



*Staphylococcus aureus* is a bacterium frequently found in the upper respiratory tract and on the skin.

# FIGHTING ANTIMICROBIAL RESISTANCE WITH VACCINES

**DRUG-RESISTANT BACTERIA** pose a major global threat, and vaccines may be a critical part of the solution.

**The SARS-CoV-2 pandemic** has had a mixed effect on the growing problem of antimicrobial resistance (AMR). The Centers for Disease Control and Prevention has described how the pandemic has contributed to resistance through the misuse and overuse of antibiotics. But the success of COVID-19 vaccines has underlined how critical they are in our armoury against infectious disease outbreaks. Increasingly, experts believe that vaccines can play a crucial role in the fight against other looming threats.

“AMR could be the next pandemic,” says Sanjay Phogat, Vice President for Research and Development at GSK. Currently, 700,000 people die each year due to drug-resistant diseases and, without urgent action, AMR could cause 10 million deaths per year by 2050<sup>1</sup>.

Even if that worst-case scenario can be avoided, Phogat has no doubt that AMR is one of the biggest challenges facing doctors, pharmaceutical

companies, and society at large.

The potential for vaccines to combat AMR was highlighted by the World Health Organization (WHO) in 2019<sup>2</sup>. The WHO called on the scientific community to study the value of vaccines in the fight against AMR. It presented an initial list of 22 bacterial infections, six viral infections and the malaria parasite as suitable targets for vaccine-based action against AMR. For some of these threats, vaccines already exist, while for others vaccines are already in the R&D pipeline.

**“ANTIMICROBIAL RESISTANCE COULD BE THE NEXT PANDEMIC.”**

The ability of vaccines to combat AMR was most recently demonstrated in a study in children using the typhoid vaccine Typhar-TCV, in 2018 and 2019, in an outbreak of drug-resistant *Salmonella typhi* in Hyderabad, Pakistan<sup>3</sup>. After

vaccinating more than 13,000 children, the researchers concluded that the vaccine was able to curtail an extensively drug-resistant *S. typhi* outbreak in a densely populated setting.

Researchers are optimistic that innovation in vaccinology will open the door to target other priority AMR threats with vaccines. Phogat suggests other suitable targets for treatment from the WHO’s list of priorities might be *Staphylococcus aureus*, *Pseudomonas*, several types of *Escherichia coli*, *Gonococcus*, *Klebsiella*, and *Clostridium difficile*.

In some cases, Phogat says, vaccines might be only one arm of an approach to patient care for high-threat bacteria. For example, vaccines could be combined with other therapies, including monoclonal antibody (mAb) treatments, which differ from the antimicrobial drugs to which pathogens are becoming increasingly resistant.

While research advances could expand the use of vaccines against AMR, awareness and

advocacy will play a vital role in successful implementation. “Bacteria continue to develop resistance to antibiotics, whereas the role of vaccines as a tool to fight AMR is currently undervalued and under-acknowledged, especially by policymakers and the public,” says John Billington, Head of Health Security and Infectious Disease Policy and Advocacy at GSK.

He emphasizes two important factors: first, reducing transmission of all types of infections, including viral infections, will help avoid unnecessary or excess antibiotic use that drives AMR. Second, and more obviously, vaccination can directly prevent the transmission of bacteria that are already resistant to therapies<sup>2</sup>.

Both Billington and Phogat say that the traditional approach of funding research focused on small molecule antibiotics is only part of the solution. Innovation for complementary approaches like vaccines and mAbs will benefit from new partnerships, with support from governments and other funders. In addition, health authorities may need to reassess the way they evaluate and recommend these types of interventions<sup>4</sup>.

They warn that without concerted global action now, AMR threatens public health and modern health care as we know it. Vaccines have served as a bulwark against the COVID-19 pandemic. There are many reasons to believe that they might be able to do the same against AMR. ■

## REFERENCES

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