

[Home](#) > [Journal](#) > [Earth & Environmental Sciences](#) > [JEP](#)
[Indexing](#) | [View Papers](#) | [Aims & Scope](#) | [Editorial Board](#) | [Guideline](#) | [Article Processing Charges](#)
[JEP](#) > Vol. 3 No. 6, June 2012



Assessing Chemical Mixtures and Human Health: Use of Bayesian Belief Net Analysis

PDF (Size: 657KB) PP. 462-468 DOI : 10.4236/jep.2012.36056

Author(s)

Anindya Roy, Neil J. Perkins, Germaine M. Buck Louis

ABSTRACT

Background: Despite humans being exposed to complex chemical mixtures, much of the available research continues to focus on a single compound or metabolite or a select subgroup of compounds inconsistent with the nature of human exposure. Uncertainty regarding how best to model chemical mixtures coupled with few analytic approaches remains a formidable challenge and served as the impetus for the study. **Objectives:** To identify the polychlorinated biphenyl (PCB) congener(s) within a chemical mixture that was most associated with an endometriosis diagnosis using novel graphical modeling techniques. **Methods:** Bayesian Belief Network (BBN) models were developed and empirically assessed in a cohort comprising 84 women aged 18 - 40 years who underwent a laparoscopy or laparotomy between 1999 and 2000; 79 (94%) women had serum concentrations for 68 PCB congeners quantified. Adjusted odds ratios (AOR) for endometriosis were estimated for individual PCB congeners using BBN models. **Results:** PCB congeners #114 (AOR = 3.01; 95% CI = 2.25, 3.77) and #136 (AOR = 1.79; 95% CI = 1.03, 2.55) were associated with an endometriosis diagnosis. Combinations of mixtures inclusive of PCB #114 were all associated with higher odds of endometriosis, underscoring its potential relation with endometriosis. **Conclusions:** BBN models identified PCB congener 114 as the most influential congener for the odds of an endometriosis diagnosis in the context of a 68 congener chemical mixture. BBN models offer investigators the opportunity to assess which compounds within a mixture may drive a human health effect.

KEYWORDS

Bayesian Belief Network; Endometriosis; Environment; Mixtures; Polychlorinated Biphenyls

Cite this paper

 A. Roy, N. J. Perkins and G. M. Buck Louis, "Assessing Chemical Mixtures and Human Health: Use of Bayesian Belief Net Analysis," *Journal of Environmental Protection*, Vol. 3 No. 6, 2012, pp. 462-468. doi: 10.4236/jep.2012.36056.

References

- [1] G. M. Buck Louis, C. D. Lynch and M. A. Cooney, " Environmental Influences on Female Fecundity and Fertility," *Seminars in Reproductive Medicine*, Vol. 24, No. 3, 2006, pp. 147-155. doi:10.1055/s-2006-944421
- [2] G. Torf, L. Hagmar, A. Giwercman and J. P. Bonde, " Epidemiological Evidence on Reproductive Effects of Persistent Organochlorines in Humans," *Reproductive Toxicology*, Vol. 19, No. 1, 2004, pp. 5-26. doi:10.1016/j.reprotox.2004.05.006
- [3] A. Mayani, S. Barel, S. Soback and M. Almagor, " Dioxin Concentrations in Women with Endometriosis," *Human Reproduction*, Vol. 12, No. 2, 1997, pp. 373-375. doi:10.1093/humrep/12.2.373
- [4] B. Trabert, A. J. De Roos, S. M. Schwartz, U. Peters, D. Scholes, D. B. Barr, et al., " Non-Dioxin-Like Polychlorinated Biphenyls and Risk of Endometriosis," *Environmental Health Perspectives*, Vol. 118, 2010, pp. 1280-1285. doi:10.1289/ehp.0901444
- [5] K. B. Moysich, P. Mendola, E. F. Schisterman, J. L. Freudenheim, C. B. Ambrosone, J. E. Vena, et al., " An Evaluation of Proposed Frameworks for Grouping Polychlorinated Biphenyl (PCB) Congener Data

- [Open Special Issues](#)
- [Published Special Issues](#)
- [Special Issues Guideline](#)

[JEP Subscription](#)
[Most popular papers in JEP](#)
[About JEP News](#)
[Frequently Asked Questions](#)
[Recommend to Peers](#)
[Recommend to Library](#)
[Contact Us](#)

Downloads:	301,511
Visits:	673,597

Sponsors, Associates, and Links >>

- [The International Conference on Pollution and Treatment Technology \(PTT 2013\)](#)

into Meaningful Analytic Units," *American Journal of Industrial Medicine*, Vol. 35, No. 3, 1999, pp. 223-231. doi:10.1002/(SICI)1097-0274(199903)35:3<223::AID-AJIM2>3.0.CO;2-L

- [6] M. S. Wolff, D. Camann, M. Gammon and S. D. Stellman, " Proposed PCB Congener Groupings for Epidemiological Studies," *Environmental Health Perspectives*, Vol. 105, No. 1, 1997, pp. 13-14. doi:10.1289/ehp.9710513
- [7] A. Pauwels, P. J. C. Schepens, T. D' Hooghe, L. Delbeke, M. Dhont, A. Brouwer, et al., " The Risk of Endometriosis and Exposure to Dioxins and Polychlorinated Biphenyls: A Case-Control Study of Infertile Women," *Human Reproduction*, Vol. 16, No. 10, 2001, pp. 2050-2055. doi:10.1093/humrep/16.10.2050
- [8] P. S. Cooke, T. Sato and D. L. Buchanan, " Disruption of Steroid Hormone Signaling by PCBs," In: L. W. Robertson and L. G. Hansen, Eds., *PCBs: Recent Advances in Environmental Toxicology and Health Effects*, The University Press of Kentucky, Lexington, 2001, pp. 257-263.
- [9] G. M. Buck Louis, J. M. Weiner, B. W. Whitcomb, R. Sperrazza, E. F. Schisterman, D. T. Lodbell, et al., " Environmental PCB Exposure and Risk of Endometriosis," *Human Reproduction*, Vol. 20, No. 1, 2005, pp. 279-285. doi:10.1093/humrep/deh575
- [10] C. Gennings, R. Sabo and E. Carney, " Identifying Subsets of Complex Mixtures Most Associated with Complex Diseases: Polychlorinated Biphenyls and Endometriosis as a Case Study," *Epidemiology*, Vol. 21, 2010, pp. 77-84. doi:10.1097/EDE.0b013e3181ce946c
- [11] G. S. DiZerega, D. L. Barber and G. D. Hodgen, " Endometriosis: Role of Ovarian Steroids in Initiation, Maintenance, and Suppression," *Fertility and Sterility*, Vol. 33, 1980, pp. 649-653.
- [12] S. Kennedy, A. Bergqvist, C. Chapron, T. D' Hooghe, G. Dunselmans, R. Greb, et al., " ESHRE Guidelines for the Diagnosis and Treatment of Endometriosis," *Human Reproduction*, Vol. 20, No. 10, 2005, pp. 2698-2704. doi:10.1093/humrep/dei135
- [13] American Society for Reproductive Medicine, Practice Committee, " Endometriosis and Infertility," *Fertility and Sterility*, Vol. 86, No. 5, 2006, pp. S156-S160. doi:10.1016/j.fertnstert.2006.08.014
- [14] M. S. Bloom, G. M. Buck Louis, E. F. Schisterman and A. Liu, " Maternal Serum Polychlorinated Biphenyl Concentrations across Critical Windows of Human Development," *Environmental Health Perspectives*, Vol. 115, 2007, pp. 1320-1324. doi:10.1289/ehp.10086
- [15] D. J. Phillips, J. L. Pirkle, V. W. Burse, J. T. Pernert, L. O. Henderson and L. L. Needham, " Chlorinated Hydrocarbon Levels in Human Serum: Effects of Fasting and Feeding," *Archives of Environmental Contamination and Toxicology*, Vol. 18, No. 4, 1989, pp. 495-500. doi:10.1007/BF01055015
- [16] T. J. Bedford and R. M. Cooke, " Vines—A New Graphical Model for Dependent Random Variables," *Annals of Statistics*, Vol. 30, No. 4, 2002, pp. 1031-1068. doi:10.1214/aos/1031689016
- [17] A. M. Hanea, D. Kurowicka and R. M. Cooke, " Hybrid Method for Quantifying and Analyzing Bayesian