**Time and location of the course:**
Tuesdays 1:30-3:00PM  
Fridays 8:45-10:15AM  
Location: Jaharis 155 (Except practicum #1: September 30th in Sacker 514 and practicum #2: October 14th in Jaharis 156)

**Instructor:** Fang Fang Zhang, MD, PhD  
Assistant Professor, Friedman School of Nutrition Science and Policy  
150 Harrison Ave, Boston, MA 02111  
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Phone: 617-636-3704

**Teaching Assistants:** Danielle Haslam, MA MS  
Ph.D. Candidate, Nutritional Epidemiology  
Friedman School of Nutrition Science and Policy  
Email: danielle.haslam@tufts.edu

Mengxi Du  
MS/MPH Candidate  
Tufts University School of Medicine  
Friedman School of Nutrition Science and Policy  
Email: mengxi.du@tufts.edu

**Office Hours:** Email anytime to set up an appointment

**Tufts Graduate Credit:** 1.0

**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 and Online Discussions
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 TRUNK. Please note that all students are responsible for doing the readings.

All students are expected to complete the required readings prior to the class, and raise at least 2 questions for 1 or 2 selected readings. Selected readings are highlighted in blue in the syllabus. Students are also required to join discussions in an online forum supported through Trunk. For classes on Tuesday, students are required to submit their questions online by noon of Monday and join the discussions by noon of Tuesday. For classes on Friday, students are required to submit their questions online by 5pm of Wednesday and join the discussions by 5pm of Thursday. Students can join the discussions by responding to others’ questions or initiating a discussion topic relevant to the required readings. Submitting questions and joining the discussions online count toward 10% of your final course grade and, as mentioned, participating in class discussions is an additional 5% of your final course grade.

Assignments: There will be two assignments for students to work on independently. Your grades on Assignments 1 and 2 account for 10% of your final course grade, respectively.
Practica: There will be two 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 two 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, is outlined later in the semester, and contributes to 30% 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) Online Discussion 10%
5) Class Participation 5%
6) Final Project: Brief Critical Review 30%

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 and join the online discussions 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. There will be no exceptions unless permission has been granted by the instructor. 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 permission is granted by the instructor.

If students anticipate 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.

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

## Class 1: Dietary Assessment Methods: Records and Recalls

**Learning Objectives for class 1:** Upon completion of this class, students will be able to understand:
1. What are the common variations in dietary assessment? How do these variations affect the validity and reliability in dietary assessment?
2. How would you conduct a 24-hour diet recall and food record? What are the advantages of disadvantages of diet recalls and records in assessing diet?
3. What are the new developments in diet recalls and records?

**Required Readings for class 1:**
- Chapter 3: Nature of Variation in Diet
- Chapter 4: 24 hour recall and Food Record Methods


Recommended:

## Class 2: Overview of Nutritional Epidemiology

**Learning Objectives for class 2:** Upon completion of this class, students will be able to understand:
1. What is the definition/objective of nutritional epidemiology research?
2. What types of study designs are used in nutritional epidemiological research?
3. What are the types of measures of nutritional exposure and outcome?
4. What are some of the key issues in nutritional epidemiology?

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


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Class 3: Dietary Assessment Methods: FFQ

Learning Objectives for class 3: Upon completion of this class, students will be able to:
1. How would you develop a FFQ for collecting dietary intake data?
2. What is the basic assumption behind FFQ and how do you decide which foods to include?
3. How would you design a calibration study and a validation study? What factors may influence the findings of a validation study?
4. What are the strengths and limitations of different methods used to measure diet in epidemiological studies?

Required Readings for class 3:
Chapter 5: Food Frequency Methods
Chapter 6: Reproducibility & Validity of Food Frequency Questionnaires


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Class 4: Energy Intake Validation and Dietary Under- and Over-reporting

**Learning Objectives for class 4:** Upon completion of this class, students will be able to:
1. Why is validity an issue when measuring energy intake?
2. What factors affect validity of reported energy intake?
3. How is validity of energy intake assessed?
4. What is the effect of poor validity of energy intake in epidemiological studies?

**Required Readings for class 4:**


*Optional:*


Class 5: Measurement Error: Effects and Remedies

**Learning Objectives for class 5:** Upon completion of this class, students will be able to:
1. What types of statistical corrections can be used to measures of association?
2. What types of statistical corrections can be used for measurement error in confounding variables?
3. How to interpret studies applying measurement error correction techniques?
Required Readings for class 5:
Chapter 12: Correction for the effects of measurement error


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Class 6: Energy Adjustment

Learning Objectives for class 6: Upon completion of this class, students will be able to:
1. Why is energy intake measured and why do we need to energy adjust?
2. What are the components of energy expenditure?
3. What are the energy adjustment methods?
4. What considerations do you need to take into account when energy adjusting nutrient data?
5. Interpret the meaning of regression coefficients in statistical models

Required Readings for class 6:

Chapter 11: Implications of Total Energy For Epidemiologic Analyses


Class 7: Practicum 1: Energy Adjustment

Recommended Reading for class 8:
None

Class 8: Nutrition Biomarkers

Learning Objectives for class 8: Upon completion of this class, students will be able to:
1. What are the advantages of using biomarkers in nutritional epidemiology?
2. What is the difference between a direct and surrogate biomarker of exposure?
3. How would you define validity, relative validity, calibration & reproducibility?
4. What is the principal behind the trial comparison methods of evaluating a FFQ?
5. What are the important considerations relating to the use of nutritional biomarkers?
6. What are the common surrogate biomarkers used in epidemiological studies?
7. What are the underlying assumptions on the use of biomarkers in epidemiological studies?

Required Readings for class 8:
Chapter 8: Biochemical Indicators of dietary intake


**Class 9: Physical Activity and Health**

**Learning Objectives for class 9:** Upon completion of this class, students will be able to:

1. Become familiar with the various methods used for assessment of physical activity in youth and adults
2. Recognize the importance of physical activity and fitness in chronic disease and health outcomes

**Required Readings for class 9:**


*Optional:*


**Class 10: Dietary Patterns: Theoretical**

**Learning Objectives for class 10:** Upon completion of this class, students will be able to:

1. Why use dietary pattern techniques to capture diet?
2. What are the types of food pattern methods used in nutritional epidemiology?
3. What are the advantages and disadvantages of theoretical derived patterns?
4. What are considerations in creating a diet index score?
5. How to interpret the results of studies using theoretically derived dietary patterns?
Required Readings for class 10:


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Class 11: Dietary Patterns: Empirical

Learning Objectives for class 11: Upon completion of this class, students will be able to:
1. Why use empirically derived dietary patterns?
2. What is the difference between factor analysis and cluster analysis?
3. How valid are these techniques?
4. What are the advantages and disadvantages of empirically derived patterns?
5. What are the limitations of dietary pattern approaches?

Required Readings for class 11:


Class 12: Practicum 2: Cluster/Factor Analysis

Class 13: Methodological considerations in study design

Learning Objectives for class 13: Upon completion of this class, students will be able to:
1. Understand the difference between categorized versus continuous presentation of independent variables
2. Understand the issues with missing data and outliers
3. Understand the approaches for using repeated dietary assessments and related hypotheses
4. Understand the need for subgroup analyses and interactions
5. Understand the importance of selection of confounders

Required Readings for class 13:

Chapter 13: Issues in Analysis and Presentation of Dietary Data


Class 14: The role of meta-analysis in Nutritional Epidemiology

Learning Objectives for class 14: 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 14:
**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.**


**Recommended:**


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**Class 15: Controversies in Epidemiology: Observational studies vs. RCT**

**Learning Objectives for class 15:**

Upon completion of this class, students will be able to understand:

1. What are the inherent differences between intervention and observational studies?
2. How do treatment (secondary) and primary prevention study paradigms differ?
3. What is the optimal way to model nutritional exposures in a prevention study?
4. What are the main reasons why nutritional intervention studies do not replicate findings from epidemiologic studies?

**Required Readings for class 15:**


Recommended:


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Class 16: Comparative Effectiveness Analysis on Diet and CVD

Required Readings for class 16:


Technical reference that will be discussed in class:


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Class 17: Mid-term Exam

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Class 18: Nutrition and Musculoskeletal Health

Learning Objectives for class 18:

Upon completion of this class, students will be able to understand:
1. The epidemiology and public health burden of osteoporosis and fracture
2. The role of calcium and vitamin D in age-related bone loss and fracture
3. The controversy surrounding evidence that calcium and vitamin D have a detrimental effect on cardiovascular health

**Required Readings for class 18:**


*Recommended:*


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**Class 19: TBA**
Learning Objectives for class 19:
1. What is gene-nutrient interaction?
2. Role of gene-nutrient interaction in susceptibility of chronic diseases
3. How to evaluate gene-nutrient interaction
4. Implications of gene-nutrient interaction

Required Readings for class 19:


Recommended:


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Class 20: Nutrition and Vision

Learning Objectives for class 20: TBA

Required Readings for class 20: TBA

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Class 21: Nutrition and Infectious Disease

Learning Objectives for class 21: 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 21:

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 22: Nutrition and Global Burden of Disease

Learning Objectives for class 22:
1. Understand the background and rationale for the Global Burden of Disease study
2. Understand the data sources and methodology used in modeling dietary burdens of disease
3. Understand the main findings on the impacts of diet on disease burdens.

Required Readings for class 22:


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Class 23: Nutrition and Diabetes

**Learning Objectives for class 23:** Upon completion of this class, students will be able to understand:
1. What are the population diabetes trends in US adults?
2. What are the metabolic consequences of diabetes?
3. What is the relationship between diet and diabetes?
4. What are the methodological issues in analyzing the relationship between diet and diabetes?

**Required Readings for class 23:**


**Recommended:**


Class 24: International Nutrition

**Learning Objectives for class 24:**
1. Recognize key topics in international nutrition.
2. Differentiate between forms of malnutrition.
3. Understand the framework for causes of and action to combat child undernutrition.
4. Understand indicators of nutritional assessment of populations and individuals in developing countries.

**Required Readings for class 24:**


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Class 25: Nutrition and Cancer

**Learning Objectives for class 25:**
1. To be able to summarize the current state of the science for diet and human cancer.
2. To be able to 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 25:**


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Class 26: Translation of nutritional epi findings into dietary guidelines and health policy

Learning Objectives for class 26: Upon completion of this class, students will be able to understand:
1. To be able to identify key nutritional problems for which a case can be made for population-wide interventions or dietary recommendations.
2. To be able to critically evaluate the strength of nutritional epidemiology evidence in terms of study design and analytic methods.
3. To understand the processes by which findings from nutritional epidemiology are translated into action and to consider potential barriers and benefits. To consider the various levels of nutrition policy and sectors involved.

Required Readings for class 26:


Watts ML, Hager MH, Toner CD, Weber JA. The art of translating nutritional

Recommended:


This schedule is subject to modifications at the discretion of the instructor
<table>
<thead>
<tr>
<th>#</th>
<th>Day and 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>Tuesday, Sept 6</td>
<td>Jaharis 155</td>
<td>1:30-3:00PM</td>
<td>Dietary Assessment Methods: Records and Recalls</td>
<td>Cheryl Gilhooly</td>
<td>Assignment 1 assigned</td>
</tr>
<tr>
<td>2</td>
<td>Friday, Sept 9</td>
<td>Jaharis 155</td>
<td>8:45-10:15 AM</td>
<td>Overview of Nutritional Epidemiology</td>
<td>Fang Fang Zhang</td>
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</tr>
<tr>
<td>3</td>
<td>Tuesday, Sept 13</td>
<td>Jaharis 155</td>
<td>1:30-3:00PM</td>
<td>Dietary Assessment Methods: FFQ</td>
<td>Sherman Bigornia</td>
<td>Complete FFQ/24HR</td>
</tr>
<tr>
<td>4</td>
<td>Friday, Sept 16</td>
<td>Jaharis 155</td>
<td>8:45-10:15 AM</td>
<td>Energy Intake Validation and Dietary Under- and Over-reporting</td>
<td>Sai Das</td>
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<tr>
<td>5</td>
<td>Tuesday, Sept 20</td>
<td>Jaharis 155</td>
<td>1:30-3:00PM</td>
<td>Measurement error: Effects and Remedies</td>
<td>Fang Fang Zhang</td>
<td>Return FFQ/24HR data</td>
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<td>6</td>
<td>Friday, Sept 23</td>
<td>Jaharis 155</td>
<td>8:45-10:15 AM</td>
<td>Energy adjustment</td>
<td>Fang Fang Zhang</td>
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<tr>
<td>7</td>
<td>Tuesday, Sept 27</td>
<td>Sackler 514</td>
<td>1:30-3:00PM</td>
<td>Practicum 1: Energy adjustment</td>
<td>Shilpa Bhupathiraju</td>
<td>Assignment 1 due</td>
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<tr>
<td>8</td>
<td>Friday, Sept 30</td>
<td>Jaharis 155</td>
<td>8:45-10:15 AM</td>
<td>Nutrition Biomarkers</td>
<td>Shilpa Bhupathiraju</td>
<td>Assignment 2 assigned</td>
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<tr>
<td>9</td>
<td>Tuesday, Oct 4</td>
<td>Jaharis 155</td>
<td>1:30-3:00PM</td>
<td>Physical activity and health</td>
<td>Jennifer Sacheck</td>
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</tr>
<tr>
<td>10</td>
<td>Friday, Oct 7</td>
<td>Jaharis 155</td>
<td>8:45-10:15 AM</td>
<td>Dietary Patterns: Theoretical</td>
<td>Fang Fang Zhang</td>
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<tr>
<td>11</td>
<td>Tuesday, Oct 11</td>
<td>Jaharis 155</td>
<td>1:30-3:00PM</td>
<td>Dietary Patterns: Empirical</td>
<td>Danielle Haslam</td>
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<tr>
<td>12</td>
<td>Friday, Oct 14</td>
<td>Jaharis 156</td>
<td>8:45-10:15 AM</td>
<td>Practicum 2: Cluster/Factor Analysis</td>
<td>Samantha Berger</td>
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<tr>
<td>13</td>
<td>Tuesday, Oct 18</td>
<td>Jaharis 155</td>
<td>1:30-3:00PM</td>
<td>Methodological considerations in study design</td>
<td>Fang Fang Zhang</td>
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<tr>
<td>14</td>
<td>Friday, Oct 21</td>
<td>Jaharis 155</td>
<td>8:45-10:15 AM</td>
<td>The role of meta-analysis in Nutritional Epidemiology</td>
<td>Marta Guasch-Ferre</td>
<td>Assignment 2 due</td>
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<tr>
<td>15</td>
<td>Tuesday, Oct 25</td>
<td>Jaharis 155</td>
<td>1:30-3:00PM</td>
<td>Controversies in Epidemiology: Observational studies vs. RCT</td>
<td>Dariush Mozaffarian</td>
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<tr>
<td>16</td>
<td>Friday, Oct 28</td>
<td>Jaharis 155</td>
<td>8:45-10:15 AM</td>
<td>Comparative effectiveness analysis on diet and CVD</td>
<td>Jose Penalvo</td>
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<td>17</td>
<td>Tuesday, Nov 1</td>
<td>Jaharis 155</td>
<td>1:30-3:00PM</td>
<td>Midterm Examination</td>
<td>Kyla Shea</td>
<td>Final critique assigned</td>
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<tr>
<td>18</td>
<td>Friday, Nov 4</td>
<td>Jaharis 155</td>
<td>8:45-10:15 AM</td>
<td>Nutrition and Musculoskeletal Health</td>
<td>Alice Tang</td>
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<td>19</td>
<td>Tuesday, Nov 8</td>
<td>Jaharis 155</td>
<td>8:45-10:15 AM</td>
<td>Gene-Nutrient Interactions</td>
<td>Fang Fang Zhang</td>
<td>NOTE: Friday Schedule</td>
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<tr>
<td>20</td>
<td>Tuesday, Nov 11</td>
<td>No Classes</td>
<td>Veteran’s Day</td>
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<tr>
<td>21</td>
<td>Friday, Nov 15</td>
<td>Jaharis 155</td>
<td>1:30-3:00PM</td>
<td>Nutrition and Vision</td>
<td>Chung-Jung Chiu</td>
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<tr>
<td>22</td>
<td>Tuesday, Nov 18</td>
<td>Jaharis 155</td>
<td>8:45-10:15 AM</td>
<td>Nutrition and Infectious Disease</td>
<td>Alice Tang</td>
<td></td>
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<tr>
<td>23</td>
<td>Tuesday, Nov 22</td>
<td>Jaharis 155</td>
<td>1:30-3:00PM</td>
<td>Nutrition and Global Burden of Disease</td>
<td>Gita Singh</td>
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<tr>
<td>24</td>
<td>Friday, Dec 2</td>
<td>Jaharis 155</td>
<td>8:45-10:15 AM</td>
<td>International Nutrition</td>
<td>Kassandra Harding</td>
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<tr>
<td>25</td>
<td>Tuesday, Dec 6</td>
<td>Jaharis 155</td>
<td>1:30-3:00 PM</td>
<td>Nutrition and Cancer</td>
<td>Dominique Michaud</td>
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<tr>
<td>26</td>
<td>Friday, Dec 9</td>
<td>Jaharis 155</td>
<td>8:45-10:15 AM</td>
<td>Translation of nutritional epi findings into dietary guidelines and health policy</td>
<td>Alice Lichtenstein</td>
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<tr>
<td>27</td>
<td>Tuesday, Dec 13</td>
<td>No class</td>
<td>Final Critique Due.</td>
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<td>Final Critique Due</td>
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