Center for Geographic Analysis
Spatial Information, Spatial Analysis, and Spatial Thinking
January 18, 2019, CGIS South, Belfer Case Study Room (S020)

(**ALL TIMES ARE APPROXIMATE**; each speaker will be timed to 10 minutes with a short transition between speakers, for questions)

Session 1, 9:30 to 10:30
SPATIAL PUBLIC HEALTH

Daria Murosko, **Mapping our most vulnerable population: spatial analysis of a cohort of opioid-exposed infants in Boston**

Lauren Moran, **Geographic variation of prescription stimulant use**

Yuning Liu, **Spatial distribution of "disease of despair" in the USA**

John Obrycki, **Identifying spatial areas of concern to reduce neural tube defects in Bangladesh**

Steven Olender, **Lead exposure: understanding who is at risk**

Ethan Kahn, **A consideration of neighborhood factors associated with independent living for senior citizens in Boston**

Session 2, 10:45 to 11:45
GLOBAL

Reva Dhingra, **Desperate times equal desperate measures? Trends in attacks on healthcare during the Syrian Civil War**

Huan Gao, **Spatial controls and state power in disaster-stricken cities**

Cresa Pugh, **Social determinants of conflict in Myanmar**

Ivanna Kuz, **Ukraine's 2004 presidential election results: beyond an ideological polarization?**

Jingkai He, **Mapping political repression in 1950's China**

-------------- **Lunch 11:45 to 12:30** -------------

Session 3, 12:30 to 1:30
ACCESS

Thierry Nyatanyi, **Understanding barriers to accessing health care among the most deprived of the deprived – The case of the Batwa in Southwestern Uganda.**

So Yon Jun, **Inequalities in food access: Suffolk County, MA**

Katie Monroe, **Mapping the ride: paratransit travel patterns in the Boston metro region**

Catherine Myong, **Visualizing health insurance provider networks to assess geographic access to care**

Alex Goodson, **Do mismatches in the geography of diabetes workforce supply and demand predict poor diabetes outcomes and healthcare utilization?**

Session 4, 1:30 to 2:30
COMMUNICATION, SHAPE AND MOVEMENT

Henry Gruber, **The collapse of interregional ceramic distribution networks in post-Roman Iberia**

Natasha Dhamankar, **Public high school zoning in Virginia Beach, Virginia**

Rhys O'Neill, **Effects of social mobilization on EVD clinical trial participation and retention in post-outbreak Liberia**

Benjamin Sacks, **Analyzing BBC relay stations: initial tests**

Jordan Kennedy, **Network formation of North American beaver damming complexes**

Session 5, 2:45 to 3:45
HUMAN-ENVIRONMENT INTERACTION

Ify Aniebo, **A review of Plasmodium falciparum molecular drug resistance in Nigeria**

María de la Luz Lobos Martínez, **Design with disturbance: Llaima volcano environmental and risk conditions.**

Ethan Raker, **Nature and neighborhood change: evidence from severe tornadoes in the United States, 1980-2010**

Jie Yin, **Association of environmental quality and socioeconomic status on frequent mental distress: A spatial analysis on the U.S. county-level**

Zachary Nowak, **Wine inside the black bine: a cartographic refutation of terroir**

ABSTRACTS

(alphabetically by author's last name)

A review of Plasmodium falciparum molecular drug resistance in Nigeria

Ify Aniebo, *Research Fellow, Harvard School of Public Health, Global Health and Population*

Malaria kills half a million people in Sub-Saharan Africa yearly, mostly children under the age of five and pregnant women. Nigeria currently suffers 50% of the global malaria burden (WMR, 2018). One of the problems of malaria control is the emergence and spread of *Plasmodium falciparum* strains that become resistant to almost all drugs available. Monitoring drug resistance is essential for early detection and subsequent prevention of the spread of drug resistance by timely changes of treatment policy. This review was performed to gather all data available on *P. falciparum* molecular resistance in Nigeria, as baseline for future study and assessments.

Public High School Zoning in Virginia Beach, Virginia

Natasha Dhamankar, *Undergraduate, Harvard College, History of Science*

This project investigates the shape, size, and demographic makeup of the zones for the 12 public high schools in Virginia Beach, Virginia. The first portion of this project maps block-level demographic information and school data for each school zone. The second portion of this project explores the appropriateness of each zone's shape by determining its compactness: how close residents live to each other and to the school. I hypothesize that certain zone boundaries are skewed so that some areas are not zoned for the most appropriate high school when considering factors such as transportation time, school capacity, and population. This exploratory analysis could be used in the future to visualize an ideal zoning map of Virginia Beach high schools.

Desperate times equal desperate measures? Trends in attacks on healthcare during the Syrian Civil War

Reva Dhingra, *Doctoral Student, Government*

Attacks on healthcare by the Syrian government have been a hallmark of the Syrian Civil War, with the targeting of clinics, hospitals, and health workers occurring on an unprecedented scale. Rather than an indiscriminate tool of mass violence, however, health attacks in Syria have displayed a grim logic across space and time. Using maps of the evolving areas of control from the start of the civil war in 2011 to 2018 and yearly data on health attacks from the Global Database of Events, Language, and Tone (GDELT), I attempt to demonstrate that the government specifically targeted healthcare in non-Kurdish rebel controlled areas both while it was losing territory and gaining support from international allies such as Iran, Russia, and Lebanon. Targeting healthcare is thus not only a desperate strategy of indiscriminate violence, but a tool of war used with impunity in the absence of international pressure and monitoring. This project is unfortunately limited by the veracity of the GDELT database, which I will discuss in the presentation.

Spatial Controls and State Power in Disaster-stricken Cities

Huan Gao, *Doctoral Student, Government*

My dissertation project examines how the changed physical environment shapes citizen activism and state-society relations after the 2008 Sichuan earthquake in China. I demonstrate that the most intense and autonomous grassroots mobilization took place in and around large, accessible, and densely populated emergency shelters, in stadiums, universities, and town squares where tens of thousands evacuees lived alongside numerous emergency personnel and volunteers. These new public spaces created by the emergency response process allowed people to form new contacts, coordinate resources, and ultimately facilitated the creation of lasting organizations without much state directives and interference. Conversely, in less impacted or more isolated localities that did not create such mega-shelters, government bureaucrats were much more successful at organizing and constraining volunteers and NGOs, and citizen initiatives were rarer. I will be using GIS to create a series of maps to display local variations in earthquake damage as well as to illustrate the geography and the population movement of the region. I will also be running basic spatial statistical analysis using GEODA.

Do mismatches in the geography of diabetes workforce supply and demand predict poor diabetes outcomes and healthcare utilization?

Alex Goodson, *Master's Student, Harvard School of Public Health, Epidemiology/Quantitative Methods*

The Centers for Disease Control estimates that over 30 million Americans have diabetes, and a additional 84.1 million Americans have Pre-diabetes and are at risk for developing the full disease. In Missouri, the burden of disease is also high - an estimated 840,000 Missourians have diabetes. The purpose of this study is twofold. First, this study will investigate whether gaps in regional demand for diabetes care and supply of diabetes care are associated with negative health outcomes after controlling for demographic characteristics. Second, this study will identify regions in the state of Missouri where poor patient outcomes may be attributable to lack of access to diabetes care. Through the course of this study, I will geocode physician addresses and medical resources to create and estimate of Missouri's diabetes workforce and geographic access to healthcare infrastructure. Diabetes demand will be estimated at the county level using CDC prevalence rates and at the ZCTA level by two methods of imputation (population weighted; population and demographics weighted). The primary predictor will be the ratio or difference between diabetes workforce and diabetes demand, first at the level of the county, then at the level of the ZCTA, for comparison purposes, while accounting for local demographic characteristics and (geography).

The collapse of interregional ceramic distribution networks in post-Roman Iberia

Henry Gruber, *Doctoral Student, History*

One of the major features of the Roman economy was a Mediterranean-wide distribution of fineware ceramics. Over the course of the fifth century, these networks collapsed. How they collapsed--and when--gives us new insight into the underlying structure of the Roman economy and the way that the end of empire affected the material lives of ordinary people. This presentation focuses on the regional distribution of African, Spanish, Gallic, and eastern Mediterranean tablewares over the course of the fourth, fifth, and sixth centuries CE, and argues that system collapse came quickly on the heels of the end of Roman governance, and that this led to isolation for the central plateau.

Mapping political repression in 1950's China
Jingkai He, *Doctoral Student, Government*

This project seeks to leverage an original dataset on the Chinese Communist Party' repression campaign in 1950 to explore the spatial pattern of the arrests and executions. The 1950 repression campaign was implemented just one year after the Communists won the revolution and established territorial control over many of the 400 districts in the dataset. This project will try to assess these state coercion and investigate whether provincial boundaries, length of preexisting CCP control, distance to major urban centers, and possibly local mountainous terrain (still trying to get elevation data) could help explain the variation of local state-initiated violence.

Inequalities in Food Access: Suffolk County, MA
So Yon Jun, *Master's Student, Harvard School of Public Health, Environmental Health*

This project examined food deserts in Suffolk County (Boston City), Ma at the census tract level in relation to demographic characteristics such as income level, race, health status, and access to transportation. Areas with the lowest access to fresh food did not necessarily correlate with areas with highest incidence of diabetes, obesity, and other indicators of poor health. Moreover, areas with the highest poverty rates and percentage of SNAP beneficiaries lacked access to supermarkets that accepted SNAP.

A Consideration of Neighborhood Factors Associated with Independent Living for Senior Citizens in Boston
Ethan Kahn, *Undergraduate, Harvard College, Statistics*

In this exploratory project, I investigate social and neighborhood characteristics associated with independence among adults in Boston 65-74 years old. I use the 2017 American Community Survey 5-year estimates for six measures of disability at the census-tract level. I consider how the prevalence of individual-level disabilities (e.g., mobility impairments, difficulties dressing) and social characteristics (e.g., insurance, poverty, and education) of seniors within a census tract relate to the portion of seniors with a high level of independence. I use GIS mapping to visualize patterns of disability and social resources across Boston. I built a model to predict the portions of seniors in a census tract that can live independently. Patterns in the modeling error indicate unobserved spatial confounders, which can be used in a future analysis. This project contributes to a better understanding of the social model of disability, which contends that disablement is due to a confluence of individual and social/environmental factors.

Network Formation of North American Beaver Damming Complexes
Jordan Kennedy, *Doctoral Student, SEAS*

The purpose of this study to observe network formation of North American Beaver (L. *Castor Canadensis*) dams. Beavers display a uniquely broad range of constructive behaviors. In addition to the build of their dams, beaver further alter their environment through the excavation of canals and pond bottoms, construction of lodges and burrows, and felling of timber. A single colony of beaver can be responsible for the construction of up to 18 dams in a single network. As a result of such activities, beavers can create extensive and complex aquatic networks that can only be readily appreciated from a bird's eye vantage. In order to observe network development, a DJI Phantom Drone was used to image network formation as a function of time during the active building season of the beaver. The resulting maps are geo-referenced, annotated (marking dams, canals, trails, lodges, trails and vegetation caches), and analyzed (changes in area, length, branching, distance away from features)

Ukraine's 2004 Presidential Election Results: Beyond an Ideological Polarization?
Ivanna Kuz, *Master's Student, REECA, Davis Center*

Ukraine's initial November 2004 presidential elections, overshadowed by massive voter fraud, were followed by a reelection the following month. The results of the election between the two candidates relay a clear divide in ideology, with the western regions favoring the pro-EU candidate and the eastern regions, the pro-Russian candidate. For my GIS Institute project, I consider a few socioeconomic and demographic variables across Ukraine's regions to explore the correlation between these variables and the election results and test whether they will illustrate the results in a different light.

Spatial distribution of "disease of despair" in the USA
Yuning Liu, *Master's Student, Harvard School of Public Health, Global Health and Population*

Mortality from drug and alcohol poisoning and suicide (DAS), defined as disease of despair, has kept increasing since 1999 in the USA. Rising mortality led by DAS was large enough to offset mortality gains for children and the elderly, and led to a decline in overall life expectancy in 2015. However, the increasing mortality didn't distributed equally among US counties. This project aims to find the differences in DAS related mortality rates between U.S. counties. Significant differences in DAS mortality among countries were identified. There was significant spatial clustering (Moran's I=0.64) with above average mortality clusters in New England, central Appalachia, the Industrial Midwest, Oklahoma, northern California, and the Pacific Northwest. The county-level clusters of high-high spots in DAS mortality show similar patterns with clusters in low household earning and less than high school education attainment.

Design with disturbance: Llaima volcano environmental and risk conditions.
María de la Luz Lobos Martínez, *Master's Student, Harvard Graduate School of Design, Landscape Architecture*

The Chilean geography includes one of the fifth more active volcanic chains in the world. In the Araucania region, there is the Llaima volcano, the second more active of the country with 48 eruptions within the last century.
This project identifies the main characteristics of the Llaima volcano to recognize what is the best area to develop a landscape project able to slow down the fluxes on a future eruption besides promoting tourism in the site in the non-emergency periods.

Mapping The Ride: Paratransit Travel Patterns in the Boston Metro Region

Katie Monroe, *Master's Student, Harvard Kennedy School*

For my project, I mapped 2017 trip data from The Ride, the MBTA's door-to-door, shared-ride paratransit service for people with disabilities. My first challenge was the best kind: too much data! After deciding to focus on a few weeks of trip data out of the year's worth I was given, I was able to use GIS to start asking spatial questions about the data: Are there census tracts where trips disproportionately originate, or end? Are there seasonal variations what types of trips people take? How can demographic census data layered with data from The Ride give us a better picture of who The Ride is serving? I hope to further develop this project as part of my master's thesis on the future impact of autonomous vehicles on mobility for people with disabilities in Boston.

Geographic variation of prescription stimulant use

Lauren Moran, *Faculty, Harvard Medical School, Department of Psychology*

In adolescents and young adults, prescription use is on the rise. There are two classes of stimulants: methylphenidate (e.g., Ritalin) and amphetamine (e.g., Adderall). Preferential use of amphetamine has been increasing over the past decade. This project will explore state-level trends in prescription amphetamine use and explore how prescriber type (family doctor, pediatrician and psychiatrist), educational funding and per capita psychiatrists in each state may influence prescription stimulant trends.

Mapping our most vulnerable population: spatial analysis of a cohort of opioid-exposed infants in Boston

Daria Murosko, *Pediatrics Resident Physician, Harvard Medical School, Department of Pediatrics*

We mapped the discharge address of 350 infants born at Boston Medical Center (BMC) who were exposed to opioids in utero, many of whom will require frequent follow-up at BMC. Preliminary analysis suggested that infants were likely to be discharged to communities with high poverty, low education attainment and high rates of opioid-related fatalities. Both Euclidean distance and network analysis were used to estimate travel time and distance back to BMC, as well as accessibility of public transportation.

Visualizing Health Insurance Provider Networks to Assess Geographic Access to Care

Catherine Myong, *Research Assistant, Harvard Medical School, Department of Health Care Policy*

Several private insurance carriers in Massachusetts offer CommCare plans, or state-subsidized health insurance plans for low-income residents who do not qualify for Medicaid. Although MA has required CommCare plans to meet standards for adequate supply of doctors for their enrollees, enforcement has been lax, especially for specialty care. This project explored methods to visualize both the geographic supply and demand of cancer specialists in CommCare plans in an effort to better assess quality of provider network design.

Wine Inside the Black Line: A Cartographic Refutation of Terroir

Zachary Nowak, *Faculty, History Department*

Terroir—a French word perhaps best translated as "the taste of place"—is the idea that location matters a lot for foods' flavor. According to the theory, differences in the various production factors of foods have an impact on our mouth's sensation. Those production factors include the underlying lithology, soil type, solar insolation, temperature, altitude, and available moisture of a certain place. The Chianti "region" (Chianti is not officially an administrative region in Italy) has been divided into seven sub-zones as well as an eighth interstitial zone. These vary wildly in altitude and soil type and other variables. I will build a map of Chianti that displays these variables. I will then aggregate them to display the combination of the variables, which I will call the "aggregate Chianti terroir value." I'll will perform a statistical test to assess if there are any clusters of variables.

Understanding barriers to accessing health care among the most deprived of the deprived – The case of the Batwa in Southwestern Uganda.

Thierry Nyatanyi, *Master's Student, Harvard Medical School, Global Health and Social Medicine*

The health indicators for the Batwa indigenous population on maternal and child health were alarming at the turn of the century. The crude under five mortality rate was twice higher than that of the average Ugandan, estimated at 152 deaths per 1000 live births. In addition, the life expectance at birth neared 28 years, significantly lower than 54 years for non-indigenous communities living within the same geographic area. The goal of the study is explore barriers related to physical accessibility and financial affordability, key parameters for determining the standard of care – that meet the WHO principles of universal health coverage. This study intends to provide evidence that will be used to orient technical and policy decisions in view improving health outcomes in this population.

Identifying spatial areas of concern to reduce neural tube defects in Bangladesh

John Obrycki, *Research Fellow, Harvard Medical School, Neurology*

Infants born with neural tube defects may have debilitating lifelong conditions or, in some severe cases, may not survive more than a few days after being born. This project uses data from an ongoing project in Bangladesh that recruits cases (infants with a neural tube defect) and controls (infants without a neural tube defect) from the National Institute of Neurosciences and Hospital in Bangladesh. Spatial data collected from families includes the location of the tubewell the mother drank from when pregnant and their current address. This project explores questions about contaminants in water, distance from the hospital, dietary practices, and mother mobility during pregnancy. The goal of this analysis is to identify spatial areas where future interventions could help reduce neural tube defects.

Lead Exposure: Understanding Who Is At Risk

Steven Olender, *Master's Student, Harvard Kennedy School*

With bans on use of lead paint and leaded gasoline in the 1970s and 1980s, the United States has made significant progress on combatting lead poisoning. However, while acute lead poisoning is now rare, low-level lead exposure, either through the lead paint in housing built before 1978 or through lead pipes and service lines, remains common, with the Public Health Institute estimating that 1.2 million children, roughly 8% of all children below the age of 5, have blood lead levels above the CDC's threshold of 5 μg/dL. Research continues to reveal that there is no safe level of lead exposure and that exposure, even below the CDC threshold, causes permanent cognitive damage, particularly in children under the age of six. Lead exposure a wide variety of cognitive symptoms, including worsened memory, impaired impulse control, ADHD, and lowered IQ, all of which are permanent. In 2015, the State of Washington released an analysis of lead risk by census tract, based on the age of housing stock and levels of poverty in the community. Still, little is being done to combat the damage that low level lead exposure causes. In this project, using comprehensive demographic information from the census and American Community Survey, I seek to understand who is most at risk of lead exposure in Washington, to shine a light on the communities that are most impacted by government inaction.

Effects of Social Mobilization on EVD Clinical Trial Participation and Retention in Post-Outbreak Liberia

Rhys O'Neill, *National Institute of Health*

The current strategy for building trust and membership in Ebola clinical trials post-outbreak in Liberia is based on a social mobilization arm of the study program. This relies on leveraging communication modes including radio, community engagement, and working with local leadership to relay accurate information to the public. Over a period of eight months, four target recruitment locations were surveyed in Liberia with the intention of understanding overall awareness of the studies. The registered awareness was evaluated based on interactions with the varying formats of the social mobilization outreach. This resource and subsequent data visualizations explores the consequences of these interactions, most importantly the change in sentiment toward the disease, vaccines, and participation in a trial.

Social Determinants of Conflict in Myanmar

Cresa Pugh, *Doctoral Student, Sociology*

Since 2012 there has been a rise in levels of intercommunal conflict in Myanmar along ethnic and religious lines. In this study I visualize the incidences of conflict nationwide against several indicators of development to understand the relationship between violence and other factors beyond ethnicity and religion. Ultimately I hope to demonstrate that the recent conflict is not simply a story of ethnoreligious tension, but is also rooted in inequality.

Nature and Neighborhood Change: Evidence from Severe Tornadoes in the United States, 1980-2010

Ethan Raker, *Doctoral Student, Sociology*

Social scientists have long been interested in understanding the relationship between the natural environment and neighborhood change. In this project, I spatially join data from the NOAA on the population of severe tornadoes in the United States with block-group data from the decennial census to understand the relationship between tornadic activity and local population change. Descriptively, I plot the tornado tracks to demonstrate their scope and breadth. Inferentially, I describe the relationship between tornadic activity within a decade and population change. Results show that following a severe tornado, local neighborhood population increases and becomes constituted with a whiter and more economically advantaged community. This suggests a displacement mechanism whereby socially disadvantaged individuals and families are forcibly mobile rather than stuck in place.

Title: Analyzing BBC Relay Stations: Initial Tests

Benjamin Sacks, *Post-Doctoral Research Associate, Center for History and Economics*

International broadcasting remains a potent form of international public diplomacy, or "soft power." The BBC, arguably the world's most influential international broadcaster, operates a global relay FM network that has neither been properly mapped nor studied. This initial ArcGIS examination uses a selection of tools to both visualize this network and examine the extent and limit of BBC FM coverage in Afghanistan--a key target of British public diplomacy efforts. These experiments constitute initial tests in the development of a central geospatial database for researchers and policymakers interested in understanding international broadcasters' reach across the FM and high-frequency (mediumwave and shortwave) radio spectrums.

Association of Environmental Quality and Socioeconomic Status on Mental Distress: A Spatial Analysis on the U.S. County-level

Jie Yin, *Doctoral Student, Harvard School of Public Health, Population Health Sciences*

Background: Mental distress is a major public health issue in the U.S. and it is associated with other chronic diseases and resulting morbidity and mortality. Yet little is known about its geographic distribution in the U.S. and its environmental and socioeconomic determinants.
Objective: Identify the spatial pattern of frequent mental distress across contiguous U.S. counties. Examine the association of environmental quality (annual PM2.5 level, greenness) and socioeconomic status (income, education, employment status, ethnicity) on frequent mental distress
Methods: We conduct ecological study by using county level data in 2016. Data on mental distress is from national Behavior Risk Factor Surveillance System (BRFSS). We use Local Indicators of Spatial Association (LISA) to identify clusters and spatial error model to examine the association of environmental quality and socioeconomic status on frequent mental distress.