**HE2AT Center Project Update**

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**Compiled by C Parker**

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**Overview:** The HE2AT Center, funded by the NIH and part of the DSI Africa project, focuses on mitigating the health impacts of climate change in Africa through data science. Now in its third year, the project is divided into two research projects (RP1 and RP2), each addressing different aspects of heat exposure and health outcomes.

**Research Project 1 (RP1):**

* **Goal:** Quantify the impacts of heat exposure on maternal and neonatal health in sub-Saharan Africa and design a district-level surveillance system.

**Progress:**

* The protocol for the individual participant data meta-analysis has been published in BMJ Open: doi: 10.1136/bmjopen-2023-077768
* Initiated contact with 167 data owners
* 23 datasets secured for analysis, with an additional 4 data transfer agreements completed and 24 data transfer agreements in progress
* Developed master codebook using common ontologies
* Ongoing data harmonisation efforts, including two studies where variables have been successfully mapped to the master codebook
* Challenges include time taken to negotiate and execute data transfer agreements and navigating data protection acts for cross-country data transfer

**Research Project 2 (RP2):**

* **Goal:** Develop an urban heat-health Early Warning System by mapping intra-urban heat vulnerability and forecasting adverse health outcomes at different temperature thresholds.

**Progress:**

* Leveraging Data Science and Machine Learning for Urban Climate Adaptation in Africa" has been **accepted with revisions** in BMJ Open
* 47 studies were identified for inclusion, and ongoing communication with principal investigators was maintained. Eight datasets are in hand from Johannesburg, and two have signed Data Agreements in Abidjan.
* Ongoing workshops with the Wits Health Research Ethics Committee(HREC) to get amendment approval for each study to be added to the RP2 database.
* Vulnerability mapping and heat-health analysis are underway. Machine learning is being used to develop a vulnerability mapping paper for Johannesburg to be submitted to the Journal of Biometeorology.

**Data Management and Analysis Core (DMAC):**

**Progress:**

* A data harmonisation tool has been developed to map incoming study variables to the overall HE2AT Center codebook using Streamlit and linked to CSAG JupyterLab.
* Development of a GeoDN User Interface for data integration of climate, health, and socio-economic variables, with deployment planned for the CSAG/UCT JupyterLab environment.
* Established pipelines for satellite-based Land Surface Temperature derivation and transforming point health outcomes data to gridded datasets.
* Ongoing work on temperature downscaling for Urban Heat Island estimation using IBM Geospatial Foundation Models (GFMs).
* Challenges include managing incoming data's various storage formats and structures, primarily assisted by AI-augmented extraction and metadata harmonisation techniques.

**Training and Engagement Core (TEC):**

**Progress:**

* Learning cohorts team has been established to drive “communities of practice” in subject areas across the HE2AT Center partners.
* Hosted team learning webinars and developed a monthly digest to share information and opportunities.
* Ongoing PhD seminars, where students actively present their research to senior HEAT Center members, fostering an environment of learning and expertise exchange.

**Significant Collaborations:**

* A supplementary grant awarded to CeSHHAR for "CHEAQI – MNCH Research Project" leveraging the HEAT Center's resources. The project aims to enhance our understanding of environmental impacts of air-pollution on maternal and child health.
* Involvement with the UN General Assembly underscores the HE2AT Center’s global engagement and significance.
* Support from the Wellcome Trust for an African climate change and health conference highlights collaborative efforts.
* Presenting to the SA Medical Research Council on Carbon Footprint Estimations of Research Project Activities.
* Pilot Projects have been awarded to four investigators and four organisations in Cameroon, Nigeria, Zimbabwe, Cote Ivoire which has expanded the Center’s collaborations and capacity-building efforts in Africa

**Publications:**

* The HE2AT Center has made significant progress in knowledge dissemination through publications and conference attendance.
* Publications and posters cover various topics, including heat exposure impacts, data harmonisation strategies, and machine learning approaches in climate and health research.
* The team has also presented abstracts at international conferences such as ENBEL Health & Climate Change 2023 and ANSER Conference 2024

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| Publication Title | Authors | Journal/Publication Outlet | Status (please include date of publication) |
| Protocol of an Individual Participant Data Meta-analysis to Quantify the Impact of High Ambient Temperatures on Maternal and Child Health in Africa (HE2AT IPD) | Darshnika P Lakhoo, Matthew F Chersich, et al. | BMJ Open | Published |
| The Effect of High and Low Ambient Temperature on Infant Health: A Systematic Review | Darshnika P Lakhoo, Helen Abigail Blake, et al. | International Journal of Environmental Research and Public Health | Published |
| Leveraging Data Science and Machine Learning for Urban Climate Adaptation in Africa: A HE2AT CENTER Study Protocol | Christopher Jack\*, Craig Parker\*, et al. | BMJ Open | Accepted with revisions |
| Characteristics of longitudinal maternal health studies in sub-Saharan Africa: a systematic mapping of literature between 2012 and 2022 | Ijeoma Solarin\*, Cherlynn Dumbura\*, et al. | Journal of Gynecology and Obstetrics | Under review |
| Impacts of Heat Exposure in Utero on Long-Term Health and Social Outcomes: A Systematic Review | Nicholas Brink, Darshnika P Lakhoo, Ijeoma Solarin, et al. | BMC Pregnancy and Childbirth | Under review |

**Next Steps:**

* RP1 will focus on expanding data acquisition while continuing to analyze and harmonise the secured datasets.
* RP2 aims to refine and implement the Early Warning System, building on the groundwork laid out by the harmonisation and vulnerability mapping efforts.
* The Center will continue to prioritise knowledge dissemination through publications and engagement in global platforms while developing cutting edge data science innovation.

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