

## Summer Institute of Advanced Epidemiology and Preventive Medicine

### Exposure Assessment for Environmental Epidemiology Course – Summer Course 2013 Outline

Sunday – Thursday (July 7<sup>th</sup> - July 12<sup>th</sup>)

14:00 to 18:30

**Led by: Michael Brauer , PhD**

**Israeli Collaborators: Chava Peretz, PhD; Itzhak Benenson, PhD; David Broday, PhD**

Course Coordinator: Gali Cohen – [co.gali@gmail.com](mailto:co.gali@gmail.com)

Day	Time	Lecturer	Topic
Sun, 7 <sup>th</sup>	14:00-15:30	Michael Brauer	Overview: Exposure assessment in environmental health; Spatial and temporal variability; Intake fraction
	16:00-17:30	Michael Brauer	Applications to epidemiology
	17:45-18:30	Michael Brauer & Chava Peretz	Applications to risk assessment – <b>group exercise in class</b>
Mon, 8 <sup>th</sup>	14:00-15:30	Michael Brauer	Exposure modeling I: Exposure factors, time –activity, questionnaires
	16:00-17:30	Michael Brauer & Itzhak Benenson	Exposure modeling II: Dispersion models , Geospatial models (Interpolation, Kriging, Co-kriging, Land use regression), Remote sensing
	17:45-18:30	Michael Brauer & Itzhak Benenson	<b>Computer exercise in class</b>
Tue, 9 <sup>th</sup>	14:00-15:30	David Broday	Exposure measurement I: Environmental monitoring in Israel and various exposure assessment strategies
	16:00-17:30	Michael Brauer	Exposure Measurement II: Passive sampling, direct reading instrumentation, integrated exposure sampling, biomonitoring
	17:45-18:30	Michael Brauer	<b>Design your own exposure assessment</b>

Wed, 10 <sup>th</sup>	14:00-15:30	Michael Brauer	Residential exposures (Indoor-outdoor relationships, Indoor sources); Consumer products
	16:00-17:30	Chava Peretz	Determinants of exposure modeling – <b>computer exercise</b>
	17:45-18:30	Michael Brauer	<b>Design your own exposure assessment</b>
Thurs, 11 <sup>th</sup>	14:00-15:30	Chava Peretz	Exposure misclassification (impacts on exposure-response relationships); Study efficiency
	16:00-17:30	Chava Peretz	Examples of Israeli studies
	17:45-18:30	Michael Brauer	<b>Design your own exposure assessment</b>
Fri, 12 <sup>th</sup>	<b>Final exam (For those who wish to receive academic credit for the course)</b>		

## Summer Course - Environmental Exposure Assessment for Epidemiological Studies

7<sup>th</sup> -12<sup>th</sup> July, 2013

**Led by: Michael Brauer, ScD (The University of British Columbia)**  
**Israeli Collaborators: Chava Peretz, PhD (Tel-Aviv University); Itzhak Benenson, PhD (Tel-Aviv University); David Broday, PhD (Technion)**

**Description:** The course will introduce classical, contemporary, and cutting-edge approaches to the estimation of human exposure to environmental agents as it relates to epidemiologic studies as well as risk assessment, regulatory compliance, exposure source/route apportionment, and susceptibility factors.

Qualitative and quantitative methods in exposure science will be covered, including surrogate measures, exposure modeling (themes: geographic information systems and geospatial data, land use regression, dispersion modeling) and biological markers of exposure, in addition to methodological concepts such as exposure measurement error and efficient study design. Emphasis will be placed on examples from air pollution but other media and environmental stressors will also be included. Thus, in lectures, review of literature, case studies and practical exercises, students will gain familiarity with exposure assessment concepts and methodology and their applications to environmental health.

**Learning objectives:** At the end of this this course participants should be able to:

1. Describe the general concepts of exposure assessment as applied to environmental health, including epidemiology, risk assessment and evaluation of product safety.
2. Explain common approaches (direct and indirect measurement, modeling, biomarkers) to assess exposures to environmental contaminants
3. Use geo-statistical approaches to develop a basic exposure assessment for an environmental hazard
4. Illustrate how routinely collected information on environmental contaminants and human behavior can be used to estimate exposure
5. Understand how to use simple measurements to directly assess exposure
6. Appreciate the role of exposure misclassification in environmental epidemiology
7. Design an exposure assessment strategy for a selected environmental hazard

**Exercises: No advance preparation before the first class session is needed but if you are so inclined it may help you to think about these in advance – the exercises will be discussed in detail and explained during the class sessions and time will be provided to work through the exercises.**

**Design your own exposure assessment (Tuesday July 9, Wednesday July 10, Thursday July 11)**

We work through some exposure assessment approaches together in class, using topics/scenarios/settings that students identify. Students should identify an exposure/source, health outcomes of interest and (if desired) an epidemiologic study design (with rationale for design)

- The more specifics that can be provided the better
- Submit a few sentences to [michael.brauer@ubc.ca](mailto:michael.brauer@ubc.ca) (We will have time to work through ~6 of these suggested scenarios during the course)
- Considering a maximum budget of ~\$100,000 (see estimated costs) **we will work together as a class to design an exposure assessment strategy for this epidemiologic study.**

Approach	Cost
Questionnaire	10 x N
Physical Modeling	35,000
Personal monitoring	200 x N
Ambient monitoring	1000 x 1 month x 1 location
Biomonitoring	500 x N
GeoData/analysis	5,000 (existing data mapping/interpolation)
GeoData/analysis	20,000 (modeling)

N: sample size. Costs are hypothetical and generic. In reality these will vary considerably based on specific exposures, existing data/expertise, etc.

## 1. Warm-up Exercise (Sunday July 7):

- Consider the previous 24 hrs. For a hypothetical exposure to a contaminant in:
  - Air (Group 1)
  - Residential Water (Group 2)
  - Food (Group 3)
  - Household furnishings (Group 4)
- How did the factors indicated below impact exposure?
- Within you group, identify the suspected highest and lowest exposures in your group based on each factor that is relevant to the exposure? (e.g. if transportation distance and mode are important, who has the mode and longest/shortest transportation distance and what were these distances?)

Factors: Residential location, Transportation (Mode, Distance, Time), Work/school location, Type of work, Types of activities, Use of products, Activities (exercise/recreation, hobbies, tasks, etc.), Foods consumed, [Impact of age/demographics all of the above]

## 2. Applications in epidemiology (Sunday July 7):

Ishigami A, Hajat S, Kovats RS, Bisanti L, Rognoni M, Russo A, Paldy A. [An ecological time-series study of heat-related mortality in three European cities.](#) Environ Health. 2008 Jan 28;7:5. doi: 10.1186/1476-069X-7-5.

Dadvand P, de Nazelle A, Figueras F, Basagaña X, Su J, Amoly E, Jerrett M, Vrijheid M, Sunyer J, Nieuwenhuijsen MJ. [Green space, health inequality and pregnancy.](#) Environ Int. 2012 Apr;40:110-5. doi: 10.1016/j.envint.2011.07.004.

For the above two examples of epidemiologic studies, we will review the exposure assessment approach (not necessary, but if you want you can read these in advance).

- Can you suggest possibilities for exposure misclassification?
- What modifications would you suggest to reduce this misclassification?

### 3. Applications in risk assessment (Sunday July 7):

- Make a source-receptor model for a complex exposure\* and use it to produce estimates of exposure<sup>#</sup> for a risk assessment
  - Identify the major exposure pathways and routes
  - How would you expect exposures to differ between
    - A pregnant woman
    - A 2 yr old infant
  - What is the greatest source of uncertainty in your estimate?
  - Be sure to consider both levels in different media/microenvironments and behavioral exposure factors
- \*Mercury (Groups 1,2)
- \*Organophosphate pesticides (Groups 3,4) (you can choose to consider the full group of compounds or a specific pesticide such as chlorpyrifos or malathion)
  - <sup>#</sup>Minimally, identify the main factors that determine exposure levels and variability in exposure and identify possible data sources.
- <sup>#</sup> Ideally, prepare a rough quantitative estimate for pregnant women and 2 yr old infants

Background:

Mercury

- <http://www.epa.gov/hg/exposure.htm>
- <http://www.ehf.org.il/en/material/mercury>

Pesticides

- <http://www.epa.gov/opp00001/factsheets/riskassess.htm>
- <http://www.ehf.org.il/en/material/pesticides>

#### 4. Questionnaires (Monday July 8)

- You are asked to help assess exposure for a case control of myocardial infarction and the potential relationship with community noise amongst residents of Tel-Aviv.
- While you may have access to other sources of data (noise models, measurements – you can state your assumptions) one key tool for the exposure assessment is a questionnaire.
- Develop a mini-questionnaire (5-10 questions) to aid in the assessment exposure to important sources of noise in an urban area and provide a short explanation for the (inclusion of) each question.
- (do not worry about confounders and health outcomes, these are included in other portions of the questionnaire/study approaches)

#### 5. Exposure Modeling II – in class computer exercise (Monday July 8). Details provided in class

#### 6. Determinants of Exposure - in-class computer exercise (Wednesday July 10). Details provided in class.

### Bibliography (\*conceptual/background; #example)

**....Not necessary to read! These are provide for you in case you want more detail or to follow-up on course materials.**

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## Course Lecturers

### **Michael Brauer, ScD**

Michael Brauer is a Professor in the School of Population and Public Health at the University of British Columbia (UBC). He joined the UBC faculty in 1991 in the Department of Medicine and served as Director of the School of Environmental Health from 2003-2008. He currently serves as the Occupational and Environmental Health theme co-lead in SPPH and is Director of the Bridge Program, a strategic training fellowship program linking public health, engineering and policy. He also holds associate appointments in the Division of Respiratory Medicine and the Institute for Resources, Environment and Sustainability at UBC. Dr. Brauer received bachelor's degrees in Biochemistry and Environmental Sciences from the University of California-Berkeley (1986) and a doctorate in Environmental Health from Harvard University (1990). He was a visiting scientist at the Institute of Environmental and Occupational Medicine at Arhus University in Denmark (1991), at the Institute for Risk Assessment Sciences at Utrecht University in The Netherlands (2000) and at the East-West Center in Hawaii, USA (2008).

Dr. Brauer's research emphasis is on the assessment of exposure and health impacts of air pollution, with specific interest in transportation-related and biomass air pollution. He has participated in monitoring and epidemiological studies throughout the world and served on advisory committees to the World Health Organization (WHO), the US National Academy of Sciences and Institute of Medicine, the Royal Society of Canada, the International Joint Commission and governments in North America and Asia. He is an Associate Editor of Environmental Health Perspectives.

### **Chava Peretz, PhD**

Chava Peretz is a senior lecturer in the Department of Epidemiology, School of Public Health at Tel Aviv University. Dr. Peretz received bachelor's degree in Mathematics and Statistics from Tel Aviv University (1976) and a PhD in Occupational and Environmental Health from the Institute for Risk Assessment Sciences at Utrecht University in The Netherlands (2003).

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Dr. Peretz's research emphasis is on air pollution and health outcomes (e.g. mortality, birth defects, cardio-pulmonary diseases) on climate change and health (e.g. mortality, foodborne infectious diseases) and on neuro-epidemiology, especially in Parkinson's disease.