BRUCE C. ALLEN

EDUCATION

1980 Master of Biomathematics, Biomathematics (Statistics minor), North Carolina State University

1978 B.A., Philosophy, University of Washington, Honors, Summa Cum Laude

1978 B.S., Mathematics, University of Washington, Honors, Summa Cum Laude

EXPERIENCE OVERVIEW

Mr. Allen has more than 35 years of experience related to human and environmental health and safety. He has expertise as a biomathematician involved in risk assessment, modeling, statistical analysis, and clinical trials, having worked for a variety of government and private clients. Mr. Allen's primary interest is in the quantitative aspects of risk analysis, reflecting his experience with dose-response analysis; with the statistical appraisal of data, models, and modeling results; and with developing rigorous approaches to decision making in risk assessment contexts. His expertise in dose-response analysis extends to the modeling, including biologically motivated modeling, of cancer, noncancer, and genotoxic endpoints as well as genomics data. Mr. Allen's statistical expertise includes computer-intensive approaches – such as Monte Carlo simulation, bootstrap analysis, and Markov chain Monte Carlo approaches for Bayesian analyses – as well as other techniques for uncertainty analyses, data quality objectives, quality control/assurance, statistical analyses for site risk assessments, and analysis of clinical trials data. Mr. Allen has provided expert testimony, is a frequent peer reviewer of risk assessment documents, and has served as manager for numerous projects including multi-disciplinary, multi-year efforts.

SELECTED EXPERIENCE

Dose-Response Analysis

- Dose-Response Modeling of Genomics Data. Mr. Allen has been working with toxicologists involved in the analysis of genomics data to determine reasonable approaches for dose-response assessment of genomics data for use in risk assessment. His efforts have focused on the used of benchmark dose approaches applied to gene ontology classifications and on the use of appropriate fitted dose-response models to assess whether or not significant changes in expression have occurred.

- Dose-Response Modeling of Genotoxicity Data. Mr. Allen has initiated a series of modeling efforts to represent the dose-response behavior of the endpoints of genotoxicity assays. Rather than summarize such studies as "positive" or "negative" these efforts use the most appropriate statistical and biologically motivated approaches to extrapolate the observed response pattern to exposure levels that are relevant for risk assessment decision making.

- Dose-Response Meta-Regression of Epidemiological Studies. Mr. Allen has developed and applied Bayesian methods for combining cohort and case-control studies in a single hierarchical analysis, yielding pooled estimates of lifetime risk. These methods address study heterogeneity and are amenable to Bayesian model averaging approaches.

- Benchmark Dose Approach. Mr. Allen has been very active in the investigation of the risk assessment method known as the benchmark dose approach. He has investigated the application of benchmark methods to a variety of types of toxicity, especially reproductive/developmental toxicity, and including responses to estrogen-active compounds.

- Dose-Response Modeling for Developmental Toxicants. Mr. Allen has completed a research project in collaboration with the EPA and the University of Washington to study dose-response modeling approaches for developmental toxicants. The project involved an evaluation of proposed empirical (statistical) models designed to handle issues particularly relevant to tests of embryo/fetal effects, such as intra-litter correlations of responses and effects of litter size. Moreover, the project involved investigation of the pertinent biological data with the aim of developing biologically based models more closely linked to the underlying processes occurring during gestation.

- Cancer Dose-Response. For much of his career, Mr. Allen has analyzed cancer dose-response relationships and the issues associated with cancer risk assessment. He has conducted studies of the dose-response modeling approaches that are best suited to interpretation of bioassay results and which best relate test-species estimates of cancer risk to epidemiological observations. He has considered the use of biologically based cancer models in conjunction with pharmacokinetic analyses for specific compounds.

- Non-Monotonic Dose-Response. Mr. Allen has investigated non-monotonic dose-response patterns associated especially with biological effects of low-level exposure. He conducted a series of simulation studies of U-shaped dose-response relationships to study the behavior and performance of several tests proposed as approaches for determining when such U-shaped relationships exist. The investigation considered type I error rates and powers for detecting the presence of U-shaped dose-response as a function of the number of dose groups, spacing of the dose groups, and number of test animals per dose group.

Statistical Analysis

- Bayesian Analyses and Markov Chain Monte Carlo (MCMC) Techniques. Mr. Allen's recent emphasis on rigorous integration of all relevant information for risk assessment decision making has been reflected in Bayesian analyses that he has supervised. He has recently completed hierarchical Bayesian analyses of arsenic epidemiological data. Another problem involved estimating methyl mercury intake among women of child-bearing ages, using a physiologically based pharmacokinetic (PBPK) model of methyl mercury distribution. Using the large NHANES data for blood mercury measured in such women and an MCMC approach, posterior estimates of methyl mercury intake were derived from prior distributions for intake and PBPK model parameters. Additional analyses have focused on application of PBPK and two-stage cancer models to a formaldehyde risk assessment and the characterization of parameter uncertainty using a Bayesian approach.

- Computer-Intensive Statistical Approaches. In many of the recent applications to which Mr. Allen has contributed, standard statistical approaches have been unavailable or inappropriate. Mr. Allen has investigated and developed approaches for applying several computer-intensive techniques, such as Monte Carlo simulation and bootstrap methodologies. Specific applications include confidence limit calculations in dose-response modeling and geostatistics, uncertainty analysis for site sampling plans, and hypothesis testing and model validation for complex models of components of radioactive wastes from nuclear weapons processing.

- Occupational Exposure Monitoring. Mr. Allen was the principal statistician involved in the development of statistical guidelines for defining how occupational exposure monitoring data should be analyzed and summarized for the purposes of occupational risk assessment. The guidelines were developed for the Chemical Engineering Branch of the U.S. EPA for use in their surveys and risk assessments. The statistical procedures discussed in the guidelines included nested analysis of variance approaches, cluster analyses, testing data for distributional characteristics, and development of summary descriptive statistics appropriate for the type of data available.

- Transportation Safety. Mr. Allen has served as an expert witness in relation to analysis of railroad accident data and the determination of site-specific safety hazards. The project required a critique of previously conducted analyses and reanalysis using appropriate statistical procedures. Mr. Allen's evaluation of the problem suggested that unique features of the application dictated consideration of Kolmogorov-Smirnov tests and a variation of multinomial analysis with computer simulations to ascertain p-values.

- Clinical Trials. Mr. Allen has performed and directed statistical analyses of several clinical trials, including a large, multi-center trial sponsored by the National Heart, Lung, and Blood Institute at NIH. He has drafted statistical analysis plans and statistical reports for those trials. He has collaborated with medical officers and scientific advisory boards to complete specialized analyses that have addressed issues of safety and efficacy. He has also participated directly in study monitoring and maintenance activities, including clinic visits, as well as data quality operations.

- Quality Control. Mr. Allen served as lead statistician on a project to define a proficiency and quality control protocol for laboratories participating in a proposed Occupational Safety and Health Administration monitoring program for occupational cadmium exposure. The protocol included provisions for self-monitoring through the use of control charts, blind quality assurance samples for outside review, and a proficiency program to certify that laboratories can appropriately analyze specimens determining cadmium exposure and cadmium-induced renal disease.

Risk Assessment Methodology

- Epidemiological Data Analysis. Mr. Allen has participated in the development of methods that allow the estimation of risks from epidemiological data. This work has included extensions of multistage models, including time-to-tumor approaches, to handle commonly reported cohort data. Recently, Mr. Allen has developed and applied Bayesian model averaging and meta-regression analyses suitable for a mixture of epidemiological study types. Mr. Allen has performed analyses and derived risk estimates from epidemiological data for benzene, chromium, asbestos, arsenic, beryllium, and over twenty other compounds.

- Physiologically Based Pharmacokinetic Modeling. Mr. Allen has supervised and provided the scientific input for several projects related to physiologically based pharmacokinetic (PBPK) modeling, especially in the context of risk assessment. The use of PBPK models for low-dose, route-to-route, and species-to-species extrapolations has been emphasized. He has developed and/or investigated PBPK models of atrazine, chloroform, trichloroethylene, perchloroethylene, vinyl chloride, TCDD, and 1,1,1-trichloroethane.

- Sensitivity/Uncertainty Analyses. Mr. Allen has been active in the development of consistent and coherent approaches to representing the effects of variability and of uncertainty on estimates of exposure and risk. He has applied Monte Carlo approaches both to site-specific exposure estimates and in the context of complex (e.g., PBPK) models for several chemicals. Mr. Allen has focused much of his recent attention, including work with chloroform pharmacokinetic/pharmacodynamic models, on the differentiation of variability and uncertainty, the estimation of uncertainty, and the proper representation of the different effects of uncertainty and variability via "two-level" Monte Carlo simulations.

Site Assessment

- Data Quality Objectives Analyses. Mr. Allen has been involved in the major new emphasis on ensuring the quality of data used for human health and ecological risk assessment known as the data quality objectives procedure. His involvement has been related to the expression of the desired results, products, or decisions associated with an assessment in statistically appropriate forms, in order to define criteria consistent with quality data collection and analysis. Mr. Allen has developed sampling plans and estimated sample size requirements for sites of contamination in several states.

- Exposure Assessment. Mr. Allen has wide experience related to estimation of exposure. That experience includes development of detailed, time-varying historical exposures for a cohort of benzene-exposed workers, estimation of relative source contributions for chloroform, and use of maximum-likelihood techniques for estimating concentration distributions, even in the presence of observations below limits of detection.

SELECTED PUBLICATIONS

Allen, B., Shao, K., Hobbie, K., Mendez, W., Lee, J., Cote, I., Druwe, I., Gift, J., Davis, J. (2019). Bayesian Hierarchical Meta-Regression of Epidemiological Studies, Part 2: Dose-Response Modeling and Target Population Predictions. Submitted.

Allen, B., Shao, K., Hobbie, K., Mendez, W., Lee, J., Cote, I., Druwe, I., Gift, J., Davis, J. (2019). Bayesian Hierarchical Meta-Regression of Epidemiological Studies, Part 1: Dose and Response Pre-Analysis. Submitted.

Vincent, M.J., Allen, B., Palacios, O.M., Haber, L.T., and Maki, K.C. (2019). Meta-regression analysis of the effects of dietary cholesterol intake on LDL and HDL cholesterol. *The American journal of clinical nutrition*, *109*(1), 7-16.

Dzierlenga, M. W., Allen, B. C., Clewell III, H. J., and Longnecker, M. P. (2019). Pharmacokinetic bias analysis of an association between clinical thyroid disease and two perfluoroalkyl substances. Submitted

Dzierlenga, M.W., Moreau, M., Song, G., Mallick, P., Ward, P.L., Campbell, J.L., Housand, C., Yoon, M., Allen, B.C., Clewell III, H.J. and Longnecker, M.P. (2019). Quantitative bias analysis of the association between subclinical thyroid disease and two perfluoroalkyl substances in a single study. Environmental Research, p.109017.

Dzierlenga, M.W., Allen, B.C., Ward, P.L., Clewell III, H.J. and Longnecker, M.P. (2019). A model of functional thyroid disease status over the lifetime. PloS one, 14(7).

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Haber, L.T., Dourson, M.L., Allen, B.C., Hertzberg, R.C., Parker, A., Vincent, M.J., Maier, A. and Boobis, A.R. (2018). Benchmark dose (BMD) modeling: current practice, issues, and challenges. Critical Reviews in Toxicology, 48(5), pp.387-415.

Haber, L., Bates, H., Allen, B., Vincent, M., and Oller, A. (2017). Derivation of an oral toxicity reference value for nickel. Regul. Toxicol Pharmacol. 87 Suppl 1:S1-S18. doi: 10.1016/j.yrtph.2017.03.011.

Chang, S., Allen, B., Andres, K., Ehresman, D., Falvo, R., Provencher, A., ... and Butenhoff, J. (2017). Evaluation of serum lipid, thyroid, and hepatic clinical chemistries in association with serum perfluorooctanesulfonate (PFOS) in cynomolgus monkeys after oral dosing with potassium PFOS. Toxicological Sciences. DOI: 10.1093/toxsci/kfw267.

Manjanatha, M., Shelton, S., Chen, Y., Parsons, B., Myers, M., Gollapudi, B., Moore, N., Haber, L., Allen, B., and Moore, M. (2017). Dose and temporal evaluation of ethylene oxide-induced mutagenicity in the lungs of male big blue mice following inhalation exposure to carcinogenic concentrations. Environmental and Molecular Mutagenesis, 58(3), pp.122-134.

Allen, B., Vincent, M., Liska, D., and Haber, L. (2016). Meta-regression analysis of the effect of *trans* fatty acids on low-density lipoprotein cholesterol. Food and Chemical Toxicology 98(Pt B):295-307. DOI: 10.1016/j.fct.2016.10.014.

Shao, K., Allen, B., Wheeler, M. (2016). Bayesian hierarchical structure for quantifying population variability to inform probabilistic health risk assessments. Risk Analysis, DOI: 10.1111/risa.12751.

Allen, B., Van Landingham, C., Yang, Y., Youk, A., Marsh, G., Esmen, N. ... and Himmelstein, M. (2014). A constrained maximum likelihood approach to evaluate the impact of dose metric on cancer risk assessment: Application to β-chloroprene. Regulatory Toxicology and Pharmacology, 70(1), 203-213.

Maier, A., Kohrman, M., Hertzberg, R., Dourson, M., Haber, L., Allen, B. (2012). Critical review of dose-response options for F344 rat mammary tumors for acrylamide - Additional insights based on mode of action. Food and Chemical Toxicology. 50:1763-75.

Thomas, R., Wesselkamper, S., Wang, N., Zhao, Q., Petersen, D., Lambert, J., Cote, I., Yang, L., Healy, E., Black, M., Clewell, H., Allen, B., and Andersen, M. (2013). Temporal concordance between apical and transcriptional points of departure for chemical risk assessment. Toxicological Sciences doi:10.1093/toxsci/kft094.

Wetmore, B., Wambaugh, J., Ferguson, S., Li, L., Clewell, H., Judson, R., Freeman, K., Bao, W., Sochaski, M., Chu, T., Black, M., Healy, E., Allen, B., Andersen, M., Wolfinger, R., and Thomas, R. (2013). The relative impact of incorporating pharmacokinetics on predicting in vivo hazard and mode-of-action from high-throughput in vitro toxicity assays. Toxicological Sciences 132(2):327-46.

Thomas, R., Clewell, H., Allen, B., Yang, L., Healy, E., and Andersen, M. (2012). Integrating pathway-based transcriptomic data into quantitative chemical risk assessment: A five chemical case study. Mutation Research 746(2):135-143.

Wetmore, B., Wambaugh, J., Ferguson, S., Sochaski, M., Rotroff, D., Freeman, K., Clewell, H., Dix, D., Andersen, M., Houck, K., Allen, B., Judson, R., Singh, R., Kavlock, R., Richard, A., and Thomas, R. (2012). Integration of dosimetry, exposure and high-throughput screening data in chemical toxicity assessment. Toxicological Sciences 125(1):157-74.

Thomas, R., Clewell, H., Allen, B., Wesselkamper, S., Wang, N., Lambert, J., Hess-Wilson, J., Zhao, Q. and Andersen, M. (2011). Application of transcriptional benchmark dose values in quantitative cancer and noncancer risk assessment. Toxicological Sciences 120(1):194-205

Crump, K. and Allen, B. (2010). Toward making epidemiologic data more useful for quantitative risk assessment. TOEPIJ 3: 83-97.

Cain, W., Dourson, M., Kohrman-Vincent, M., and Allen, B. (2010). Human Chemosensory Perception of Methyl Isothiocyanate: Odor and Chemesthesis. Regulatory Toxicology and Pharmacology 58: 173-180.

Dourson, M., Kohrman-Vincent, M., and Allen, B. (2010). Dose response assessment for effects of acute exposure to methyl isothiocyanate (MITC). Regulatory Toxicology and Pharmacology 58: 181-188.

Yang, Y., Allen, B, Tan, Y., Liao, K., and Clewell, H. (2010). Bayesian analysis of a rat formaldehyde DNA-protein cross-link model. Journal of Toxicology and Environmental Health, Part A, 73:787-806.

Dourson, M., Hertzberg, R., Allen, B., Haber, L., Parker, A., Kroner, O., Maier, A., and Kohrman, M. (2008). Evidence-based dose response assessment for thyroid tumorigenesis from acrylamide. Regulatory Toxicology and Pharmacology 52(3):264-89.

Moore, M., Heflich, R., Haber, L., Allen, B., Shipp, A., and Kodell, R. (2008). Analysis of in vivo mutation data can inform cancer risk assessment. Regulatory Toxicology and Pharmacology 51:151.

Yang, L., Allen, B., and Thomas, R. (2007). BMDExpress: a software tool for the benchmark dose analyses of genomic data. BMC Genomics 8:387.

Thomas, R., Allen, B., Nong A., Yang, L., Bermudez, E., Clewell, H., and Andersen, M. (2007). A method to integrate benchmark dose estimates with genomic data to assess the functional effects of chemical exposure. Tox. Sci. 98: 240-248.[1]

Allen, B., Hack, C. E., and Clewell, H. (2007). Use of Markov chain Monte Carlo analysis with a physiologically based pharmacokinetic model of methylmercury to estimate exposures in U.S. women of child-bearing age. Risk Analysis 27:947-959.

Allen, B., Zeiger, E., Lawrence, G., Friedman, M., and Shipp, A. (2005). Dose-response modeling of in vivo genotoxicity data for use in risk assessment: some approaches illustrated by an analysis of acrylamide. Reg. Tox. Pharm. 41:6-27.

Van Landingham, C., Allen, B., Shipp, A., and Crump, K. (2001). Comparison of the EU T25 single point estimate method with benchmark dose response modeling for estimating potency of carcinogens. Risk Analysis 21:641-656

Clewell, H., Gentry, P., Gearhart, J., Allen, B, and Andersen, M. (2001). Comparison of cancer risk estimates for vinyl chloride using animal and human data with a PBPK model. Sci Total Environ 274:37-66.

[1] Selected as outstanding published paper in 2007 by Risk Assessment Specialty Section, Society of Toxicology.

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Clewell, H., Gentry, P., Allen, B., Covington, T., and Gearhart, J. (2000). Development of a physiologically-based pharmacokinetic model of trichloroethylene and its metabolites for use in risk assessment. *Environmental Health Perspectives*, 108(suppl 2):283-305.

K.S. Crump Group, Inc. (2000). Estimation of lifetime skin cancer risk from the use of coal tar-containing shampoos**.** Toxicology Excellence for Risk Assessment ITER Data Base (www.tera.org/iter/coaltar.htm).

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Barton, H., Andersen, M., and Allen B. (1998). Dose-response characteristics of uterine responses in rats exposed to estrogen agonists. Reg Tox Pharm, 28:133-149.

Haber, L., Allen, B., and Kimmel, C. (1998). Noncancer risk assessment for nickel compounds: issues associated with dose-response modeling of inhalation and oral exposure. Toxicol Sciences, 43:213-229.

Berman, D., Allen, B., and Van Landingham, C. (1998). Evaluation of the Performance of Statistical Tests Used in Making Cleanup Decisions at Superfund Sites. Part 1: Choosing an Appropriate Statistical Test. *Superfund Risk Assessment in Soil Contamination Studies: Third Volume, ASTM STP 1338*, K.B. Hoddinott, Ed., American Society for Testing Materials.

Berman, D., Allen, B., and Van Landingham, C. (1998). Evaluation of the Performance of Statistical Tests Used in Making Cleanup Decisions at Superfund Sites. Part 2: Real World Implications of Using Various Decision Rules. *Superfund Risk Assessment in Soil Contamination Studies: Third Volume, ASTM STP 1338*, K.B. Hoddinott, Ed., American Society for Testing Materials.

Andersen, M., Clewell, H., Gearhart, J., Allen, B., and Barton, H. (1997). Pharmacodynamic model of the rat estrus cycle in relation to endocrine disruptors. *J Toxicol Environ Health* 52:189-209.

Allen, B., Covington, T., and Clewell H. (1996). Investigation of the impact of pharmacokinetic variability and uncertainty on risks predicted with a pharmacokinetic model for chloroform. Toxicol 110:1-15.

Allen, B. and Crump, K. (1996). Application of the benchmark dose approach to glycol ethers risk assessment. Occup Hyg 2:427-437.

Allen, B., Strong, P., Price, C., Hubbard, S., and Daston, G. (1996). Benchmark dose analysis of developmental toxicity in rats exposed to boric acid. Fundam Appl Toxicol 32:194-204.

Clewell, H., Gentry, P., Gearhart, J., Allen, B., and Andersen, M. (1995). Considering pharmacokinetic and mechanistic information in cancer risk assessments for environmental contaminants: examples with vinyl chloride and trichloroethylene. Chemosphere 31:2561-2578.

Kavlock, R., Allen, B., Faustman, E., and Kimmel, C. (1995). Dose-response assessment for developmental toxicity: IV. Benchmark doses for fetal weight changes. Fundam Appl Toxicol, 26:211-222.

Kimmel, C., Kavlock, R., Allen, B. and Faustman, E. (1995). The application of benchmark dose methodology to data from prenatal developmental toxicity studies. Toxicol Letters 82/83:549-554.

Allen, B., Kavlock, R., Kimmel, C., and Faustman, E. (1994). Dose-response assessment for developmental toxicity: III. Statistical models. Fundam Appl Toxicol 23:496-509.[2]

Allen, B., Kavlock, R., Kimmel, C., and Faustman, E. (1994). Dose-response assessment for developmental toxicity: II. Comparison of generic benchmark dose estimates with NOAELs. Fundam Appl Toxicol 23:487-495.

Faustman, E., Allen, B., Kavlock, R., and Kimmel, C. (1994). Dose-response assessment for developmental toxicity: I. Characterization of data base and determination of NOAELs. Fundam Appl Toxicol 23:478-486.

Allen, B. and Fisher, J. (1993). Pharmacokinetic modeling of trichloroethylene and trichloroacetic acid in humans. Risk Anal 13:71-86.

Fisher, J. and Allen, B. (1993). Evaluating the risk of liver cancer in humans exposed to trichloroethylene using physiological models. Risk Anal 13:87-95.

Fisher, J., Gargas, M., Allen, B., and Andersen, M. (1991). Physiologically based pharmacokinetic modeling with trichloroethylene and its metabolite, trichloroacetic acid, in the rat and mouse. Toxicol Appl Pharmacol 109:183-195.

Allen, B., Fisher, J., Shipp, A., Andersen, M., and Gargas, M. (1990). Pharmacokinetic modeling of trichloroethylene relevant to its hepatocarcinogenicity. The Toxicologist 10:71.

Crump, K., Allen, B., and Shipp, A. (1989). Choice of dose measure for extrapolating carcinogenic risk from animals to humans: an empirical investigation of 23 chemicals. Health Phys 57, Sup 1:387-393.

Farrar, D., Allen, B., Crump, K., and Shipp, A. (1989). Evaluation of uncertainty in input parameters to pharmacokinetic models and the resulting uncertainty in output. Toxicol Lett 49:371-385.

Shipp, A., Crump, K., and Allen, B. (1989). Correlation between carcinogenic potency of chemicals in animals and humans. Comments in Toxicology 5/6:289-303.

Kipen, H., Cody, R., Crump, K., Allen, B., and Goldstein, B. (1988). Hematologic effects of benzene: A thirty-five year longitudinal study of rubber workers. Toxicol Ind Health 4:411-430.

Allen, B., Crump, K., and Shipp, A. (1988). Correlation between carcinogenic potency of chemicals in animals and humans. Risk Anal 8:531-544.

Allen, B., Crump, K., and Shipp, A. (1988). Is it possible to predict the carcinogenic potency of a chemical in humans using animal data? Banbury Report 31: Carcinogen Risk Assessment: New Directions in the Qualitative and Quantitative Aspects. Cold Spring Harbor Laboratory, New York. pp. 197-209.

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[2] Selected "Best Paper of the Year" for Fundamental and Applied Toxicology.

Crump, K., Allen, B., Howe, R., and Crockett, P. (1987). Time-related factors in quantitative risk assessment. J Chronic Dis 40(Suppl. 2):101-111.

Allen, B. and Crump, K. (1986). Aspects of quantitative risk assessment as applied to cancer. In: Biomedical Ethics Reviews. Humber and Almeder (eds.). Humana Press, Clifton, New Jersey. pp. 129-146.

Crump, K. and Allen, B. (1985). Methods for quantitative risk assessment using occupational studies. Amer Stat 39:442-450.

SELECTED PRESENTATIONS

Bayesian Hierarchical Modeling as a Means of Conducting Meta-Regression: Case Study of Cardiovascular Mortality Following Arsenic Exposure. SRA Annual Meetings, December, 2015.

Bayesian Model Averaging in the Estimation of Arsenic-Associated Urinary Cancer Risks SRA Annual Meetings, December, 2015.

Performance Assessment to Compare a CxT Protocol with the Traditional Protocol for LC50 Determination (OECD TG-403). Presented at the Toxicology and Risk Assessment Conference, Cincinnati, OH, April, 2009.

Sensitivity Analysis for the CIIT Two-Stage Model of Formaldehyde Carcinogenicity Using Markov Chain Monte Carlo Analysis. Presented at the Society for Risk Analysis Annual Meeting, Baltimore, MD, December, 2006.

New Application of Dose-Response Models: Use with Genotoxicity Data. American College of Toxicology Annual Meetings, Williamsburg, VA, December, 2005.

Dose-Response Modeling of In Vivo Genotoxicity Data: Its Relevance to Risk Assessment Illustrated by an Application to Acrylamide. Presented at the Society of Toxicology Annual Meetings, New Orleans, LA, March, 2005.

A Time Course Model to Allow the Prediction of the Optimal Period after Box Closure to Commence Resampling in King Scallop Boxes in Scottish Offshore Waters. Presented to Food Standards Agency, Scotland. Aberdeen, Scotland, November, 2004.

Estimation of Methyl mercury Exposures in U.S. Women of Child-Bearing Age Using Markov Chain Monte Carlo Analysis with a Physiologically Based Pharmacokinetic Model. Presented at the Society of Toxicology Annual Meetings, Salt Lake City, UT, March, 2003.

Dose-Response Data Modeling Improvements: Developmental Toxicity. Presented at the Workshop on the Risk Assessment of Mixtures of Disinfection By-Products (DBPs) for Drinking Water Treatment Systems**,** Cincinnati, OH, April, 1999.

Categorical Regression for Dose-Response Modeling of Toxicity Data and Its Application to RfD/C Development. Workshop presented at the Department of Defense Annual Conference, Wright-Patterson AFB, OH, April, 1998.

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The Use of Monte Carlo Analysis and Physiologically Based Pharmacokinetic (PBPK) Modeling to Investigate Uncertainty and Variability in Delivered Dose. Presented at the Society for Risk Analysis Annual Meeting, Honolulu, HW, December, 1995.

Impact of Human Variability and Parameter Uncertainty on Risks Predicted by a Physiologically Based Pharmacokinetic Model for Chloroform. Presented at the Conference on Risk Assessment Issues for Sensitive Human Populations, Wright-Patterson AFB, OH, April, 1995.

Benchmark Dose Analysis of the Developmental Toxicity of Boric Acid in Rats. Presented at the Society for Risk Analysis Annual Meeting, Baltimore, MD, December, 1994.

Application of the Benchmark Approach to Glycol Ethers Risk Assessment. Presented at the International Symposium on Health Hazards of Glycol Ethers, Nancy, France, April, 1994.

A Statistical Method to Evaluate the Impact on Estimates of Risk at a Hypothetical Maximum Tolerated Dose. Presented at the Society of Toxicology Annual Meetings, New Orleans, LA, March, 1993.

Benchmark Doses for Developmental Toxicity Studies. Presented at the Workshop on Quantitative Methods in Developmental Toxicity. Sponsored by the Committee on Risk Assessment Methodology (NAS/NRC) and Health and Welfare Canada, May, 1992.

Comparisons of Benchmark Dose and NOAEL Approaches. Presented at the Workshop on Safety Assessment for Non-Cancer Endpoints: The Benchmark and Other Possible Approaches. Sponsored by CAL/EPA, USEPA, and ATSDR, May, 1992.

Dose-Response Modeling for Developmental Toxicity. Presented at the 31st Annual Meeting of the Society of Toxicology, February, 1992.

Comparison of Approaches to Risk Assessment for Developmental Toxicants. Presented at the Society for Risk Analysis Annual Meeting, December, 1991.

Physiologically Based Pharmacokinetic Modeling and Risk Assessment: The Case of Trichloroethylene. Presented at the Conference on Chemical Risk Assessment in the DoD: Science, Policy, and Practice, April, 1991.

Cross-Chemical Extrapolations of Risks: Utilization of Information Regarding Common Metabolites. Presented at the Society for Risk Analysis Annual Meeting, October, 1990. (Session Chairman).

Mathematical Alternatives to Reproductive Risk Modeling. Workshop presentation for California Department of Health Services. September, 1990.

Uncertainty/Sensitivity Analysis for Cancer Risk Assessment: Pharmacokinetics and Dose-Response for Perchloroethylene. Presented at the ENSOL '90 Conference. September, 1990.

Pharmacokinetics. Presented at the Workshop on Human Health Risk Assessment: Current Practices and New Directions; sponsored by the Electric Power Research Institute, May and December, 1990.

Dose-Response Models for Noncancer Endpoints. Presented at the Workshop on Human Health Risk Assessment: Current Practices and New Directions; sponsored by the Electric Power Research Institute, May and December, 1990.

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Pharmacokinetics of Trichloroethylene/Trichloroacetic Acid for Use in Cancer Risk Assessment. Presented at the 3rd Symposium on Frontiers of Pharmacokinetics and Pharmacodynamics, April 1990.

Pharmacokinetic Modeling of Trichloroethylene Relevant to its Hepatocarcinogenicity. Presented at the 29th Annual Meeting of the Society of Toxicology, February 1990.

Evaluation of Uncertainty in Input Parameters to Pharmacokinetic Models and the Resulting Uncertainty in Output. Presented at the 18th Conference on Toxicology, November 1988.

Risk Assessments Involving Pharmacokinetic Modeling: The Effect of Uncertainty in Model Parameters. Presented at the 2nd Symposium on Frontiers of Pharmacokinetics and Pharmacodynamics, October 1988.

Aspects of Quantitative Risk Assessment as Applied to Cancer. Presented at the Georgia State University Conference on Ethical Issues and Public Problems Emerging from the Employment of the Method of Quantitative Risk Assessment, September 1985.

EXPERT TESTIMONY

Expert witness deposition on behalf of Johnson & Johnson for a California Proposition 65 case concerning skin cancer risks associated with the use of coal tar-containing shampoos. Oakland, CA, December, 2001.

Expert witness on behalf of Southern Pacific Railroad before the California Public Utilities Commission concerning derailment statistics and the determination of a local safety hazard. San Francisco, CA, November, 1992.

Testimony on behalf of the Occupational Safety and Health Administration at public hearings on proposed OSHA benzene exposure standards. Regarding risks of leukemia associated with occupational benzene exposure. Washington, DC, February, 1986.

EMPLOYMENT HISTORY

Bruce Allen Consulting	Independent Consultant	12/05 - Present
Environ International Corporation	Senior Science Manager	3/02 - 12/05
ICF Consulting, KS Crump Group	Project Manager	5/00 - 2/02
RAS Associates	Independent Consultant	5/97 - 5/00
ICF Kaiser, KS Crump Group	Senior Scientist	12/83 - 5/97
University of North Carolina, Department of Biostatistics, Lipid Research Clinics Program	Research Assistant	11/80 - 12/83

CONTACT INFORMATION

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