

**Wits RHI Research Review Committee**

**Research Proposal – Submission Cover Form**

*Note: Proposals submitted with incomplete information will be returned (responses must be provided for all questions). Please submit any proposal you have with this application*

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| 1. Author of concept: |
| Craig Parker |

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| 1. This submission has been approved by: | |
| Director Name: | Gloria Maimela |
| Signature: |  |
| Date: | 22 February 2023 |

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| 1. Date of submission to RRC: |
| 22 February 2023 |

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| 1. Application Title |
| Protocol for mitigation interventions evaluation in Kenya, South Africa, and Zimbabwe. |

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| 1. Investigators from Wits RHI:   (Please include against investigators name whether they are PI/co-PI or other study role) |
| * Gloria Maimela (MBBCH, MBA), Principal Investigator * Craig Parker, Data Scientist, Co-Investigator * Matthew Chersich, Research Professor, Principal Investigator * Feziwe Mpondo BSc (Hons), MSc, PhD, Co-Investigator |

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| 1. Investigators from other institutions:   (Please include against investigators name whether they are PI/co-PI or other study role) |
| * Sohail Muhammad Syed, Chief Executive Officer of Aga Khan Hospital Mombasa Cluster, Kenya * Aquinius Mungatia, Head of Grants & Security and Environment and Climate Change Focal Person at Aga Khan Hospital Mombasa, Kenya * Stanley Luchters, Professor and Executive Director of the Centre for Sexual Health and HIV AIDS Research, Zimbabwe * Thabani Muronzie, Climate & Health Research Officer of the Centre for Sexual Health and HIV AIDS Research, Zimbabwe * Jetina Tsvaki, Climate & Health Data Management and Science Analyst of the Centre for Sexual Health and HIV AIDS Research, Zimbabwe |

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| 1. Is this project for post-graduate degree purposes? (Masters / PhD), If yes in what discipline. | |
| Discipline: | NA |
| Institution where registered: | NA |

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| 1. What is the proposed role of Wits RHI in the implementation of the study? |
| Wits RHI provides expertise in climate change and health, statistics, maternal health, anthropology, and intervention co-creation. Additionally, Wits RHI will be leading the implementation of the carbon tracking in facilities in Tshwane |

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| 1. For collaborative studies involving other institutions, please state Wits RHIs role in the protocol development and writing? |
| Wits RHI led the writing and coordination of inputs to the protocol. |

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| 1. What is the proposed role of Wits RHI in the preparation of publications?  (This is only for those studies that involve other institutions) |
| Wits RHI will take a leading role in the preparation of publications targeting high impact journals. This means that Wits RHI will likely play a key role in the writing and preparation of manuscripts for publication in peer-reviewed journals.  As a leading research institution in the region, Wits RHI is well-positioned to contribute to the project's research outputs, and our expertise will be valuable in ensuring the quality and impact of the publications. They will work closely with other project partners to ensure that the publications accurately reflect the research findings and meet the standards of high-impact journals.  Wits RHI will also likely play a role in identifying suitable journals for publication, based on our knowledge of the field and existing relationships with publishers. They will collaborate with other project partners to ensure that the publications are submitted to high-impact, peer-reviewed journals that are widely read and recognized in the relevant fields.  Overall, the proposed role of Wits RHI in the preparation of publications is to help ensure that the research findings are disseminated through high-impact journals and that they have the necessary visibility and recognition to contribute to advancing knowledge and evidence-based practices in the field. |

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| 1. What is the background to the proposed research? Focus on the knowledge gap the research intends to fill? |
| The proposed research project aims to fill a critical knowledge gap in the relationship between carbon emissions, climate change, and health outcomes in healthcare facilities in Kenya, South Africa, and Zimbabwe. Despite the growing evidence linking climate change to public health, there is still a significant gap in knowledge on the role of healthcare facilities in contributing to carbon emissions and the associated impact on health outcomes. The project seeks to address this gap by measuring carbon emissions from healthcare facilities and evaluating the effectiveness of interventions to reduce emissions and improve health outcomes.  The research project also aims to address the lack of evidence on the cost-effectiveness of different carbon reduction interventions in healthcare facilities. While several interventions have been proposed to reduce carbon emissions in healthcare facilities, there is limited evidence on their effectiveness and cost-effectiveness. The project will evaluate the costs and outcomes of different interventions to identify the most economically feasible and effective strategies to reduce carbon emissions in healthcare facilities.  By filling these critical knowledge gaps, the research project aims to provide evidence-based recommendations for policy development, resource allocation, and public health interventions. It will also promote the use of evidence-based practices to reduce carbon emissions and improve health outcomes in healthcare facilities in the participating countries and beyond. |

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| 1. What is the research rationale? |
| The research rationale for the proposed study is to better understand the impact of carbon emissions on health outcomes in healthcare facilities and to identify effective interventions to mitigate the impact of emissions. Climate change and its associated health risks, including air pollution, have become increasingly pressing global issues that need to be addressed urgently. The health sector is responsible for a significant portion of carbon emissions, and healthcare facilities have been identified as a significant source of these emissions. However, little is known about the extent of the problem, and there is a lack of evidence on the most effective interventions to reduce carbon emissions in healthcare facilities.  The proposed research aims to fill this knowledge gap by measuring carbon emissions in healthcare facilities in Kenya, South Africa, and Zimbabwe and identifying effective interventions to reduce these emissions. By doing so, the study seeks to contribute to the global effort to mitigate the impact of climate change on human health and reduce the healthcare sector's carbon footprint. The research findings will inform policy development and contribute to the growing body of evidence on the relationship between carbon emissions and health outcomes.  The proposed study's rationale is therefore based on the urgent need to address the impact of carbon emissions on human health and the limited knowledge about effective interventions to reduce these emissions in healthcare facilities. |

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| 1. What is the overarching research problem / hypothesis? |
| The overarching research problem being addressed in this study is the urgent need to mitigate the carbon footprint of healthcare facilities in low- and middle-income countries.  The hypothesis is that implementing targeted interventions can significantly reduce carbon emissions from healthcare facilities, leading to substantial benefits for both public health and the environment.  This study aims to provide much-needed evidence on the effectiveness and cost-effectiveness of various interventions, including behavior change, energy efficiency, and renewable energy, in reducing carbon emissions. The ultimate goal is to inform policy and practice and support the transition towards sustainable, low-carbon healthcare systems globally. |

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| 1. What are the specific aims (maximum of 3) and supporting hypothesis for each aim? |
| The specific aims of this research project are:   1. To determine the baseline carbon emissions of healthcare facilities in Kenya, South Africa, and Zimbabwe, and to identify the sources and scopes of these emissions. Hypothesis: Healthcare facilities in Kenya, South Africa, and Zimbabwe have varying levels and sources of carbon emissions, with the majority coming from energy consumption. 2. To evaluate the effectiveness and cost-effectiveness of different carbon reduction interventions in healthcare facilities in Kenya, South Africa, and Zimbabwe. Hypothesis: Carbon reduction interventions in healthcare facilities can effectively reduce carbon emissions and are economically feasible. 3. To identify the factors that facilitate or hinder the implementation of carbon reduction interventions in healthcare facilities in Kenya, South Africa, and Zimbabwe. Hypothesis: The implementation of carbon reduction interventions in healthcare facilities is influenced by a range of factors, including financial, social, and structural factors. |

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| 1. What is the research strategy for each specific aim listed above? |
| *- Describe the study population. How are they selected? What are the inclusion/exclusion criteria?*  *- What is the study setting – describe why it was selected and what its attributes are that make it a good site for recruiting participants?*  *- What is the sample size?*  *- Describe the sampling plan*  *- How will the data be collected? By whom? Will any lab testing be performed? If yes, please specify*  *the primary data collection mechanism will be the AKDN tool to track carbon emissions in the three health facilities in Tshwane, South Africa.*  *The study setting is characterized by a subtropical climate with dry winters and hot summers, and the facilities offer a range of healthcare services, including emergency care, maternal and child health, treatment for acute and chronic diseases, and primary health services such as dental and reproductive health, mental health, and social services.*  *The sample size will be determined by the availability of data from the three healthcare facilities in Tshwane, and the sampling plan will involve collecting data on carbon emissions from these facilities using the AKDN tool. The data will be collected by personnel responsible for data management and protection project activities in compliance with relevant data protection regulations and standards, including the principle of data minimization.*  *No lab testing will be performed as this study is focused on tracking carbon emissions in the three health facilities. Data will be collected using the AKDN tool, which will provide a password-protected, secure platform for data management and storage. The project team will continuously monitor the data management practices and take necessary measures to address any issues arising during the project.* |

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| 1. What are the anticipated problems and resolutions |
| *Explain any possible biases and strategies to minimize or account for bias?*   1. *Access to data: Obtaining data on carbon emissions in healthcare facilities may be challenging due to the lack of established monitoring systems or data that may not be readily available. To address this issue, the research team will collaborate with local partners to establish a system for measuring and monitoring carbon emissions in healthcare facilities.* 2. *Obtaining buy-in from relevant stakeholders: As this project involves healthcare facilities, obtaining buy-in from the relevant stakeholders, such as the department of health, may be challenging. To address this issue, the research team will engage in ongoing communication with stakeholders to ensure that the project's goals and benefits are clearly communicated and understood.* 3. *Generalizability of findings: This research project will be conducted in three specific countries and may not be generalizable to other countries or regions. To address this issue, the research team will ensure that the study design is rigorous and that the findings are accurately reported. The team will also encourage further research to be conducted in different regions and contexts to expand the generalizability of the findings.* 4. *Bias: As with any observational study, there is a potential for bias, such as selection bias, information bias, and confounding. To minimize or account for bias, the research team will use standard and rigorous methods for data collection, such as using the AKDN tool to ensure uniformity and consistency in data collection across sites. The team will also use appropriate statistical methods to adjust for confounding factors and minimize the impact of bias on the study results.*   *Overall, the research team will take a proactive approach to address potential issues and biases and ensure that the study is conducted in a rigorous, transparent, and unbiased manner.* |

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| 1. What are the expected outcomes / results and interpretation for each aim? |
| Aim 1:  Expected outcome/result: The expected outcome of Aim 1 is to identify the carbon emissions from healthcare facilities in Tshwane, South Africa. Specifically, we aim to identify the sources and levels of carbon emissions, including electricity consumption, water usage, waste production, and transportation.  Interpretation: The interpretation of the results will provide a baseline for the carbon footprint of healthcare facilities in the study area. This will help in identifying carbon reduction interventions that are most suitable for the area. The results will also help in developing policies and guidelines for reducing carbon emissions in the healthcare sector in South Africa.  Aim 3:  Expected outcome/result: The expected outcome of Aim 3 is to determine the cost-effectiveness of different interventions for reducing carbon emissions in healthcare facilities in Tshwane, South Africa. Specifically, we aim to compare the costs and outcomes of different interventions and calculate the cost per unit of outcome across various interventions.  Interpretation: The interpretation of the results will help identify the most economically feasible carbon reduction interventions for healthcare facilities in the study area. By comparing the cost-effectiveness of different interventions, we will be able to determine the most efficient use of resources and generate valuable information to help inform policy decisions in the participating countries.  Overall, the expected outcomes of this study will provide valuable information on the carbon emissions from healthcare facilities in Tshwane, South Africa, and help in identifying carbon reduction interventions that are most suitable for the area. The results will also help in developing policies and guidelines for reducing carbon emissions in the healthcare sector in South Africa. The study's findings will be disseminated to policymakers, healthcare providers, and the scientific community to help inform policy decisions and contribute to the global efforts to mitigate climate change. |

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| 1. What are the ethical considerations for this project? Are study participants from a vulnerable population? Consent? Risks/benefits? Alternatives to participation? |
| The study team will ensure that the project is carried out in a responsible and ethical manner, with respect for the rights and well-being of all involved. One of the primary ethical considerations in this project is the vulnerability of the study population, which includes healthcare workers and district staff. These individuals may be vulnerable to coercion or undue influence due to the power dynamic inherent in their relationship with the research team. To address this, the study team will prioritize respectful communication and transparent, open dialogue with all participants.  Another ethical consideration is the potential risks and benefits of participation. While the project is not expected to pose significant risks to participants, there is a possibility of risks associated with data collection and management, including confidentiality breaches, unauthorized access, or loss of data. To minimize these risks, the team will ensure that data collection is done securely by implementing password-protected access to data and using encrypted data storage devices. Additionally, the potential benefits of this research project are significant and extend beyond the participating communities to society as a whole. The project's main objective is to understand the association between climate change, health outcomes, and carbon emissions, which can inform policy development and strategies to mitigate environmental and health risks.  The study team has taken steps to address these ethical considerations, including seeking ethical approval from the appropriate regulatory bodies, enlisting the services of local partners to navigate the local regulatory environment, and ensuring that all data is collected and stored confidentially. The team will continue to work closely with all participants and stakeholders to ensure that the project is conducted with the utmost respect for ethical principles and that any ethical considerations that emerge are carefully considered and addressed |

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| 1. Has a Good Participatory Practice plan been developed? |
| Good Participatory Practice (GPP) plan has been developed for the overall High Horizons project, of which this specific aspect is a part. The GPP plan outlines the project's commitment to promoting community engagement and participation, ensuring that the community is involved in all aspects of the project, from the planning phase to the dissemination of results. The GPP plan emphasizes the importance of transparency, accountability, and community ownership, and it provides guidance on how to achieve these goals.  For this specific aspect of the project, the GPP plan will be integrated to ensure that the project adheres to the principles of community engagement and participation, and that vulnerable populations, such as healthcare workers and district staff, are involved in the research process. The project team will engage with these stakeholders to ensure that their perspectives and concerns are taken into account, and that they are involved in decision-making throughout the project. The GPP plan will also provide guidance on how to ensure that the research is conducted in a manner that is respectful and responsive to the needs of the community. |

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| 1. Describe the data safety and monitoring plan (for clinical trials) |
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| 1. Describe the data management and storage plan (for all studies) |
| The data management and storage plan for this project is designed to ensure the confidentiality and security of all collected data. Data will be collected using the AKDN tool, and will be stored on secure servers with limited access. All data will be de-identified, and any identifying information will be kept separate from the data.  Data management and storage will be conducted in compliance with all relevant regulations and guidelines for data privacy and confidentiality, including the General Data Protection Regulation (GDPR) and local data protection laws in each participating country.  To ensure accuracy and consistency, data will be double-checked and validated before analysis. The AKDN tool will allow for data collection in real time, and the data will be regularly backed up to ensure its integrity.  In terms of analysis, the data will be aggregated and analyzed at the facility level, with no patient-level data collected. Data will be analyzed using standard statistical methods, and any results will be reported in an aggregated, de-identified manner to ensure privacy and confidentiality.  The data management and storage plan will be reviewed and approved by the relevant institutional review boards and ethics committees in South Africa. Any updates or modifications to the plan will be reported and approved by these bodies. |

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| 1. What are the timelines? What are the staffing requirements? How does this fit in with your current activities/activities of your team? Who is the project team? How much will the study cost and what will be the source of funding for the study? |
| Timelines:  The project is expected to run from October 2022 to July 2026. Activities such as consultation/planning, ethics submissions, and measurement of carbon footprints will take place from October 2022 to February 2023. The design and optimization of mitigation interventions, tool for modeling alternative mitigation interventions, and implementation of mitigation interventions will take place from April 2023 to December 2023. Evaluation of effectiveness and cost-effectiveness will take place from October 2022 to July 2026. Dissemination of findings will occur from February 2023 to August 2026.  Staffing requirements:  The project team will consist of highly trained and experienced researchers with expertise in various relevant fields, including public health, epidemiology, environmental science, and data management. The team will include research coordinators, research assistants, data analysts, and statisticians. The project team will work with local partners in each participating country to ensure the project is carried out in a responsible and ethical manner.  Fit with current activities:  The project team will prioritize this project, and other activities will be adjusted to ensure that the project runs smoothly. Staffing will be adjusted to ensure that all project activities are completed on time.  Project team:  The project team will consist of individuals from various institutions, including universities and research organizations, who have expertise in public health, epidemiology, environmental science, and data management. The team will include research coordinators, research assistants, data analysts, and statisticians.  Study cost and funding source:  The study cost will be covered by the grant for High Horizons from the European Union. The total cost of the study will depend on factors such as staffing requirements, equipment, and data analysis. The project team will ensure that the study is conducted in a cost-effective manner without compromising the quality of the research. |

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| 1. What is your dissemination plan – identify three possible publications and the writing team. |
| Our dissemination plan involves publishing our research findings in peer-reviewed journals, presenting at conferences, and engaging with stakeholders through various media outlets. We aim to disseminate our findings widely to ensure that they reach relevant stakeholders and inform policy and practice.  As for possible publications, we plan to publish our research findings in three high-impact journals that are relevant to our research aims. These journals are:   1. The Lancet Planetary Health 2. Environmental Health Perspectives 3. Global Environmental Change   For each publication, the writing team will comprise the principal investigators and other key researchers involved in the specific aim being reported. The writing team will also include relevant experts in the fields of environmental health, climate change, and public health.  The expected timeline for the first publication is in late 2024, with the subsequent publications following in 2025 and 2026. We will ensure that all publications adhere to the highest ethical standards and are compliant with relevant guidelines and regulations. We will also work closely with our partners to ensure that the publications are accessible to stakeholders in the countries where the research was conducted. Finally, we will engage with the media and other outlets to disseminate our findings and increase awareness of the study's significance. |

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| 1. What are the strengths and limitations of the study? |
| 1. **Strengths:**   One strength of this study is the use of a standardized tool, the AKDN carbon footprint tool, to measure carbon emissions in healthcare facilities. This provides a systematic and replicable approach for measuring emissions and identifying areas for mitigation interventions. Additionally, the study focuses on healthcare facilities in an urban setting, which are vulnerable to the impacts of climate change and are important sources of carbon emissions.   1. **Limitations:**   However, there are some limitations to this study. Firstly, the study only measures carbon emissions at two facilities in Kenya, three healthcare facilities in South Africa, three health facilities in Zimbabwe , which may limit the generalizability of the findings. Secondly, the study uses a pre-post design, which may not fully capture the temporal changes in carbon emissions and may be subject to confounding factors. Thirdly, the study does not directly involve the community, which may limit the ability to understand the broader social and environmental factors that influence carbon emissions in healthcare facilities.  Despite these limitations, this study contributes to the understanding of carbon emissions in healthcare facilities and provides evidence-based interventions for mitigating these emissions |