Public Summary

This thesis dives into the development of a LAB liner for the handling of infectious materials in a tent-based structure. This thesis is commissioned by the Humanitarian engineering research group, alongside with the World Health Organization Technical Science for Health Network (Téchne) under the Health Emergency Facility (HEF) initiative. This addresses the need for developing swift and effective tent-based laboratories in the context of an infectious diseases outbreak. This research focuses on the ergonomic design of the LAB liner including glove replacement mechanism and material selection. The objectives are: ensuring the design of the LAB liner facilitates medical personnel in conducting diagnostic activities, that involves insights into ergonomic design, prototyping and testing the interchangeability model to ensure ease of use in glove replacement. The thesis presents valuable insights on the development of glove-wall systems in tent-based structures in various medical applications to enhance the design effectiveness of laboratory liners.

Thesis Summary

This thesis examines the design and development of a LAB liner that incorporates interchangeable gloves alongside a transparent that ensures the safe handling of infectious disease samples. This thesis in collaboration with the World Health Organization (WHO) Technical Science for Health Network (Téchne) under the Health Emergency Facility (HEF) initiative which specializes in facilitating the swift and effective facilities to respond to outbreak diseases. The goal of this research is the development of a LAB liner in a tent-based structure that acts as a glove wall system that ensures a safe partition between green and red area. An imperative point of focus in this lab liner is the development a glove wall system where the gloves can be interchangeable whilst ensuring no airflow between partition. The LAB liner must integrate design strategies that encompass ergonomics and material analysis to ensure the safe and ergonomic use of the liner by medical personnel to conduct diagnostic activities. A redesign is required as current methods lack functionality and efficiency. Therefore, this thesis addresses this issue by developing the innovative LAB liner to ensure a safe environment for personnel to have a coherent workspace that allows safe manipulation of an infected sample from a non-contaminated area.

This thesis explored the design considerations and strategies needed for the development of a LAB liner incorporating interchangeable gloves integrated into a transparent screen for

manipulating contaminated samples in a tent-based laboratory. By addressing this research question, an across-the-board analysis of glove wall systems and glove box case studies, integrated with the continual feedback of the client, lead to the development of well-rounded requirements set as the foundation for the development of the lab liner. This research encompassed the ergonomic design choices and material selection that contributed the final design of the lab liner.

Collaborating with the client in this regard was essential to identify obstacles in the research plan as well as ensuring comprehensive user-centred criteria and standards were set for the development of the final product. The methodological approach used in the triple triangle methodology were ones that emphasized a detailed research, design ideation and structured and rigorous prototyping evaluation. This led to the ideation and development and prototyping of solutions for the lab liner that integrated design strategies and ergonomic consideration with respect to the set requirements to yield a refined design.

Studies on ergonomics backed by intensive anthropometric data were heavily integrated into design rational, as well as constant feedback loops and extensive refinement of the prototypes or designs. The yielded results developed valuable insights on the development of a LAB liner which can be implemented in practical applications alongside the WHO-Téchne under the HEF initiative. Future development's focal point in this regard will be the further refinement of the prototypes as well usability testing post-manufacturing to examine any underlying weaknesses and potential adaptations required for varying field conditions and function transformation.