

Sociology 756
Demographic Techniques II
Location: 8146 Social Science

Fall 2025
M, W 9:30-10:45

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This course builds on students' previous demographic research training in three ways. We derive and develop the continuous-time extension of life table quantities. We grow the state-space in which we work and the types of possible transitions we consider. We cover a series of additional demographic models that reveal (1) how populations change as a function of the interaction of multiple demographic processes, (2) how aggregate population change and individual life course experiences are connected, and (3) how demographic phenomena can be modeled in the absence of perfect information. Throughout the semester, we will consider how knowledge in the social sciences can be advanced with the tools of formal demography. As a secondary goal, the course is designed to augment students' data acquisition, management, and visualization skills through application of these methods in real-world inquiry.

Prerequisite: Sociology 674 (or equivalent introductory demographic techniques course) or discussion with instructor.

Required Texts:

Preston, S., P. Heuveline, and M. Guillot. 2001. *Demography: Measuring and Modeling Population Processes*. London: Blackwell Publishers.

Recommended: Wachter, K. *Essential Demographic Methods*. 2014. Cambridge: Harvard University Press.

Recommended: Healy, K. 2019. *Data Visualization: A Practical Introduction*. Princeton University Press. [Here](#).

Recommended: Wickham, H. & G. Grolemund. 2017. *R for Data Science*. O'Reilly. [Here](#).

Additional readings can be found through jstor.org, Google Scholar, and the UW-Madison MadCat system. Note: students should not need to pay for these.

Computing:

All of the problem sets for this class should be completed in R. R is more powerful than Excel for dynamic modeling. It is also the dominant programming language used by demographers; you will find a great deal of shared code that facilitates more complex demographic analysis. Knowledge of R

will augment your ability to efficiently answer a wide range of research questions and effectively communicate your research findings. This has value for securing research jobs within and beyond the academy. **You will be submitting programs with problem sets.** If you have not yet used R, do not fear! You are not alone in this class. We will start slowly and build each week. Download R here: <https://cran.r-project.org> and R Studio here: <https://www.rstudio.com>. Consider signing up for the [Intro to R](#) session taught by the SSC staff. Then work through the short chapters 5, 3, 4, and 10-12, in that order, of Wickham and Grolemund 2017.

Evaluation:

Grades will be based on weekly problem sets (35%) and two exams (exam 1: 30%, exam 2: 35%). Problem sets will be posted to our canvas page Wednesdays. They should take between 4 and 8 hours (including learning new R code) and are due the following Wednesday by the beginning of class. It is acceptable, even advisable, to work in groups on problem sets. You are responsible for turning in your own work. You are strongly encouraged to make sure you understand anything produced in partnership with classmates. Later in the semester, we will work on posting code and conducting code review.

AI policy:

You may use AI like you would consult a tutor. You would not ask a tutor to do an entire problem or the entire homework assignment for you. That is and would be cheating regardless of whether you do it with AI, answers from another internet source, or another student. You must attempt to do the problem on your own and/or in consultation with your homework group first. If you run into problems such as, "I can't figure out what the R code is for generating a variable" or "teach me how to install R" it is acceptable to ask AI, your instructor, and/or your TA. Also note that the exams are open-book and open-note. They do not require R programming. You will not have access to electronics or the internet. Focusing on learning the concepts and methods as you complete the homework assignments is a good way to lay the groundwork for doing well on the exams.

University of Wisconsin-Madison & University of Minnesota DemTech Partnership:

This course "meets with" POP 8093 Directed Study at the University of Minnesota. The mode for UW-Madison students is in-person. University of Minnesota students may participate using the Zoom link: <https://uwmadison.zoom.us/j/92412307274>

Anticipated Course Schedule (subject to change):

September 3: Introductions & Preliminaries

September 8, 10: Single Decrement Processes

Preston et al. Chapter 3

Healy. Chapter 1 & 2

Chiang, C.L. 1984. The Life Table and Its Applications. Krieger Publishing. Pages 147-152.

Wildeman, C. 2009. Parental Imprisonment, the Prison Boom, and the Concentration of Childhood Disadvantage. *Demography* 46(2):265-280.

Eloundou-Enyegue, P. 2004. Pregnancy-Related Dropouts and Gender Inequality in Education. *Demography* 41(3): 50-528.

September 15, 17: Modeling Mortality & Variance

Guest lecturer for either 15th or 17th: Prof. Michal Engelman (UW)

Healey. Chapter 3-4.

Goldstein, J. and R. Lee. 2020. Demographic Perspectives on Mortality in COVID-19 and Other Epidemics. *Proceedings of the National Academy of Sciences* 117(36): 22035-22041.

Chiang, C.L. 1984. *The Life Table and Its Applications*. Krieger Publishing.
Pages 78-85, 103-109, 153-167.

Molla, M.T., D.K. Wagener, and J.H. Madans. 2001. Summary Measures of Population Health: Methods for Calculating Healthy Life Expectancy. *Healthy People 2010*: 21. National Center for Health Statistics.

Efron, B. and R.J. Tibshirani. 1993. *Introduction to the Bootstrap*. Chapters 1, 2, and 6.

Keyfitz, N. Choice of Function for Mortality Analysis: Effective Forecasting Depends on a Minimum Parameter Representation. *Theoretical Population Biology*.

Optional: Goldstein, J., M. Osbourne, C. Breen, S. Atherwood. 2023. Mortality Modeling of Partially Observed Cohorts using Administrative Death Records. *Population Research and Policy Review* 42(3).

September 22, 24: Multiple Decrement Processes

Preston et al. Chapter 4

Hajnal, J. 1953. Age at Marriage and Proportions Marrying. *Population Studies* 7(2): 111-32.

Mensch, B.S., M.J. Grant, and A.K. Blanc. 2006. The Changing Context of Sexual Initiation in Sub-Saharan Africa. *Population and Development Review* 32(4):699-727.

Preston, S.H. 1970. The Age-Incidence of Death from Smoking. *Journal of the American Statistical Association* 65(331):1125-1130.

September 29, October 1: Increment Decrement Processes

Preston et al. Chapter 12

Rogers, A. 1975. *Introduction to Multiregional Mathematical Demography*. John Wiley and Sons. New York. Chapter 3.

Heuveline, P., J. Timberlake, F. Furstenberg. 2003. Shifting Childrearing to Single Mothers: Results from 17 Western Countries. *Population and Development Review* 29(1): 47-71.

Land, K.C., J. M.Guralnik, and D.G.Blazer. 1994. Estimating Increment-Decrement Life Tables with Multiple Covariates from Panel Data: The Case of Active Life Expectancy. *Demography* 31(2):297-319.

Lynch, S, E Zang. 2022. Bayesian Multistate Lifetables for Large and Complex State Spaces. *Sociological Methodology* 52(2):256-284.

October 6, 8: Measuring and Modeling Fertility, Demographic Translation

Guest lecturer: Prof. Monica Grant (UW). (Schwartz out of town Oct 8)

Preston et al. Chapter 5

Bongaarts, J. 1982. The Fertility-Inhibiting Effects of the Intermediate Fertility Variables. *Studies in Family Planning* 13:179-189.

- Bongaarts, John, and Griffith Feeney. "On the quantum and tempo of fertility." *Population and development review* (1998): 271-291.
- Bhrolcháin, M.N. 2011. Tempo and the TFR. *Demography* 48: 841-861.
- Johnson-Hanks, J., 2007. Natural intentions: fertility decline in the African Demographic and Health Surveys. *American Journal of Sociology*, 112(4), pp.1008-1043.
- Schöley, J. Willekens, F. Visualizing Compositional Data on the Lexis Surface. *Demographic Research* 36(21):627-658.
- Riffe, Tim. [The Joy of Fertility](#).
- Schoen, R. 2004. Timing Effects and the Interpretation of Period Fertility. *Demography* 41(4): 801-819.
- Wu, Lawrence L., and Nicholas DE Mark. "Is US fertility now below replacement? Evidence from period vs. cohort trends." *Population Research and Policy Review* 42.5 (2023):76.

October 13, 15, 20: Population Projection and Models of Renewal

Guest lecturer Oct 13: Yue Qin (UW).

- Preston et al. Chapter 6.
- Lutz, W. W. Sanderson, and S. Scherbov. 2001. The End of World Population Growth. *Nature*. 412:543-545.
- Mare, R. 1997. Differential Fertility, Intergenerational Educational Mobility, and Racial Inequality. *Social Science Research* 26(3): 263-291.
- Preston, S.H. and C. Campbell. 1993. Differential Fertility and the Distribution of Traits: The Case of IQ. *American Journal of Sociology* 98(5):997-1019.
- Mare, R. and V. Maralani. 2006. The Intergenerational Effects of Changes in Women's Educational Attainments. *American Sociological Review* 71:542-564.
- Loveman, M. and J.O. Muniz. 2007. How Puerto Rico Became White: Boundary Dynamics and Intercensus Racial Reclassification. *American Sociological Review* 72(6):915-939.
- Optional: Keyfitz, N. 1972. The Mathematics of Sex and Marriage.
https://digitalassets.lib.berkeley.edu/math/ucb/text/math_s6_v4_article-10.pdf
- Optional: Song, X. and R. Mare. Short- and Long-term Educational Mobility of Families: A Two-Sex Approach. *Demography* 54: 145-173.

October 22: Midterm exam

October 27, 29: The Stable Population Model

- Preston et al. Chapter 7, pp. 138-161.
- Preston, S.H. 1982. Relations between Individual Life Cycles and Population Characteristics. *American Sociological Review* 47: 253-264.
- Alho, J.M. 2008. Migration, Fertility, and Aging in Stable Populations. *Demography* 45(3): 641-650.
- Tucker, C. and J. Van Hook. 2013. Surplus Chinese Men: Demographic Determinants of the Sex Ratio at Marriageable Ages in China. *Population and Development Review* 39(2): 209-229.

November 3, 5: Population Momentum, Introduction to Variable-r

Guest lecturer: Prof. Jenna Nobles (UC Berkely)

Preston et al. Chapter 8

Preston, S. and A. Coale. 1982. Age Structure, Growth, Attrition and Accession: A New Synthesis. *Population Index* 48(2):217-259.

Merli, M.G. 1998. Mortality in Vietnam, 1979-1989. *Demography* 35(3): 345-360.

Cai, Y. 2008. An Assessment of China's Fertility Level Using the Variable-r Method. *Demography* 45(2): 271-281.

November 10, 12: Population Selection and Length-Biased Sampling

Guest lecturer: Prof. Elizabeth Wrigley Field (UM)

Wickham and Grolemond Chapter 28.

Vaupel, J.W. and A.I. Yashin. 1985. Heterogeneity's Ruses: Some Surprising Effects of Selection on Population Dynamics. *American Statistician* 39(3):176-185.

Wrigley-Field, E. and D. Feehan. 2022. In a Stationary Population, the Average Lifespan of the Living Is a Length-Biased Life Expectancy. *Demography* 59(1):207-220.

Dowd, J.B. and A. Hamoudi. 2014. Lagged Selection Bias and Artefactual Trends in Mortality. *International Journal of Epidemiology* 43(4): 983-988.

Palloni, A. and J.R. Thomas. 2013. Estimation of Covariate Effects with Current Status Data and Differential Mortality. *Demography* 50(2): 521-544.

Engelman, M., V. Canudos-Romo, and E. Agree. 2010. The Implications of Increased Survivorship for Mortality Variation in Aging Populations. *Population and Development Review*. 36(3): 511-539.

November 17, 19: Population Dynamics and Kinship Structure

Watkins, S.C., J.A. Menken, J.G. Bongaarts. 1987. Demographic Foundations of Family Change. *American Sociological Review* 52:346-358.

Schwartz, C.R., R. González-Velastín, A. Li. 2023. Lifetime Years Married Held Steady for Men with a BA Degree Since 1960 but Dropped to Lowest Level Since 1880 for Men Without a BA. *PNAS* 120 (28), e2301983120.

Song, X. and R. Mare. 2019. Demographic Transitions, Shared Lifetimes, and Multigenerational Transmission of Inequality. *Demography*.

Zagheni, E. The Impact of the HIV/AIDS Epidemic on Kinship Resources for Orphans in Zimbabwe. *Population and Development Review* 37(4):761-783.

Murphy, M. 2004. Tracing Very Long-Term Kinship Networks Using SOCSIM. *Demographic Research* 10: 171-196.

Chung, P. and M. Alexander. Kin Dependency Ratios: An Extension and Application of the Goodman Method for Estimating the Availability of Kin. [Here](#).

Umberson, D. and colleagues. 2017. Death of Family Members as an Overlooked Source of Racial Disadvantage in the United States. *Proceedings of the National Academy of Sciences* 114(5): 915-920.

Caswell, H. and X. Song. 2021. Kinship Dynamics with Time-Varying Demographic Rates. <https://www.biorxiv.org/content/10.1101/2021.03.15.435377v1.full.pdf>

November 24: **Guest lecturer: Prof. Héctor Pifarré i Arolas (UW)** “Recent innovations in life table methodology”

- Guillot, M. (2003). The cross-sectional average length of life (CAL): A cross-sectional mortality measure that reflects the experience of cohorts. *Population Studies*, 57, 41–54.
- Nepomuceno, M. R., Cui, Q., van Raalte, A., Aburto, J. M., & Canudas-Romo, V. (2022). The cross-sectional average inequality in lifespan (CAL \dagger): A lifespan variation measure that reflects the mortality histories of cohorts. *Demography*, 59, 187–206.
- Pifarré i Arolas, H., Andrade, J. and Myrskylä, M., 2025. An Overlapping Cohorts Perspective of Lifespan Inequality. *Demography*, 62(2), pp.441-465.

November 26: No class. Wednesday of Thanksgiving week.

December 1, 3: Estimating Demographic Quantities from Multiple Sources

- Preston et al. Chapter 9
- Healy Chapter 8
- Schmertmann, C.P. 2002. A Simple Method for Estimating Age-Specific Rates from Sequential Cross-Sections. *Demography* 39(2):287-310.
- Feehan, D.M., M. Mahy, and M. Salganik. 2017. The Network Survival Method for Estimating Adult Mortality. *Demography* 54(4): 1503-1528.
- Bruch E. and M. Newman. 2019. The Structure of Online Data Markets in U.S. Cities. *Sociological Science* 6(9): 219-234.
- Cowan, S. 2013. Cohort Abortion Measures for the United States. *Population and Development Review* 39(2): 289-307.
- Heuveline, P. 2015. The Boundaries of Genocide: Quantifying the Uncertainty of the Death Toll During the Pol Pot Regime in Cambodia (1975-79). *Population Studies* 69(2): 201-218.
- Cesare N., H. Lee, T. McCormick, E. Spiro, E. Zagheni. 2018. Promises and Pitfalls of Using Digital Traces for Demographic Research. *Demography* 55(5): 1979-1999.
- Leasure et al. 2023. Nowcasting Daily Population Displacement Data through Social Media Advertising Data. *Population and Development Review*.
- Dobra, A., N. Williams, and N. Eagle. Spatiotemporal Detection of Unusual Population Behavior Using Mobile Phone Data. *PLOS One* 10(3).

December 8. Review, catch-up

December 10. Final Exam, in class