

University of Florida

College of Public Health & Health Professions Syllabus
 PHC 7017: Advanced Epidemiologic Methods III (3 credit hours)
 Spring 2020
 Delivery Format: On-Campus (HPNP G-110), Friday 9:35 to 12:35

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 Preferred course communications: Email, office hours

Prerequisites

PHC 6000 Epidemiology Research Methods I, PHC 6011 Epidemiology Research Methods II,
 or consent of instructor

PURPOSE AND OUTCOME

Course Overview

To expand students' methodology inventory in epidemiology by introducing a set of novel and advanced analytical and modeling methods involving measurement, descriptive, comparative, associative and causal relationship analysis. The main contents include advanced measurement modeling, developmental trajectory analysis, mixed effect modeling and generalized mixed effect modeling, age-period-cohort modeling and hierarchical age-period-cohort modeling, probabilistic discrete event systems modeling, and cusp catastrophe modeling. This course will focus on theories and principles, method selection and application through lectures, hands-on data analysis, short essays, and student presentations.

Course Objectives and/or Goals

1. Strengthening the significance of methods and methodologies in epidemiology; the concepts of data and information; tailoring the contents to meet students' need for different methods through in-class assessment (1 session)
2. Mastering the measurement modeling methods/techniques capable of converting subjective data into objective through theoretical analysis, scale development and evaluation (2 sessions)
3. Utilizing three advanced modeling methods with focus on descriptive epidemiology, including (a) developmental trajectory analysis, (b) age-period-cohort modeling analysis, and (c) probabilistic discrete event system analysis (6 sessions)
4. Employing mixed effect modeling methods, including the generalized mixed effect modeling methods in associative, causal and randomized controlled trial analysis, particularly cluster- randomized trials (2 sessions)
5. Exploring cusp catastrophe modeling methods in analyzing epidemiologic data to quantify nonlinear complex quantum associative/causal relationships (2 sessions)

DESCRIPTION OF COURSE CONTENT

Course Schedule

Session I: Introduction (*January 10*)

Starting with discussion about the concept of data and information, significance of methodologies, followed by a self-assessment of the methods already learned or familiar with, and ending with an introduction to the

methods to be covered in this class and potential changes to meet the need of the majority of the class. By the end of the class, each student selects one method he or she likes the most, and will serve as the lead discussant for each session that covers the corresponding method later.

Homework (1) due by session two: Write a one-page essay (with 1 inch's margin, double-spaced, time new roman font size 12) to describe the significance of analytical methodologies in epidemiology, a list of all the methods already learned, and identify the methods you want learn the most (due by Session II)

Readings:

1. Rajasekar S, Philominathan P, Chinnathambi V. (2013). Research methodology. Available from Cornell University Library (url: <http://arxiv.org/pdf/physics/0601009.pdf>). It is a long paper but not hard to read.
2. Yim, Kyoung Hoon, et al. (2010). Analysis of statistical methods and errors in the articles published in the Korean journal of pain. *The Korean Journal of Pain*, 23 (1): 35-41., DOI: 10.3344/kjp.2010.23.1.35.
3. Lang, Tom. Twenty statistical errors even you can find in biomedical research articles. *Croatian Medical Journal*, 45(4): 361-370

Session II: Measurement Errors and Measurement Modeling - Theory (January 17)

Introduction to the basic concept of measurement errors, the need for measurement tools to objectively assess beliefs and behaviors that are subjective, the five-step measurement modeling approach, concept mapping for scale item development and measurement modeling, advanced measurement modeling methods, SAS program for measurement modeling analysis.

Homework (2): (a) Conduct measurement modeling analysis of the Brief Sensation Seeking Scale with provided data (leading discussant prepare to report and discuss results in the next session); (b) Conduct a critical review, in writing of no more than one page, of one published scale with the idea of "concept mapping", item responses, internal consistency, reliability and validity (due by Session IV).

Readings:

1. Bollen K, Lennox R. (1991). Conventional wisdom on measurement: A structural equation perspective. *Psychological Bulletin* 110 (2): 305-14.
2. Chen X, Li F, et al. (2013). Brief sensation seeking scale for Chinese – cultural and psychometric assessment. *Personality and Individual Differences* 54, 604-09.
3. Chen, X., Wang, Y., Li, F., Gong, J., & Yan, Y. (2015). Development and evaluation of the Brief Sexual Openness Scale—A construal level theory based approach. *PLoS one*, 10(8), e0136683.. DOI: 10.1371/journal.pone.0136683

Session III: Measurement Errors and Measurement Modeling - Practice (January 24)

Student's report of the results from the critical review/measurement modeling analysis, discussion; recap of the contents covered in the previous session, old and new questions, answers and discussion.

Readings:

1. Edwards, J. R., & Bagozzi, R. P. (2000). On the nature and direction of relationships between constructs and measures. *Psychological Methods*, 5(2), 155-174.
2. Xiao, H., Li, S., Chen, X., Yu, B., Gao, M., Yan, H. Okafor, C. Protection Motivation Theory in predicting intention to engage in protective behaviors against Schistosomiasis. *Plos Neglected Tropical Disease* 8(10): e3246. Doi: 10.1371/journal.pntd.0003246

Session IV: Developmental trajectory analysis - Theory (January 31)

Patterns and process of development, heterogeneity of study populations, principles of group-based modeling, applications with examples, and SAS programming PROC TRAJ

Homework (3): Conduct developmental trajectory analysis of your own data or data provided by class (due before session five); and write a one-page essay to demonstrate the need for developmental trajectory analysis (due by Session VI).

Readings:

1. Jones BL, Nagin DS. (2007). Advances in group-based trajectory modeling and an SAS procedure for estimating them. *Sociological Methods and Research*, 35(4): 542-71.
2. Chen X & Brogan K. (2012). Developmental trajectories of overweight and obesity of US youth through the life course of adolescence to young adulthood. *Adolescent Health, Medicine and Therapies*, 2013(3): 33-42.

Session V: Developmental trajectory analysis - Practice (February 7)

Student's report of results from the developmental trajectory analysis using the PROC TRAJ in SAS or STATA, recap of the contents covered in the previous session, old and new questions, answers and discussion.

Readings:

1. Chen X & Jacques-Tiura A. (2014). Smoking initiation associated with specific periods in the life course from birth to young adulthood: data from the National Longitudinal Survey of Youth 1997. *American Journal of Public Health*, 104(2): e119-26.
2. Nonnemaker JM, Morgan-Lopez AA, Pais JM et al. (2009). Youth BMI trajectories: Evidence from the NLSY97. *Obesity*, 17: 1274-80.

Session VI: Mixed effect modeling analysis - Theory (February 14)

Complex sampling design and longitudinal data; the concept of fixed, mixed, and random effects; hierarchical modeling, mixed and generalized mixed effect models; and the application of PROC MIX and PROC GLIMMIX.

Homework (4): Conduct a mixed effect modeling analysis using either PROC MIX or PROC GLIMMIX with your own data or data provided by class (due before session seven), and write a one-page essay indicating the when a mixed effect modeling method is needed (due by Session VIII).

Readings:

1. Chen X, Fang X, Li X, et al. (2006). Stay away from tobacco: A pilot trial of a school-based adolescent smoking prevention program in Beijing, China. *Nic & Tobacco Research*, 8(2): 227-37
2. Twisk, Hos WR. (2013). *Applied longitudinal data analysis for epidemiology: A practical Guide* (2nd Ed). Cambridge University Press.

Session VII: Mixed effect modeling analysis - Practice (February 21)

Student's report of the results from the homework, recap of the contents covered in the previous session, old and new questions, answers and discussion.

Readings:

1. Dinaj-Koci V, Lunn S, Deveaux L, Wang B, Chen X, et al. (2013). Adolescent age at time of receipt of one or more sexual risk reduction interventions. *Journal of Adolescent Health*, 55(2): 228-32.
2. Muirray D. (1998). *Design and analysis of group-randomized trials*. Oxford University Press.

Session VIII: Age-Period-Cohort (APC) Modeling Analysis - Theory (February 28)

Concept of age-period-cohort (APC) modeling, utility in exploring history of disease epidemiology using current data, history of the method development, challenge to solving non-identifiable and new progress, approaches for analysis, regression approach using SAS or other related programs, intrinsic estimate using STATA, generalized inverse matrix methods through R.

Homework (5): Locate dataset or use data provided by the class to conduct an APC modeling analysis (due before session nine), and write a one-page essay describing the utility of APC modeling in research (due by session X).

Readings:

1. Chen, X., Sun, Y., Li, Z., et al. (2018). Historical trends in suicide risk for the residents of mainland China: APC modeling of the archived national suicide mortality rates during 1987-2012. *Social psychiatry and psychiatric epidemiology*, 54(1): 99-110.
2. O'Brien, RM. (2014). Age-period-cohort models: Approaches and analyses with aggregate data. CRC Press.

Session IX: Age-Period-Cohort (APC) Modeling Analysis - Practice (March 6)

Student report of the results from the homework, recap of the contents covered in the previous session, old and new questions, answers and discussion.

Readings:

1. Chen X, et al. (2003). Secular trends in adolescent never smoking from 1990 to 1999 in California: An age-period-cohort analysis. *American Journal of Public Health*, 93(12): 2099-104.
2. Mousavi-Jarrahi SH, Yu, B. & Chen X. (2019). Age and birth cohort-adjusted rates of suicide mortality among US male and female youth aged 10 to 19 years from 1999 to 20174. *JAMA Network Open*, 2(9): e1911383. doi: [10.1001/jamanetworkopen.2019.11383](https://doi.org/10.1001/jamanetworkopen.2019.11383)

Session X: Cusp Catastrophe Modeling of Quantum Change - Theory (March 13)

Methodological challenges for analyzing epidemiologic data for etiological research, concept of nonlinear quantum dynamics of outcome variables, cusp catastrophic modeling, methods to solve a cusp models, analytical software and programming with SAS and R.

Homework: (7) Try to conduct a cusp modeling analysis with data provided by the instructor or of your own (due by session XII).

Readings:

1. Chen, X. & Chen, D. Cognitive theories, paradigm of quantum behavior change, and cusp catastrophe modeling in social behavioral research. *J. Society for Social Work and Research*, 10(1): 127-160
2. Grassman RP, Mass HJ, Wagemakers E. (2009). Fitting the cusp catastrophe in R: A Cusp package primer. *Journal of Statistical Software*, 32(8): 1-27.

Session XI: Cusp Catastrophe Modeling of Quantum Change - Practice (March 20)

Student report the CUSP modeling results, recap of the contents covered in the previous session, old and new questions, answers and discussion.

Readings:

1. Yu, b., Chen, X. Stanton, B., Chen, D., Xu, Y., Wang Y. (2018). Quantum changes in self-efficacy and condom-use intention among youth: A chained cusp catastrophe model. *Journal of Adolescence*, 68: 187-197.
2. Chen, X., Wang, Y., Chen D. (2019). Nonlinear dynamics of binge drinking among U.S. high school students in Grade 12: Cusp catastrophe modeling of national survey data. *Nonlinear dynamics, psychology, and life sciences*, 23(4): 465-490.

Session XII: Probabilistic Discrete Event Systems (PDES) Modeling - Theory (March 27)

Concept of dynamic changes and system modeling, continuous and discrete change, longitudinal and cross-sectional design, PDES modeling, challenges to solving non-identifiable PDES models and solutions, solutions with generalized inverse matrix methods through R.

Homework (6): Conduct PDES modeling with data provided by class or of your own (in class).

Readings:

1. Chen X, and Lin F. (2013). Estimating transitional probabilities with cross-sectional data to assess smoking behavior progression: A validation analysis. *J. Biometrics and Biostatistics* 4 (3): 1-6.
2. Lin F and Chen X. (2010). Estimation of transitional probabilities of discrete event systems from cross-sectional survey data and its application in tobacco control. *Information Science*, 180(3): 432-440.

Session XIII: Probabilistic Discrete Event Systems (PDES) Modeling - Practice (April 3)

Student report of the PDES modeling results, recap of the contents covered in the previous session, old and new questions, answers and discussion.

Readings:

1. Chen X, Ren YJ, Lin F, MacDonell K, Jiang YF. (2012), Exposure to school and community based prevention programs and reductions in cigarette smoking among adolescents in the United States, 2000-08. *Evaluation and Program Planning*, 35(3): 321-28.
2. Hu, X., Chen, X., Cook, R. L., Chen, D. G., & Okafor, C. (2016). Modeling Drinking Behavior Progression in Youth with Cross-sectional Data: Solving an Under-identified Probabilistic Discrete Event System. *Current HIV Research*, 14(2), 93-100.

ACADEMIC REQUIREMENTS AND GRADING

Textbooks

No one single textbook meets the need of this class. The following books are recommended:

1. Twisk Jos W.R. (2013). Applied longitudinal data analysis for epidemiology, (2nd ed). Cambridge University Press.
2. O'Brien, R.M. (2014). Age-period-cohort models: Approaches and analyses with aggregate data. CRC press.
3. Nagin, D.S. (2005). Group-based modeling of development. Harvard University Press.
4. Saunders, P.T. (1980). An introduction to catastrophe theory. Cambridge University Press.

Assignments and Grading

Grades will be based on points accumulated for class attendance and participation, assignments, exams and final project. Total points earned will be assigned as follows:

Component	Percent
Attendance	10%
Participation	20%
Homework Assignments	70%

(1) Attendance will be graded based on absence from classes. One percent point will be deducted for each absence of a class session without notifying the instructor of any excusable reason. (2) Participation will be assessed based on required presentation made in class and participation in classroom discussion. Fail to make presentation will lost the total 20% point; points will also be deducted according to the quality of the work presented in class and active in participating classroom discussion. (3) There are seven homework assignments for this class. Students earn up to 10% points per assignment. Turning homework on time with quality work will ensure full marks. Points will be deducted for delayed submission and poor quality of work.

Homework #	Assigned during	Contents	Due
HW (1)	Session I	Short essay	By session II
HW(2)	Session II	Measurement modeling analysis Short essay	By session III By Session IV
HW(3)	Session IV	Trajectory analysis Short essay	By session V By Session VI
HW(4)	Session VI	Mixed effect modeling analysis Short essay	By session VII By Session VIII
HW(5)	Session VIII	Age-period-cohort analysis Short essay	By session IX By Session X
HW(6)	Session X	Cusp modeling analysis	By Session XI
HW(7)	Session XII	PDES modeling analysis	N/A

Point System

Point earned	93-100	90-92	87-89	83-86	80-82	77-79	73-76	70-72	67-69	63-66	60-62	<60
Letter grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
Grade points	4.0	3.67	3.33	3.00	2.67	2.33	2.00	1.67	1.33	1.00	0.67	0.00

For greater detail on the meaning of letter grades and university policies related to them, see the Registrar's Grade Policy regulations at: <http://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Exam Policy

Policy Related to Make up Exams or Other Work

Please note: Any requests for make-ups due to technical issues MUST be accompanied by the ticket number received from LSS when the problem was reported. The ticket number will document the time and date of the problem. You MUST e-mail me within 24 hours of the technical difficulty if you wish to request a make-up.

Policy Related to Required Class Attendance

Class attendance is mandatory. Excused absences follow the criteria of the UF Graduate Catalogue (e.g., illness, serious family emergency, military obligations, religious holidays), and should be communicated to the instructor prior to the missed class day when possible. UF rules require attendance during the first two course sessions. Missing more than two scheduled sessions without excuse (each session is about 4 hours of instruction) will result in a failure. Students are responsible for all material presented in class and meeting the scheduled due dates for class assignments.

All faculty are bound by the UF policy for excused absences. For information regarding the UF Attendance Policy see the Registrar website for additional details:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

STUDENT EXPECTATIONS, ROLES, AND OPPORTUNITIES FOR INPUT

Expectations Regarding Course Behavior

Please come to class on time and be prepared to stay until the time scheduled as the end of class. We think your investment in the degree is worth maximizing your in-class experience, and we expect to provide materials that utilize the full, scheduled class times. The use of cell phones is not permitted. Please turn them off or, if you expect urgent calls, set them to vibrate."

Communication Guidelines

Assistance with course material is available during scheduled office hours or by appointment. Emailed questions are also welcome, and we aim to address all such inquiries within 24 hours of receipt (or on Monday if the email was sent on Friday). Please do not re-send the same question until the appropriate time frame has elapsed (24 hours or end of day Monday for emails sent on Friday). Student success and understanding is of the utmost importance, so each email receives careful consideration. Because the number of students in the course is not small, substantial time may be spent by the instructor and TA on emailed concerns; your patience and understanding is appreciated. When emailing a question, please also copy the TA, as this may increase your chances of getting a quick reply!

Academic Integrity

Students are expected to act in accordance with the University of Florida policy on academic integrity. As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge:

"We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."

You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied:

"On my honor, I have neither given nor received unauthorized aid in doing this assignment."

It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For additional information regarding Academic Integrity, please see Student Conduct and Honor Code or the Graduate Student Website for additional details:

<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>
<http://gradschool.ufl.edu/students/introduction.html>

Please remember cheating, lying, misrepresentation, or plagiarism in any form is an unacceptable and inexcusable behavior.

Online Faculty Course Evaluation Process

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

It is very important to me that you are able to develop a set of epidemiologic tools in this course that you will find useful in your career. Naturally, the presentation of some tools may be stronger than others. Your feedback on this issue is extremely valuable. Please feel free to comment on what strategies worked and which might be improved. Your input will be essential for us to modify future versions of this course to leverage such knowledge of strengths and weaknesses. As an additional consideration, these evaluations are also useful at the University level, as they are examined in the context of faculty tenure and promotion procedures.

SUPPORT SERVICES

Accommodations for Students with Disabilities

If you require classroom accommodation because of a disability, you must register with the Dean of Students Office <http://www.dso.ufl.edu> within the first week of class. The Dean of Students Office will provide documentation of accommodations to you, which you then give to me as the instructor of the course to receive accommodations. Please make sure you provide this letter to me by the end of the second week of the course. The College is committed to providing reasonable accommodations to assist students in their coursework.

Counseling and Student Health

Students sometimes experience stress from academic expectations and/or personal and interpersonal issues that may interfere with their academic performance. If you find yourself facing issues that have the potential to or are already negatively affecting your coursework, you are encouraged to talk with an instructor and/or seek help through University resources available to you.

- The Counseling and Wellness Center 352-392-1575 offers a variety of support services such as psychological assessment and intervention and assistance for math and test anxiety. Visit their web site for more information: <http://www.counseling.ufl.edu>. On line and in person assistance is available.
- You Matter We Care website: <http://www.umatter.ufl.edu/>. If you are feeling overwhelmed or stressed, you can reach out for help through the You Matter We Care website, which is staffed by Dean of Students and Counseling Center personnel.
- The Student Health Care Center at Shands is a satellite clinic of the main Student Health Care Center located on Fletcher Drive on campus. Student Health at Shands offers a variety of clinical services. The clinic is located on the second floor of the Dental Tower in the Health Science Center. For more information, contact the clinic at 392-0627 or check out the web site at: <https://shcc.ufl.edu/>
- Crisis intervention is always available 24/7 from:
 Alachua County Crisis Center
 (352) 264-6789
<http://www.alachuacounty.us/DEPTS/CSS/CRISISCENTER/Pages/CrisisCenter.aspx>

Do not wait until you reach a crisis to come in and talk with us. We have helped many students through stressful situations impacting their academic performance. You are not alone so do not be afraid to ask for assistance.