# HEALTH GIS
## GEOG-368
## Spring 2019

### Tues/Thurs 1:20-2:50 pm, Carnegie 109

**Instructor:** Kelsey McDonald, PhD
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**Office:** Carnegie 110
**Office Hours:** Mon. 1-2:30pm,
Wed. 11am-12pm, or by appointment

**GIS Lab Instructor:** Ashley Nepp
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**Office Hours:** Mon. 3-5pm, Wed. 1-3pm,
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**Teaching Assistant:** Dio Cramer (dcramer@macalester.edu), office hours TBD

### Course Description and Objectives:
This course builds on skills learned in the Introductory Geographic Information Systems (GIS) course by focusing explicitly on geospatial techniques used for analyzing problems in public health. Through lectures, discussions, hands-on labs, and an independent project, students will learn how to access, process, and map health outcomes data. Using advanced spatial-statistical and epidemiological tools, we will analyze health disparities, neighborhood effects on health, and spatial clustering of disease events, such as rare cancers. We will use similar techniques to examine environmental health and environmental justice questions in a spatial framework; analyze the spread of infectious diseases; model the spatial ecology of vector-borne diseases, such as Lyme disease and malaria; and optimize spatial access of populations to health care services. Students will be required to complete a final independent project on a topic of their choice.

Lab section registration is required.
*Prerequisite:* GEOG-225 and permission of instructor; completion of GEOG 256 and/or MATH 125 is highly encouraged before taking this course.

### Required Readings:
<u>All of the required readings</u> for this course will be available electronically, via Moodle.

### Recommended Readings and References (available on reserve in library):
1. Cromley, E. and S. McLafferty (2012). *GIS and Public Health*, 2nd. ed. Guilford Press. (recommended textbook)
2. Koch, T. (2005). *Cartographies of disease: maps, mapping, and medicine*. Redlands, CA: Esri Press.
3. Koch, T. (2011). *Disease maps: epidemics on the ground*. University of Chicago Press.
4. Krivoruchko, K. (2011). *Spatial statistical data analysis for GIS users*. Esri Press. *(Note: not available in library.)*
5. Kurland, K. S. & W. L. Gorr (2012). *GIS tutorial for health*, 4th ed. Redlands, CA: Esri Press. *(or 2014, 5th ed.)*
6. Maantay, J. A., & McLafferty, S. (Eds.). (2011). *Geospatial analysis of environmental health*. Springer.
7. McGrew, J.C., Jr. & Monroe, C. B. (2014). *An introduction to statistical problem solving in geography*. Waveland Press.
8. Waller, L. A., & Gotway, C. A. (2004). *Applied spatial statistics for public health data*. John Wiley & Sons.

## Class Format:

In the **first half** of the course, we will focus on a common set of topics, readings, and exercises, in order to build our knowledge and skills in GIS analysis for public health. Generally, on **Tuesdays** we will use a hybrid lecture-discussion format during class time. Feel free to ask questions, and expect that I will ask you questions, too. The readings are an accompaniment to the day's lecture-discussion. The more closely you do the readings, *before class starts*, the better you will understand the course material. On **Thursdays**, we will critique a couple of maps from a recent lab exercise, then I will assign a new lab exercise and you will have some time to start working on them during class time. Note that you will need to continue working on the lab outside of class. Ashley Nepp (GIS Instructor/Lab Supervisor) will also be available to help you with your GIS lab exercises.

You will begin to develop your independent projects during the first half of the course, and during the **second half** of the course you will devote yourself to your independent projects. We will be available for assistance throughout the process.

## Course Assignments

Unless otherwise indicated, all assignments must be submitted on Moodle.

1) Attendance and Participation (see policy below).

2) Lab Exercises. These weekly lab assignments (7 total, in the first part of the semester) will serve as the main way for you to turn theory and concepts into practice. Typically, these labs will help you develop mastery of important tools and techniques for analysis of public health problems in GIS. Generally speaking, the labs will be due the week *after* they are assigned; due dates will be indicated on each lab assignment.

3) Research Project. In your final project, you will use GIS-based, statistical, and epidemiological methods to answer a research question of significance in public health. You will employ GIS analytically and as a way of visualizing your results to present them to a broad audience. The final project will have several stages with corresponding due dates. The format for presentation of project results will be an academic poster.

## Grading

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|---|---|
| Attendance and Participation | 15% |
| Lab Exercises (7 x 5%) | 35% |
| Research Project (includes several components) | 50% |
| **TOTAL** | **100%** |

| Course Grades: | | | | | | | |
|---|---|---|---|---|---|---|---|
| Letter grades will be assigned as follows: | | | C+ | 77 - <80% | Achievement **meets** course requirements in every respect | F | < 60%   No credit: |
| A | ≥ 94% | Achievement is **outstanding** relative to level necessary to meet course requirements | C | 73 - <77% | | | Work was unworthy of credit, or incomplete and no agreement was reached for an official Incomplete. |
| A- | 90 - <94% | | C- | 70 - <73% | | | |
| B+ | 87 - <90% | Achievement is **significantly above** level necessary to meet course requirements | D+ | 67 - <70% | Achievement is worthy of credit but fails to fully meet course requirements | I | The policy for incompletes is in accordance with that of the college: **http://www.macalester.edu/academicprograms/academicpolicies/grading/** |
| B | 83 - <87% | | D | 63 - <67% | | | |
| B- | 80 - <83% | | D- | 60 - <63% | | | |

## Late Policy:
Any paper or assignment turned in after the due date will be **graded down 25% for each day** it is late. Exceptions may be made for extraordinary circumstances, if requested before the due date.

## Class Attendance and Participation Policy:
In this class, 15% of your grade derives from attendance and participation. Consistent attendance is necessary to fully comprehend the course material, and there will be plenty of opportunities to participate in this class. "Participation" can include many kinds of contributions: asking questions in class, contributing to class discussions, coming to see the professor during office hours with questions or comments, etc. Reaction papers and other small assignments also count towards your participation grade. I also encourage students to engage with relevant events and news beyond the course. I will create an Open Forum on our course Moodle for you to post news items on mapping and spatial analysis in public health.

You should think of this course as seminar-like in terms of how much active, engaged participation I expect from you. If you attend class consistently (zero or very few absences), participate frequently, and make significant contributions to everyone's learning experience, you can expect to get a high grade for attendance and participation. If you show up to every class but never say anything, you will get fewer points. If you miss many classes, and then make little or no effort to participate, you should expect to get a very low attendance/participation score.

## Academic Dishonesty Policy:
Academic dishonesty will not be tolerated in this course. Acts of academic dishonesty include, but are not limited to, plagiarism, fabrication of data, cheating, stealing or buying copies of exams or papers, unauthorized collaboration, and taking exams for someone else. Be aware that at Macalester penalties for academic dishonesty include verbal reprimand, written reprimand, lowering of grade on a specific exam or assignment, a failing grade on specific exam or assignment, lowering of course grade, a failing course grade, suspension from the college, and expulsion from the college. Depending on the circumstances of the infraction, you may be subject to any of these penalties. For more details, see the college's information on Academic Integrity at http://www.macalester.edu/academicprograms/academicpolicies/academicintegrity/ . There will be some collaborative work in this class, but I will indicate clearly when an assignment is meant to be done with a partner, in a group, or alone.

## Special Accommodations:
In some circumstances, course design may pose barriers to a student's ability to access or demonstrate mastery of course content. Reasonable accommodations are available for students with documented disabilities. If you think you need an accommodation, please contact the Office of Student Affairs early in the semester. The Assistant Dean of Students coordinates services for any student in need of accommodations. You may schedule an appointment by contacting the Office of Student Affairs, 119 Weyerhaeuser, 651-696-6220.

## Course Outline

| Wk | Dates | Topic(s) | Readings/Other | Lab Exercises | Project Milestones |
|---|---|---|---|---|---|
| 0 | Jan. 24 | Introduction. | | Assignment: Data Sources, Part I (due Tues. 1/29) | |
| 1 | Jan. 29, 31 | Spatial Epidemiology | Koch, T. (2005). *Cartographies of Disease*, ch. 1 & 6.<br>*GIS and Public Health*, Ch. Introduction, 1, 2 (recommended).<br>Johnson, S. (2007). *The Ghost Map* (optional). | Lab 1. John Snow and the 1854 London Cholera Epidemic<br>-----------------------<br>Assignment: Data Sources, Part II (due Thurs. 2/7) | |
| 2 | Feb. 5, 7 | Finding and Preparing Spatial Data | *GIS and Public Health*, Ch. 3 (recommended)<br>Other readings on Moodle (see Georeferencing Resources) | Lab 2. Finding and Preparing Spatial Data | |
| 3 | Feb. 12, 14 | Mapping Health Information; Health Disparities | Beyer, K. M., Tiwari, C., & Rushton, G. (2012). "Five Essential Properties of Disease Maps." *Annals of the Association of American Geographers*, *102*(5), 1067-1075.<br>Beyer, K.M.M. and G. Rushton (2009). "Mapping cancer for community engagement." *Prev Chronic Dis* 6(1).<br>Grubesic, T., & Pridemore, W. (2011). "Alcohol outlets and clusters of violence." *International Journal of Health Geographics, 10*(1), 30.<br>Holt, J.B. (2007). "The topography of poverty in the United States." *Prev Chronic Dis* 4 (4).<br>*GIS and Public Health*, Ch. 4 (recommended) | Lab 3. Mapping Elevated Blood Lead Levels in Allegheny County, Pennsylvania. | Research Topic Statement Due (due Thurs. 2/14) |
| 4 | Feb. 19, 21 | Analyzing Spatial Clustering of Health Events | Parker-Pope, T. (2013, Dec. 20). "Tackling a Racial Gap in Breast Cancer Survival." *New York Times*.<br>Silent Spring Institute (2006). *Findings of the Cape Cod Breast Cancer and Environment Study*<br>Oyana, T. J. and Margai, F. M. 2010. "Spatial Patterns and Health Disparities in Pediatric Lead Exposure in Chicago: Characteristics and Profiles of High-Risk Neighborhoods." *The Professional Geographer* 62: 46-65.<br>*GIS and Public Health*, Ch. 5 (recommended) | Lab 4. Analyzing Cancer Clusters | |

| Wk | Dates | Topic(s) | Readings/Other | Lab Exercises | Project Milestones |
|---|---|---|---|---|---|
| 5 | Feb. 26, 28 | Analyzing Environmental Hazards | *GIS and Public Health*, Ch. 6 (recommended)<br>At least one of the following will be assigned to you as required reading:<br>Brulle, R. J., & Pellow, D. N. (2006). Environmental justice: Human health and environmental inequalities. *Annual Review of Public Health, 27*, 103-124.<br>Hanchette, C. (2008). "The political ecology of lead poisoning in eastern North Carolina." *Health and Place* 14: 209-216.<br>Pulido, L. (2000). "Rethinking Environmental Racism: White Privilege and Urban Development in Southern California." *Annals of the Association of American Geographers, 90*(1), 12-40.<br>Morello-Frosch, R., Pastor, M., Jr., Porras, C., & Sadd, J. (2002). "Environmental justice and regional inequality in southern California: implications for future research." *Environ Health Perspect, 110 Suppl 2*, 149-154.<br>Ash, M., Boyce, J. K., Chang, G., Pastor, M. J., Scoggins, J., & Tran, J. (2009). *Justice in the Air*. Amherst, Mass.: PERI. | Lab 5. Using Toxic Release Inventory Data for Environmental Justice Analysis | Research Project Proposal Due (due Thurs. 2/28) |
| 6 | Mar. 5, 7 | Infectious and Vector-Borne Diseases | *GIS and Public Health*, Ch. 7-8 (recommended)<br>Hay, S., Guerra, C., Gething, P., et al. (2009). "A World Malaria Map: *Plasmodium falciparum* Endemicity in 2007." *PLoS Medicine* 16(3):0286-0302.<br>Ghosh, D. (2011). "Chapter 7: Geospatial Analysis of West Nile Virus (WNV) Incidences in a Heterogeneous Urban Environment: A Case Study in the Twin Cities Metropolitan Area of Minnesota." In Maantay, J.A. and S. McLafferty (eds.) *Geospatial Analysis of Environmental Health.* Springer.<br>Guerra, M., Walker, E., Jones, C., et al. (2002). "Predicting the Risk of Lyme Disease: Habitat Suitability for *Ixodes scapularis* in the North Central United States." *Emerging Infectious Diseases* 8(3): 289-297.<br>See also Malaria Atlas Project link on Moodle. | Lab 6. Lyme Disease Risk Mapping | |

| Wk | Dates | Topic(s) | Readings/Other | Lab Exercises | Project Milestones |
|---|---|---|---|---|---|
| 7 | Mar. 12, 14 | Access to Health Services | *GIS and Public Health*, Ch. 9-10 (recommended) <br> Hare, T. S., & Barcus, H. R. (2007). Geographical accessibility and Kentucky's heart-related hospital services. *Applied Geography*, *27*(3), 181-205. | Lab 7. Modeling Access to Health Services Using Network Analyst | Research Project Working Bibliography and Progress Report (due Thurs. 3/14) |
| *SPRING BREAK 3/16-3/24* | | | | | |
| 8 | Mar. 26, 28 | Project Updates | | | |
| 9 | Apr. 2, 4 | Work on Projects | | | |
| 10 | Apr. 9, 11 | Work on Projects | | | Research Project Preliminary Results (due Thurs. 4/11 <u>by noon</u>) |
| 11 | Apr. 16, 18 | Work on Projects; Peer Review, Finalize Posters (due Monday) | | | Peer Review Assignment (due Tues. 4/16) |
| 12 | Apr. 23, 25 | Present Projects in Class | | | Research Poster Due (<u>Monday</u> 4/22) <br><br> Research Presentation |
| *MUGS Conference at UW Madison 4/26-4/27* | | | | | |
| 13 | Apr. 30, May 2 | Present Projects in Class; Public Poster Session | | | Research Presentation |
| | May 9, 1:30-3:30 pm | FINAL EXAM period (may use for presentations or open house) | | | |