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Genetic vector control strategies to reduce the burden of mosquito-borne diseases

Vector-borne diseases impose enormous health and economic burdens and additional methods to control vector populations are clearly needed. The Sterile Insect Technique (SIT) is an area-wide method of biological pest control whereby large numbers of a pest insect are bred, sterilized (currently by irradiation) and then released. The sterile insects mate with wild insects, but no viable offspring result from those matings. The SIT has been successful against agricultural pests, but is not in large-scale use for suppressing or eliminating populations of mosquito disease vectors. Genetic RIDL® technology (Release of Insects carrying a Dominant Lethal)* is a modification that involves releasing insects that are homozygous for a repressible dominant lethal genetic construct rather than being sterilized by irradiation, and could potentially overcome some technical difficulties with the conventional SIT technology. Field trials in *Aedes aegypti*, the principal vector of the arbovirus dengue, are ongoing.

Using dengue as an example, we combine vector population dynamics and epidemiological models to explore the effect of a programme of RIDL releases on disease transmission. We use these to derive a preliminary estimate of the potential cost-effectiveness of vector control by applying estimates of the costs of SIT. Through mathematical modelling, we predict that this genetic control strategy could eliminate dengue from a human community in a timescale within one year, and at lower cost than the direct and indirect costs of disease that would be averted by doing so.

The theoretical framework has wider potential use; by appropriately adapting or replacing each component of the framework (entomological, epidemiological, vector control bio-economics and health economics), it could be applied to other vector-borne diseases or vector control strategies and extended to include other health interventions.

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