NUTR 305: NUTRITIONAL EPIDEMIOLOGY  
Fall 2018  
Course Syllabus

Time and location of the course:  
Mondays 1:30-4:30PM  
Location: Dental School, Rachel’s Amphitheater Rm 1414 (Except October 9th lecture, to be held in Sackler 108)

Instructor: Fang Fang Zhang, MD, PhD  
Associate Professor, Friedman School of Nutrition Science and Policy  
150 Harrison Ave, Boston, MA 02111  
Email: fang.fang.zhang@tufts.edu | Phone: 617-636-3704

Teaching Assistant: Silvia Berciano, MS.  
PhD Candidate, Biochemical and Molecular Nutrition  
Friedman School of Nutrition Science and Policy  
Email: silvia.berciano_benitez@tufts.edu

Office Hours: Flexible. Email anytime to set up an appointment

Tufts Graduate Credit: 1.0 (3 credit hours)

Prerequisites for taking this course:  
Required prerequisites for this course are the following:  
1) Introductory Human Nutrition (e.g., NUTR 201 or 202)  
2) Introductory Epidemiology (e.g., NUTR 204 or MPH 201)  
3) Biostatistics (e.g., NUTR 209/309 A&B or MPH 205)

Course Description: This course is designed for graduate students who are interested in conducting or better interpreting epidemiological studies relating diet and nutritional status to disease and health. There is an increasing awareness that various aspects of diet and nutrition may be important contributing factors in chronic disease. There are many important problems, however, in the implementation and interpretation of these studies. The purpose of this course is to examine methodologies used in nutritional epidemiological studies, and to review the current state of knowledge regarding diet and other nutritional indicators as etiologic factors in disease.

Course Objectives: At the conclusion of the course, students should be able to:  
1. Describe the utility and limitations of different epidemiological study designs for research in nutritional epidemiology.  
2. Describe the strengths and limitations of different methods of measuring diet and identify when specific dietary methods may be most appropriate.  
3. Explain the statistical methods commonly used in nutritional epidemiology
to analyze diet-disease associations.
4. Describe strategies that can be used to evaluate or adjust for other dietary and lifestyle factors that may explain or influence relationships of diet and disease.
5. Describe the current state of epidemiological evidence for relationships of diet to the development of selected diseases.
6. Describe the issues in studying gene-nutrient interactions and discuss the influence of genetics on data collected in nutritional epidemiological studies.
7. Critically evaluate nutritional epidemiology research publications.

Course texts and Materials (for the course as a whole):

Readings
To further understand the material, a selection of classic and contemporary research articles are assigned. The majorities are assigned as required reading and others are recommended readings to enhance learning. All additional readings are posted online on CANVAS. Please note that all students are responsible for doing the readings.

All students are expected to complete the required readings prior to the class (e.g., the instructors may ask questions in class about required readings). Both required and recommended readings are assigned to help students prepare for each lecture. Participating in class discussions counts towards 5% of your final course grade.

Workshops: There will be weekly workshops for students to practice the key concepts learned in each lecture. Each workshop will consist in two exercises. Students may discuss the exercises with their peers and instructors, but the answers submitted must be your own work. Weekly workshops account for 20% of the final course grade.

Assignments: There will be two assignments for students to work on independently. Your grades on Assignments 1 and 2 each account for 10% of your final course grade.

Practica: There will be three practica during the semester. These classes are intended to reinforce important concepts covered in the lectures and are designed to help students critically evaluate and interpret the findings from nutritional epidemiological studies. The three practica will be instructor-led and will require students to interpret SAS statistical output and published data.

Final project: There will be one final project on a Brief Critical Review, to be outlined later in the semester, contributing 20% of your final course grade.
Summary of Grade Contribution:
1) Assignment 1: Dietary Assessment Methods 10%
2) Assignment 2: Energy Adjustment & Measurement Error 10%
3) Midterm Exam (in-class, closed book exam) 35%
4) Weekly workshops 20%
5) Class Participation 5%
6) Final Project: Brief Critical Review 20%

Class Policies and Expectations: Students will be expected to complete all required readings (textbook and assigned research articles) prior to each lecture. All students will be required to read the articles before class in order to be able to participate in the class discussion.

Students will have only one opportunity to complete each assignment, and all assignments are due on the date/time specified. Late submissions will not be accepted. There will be no exceptions unless permission has been granted by the instructor in advance. Students will have only one opportunity to complete the midterm exam and final project. The exam and final project must be completed and successfully submitted within the specified time period. There will be no exceptions unless an extension is granted prior to the deadline by the instructor.

If students anticipate missing a lecture, arriving late to lecture, or need to leave early, they must notify the instructor beforehand. It is preferable for students who arrive more than 10 minutes late to not disrupt the class or disrespect the lecturer and fellow students by entering the classroom. They can join the second session of the class after the break.

Academic Conduct
Academic integrity, including avoiding plagiarism, is critically important. Each student is responsible for being familiar with the standards and policies outlined in the Friedman School’s Policies and Procedures manual (http://nutrition.tufts.edu/student/documents). It is the responsibility of the student to be aware of, and comply with, these policies and standards. In accordance with Tufts University’s policy on academic misconduct, violations of standards of academic conduct will be sanctioned by penalties ranging from grade reduction or failure on an assignment; grade reduction or failure of a course; up to dismissal from the school, depending on the nature and context of any infraction (http://uss.tufts.edu/studentaffairs/judicialaffairs/Academic%20Integrity.pdf).

Accommodations of Disabilities
Tufts University is committed to providing equal access and support to all students through the provision of reasonable accommodations so that each student may access their curricula and achieve their personal and academic potential. If you have a disability that requires reasonable accommodations, please contact the Friedman School Assistant Dean of Student Affairs at 617-636-6719 to make arrangements for determination of appropriate
accommodations. Please be aware that accommodations cannot be enacted retroactively, making timeliness a critical aspect for their provision.
Course Schedule

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Class 1: Overview of Nutritional Epidemiology

Learning Objectives for class 1: Upon completion of this class, students will be able to:
1. Define and describe the objectives of nutritional epidemiology research
2. Discuss different types of study designs are used in nutritional epidemiological research
3. Understand the types of measures of nutritional exposure and outcome
4. List some of the key issues/challenges in nutritional epidemiology

Required Readings for class 1:
Willett, Chapter 1: Overview of Nutritional Epidemiology
Willett, Chapter 2: Foods and Nutrients


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Class 2: Dietary Assessment Methods: Food Frequency Questionnaires

Learning Objectives for class 2: Upon completion of this class, students will be able to:
1. Explain how FFQs are developed for collecting dietary intake data
2. Describe the basic assumption behind FFQs and the rationale behind the selection of foods included
3. Discuss how calibration and validation studies are designed, and the different factors that may influence the results of a validation study
4. Understand the strengths and limitations of different methods used to measure diet in epidemiological studies

Required Readings for class 2:
Chapter 5: Food Frequency Methods
Chapter 6: Reproducibility & Validity of Food Frequency Questionnaires


Recommended:


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Class 3: Dietary Assessment Methods: Records and Recalls

Learning Objectives for class 3: Upon completion of this class, students will be able to:
1. Understand the sources of variability in dietary assessments and how variations affect the validity and reliability of the method
2. Explain how 24-hour diet recalls and food records are conducted, as well as their respective advantages and disadvantages in assessing diet
3. Discuss recent developments and new methods for the administration of diet recalls and records

Required Readings for class 3:
Chapter 3: Nature of Variation in Diet
Chapter 4: 24 hour recall and Food Record Methods


Recommended:

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Class 4: Measurement Error: Effects and Remedies

**Learning Objectives for class 4:** Upon completion of this class, students will be able to:
1. Understand the different types of measurement error and the statistical approaches can be used to correct measures of association
2. Discuss the different statistical corrections can be used for measurement error in confounding variables
3. Be able to interpret studies applying measurement error correction techniques

**Required Readings for class 4:**
*Chapter 12: Correction for the effects of measurement error*


Class 5: Energy Adjustment

**Learning Objectives for class 5:** Upon completion of this class, students will be able to:
1. Understand why energy intake is measured and when energy adjustment is necessary
2. Explain the components of total energy expenditure
3. Compare and contrast the different energy adjustment methods
4. Understand the factors that must be considered when energy adjusting nutrient data
5. Interpret the meaning of regression coefficients in statistical models

**Required Readings for class 5:**
*Chapter 11: Implications of Total Energy For Epidemiologic Analyses*


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Class 6: Practicum 1: Energy Adjustment

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Class 7: Dietary Patterns: Empirical

Learning Objectives for class 7: Upon completion of this class, students will be able to:
1. Explain why empirically derived dietary patterns are used
2. Differentiate between factor analysis and cluster analysis
3. Discuss the validity of these pattern analysis techniques
4. List the advantages and disadvantages of empirically derived patterns
5. Identify the limitations of dietary pattern approaches

Required Readings for class 7:


Class 8: Practicum 2: Diet Pattern Analysis

Class 9: Methodological considerations in study design

Learning Objectives for class 9: Upon completion of this class, students will be able to:
1. Understand the difference between categorized versus continuous presentation of independent variables
2. Explain the issues of missing data and outliers
3. Discuss the approaches used for handling repeated dietary assessments and related hypotheses
4. Explain the need for subgroup analyses and interactions
5. Understand the importance of selection of confounders

Required Readings for class 9:

Chapter 13: Issues in Analysis and Presentation of Dietary Data


Class 10: Nutrient-Gene Interactions and Epigenetics

Learning Objectives for class 10: Upon completion of this class, students will be able to:
1. Define nutrient-gene interaction
2. Understand the role of nutrient-gene interactions in human disease
3. Know how to evaluate nutrient-gene interactions in epidemiologic studies
4. Understand the concept of Mendelian Randomization
5. Discuss the role of epigenetic mechanisms in the relationship between diet and disease

**Required Readings for class 10:**


**Recommended:**


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**Class 11: Nutrition Biomarkers**

**Learning Objectives for class 11:** Upon completion of this class, students will be able to:
1. Explain the advantages of using biomarkers in nutritional epidemiology
2. Differentiate between a direct and surrogate biomarker of exposure
3. Define validity, relative validity, calibration & reproducibility
4. Explain the principle behind the trial comparison methods of evaluating a FFQ
5. Identify the most important considerations relating to the use of nutritional biomarkers
6. List the most common surrogate biomarkers used in epidemiological studies
7. Discuss the underlying assumptions on the use of biomarkers in epidemiological studies
8. Understand how metabolomics approaches are used to identify novel biomarkers of intake

**Required Readings for class 11:**

**Chapter 8: Biochemical Indicators of dietary intake**


**Class 12: Controversies in Epidemiology: Observational studies vs. RCT**

**Learning Objectives for class 12:** Upon completion of this class, students will be able to:

1. Explain the inherent differences between intervention and observational studies
2. Differentiate the paradigms of treatment (secondary prevention) and primary prevention studies
3. Discuss the optimal way to model nutritional exposures in a primary prevention study
4. Explain the main reasons why nutritional intervention studies do not always replicate findings from epidemiologic studies

**Required Readings for class 12:**

Recommended:
Anglemyer A, Horvath HT, Bero L. Healthcare outcomes assessed with observational study designs compared with those assessed in randomized trials. Cochrane Database Syst Rev. 2014 Apr 29; Review.


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Class 13: Advances in Nutritional Genomics and Multi-omic integration

Learning Objectives for class 13:

1. Understand how Nutrient-Gene Interactions are identified
2. Learn about the most recent advances in Nutritional Genomics
3. Know how to use Gene-Environment interaction databases and other publicly available tools
4. Understand how multi-omic integration studies can provide mechanistic insights into the nature of Nutrient-Gene Interactions

Required Readings for class 13:

TBD

Recommended:


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Class 14: Energy Intake Validation and the Microbiota

**Learning Objectives for class 14:** Upon completion of this class, students will be able to:
1. Explain why validity is an issue when measuring energy intake
2. List the different factors that affect the validity of reported energy intake
3. Explain the methods used to assess validity of energy intake assessed
4. Discuss the effects of poor validity of energy intake in epidemiological studies
5. Understand the role of the gut microbiota in energy metabolism and health, and the factors that modulate microbiota composition.

**Required Readings for class 14:**


Recommended:


Class 15: Dietary Patterns: Theoretical

Learning Objectives for class 15: Upon completion of this class, students will be able to:
1. Understand why diet quality indices are used to assess dietary patterns
2. List common diet quality indices used in nutritional epidemiology
3. Discuss the most important considerations in creating a diet index score
4. Discuss the advantages and disadvantages of theoretical derived patterns
5. Interpret the results of studies using theoretically derived dietary patterns

Required Readings for class 15:


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Class 16: Practicum 3: Diet Quality Indices

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November 5, 2018: Mid-term Exam

Class 17: Nutrition and Musculoskeletal Health

Learning Objectives for class 17: Upon completion of this class, students will be able to:

1. Understand the epidemiology and public health burden of osteoporosis and fracture
2. Discuss the role of calcium and vitamin D in age-related bone loss and fracture
3. Explain the controversy surrounding evidence that calcium and vitamin D have a detrimental effect on cardiovascular health

Required Readings for class 17:


Recommended:


Class 18: Nutrition and Infectious Disease

**Learning Objectives for class 18:** Upon completion of this class, students will be able to:

1. Recognize the importance of nutritional status in relation to immune function in people living with HIV (PLHIV)
2. Identify methods of nutritional assessment to address issues related to nutritional status, dietary quality, and food security in PLHIV.
3. Develop awareness of the complex relationships between nutrition and metabolic status, food insecurity, and adherence to medications among PLHIV

**Required Readings for class 18:**

Sarah J. Fielden, Aranka Anema, Pamela Fergusson, Katherine Muldoon, Nils Grede, Saskia de Pee. Measuring Food and Nutrition Security: Tools and Considerations for Use Among People Living with HIV. AIDS Behav. Published Online: 03 Dec 2013

Saskia de Pee and Richard D. Semba. Role of nutrition in HIV infection: Review of evidence for more effective programming in resource-limited settings. Food and Nutrition bulletin. 2010 Vol 31, No. 4


Class 19: Epidemiology of Obesity

**Learning Objectives for class 19:** Upon completion of this class, students will be able to:

1. Explain how obesity is assessed in children and adults
2. List different sources of misclassification of obesity in each group
3. Understand how the prevalence of obesity varies by age, race/ethnicity, sex, SES, place and time
4. Propose a useful way to characterize obesity risk factors
5. Discuss obesity as an exposure with respect to psychosocial and physical health outcomes

**Required Readings for class 19:**

Chapter 20 of *Frank Hu's Book Obesity Epidemiology* Predictors and consequences of childhood obesity


Freedman DS, Butte NF, Taveras EM, et al. BMI z-scores are a poor indicator of adiposity among 2- to 19-year-olds with very high BMIs, NHANES 1900-2000 to 2013-2014. Obesity 2017;25:739–746


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**Class 20: The role of meta-analysis in Nutritional Epidemiology**

**Learning Objectives for class 20:** Upon completion of this class, students will be able to:
1. Understand the utility of meta-analysis in nutrition epidemiology, including strengths and limitations.
2. Evaluate, summarize and interpret findings from meta-analyses while considering prior and new evidence.
3. Discuss how findings from meta-analysis can be used to shape dietary recommendations and policy and be communicated to the public.

**Required Readings for class 20:**


**Recommended:**

Flegal KM, Kit BK, Orpana H, Graubard BI. Association of all-cause mortality with overweight and obesity using standard body mass index categories: a systematic review and meta-analysis. JAMA. 2013 Jan 2;309(1):71-82.


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**Class 21: Nutrition and Global Burden of Disease**

**Learning Objectives for class 21:** Upon completion of this class, students will be able to:

1. Explain the background and rationale for the study of the Global Burden of Disease
2. Understand the data sources and methodology used in modeling dietary burdens of disease
3. Discuss the main findings on the impacts of diet on disease burdens.

**Required Readings for class 21:**


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**Class 22: Diet, Lifestyle, and Diabetes**

**Learning Objectives for class 22:** Upon completion of this class, students will be able to:
1. Discuss the population diabetes trends in US adults
2. Explain the metabolic consequences of diabetes
3. Understand the relationship between diet and diabetes
4. List the most important methodological issues in analyzing the relationship between diet and diabetes

**Required Readings for class 22:**


*Recommended:*
Curbing the Diabetes Pandemic: The Need for Global Policy Solutions.  

Understanding nutritional epidemiology and its role in policy.  


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Class 23: Nutrition Interventions and Health Disparities

**Learning Objectives for class 23:** Upon completion of this class, students will be able to:
1. Understand the epidemiology of health disparities and the importance of disparities research
2. Learn about different analysis and visualization tools used to monitor and report health disparities
3. Describe key considerations of planning a dietary intervention.
4. Discuss the challenges and rewarding aspects of community-based intervention studies

**Required Readings for class 23:**  
TBC

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Class 24: Nutrition and Cancer

**Learning Objectives for class 24:** Upon completion of this class, students will be able to:
1. Summarize the current state of the science for diet and human cancer.
2. Discuss major methodological challenges (specific to the study of cancer) that have slowed down our understanding of the relation of diet to cancer.
3. Understand important questions that remain unanswered in the relation of diet to cancer.

**Required Readings for class 24:**


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This schedule and assigned readings are subject to modifications at the discretion of the instructor.
<table>
<thead>
<tr>
<th>Session #</th>
<th>Monday Date</th>
<th>Location</th>
<th>Time</th>
<th>Lecture Topic</th>
<th>Lecturer</th>
<th>Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sept 10</td>
<td>RA 1414</td>
<td>1:30-3:00pm</td>
<td>Nutritional Epidemiology: An overview</td>
<td>Fang Fang Zhang</td>
<td>Assignment 1 assigned</td>
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<tr>
<td>2</td>
<td>Sept 17</td>
<td>RA 1414</td>
<td>1:30-3:00pm</td>
<td>Dietary Assessment Methods I: FFQs</td>
<td>Fang Fang Zhang</td>
<td>FFQ and 24HR due</td>
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<tr>
<td>3</td>
<td>Sept 24</td>
<td>RA 1414</td>
<td>1:30-3:00pm</td>
<td>Dietary Assessment Methods II: Records and Recalls</td>
<td>Cheryl Gilhooly</td>
<td>FFQ and 24HR due</td>
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<tr>
<td>4</td>
<td></td>
<td>RA 1414</td>
<td>3:00-4:30pm</td>
<td>Measurement Error: Effects and Remedies</td>
<td>Fang Fang Zhang</td>
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<tr>
<td>5</td>
<td></td>
<td>RA 1414</td>
<td>3:00-4:30pm</td>
<td>Energy Adjustment</td>
<td>Fang Fang Zhang</td>
<td>FFQ/24HR data returned</td>
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<tr>
<td>6</td>
<td>Oct 1</td>
<td>RA 1414</td>
<td>1:30-3:00pm</td>
<td>Dietary Patterns: Empirical approaches</td>
<td>Fang Fang Zhang</td>
<td>Assignment 1 due</td>
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<td>7</td>
<td></td>
<td>TBD</td>
<td>3:00-4:30pm</td>
<td>Practicum 1: Energy adjustment</td>
<td>Fang Fang Zhang</td>
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<tr>
<td>8</td>
<td>Oct 9</td>
<td>S 108</td>
<td>1:30-3:00pm</td>
<td>Methodological considerations in Study Design</td>
<td>Fang Fang Zhang</td>
<td>Assignment 2 assigned</td>
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<tr>
<td>9</td>
<td>Oct 15</td>
<td>RA 1414</td>
<td>1:30-3:00pm</td>
<td>Nutrition Biomarkers and Metabolomics</td>
<td>Shilpa Bhupathiraju</td>
<td>Assignment 2 due</td>
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<tr>
<td>10</td>
<td>Oct 22</td>
<td>RA 1414</td>
<td>1:30-3:00pm</td>
<td>Controversies in Epidemiology: Observational studies vs. RCTs</td>
<td>Dariush Mozaffarian</td>
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<tr>
<td>11</td>
<td>Oct 29</td>
<td>RA 1414</td>
<td>1:30-3:00pm</td>
<td>Advances in Nutritional Genomics and Multi-omic Integration</td>
<td>Laurence Parnell</td>
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<tr>
<td>12</td>
<td>Oct 29</td>
<td>RA 1414</td>
<td>3:00-4:30pm</td>
<td>Gene-Nutrient Interactions and Epigenetics</td>
<td>Jiantao Ma</td>
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<tr>
<td>13</td>
<td>Nov 19</td>
<td>RA 1414</td>
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<td>Diet, Lifestyle and Diabetes</td>
<td>Frank Hu</td>
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<tr>
<td>14</td>
<td>Nov 26</td>
<td>RA 1414</td>
<td>1:30-3:00pm</td>
<td>Nutrition Interventions and Health Disparities</td>
<td>Sabrina Noel</td>
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<tr>
<td>15</td>
<td>Nov 26</td>
<td>RA 1414</td>
<td>3:00-4:30pm</td>
<td>Nutrition and Cancer</td>
<td>Fang Fang Zhang</td>
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<td>16</td>
<td>Nov 5</td>
<td>RA 1414</td>
<td>1:30-4:30pm</td>
<td>Midterm Examination</td>
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<td>Final Critique assigned</td>
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<tr>
<td>17</td>
<td>Nov 12</td>
<td>RA 1414</td>
<td>1:30-4:00pm</td>
<td>No class (Veteran’s day)</td>
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<tr>
<td>18</td>
<td>Nov 26</td>
<td>RA 1414</td>
<td>1:30-3:00pm</td>
<td>Nutrition and Musculoskeletal Health</td>
<td>Kyla Shea</td>
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<tr>
<td>19</td>
<td>Nov 26</td>
<td>RA 1414</td>
<td>3:00-4:30pm</td>
<td>Epidemiology of Obesity</td>
<td>Alice Tang</td>
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<tr>
<td>20</td>
<td>Dec 3</td>
<td>RA 1414</td>
<td>1:30-3:00pm</td>
<td>The role of meta-analysis in Nutritional Epidemiology</td>
<td>Hassan Dashti</td>
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<tr>
<td>21</td>
<td>Dec 10</td>
<td>RA 1414</td>
<td>3:00-4:30pm</td>
<td>Diet, Lifestyle and Diabetes</td>
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<tr>
<td>22</td>
<td>Dec 10</td>
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<td>23</td>
<td>Dec 17</td>
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<td>Nutrition and Cancer</td>
<td>Fang Fang Zhang</td>
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<tr>
<td>24</td>
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<td>RA 1414</td>
<td>1:30-4:30pm</td>
<td>Midterm Examination</td>
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<td>Final Critique Due</td>
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