Research Methods In Demography (CSSS/CSDE/SOC 533)

Class Schedule

Lecture: TU 11:30 - 2:20 PM
Room: ARC G070
Zoom: [Link available via Canvas]
URL   https://canvas.uw.edu/

Professor

Name: Zack W. Almquist
Office: Savery 231
Office Hours: By appointment
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Course Description

The aim of this course is to give a general introduction to demographic methods for the Center for Demography and Social Ecology Graduate Certificate Program. Demographic methods are tools for population research and related disciplines. In this course, we examine the fundamental concepts, measures, and models that demographers use to understand human population dynamics. The course covers how demographers measure and estimate population growth, mortality, fertility, marriage, and migration. We will examine empirical and model-based methods for description, hypothesis testing, and forecasting.

Learning Goals

After completing this course, you will be familiar with the concepts and tools of demographic analysis and demographic methods applied in data science context. You will be able to apply many of these tools to demographic data in your own research.

Prerequisites

- This is a graduate class and as such there are no formal prerequisites. Students are assumed to have or be willing to quickly acquire sufficient understanding of R to complete the major project and lead one tutorial over the quarter.
  - Expectation is that you have taken a statistics course equivalent to SOC 504/505/506.
  - Expectation is that you have experience with R at the level of CSSS 508, see Charles Lanfear's infamous notes if you are not sure, https://clanfear.github.io/CSSS508/.

Course Structure

- 90 Minutes of Lecture
- 60-90 Minutes of R Lab Student taught

Assignments

Homework

There will be 5 Homeworks. The first homework will be released in the second week of class. All homeworks will be due two weeks later by midnight on the following TUESDAY. Two homeworks will be holistic checks on the material covered in the class. Homeworks will be graded out of 100 points.

- All homeworks will be released as RMarkdown and HTML documents on CANVAS
  - You can submit assignments as PDF, HTML, RMarkdown (if it compiles) or Google Documents.
- Late work policy. Come talk to me ASAP if you need more time and we will make a clear plan for you to finish your work before solutions are released.

R Labs and CSDE 502

Sign up: 🔁 Sign up for R Tutorials 533 - Winter 2023 . Everyone is expected to present one R tutorial over the quarter. Expectations are that these will be 15-25 minutes long (including questions). Tutorials need to be sent out SUNDAY night before Tuesday's lecture via email with the material uploaded into a folder on google drive: Tutorials Winter 2023.

Consider signing up for CSDE 502 if you plan to get the CSDE Demographic Methods Certification. Credit will be awarded based on your tutorial presentation. Currently there is no plan to hold the Friday course. All work will be concurrent with CSSS/CSDE/SOC 533.

- **Week 2 - Concepts and measures**
  - Review R and RStudio – tips, tricks and system management
  - Review to R Data Structures
  - Review to RMarkdown
- **Week 3 - Mortality: Age-specific rates and probabilities**

- ○ Review data manipulation in tidyverse
- ○ Keyring: securely store secrets
- ○ Introduction to Human Mortality Database
- **Week 4 - Mortality: Life tables and single decrement process**
  - ○ Review R plotting base R plotting
  - ○ Review R Plotting ggplot
  - ○ Review R functions
- **Week 5 - Mortality: Multiple decrement process**
  - ○ Introduction to demogR package for mortality process
  - ○ Introduction to tidycensus
  - ○ Introduction to tigris and map plots
- **Week 6 - Fertility: Fertility and reproduction**
  - ○ Introduction to Human Fertility Database
  - ○ Introduction to IPUMS (2x)
- **Week 7 - Fertility: Fertility and reproduction**
  - ○ Introduction to demogR package for fertility process (3x)
- **Week 8 - Population projections: Introduction and overview**
  - ○ Introduction to demography package (3x)
- **Week 9 - Population projections: Stable population model**
  - ○ Advanced R tips and tricks (3x)

Don't try to build these tutorials from scratch. Use the great resources that are available (among others):
- ● Materials for teaching demographic methods
- ● https://hanowell.github.io/uwsoc533a/index.html
  - ○ Covers HMD and HFD access
- ● https://clanfear.github.io/CSSS508/
- ● https://csde-uw.github.io/csde502-winter-2022/
- ● Basic usage of tidycensus
- ● Beginners - RStudio Education
- ● An R intro to the demography package
- ● demogR: A Package for the Construction and Analysis of Age-structured Demographic Models in R | Journal of Statistical Software
- ● 1 Introduction | ggplot2
- ● 4.2 Simple base R plots | An Introduction to R
- ● Introduction Markdown
- ● Data Types and Structures – Programming with R
- ● Dplyr tidyverse
- ● 1 Introduction to R and tidyverse | Data Management for Analytics and Applications

Grading

Homeworks:	80%
R lab:	20%

Letter grade assignment

% Points Earned	Number grade	Letter Grade
100-97	4.0-3.9	A
96-90	3.8-3.5	A-
87-89	3.4-3.2	B+
86-84	3.1-2.9	B
83-80	2.8-2.5	B-
79-77	2.4-2.2	C+
76-74	2.1-1.9	C
73-70	1.8-1.5	C-
69-67	1.4-1.2	D+
66-64	1.1-0.9	D
63-60	0.8-0.7	D-
59-0	0	F

Course Schedule

Note that the dates listed below are subject to change. Changes will be announced in class.

	DOW				Readings
1/3/2023	Tue	**Week 1 - Introductions & overview: Mortality, fertility, and population projections**			
		Lecture	01 Week - CSDE 533 Lecture		
		R Lab			
1/10/2023	Tue	**Week 2 - Concepts and measures**			
		Lecture		HW #1 Handed out	PHG: Chapter 1 EDM: Chapters 1 & 2 (not required) BHN: https://hanowell.github.io/uwsoc533a/concepts-and-measures.html
		R Lab			
1/17/2023	Tue	**Week 3 - Mortality: Age-specific rates and probabilities**			

					PHG: Chapter 2 EDM: 4.2, 6.2 BHN: https://hanowell.github.io/uwsoc533a/age-specific-rates-and-probabilities.html#age-specific-rates-and-probabilities
		Lecture			
		R Lab			
1/24/2023	Tue	**Week 4 - Mortality: Life tables and single decrement process**			
		Lecture		HW #1 Due; HW #2 Handed Out	PHG: Chapter 3
		R Lab			
1/31/2023	Tue	**Week 5 - Mortality: Multiple decrement process**			
		Lecture			PHG: Chapter 4
		R Lab			
2/7/2023	Tue	**Week 6 - Fertility: Fertility and reproduction**			
		Lecture		HW #2 Due; HW #3 Handed Out	PHG: Chapter 5
		R Lab			
2/14/2023	Tue	**Week 7 - Fertility: Fertility and reproduction**			
		Lecture			PHG: Chapter 5
		R Lab			
2/21/2023	Tue	**Week 8 - Population projections: Introduction and overview**			
		Lecture		HW #3 Due; HW # 4 Handed Out	PHG: Chapter 6
		R Lab			
2/28/2023	Tue	**Week 9 - Population projections: Stable population model**			
		Lecture			PHG: Chapter 7
		R Lab			
3/7/2023	Tue	**Week 10 - Research Horizon: Statistical demography, migration, kinship**			
		Lecture		HW #4 Due; HW #5 Handed Out	
		R Lab			
3/14/2023	Tue	**Week 11**			
			No Lecture	HW #5	
			No Lab		

Text Books

- [PHG] Preston, S. H., Heuveline, P., & Guillot, M. (2001). Demography: Measuring and modeling population processes. 📄 2001-preston-demography.pdf
- [EDM]Watcher, K. (2014). Essential Demographic Methods. Harvard Press. Essential Demographic Methods - Ken Watcher (Berkeley School)

Ben Hanowell's Notes

Ben Hanowell who taught this class in 2021 has an excellent set of notes and can be found here:

- [BHN] https://hanowell.github.io/uwsoc533a/index.html

Primary Texts

This is largely based on Dr Monica Alexander's excellent 5 week course on demographic methods, see Materials for teaching demographic methods.

- **Week 1 - Introductions & overview: Mortality, fertility, and population projections**
  - **Demographic transition theory:**
    - Lee, R. 2003. 'The Demographic Transition: Three Centuries of Fundamental Change.' Journal of Economic Perspectives 17(4):167-190.
    - Myrskylä, M., Kohler, H.P. and Billari, F.C., 2009. 'Advances in development reverse fertility declines'. Nature, 460(7256), pp.741-743.
    - Lesthaeghe, R., 2014. 'The second demographic transition: A concise overview of its development.' Proceedings of the National Academy of Sciences, 111(51), pp.18112-18115.
    - Zaidi, B. and Morgan, S.P., 2017. 'The second demographic transition theory: A review and appraisal. Annual review of sociology, 43, pp.473-492.'
  - **Population debates**
    - **Malthus v Boserup:**
      - Malthus, T. 1798. 'An Essay on the Principle of Population'. Chapters 4-5.
      - Boserup, E., 1965 'The conditions of agricultural growth: The economics of agrarin change under population pressure.'
      - Turner, B.L. and Fischer-Kowalski, M., 2010. 'Ester Boserup: An interdisciplinary visionary relevant for sustainability.' Proceedings of the National Academy of Sciences, 107(51), pp.21963-21965.
    - **Erlich v Simon:**
      - Ehrlich, P.R., Parnell, D.R. and Silbowitz, A., 1971. 'The population bomb'. New York: Ballantine books.
      - Simon, J.L., 1981. 'The Ultimate Resource'. Princeton University Press.

- ● Sabin, P., 2013. 'The bet: Paul Ehrlich, Julian Simon, and our gamble over Earth's future.' Yale University Press.
- **Week 2 - Concepts and measures**
- **Weeks 3, 4, 5 - Mortality**
    - ○ **Background**
        - ■ **Oldest-old mortality, mortality improvement:**
            - ● Barbi, E, Lagona, F, Marsili, M, Vaupel, J and Wachter, K. 2018. 'The plateau of human mortality: Demography of longevity pioneers', Science, 360: 1459-1461.
            - ● Critique: Newman, SJ. 2018. 'Plane inclinations: A critique of hypothesis and model choice in Barbi et al'. PLoS Biol 16(12): e3000048.
            - ● Ken's response: Wachter, K. 2018. 'Hypothetical errors and plateaus: A response to Newman'. PLoS Biol 16(12): e3000076.
            - ● Oeppen, J, and Vaupel, JW. 2002. 'Broken limits to life expectancy.' Science 296.5570: 1029-1031.
        - ■ **Mortality models:**
            - ● Lee, RD, and Carter, LR. 1992. 'Modeling and Forecasting US Mortality.' Journal of the American Statistical Association 87 (419). Taylor & Francis: 659-71.
            - ● Feehan, D. 2018. 'Separating the Signal From the Noise: Evidence for Deceleration in Old-Age Death Rates'. Demography 55(6):2025–2044.
            - ● Alexander, M., Zagheni, E., and Barbieri, M., 'A Flexible Bayesian Model for Estimating Subnational Mortality', Demography, 2017, 54(6): 2025–2041.
- **Week 6 & 7 - Fertility**
    - ○ Alkema, L, Raftery, A, Gerland, P and Clark, S 2011. 'Probabilistic Projections of the Total Fertility Rate for All Countries'. Demography. 48(3): 815-839.
    - ○ Bongaarts, J and Feeney, G. 1998. 'On the Quantum and Tempo of Fertility'. Population and Development Review, 24(2):271-291.
    - ○ Coale, A. and Trussel, J. 1974. 'Model Fertility Tables: Variations in the Age Structure of Childbearing in Human Populations' in Smith, D and Keyfitz, N. 'Mathematical Demography'. Chapter 30.
    - ○ Kohler, H and Philipov, D. 2001. 'Variance effects in the Bongaarts-Feeney Formula'. Demography. 38(1): 1-16.
    - ○ Schmertmann, C and Hauer, M. 2018. 'Bayesian estimation of total fertility from a population's age–sex structure'. Statistical Modelling 19(3): 1-23.
    - ○ Hauer, M. E., & Schmertmann, C. P. (2020). Population pyramids yield accurate estimates of total fertility rates. Demography, 1-21.
- **Weeks 8 & 9 - Population projections**
    - ○ Keyfitz, N. 1985. Applied mathematical demography. Second edition. Chapter 6.
    - ○ Bernadelli, H. 1941. 'Population Waves' in Smith, D and Keyfitz, N. 'Mathematical Demography'. Chapter 23.

- ○ Goodkind, D. 2017. 'The Astonishing Population Averted by China's Birth Restrictions: Estimates, Nightmares and Reprogrammed Ambitions'. 54:1375-1400.
    - ■ See responses, for example: Zhao, Z and Zhang, G. 2018. 'Socioeconomic Factors Have Been the Major Driving Force of China's Fertility Changes Since the Mid-1990s'. Demography. 55: 733-742.
- **Week 10 - Research Horizon: Statistical demography, migration, kinship**
    - ○ Byrant and Zhang, 2018. Bayesian Demographic Estimation and Forecasting. CRC Press.
    - ○ Wheldon, Raftery, Clark and Gerland, 2016. 'Bayesian population reconstruction of female populations for less developed and more developed countries'. Popul Studies. 70(1): 21–37.
    - ○ Raftery, A, Alkema, L and Clark, S. 2014. 'Bayesian Population Projections for the United Nations', Statistical Science. 29(1):58-68.
    - ○ Goodman, L, Keyfitz, N and Pullum, T. 1974 'Family Formation and the Frequency of Various Kin Relationships'. Theoretical Population Biology. 5: 1-27.
    - ○ Zagheni, E, Weber, I and Gummadi K. 2017. 'Leveraging Facebook's Advertising Platform to Monitor Stocks of Migrants'. Population and Development Review. 43(4): 721-734.

R Resources

I am always adding to this, so if you have recommendations add them as comments to the syllabus.

Datacamp

This class is supported by DataCamp, the most intuitive learning platform for data science and analytics. Learn any time, anywhere and become an expert in R, Python, SQL, and more. DataCamp's learn-by-doing methodology combines short expert videos and hands-on-the-keyboard exercises to help learners retain knowledge. DataCamp offers 325+ courses by expert instructors on topics such as importing data, data visualization, and machine learning. They're constantly expanding their curriculum to keep up with the latest technology trends and to provide the best learning experience for all skill levels. Join over 5 million learners around the world and close your skills gap.

Datacamp Recommendations

- Programming - Part 1 (Writing code in RStudio)
- Introduction to R
- Intermediate R
- Introduction to the Tidyverse
- Reporting with R Markdown

- [Managing - Part 1 (Projects in RStudio)](#)
- [Introduction to Writing Functions in R](#)
- [Introduction to Statistics in R](#) (Chapters 1-3)
- [Foundations of Probability in R](#) (Chapters 1-2)

UW Specific R Material (Written largely for graduate students)

Chuck's R Introduction to R for Social Scientists

- [CSSS 508 | UW CSSS508](#)

Chris Adolph's Visualization Course

- [Chris Adolph :: Visual](#)