of Biological Anthropology, University of Louisville, 2011-2013.

Researched the effects of pathogenic antigens on the differential expression of phenotypes for different cytokines and the relationship with cytokine gene polymorphism.

Professional Membership and Service

- Society for Epidemiology Research (SER), 2014-Present
- American Industrial Hygiene Association (AIHA), 2015-2019
- American Association of Physical Anthropologists (AAPA), 2012-2015

Peer-Reviewed Publications

Miller, E.W, B. Roberts, **K. Keeton**, A. Monnot, T. Tarpey, N. Zoghby, A. Segrave, and J.S. Pierce. 2022. Evaluation of asbestos exposure resulting from simulated application of spiked talcum powders. *Inhal Tox.* Advance online publication, Oct. 13, 2022. doi: 10.1080/08958378.2022.2132324.

Pierce, J.S., B. Roberts, D.G. Kougias, C.E. Comerford, A.S. Riordan, **K.A. Keeton**, H.A. Reamer, N.F.B. Jacobs, and J.T. Lotter. 2020. Pilot study evaluating inhalation and dermal glyphosate exposure resulting from simulated heavy residential consumer application of Roundup®. *Inhal Tox.* Advance online publication, Sept. 6, 2020. doi: 10.1080/08958378.2020.1814457.

Marsh, G.M., **K.A. Keeton**, A.S. Riordan, E.A. Best, and S.M. Benson. 2019. Ethylene oxide and risk of lymphohematopoietic cancer and breast cancer: A systematic literature review and meta-analysis. *Int Arch Occup Env Health.* Advance online publication, May 20, 2019. doi: 10.1007/s00420-019-01438-z.

Keeton, K.A., M.E. Glynn, S.H. Gaffney, and J. Sahmel. 2018. Response to letter to the editor regarding "Ambient asbestos fiber concentrations and long-term trends in pleural mesothelioma incidence between urban and rural areas in the United States (1972-2012)" by Finkelstein. *Risk Anal.* 38(8):1524-1528.

- Marsh, G.M., A.S. Riordan, **K.A. Keeton**, and S.M. Benson. 2018. Response to: 'Reanalysis of non-occupational exposure to asbestos and the risk of pleural mesothelioma' by Finkelstein. *Occup Env Med*. Advance online publication, March 24, 2018. doi: 10.1136/oemed-2018-105020.
- Glynn, M.E., **K.A. Keeton**, S.H. Gaffney, and J. Sahmel. 2018. Ambient asbestos fiber concentrations and long-term trends in pleural mesothelioma incidence between urban and rural areas in the United States (1973-2012). *Risk Anal*. 38(3):454-471.
- Marsh, G.M., A.S. Riordan, **K.A. Keeton**, and S.M. Benson. 2017. Non-occupational exposure to asbestos and risk of pleural mesothelioma: Review and meta-analysis. *Occup Env Med*. 74:838-846.
- Benson, S. M., P. Ruestow, **K. A. Keeton**, R. M. Novick, G. M. Marsh, and D. J. Paustenbach. 2017. The 2014 crude 4-methylcyclohexanemethanol chemical release and birth outcomes in West Virginia. *Arch Environ Occup Health*:1-10.
- Pierce, J. S., A. Abelmann, J. T. Lotter, C. Comerford, **K. Keeton**, and B. L. Finley. 2015. Characterization of naturally occurring airborne diacetyl concentrations associated with the preparation and consumption of unflavored coffee. *Toxicology Reports* 2:1200-1208.

Presentations

- Keeton, K.A.**, A. Blanchette, S.M. Benson, L.T. Covell, A.K. Madl. 2024. Analysis and Comparison of Nicotine Pharmacokinetics of Modern Oral Nicotine Pouches. Poster Presentation 48 at the 77th Tobacco Science Research Conference, Atlanta, GA; September 8-11, 2024.
- Keeton, K.A.**, L Covell, M.T. Donnell, and A.K. Madl. 2024. Comparison of In Vitro Nicotine Dissolution Profiles Across a Range of Oral Nicotine Products. Poster presentation P655 at the Society of Toxicology (SOT) Annual Meeting & ToxExpo, Salt Lake City, UT; March 10-14, 2024. *Toxicologist* 198(S1):441-442. Abstract 4121.
- D. Lauer III, S. Benson, L. Marshall, L. Wood, **K. Keeton**, D. Steigerwald, L. Dobyys, and B. Finley. Asbestos and Laryngeal Cancer, a Fiber-Type Specific Meta-Analysis. Poster presentation P535 at the Society of Toxicology (SOT) Annual Meeting & ToxExpo, Salt Lake City, UT; March 10-14, 2024. *Toxicologist* 198(S1):224. Abstract 3392.
- Donnell, M.T., **K.A. Keeton**, L. Covell, and A.K. Madl. 2024. Oral Exposure to Titanium Dioxide (TiO₂): Comparison of Adverse Outcome Pathway (AOP) Key Event (KE) Effect Levels to Human Daily Dietary Exposures. Poster presentation P190 at the Society of Toxicology (SOT) Annual Meeting & ToxExpo, Salt Lake City, UT; March 10-14, 2024. *Toxicologist* 198(S1):130. Abstract 3087.
- Covell, L.T., M.T. Donnell, **K.A. Keeton**, and A.K. Madl. 2024. Human Health Risk Assessment of Per- and Polyfluoroalkyl Substances (PFAS) in Facial Cosmetics. Poster presentation P342 at the Society of Toxicology (SOT) Annual Meeting & ToxExpo, Salt Lake City, UT; March 10-14, 2024. *Toxicologist* 198(Late-Breaking S1):233-234. Abstract 5240.
- Abelmann, A., E. Miller, **K. Keeton**, L. Gloekler, and S. Hoyt. 2023. Evaluation of the Potential for Cannabis Odors to Permeate Garments and Methods for Odor Remediation – Implications for Air Quality and Other Aspects. Podium Presentation at American Industrial Hygiene Conference & Exposition (AIHce). May 22-24, 2023, Phoenix, AZ.
- Keeton, K.A.**, L. Marshall, A. Hernandez, E. Sutherland, O. Leleck, H. Allen, S. Benson. The Impact of Denominator Definitions on Measures of Electronic Nicotine Delivery Systems (ENDS) Use among Youth in the U.S. Across Nationally Representative Surveys. Poster Presentation POS3-55 at the Society for Research on Nicotine and Tobacco 29th Annual Meeting, March 1-3, 2023, San Antonio, TX.

- Keeton, K.A.**, A. Hernandez, O. Leleck, A. Blakney, H. Allen, E. Sutherland, L. Marshall, and S. Benson. 2022. Variation in prevalence estimates of ENDS use in the US across nationally representative surveys. Poster presentation P529 at the Society of Toxicology (SOT) Annual Meeting & ToxExpo, San Diego, CA; March 27- 31, 2022. Toxicologist 186(S1):405. Abstract 4518.
- Keeton, K.A.** and G. Marsh. 2022. Applying the US EPA OPP framework for epidemiologic data to meta-analysis of EO epidemiology literature. Workshop at the Society of Toxicology (SOT) Annual Meeting & ToxExpo, San Diego, CA; March 27-31, 2022. Toxicologist 186(S1):43. Abstract 1211.
- Comerford, C.E., B. Roberts, D.G. Kougias, **K.A. Keeton**, H.A. Reamer, N.F.B. Jacobs, J.T. Lotter, J.S. Pierce. 2021. Evaluation of Urinary Glyphosate Levels Following Simulated Residential Consumer Application of Roundup®. Poster Presentation at Virtual American Industrial Hygiene Conference & Exposition (AIHce) May 24-26, 2021, Dallas, TX.
- Keeton, K.A.**, B. Roberts, D.G. Kougias, C.E. Comerford, H.A. Reamer, N.F.B. Jacobs, J.T. Lotter, J.S. Pierce. 2021. Evaluation of Inhalation and Dermal Exposures to Glyphosate during Simulated Residential Consumer Application of Roundup®. Poster Presentation at Virtual American Industrial Hygiene Conference & Exposition (AIHce) May 24-26, 2021, Dallas, TX.
- Benson, S.M., A. Bowman, **K.A. Keeton**, R.C.D Reid, E.S. Fung, N.S. Egnot. 2019. The Risk of Lung Cancer Due to Occupational Exposure to Talc: A Meta-Analysis of Miners and Millers. Poster presentation at Society of Toxicology annual meeting. May 10-14, 2019. Baltimore, MD.
- Marsh, G.M., **K.A. Keeton**, A.S. Riordan, E.A. Best, S.M. Benson. 2018. Ethylene Oxide and Risk of Lymphohematopoietic Cancer and Breast Cancer: A Systematic Review and Meta-Analysis. Poster presentation at American Industrial Hygiene Conference & Exposition. May 21-23, 2018. Philadelphia, PA.
- Keeton, K.A.**, S.M. Benson, R.M. Novick, G.M. Marsh and D.J. Paustenbach. 2017. The 2014 Crude 4-Methylcyclohexanemethanol Chemical Release and Birth Outcomes in West Virginia. Poster presentation at Society of Epidemiologic Research annual meeting. June 20-23, 2017. Seattle, WA.
- Riordan, A.S., S. Selix, P. Ruestow, **K.A. Keeton**, and G.M. Marsh. 2016. Risk Comparison of Malignant Mesothelioma in Industrial Versus Shipyard Pipefitters and Plumbers: A Preliminary Meta-Analysis. Poster Presentation at Epidemiology Congress of the Americas meeting. June 21-24, 2016. Miami, FL.
- Pierce, J.S., A. Abelmann, J.T. Lotter, C.E. Comerford, **K.A. Keeton** and B.L. Finley. 2016. Characterization of Naturally Occurring Airborne Diacetyl Concentrations Associated with the Preparation and Consumption of Unflavored Coffee. Poster Presentation at American Industrial Hygiene Conference & Exposition. May 21-26, 2016. Baltimore, MD.
- Glynn, M.E., **K.A. Keeton**, S.H. Gaffney, J. Sahmel. 2016. Ambient asbestos and long-term trends in pleural mesothelioma incidence between urban and rural areas in the United States (1973 to 2012). Poster presentation at Society of Toxicology annual meeting. March 13- 17, 2016. New Orleans, Louisiana
- Keeton, K.**, M.E. Glynn, S.H. Gaffney, J. Sahmel. 2015. Ambient Asbestos and Long-Term Trends in Pleural Mesothelioma Incidence between Urban and Rural Areas in the United States. Poster presentation at Society of Epidemiologic Research annual meeting. June 16-19, 2015. Denver, CO.
- Pierce, J.S., A. Abelmann, J. Lotter, C. Comerford, **K. Keeton** and B.L. Finley. 2015. Characterization of Diacetyl Exposures Associated with the Preparation and Consumption of

Unflavored coffee. Poster presentation at Society of Toxicology annual meeting. March 22-26, 2015. San Diego, CA.

Short N., **K. Keeton**, R.F. Botran, and F. Crespo. 2013. Phenotypic Plasticity in Humans: Lessons from the Immune System. Podium presentation at the American Association of Physical Anthropologists annual meeting. April 2013. Knoxville, TN.

Keeton, K., Short, S. R.F. Botran, F. Crespo. 2012. Differential Immune Responses in Human Populations: Searching for Evolutionary Clues. Poster presentation at the American Association of Physical Anthropologists annual meeting. April 2012. Portland, OR.