EWH 2018 Design Competition Design Proposal
Dry Heat Sterilizer

Surgical intervention is an essential implementation of care to address major injury, malignancies, obstructed labor, circulatory system failure, and orthopedic implantation. Despite the need for surgical intervention, the World Health Organization (WHO) estimates that between 2.5% and 41.9% of surgical interventions lead to surgical-site infections (SSI's), ranging from 2-3% occurrence in US and European hospitals to 5.7- 45.8% occurrence in Ethiopia and Nigeria, significantly increasing risk of mortality. According to an associate biomedical engineering professor consulted who has worked for the WHO, many small medical centers also neglect to sterilize waste such as gauze prior to disposal, which can lead to the spread of pathogens in a community. Given the relationship between contaminated surgical equipment and higher surgical-site infection rates as well as disease spreading in a community through waste, there is a definitive need to supply developing countries with inexpensive yet effective means to sterilize surgical equipment and waste such as lab coats and gauze.

Dry heat sterilizing units increase the temperature of an isolated containment unit to quickly and effectively sterilize surgical equipment, eliminating potential microbial contaminants from the equipment. The reliability and efficiency of dry heat sterilization optimizes their use in hospital settings, allowing for frequent and reliable use of surgical equipment without major concern for acquisition of SSI's. Currently, 'off-grid' medical centers either send used surgical instruments to a central collection and sterilization facility or implement less effective techniques such as chemical baths or antiseptics, which can be lengthy and rust the material. Generally, medical centers in underdeveloped areas do not have either the power or money to facilitate the consistent use of industrial dry heat sterilizers or autoclaves, which establishes a need for a smaller, more efficient alternative to provide effective sterilization for at least a portion of prioritized equipment.

The proposed design implements a dry heating coil element, which will decrease power usage while still maintaining an effective sterilization. Dry heat sterilizers also do not rust instruments over time as compared to steam-heated autoclaves. In discussion of alternative power sources in places that do not have reliable access to power, our advisor noted that car batteries are accessible as one means. Our project aims to address the issue of intermittent power in 'off-grid' medical centers by using car batteries to power the device by using the car battery to kick in and allow the sterilization process to complete. This

component of the project is planned for a future iteration, with innovation in the current iteration focusing on decreasing cost via on-location assembly.

The device will be 16 inches wide by 16 inches tall by 17 inches deep and encased with aluminum. Additionally, the interior of the sterilizer will have two shelves that will hold trays of surgical equipment or waste of the kind mentioned above. There will be a temperature sensor that will trigger a signal to the user the status of the autoclaving process. A solenoid door lock will keep the process from being halted before sterilization is achieved, and an LED will indicate when the device is operating.

For the surgical equipment to be considered sterilized in a dry heat autoclave, the container must maintain a temperature of 170C for 60 minutes. It is also vital that the components used to assemble the device be long lasting and easily obtained from recycled appliances to fit the needs of our customers.

The current design process includes breakdown of the device into 4 sub-teams: power, heating, cooling, and packaging, which have each verified the need and feasibility of each process. The sub-teams are working together to construct a functioning prototype, which will then be tested and validated. There is a clear need for reliable sterilization processes in medical centers with inconsistent access to power, and our project aims to provide a solution.