

GEOG 510

GIS and Spatial Analysis for Public Health

Spring 2025

TR 2:50 – 4:05 PM

Callcott Social Science Center 302

Instructor: Varun Goel

E-mail: varungoel@sc.edu

Office: Callcott Social Science Center 111

Student Support Hours Hours: **TR 1:30-2:30 pm** & by appointment

Academic Bulletin Description

Topics in Geography: GIS and Spatial Analysis for Public Health

Course Description

This course will introduce GIS and spatial data, including the spatial representation and modeling of health-related data, and review common GIS-based visualization and spatial analytic methods used in public health studies. The overall objective of the course is to provide students with a solid theoretical foundation for visualizing, exploring, and analyzing public health-related issues within the framework of GIScience and to gain practical skills that can be used to leverage this knowledge. Students will learn and use various GIS software and spatial and non-spatial data from different sources to address specific health-related questions. Various public health topics will be covered, including access to health care, food (in)security, infectious diseases, environmental health, and social determinants of health among others.

Prerequisites

There are no prerequisites for this course. However, any previous experience with GIS and statistical software will be helpful. As such, the course is designed to get you “up to speed” very quickly on geographic concepts, spatial data, and the use of GIS software. The instructor will also provide additional links to tutorials for students without any working knowledge of GIS and statistical software.

Learning Outcomes

Upon successful completion of this course, you will be able to:

1. Understand the concepts of spatial representation of health information
2. Make and interpret health data maps using different GIS methods
3. Extract and integrate various spatial and non-spatial health data from multiple sources
4. Have a working knowledge of the functionality provided by GIS for monitoring, assessing, and analyzing public health-related issues
5. Understand how GIS is used to solve public health related-problems

6. Have basic mapping, GIS, and spatial analysis skills using various GIS and statistical software

Course Materials

Required Textbook: Cromley, E.K., & McLafferty, S.L. (2012). *GIS and Public Health*, (2nd Edition) New York: The Guilford Press (also available online through USC library)

Other reading materials will be placed on the course website.

All course will materials comply with copyright/fair use policies.

Technology Requirements

Lecture presentations, links to articles, assignments, and other course materials will be available on the dedicated [course website](https://gisph.netlify.app) [https://gisph.netlify.app]. To participate in learning activities and complete assignments, you will need access to a working computer, reliable Internet access and a USC email account, a current Internet browser that is compatible with OneDrive, a word processing program, and reliable data storage for your work. Students will use mapping and data processing software such as QGIS, R, GeoDa and SatScan for the course. Detailed instructions will be provided, and all software will also be available on computers in the class lab.

Please note that we will use blackboard only for posting grades. All the course materials will be submitted through OneDrive in a student folder that will only be accessible to the student and the instructor.

Course Policies and Procedures

Attendance Policy

Students are responsible for all material covered in class, including assignments, even if absent. To be respectful of your fellow classmates, please be ready for class at the scheduled time. Per University Policy, frequent absences and lateness will be penalized by the instructor. Students with more than **four unexcused** absences will have their final course letter grade dropped by one full grade (a "B" becomes a "C", etc.). If you have an [excused absence](https://academicbulletins.sc.edu/undergraduate/policies-regulations/undergraduate-academic-regulations) (https://academicbulletins.sc.edu/undergraduate/policies-regulations/undergraduate-academic-regulations), you should, at the first opportunity, notify me through a written request (email is acceptable) stating:

- The date(s) of absence
- The reason for absence. In some cases, documentation may be required. For additional information, please consult the [USC attendance policy](#).

Regardless of whether you have an excused or unexcused absence, you will be expected to complete a makeup assignment in either case. Makeup assignments and their instructions will be provided by the instructor.

In Class Smartphone and Computer Use Policy

Unless instructed, your electronic devices, other than your laptop should be placed on silent and should be put away in your pocket or bag. Lecture slides will be available on the course website before the class for you to print and take notes with a pen if you would like. If there is a serious need to leave your phone on vibrate (such as a family emergency), please let me know. If you happen to leave the class to accept a phone call, then I will have advance knowledge of the potential emergency.

Late Work Policy

All assignments will be posted on the course website with detailed instructions including the due dates. All assignments must be submitted electronically prior to the due date/time. Unless you have an [excused absence](#) or have a previous agreement with me, late submissions will be penalized 10% for each day overdue.

Academic Integrity

From *Academic Responsibility* – The Honor Code (STAF 6.25): “It is the responsibility of every student at the University of South Carolina to adhere steadfastly to truthfulness and to avoid dishonesty in connection with any academic program. A student who violates, or assists another in violating the Honor Code, will be subject to university sanctions.” Students who engage in this type of behavior will receive, at a minimum, a “0” (zero) for the work in question and risk failure for the course. Other sanctions may also be pursued.

Plagiarism

Using the words or ideas of another as if they were one’s own is a serious form of academic dishonesty. If another person’s complete sentence, syntax, key words, or the specific or unique ideas and information are used, one must give that person credit through proper citation.

Generative Artificial Intelligence (AI) Policy

To maintain a culture of integrity and respect, these generative AI tools should not be used in the completion of course assignments unless the instructor specifically authorizes their use. You will be informed as to when and how these tools may be used, along with guidance for attribution if/as needed. Any use of generative AI tools outside of these parameters constitutes plagiarism and will be treated as such.

As an exception to the default prohibition on using AI tools for this course, you may use ChatGPT and similar tools for assistance with all assignments. You are not allowed to use word-for-word use. Instead, you are to paraphrase and/or substantively edit AI-generated content (at least 85% as a guideline) and cite your use of the tool. You must double-check the work

generated by AI, which can be wrong. If you submit work that is incorrect or irrelevant, even if it was generated by AI, you will not receive credit for it. If you are not sure if a tool you wish to use is permitted for our course or you wish to use a tool for specific purpose you think does not violate the principles articulated here, please contact the instructor to discuss it first.

Class Conduct

Professionalism will be expected at all times. Because the university classroom is a place designed for the free exchange of ideas, we must show respect for one another in all circumstances. We will show respect for one another by exhibiting patience and courtesy in our exchanges. Appropriate language and restraint from verbal attacks upon those whose perspectives differ from your own is a minimum requirement. Courtesy and kindness are the norm for those who participate in my class.

Course Assignments and Grading

General Assignment Information

- All coursework (e.g., assignments, projects) and rubrics will be available on the course website.
- All assignments will be due, and all exams administered on the day indicated on the course schedule.
- All checkpoint assessments and exercises will be posted on the course website and will be submitted to OneDrive.
- All -class exercises will be administered in class.

Evaluation

Final grades in this course will be assigned based on the performance on weekly reflections, in class exercises, leading discussion, checkpoint assessments, midterm exam, and your final project.

1) Attendance and Participation (100 points)

Class meetings will include lecture, discussion, applied activities. These applied activities will also involve instructor demos followed by pop quizzes or other in-class Participation scores will be evaluated via contributions made to class discussions and attendance in class.

2) In-Class Exercises (150 points)

Class meetings every week will also consist of various active In-class exercises. During class meetings, the instructor will conduct a tutorial that highlights the week's core concepts in 'action'. Building on those tutorials, students will answer a case study or relevant questions in-class for submission on OneDrive.

4) Checkpoint Assessments (500 points, 125 each)

To assess understanding of course material as it relates to contemporary issues, students will be asked to complete 4 structured “Checkpoint Assessments” throughout different points of the semester. The purpose of these checkpoint assessments is to help you apply techniques and concepts learned in class to major contemporary real world global health issues.

Checkpoint assessments are individual assignments and will be assessed based on completion and a grading rubric that will be distributed by the instructor.

5) Final Project + Presentation/Evaluation (200 points + 50 points for presentation/evaluation)

All students are required to submit a Final GIS Project Paper. You will get feedback from the instructor and your classmate to improve your papers for the final submission. The instructor will provide detailed requirements and rubrics for the paper. In addition, students will also have the opportunity to develop their ideas throughout the semester. Please discuss this with the instructor early in the semester about your topic for the final project paper.

GRADUATE STUDENTS ONLY: All graduate students will deliver a 15-minute oral presentation related to their final project during class at the end of the semester. A detailed grading rubric will be provided by the instructor.

UNDERGRADUATE STUDENTS ONLY: Each undergraduate student will write a peer assessment for 1 presentation based on a grading criteria that will be distributed at the beginning of class. Assessments will be filled and submitted in class before the end of class, using a grading rubric provided by the instructor.

Grading Scale

All graded assignments will be returned to your folder on OneDrive. You are strongly encouraged to check your grades regularly. A final letter grade will be assigned based on percentages.

Assignment Weights	Points
Attendance/Participation	100
In-Class Exercises	150
Checkpoint Assignments	500
Final Project Presentation/Evaluation	50
Final Project Poster/Paper	200
Total	1000

Grading Scale

900 - 1000 = A

850 - 899 = B+

800 - 849 = B

750 - 799 = C+
 700 - 749 = C
 650 - 699 = D+
 600 - 649 = D
 0 - 599 = F

Course Schedule

The instructor reserves the right to make changes to this schedule; students will be informed in advance where practical. The required textbook will be labelled as CM. Additional readings will be provided on course website or OneDrive.

Day	Date	Topic	Readings/Assignments Due
T	13-Jan	<ul style="list-style-type: none"> Class Introduction Introduction to Health Geography Geographic Concepts and GIS 	<ul style="list-style-type: none"> CM introduction and Ch. 1
TH	15-Jan		
T	20-Jan	<ul style="list-style-type: none"> Introduction to Spatial Health Data Projections and Coordinate Systems Data Quality and Metadata 	<ul style="list-style-type: none"> CM Ch. 2 O'Sullivan, D., & Unwin, D. J. (2010). Geographic Information Analysis, Ch. 2
Th	22-Jan		
T	27-Jan	<ul style="list-style-type: none"> Geocoding Table and Spatial Join Data Integration 	<ul style="list-style-type: none"> CM Ch. 3 <i>Assignment 1</i>
Th	29-Jan		
T	3-Feb	<ul style="list-style-type: none"> Mapping Health Information Map Design 	<ul style="list-style-type: none"> CM Ch. 4 Koch, T. (2005). Cartographies Of Disease: Maps, Mapping, And Medicine, Ch. 1
Th	5-Feb		

Day	Date	Topic	Readings/Assignments Due
T	10-Feb	<ul style="list-style-type: none">Query and Field CalculationGIS Overlay, Distance, BufferSpatial Variation and Clustering	<ul style="list-style-type: none">CM Ch. 5
Th	12-Feb		
T	17-Feb	<ul style="list-style-type: none">Pattern and ProcessSpatial Neighbors and Autocorrelation	<ul style="list-style-type: none">O’Sullivan, D., & Unwin, D. J. (2010). Geographic Information, Ch. 4Assignment 2
Th	19-Feb		
T	24-Feb	<ul style="list-style-type: none">Disease ClustersGrouping and Regionalization	<ul style="list-style-type: none">Sabel, C. E., & Loytonen, M. (2004). Clustering of Disease. In R. Maheswaran & M. Craglia (Eds.), GIS in Public Health Practice (pp. 51–67). CRC Press
Th	26-Feb		
T	3-Mar	<ul style="list-style-type: none">Applications of Autocorrelation, Clustering, and Grouping	<ul style="list-style-type: none">Delamater, P.L et al., 2018. Examining the spatiotemporal evolution of vaccine refusal: nonmedical exemptions from vaccination in California, 2000–2013. BMC Public Health 18, 1–13
Th	5-Mar		
TR 10-12 Mar Spring Break (No Classes)			
T	17-Mar	<ul style="list-style-type: none">Environmental HazardsSpatial Interpolation	<ul style="list-style-type: none">CM Ch. 6Assignment 3
Th	19-Mar		
T	24-Mar	<ul style="list-style-type: none">Disease Risk and DiffusionEcology of Disease	<ul style="list-style-type: none">CM Ch. 7CM Ch. 8
Th	26-Mar		

Day	Date	Topic	Readings/Assignments Due
T	31-Mar	<ul style="list-style-type: none">Spatial Regression TechniquesTemporal Analysis and Change Detection	<ul style="list-style-type: none">Sparks, P. J., & Sparks, C. S. (2010). An application of spatially autoregressive models to the study of US county mortality rates. <i>Population, Space and Place</i>, 16(6), 465–481
Th	2-Apr		
T	7-Apr	<ul style="list-style-type: none">Neighborhoods and Health	<ul style="list-style-type: none">CM Ch. 11Diez Roux, A. V. (2001). Investigating Neighborhood and Area Effects on Health. <i>American Journal of Public Health</i>, 91(11), 1783–1789<i>Assignment 4</i>
Th	9-Apr		
T	14-Apr	<ul style="list-style-type: none">Access to Health CareNetwork AnalysisSpatial Interaction Models	<ul style="list-style-type: none">CM Ch. 9Delamater, P. L. (2013). Spatial accessibility in suboptimally configured health care systems: A modified two-step floating catchment area (M2SFCA) metric. <i>Health & Place</i>, 24, 30–43.
Th	16-Apr		
M	21-Apr	<ul style="list-style-type: none">Health Care Service Utilization and locationFinal Paper/Poster Presentations	CM Ch. 10
W	23-Apr		
M	30-April	Final Project Paper Due by 4 pm	

Academic Success

Your instructor is committed to helping you achieve the best in this course. Below is a list of valuable support resources available at USC. Please reach out to me for assistance in accessing any of these support services.

Disability Services

The [Student Disability Resource Center](http://www.sa.sc.edu/sds/) (SDRC) (<http://www.sa.sc.edu/sds/>) empowers students to manage challenges and limitations imposed by disabilities. In order to receive reasonable accommodations from me, you must be registered with the Student Disability Resource Center (1705 College Street, Close-Hipp Suite 102, Columbia, SC 29208, 803-777-6142). Any student with a documented disability should contact the SDRC to make arrangements for appropriate accommodations. Once registered, students with disabilities are encouraged to contact me (within the first week of the semester) to discuss the logistics of any accommodations needed to fulfill course requirements.

Student Success Center

In partnership with USC faculty, the [Student Success Center](https://sc.edu/about/offices_and_divisions/student_success_center/index.php) (SSC) (https://sc.edu/about/offices_and_divisions/student_success_center/index.php) offers a number of programs to help you better understand your course material and to support your path to success. SSC programs are facilitated by professional staff, graduate students, and trained undergraduate peer leaders who have previously excelled in their courses. Resources available to you in this course may include:

- **Peer Tutoring:** You can make a one-on-one appointment with a [Peer Tutor](http://www.sc.edu/success) (www.sc.edu/success). Drop-in Tutoring and Online Tutoring may also be available for this course. Visit their website for a full schedule of times, locations, and courses.
- **Supplemental Instruction (SI):** SI Leaders are assigned to specific sections of courses and hold three weekly study sessions. Sessions focus on the most difficult content being covered in class. The SI Session schedule is posted through the SSC website each week and will also be communicated in class by the SI Leader.
- **Peer Writing:** Improve your college-level writing skills by bringing writing assignments from any of your classes to a Peer Writing Tutor. Similar to Tutoring, you can visit the website to make an appointment, and to view the full schedule of available drop-in hours and locations.
- **Success Consultations:** In Success Consultations, SSC staff assist you in developing study skills, setting goals, and connecting to a variety of campus resources. Throughout the semester, I may communicate with the Student Success Center regarding your progress, which indicates your instructor is concerned about your progress in this course. If contacted by the Student Success Center, please schedule a Success Consultation right away. Referrals are not punitive, and any information shared by your professor is confidential and subject to FERPA privacy laws. Student Success Center services are offered to all USC undergraduates at no additional cost. Please call 803-777-1000, visit www.sc.edu/success, or come to the Student Success Center in the Thomas Cooper Library (Mezzanine Level) to check schedules and make appointments.

Writing Center

This course has many writing assignments. The University [Writing Center](http://artsandsciences.sc.edu/write/university-writing-center) (<http://artsandsciences.sc.edu/write/university-writing-center>) is an important resource you should use! It's open to help any USC student needing assistance with a writing project at any stage of development. The main Writing Center is in Byrnes 703.

University Library Resources

[University Libraries Resources](https://sc.edu/libraries) (sc.edu/libraries)

- University Libraries has access to books, articles, subject specific resources, citation help, and more. If you are not sure where to start, assistance is available at [Ask a Librarian!](https://sc.edu/libraries/ask) (<https://sc.edu/libraries/ask>).
- Remember that if you use anything that is not your own writing or media (quotes from books, articles, interviews, websites, movies – everything) you must cite the source in MLA (or other appropriate and approved) format.

Counseling Services

The University offers [Counseling and crisis services](https://sc.edu/about/offices_and_divisions/student_health_services/medical-services/counseling-and-psychiatry/index.php) (https://sc.edu/about/offices_and_divisions/student_health_services/medical-services/counseling-and-psychiatry/index.php) as well as outreach services, self-help, and frequently asked questions.

Mental Health

If stress is impacting you or getting in the way of your ability to do your schoolwork, maintain relationships, eat, sleep, or enjoy yourself, then please reach out to any of USC's mental health resources. Most of these services are offered at no cost as they are covered by the Student Health Services tuition fee. For all available mental health resources, check out [Student Health Services Mental Health](https://www.sc.edu/about/offices_and_divisions/health_services/mental-health/index.php) (https://www.sc.edu/about/offices_and_divisions/health_services/mental-health/index.php) and the quick reference list below.

- Wellness Coaching can help you improve in areas related to emotional and physical well-being (e.g., sleep, resiliency, balanced eating and more) – schedule an appointment at (803) 777-6518 or on [MyHealthSpace](https://myhealthspace.ushs.sc.edu/login_dualauthentication.aspx) (https://myhealthspace.ushs.sc.edu/login_dualauthentication.aspx)
- Access virtual self-help modules via [Therapy Assistance Online \(TAO\)](https://us.taoconnect.org/register) (<https://us.taoconnect.org/register>) – see [TAO registration instructions](https://www.sc.edu/about/offices_and_divisions/health_services/medical-services/counseling-and-psychiatry/online-support/index.php) (https://www.sc.edu/about/offices_and_divisions/health_services/medical-services/counseling-and-psychiatry/online-support/index.php).
- Access additional articles and videos on health and wellness topics on the Wellness Hub, thriveatcarolina.com, or by downloading the [CampusWell](https://www.campuswell.com/) (<https://www.campuswell.com/>) app and searching for University of South Carolina.

- Counseling & Psychiatry offers individual and group counseling and psychiatric services – schedule an appointment at (803) 777-5223 or on [MyHealthSpace](https://myhealthspace.ushs.sc.edu/login_dualauthentication.aspx) (https://myhealthspace.ushs.sc.edu/login_dualauthentication.aspx).
- Access the 24-hr Mental Health Support Line at (833) 664-2854.
- Access an anonymous [mental health screening program](https://www.uscscreening.org/welcome.cfm?access=website) (<https://www.uscscreening.org/welcome.cfm?access=website>).

Interpersonal Violence

Interpersonal violence - including sexual harassment, relationship violence, sexual assault, and stalking - is prohibited at USC. Faculty, staff, and administrators encourage anyone experiencing interpersonal violence to speak with someone, so they can get the necessary support and USC can respond appropriately. If you or someone you know has been or is currently impacted by interpersonal violence, you can find the appropriate resources at the [Sexual Assault and Violence Intervention & Prevention](https://sc.edu/safety/interpersonal-violence/index.php) (SAVIP) (<https://sc.edu/safety/interpersonal-violence/index.php>) website.

As faculty, I must report all incidents of interpersonal violence and sexual misconduct, and thus cannot guarantee confidentiality. Please know that you can seek [confidential resources](https://sc.edu/safety/interpersonal-violence/index.php) (<https://sc.edu/safety/interpersonal-violence/index.php>). If you want to make a formal report, you can [report here](https://cm.maxient.com/reportingform.php?UnivofSouthCarolina&layout_id=25) (https://cm.maxient.com/reportingform.php?UnivofSouthCarolina&layout_id=25) or contact the institution's Title IX Coordinator, or one of the Deputy Title IX Coordinators listed on the SAVIP website. You can also file a police report by contacting USC Police at 803-777-4215.

Diversity and Inclusion

The university is committed to a campus environment that is inclusive, safe, and respectful for all persons, and one that fully embraces the Carolinian Creed. To that end, all course activities will be conducted in an atmosphere of friendly participation and interaction among colleagues, recognizing and appreciating the unique experiences, background, and point of view each student brings. You are expected at all times to apply the highest academic standards to this course and to treat others with dignity and respect.

Diversity, Ethics, and the Carolinian Creed

This course works to foster a climate free of harassment and discrimination, and it values the contributions of all forms of **diversity**. The decision to enter university and pursue advanced study is a choice that entails commitment to personal **ethics** expressed in the [Carolinian Creed](https://sc.edu/about/offices_and_divisions/student_affairs/our_initiatives/involvement_and_leadership/carolinian_creed/index.php) (https://sc.edu/about/offices_and_divisions/student_affairs/our_initiatives/involvement_and_leadership/carolinian_creed/index.php): "I will discourage bigotry, while striving to learn from differences in people, ideas and opinions." Likewise, the [Student Code of Conduct](http://www.sc.edu/policies/ppm/staf626.pdf) (STAF 6.26: <http://www.sc.edu/policies/ppm/staf626.pdf>) stresses, "The University of South Carolina strives to maintain an educational community that fosters the development of students who are ethical, civil and responsible persons."

Title IX and Gendered Pronouns

This course affirms equality and respect for all gendered identities and expressions. Please don't hesitate to correct me regarding your preferred gender pronoun and/or name if different from what is indicated on the official class roster. Likewise, I am committed to nurturing an environment free from discrimination and harassment. Consistent with Title IX policy, please be aware that I as a responsible employee am obligated to report information that you provide to me about a situation involving discrimination, sexual harassment, or assault.