Instructors:  
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685-7189  
616-2722

Meetings:  
Class: Tuesday, 8:30 - 10:20;  
Laboratory: Thursday, 8:30-9:20  
HSB BB-1404  
Health Sciences Library Classroom C (except Classroom B on 3/5 and the DEOHS Computer Lab on 2/19)

Optional Help Sessions: Fridays 1:30-2:20  
(HS Library Lab ?)

Class Website: https://canvas.uw.edu/courses/947079

Office Hours:  By arrangement

Course Goals: This course will introduce students to quantitative aspects of occupational/environmental exposure data analysis with the goal of better understanding the nature of exposures and their interpretation for human health. Issues in the analysis and interpretation of exposure data will be explored through reading and discussions of the primary literature on exposure assessment methods. Practice exposure data analysis will be conducted using "real" exposure datasets and statistical analysis software. Specific topics will include:

1. Purposes and use of exposure data  
2. Exposure distributions and their description  
3. Sampling strategies  
4. Modeling of exposure  
5. Statistical and biological basis of exposure metrics  
6. Measurement error  
7. Special topics

Learning Objectives: By the conclusion of this class, students should be able to:

1. Describe the primary purposes of exposure assessment.  
2. Calculate and describe the meaning of measures of central tendency and distributional properties of normal and lognormal data.  
3. Describe and design major exposure assessment strategies, citing the logistical and statistical strengths and weaknesses of each.  
4. Develop, validate, interpret, and use multivariable linear models from existing exposure datasets to describe and predict exposures.  
5. Effectively use random, fixed and mixed models for exposure determinants.  
6. Identify importance of time-related factors in exposure distributions in predicting risk, including short-term peak exposures and the effects of biological dampening of variability.  
7. Describe sources and effects of different types of measurement error.  
8. Discern general lessons from and implications of primary research papers on exposure assessment methods, and use these lessons to design effective assessment strategies for future studies.
**Course Requirements:**

1. Read and be prepared to discuss weekly readings in class. (It is possible that written reflections of these assignments will be required. Regardless, be prepared with comments.) Due Tuesdays in class.

2. Complete weekly data analysis assignments, presented as summarized results and interpretation. (This means data analyses are in the form of a presentation (e.g., tables/figures) of results accompanied by a brief written description and interpretation.) Due Tuesdays.

3. Analyze a dataset to answer a set of specific questions and provide a written report including rationale, methods, results and discussion. Due finals week.

**Grading:**

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<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Class preparation/participation</td>
<td>25%</td>
</tr>
<tr>
<td>Homework Assignments</td>
<td>50%</td>
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<tr>
<td>Final paper</td>
<td>25%</td>
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**Software:** Students are encouraged to use Stata, and some assignments may require Stata familiarity. Use of other statistical software packages is acceptable, but assistance will not be available. All course-provided datasets will be backward compatible to Stata version 10.

**Texts:** Readings will be drawn primarily from the primary research literature. These and additional supplementary papers are posted on the class website.

The additional recommended texts listed below are on reserve in F225.


WEEK 1

6-Jan  2 Hours  Introduction and Basic Concepts  (NS)
Class structure, general introduction to term project
Introduction to datasets: DEMS, snapshot, Welding School Exposures
Exposure assessment for epidemiology, risk assessment, compliance
Descriptive statistics
Variability and uncertainty (including formulas for bias, precision and uncertainty)
Lognormal distribution and its parameters
Exceedance probabilities


8-Jan  1 Hour  Lab: Stata, Data, and Distributions  (LS)
Introduction to Stata, syntax, do files, logging results, exploring data, basic data analysis using the DEMS data

WEEK 2

13-Jan  Week 2  2 Hours  Regression Models  (LS)
Linear regression introduction Estimation vs. prediction goals Dummy Variables
Co-factors, Confounding, Interaction
Mean and variance models concepts
Model selection for association models

Friesen MC, Davies HK, Teschke K, Marion S, Demers PA. Predicting historical dust and wood dust exposure in sawmills: Model development and validation. JOEH, 2005, 2:650-8
Optional reading: Burstyn and Teschke 1999. Review on determinants modeling

Lab Due:  Data exploration

15-Jan  1 Hour  Lab: Fitting and Interpreting Regression Models  (LS)
Regression model practice using the Infiltration data
WEEK 3

20-Jan  2 Hours  Exposure Assessment Strategies (NS)
Survey design
Sample size
Exposure Metrics
Individual, task and group assessment
Concept of HEGs/SEGs – history and use in compliance monitoring and surveillance
Variance components concepts

Readings Due:  DEMS IV – Vermeulen et al 2012


Lab Due:  Regression models

22-Jan  1 Hour  Lab:  Presentation and precision of distribution parameters (NS)
Exceedance fractions, sample size and compliance exercise using the DEMS data. Includes assessing distributions, calculation of lognormal (LN) parameters, exceedance. Data presentation principles.

22-Jan  1 Hour  Special Extra Session:  Discuss DEMS with Roel Vermeulen
9:30-10:30; Details to be provided later

WEEK 4

27-Jan  2 Hours  Prediction Modeling and Validation (LS)
Regression for prediction
Model selection for prediction
Validating regression models: In sample vs. out of sample validation, cross validation
Bias-variance tradeoff


Lab Due:  DEMS V – Stewart et al 2012
Distributions

29-Jan  1 Hours  Lab:  Prediction Modeling and Validation (LS)
Bias-variance tradeoff and cross-validation exercise using the Snapshot data
**WEEK 5**

3-Feb 2 Hours Review and DEMS Papers Discussion (NS)

Discussion on papers and material read up to this point
Introduction of Term Paper Assignment and Discussion of Approach

Readings

DEMS IV – Vermeulen et al 2012


Also reconsider:

DEMS II – Coble
DEMS V – Stewart et al 2012

Lab Due: Cross-validation

5-Feb 1 Hour Begin Term Project Lab Assignment (NS)

Explore and select models for prediction using personal REC data
Explore and describe CO historical data and covariates

**WEEK 6**

10-Feb 2 Hours Variance Components and Mixed Models (LS)

Variance components estimation
Integration of variance components and regression: Mixed models

Readings Due:


Lab Due: None

12-Feb 1 Hour Lab: Variance Components from Mixed Models (LS)

Fit a mixed model, adjusting variable included in random and fixed terms and provide contrasting interpretations. Describe fixed and random effects in Welding School data.
WEEK 7

17-Feb  2 Hours  Measurement Error in Epidemiology (LS)
Misclassification
Regression measurement error
Classical and Berkson error models
Consequences and exceptions


Lab Due:  Variance Components

19-Feb  1 Hour  Lab: Measurement Error Exercise (LS)
Measurement error exercise using simulation

WEEK 8

24-Feb  2 Hours  Special Topic: Air Pollutantion Exposure Modeling (LS)
Land Use Regression (LUR) with extension to geostatistical smoothing. Kriging and variograms.


Lab Due:  Measurement Error

26-Feb  1 Hour  Lab: Geostatistics and Universal Kriging (LS)
Geostatistics: Kriging and Variograms using the Snapshot data
WEEK 9
3-Mar 2 Hours Bayesian Decision-making (NS/LS)
Bayes Theorem
Subjective/Expert estimation
Combining data sources
Bayesian estimation and decision making


Add’l Background:

Lab Due: Geostatistics and Variograms

5-Mar Week 9 1 Hours Lab: Bayesian Estimation (NS)
Details to be added

WEEK 10

10-Mar 2 Hours Special Topic: Exposure Models in Management (NS)
Control and Exposure Banding,
Stoffenmanager and Advanced Reach Tool Applications

Readings Due: ?

12-Mar 1 Hours Lab: Problem-solving for term project (NS)
Review and problem-solving for term project

EXAM WEEK

16-Mar
Term project due