Gene drive is a pattern of preferential inheritance. It promotes the spread of certain genes from generation to generation, so that in a relatively short time those genes become highly prevalent in a population.

Gene drive occurs naturally in many organisms. Using examples from nature, scientists are working in the laboratory to engineer gene drive systems that would introduce genetic traits into certain animal populations for the benefit of public health, conservation or agriculture. For these purposes, gene drive will work best in sexually reproducing organisms with a short generation time, such as insects or rodents.

Research indicates that gene drive has unique potential to address intractable public health challenges posed by vector-borne disease — for example, by stopping mosquitoes from transmitting malaria or viral disease or mice from carrying ticks that spread Lyme disease. Vector-borne diseases cause 700,000 deaths per year worldwide* (see map at left).

Gene drive could, for example, help to reduce the toll of malaria either by reducing the fertility of malaria-carrying mosquitoes, so fewer will be present to spread disease, or by decreasing their ability to carry the malaria parasite. In either approach, gene drive would spread the trait from one generation to the next, eventually lessening the number of mosquitoes that can infect people.

Gene drive research is still in the laboratory. Gene drive–engineered organisms will only be introduced into the wild after approval by appropriate authorities, such as regulators and policymakers, in the communities where a release is being considered. These authorities will assess the potential benefits, costs and risks of a release, based on input from stakeholders and information from laboratory experiments and ecosystem surveys.

Because of the potential for gene drive–engineered organisms to spread, authorities will need to consider the possible impact on other areas as well as their own community. Community engagement, timely and accurate data, and international treaties and agreements will be important to informing these decisions, which will govern whether and how gene drive–engineered organisms are introduced.

Gene drive–engineered organisms hold enormous potential to save lives. The introduction of a small number of engineered mosquitoes could eliminate malaria-carrying wild mosquitoes in a community, benefitting everyone who lives there — not only those who can afford treatment. Gene drive–engineered organisms also have potential to be cost-effective. Gene drive mosquitoes, once released, do the work of preventing malaria transmission themselves. Compared to ongoing costs of repeated treatment with insecticides or medicines, this technology may be simpler and cheaper to deliver.

That said, there are unanswered questions. It is critical to understand whether a gene drive modification would affect mosquitoes in any unintended way that might adversely impact human health or the environment. While researchers have not yet identified harms of this nature, ongoing investigation is essential.

Gene drive research continued at the forefront of discussions on responsible use of gene drive for public health.