Comment

The Global Antibiotic Research and Development Partnership (GARDP): a not-for-profit antibiotic development organisation

WHO has identified the need to address the threat posed by drug-resistant bacterial infections as a global public health priority. However, the current pipeline for new antibiotics and biological treatments is inadequate for the size of the task. New approaches are urgently needed spanning research and development, through to access and stewardship—to ensure both antibiotics that have been approved for many years and new antibiotics remain available.

An alternative to the commercial antibiotic development model, is a not-for-profit research and development organisation such as the Global Antibiotic Research and Development Partnership (GARDP). Initiated by the WHO and Drugs for Neglected Diseases initiative in 2016, GARDP addresses global public health priorities by developing and delivering new or improved antibiotic treatments, while endeavouring to ensure their sustainable access. Essentially, stewardship and conservation are built into GARDP's research and development strategies from the beginning, and embedded within an access approach.

GARDP's ambitious objective is to develop four new treatments by either improving existing antibiotics or developing new chemical entities by 2023. GARDP prioritises its research and development strategies based on global public health needs, clear target product profiles, and research and development roadmaps. Global health needs are determined by considering the intersection between priority pathogens identified by WHO, specific populations' health needs, and individual diseases and broader syndromes, while targeting important indications for which others are less likely to develop treatments. A key feature of GARDP's model is the ability to enter at any point along the drug development pipeline-from early exploratory studies to preclinical and clinical studies, all the way through to patient access.

Partnerships with industry, research institutions or academia, governments, civil society, and not-for-profit organisations are key to GARDP's strategy. GARDP addresses collective antibiotic research and development challenges by taking a portfolio approach, making a longterm commitment to partners and projects by working collaboratively, and building global partnerships. By doing and sponsoring complex research and development with partners in preclinical and clinical studies; pharmaceutical quality and chemistry, manufacturing, and controls; regulatory; manufacturing; and supply, GARDP can absorb substantial development risks. It can separate the costs to develop new treatments from sales and volumes, and negotiate appropriate margins while establishing accessibility and affordability and stewardship measures with its partners.

GARDP's initial clinical development programmes focus on developing antibiotics for sexually transmitted infections, neonatal sepsis, and paediatric infections. Starting with a focus on gonorrhoea, the sexually transmitted infections programme aims to deliver one new treatment that will be effective against drug-sensitive and drug-resistant bacteria. This treatment will need to be suitable for integration into the syndromic management of sexually transmitted infections and ideally be active against urogenital and extragenital infections. Notably, GARDP is one of the few entities working in partnership with a small and mediumsized enterprise, Entasis Therapeutics, in the late-stage development of a novel, first-in-class treatment for gonorrhoea. A phase 3 clinical trial is due to commence in 2019.

The neonatal sepsis programme aims to deliver an empirical treatment for infections by drug-resistant, Gram-negative bacteria and develop a treatment for infections in which the causative pathogen is confirmed to be multidrug resistant (eg, carbapenemase-producing Enterobacteriaceae). GARDP's global observational study to understand the clinical management and treatment of sepsis in neonates will inform the development of optimised treatment regimens. A development programme for fosfomycin has commenced with a phase 2 pharmacokinetic and safety study in neonates currently underway (NCT03453177).

GARDP's paediatric antibiotic platform to expedite development of new and late-stage pipeline drugs has recently been approved. It aims to extend use, improve or optimise formulations of existing antibiotics for use in childhood infections, support the updating of paediatric



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For the **Global Antibiotic** Research & Development Partnership see https://www. gardp.org evidence-based treatment guidelines, and develop an international neonatal and paediatric clinical trial network.

GARDP's transversal research and development programme comprises two elements. The memory recovery component aims to champion a new generation of antimicrobial research and development researchers by connecting this community via REVIVE, a website with open access to numerous resources including bespoke webinars. The memory recovery component is also identifying undeveloped or forgotten antibiotics that could be developed into new treatments. The exploratory component aims to build a portfolio of novel chemical entities or drugs, including drug combinations, to support GARDP's clinical programmes.

GARDP is working with others in the global landscape of research and development of new antibiotics, including CARB-X, The Pew Charitable Trusts, Novo REPAIR Impact Fund, Joint Programming Initiative on Antimicrobial Resistance, and the Wellcome Trust, and with societies including British Society for Antimicrobial Chemotherapy, European Society of Clinical Microbiology and Infectious Diseases, and American Society for Microbiology to copromote activities as well as co-organise conferences and symposia.

GARDP's rapid evolution since 2016 highlights that a not-for-profit, public health focused model can offer a realistic alternative to commercial drug development and is an important component of the antibiotic research and development landscape.

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I declare no competing interests.

For **REVIVE** see https://www. revive.gardp.org