CARB-X Supports the Development of Products that Address Antimicrobial Resistance in Low- and Middle-Income Countries (LMICs)

The Impact of Antimicrobial Resistance on LMICs
Antimicrobial-resistant (AMR) bacterial infections kill more people annually than HIV/AIDS or malaria. While it is estimated that 1.27 million people died in 2019 due to AMR infections, the burden is most acute in Low- and Middle-Income Countries (LMICs). Sub-Saharan Africa has the highest death rate, where an estimated 255,000 people died in 2019. **One in five deaths attributed to AMR were in children under 5**, and **99.65% of those children were from LMICs**. While people of LMICs face the greatest AMR burden, their access to life-saving antibiotics, vaccines and diagnostics is often limited.

A Comprehensive Approach
As shown by the Covid-19 pandemic, infection spreads beyond borders. **Resistance that starts in one nation will travel and impact the global population.** CARB-X supports vaccines, diagnostics, antibiotics, and other non-traditional products to help identify, treat, and prevent infections, curb resistance and save lives throughout the world.

CARB-X Portfolio Examples
**Preventative:** Lumen Bioscience is targeting *Campylobacter jejuni* and enterotoxigenic *Escherichia coli* (ETEC) to prevent life-threatening diarrheal diseases which kill 800,000 children per year—more than malaria, measles and AIDS combined. Lumen uses a spirulina-based platform, derived from food algae. The low-cost oral product could be easily shipped and stored without cold chain distribution.

**Diagnostic:** SpeeDx is developing its rapid diagnostic technology, *InSignia™*, with QuantuMDx as a portable, battery-operated device that could be used in resource-limited settings. It aims to detect chlamydia and gonorrhea, two common sexually transmitted diseases, and provide definitive results in under 1 hour. Rapid test results could enable patients to be diagnosed and treated with effective antibiotics in the same appointment to help improve patient outcomes and curb resistance.

**Therapeutic:** Amicrobe is engineering its *Amicidin-β* synthetic proteins in two formulations: a solution to treat orthopedic and trauma-related infections, and a foam designed to treat infections during emergency surgeries, like cesarean deliveries. These represent more than 50% of surgical procedures in sub-Saharan Africa, where up to 20% of mothers develop infections.

Select CARB-X Products are Engineered for:

- Affordability
- Speed
- Oral use
- Shelf life
- Easy transport

*As of 17 October, 2022*
Portfolio Acceleration Tools
Targeted data are essential to create products that function globally. That is why CARB-X launched Portfolio Acceleration Tools (PATs) to address common challenges faced by product developers. One PAT focused on evaluating resistance risks, and prepared a panel of 3,000 bacterial isolates of WHO priority pathogens. 32.5% of these isolates came from LMICs. Select CARB-X product developers tested their therapeutics’ activity against the bacterial isolates. The panel, results and genomic data were shared with all CARB-X product developers—including those engineering preventatives and diagnostics. The goal was to help developers optimize their products and evaluate their effectiveness in regions where resistance genes may differ.

Supporting Product Innovation in India
CARB-X has supported Bugworks Research, GangaGen Biotech, and Module Innovations. Based in Bangalore, Bugworks and GangaGen are developing novel first-in-class antibacterial products that target bacteria prevalent in LMICs. Based in Pune, Module is developing an affordable, rapid diagnostic to detect resistant UTIs, help guide effective treatments, and slow resistance.

Stewardship & Access Plan
When antibiotics are misused and infections are not treated quickly with effective antibiotics, people die at higher rates, and resistance spreads. CARB-X and its partners created a Stewardship and Access Plan (SAP) Development Guide to help product developers identify solutions to ensure their new products are accessible in LMICs, and used appropriately to increase the lifespan of new drugs. The Plan must be developed during Phase 3 clinical trials, or the equivalent for diagnostics.

Targeting the World’s Deadliest Bacteria
CARB-X products are designed to benefit everyone. They target the world’s most deadly resistant bacteria identified by the CDC and WHO, including the nine bacteria above that cause the highest death rates in LMICs.

Partnering with Global Experts
CARB-X partners with subject matter experts and a Global Accelerator Network (GAN) that provide scientific, technical, regulatory, and business support to product developers around the world. Based in Bangalore, C-CAMP promotes CARB-X’s mission, innovation and entrepreneurship, and encourages product developers in India to apply for CARB-X support. FIND encourages developers to build diagnostics that meet the needs of LMICs. Acceleration partners, like the Clinton Health Access Initiative (CHAI) and the International Vaccines Institute (IVI), advise product developers about in-country manufacturing, regulatory and clinical considerations.

1. A. baumannii
2. E. coli
3. K. pneumoniae
4. N. gonorrhoeae
5. P. aeruginosa
6. Salmonella sp
7. Shigella sp
8. S. aureus
9. S. pneumoniae

* As of 17 October, 2022