EPI 953
Analytical Strategies for Observational Studies

Instructor: Dr. Zhehui Luo, B627 W. Fee Hall, phone: 517-884-3966, email: zluo@msu.edu

Time and Location: Fr 12:40 - 3:30, E111 E. Fee Hall

Office Hours: Fr 4:00-5:00 or by appointment

Materials: Lecture notes, data and programs will be distributed on D2L.

Grading: Homework assignments (50%) based on simple extensions of the material presented in the lectures will be given during the course. There will be a mid-term exam (20%) and a final exam (30%). The distribution of grades will be as follows.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Score Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0</td>
<td>[90 – 100]</td>
</tr>
<tr>
<td>3.5</td>
<td>[80 – 90]</td>
</tr>
<tr>
<td>3.0</td>
<td>[70 – 80]</td>
</tr>
<tr>
<td>2.5</td>
<td>[60 – 70]</td>
</tr>
<tr>
<td>2.0</td>
<td>[50 – 60]</td>
</tr>
<tr>
<td>1.5</td>
<td>[40 – 50]</td>
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</tbody>
</table>

Exams: The midterm exam will be in class on Friday, October 13, five days before the last day to drop with no grade reported. The final exam is on Tuesday, December 12 from 12:45 to 2:45 p.m. This time is common to all sections with the same schedule according to the University calendar. The exams will be in-class and with one-page of notes allowed.

Description of the Course

This course will cover approaches to dealing with observed (first half of the semester) and unobserved confounding and sensitivity/bias analyses (second half of the semester) in observational studies. Topics will include: concepts in causal effect and causal diagram, comparison of regression, stratification and propensity score matching methods; marginal structural models; time varying covariates and mediation analysis; instrumental variables in linear and nonlinear models, and bias and sensitivity analysis.

There is no required textbook; readings will come largely from journal articles in the biostatistics and epidemiology literature, as well as from chapters in various books (Pearl, 2009b; Rothman et al., 2008; Morgan & Winship, 2007; Rosenbaum, 2002; Lash et al., 2009; VanderWeele, 2015; Guo & Fraser, 2015; Imbens & Rubin, 2015; Hernán & Robins, 2017). The statistical software for this class is Stata. Stata commands are indicated with the Sans Serif font.
<table>
<thead>
<tr>
<th>WEEK</th>
<th>DATE</th>
<th>TOPIC: REQUIRED READING</th>
<th>ADDITIONAL READING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9/1</td>
<td>Counterfactual framework for causal inference: Hernán &amp; Robins (2017, Chapters 1,2,3)</td>
<td>Holland (1986); Pearl (2009a); Heckman (2005); Morgan &amp; Winship (2007, Chapter 2)</td>
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<tr>
<td>2*</td>
<td>9/8</td>
<td>Causal diagrams: Greenland et al. (1999a); Hernán &amp; Robins (2017, Chapters 6); Rothman et al. (2008, Chapter 12)</td>
<td>Shrier &amp; Platt (2008); Textor &amp; Liskiewicz (2011); Didelez et al. (2010a); Elwert (2013, Chapter 13)</td>
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<tr>
<td>3</td>
<td>9/15</td>
<td>Confounding, back-door criterion, regression adjustment and stratification: Greenland et al. (1999b); Greenland &amp; Robins (2009); Hernán &amp; Robins (2017, Chapters 7,8)</td>
<td>Paik (1985); Kang &amp; Schafer (2007); Shpitser et al. (2010); VanderWeele &amp; Shpitser (2011)</td>
</tr>
<tr>
<td>4</td>
<td>9/22</td>
<td>Propensity score methods (I): Rosenbaum &amp; Rubin (1983b)</td>
<td>Austin et al. (2007); Austin (2008)</td>
</tr>
<tr>
<td>6</td>
<td>10/6</td>
<td>Marginal structural model, inverse probability weighting: Hernán &amp; Robins (2015, Chapters 11, 12, 13)</td>
<td>Robins et al. (2000); Sato &amp; Matsuyama (2003); Mortimer et al. (2005)</td>
</tr>
<tr>
<td>7</td>
<td>10/13</td>
<td>Time-varying treatment, g-estimation: Robins &amp; Hernán (2008); Hernán &amp; Robins (2017, Chapter 19)</td>
<td>Bodnar et al. (2004); Faries et al. (2010, Chapter 9)</td>
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<td>11</td>
<td>11/10</td>
<td>Instrumental variables (II): Baum et al. (2007); Didelez &amp; Sheehan (2007); Didelez et al. (2010b)</td>
<td>Imbens &amp; Angrist (1994); Stock et al. (2002); Imbens &amp; Wooldridge (2009); Burgess et al. (2011)</td>
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<tr>
<td>13</td>
<td>11/24</td>
<td>Holiday-University Closed</td>
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<tr>
<td>14</td>
<td>12/1</td>
<td>Bias and sensitivity analysis: Rosenbaum &amp; Rubin (1983a); Rothman et al. (2008, Chapter 19)</td>
<td>DiPrete &amp; Gangl (2004); Nannicini (2007); Lash et al. (2009, Chapters 4,5)</td>
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<td>Final</td>
<td>12/12</td>
<td>12:45-2:45 in E111 East Fee</td>
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</table>

*a Open adds end: 9/6.  
*b Last day to drop with refund: 9/25.  
*c Last day to drop with no grade reported: 10/18
Academic integrity

All Michigan State University policies regarding academic integrity apply. I also endorse the Spartan Code of Honor and would love for you to make a pledge at honorcode.msu.edu. Collaboration on homework assignments is allowed, but each student must turn in written answers that reflect their own understanding of the materials. Academically dishonest behaviors will not be tolerated.

References


McClellan & Newhouse (2000). Overview of the special supplement issue "instrumental variables analysis: Applications in health services research.". Health Services Research, 35(5 Part II), 1061–1069.


