White Paper: Mosquito Exclusion Doors and Windows

Abstract

The Global Good Fund at Intellectual Ventures; Durham University; The Royal Danish Academy of Fine Arts, School of Architecture; and the Medical Research Council Unit, The Gambia (MRCG) are collaborating to conduct a pilot field trial of doors and windows designed to exclude mosquitos from houses while also providing security, indoor comfort, and privacy. The aim of this effort is to reduce indoor transmission of vector-borne diseases such as malaria by excluding mosquitos from homes. Outcomes from the field evaluation in sub-Saharan Africa will inform future design iterations.

Background

The original door design of Jakob Knudsen (The Royal Danish Academy of Fine Arts, School of Architecture, Denmark), features bent panels with vented slots that prevent mosquitos from entering homes, while allowing increased comfort by enabling greater ventilation than traditional solid construction (figure 1). The bent panel design increases strength while appearing completely solid, thereby providing both security and privacy.

Prototype Development and Field Evaluation

A second generation of doors and windows were designed and manufactured at Intellectual Ventures Laboratory, an affiliate of Global Good. A modular design was developed for prototype doors and windows, which allowed different configurations of panels to be evaluated in the field (figure 2).

Durham University and MRCG are conducting a pilot field trial in Wellingara Village, The Gambia (figures 3 and 4). Thirty homes are enrolled in the field trial. Twenty-four homes were fitted with improved doors (four configurations with different combinations of panels) and windows (two configurations). Six unimproved homes serve as the control houses, which will be fitted with improved doors and windows at the conclusion of the field evaluation. Data are being collected inside the homes to assess the improved mosquito exclusion and indoor comfort afforded by the doors and windows: the number of mosquitos captured inside the house at night are being recorded, as are indoor temperatures and humidity, and door sensors record when the door is open and when it is closed. A video of the installation process courtesy of Jakob Knudsen can be viewed here.

Joint Disclosure

The Global Good Fund I, LLC (United States of America) and Durham University (United Kingdom) are collaborating to develop doors and windows that aim to exclude mosquito entry to the houses while also providing security, comfort and privacy. The Parties acknowledge that, based on the original design of Jakob Knudsen (The Royal Danish Academy of Fine Arts, School of Architecture), several prototypes were developed and were evaluated in The Gambia in September 2017. The Parties hereby disclose the original design, as well as the improvements made by Jakob Knudsen, Durham University and the Global Good Fund I, LLC. Further improvements by Jakob Knudsen and the Parties will also be disclosed.

No authors will seek copyright, patent or in any other way claim ownership of the designs. It is the intent of all the authors that the designs be made publicly available.

All the authors request third parties to acknowledge their respective contributions in scientific publications or in other ways when the designs will be presented to the public.

For more information, please contact Global Good at www.globalgood.com
Steve Lindsay at Durham University can be reached at: s.w.lindsay@durham.ac.uk
Jakob Knudsen at The Royal Danish Academy of Fine Arts, School of Architecture is reachable at: jknud@kadk.dk
The Medical Research Council, The Gambia Unit can be reached at: information@mrc.gm

Figure 1. The original door design by Jakob Knudsen (The Royal Danish Academy of Fine Arts, School of Architecture). Panel detail (left) and full door (right). *Photo: Katie Neely (Intellectual Ventures Laboratory).*

Figure 2. A modular design was developed for the prototype door which allowed different configurations of panels to be evaluated in the field. Panel detail (left) and full door (right). One panel has an accordion design, with holes small enough to exclude mosquitos from entering the home, while allowing improved airflow for indoor ventilation. This accordion panel appears solid (providing privacy) but is robust and thereby provides security. Other panel designs include a translucent pane which increases light to the house but proves privacy by not allowing the interior of the house to be viewed from outside. A perforated flat panel excludes mosquitos while allowing air flow and has louvers that can be closed during cold or rainy weather to increase the comfort of the home or for privacy. The doors self-closes and self-latches, to ensure that doors close completely after home occupants enter or leave their house. *Photo: Katie Neely (Intellectual Ventures Laboratory).*

Figure 3. Photos of an entry way to a home in Wellingara Village, The Gambia, before (top) and after (bottom) installation of mosquito exclusion doors and windows. The home is one of thirty (30) houses participating in a pilot field evaluation of the doors and windows. The field evaluation began with door installation in August 2017. *Photos: Steve Lindsay (Durham University).*

Figure 4. Photo of interior of a home in Wellingara Village, The Gambia, after installation of mosquito exclusion doors and windows. The doors feature perforations for ventilation, and transparent panels to allow light to enter the home, as shown. Perforations in the doors and windows are too small for mosquitos to pass through. *Photo: Steve Lindsay (Durham University).*