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Application of Gene Drive Technology for Malaria Elimination in Africa

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Policy Brief

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Key Messages

- Gene drive technology is a genetic engineering tool which changes the genetic composition of a population by ensuring that particular desirable genes are passed on to more offspring than would occur naturally.
- The application of the technology towards malaria elimination in Africa is currently in its infancy, under development in labs.
- Concerns are raised over the ethical, ecological, and social implications of the technology.
- There is a need for comprehensive frameworks to guide their development and deployment, and ongoing dialogue with researchers and communities to limit any unintended consequences of the technology.

Context

Malaria is both endemic and perennial in many countries in Africa, posing significant health challenges. There is urgent need to address the high malaria burden, the declining effectiveness of conventional vector control methods and the challenges posed by insecticide resistance. Integration of gene drive technology for malaria elimination represents a promising and innovative approach to combatting the disease in the region. Gene drive technology offers a transformative potential by introducing genetic modifications that can reduce the ability of malaria-transmitting mosquitoes to transmit the parasites. However, there are challenges in its integration in malaria elimination efforts across Africa implementation, which require a collaborative and comprehensive approach to implement.

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Methodology

The data and other information used to compile this brief were drawn from a review of existing sources, including scholarly and conference papers, books and reports, newspapers and reputable online literature. The authors reviewed the sources to identify opportunities, benefits, and challenges of using gene drive technology in the health sector. The brief was further enriched with information gathered during meetings with experts on emerging technologies convened by the African Institute for Development Policy (AFIDEP) and the African Union Development Agency (AUDA-NEPAD) in August, September and October 2024. The meetings included the emerging health technologies expert meeting, biannual statutory meeting for the African Union High Level Panel on Emerging Technologies (APET) and a Regional Dialogue on Leveraging Emerging Technologies to Improve Healthcare Delivery Systems in Africa.

Findings

Gene drive technology can be used in precision targeting of mosquito populations, to control their population, and resistance management, making it a crucial tool in efforts to eradicate malaria in Africa. By precisely targeting malaria-transmitting mosquitoes, this innovative technology could decrease the overall malaria transmission risk in specific geographic areas and serve as a complement to existing malaria control strategies.

There is active research and development going on in Burkina Faso, Uganda, Tanzania, and Mali on gene drive technology to control malaria-transmitting mosquitoes. These studies aim to develop sustainable interventions to suppress mosquito populations, reduce malaria transmission rates, and alleviate the burden of the disease. The technology has shown promising results in laboratory studies. Field trials are planned to evaluate the effectiveness and safety of genetically modified mosquitoes with gene drive mechanisms in real-world settings.

The implementation of gene drive technology for malaria elimination in Africa faces several challenges, including limited long-term funding, navigating new regulatory frameworks, limited technical multidisciplinary capacity, and inadequate community engagement and social acceptance. It is important to engage with local communities when implementing this technology, obtaining informed consent for trials, evaluating potential risks and uncertainties, and promoting transparent communication and decision-making.

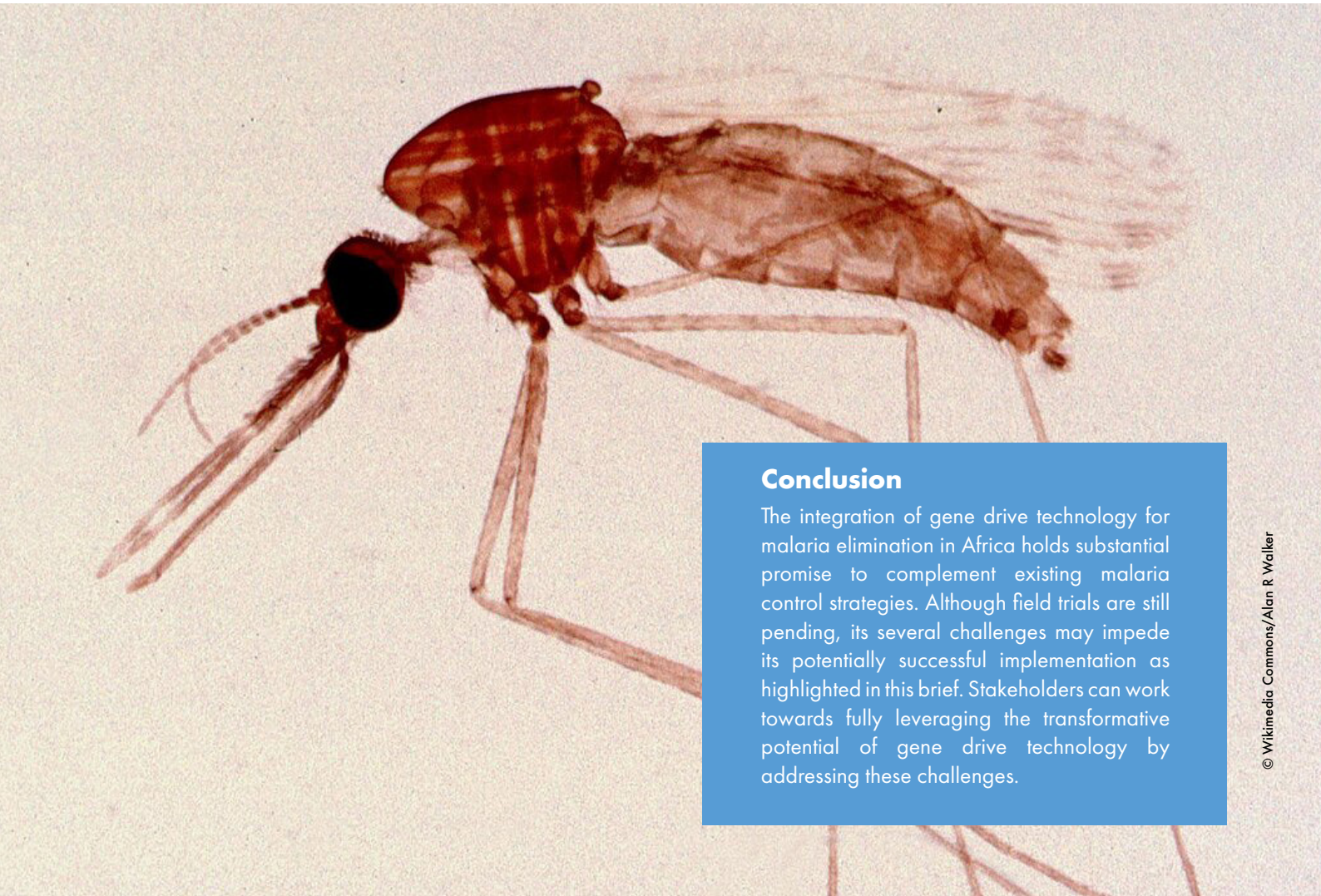
Local communities should also be involved in research activities in a meaningful way. Regulatory bodies play a crucial role in ensuring the responsible and ethical use of gene drive technology in malaria control programmes. There is need for comprehensive regulatory frameworks, thorough risk assessments, and ethical review committees to ensure responsible, ethical, and sustainable use of this technology. Implementers should also maintain transparency in communication, decision-making processes, and research activities to build trust and credibility.

Priority research for gene drive technology for malaria elimination in Africa include investigations into the technology's interaction with existing interventions, potential for selection or evolution of resistance, and ecological and gene flow. Studies are also needed on sociological and human behaviour as well as economic evaluations and impact assessments. Research in these areas will contribute to increasing understanding of the implications, impacts, and potential gains associated with gene drive technology in the context of malaria control and elimination efforts.

Policy Recommendations

To guide the application of gene drive technology for malaria control, policymakers should consider the following:

1. Involve all stakeholders in discussions, planning, and decision-making to ensure their perspectives and concerns are considered.
2. Establish multidisciplinary teams that bring together researchers, policymakers, public health authorities, and community representatives to work together on gene drive projects.
3. Provide regular updates, share information openly, and adhere to ethical standards to build trust and accountability among stakeholders.
4. Offer capacity building opportunities and training programmes to enhance the understanding of gene drive technology among policymakers, public health authorities, and community representatives.
5. Collaborate with existing platforms, such as research consortia, public health organisations, and civil society groups, to leverage expertise, resources, and support.
6. Establish clear ethical and social guidelines for the deployment of gene drive technology in malaria control.



Conclusion

The integration of gene drive technology for malaria elimination in Africa holds substantial promise to complement existing malaria control strategies. Although field trials are still pending, its several challenges may impede its potentially successful implementation as highlighted in this brief. Stakeholders can work towards fully leveraging the transformative potential of gene drive technology by addressing these challenges.

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