2025 Climate Health Frontiers Symposium:
AI and Data for Mitigation, Adaptation, and Resilience

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POSTER ABSTRACTS

1. Enhancing Disaster Resilience of Dialysis Care Through Geospatial Risk Mapping and Mobility Analytics

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Disasters, like hurricanes, floods, and tornadoes, disrupt human mobility and access to essential healthcare services, disproportionately impacting vulnerable populations. This study investigates how disaster-induced perturbations affect access to dialysis treatment, and unravels the inequities exacerbated by such events. We primarily focus on how disaster events affect human mobility patterns from Census Block Groups (CBGs) to dialysis facilities, leading to challenges like reduced accessibility and facility overcrowding, particularly for socioeconomically disadvantaged communities. The study has three components. (1) examining disparities in geographical access to dialysis care under normal circumstances, focusing on minority and vulnerable populations. (2) evaluating access disruptions during disasters, including patient reassignment to alternative facilities. (3) developing a predictive model to forecast weekly visit patterns during extreme weather events using mobility, socioeconomic, and environmental data. Our work integrates human mobility data from SafeGraph with dialysis facility data from the Centers for Medicare & Medicaid Services (CMS). By analyzing weekly visitation patterns between Census Block Groups (CBGs) and dialysis facilities, study how disaster events, such as floods, disrupt access to care. Using FEMA flood maps and historical disaster data, we examine how flooding impacts movement patterns, identifying which CBGs lose access to dialysis facilities due to inundation or isolation. This analysis reveals geographic areas where distances from CBGs to dialysis facilities increase significantly, highlighting regions disproportionately affected by these disruptions. Vulnerable populations, such as those in minority-dense areas or with limited vehicle access, are particularly impacted, facing heightened barriers to care. These findings highlight inequities in access and emphasize the critical need for targeted interventions to address the increased burden on vulnerable communities. Additionally, the predictive model provides actionable insights for healthcare agencies, enabling them to identify communities likely to experience discomfort in dialysis access and plan resource allocation to mitigate facility overcrowding. For instance, by forecasting increased patient volume at specific dialysis facilities, agencies can prepare in advance by redistributing resources and ensuring equitable access to care.

This work contributes to the "Extreme Weather Impact on Health and Communities", “Environmental

Justice" and "Racial Disparities in Climate Change-Related Health" tracks by addressing the intersection of healthcare accessibility, disaster preparedness, climate equity, and identifying geographic areas and populations disproportionately affected by disasters. By incorporating human mobility data, this study unravels the underlying need for targeted interventions to ensure equitable access to critical healthcare services during extreme weather events, ultimately reducing the disproportionate burden on vulnerable populations.

2. Student Perspectives on Heat and Quality of Life on a College Campus

Ngoc-Trang Adrienne Nguyen,[1] Sally Nguyen,[1] Ryan Lester,[1] Mia Lukenbill,[1] Chloe Clark[1], Nomita Bajwa PharmD, EdD,[2] Cori Grant, PhD, MBA,[2] Quinn Valier PhD.[2]
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Rising temperatures significantly impact college campuses, affecting not only the physical environment but also the mental and physical well-being of students, staff, and faculty. Leaders of the IAPHS Student Chapter at the University of Houston, assisted by mentors within UH Population Health, are spearheading a multi-phase study to examine how elevated campus temperatures impact quality of life, according to UH students' experiences. The project aims to address and promote climate health equity in a way that empowers students and provides evidence-based policy input for UH administrators. As we plan to reshape our campus in anticipation of UH's centennial anniversary in 2027, our mission as population health researchers is to develop a more sustainable, health-supporting environment at UH aimed at enhancing the quality of life of all.

Phase I (Fall 2024) of this study is underway and employs a sequential, mixed-methods research approach to develop and refine informational goals for a Phase II (Spring 2025) Photovoice study. We are conducting a comprehensive review of the existing literature, including grey literature, to identify key themes and gaps in understanding related to climate and quality of life on college campuses. This step will inform the initial framework for our project and guide the development of interview questions for subsequent phases. Following the literature review, semi-structured interviews will be conducted with University of Houston students and a purposive sample will be drawn from the student population, ensuring diversity in experiences and backgrounds. These interviews will explore themes not apparent in the existing literature. Based on the findings from the interviews, a structured survey will be developed to validate the qualitative insights on a broader, quantitative scale. Combined insights from the literature review, interviews, and survey will establish informed goals for the Photovoice study and will ensure those goals are grounded in both empirical evidence and community input.

The poster will show the results of our literature survey and demonstrate how the evidence gleaned will inform the creation of interviews, surveys, and Photovoice project. In addition to Phase I evidence, our poster will detail our chosen method of systematic review – the narrative literature review – and present an argument for why a narrative review, and not another type of systematic review like PRISMA-SR, is best suited to our sequential project and its end goals.

3. Climate and Health: Machine Learning Insights into Heat-Related Mortality

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ABSTRACT
Heat-related mortality is an increasingly significant issue as climate change intensifies, with extreme heat events posing a serious public health challenge to our community. This project, developed through MATLAB App Designer, explores the relationship between climate change and heat-related mortality through the use of various machine learning models. The app utilizes data on heatwave occurrences, average U.S. summer temperature, and heat-related death rates in the U.S. across the years of 1979 to 2022 to build predictive models and visualizations. The app allows the user to interact with each model, adjusting data variables to explore future scenarios. Each machine learning technique, including a Generalized Linear Model (GLM), Random Forest, K-means clustering, and Support Vector Machine (SVM), are applied to understand the impact of extreme heat events on public health. These machine learning models display different manners of grouping, averaging, and manipulating the data, offering insights into how different models approach future scenarios. Some of the models suggest that addiNonal factors beyond temperature and heatwaves may contribute to heat-related mortality, indicaNng that further research may be needed to grasp the complexities of this issue. By employing these models, the app visualizes pa[erns and trends in mortality rates in the U.S. across decades, offering valuable insights into the growing public health risk posed by rising temperatures.

4. Addressing Health Equity Using an Environmental Justice Approach

Amirhooman Yalali [1], Dr. Hanadi Rifai[2], Dr. Omolola Adepoju[3]

Abstract

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Achieving health equity in the face of environmental disparities is critical to improving outcomes for marginalized and disproportionately burdened communities. Our study employs a robust Environmental Justice (EJ) framework by integrating insights from two major tools: the Environmental Justice Index (EJI) developed by the CDC/ATSDR and the U.S. Environmental Protection Agency's (EPA) EJSCREEN tool. This approach supports the identification of health inequities driven by cumulative environmental and social stressors and facilitates targeted intervention strategies.

The **Environmental Justice Index (EJI)** quantifies cumulative impacts on community health by synthesizing data across three core modules: environmental burden, social vulnerability, and health vulnerability. Key indicators in the environmental burden module encompass air quality metrics, including ozone and fine particulate matter (PM2.5), proximity to hazardous waste sites, and access to recreational spaces. Social vulnerability indicators, derived from U.S. Census data, capture factors such as poverty rate, educational attainment, and racial/ethnic minority status, all of which influence a community's resilience to environmental stressors. Meanwhile, health vulnerability is characterized by chronic conditions like asthma, diabetes, and high blood pressure, which exacerbate susceptibility to environmental hazards. By combining these measures, the EJI reveals a comprehensive view of how environmental and social stressors coalesce to influence health outcomes at the census-tract level, serving as a tool for policymakers and community leaders to prioritize high-need areas.

EJSCREEN, the EPA's mapping and screening tool, enhances this analysis by providing high-resolution spatial data on environmental and demographic indicators. Its suite of socioeconomic variables, including low- income status, limited English proficiency, and unemployment, are overlaid with environmental measures such as proximity to traffic and toxic sites, diesel particulate matter concentration, and air toxics risk levels. The combination of these indicators allows for a precise identification of communities most at risk of cumulative environmental burdens. Notably, EJSCREEN's demographic and supplemental indexes enable the visualization of disparities in ways that make environmental justice concerns more comprehensible to stakeholders and actionable by decision-makers.

Applying these tools, we analyze health disparities in three historically underserved neighborhoods in Houston, Texas—Kashmere Gardens, Third Ward, and Fifth Ward. Our findings highlight the disproportionate burden faced by these communities due to high exposure to toxic sites, elevated air pollution, and compounded socioeconomic stressors, such as poverty and limited healthcare access. By examining key variables, we demonstrate how targeted interventions—such as increasing green spaces, improving air quality, and reducing proximity to hazardous facilities—can lead to meaningful improvements in health outcomes.

5. Preparing, reacting, and adapting: Prioritizing social work students as natural disasters compound

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Abstract

In 2017, the Gulf Coast region absorbed the staggering blow of Hurricane Harvey, a Category Four hurricane that brought over 60 inches of rain and left over 100 people dead. This came on the heels of two 500-year flood events experienced by Greater Houston in just the two years prior: the April

2016 Tax Day Storm and the 2015 Memorial Day Storm. Hurricane Harvey has been followed by even more disasters across the state of Texas; since 2017, the state has experienced 57 weather and climate disasters where costs exceeded $1 billion. Social workers not only experience disaster response and recovery as front-line workers and climate justice advocates, but also as residents of disaster-impacted communities. Students in social work programs situated in communities like Greater Houston may be supporting survivors' biopsychosocial needs at work or in practica, while also experiencing their own trauma and displacement. Therefore, social work programs must develop, implement, and continuously adapt student-centered planning protocols that acknowledge how students experience disasters and recovery. We describe one university's effort to proactively address the impact of natural disasters in social work education and consider ways to mitigate harm when oppression and compounding disasters intersect.

6. PFAS – A Challenging Emerging Pollutant for Health in a Changing Climate

Authors: Jessica Alanis, Hanadi Rifai (University of Houston)

Per- and polyfluoroalkyl substances (PFAS) are stable, heat-resistant chemicals that have been widely used in industrial and commercial applications. These chemicals are highly persistent in the environment and have potential negative impacts on human and ecological health. Routes of exposure include ingestion (food, consumer products, drinking water) and inhalation (dust, particulates). In humans, exposure to PFAS has been found to potentially alter metabolism and cholesterol levels, impact fertility and childhood development, impact the liver and kidneys functions, and weaken the immune system. Though still a developing area of research, PFAS also pose ecological risks by potentially bioaccumulating in food chains and impacting the reproductive and growth health of flora and fauna. Remedial technologies for PFAS treatment are in early development stages, making the need for source control and pathway understanding important for health impact prevention.

Climate change may exacerbate these impacts by altering PFAS distribution and consequently, its routes of exposure to humans and the environment. Extreme weather events such as high intensity rains and flooding may redistribute PFAS from contaminated sites into communities. Additionally, higher temperatures in the Arctic regions will degrade permafrost, potentially releasing PFAS from this environmental sink and distributing to the ocean. Evaluating potential changes in PFAS distribution in a changing climate is important to understanding the future of this challenging emerging pollutant.

7. Sentiment Analysis Using Word2Vec and Bi-LSTM Networks

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Abstract:

This project develops a sentiment analysis tool to classify Amazon product reviews as positive, neutral, or negative. The tool focuses the Amazon Reviews 2023 dataset, specifically the Automotive.jsonl.gz subset, containing over 10,000 reviews. The text is preprocessed with standard methods, including removing special characters, converting text to lowercase, and tokenization. Word2Vec transforms words into numerical vectors, processed by a Bi-directional Long Short-Term Memory (Bi-LSTM) network. The Bi-LSTM architecture captures the context of words in both forward and backward directions, enhancing classification accuracy. SMOTE is used to address dataset imbalances, particularly for underrepresented neutral reviews. The model achieves an overall accuracy of 85%, with F1-scores of 0.80, 0.68, and 0.90 for negative, neutral, and positive classes, respectively. By automating sentiment analysis, this tool enables businesses to better understand customer preferences, address pain points, and enhance marketing and product strategies based on real customer feedback.

8. Healthcare Greenhouse Gas Inventory Evaluation

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Hospitals and the healthcare industry have a substantial impact on the environment. Their energy use intensity, waste generation, and pollution, contribute significantly to global greenhouse gas emissions. A greenhouse gas inventory (GHG inventory) is the first step to lowering the carbon footprint of hospital systems. GHG inventories consist of a list of emission sources and the associated emissions, quantified using standardized methods. This is a review of existing carbon emission calculation tools for healthcare facilities, describing their reporting inputs/outputs and informing more standardized healthcare specific emissions calculations. After finding the current tools on the market, we created a set of guidelines for evaluation based on existing methodology for carbon footprint calculator evaluation. Adaptations were made from commercial and personal footprint evaluators to include healthcare specific metrics. We screened 12 calculators, identifying 3 for inclusion. Evaluation was conducted based on the established metrics, including number of inputs for Scope 1 and 2 emissions, and normalization factors, such as building sq ft., number of operating rooms, etc. There were differences in reporting practices between each calculator, both in data normalization metrics and input categories. Further analysis showed that there is a limited number of calculation tools available to hospital systems, and no standardized practices between tools. A greater emphasis on consistent reporting standards would improve the quality, comparability, and usefulness of carbon emissions calculators. From the evaluation done on existing tools, we developed a new GHG emissions calculator to fit with the established literature criteria. This calculator is customizable, easy to use, and is able to convert data from energy and transportation bills to associated emissions. The number of hospitals looking for ways to consistently track GHG emissions is increasing, and a tool which is easy to maintain and use would encourage annual reporting. The data populated and managed in this calculator tool can also help to identify key opportunities for energy reduction in both individual buildings, and at a portfolio level. As the United States healthcare system approaches its 2030 decarbonization goals, utilizing an accurate and streamlined greenhouse gas calculation tool will make all the difference.

9. Strategic Microgrid Investment and Resilient Society

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Abstract

Problem Definition: Climate change and weather-related disaster, particularly hurricanes, have increased frequency and severity of power system disruptions, jeopardizing the well-being of individuals, particularly those who are socially vulnerable. This paper proposes a shared residential community microgrid (RCMG) integrated with solar energy to enhance energy resilience for vulnerable consumers during power outages. **Academic Relevance:** Our work is motivated by the ever-increasing attention toward microgrids as the most intelligent solution for enhancing energy resilience. We provide a model and comprehensive numerical analysis to investigate the efficiency of RCMG for socially vulnerable communities, addressing critical managerial concerns on optimal investment strategies and resilience. **Methodology:** We formulate the RCMG as a two-stage stochastic programming model, where the first stage involves making first-year investment decisions, and the second stage focuses on expansion investments in the future and device scheduling decisions under various uncertainties. To further enhance energy resilience, we propose a load-shifting-based demand response program in the model. In addition, four energy resilience metrics are defined to assess resilience from different perspectives. **Results:** By applying the model on three communities with varying levels of vulnerability, our results demonstrate that the proposed RCMG significantly enhances energy resilience. Our extensive analysis reveals that social vulnerability can significantly affect strategies related to long-term investment decision, hourly-based scheduling of devices, and scaling for larger consumer bases. **Managerial implications:** Our findings indicate that managers should prioritize investment strategies that account for factors such as electricity prices, demand response configuration, and expansion timing, which significantly

influence device capacity and energy resilience. Key findings emphasize tailoring strategies based on consumer vulnerability, environmental factors, and device scaling.

Keywords: Climate Change, Microgrids, Social Vulnerability, Resilience, Renewable Energy

10. Hurricane Exposure, Character Traits, and Hurricane Event Centrality

Cristy Pestilos[1] and Rodica Ioana Damian[1]
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Event centrality describes the extent to which an adverse experience becomes a core component of one's identity and life story. Although natural disasters, particularly hurricanes, are on the rise due to climate change, little is known about individual difference antecedents of hurricane event centrality. Thus, it is key to identify potential antecedents of event centrality and protective factors. To this end, we collected two waves of longitudinal data from a diverse sample of emerging adults (n = 691; mean age = 22; 72% female; 27% White/European American, 29% Latino/Hispanic, 23% Asian/Asian American, 15% Black/African American, and 6% other) who were exposed to Hurricane Harvey, one of the most devastating hurricanes recorded in the US. At baseline, we measured objective hurricane exposure, character traits (i.e., social support, purpose in life, hope, spirituality), and demographics (age, gender, race/ethnicity, socio-economic status). One year later, we assessed hurricane event centrality. A series of regression analyses tested the association between objective hurricane exposure and hurricane event centrality and the moderating role of character traits on this association. We found that hurricane exposure was strongly associated with hurricane centrality, but none of the character traits moderated the link between objective hurricane exposure and hurricane event centrality. These findings remained consistent after statistically controlling for demographics. Thus, hurricane experiences can profoundly shape the life stories of emerging adults, especially those with higher levels of exposure.

11. PRESCRIBING JUSTICE: HOUSTON'S REDLINING IMPACT ON MEDICAL ACCESS

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Abstract

In 1933, the Home Owners' Loan Corporation (HOLC) implemented a practice known as "redlining," which assigned grades (A-D) to neighborhoods based on perceived mortgage lending risk. This system marginalized minority communities, particularly Black communities, and restricted their access to areas with greater capital investment. Although the Fair Housing Act of 1968 outlawed redlining, its legacy continues to affect healthcare access today. This research investigates the lasting impact of redlining on healthcare access, focusing on the distribution of primary care physicians in Houston, Texas, with particular attention to the Greater Fifth Ward, a historically Black community designated as a cancer cluster in 2019. Redlining has had, and continues to have, a significant detrimental effect on minority communities by limiting access to essential resources and opportunities, including healthcare. Black and Latino populations in Texas face persistent disparities in healthcare access, including reduced preventative care and longer treatment delays. Understanding the connection between redlining and present-day healthcare disparities is essential for addressing health inequities and improving outcomes in historically marginalized communities. The central question of this study is whether the historical practice of redlining continues to influence the distribution of primary care physicians in Houston, particularly in areas like the Greater Fifth Ward.

This research contributes to the growing body of evidence on the lasting effects of systemic racism on health and well-being. Data on primary care physician distribution were obtained from the Texas Medical Board and filtered to include only those specializing in primary care for two time periods: 1913–1968 and 1969–2019. These data were overlaid onto historical redlining maps of Houston, sourced from the University of Richmond. The analysis reveals a clear disparity in the distribution of primary care physicians, closely aligned with historical redlining grades. Areas with lower redlining grades (C & D), including the Greater Fifth Ward, consistently show a lower concentration of primary care physicians, even in the period following the enactment of the Fair Housing Act in 1968. This disparity is especially pronounced when comparing the Greater Fifth Ward to neighborhoods with higher redlining grades, such as River Oaks and Montrose. The findings highlight the enduring legacy of redlining and its continued influence on healthcare access in historically marginalized communities. This research

underscores the urgent need for targeted interventions and policy reforms to address these disparities and ensure equitable healthcare access for all residents of Houston.

12. THE FIFTH WARD CANCER CLUSTER: ANALYZING THE FINANCIAL BURDEN OF CANCER CARE

Authors: Elizabeth Tran, Elyse Tran, Thomas Ton, Amsha Rehan, Nursemin Ugur, Dr. Andrew Kapral, Dr. Dan Price

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Abstract

The Greater Fifth Ward, a historically Black and low-income neighborhood in Houston, is currently grappling with the challenges of a cancer cluster. Financial toxicity, which refers to the financial hardship caused by costly medical treatments such as cancer care, is a major concern for residents, particularly those battling cancer. This research examines the financial strain experienced by Fifth Ward residents due to the high costs of cancer care, focusing on the relationship between socioeconomic factors, cancer care expenses, and health outcomes. Financial toxicity from cancer treatment has been shown to lead to treatment non-adherence, reduced quality of life, and severe financial distress. This research addresses the critical need to understand the financial burden of cancer care in communities like the Fifth Ward, which already face substantial health disparities. Investigating the interplay between socioeconomic factors, cancer care costs, and health outcomes can inform policies and interventions that could help reduce this burden and improve health equity.

To conduct the research, demographic and health data for Harris County, with a specific focus on the Fifth Ward, were collected from the U.S. Census Bureau and the Texas Department of State Health Services. The data included socioeconomic indicators, cancer rates, and health insurance coverage. Data visualization tools, such as Excel and Kepler.gl, were used to illustrate key findings, and the MIT Living Wage Calculator was utilized to estimate annual living expenses. The analysis identified a correlation between lower educational levels and higher rates of uninsured residents, suggesting a connection between education and healthcare access. Notably, the median cancer care charges for residents with public insurance in the Fifth Ward often exceeded their median individual income, highlighting the significant financial strain experienced by these individuals. The findings reveal a concentration of high cancer care costs among public insurance holders in the Fifth Ward, emphasizing the disparity between their healthcare expenses and their low median incomes. This pattern suggests a potential link between financial toxicity and the cancer cluster in the area. Overall, the financial burden of cancer care poses a substantial issue for residents of the Fifth Ward, potentially worsening existing health disparities. The study underscores the urgent need for policies and programs aimed at reducing the financial strain of cancer treatment and improving access to affordable healthcare in underserved communities.

13. USING USLE TO PREDICT THE THEORETICAL EXTENT ENHANCED POCKET PRAIRIES CAN MITIGATE TOXIN IN RAINFALL RUNOFF

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Abstract

Houston frequently experiences heavy rainfall events that can cause significant environmental damage, particularly in low-income communities and communities of color. As a potential natural solution, pocket prairies, which have the ability to slow water flow, are being explored to mitigate flooding and reduce toxin exposure. This research specifically investigates the potential of pocket prairies to reduce dioxin levels in rainfall runoff, focusing on two contaminated sites in Houston: 2603 Amboy St. (Site 1) and 4704 Wylie St. (Site 2). The central research questions examine whether pocket prairies can effectively reduce dioxin levels in runoff from these sites and what their theoretical reduction potential might be. Prairies have been shown to slow water flow and filter pollutants, making them promising tools for environmental remediation. The Universal Soil Loss Equation (USLE), a widely used method for estimating soil erosion by rainfall, was adapted in this study to assess toxin transport instead of soil loss. This research aims to quantify the potential of pocket prairies as a sustainable and cost-effective nature-based solution for reducing toxin levels in runoff.

The study used data from the EPA's report on dioxin contamination at the two sites, along with established USLE parameters tailored to the specific characteristics of each site. Several scenarios were modeled, including different vegetation mixes in the pocket prairies, the addition of swales, and the implementation of phytoremediation using alfalfa. The model predicted that pocket prairies could retain up to 60% of dioxin in runoff, with the addition of swales significantly enhancing retention, reaching nearly 95% for both sites. Phytoremediation with alfalfa also demonstrated a notable, though less pronounced, reduction in dioxin levels. The findings suggest that pocket prairies, particularly when combined with swales, offer substantial promise for reducing dioxin levels in runoff from contaminated areas. This research highlights the potential of nature-based solutions for environmental remediation and their capacity to improve environmental health in urban settings. However, limitations due to idealized model assumptions are acknowledged, and further research is recommended to validate these results and refine the model's accuracy.

14. MEASURING CREOSOTE EXPOSURE THROUGH PREVALENCE OF LINKED DISEASES IN HOUSTON'S FIFTH WARD AND SURROUNDING AREAS

Authors: Loyed Siby, Jyothylakshmi Manoj, Joyce Joy, Salwa Khan, Dr. Andrew Kapral, Dr. Dan Price

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Abstract

The Fifth Ward, a historically Black community in Houston, was designated a cancer cluster by the Texas Department of State Health Services (DSHS) in 2019. While the Environmental Protection Agency (EPA) classifies creosote as a Group 2A carcinogen, the Texas DSHS, in late 2023, stated that no direct link between creosote and the cancer cluster has been identified. This research examines the relationship between industrial sites, including potential creosote exposure, and the incidence of related diseases in the Fifth Ward and surrounding areas within a 10-mile radius. The study focuses on the prevalence of chronic kidney disease, bronchitis, and asthma, which have all been associated with creosote exposure. Research questions address whether a correlation exists between the proximity of industrial sites and higher incidence rates of diseases linked to creosote exposure in the Fifth Ward and nearby areas. Creosote is recognized as a probable human carcinogen, connected to various health issues, including kidney and respiratory problems. The Fifth Ward is characterized by a high concentration of industrial sites and significantly elevated cancer rates. Investigating the link between industrial sites and disease incidence rates may provide crucial insights for public health interventions and environmental regulations.

Data on industrial sites releasing carcinogenic and persistent, bioaccumulative, and toxic (PBT) chemicals were sourced from the EPA's Toxics Release Inventory. Disease prevalence related to creosote exposure, including chronic kidney disease, bronchitis, and asthma, was determined using inpatient data and ICD codes from the Texas DSHS. Incidence rates were mapped and compared across the Fifth Ward and three nearby areas within a 10-mile radius: Third Ward, Neartown-Montrose, and University Place. The analysis revealed that the Fifth Ward exhibits significantly higher rates of chronic kidney disease and asthma compared to the other areas, while bronchitis incidence is elevated in both the Fifth Ward and Third Ward. The spatial analysis demonstrated a strong correlation between the clustering of industrial sites and the prevalence of these diseases. Areas closer to industrial site clusters, such as the Fifth Ward and Third Ward, show higher incidence rates than those farther away. These findings reinforce

the connection between industrial activity and the prevalence of diseases linked to creosote exposure, particularly in communities near industrial sites. The results underscore the need for further investigation into the specific environmental contaminants contributing to the Fifth Ward cancer cluster and highlight the importance of environmental regulations and public health interventions to protect vulnerable communities.

15. Hurricane Exposure, Character Traits, and Hurricane Event Centrality

Cristy Pestilos[1] and Rodica Ioana Damian[1]
[1]University of Houston

Event centrality describes the extent to which an adverse experience becomes a core component of one's identity and life story. Although natural disasters, particularly hurricanes, are on the rise due to climate change, little is known about individual difference antecedents of hurricane event centrality. Thus, it is key to identify potential antecedents of event centrality and protective factors. To this end, we collected two waves of longitudinal data from a diverse sample of emerging adults (n = 691; mean age = 22; 72% female; 27% White/European American, 29% Latino/Hispanic, 23% Asian/Asian American, 15% Black/African American, and 6% other) who were exposed to Hurricane Harvey, one of the most devastating hurricanes recorded in the US. At baseline, we measured objective hurricane exposure, character traits (i.e., social support, purpose in life, hope, spirituality), and demographics (age, gender, race/ethnicity, socio-economic status). One year later, we assessed hurricane event centrality. A series of regression analyses tested the association between objective hurricane exposure and hurricane event centrality and the moderating role of character traits on this association. We found that hurricane exposure was strongly associated with hurricane centrality, but none of the character traits moderated the link between objective hurricane exposure and hurricane event centrality. These findings remained consistent after statistically controlling for demographics. Thus, hurricane experiences can profoundly shape the life stories of emerging adults, especially those with higher levels of exposure.

16. Novel Techniques of Carbon Capture Monitoring: A Crucial Step in CO_2 Sequestration in the Permian Basin

Muhammad N. Khan, PhD Candidate (Petroleum Engineering) University of Houston

Advisor: Dr. Ganesh C. Thakur, Professor (Petroleum Engineering) University of Houston

Abstract

This research presents an innovative combinational petrophysical approach to address geochemical interactions for CO_2 sequestration. We aim to provide a thorough understanding of reactive transport mechanisms, including permeability, porosity, CO_2 dry-out effects, and mineralogical changes. It focuses on CO_2 MPD (mineralization, precipitation, and dissolution) and explores alterations in rock petrophysical properties during core flooding and in static batch reactors. Geo-electrical properties characterize and evaluate carbon capture monitoring, including complex conductivity, dielectric dispersion, and zeta potential. Our analysis of core samples from the San Andres and Grayburg formations for rock characterization, mineralogy alteration, and monitoring. Dual-energy CT scanning and micro-CT scans provide visual insights into geochemical interactions. With in-situ techniques, industrial CT scanners can observe and quantify complex structural effects of these processes and potentially mitigate the risks and challenges they pose. Static batch reactor with resistivity monitoring establishes CO_2 /rock equilibrium and reaction progress. In addition, dielectric permittivity and dielectric dispersion are used to characterize the molecular modeling of MPD. NMR is used to analyze the pore structure of the core pre- and post-carbon storage in terms of MPD and geochemistry. The findings show MPD monitoring to be essential for addressing the environmental impact of advancing sustainable carbon capture solutions.

17. Promoting health and mitigating Environmental degradation in the top 20 emitting countries

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Abstract:

The Impact of Environmental Regulations and CO2 Emissions on Health Outcomes in the Top 20 Emitting Countries and How Environmental Regulations Moderate to Improve Health Outcomes. This research topic is highly significant as it addresses the intersection of environmental, economic, and public health challenges faced by the world's largest carbon emitters. The top 20 emitting countries contribute the majority of global CO2 emissions, directly impacting air quality, ecosystems, and, ultimately, human health. Understanding how CO2 emissions affect health outcomes is crucial for shaping policies aimed at improving public well-being.

1. **Public Health Relevance**: CO2 emissions are closely linked to air pollution, which has been proven to cause respiratory illnesses, cardiovascular diseases, and premature death. Investigating how emissions in major countries impact health provides valuable insights into global and national health risks. Improving health outcomes by curbing emissions is vital for achieving Sustainable Development Goals (SDGs), especially SDG 3 (Good Health and Well-being).
2. **Environmental Regulations as Moderators**: Environmental regulations are designed to mitigate the harmful effects of pollution by setting standards for emissions control, promoting cleaner energy, and encouraging sustainable practices. Analyzing how such regulations moderate the relationship between CO2 emissions and health outcomes helps to evaluate their effectiveness in reducing health risks. This provides evidence for policymakers to improve existing regulations or develop new frameworks to protect public health.
3. **Global Impact**: As the top 20 emitting countries include both developed and developing nations, the findings of this research could have broad global implications. It highlights the role of stringent environmental policies in reducing emissions and mitigating adverse health effects, potentially influencing international climate negotiations and cooperation on environmental standards.
4. **Economic and Social Benefits**: In addition to the health benefits, stricter environmental regulations can stimulate the transition to greener technologies, create new jobs in the clean energy sector, and reduce healthcare costs associated with pollution-related illnesses. This fosters economic growth while promoting social equity, especially in vulnerable communities disproportionately affected by pollution.

Overall, this research offers an essential contribution to understanding the role of environmental governance in safeguarding public health, emphasizing the need for strong regulatory frameworks to mitigate the harmful effects of CO2 emissions.

18. The Climate Divide: Unveiling the Disproportionate Burden on Immigrant Communities in the United States

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Climate change impacts are not felt equally across all communities. In the United States, immigrant populations bear a disproportionate burden of climate-related risks and challenges. This research aims to illuminate the multifaceted vulnerabilities experienced by immigrant communities in the face of escalating climate hazards and propose strategies to advance climate equity, drawing upon a comprehensive systematic literature review of 17 studies published between 2018 and 2023. The review reveals four interconnected dimensions of climate injustice disproportionately impacting immigrant communities: increased exposure to climate hazards, barriers to critical resources, heightened occupational risks, and exacerbated health vulnerabilities.

These challenges are amplified by factors unique to the immigrant experience, such as fear of deportation, restrictive immigration status and visa policies, excessive economic exploitation, limited social capital, and selective disaster relief measures. Preliminary findings from fieldwork conducted with West African migrants in South Philadelphia further illuminate the complexities of addressing climate change within immigrant communities. Quotes such as "Climate change is God's work" and "I don't believe in Climate change. There are only four seasons!" reveal a limited understanding of the issue, which is understandable given the pressing priorities of securing asylum status and employment. These insights underscore the importance of meeting the immediate needs of immigrant populations while simultaneously providing accessible, culturally responsive education on climate change. To address these disparities, the research proposes an equity-centered approach that prioritizes the needs, knowledge, and voices of immigrant communities in climate resilience planning and decision-making processes. Recommendations include culturally responsive communication, collaborative partnerships, inclusive policy reforms, and empowering communities to strengthen their adaptive capacity and resilience. Addressing the disproportionate climate burden on immigrant communities is crucial for achieving climate justice and building a more resilient society for all. This research serves as a call to action for researchers, policymakers, and practitioners to prioritize the needs and voices of immigrant populations in the collective fight against climate change. By embracing equity-centered approaches, collaborative partnerships, and policy reforms, we can chart a path towards a more just and sustainable future.

19. Empowering Patients through Improved Consent Form Readability:

A Comparative Study of Language Complexity Tools and ChatGPT at UCLA Health

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Abstract

Introduction:

Informed consent forms are essential for fostering patient autonomy and promoting transparency in healthcare. However, many institutional forms exceed the readability standards recommended by the NIH and AMA, which suggest that patient materials be written at a 6th-grade reading level. This study aims to evaluate the language complexity of UCLA consent forms using readability metrics and compare these with AI-generated scores from ChatGPT to enhance accessibility.

Methods:

A total of 30 consent forms (20 English, 10 Spanish) were analyzed using the Flesch-Kincaid Grade Level, Flesch Reading Ease, Gunning Fog Index, and Inflesz Scale. The readability scores obtained manually were compared to those generated by ChatGPT. Both English and Spanish forms were evaluated to assess the tool's performance across different languages.

Results:

The average Flesch Reading Ease score for English forms was 49.855 manually and 51.214 using ChatGPT, with minimal differences in grade-level interpretation. Outliers were identified due to incomplete sentences. Spanish forms showed more significant disparities between manual and AI-generated scores, highlighting the need for further AI refinement. The Inflesz Scale was found to be the most consistent measure for Spanish forms, offering a closer alignment between human and AI calculations.

Conclusion:

While manual assessments remain valuable, ChatGPT shows potential for streamlining readability analysis. Its adaptability allows for rapid evaluations of consent forms,

enhancing patient comprehension and bridging communication gaps between healthcare providers and patients.

20. Subtyping Social Determinants of Health in Cancer: Implications for Precision Healthcare Policies

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Introduction. Although mortality rates for many cancers have declined over the last 20 years,[1] large disparities in cancer-related outcomes persist among subpopulations. Numerous studies in cancer have identified strong associations between specific social determinants of health (SDoH) such as income insecurity, and outcomes such as significantly lower rates of breast screening.[2] However, most people experience *multiple* SDoH concurrently in their daily lives.[3] For example, limited access to education, unstable employment, and lack of insurance tend to frequently co-occur leading to adverse outcomes such as delayed medical care and depression.[4] Here we analyze how SDoH co-occur across all participants in the *All of Us* program[5] with a cancer diagnosis, and its implications for designing precision policies to enable more targeted allocation of resources.

Results. *SDoH Subtypes.* As shown in Fig. 1A, the subtype analysis (training n=3361, d=18) using bipartite modularity maximization identified 4 biclusters with significant biclusteredness (Q=0.13, random-Q=0.11, z=9.94, $P<.001$), and significant similarity to the any-condition dataset (Real-RI=0.88, Random-RI=0.62, $P<.001$). Furthermore, the 4 biclusters were labeled through expert consensus. Compared with the any-condition network (Fig. 1B), the cancer network had two critical differences: 3 SDoH from Cluster-2 (*discrimination experiences in everyday life*, *discrimination experiences in medical settings*, and *poor interactions with providers*) and 1 SDoH from Cluster-1 (*housing insecurity)* were in Cluster-3. *Risk Stratification.* For most pair-wise comparisons, the four clusters were significantly different in their risk profiles. For example, subtype *Socioeconomic Barriers* (containing *low educational attainment, low literacy, low income, not employed, and food insecurity*) had a significantly higher risk for depression when compared with the subtype *Sociocultural Barriers* after multiple testing correction (OR=6.8, CI=5.1-9.3, P-corr<.001). Furthermore, across all outcomes, *Sociocultural Barriers* most often had the lowest risk when compared to the other subtypes.

Discussion. The overall results suggest that participants with specific conditions like cancer have critical similarities and differences when compared to those with any conditions. Furthermore, the results have implications for the design of more precise health equity policies. For example, many health equity policies allocate resources by categorizing Americans based on sociodemographic factors like race and income. While this is a critical first step to address health inequities, such

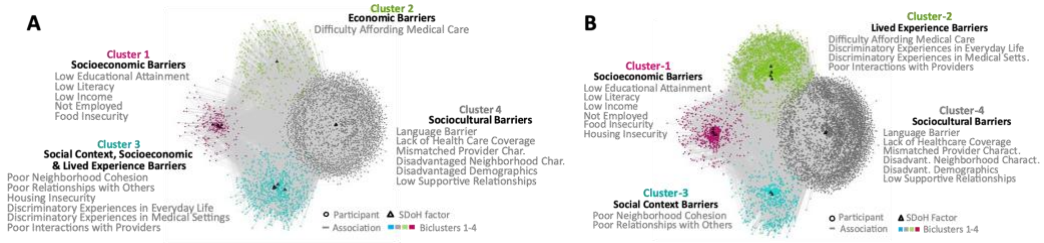

Fig. 1. (**A**) SDoH subtypes consisting of subgroups of participants with cancer (n=3361), and their most frequently co-occurring SDoH factors (d=18), with cluster labels (shown bolded) determined through expert consensus. (**B**) SDoH subtypes of participants with any condition (n=6492), and their most frequently co-occurring SDoH factors (d=18).

policies could be more precise if they were based directly on combinations of need using SDoH subtypes and their risk stratification, which could be examined at different levels of granularity (e.g., for cancer types like breast cancer).

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21. Visualizing Community Voices: Community-Driven Insights on Mental Health and Climate Disasters in Houston

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Introduction

Natural disasters driven by climate change disproportionately impact low-income communities, exacerbating mental health challenges through compounded environmental and systemic stressors. The increasing prevalence of disasters such as floods, hurricanes, and extreme heat events poses distinct challenges, particularly in historically underserved neighborhoods. Bottom-up, community-driven approaches are essential to addressing the intersection of climate change and mental health disparities. This qualitative study explored the experiences and perspectives of residents from two historically underserved Houston neighborhoods—Greater Third Ward and Kashmere Gardens—regarding the mental health impacts of successive disasters. Through organized, researcher-led community conversations, we gathered residents' experiences related to mental health and support systems following natural disasters. Data were collected during two community conversations, each including 30-50 community members who were either English or Spanish-speaking.

Methodology

Using an innovative adaptation of photo ethnography, a professional graphic artist specializing in visual storytelling attended each community conversation and created graphic recordings of the discussions. This novel method offered a dynamic, participant-driven approach to data collection, providing a unique visual narrative of community voices. Data were analyzed using an inductive reflexive thematic analysis approach. Trustworthiness was ensured through reflexivity and researcher triangulation, with independent review by multiple trained researchers. The bilingual nature of discussions was carefully addressed through translation processes designed to preserve participant
perspectives.

Results

Analysis generated four primary themes: Individual navigation of mental health amid collective and successive disasters ; the multifaceted loss experienced in the aftermath of disasters, the importance of strategic organization and coordinated preparedness across individuals and communities, to enhance mental health and resource access; and structural socioeconomic impact on mental health.

Key findings highlighted overwhelming anxiety and mental health struggles attributed to natural disasters, compounded by barriers to accessing critical resources and the deprioritization of mental health due to urgent basic needs. The profound sense of loss—encompassing homes, jobs, loved ones, and personal belongings—emerged as a pivotal factor shaping mental health outcomes. Findings highlighted the negative impact of challenges accessing mental health resources (e.g., scarcity and socioeconomic disruptions) on mental health, emphasizing the necessity for intentional preparedness as a mitigating strategy.

Conclusion

By incorporating photo ethnography to craft a visual narrative, this research offers a groundbreaking perspective on how recurring disasters impact mental well-being. Findings highlight current community needs and associated gaps in service, thus providing actionable insights that support the development of targeted funding initiatives to increase the availability and accessibility of mental health care in underserved communities. Furthermore, our findings underscore the necessity of proactive, inclusive strategies that both recognize and listen to community voices in order to advance equity in disaster response.

22. Using Artificial Intelligence to Improve Cardiometabolic Health: Developing a Kidney Transplant Derailers Index to Predict Transplant Dropout Risk for African American and Hispanic Patients

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INDEX TERMS – Artificial Intelligence; Disparities; Kidney Transplant.

I. MOTIVATION

Cardiometabolic disease incidence is higher in patients with chronic kidney disease and significantly contributes to racial/ethnic health disparities.[1] Patients with kidney failure who receive transplants live longer and have a better quality of life than those who remain on dialysis.[2] African American (AA) and Hispanic patients are less likely to receive a transplant than White patients,[3,4] therefore, identifying high-risk patients ahead of time can allow for improved care before dropout.

II. HYPOTHESIS

Racial/ethnic minorities are at higher risk of dropout prior to completing kidney transplant evaluation (KTE).

No previous studies have evaluated a large, multi-ethnic population, an expanded list of patient- and contextual-level socioeconomic variables and used machine learning (ML) models to predict the risk of patients dropping out prior to completing KTE.

III. METHODS AND RESULTS

We queried the Houston Methodist (HM) Transplant Registry for patients with kidney failure evaluated for transplant between 2016-2022. We collected demographic, clinical, and patient- and contextual-level socioeconomic variables from electronic health records and publicly available census data. We used random forest, support vector machines, and

extreme gradient boosting ML models to predict the characteristics of patients at higher risk of dropping out before completing KTE. We used the area under the receiver operating characteristic curve (AUROC) as the main performance measure.

Of the 4,471 individuals who presented for KTE at HM, 2,414 (54%) dropped out before completing KTE. Patients predicted to have low dropout risk (0-30%) had 80% KTE completion rate, middle risk (30-60%) had 53% KTE completion rate, and high-risk (>60%) had 28% KTE completion rate (AUROC=0.7051, $p<0.001$).

Compared to low-risk patients, high-risk patients were more likely to be AA (44% vs. 17%), Hispanic (32% vs. 16%), older (60 vs. 48 years old), single (54% vs. 19%), unemployed (72% vs. 8%), obese (47% vs. 30%) and live in areas with more residents living below the poverty line (29% vs. 11%; $p<0.001$).

IV. CONCLUSION

We identified characteristics of patients at higher risk of dropout before completing KTE. We are currently externally validating our findings; interviewing high risk patients to identify KTE challenges and support interventions; and expanding our risk algorithms to other timepoints of chronic kidney disease care.

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23. Hunting Bayou Floods: How expanding floodplains exacerbate the resilience of historically underserved communities.

Francisco Haces-Garcia, Craig Glennie, Hanadi Rifai

Hunting Bayou is a 15-mile watershed feeding into the Houston Ship Channel in Harris County, TX, USA. A historically industrial area, it encompasses both the Kashmere Gardens and parts of the Greater Fifth Ward super neighborhoods, which have been nationally recognized as underserved communities. Hunting Bayou is characterized by flat topography and a wide basin, which causes it to drain slowly. Therefore, Hunting Bayou has a long history of flooding, and one of the highest rates of flood damage per watershed mile in Harris County. The spatial and temporal changes in the floodplain of Hunting Bayou remains understudied, with critical implications for its underserved communities. This study implements novel mapping techniques to study spatiotemporal floodplain change in Hunting Bayou and examines the evolving flood resilience of its underserved communities. Flood Insurance Rate Maps (FIRMs) have been used since the late 1970s to provide reliable estimates of flood risk for communities. Early FIRMs were developed before the advent of Geographical Information Systems, and therefore, they do not contain critical georeferencing information, which has precluded their use in modern mapping analysis. Using spatially constrained artificial intelligence, all the historical FIRMs for Hunting Bayou were georeferenced and registered. Then, the floodplain extents were extracted and incorporated into a geospatial longitudinal analysis of resilience. Hunting Bayou's floodplain has significantly expanded since 1979 (the first year on record), exacerbating the flood hazard of underserved communities. Contemporaneously, the floodplain underwent rapid urbanization, exacerbating flood risk and vulnerability. The floodplain expanded towards critical infrastructure, including healthcare facilities and wastewater treatment plants. It also expanded towards a local Superfund site. Thus, flood resilience was exacerbated in the underserved communities of Hunting Bayou because of floodplain change. This carried significant policy implications: in 2014, local and federal stakeholders approved an ongoing project valued at $100 million USD to improve the drainage of Hunting Bayou and decrease flood hazard. Therefore, Hunting Bayou serves as a key case study to exemplify the importance of long-term floodplain change to flood control and its associated resilience outcomes.

24. Wildfire Risk in Texas Communities

Nile Hanife Incekara, William Vines and Hanadi S. Rifai

Texas faces a 76% higher wildfire risk compared to other U.S. states due to the extreme heat, drought, and diverse vegetation. These environmental factors contribute to more frequent and intense fires, particularly in Central and Northern Texas. However, wildfire vulnerability is broad term that includes more than just the environmental factors. Socioeconomic factors such as income, housing type, employment, access to healthcare and risk reduction measures can have a significant impact on how wildfires affect communities and how these communities experience them. Along with the physical damage, wildfires pose a serious threat to public health. Fine particulate matter (PM2.5) in smoke can enter the bloodstream and lungs, affecting vulnerable populations, including children, the elderly, pregnant women, and individuals with pre-existing health conditions like asthma, bronchitis, and cardiovascular diseases. As a result, counties with higher rates of cardiovascular disease are more likely to be classified as at higher risk. Understanding both the socioeconomic and health factors is important for developing targeted evacuation strategies and enhancing communities' ability to prepare for, respond to, and recover from wildfires.

25. Global Flood Simulation with a New Runoff Scheme in Xanthos

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The frequency and intensity of extreme events including floods are increasing due to climate change. To enhance flood risk management and support climate change adaptation strategies, there is a critical need for a comprehensive global framework capable of simulating flood events across diverse geographical regions. While existing global hydrological models, such as Xanthos, have been designed to simulate water availability, they often operate at monthly timescales, limiting their ability to capture the dynamics of flood events. Additionally, there is a gap in flood simulation at the global scale in representing the dominant saturation excess runoff or infiltration excess runoff generation mechanisms that vary by geographical regions, initial soil moisture conditions, and other local characteristics. We address these limitations by enhancing Xanthos with a new runoff generation scheme that incorporates both saturation and infiltration excess at a daily timescale in a single framework. We calibrate and validate the enhanced Xanthos using daily streamflow observations from 35 basins worldwide. By improving the simulation of flood events across diverse geographical contexts, this new Xanthos runoff scheme advanced our ability to analyze the impacts of climate change and human activities on flood occurrence and intensity.

26. Assessing Air Quality Disparities at the County Level in the US

Sophia Soltes, William Vines, and Hanadi S. Rifai

Air quality has been a focus and concern in the United States for decades, with much research existing to show the effects of air pollution as well as changes in concentrations over time. While improvements in air quality have been seen nationally, with criteria air pollutant emissions decreasing by 78% from 1970 to 2020, they haven't been experienced equally across the nation, namely in underserved communities. The idea of environmental justice has emerged to lessen these disparities, but it has proven difficult to achieve. In this study, we introduce the idea of the Air Quality Vulnerability Index (AQVI), designed to comprehensively assess air quality disparities at the county level in the United States and bridge data gaps that prevent environmental justice from being attained. Our design incorporates an inclusive set of indicators, including socioeconomic, environmental, and health variables. Results revealed limitations in EPA air data. There was insufficient data on air pollutant concentrations to create a county-level index, and we found disparities in the amount of air quality monitors in disadvantaged counties when compared to national averages. Although there wasn't enough data to complete our index, we recommend that future studies build on the AQVI template as it stands on sound, thorough research. Additionally, we suggest that the EPA create stricter guidelines for state and local agencies surrounding monitor placement. This study underscores the need for improved air quality monitoring systems and policy interventions to achieve equitable air quality data, education, and improvements in all communities across the United States.

27. Investigating Relationships Using Data Analytics between Health and Air Quality for Houston

Ainaz Khalili Param, William Vines, Hanadi Rifai

Air pollution remains a significant public health and environmental concern in urban and industrial regions, where pollutants such as particulate matter (PM2.5), nitrogen oxides (NOx), sulfur dioxide (SO_2), and ozone (O_3) are prevalent. These pollutants, primarily generated from industrial activities, vehicular traffic, and energy production, contribute to adverse health outcomes and environmental harm. In Houston, Texas, a region known for its extensive industrial base and rapid urban growth, elevated levels of air pollution are frequently observed, disproportionately affecting low-income and marginalized communities. This study evaluates the relationships between environmental parameters—such as PM2.5 and ozone levels—and health metrics (e.g., coronary heart disease, stroke, asthma, etc.). Using data analytics and spatial modeling, we explore how socioeconomic factors and environmental justice contexts intersect with pollution exposure and health disparities. Preliminary findings suggest that neighborhoods with higher pollutant concentrations often coincide with communities facing greater social and economic vulnerabilities, amplifying health risks. This work highlights the importance of integrating environmental and health data to inform targeted interventions and policies that address health inequities associated with air pollution.

28. Chemo-preventive of Garlic in Human Leukemia cells: Involvement of Oxidative Stress, Apoptosis, and Cell Cycle Arrest

Sylvianne Njiki

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Garlic supplementation in diet has been shown to be beneficial to cancer patients. Recently, its pharmacological role in the prevention and treatment of cancer has received increasing attention. However, the mechanisms by which garlic extract (GE) induces cytotoxicity, oxidative stress, apoptosis, and cell cycle arrest in cancer cells remain largely unknown. The present study was designed to use HL-60 cells as a test model to evaluate whether or not GE-induced cytotoxicity, apoptosis, and cell cycle arrest in human leukemia (HL-60) cells is mediated through oxidative stress. Human leukemia (HL-60) cells were treated with different concentrations of GE for 12 hr. Cell survival was determined by MTT assay. The extent of oxidative cell/tissue damage was determined by measuring malondialdehyde (lipid peroxidation biomarker) concentrations by spectrophotometry. Cell apoptosis was measured by flow cytometry assessment (Annexin-V and caspase-3 assays) and agarose gel electrophoresis (DNA laddering assay). Cell cycle distribution was detected by the cellometer vision. Data obtained from the MTT assay indicated that GE significantly ($p < 0.05$) reduced the viability of HL-60 cells in a concentration-dependent manner. We detected a significant ($p < 0.05$) increase in malondialdehyde (MDA) concentrations in GE-treated HL-60 cells compared to the control. Flow cytometry data showed a strong concentration-response relationship between GE exposure and Annexin-V positive HL-60 cells. Similarly, a statistically significant and concentration-dependent increase ($p <0.05$) were recorded with regard to caspase-3 activity in HL-60 cells undergoing late apoptosis. Annexin V and Caspase-3 data were confirmed by the result of DNA laddering assay showing clear evidence of nucleosomal DNA fragmentation in GE-treated cells. GE treatment induced G0/G1 cell cycle arrest in in GE-treated HL-60 cells. Together, our findings indicated that garlic significantly inhibited the proliferation of human leukemia (HL-60) cells via G0/G1 cell cycle arrest, induction of apoptosis, and the induction of apoptosis was associated with oxidative stress. This old drug may be valuable for both the prevention and treatment of acute promyelocytic leukemia.

29. Enhancing Rapid Flood-Inundation Prediction and Mapping with Fourier Neural Operators: A Hybrid Approach to Compound Flooding Events

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Abstract:

Increasing intensity of compound flooding events leads to substantial human and economic losses in coastal regions. It is often difficult for traditional flood-inundation models to address the complexities and rapid dynamics of compound drivers. These events are characterized by concurrent flooding from storm surge, extreme rainfall, and river discharge, which interact with non-linear dynamics. However, this complexity poses a challenge for conventional modeling approaches, which may not capture the intricate interdependencies and rapid-evolving nature of such events effectively. To address this challenge, Machine Learning (ML) offers a promising solution by leveraging large datasets to identify flood patterns and relationships that traditional models may miss. This study introduces a hybrid approach, combining a process-based model (Super-Fast Inundation of Coasts-SFINCS), and a deep learning (DL) technique for predicting flood extent and inundation depth. SFINCS (a reduced complexity model) combined with ML allows large ensembles (e.g., 100) to be rapidly simulated within 4 hours on a single multi-core CPU. Previous studies show that SFINCS outputs compare favorably with NOAA tide gage and USGS gage data, using example hurricanes. We applied a Fourier Neural Operator (FNO) model to the Houston-Galveston areas. Emerging from the partial differential equation surrogate modeling literature, FNO has shown great potential in modeling multi spatiotemporal scale phenomena. FNO consists of Fast Fourier transform and weight multiplication blocks in the Fourier space, where low Fourier modes are trained to capture global information, while high Fourier modes are used to capture local information. In this work, we trained FNO with simulated water depths from seven historical storm events (e.g., Rita-2005, Humberto-2007, Edouard-2008, Ike-2008, Harvey 2017, Imelda-2019, Beta-2020). Inputs included static (elevation, cumulative infiltration depth) and dynamic (precipitation, wind speeds/direction, flow velocity/direction, air-pressure at mean sea level and simulated water depths) variables, while outputs included predicted surface

water depths. This study showcases the potential of the FNO approach to enhance rapid flood-inundation prediction and mapping, particularly for compound flooding events. The integration of static and dynamic inputs in a highly efficient DL framework offers a promising direction for real-time flood risk management and emergency response planning.

30. Assessment of physical environment features on outdoor thermal comfort: a campus case study using a machine learning-based prediction

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Abstract:

To fill the research and knowledge gaps about the relationship between environmental features and the thermal comfort within the campus environment, this study proposed a nonparametric approach using machine learning methods to understand the association of outdoor thermal stress with physical environment factors and evaluate the relative importance of each environment factors on outdoor thermal stress prediction in different campus morphology and under students' different activity states.

We conducted the study on 12 preselected public spaces at Texas A&M University in College Station, Texas, from September 2023 to September 2024. Those study sites are categorized into three groups according to the typology of campus layout: 1) deep symmetrical canyon, 2) shallow symmetrical canyon, 3) asymmetrical canyon. Sunny days from different seasons were randomly selected to do in-situ measurements and collect representative meteorological data. The measurement was conducted from 12pm to 4pm, the hottest period during the day, to capture the potential thermal stress on site. Physical environmental features of study sites were surveyed within a 20m radius centered on each site. We classified 19 physical environmental factors into three primary categories based on consideration of view factors from sky, ground, and vertical structures in this study. The Comfort Formula was used to calculate human energy budget and estimate thermal risks. We performed Random Forest classifier models to reveal the best predictors of students' outdoor thermal stress under six scenarios (2 activity levels x 3 layouts) in campus environments.

Our results showed that both different micrometeorological parameters and thermal stress at different activity levels varied considerably across various campus layouts. Additionally, models suggested that the sky view Factor, building view factor, and free View Factor are consistently the top three influential environmental factors affecting thermal stress across the six conditions. Furthermore, environmental factors had a more pronounced impact on thermal stress levels in shallow symmetrical canyons and asymmetrical canyons. Our study identified campus layouts and landscape elements that pose thermal threats to outdoor activities. These findings will help campus redesign efforts and help direct student programs and events. The results will also provide evidence for landscape designers to improve the campus's thermal environment and promote health outcome through appropriate environmental design interventions.

31. Single-cell and Spatial Characterization of the DFUs microenvironment

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Karla Paniagua, University of Texas at San Antonio

Abstract

Spatial characterization of the diabetic foot ulcer microenvironment (DFUm) using single-cell and spatial transcriptomics is an emerging area of research that can potentially provide a detailed understanding of the tissue composition, cellular interactions, and molecular pathways involved in Diabetic Foot Ulcers (DFUs). DFUs are chronic wounds that develop in diabetic patients and are notoriously difficult to heal due to impaired tissue regeneration, chronic inflammation, and infection. San Antonio reports some of the highest rates of diabetic amputations in Texas. This is alarming because amputation is often a preventable outcome if DFUs are identified and treated early. The high amputation rate reflects not just poor diabetes management but also delays in recognizing and addressing foot ulcers, leading to severe tissue damage that necessitates surgical intervention. The aim of this study is to identify molecular factors related to the severity of DFUs by leveraging a multimodal approach that advances our understanding of the DFUm and its pathogenesis. By integrating multiple datasets, we aim to uncover a comprehensive set of molecular signatures and cellular interactions that contribute to the development and progression of DFUs. Our results show the identification of a distinct group of cells present almost exclusively in severe DFU tissues. Further analysis revealed that keratinocytes formed most of these group, alongside smaller populations of epithelial cells and fibroblasts. These cell types may be critical for maintaining the skin barrier and promoting tissue repair, suggesting that their dysfunction could be contributing to the impaired wound healing observed. Differential gene expression analysis provided additional insights into this population’s unique gene expression profile. The downregulation of genes involved in cell migration, lipid metabolism, and immune responses suggests that these keratinocytes are not only dysfunctional but may also contribute to a pro-inflammatory environment that hinders healing. The high rates of diabetic foot ulcers, and amputations in South Texas, particularly among Hispanic adults, represent a pressing public health issue. Early identification and intervention in the management of foot ulcers are critical to reducing the risk of amputations. Addressing the underlying health disparities through early detection programs is essential to improving the quality of life and outcomes for diabetic patients in the region.

32. Effects of Climate Change on Extreme Heat in Texas

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Climate change is raising global temperature and increasing the frequency of extreme heat events. In Texas, the number of extreme heat days increased over the period of 1979-2015 due to increased solar radiation and reduced precipitation. This trend is likely to continue, with average temperatures expected to increase by 3.0° Fahrenheit and the annual number of days with temperatures exceeding 100° Fahrenheit expected to double by the year 2036 compared to the 1950-1999 average. These temperature increases are most strongly felt in urban regions of the state due to the urban heat island effect, where asphalt and other manmade materials absorb heat and cause temperatures within cities to rise. The higher-than-average temperature increases in the United States coupled with the heat island effect have caused the average number of extreme heat events per year to increase from two in the 1960s to six in the 2020s. Extreme heat caused by climate change leads a wide range of impacts on health outcomes, specifically cardiovascular, respiratory, and mental health. The main predictor of both the physical and mental health impacts of extreme heat is an individual's pre-existing chronic illness. For example, the connection between renal disease and increased mortality due to extreme heat is significant and is caused by an increased risk of dehydration during extreme heating events. Ischemic heart disease mortality also increases during heatwaves, and there is evidence that this increase is caused by excess heat and by additional factors such as reduced air quality during a heatwave. Research has shown that cardiovascular mortality rates during extreme heat events are higher in areas with low green space, indicating that land use decisions significantly influence the severity of extreme heat events. Individuals with a wide range of mental health disorders such as dementia, substance abuse, and mood and anxiety disorders are more likely to be hospitalized during extreme heat events as compared to the general population. As climate change accelerates, the negative health outcomes associated with extreme heat will worsen, especially in newly developed residential and industrial areas. In this study, the effects of extreme heat on human health in Texas were examined over time according to a variety of climate change scenarios. The purpose of this research is to determine the impact of extreme heat events on the physical and mental health of Texas residents based on vulnerability factors such as minority status, economic status, and land use.