

## **NUTR 813: NUTRITIONAL EPIDEMIOLOGY, SPRING 2015**

**COURSE OBJECTIVES:** The course introduces students to key concepts and methods in Nutrition Epidemiology in order to equip them with the tools needed to design, analyze, and critically evaluate population-based nutrition research. Through team-based discussions, lectures, computer exercises, and homework, this course aims to provide students with hands-on experience in selecting nutritional measures, and in analyzing and interpreting data. The course is intended for second year Master's students and first or second year PhD students depending on experience; knowledge in nutrition is desirable but not required. Prerequisites include basic biostatistics and introductory epidemiology. Two major themes are addressed.

I. Measures. The course will discuss and debate the utility of alternative methods for nutritional measures in three major areas: (i) dietary intakes (foods, nutrients, non-nutrients, diet patterns, food contaminants); (ii) nutritional status including obesity; and (iii) various dimensions of physical activity and inactivity. An in-depth understanding of these measures is fundamental for correctly interpreting and evaluating nutritional epidemiology literature, which is essential for successful practice and research in clinical as well as public health nutrition.

II. Analysis, interpretation and critical evaluation. Appropriate data analysis, taking into account issues such as measurement error and bias, is also essential for effective research that reaches valid conclusions. To provide practical experience on this issue, the course includes a hands-on introduction to the analysis of nutritional data, as well as active participation in interpreting and evaluating the analytic methods applied in published research.

Competencies: Students are expected to gain competency in the following areas:

1. Describe strengths and weaknesses of common dietary assessment methods in the context of particular populations and specific research topics.
2. Evaluate and propose appropriate dietary assessment methods for different research scenarios, study designs, and practical constraints (e.g. subject burden, budget), including proposing modifications to existing instruments.
3. Describe the primary strengths and weaknesses of common methods used in epidemiological research to assess (a) nutritional status, with an emphasis on obesity; and (b) physical activity. Students should be able to evaluate these strengths and weaknesses in the context of their application to specific population groups and particular research topics.
4. Evaluate and suggest appropriate measures of obesity and physical activity for particular research scenarios and study designs, keeping in mind practical constraints.

5. Critically interpret and evaluate scientific literature in nutritional epidemiology taking into account issues such as: the appropriateness of the study design and measures used for the research question; potential sources of error or bias; and adequacy of the data analysis approaches used.
6. Be equipped to conduct or help to guide the basic (Master's) or intermediate/advanced (PhD) analysis of nutritional epidemiology data involving measures of dietary intake, including addressing potential confounding by energy intake.

**Tuesdays and Thursdays, 9:30-10:45**

**235 Rosenau Hall**

**\* Indicates separate breakout groups for doctoral vs. MPH students in Rosenau 241**

**Recommended Textbooks (HSL library and NUTR student room)**

-Willett W. Nutritional Epidemiology

-Hu FB. Obesity Epidemiology

**Instructors**

-Michelle Mendez, McGavran-Greenberg 2205A (office hours Tuesday, 10:50-11:50 and by appointment)

-Co-instructor: Sandra Albrecht, 137 E Franklin St, Carolina Population Center (office hours TBA and by appointment)

**Teaching assistants**

-Melecia Wright (office hours Thursday, 10:50-11:50am & by appointment, McGavran-Greenberg 2221)

-Fei Dong (office hours Thursday, 10:50-11:50am & by appointment, McGavran-Greenberg 2221)

**Grades** will be based on:

- Active participation in class exercises/case studies: 10 points
- Epi quiz: 5 points
- Homework assignments (diet data tools; food composition; group in-class physical activity exercise) : 15 points
- Mid-term exam: 20 points
- Group analysis project: Introduction to data analysis in nutritional epidemiology: 20 points
- Final paper (3-5pages): 30 points

### **Turning in assignments**

- Please save all files as Word Docs with the following convention: *assignment\_lastname\_first name.doc* or *assignment\_group#* for group work. Examples: *hw1\_smith\_ann.doc* / *projectpart1\_group1.doc*
- Post all individual assignments by the due date to your personal Dropbox on Sakai. For all group assignments, please post your assignments by the due date to your Group's Drop Box. These will be located under Resources->Assignments and Project --> Group DropBox --> [individual groups that only members and instructors can see].
- We will also use your respective Dropboxes to return all assignments to you.

## **DETAILED SYLLABUS WITH READINGS**

### **EPIDEMIOLOGY CONCEPTS AND METHODS REVIEW SESSION: STRONGLY RECOMMENDED**

**January 12, 2015**

***Learning objectives:*** Review basic study designs, interpretation of different measures of association, potential sources of bias (e.g. selection, information bias such as recall bias, confounding), and criteria for causal relationships. The main objective is to provide a solid review for students who have had only a brief introduction to basic epidemiology methods and concepts. **There will be a short quiz based on the material covered.**

### **INTRODUCTION TO THE COURSE**

## 1: Thursday Jan 8

[1a] **Introduction to nutritional epidemiology** Overview of the scope of nutrition epidemiology research and syllabus review exercise [MM].

[1b] **Case study exercise:** Adapting a dietary intake assessment tool to meet study aims: group discussion. [MM]

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**Learning objectives:** Course overview. Introduce objectives and challenges in nutritional epidemiology research, noting the broad scope of the field, and describing challenges involved in measuring the main variables of interest (diet, activity, nutritional status).

**Required readings:** None

## PART 1A (MEASURES): ASSESSMENT OF FOOD INTAKES

### 2: Tuesday Jan 13

[2a] **Small group brainstorming** [35 min]: *The participant perspective on dietary assessment*—how might factors such as time required, cognitive burden, and social desirability affect intake reporting? Students will prepare to meet in small groups to develop a list of pros and cons of using alternative methods to collect data on usual intake of major food groups, keeping in mind challenges of providing such data from the perspective of the *respondent*. Keep in mind personal experiences from the preparatory assignment below, which is to complete a dietary 24h recall, a diet record, an FFQ, and a brief fruit and vegetable screener. **Readings:** Be prepared to integrate/discuss Thompson et al (*especially Table 1*) and Scagliusi et al (*especially paragraph 3 of results and Table 3*) in developing your pros and cons.

[2b] **Dietary assessment overview:** Building on the group activity, we will review the main methods for dietary assessment, focusing on strengths and limitations of each approach. We will also conduct a brief review of potential research/clinician goals of conducting a dietary assessment (e.g. estimate intakes of various dietary factors to assess compliance with guidelines, assess nutrient status, evaluate a policy or intervention program, or evaluate relationships with health outcome). [30 min MM]

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**Learning objectives:** Heighten awareness of how alternative dietary assessment methods and participant characteristics may influence the quality/validity of self-reported dietary data.

### ***Required preparatory activities:***

-Partial completion of a 24-h recall, a diet record, an FFQ, and a fruit and vegetable screener. Instruments can be found at:

1. ASA24 recall: <http://asa24demo.westat.com/> [input at least 2 meals];
2. Diet record/ diary: In excel or word using format as in: [http://www.nhlbi.nih.gov/health/educational/lose\\_wt/eat/diary.htm](http://www.nhlbi.nih.gov/health/educational/lose_wt/eat/diary.htm) [input at least 1 large meal, noting ingredients in as much detail as possible (oils, condiments, etc.)]
3. Food frequency questionnaire [the NCI's Diet History Questionnaire]: [http://appliedresearch.cancer.gov/archive/dhq2/dhq2\\_pastmonth.pdf](http://appliedresearch.cancer.gov/archive/dhq2/dhq2_pastmonth.pdf) [complete at least 50%];
4. F&V screener: <http://riskfactor.cancer.gov/diet/screeners/fruitveg/allday.pdf> [complete in full].

### ***Required readings:***

-Thompson FE, Subar A F. Dietary assessment methodology. Chapter 1. NCI Assessing Dietary Intakes. [http://riskfactor.cancer.gov/diet/adi/thompson\\_subar\\_dietary\\_assessment\\_methodology.pdf](http://riskfactor.cancer.gov/diet/adi/thompson_subar_dietary_assessment_methodology.pdf)

-Scagliusi FB et al. Selective underreporting of energy intake in women: magnitude, determinants, and effect of training. *J Am Diet Assoc.* 2003 Oct;103(10):1306-13.

### ***Suggested readings/resources for future reference:***

-Hu textbook, pp 84-88

-Willett textbook, pp. 4 to 148

### ***Begin homework assignment 1 (due Jan 22)—dietary assessment***

**comparisons:** Students will review and compare reported intakes of energy and selected nutrients (dietary fat, fiber) obtained using 24-h recalls, diet records and an FFQ.

### **3: Thursday Jan 15**

[3a] **Small group case study: dietary assessment consulting** [15 min small group discussion/20 min class feedback to groups]. *The researcher perspective on dietary assessment.* Each group has been asked to advise a research group on appropriate dietary assessment methods for *one* of the following studies: (a) a randomized weight loss intervention in overweight and obese adults involving reduced sedentarism and

dietary behavior changes (e.g. increased fruit and vegetable intakes); (b) a case-control study on dietary risk factors (e.g. fruit/vegetable or cereal fiber; probiotics) for irritable bowel syndrome, believed to develop over many years, and (c) a prospective study which will explore diet quality (e.g. fruit and veg intake) and incident obesity in a small multi-ethnic cohort of 9-10y old children, and (d) a prospective cohort study on maternal diet during pregnancy and infant neurodevelopment at one year of age, with a particular interest in fish consumption. As limited resources are available for collecting these data, the researchers have asked about the possibility of using low-cost approaches such as web-based methods, or brief tools. What approach will you suggest they use to collect dietary data? Justify your recommendation. *Readings:* Keep in mind to mention in your justification any relevant findings from Bingham et al (*esp Table 4 and Figure 1*), Mendez et al (*esp Figure 2 and Table 3*), and Martínez-González et al (*e.g. Table 3*).

[3b] **Strengths, weaknesses and validity of dietary assessment methods:** Building on small group activity, review typical sources of error and bias in estimates of dietary intake including variation; approaches for validating intakes [35 min MM].

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**Learning objectives:** Provide insights on how the choice of dietary assessment method depends on study goals and designs.

**Required readings:**

-Bingham S et al. Associations between dietary methods and biomarkers, and between fruits and vegetables and risk of ischaemic heart disease, in the EPIC Norfolk Cohort Study. *Int J Epidemiol.* 2008 Oct;37(5):978-87.

-Mendez MA et al. Under- and overreporting of energy is related to obesity, lifestyle factors and food group intakes in Jamaican adults. *Public Health Nutr.* 2004;7(1):9-19.

-Martínez-González MA et al. A 14-Item Mediterranean Diet Assessment Tool and Obesity Indexes among High-Risk Subjects: The PREDIMED Trial. *PLoS One.* 2012;7(8):e43134

**Suggested readings/resources for future reference:**

-Sempos CT et al. Effects of intraindividual and interindividual variation in repeated dietary records. *Am J Epidemiol.* 1985 Jan;121(1):120-30.

-Greene GW et al. Correspondence of the NCI Fruit and Vegetable Screener to repeat 24-H recalls and serum carotenoids in behavioral intervention trials. *J Nutr.* 2008 Jan;138(1):200S-204S

-Ma Y et al. Seasonal variation in food intake, physical activity, and body weight in a predominantly overweight population. *Eur J Clin Nutr.* 2006 Apr;60(4):519-28.

## **Tuesday Jan 20**

[4a] **Dietary patterns:** Rationale for studying dietary patterns. Methods for developing and analyzing patterns that account for health effects of multiple dietary factors in dietary patterns [30 minutes MM]

[4b] **Debate on dietary pattern methods\*:** The class will break into groups to debate the pros and cons of assessing dietary patterns using either (i) an *a priori* method (eg Mediterranean diet scores, Healthy Eating Index) or (ii) data-driven methods (e.g. factor or cluster analysis). [10 min brainstorming, 20 min debate]. -Readings: In your discussions, build on information from Reedy et al *Table 1 (overview of interpreting different types of patterns)*; Fung et al methods section (*especially methods section on construction of alternative a priori indices*), and Varraso et al (*results table illustrating distribution of food intakes across factor scores*).

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**Learning objectives:** To discuss how synergies in health effects of multiple foods/nutrients can be potentially relevant for health outcomes. To raise awareness of the difference questions being addressed by research applying a priori vs. data-driven methods for developing dietary patterns. To discuss the relevance of exploring diet-disease relationships at multiple levels, including individual nutrients and foods as well as overall patterns.

### **Required readings:**

-Reedy J, Wirfält E, Flood A, Mitrou PN, Krebs-Smith SM, Kipnis V, Midthune D, Leitzmann M, Hollenbeck A, Schatzkin A, Subar AF. Comparing 3 dietary pattern methods--cluster analysis, factor analysis, and index analysis--With colorectal cancer risk: The NIH-AARP Diet and Health Study. *Am J Epidemiol.* 2010 Feb 15;171(4):479-87.

-Fung TT, McCullough ML, Newby PK, Manson JE, Meigs JB, Rifai N, Willett WC, Hu FB. Diet-quality scores and plasma concentrations of markers of inflammation and endothelial dysfunction. *Am J Clin Nutr.* 2005 Jul;82(1):163-73.

-Varraso R, Fung TT, Barr RG, Hu FB, Willett W, Camargo CA Jr. Prospective study of dietary patterns and chronic obstructive pulmonary disease among US women. *Am J Clin Nutr.* 2007 Aug;86(2):488-95.

*Suggested readings/resources for future reference:*

-Hu FB. Dietary pattern analysis: a new direction in nutritional epidemiology. 2002

-Mendez MA, Popkin BM, Jakszyn P et al. Adherence to a Mediterranean diet is associated with reduced 3-year incidence of obesity. J Nutr. 2006 Nov;136(11):2934-8. *See especially: Methods section paragraph on constructing diet score and Figure 1.*

**PART 1B (MEASURES): ASSESSMENT OF NUTRITIONAL STATUS**

**5: Thursday Jan 22**

**Short epi methods take-home quiz handed out in class today (DUE Jan 29)**

[5] **Assessment of nutritional status, part 1** [60 min SA or MM with integrated discussion] Use and interpretation of anthropometric and more direct measures of body composition/adiposity; sources of error and bias; relationships between anthropometry and measures of adiposity; use of multiple measures of obesity. *Readings:* Be prepared to discuss table 4 and Figure 2 of Janssen et al.

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**Learning objectives:** Highlight sources of error and bias in anthropometric as well as direct measures of obesity (e.g. inter-observer variability, bioelectric impedance prediction equations), differences in interpretation, and strengths as well as limitations of various measures.

**Required readings (for discussion in class):**

-Janssen I, Mark AE. Separate and combined influence of body mass index and waist circumference on coronary artery disease risk factors among children and adolescents. Pediatrics. 2005 June;115(6):1623-30. *Be prepared to discuss Table 4 and Figure 2.*

-Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ. 2000 May 6;320(7244):1240-3.

*Suggested readings/resources for future reference:*

-Ashwell M, Gunn P, Gibson S. Waist-to-height ratio is a better screening tool than waist circumference and BMI for adult cardiometabolic risk factors: systematic review and meta-analysis. *Obes Rev.* 2012 Mar;13(3):275-86

-Shah NR, Braverman ER. Measuring adiposity in patients: the utility of body mass index (BMI), percent body fat, and leptin. *PLoS One.* 2012;7(4):e33308.

**Upload your homework assignment 1 to your Drop Box: Comparison of data from alternative dietary assessment methods**

**6: Tuesday Jan 27\***

[6] **Assessment of nutritional status, part 2** [60 min SA or MM with integrated discussion] Use and interpretation of anthropometric and more direct measures of body composition/adiposity; sources of error and bias; relationships between anthropometry and measures of adiposity; use of multiple measures of obesity. *Readings:* Be prepared to discuss table 4 and Figure 2 of Janssen et al.

**7: Thursday Jan 29**

[7a] **Small group debates** on two topics: 1) Should different BMI cutpoints be used for different ethnic groups when comparing adult overweight and obesity across the globe? And 2) Should a single waist circumference criterion be used for all US children and adolescents or should ethnic group specific criterion be utilized? *Readings:* Be prepared to cite the assigned readings to support the side of the debate to which you are assigned.

[7b] **Assessment of nutritional status, part 3:** Building on the debate, provide lecture to review approaches to the assessment of obesity in global and diverse populations [30 min SA or MM]

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**Learning objectives:** Highlight variable associations between direct measures of adiposity and anthropometry across populations.

**Required readings (for discussion in class):**

-Flegal KM, Ogden CL, Yanovski JA, Freedman DS, Shepherd JA, Graubard BI, Borrud LG. High adiposity and high body mass index-for-age in US children and

adolescents overall and by race-ethnic group. Am J Clin Nutr. 2010 Apr;91(4):1020-6. (See especially figure 3)

-Yajnik CS, Yudkin JS. The Y-Y paradox. Lancet. 2004 Jan 10;363(9403):163.

-WHO expert consultation, Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004 Jan 10; 363: 157-63.

-Messiah SE et al. Ethnic group differences in waist circumference percentiles among U.S. children and adolescents: estimates from the 1999-2008 National Health and Nutrition Examination Surveys. Metab Syndr Relat Disord. 2011 Aug;9(4):297-303

***Suggested readings/resources for future reference:***

-Freedman DS, Ogden CL, Berenson GS, Horlick M. Body mass index and body fatness in childhood. Curr Opin Clin Nutr Metab Care. 2005 Nov;8(6):618-23.

**Turn in epi methods quiz before class.**

**PART 1C (MEASURES): ASSESSING INTAKES OF NUTRIENTS, NON-NUTRIENTS**

**\*8: Tuesday Feb 3**

[8a] **Biomarkers** in nutritional epidemiology: Challenges and considerations in the use of biomarkers as proxies or gold standards of dietary intakes, including variability related to within-person/daily changes, seasonal effects, genetic and other influences on metabolism, and factors that may impact bioavailability and turnover. [30 minutes MM]

[8b] \*Group discussion on (a) impact of factors such as supplement use, tobacco, alcohol and genetics on the interpretation of biomarker vs. dietary intake measures of vitamin C, (b) use of biomarkers in the validation and calibration of dietary instruments.

Readings: Be prepared to discuss Table 4 of Prentice et al, which shows associations between energy intake and different types of cancer before and after biomarker calibration.

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**Learning objectives:** Review biomarker media reflecting dietary intakes (blood, urine, adipose tissue, nails, hair), the interpretation of different types of biomarkers (concentration, recovery, replacement), and factors that influence biomarker variability. Describe the use of biomarkers to validate, calibrate and substitute for intake estimates, and limitations such as the absence of reliable markers for many diet components.

**Required readings:**

-Hu, Obesity Epidemiology, pp 88-100

-Prentice RL, Shaw PA, Bingham SA et al. Biomarker-calibrated energy and protein consumption and increased cancer risk among postmenopausal women Am J Epidemiol. 2009 Apr 15;169(8):977-89.

**Suggested readings/resources for future reference:**

-Dehghan M, Akhtar-Danesh N, McMillan CR, Thabane L. Is plasma vitamin C an appropriate biomarker of vitamin C intake? A systematic review and meta-analysis. Nutr J. 2007 Nov 13;6:41.

-Crews H, Alink G, Andersen R, Braesco V et al. A critical assessment of some biomarker approaches linked with dietary intake. Br J Nutr. 2001 Aug;86 Suppl 1:S5-35

-Potischman N. Biologic and methodologic issues for nutritional biomarkers. J Nutr. 2003 Mar;133 Suppl 3:875S-880S.

-Shai I, Rosner BA, Shahar DR, Vardi H, Azrad AB, Kanfi A, Schwarzfuchs D, Fraser D; DEARR study. Dietary evaluation and attenuation of relative risk: multiple comparisons between blood and urinary biomarkers, food frequency, and 24-hour recall questionnaires: the DEARR study. J Nutr. 2005 Mar;135(3):573-9.

**9: Thursday Feb 5**

**[9] Development and use of food composition tables (nutrients and non-nutrients)**

[9a] Part 1: Overview of major food composition resources, challenges in linking intake data with FCTs, and the range of dietary factors of interest to estimate using FCTs (n-3s, PAHs, glycemic index, antioxidant capacity) [20 min MM].

[9b] Part 2: Methods being used to improve the precision of FCT data by the UNC Food Research Program (FRP) [50 min]. In-class exercise by FRP.

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**Learning objectives:** Introduce the challenge of compiling sufficiently valid food composition data. Review major sources of food composition data and potential discuss sources of error, including variability in nutrient content and missing values.

**Required readings:**

-Pennington JA, Stumbo PJ, Murphy SP, McNutt SW, Eldridge AL, McCabe-Sellers BJ, Chenard CA. Food composition data: the foundation of dietetic practice and research. J Am Diet Assoc. 2007 Dec;107(12):2105-13.

**Suggested readings/resources for future reference:**

-Garcia V, Rona RJ, Chinn S. Effect of the choice of food composition table on nutrient estimates: a comparison between the British and American (Chilean) tables. Public Health Nutr. 2004 Jun;7(4):577-83.

-Gibson R. Principles of Nutritional Assessment, Chapter 4, pp 65 through 69.

-Jakszyn P, Agudo A, Ibáñez R, García-Closas R, Pera G, Amiano P, González CA. Development of a food database of nitrosamines, heterocyclic amines, and polycyclic aromatic hydrocarbons. J Nutr. 2004 Aug;134(8):2011-4.

-Directory of international food composition data: [http://www.fao.org/infoods/directory\\_en.stm](http://www.fao.org/infoods/directory_en.stm)

-Composition of Foods Raw, Processed, Prepared. USDA National Nutrient Database for Standard Reference, Release 25: [http://www.ars.usda.gov/SP2UserFiles/Place/12354500/Data/SR25/sr25\\_doc.pdf](http://www.ars.usda.gov/SP2UserFiles/Place/12354500/Data/SR25/sr25_doc.pdf)

**Begin homework assignment 2 (due Feb 12):** Short exercise on adapting **food composition data** for use in a global context.

**PART 1D (MEASURES): ASSESSMENT OF PHYSICAL ACTIVITY (ENERGY EXPENDITURE)**

**10: Tuesday Feb 10**

[10a] **Physical activity assessment and analysis:** Critical review of subjective and objective methods for measuring different types of physical activity and sedentarism [40 min SA or MM].

[10b] **Start group homework exercise (due Feb 19)** on the challenges of physical activity assessment using self-reports.

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**Learning objectives:** Review of main methods for assessing self-reported and objective measures of physical activity and inactivity (recalls, records and other questionnaires), as well as objective measures activity (pedometers, accelerometers, heart rate monitoring, doubly-labeled water). Critical assessment of the strengths and limitations of alternative approaches.

**Required readings:**

-Lagerros YT, Lagiou P. Assessment of physical activity and energy expenditure in epidemiological research of chronic diseases. *Eur J Epidemiol.* 2007;22(6):353-62.

**Suggested readings:**

-Ainsworth BE, Haskell WL et al. Compendium of physical activities: an update of activity codes and MET intensities. *Med Sci Sports Exerc.* 2000;32(9 Suppl):S498-504.

-Welk GJ, Corbin CB, Dale D. Measurement issues in the assessment of physical activity in children. *Res Q Exerc Sport.* 2000;71(2 Suppl):S59-73.

-Wareham NJ, van Sluijs EM, Ekelund U. Physical activity and obesity prevention: a review of the current evidence. *Proc Nutr Soc.* 2005;64(2):229-47.

**Homework assignment:** Become familiar with accessing the statistical analysis software STATA via the UNC virtual computing lab, which we will begin to use in the next class. <https://vcl.unc.edu/index.php?mode=selectauth>

**Begin group homework assignment 3 (due Feb 19):** Students will begin in class a short exercise in which they will evaluate the ability of alternative physical activity questionnaires to rank subjects with respect to activity-related energy expenditure, compared with more detailed data from an activity diary.

**PART 2A (ANALYZING/INTERPRETING DATA): HYPOTHESIS GENERATION AND CONFOUNDING**

**\*11: Thursday Feb 12**

[11a] **Introduction to data analysis issues:** Integrating hypothesis generation, design and analysis [30 min SA or MM].

[11b] **\*Begin data analysis lab project, part 1 (DUE FEB 26):** Overview of STATA commands for descriptive analyses. Introduction to descriptive analysis: begin estimating food group intakes from FFQ data, and estimating the prevalence of child overweight [30 minutes, TAs].

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**Learning objectives:** Developing study hypotheses and specific aims in nutritional epidemiology; introduction to conducting appropriate basic data analyses in nutritional epidemiology.

**Required readings:** *None*

**Suggested readings:**

- Wang Y, Beydoun MA. Meat consumption is associated with obesity and central obesity among US adults. *Int J Obes (Lond)*. 2009 Jun;33(6):621-8. Epub 2009 Mar 24.

**Upload your homework assignment 2 to your Drop Box: adapting food composition data for use in a global context.**

**\*12: Tuesday Feb 17**

[12a] **Data analysis and study design continued: Confounding and interactions** [30-40 mins, TAs].

[12b] **\*Group discussion (30 mins):** How might socioeconomic, lifestyle and community factors influence reported intakes and diet-disease associations? What are other key potential confounders or diet-disease associations? –*Readings:* Kesse et al (especially Figure 1). Be prepared to brainstorm about the types of community and policy as well as individual factors they think may influence patterns and trends in diet and physical activity, and whether/how these factors should be taken into account in study designs and analyses.

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**Learning objectives:** Reinforce understanding of the concepts of confounding and effect modification, how these concepts differ, and how multivariate analyses can try to address these issues. Discuss lifestyle, socioeconomic and sociodemographic (disparities) factors, as well as other dietary variables, as potential confounders in diet-disease research.

**Required readings and activities:**

-Kesse E, Clavel-Chapelon F, Slimani N, van Liere M; E3N Group. Do eating habits differ according to alcohol consumption? *Am J Clin Nutr.* 2001;74(3):322-7.

**Suggested readings:**

-Mullie P, Clarys P, Hulens M, Vansant G. Dietary patterns and socioeconomic position. *Eur J Clin Nutr.* 2010 Jan 20.

**\*13: Thursday Feb 19**

[13a] **Challenges in the analysis of dietary data continued: Energy adjustment, and introduction to dietary data validation and calibration** [MM]. \*Group discussion: interpreting energy-adjusted data.

[13b] **\*Begin data analysis exercise part 2 (DUE MARCH 5):** Continue analysis including calculation of energy-adjusted intakes using the density method and discussion of interpretation vs. absolute intakes.

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**Learning objectives:** Overview of alternative methods for adjusting for total energy intake and of how to interpret adjusted intake measures. Introduce the use of alternative dietary measures to calibrate intake data.

**Required readings:**

-Mackerras D. Energy adjustment: the concepts underlying the debate. *J Clin Epidemiol.* 1996;49(9):957-62.

-Thiébaud AC, Kipnis V, Chang SC, Subar AF, Thompson FE, Rosenberg PS, Hollenbeck AR, Leitzmann M, Schatzkin A. Dietary fat and postmenopausal invasive breast cancer in the National Institutes of Health-AARP Diet and Health Study cohort. *J Natl Cancer Inst.* 2007 Mar 21;99(6):451-62.

**Suggested readings:**

-Hu text pp 101-108

-Willett text pp 288-298, also 273-288

**Post homework assignment 3 to your group's Drop Box: physical activity measures.**

## **PART 2B (ANALYZING/INTERPRETING DATA): IMPLICATIONS OF STUDY DESIGNS**

**\*14: Tuesday Feb 24**

[14a] **Study designs 1: Ecological, cohort, case-control and cross-sectional studies:** Strengths and weaknesses of different designs to keep in mind when evaluating the literature [30-40 min TAs].

[14b] **\*Data analysis lab project, part 3 (DUE MARCH 17):** Continue data analysis project work (i) begin to estimate the bivariate association between intakes of these food groups and child overweight. (i) multivariate analysis of the association between selected food groups and child obesity.

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**Learning objectives:** Reinforce the potential impact of issue including basic designs, sample selectivity (poor response rates, loss to follow-up, missing data) and information bias (recall bias, measurement error, systematic misreporting) on estimates of diet-disease relationships.

### **Required readings:**

-Riboli E, Norat T. Epidemiologic evidence of the protective effect of fruit and vegetables on cancer risk. *Am J Clin Nutr.* 2003 Sep;78(3 Suppl):559S-569S.

-Freedman LS, Schatzkin A, Midthune D, Kipnis V. Dealing with dietary measurement error in nutritional cohort studies. *J Natl Cancer Inst.* 2011 Jul 20;103(14):1086-92.

**Suggested readings/resources for future reference:**

-Metcalf BS, Hosking J, Jeffery AN, Voss LD, Henley W, Wilkin TJ: Fatness leads to inactivity, but inactivity does not lead to fatness: a longitudinal study in children (EarlyBird 45). Arch Dis Child 2010.

**\*15: Thursday Feb 26**

[15] **Study designs 2: Randomized Trials vs. Observational studies (TBA):** This session will introduce and reinforce key considerations in developing and evaluating randomized trials and intervention studies, highlighting strengths and limitations of interventions and RCTs relative to observational designs. The lecture will also introduce students to the methods and aims of important nutrition intervention studies such as DASH and DPP.

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**Learning objectives:** Review strengths and limitations of interventions and RCTs relative to observational designs. Highlight the critical importance of the randomization process in RCTs.

**Required readings:** None

**Suggested readings:**

-Byers TE. Nutrition and cancer: ten lessons from the 20th century. Nutrition. 2000 Jul-Aug;16(7-8):561-3.

-Natarajan L, Pu M, Fan J, Levine RA, Patterson RE, Thomson CA, Rock CL, Pierce JP. Measurement error of dietary self-report in intervention trials. Am J Epidemiol. 2010 Oct 1;172(7):819-27.

**Turn in data analysis lab project, part 1 (Post it to your group's Drop Box).**

**Begin take-home mid-term, individual assignment: Due on March 19.**

**PART 2C (ANALYZING/INTERPRETING DATA): CRITICAL EVALUATION**

**\*16: Tuesday Mar 3**

[16] **\*Evaluating a nutrition epidemiology study:** Students will form groups to conduct a case study based on the Halton et al paper below on approaches to critically evaluating, in depth, an individual nutrition epidemiological study, including use of the STROBE guidelines. This exercise will build on issues addressed in class to date (e.g. study design, measures used, error and bias, confounding).

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***Required readings:***

-von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet. 2007 Oct 20;370(9596):1453-7.

-Halton T, Willett W, Liu S, Manson J, Stampfer M, Hu F. Potato and French fry consumption and risk of type 2 diabetes in women. Am J Clin Nutr 2006; 83:284-90.

**\*17: Thursday Mar 5**

[17a] **Case study: conducting a critical review of nutritional epidemiology literature** [30 min lecture].

[17b] **\*Small group case study discussion** [20 min small groups/20 min class discussion]: Four small groups will each design a new study to increase knowledge on the topic presented, taking into account limitations of existing literature presented in class. Proposed projects will be presented to the class, highlighting how the design they propose addresses weaknesses of earlier studies to contribute new knowledge. Class discussion will focus on common design ideas across groups, as well as strengths and weaknesses of any differences in proposed designs.

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***Learning objectives:*** Introduction to evaluating the literature: the potential impact of factors including (among others) definitions of intake variables, ranges of intake or exposure, and data analysis approaches on individual study results, and implications for evaluating a body of literature. Define different types of reviews: non-systematic eg state-of-the-art, systematic review and meta-analyses.

***Required readings:*** None

***Suggested readings:*** None

**Turn in data analysis lab project, part 2. (Post it to your group's Drop Box)**

**Spring break, March 6 - 16**

**\*18: Tuesday Mar 17**

[18a] **Evaluating the Nutrition Epidemiology Literature:** Evaluating the literature to guide practice, policy, interventions or programs, and new research. Guided discussion. \*Students will form groups to discuss the development and use of the nutrition evidence library, and to discuss and debate key considerations in evaluating nutritional epidemiology literature, including intervention studies/trials as well as observational studies.

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**Learning objectives:** Provide background on important resources related to reviewing and contributing to the body of scientific evidence in nutritional epidemiology.

**Required readings/preparation:**

-Review selected topics of interest in the Nutrition Evidence Library (to be selected by popular vote) <http://www.nel.gov/>

**Suggested readings/resources for future reference:**

-Moher D, Hopewell S, Schulz KF, Montori V, Gøtzsche PC, Devereaux PJ, Elbourne D, Egger M, Altman DG; Consolidated Standards of Reporting Trials Group. CONSORT 2010 Explanation and Elaboration: Updated guidelines for reporting parallel group randomised trials. J Clin Epidemiol. 2010 Aug;63(8):e1-37.

**Turn in data analysis lab project, part 3 (Post it to your group's Drop Box).**

**\*19: Thursday Mar 19**

[19] **\*Continue final analyses for lab project (DUE APRIL 2):** Students will complete analyses to identify subjects with implausible energy intakes, and evaluate the effect of excluding or adjusting for implausible energy reporters in their multivariate analysis.

Upload your take-home mid-term to your Drop Box

**\*20: Thursday Mar 24**

[20] Presenting findings in nutritional epidemiology: Continue work on data analysis project—students will begin to **develop an abstract and tables/figures to summarize and present their key findings.**

**PART 3: SPECIAL TOPICS AND CASE STUDIES**

**\*21: Tuesday Mar 26**

[21a] Review of mid-term exam.

[21b] **\*Critical thinking on variability in nutrition measures.** Discussion and review on the importance and impact of within- vs. between-person variability in diet and physical activity. MM and SA

**\*22: Tuesday Mar 31**

[22] **\*Integrative approaches to epidemiologic research, case study 1** (MM): Junk food” diets and health – linking biochemistry and mechanisms with research designs and intervention/policy implications. Brief lecture; \*group case study discussion.

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**Learning objectives:** Promote critical thinking in linking biochemistry, epidemiology and intervention/policy.

**Required readings:**

-Sampey BP et al (Makowski L senior author). Cafeteria diet is a robust model of human metabolic syndrome with liver and adipose inflammation: comparison to high-fat diet. *Obesity* (Silver Spring). 2011 Jun;19(6):1109-17.

-Oellingrath IM, Svendsen MV, Brantsaeter AL. Eating patterns and overweight in 9- to 10-year-old children in Telemark County, Norway: a cross-sectional study. *Eur J Clin Nutr.* 2010 Nov;64(11):1272-9

-Lioret S, Volatier JL, Lafay L, Touvier M, Maire B. Is food portion size a risk factor of childhood overweight? *Eur J Clin Nutr.* 2009 Mar;63(3):382-91. Epub 2007 Nov 21.

-Bes-Rastrollo M, Sanchez-Villegas A, Basterra-Gortari FJ, Nunez-Cordoba JM, Toledo E, Serrano-Martinez M. Prospective study of self-reported usual snacking and weight gain in a Mediterranean cohort: the SUN project. *Clin Nutr.* 2010 Jun;29(3):323-30.

### **\*23: Thursday Apr 2**

[23] **Integrative approaches to epidemiologic research, case study 2:** Sugar sweetened beverages diets and obesity – linking biochemistry and mechanisms with research designs and intervention/policy implications. Students will be assigned roles with different areas of expertise in this translational case study. As panels of experts in the areas of nutritional biochemistry, epidemiology and intervention/policy, each group will be asked to provide perspectives to our school committee regarding the possible mechanisms linking SSB to energy intake and obesity based on your area of expertise. You will also be asked to evaluate the epidemiologic evidence supporting this link, and focusing on evidence that SSB-related policies will lead to a reduction of caloric intake and/or weight loss in school children.

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*Learning objectives:* Promote critical thinking in linking biochemistry, epidemiology and intervention/policy.

*Required readings for each panel:*

*a) Nutritional biochemistry experts:*

-McDevitt RM et al. De novo lipogenesis during controlled overfeeding with sucrose or glucose in lean and obese women. *Am J Clin Nutr.* 2001 Dec;74(6):737-46.

-Cha SH et al. Differential effects of central fructose and glucose on hypothalamic malonyl-CoA and food intake. *Proc Natl Acad Sci U S A.* 2008 Nov 4;105(44):16871-5.

-Stanhope KL et al. Consuming fructose-sweetened, not glucose-sweetened, beverages increases visceral adiposity and lipids and decreases insulin sensitivity in overweight/obese humans. *J Clin Invest*. 2009 May;119(5):1322-34.

*b) Epidemiology experts:*

-Ludwig DS et al. Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. *Lancet*. 2001 Feb 17;357(9255):505-8.

-Fiorito LM et al. Beverage intake of girls at age 5 y predicts adiposity and weight status in childhood and adolescence. *Am J Clin Nutr*. 2009 Oct;90(4):935-42. doi: 10.3945/ajcn.2009.27623. Epub 2009 Aug 19.

-Giammattei J et al. Television watching and soft drink consumption: associations with obesity in 11- to 13-year-old schoolchildren. *Arch Pediatr Adolesc Med*. 2003 Sep;157(9):882-6.

*c) Intervention and policy experts:*

-James J et al. Preventing childhood obesity: two year follow-up results from the Christchurch obesity prevention programme in schools (CHOPPS). *BMJ*. 2007 Oct 13;335(7623):762. Epub 2007 Oct 8.

-Blum JE et al. Reduced availability of sugar-sweetened beverages and diet soda has a limited impact on beverage consumption patterns in Maine high school youth. *J Nutr Educ Behav*. 2008 Nov-Dec;40(6):341-7.

-Johnson DB et al. Impact of school district sugar-sweetened beverage policies on student beverage exposure and consumption in middle schools. *J Adolesc Health*. 2009 Sep;45(3 Suppl):S30-7.

*All:*

-Briefel RR, Crepinsek MK, Cabili C, Wilson A, Gleason PM. School food environments and practices affect dietary behaviors of US public school children. *J Am Diet Assoc*. 2009 Feb;109(2 Suppl):S91-107.

**Upload your data analysis final project**

**\*24: Tuesday Apr 7**

[24] \***Nutrition epidemiology in public health practice case study.** (SA and MM)  
Nutritional epidemiology in public health practice: A case study in quantitative considerations for local-level policies related to menu labeling. This case study was motivated by a kind of problem you can encounter as a chronic disease epidemiologist working in a health agency. In evaluating health-related bills, the legislature may request an assessment of policy impact for the local population. We will consider the specific question of menu labeling. Kuo, et al, provides a general illustration of the exercise. In particular, please study table 1 until you understand the logic of their approach. In class, we will evaluate Kuo's model inputs and assumptions, and consider the effects of input modifications on estimated impact.

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*Learning objectives:* Promote an understanding of the role of nutritional epidemiology in applied public health / public health practice. Issues to consider include how to identify appropriate data sources, how to summarize and evaluate the evidence base, how to apply evidence to the relevant population, including how to quantify potential impact of proposed policies on populations.

*Required readings:*

-Kuo T, Jarosz CJ, Simon P, Fielding JE. Menu labeling as a potential strategy for combating the obesity epidemic: a health impact assessment. Am J Public Health. 2009 Sep;99(9):1680-6.

## **25: Thursday Apr 9**

[25] Nutrition **monitoring and surveillance (TBA):** Sources and applications of global and local nutritional surveillance data and their strengths and limitations.

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*Learning objectives:* Provide a framework for discussing how to promote scientific progress in nutritional epidemiology.

## **26: Tuesday Apr 14**

[26] **Review** of data analysis project. We will review and discuss lessons learned from the laboratory project designed to introduce students to data analysis considerations in nutritional epidemiology. Students will discuss how they would design and analyze data from a new project on the study topic.

**\*27: Thursday Apr 16**

[27] **\*Critical thinking global case study:** Nutritional epidemiology studies in a global context. How do we adapt to international nutritional cultures and conditions? How do we develop and test appropriate hypotheses for these contexts building on prior evidence from both epidemiology and biochemistry? These issues will be addressed via a case study: The Ministry of Health in Ecuador is interested in looking at respiratory health (asthma) and diet as a protective factor. They have proposed initiating a prospective longitudinal cohort study of elderly (65+ y) men and women in Ecuador. You have been asked to consult on the development of an FFQ for assessing dietary intakes at baseline in the elderly. No FFQ currently exists in Ecuador. While you may or may not agree with this choice of dietary assessment instrument, it is all that the Ministry of Health can afford at this time (it is costly to training dieticians to collect multiple standardized 24-h recalls as well as to subsequently develop methods to convert data on many hundreds of food and beverages reported in recalls to estimate energy and nutrient intakes). Objective: Based on the research question, the objective is to measure intakes of key antioxidant nutrients, zinc, vitamin D, and other nutrients thought to be potentially most relevant for respiratory health outcomes (infections, wheeze, asthma), a public health concern for this age group in Ecuador. It is also important to note that there may be regional and seasonal differences in dietary intakes. Your task during the class period will be to develop a proposal for how you will develop the FFQ and design a study to validate it.

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*Learning objectives:* Promote critical thinking on adapting to the global context in conducting nutritional epidemiology research. Promote integrative thinking on multi-disciplinary testing of hypotheses.

*Required readings:*

-Jayawardena R et al. Developing an FFQ Development of a food frequency questionnaire for Sri Lankan adults. *Nutr J.* 2012 Aug 31;11:63

-Eysteinsdottir T et al. Assessing validity of a short food frequency questionnaire on present dietary intake of elderly Icelanders. *Nutr J.* 2012 Mar 13;11:12.

-Sempértegui F et al. Nutritional, immunological and health status of the elderly population living in poor neighbourhoods of Quito, Ecuador. *Br J Nutr.* 2006 Nov;96(5):845-53.

-Examples of Ecuadorian diet: <http://www.thelatinkitchen.com/recipe-origin/ecuadorian-food-recipes>

-Pennington JAT. Applications of food composition data: Data sources and considerations for use *Journal of Food Composition and Analysis* 21 (2008) S3–S12 [See especially sections 2.3 2.4 and 2.5]

**BEGIN TAKE HOME FINAL EXAM: CRITICAL COMPARATIVE ANALYSIS OF NUTRITIONAL EPIDEMIOLOGY LITERATURE**

**28: Tuesday Apr 21**

[28] **Genetics in nutritional epidemiology (guest lecturer Kari North)**: Integrating genetic variation and epigenetics in nutritional epidemiology studies: essential concepts and methods.

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*Learning objectives*: Provide background on how genetic factors may be an important influence on associations between nutritional exposures and health outcomes, and describe different approaches to gene-environment analysis. Briefly introduce the potential relevance of nutritional influences on epigenetics for some research topics.

**29: Thursday Apr 23**

[29] **Wrap up** (all): Review of lessons learned and implications for future directions in nutritional epidemiology.

**Upload your FINAL EXAM to your Drop Box. Due on APRIL 28**