A SHOT IN THE ARM: INNOVATION IN VACCINES AND POTENTIAL TO IMPACT HEALTHCARE AND ADDRESS ANTIMICROBIAL RESISTANCE

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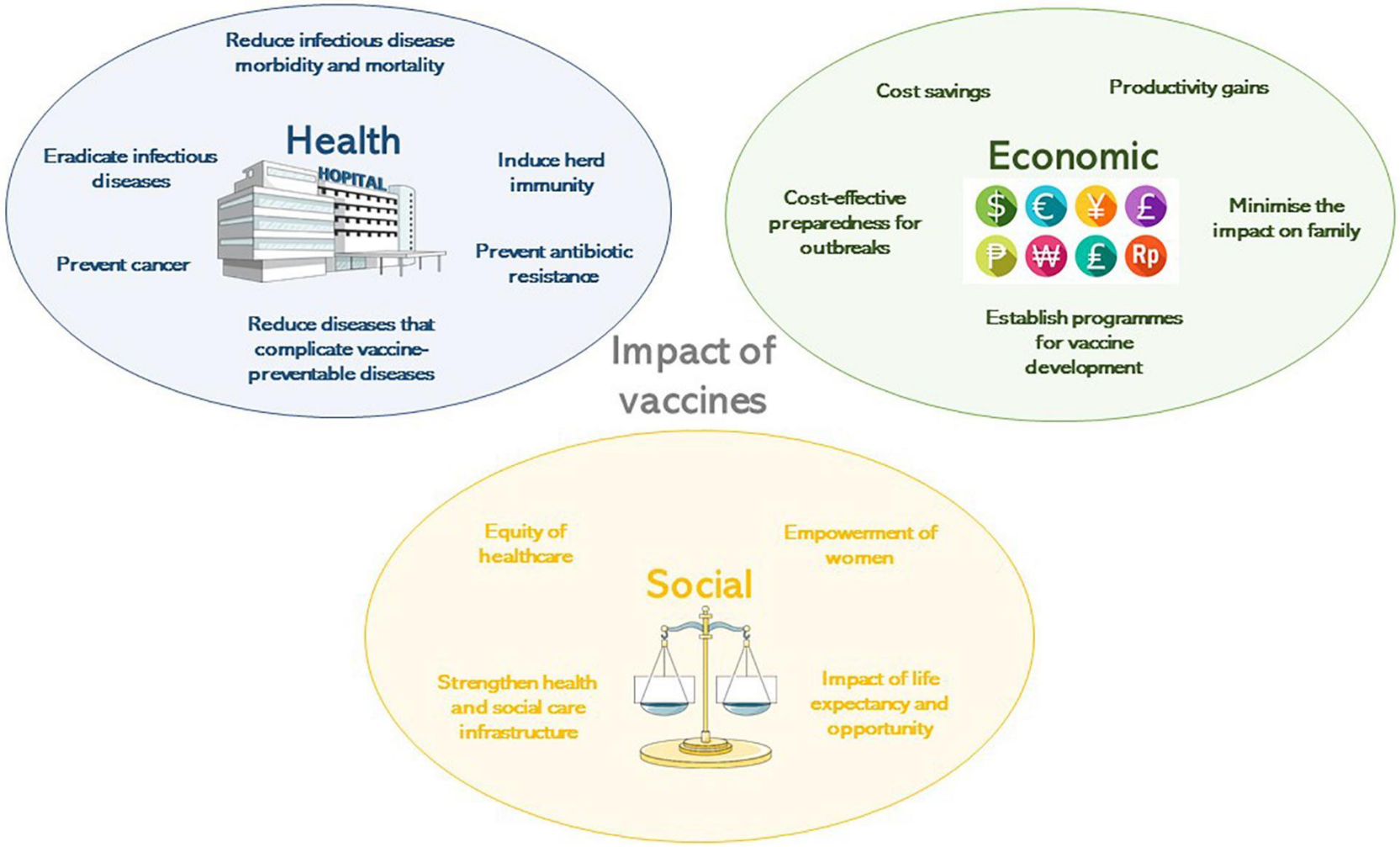
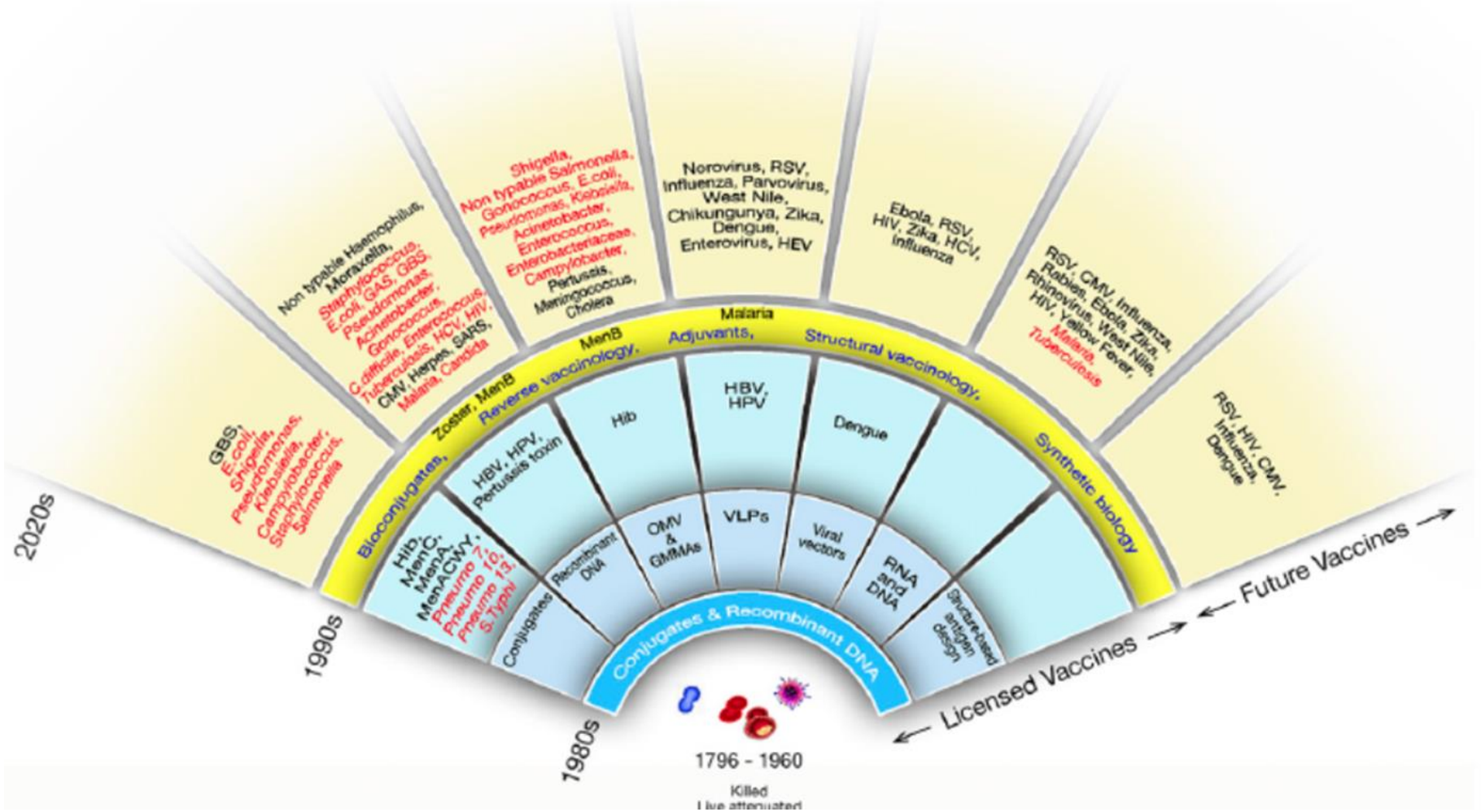
THE HEALTH, ECONOMIC, AND SOCIAL IMPACT OF VACCINES



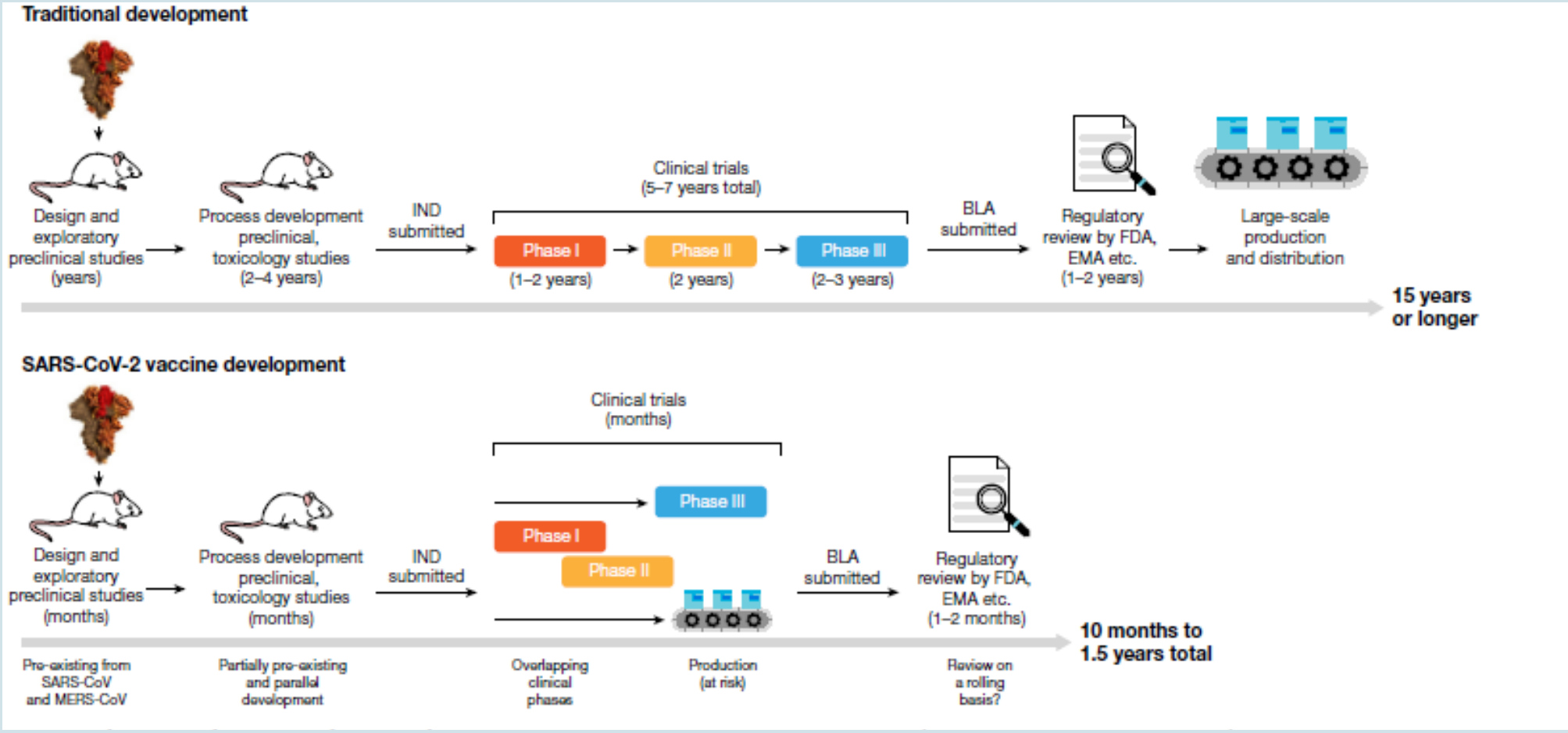
Source: Rodrigues and Plotkin, *Frontiers in Microbiology,* 2020

EVOLUTION OF VACCINE TECHNOLOGIES AND PLATFORMS



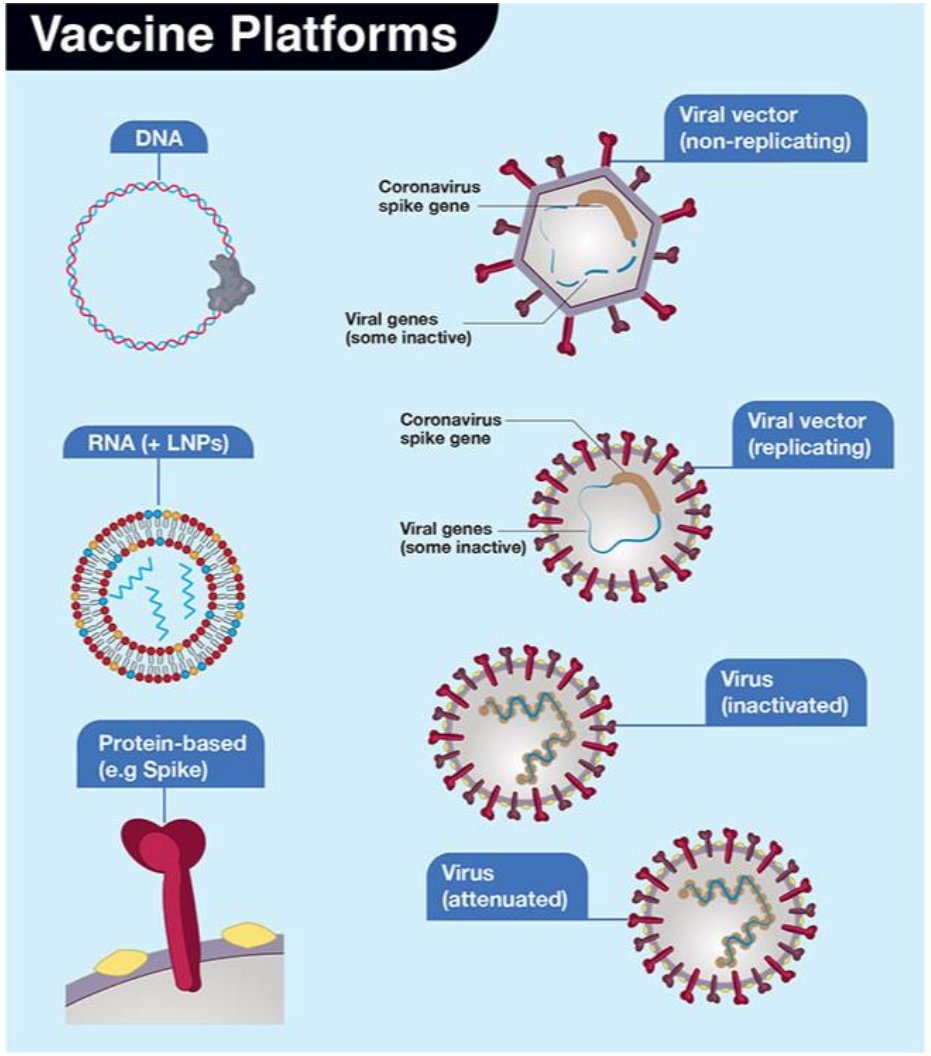
Source: Baker et al, *PNAS,* 2019

VACCINE DEVELOPMENT TIMELINES: TRADITIONAL AND COVID

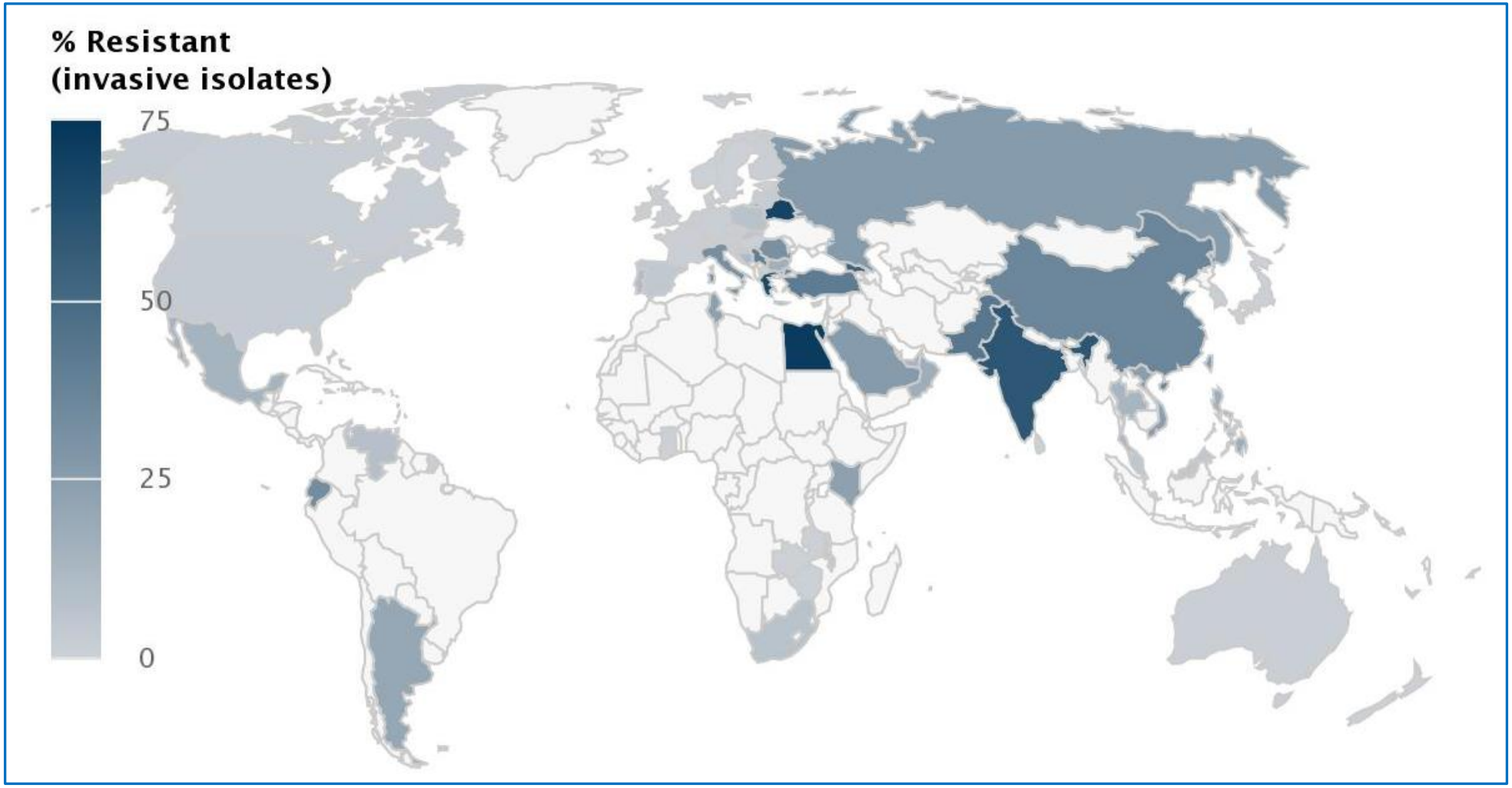


Source: Krammer, *Nature,* 2020

DE-RISKING NOVEL VACCINE PLATFORMS IN THE CONTEXT OF COVID

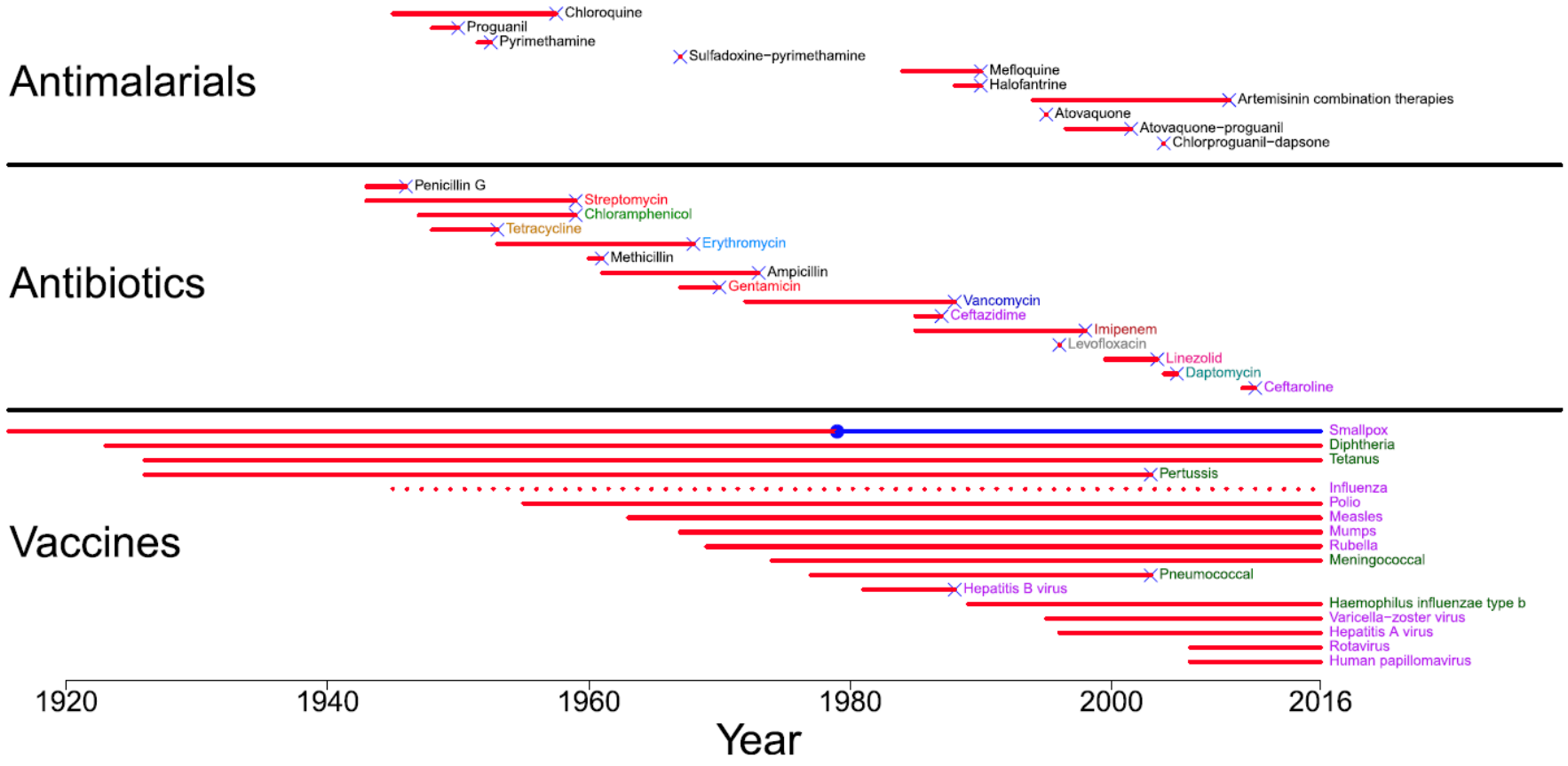


INCREASING BURDEN OF ANTIMICROBIAL RESISTANCE (AMR): RESISTANCE OF *KLEBSIELLA PNEUMONIAE* TO CARBAPENEMS, 2021



Source: The Center for Disease Dynamics Economics & Policy. ResistanceMap: Antibiotic resistance. 2021. https://resistancemap.cddep.org/AntibioticResistance.php.

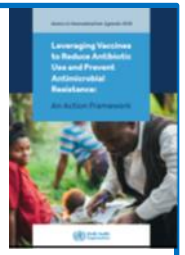
TIME BETWEEN DEPLOYMENT AND THE FIRST DOCUMENTED FAILURE IN HUMANS DUE TO RESISTANCE: ANTIMICROBIALS VS. VACCINES



Source: Kennedy, et al. Proc Natl Acad Sci, 2019

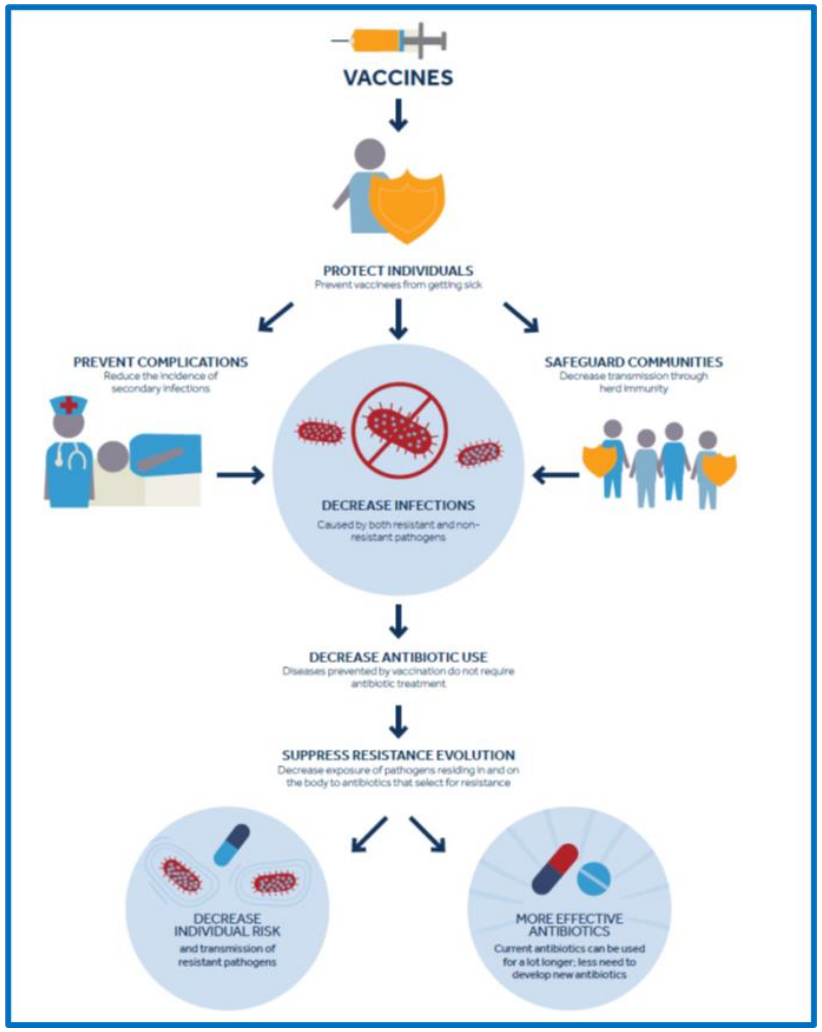
WHO AMR VACCINE ACTION FRAMEWORK

1. Expanding use of licensed vaccines to maximize impact on AMR



2. Developing new vaccines that contribute to prevention and control of AMR

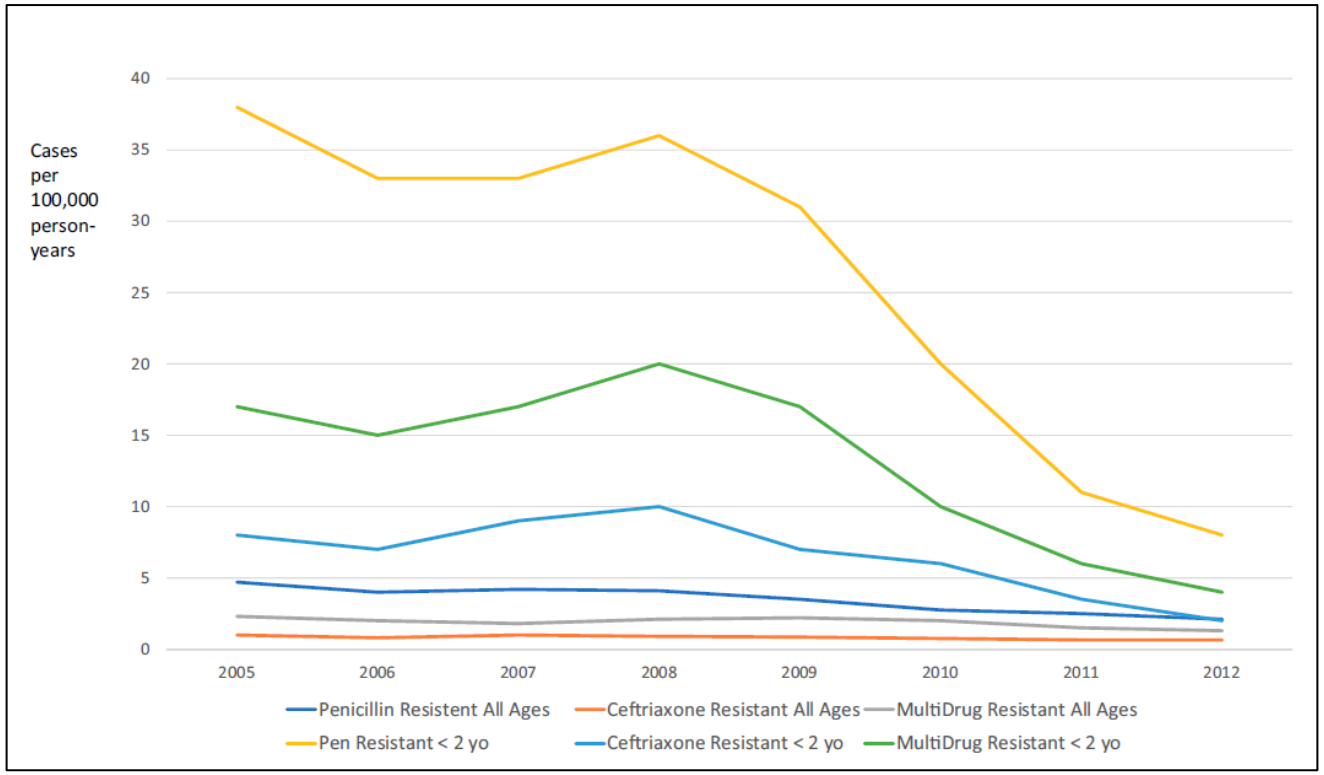
3. Expanding and sharing knowledge of vaccine impact on AMR



Source: WHO Vaccine Action Framework, 2021

IMPACT OF PNEUMOCOCCAL CONJUGATE VACCINE ON PENICILLIN NON-SUSCEPTIBLE STRAINS

Trends in Invasive Pneumococcal Disease in South Africa, pre and post PCV Introduction

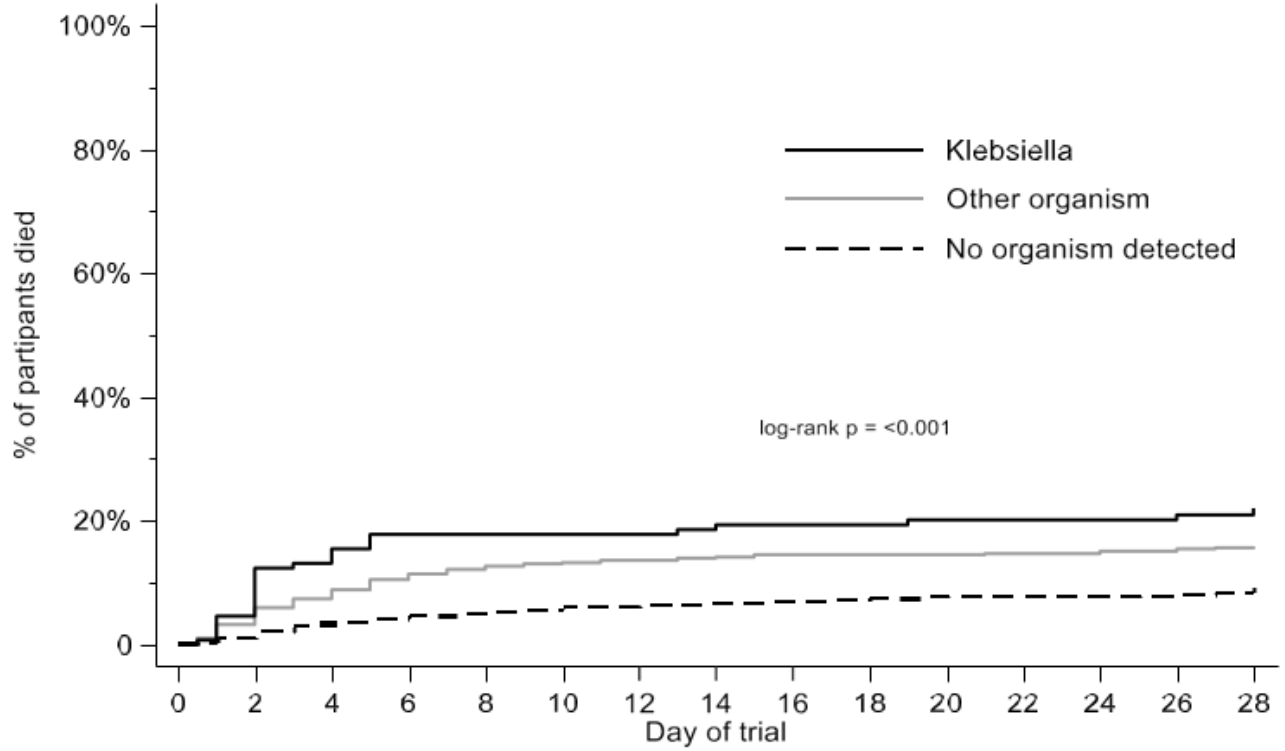


- In South Africa, PCV10 and PCV13 introduction associated with
  - 82% reduction in PCN-resistant invasive pneumococcal disease (IPD) in children
  - 85% reduction in ceftriaxone non-susceptible strains
- Introduction of PCV was associated with a reduction in antibiotic use due to the decrease in pneumococcal infections

Sources: Klugman, PNAS 2019, Von Gottberg, NEJM, 2014

KLEBSIELLA PNEUMONIAE: LEADING ETIOLOGY OF NEONATAL SEPSIS IN LOW AND MIDDLE-INCOME COUNTRIES

28-day Mortality in Neonatal Sepsis Cases, GARDP Neonatal Observational Cohort Study, 2020



Number at risk								
Klebsiella	130	113	107	107	103	100	99	75
Other organism	551	509	480	469	461	461	458	346
No organism detected	2523	2441	2353	2291	2267	2237	2219	1541

GARDP NeoOBs Study Data (Unpublished)

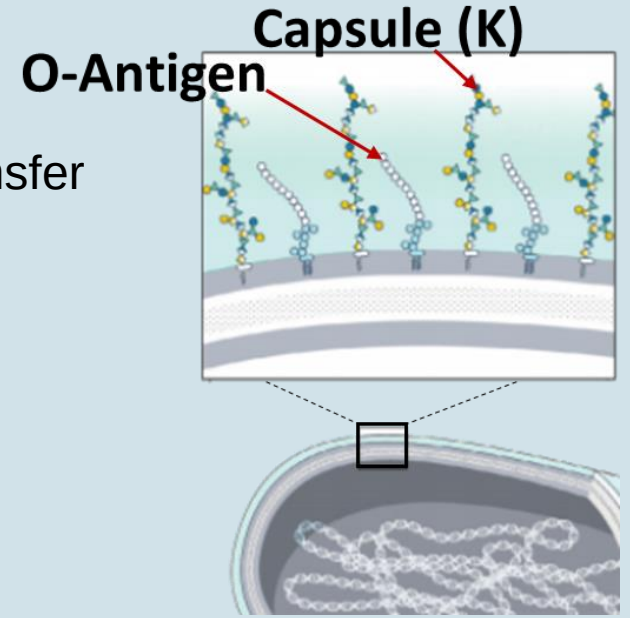
KLEBSIELLA PNEUMONIAE: POTENTIAL MATERNAL VACCINE TARGET TO PREVENT NEONATAL SEPSIS

- *Klebsiella pneumoniae*
  - 8 lipopolysaccharide (LPS) O-antigens and 77 capsular K antigens are potential targets for conjugate vaccine

- Maternal immunization:
  - Vaccine given to pregnant woman in 3rd trimester, transplacental transfer of antibodies can confer protection to newborn infant

- Current BMGF priorities:
  - Enhanced understanding of sero-epidemiology of *K. pneumoniae* invasive strains
  - Biological proof of principle for conjugate vaccine approach targeting capsular and sub-capsular antigens

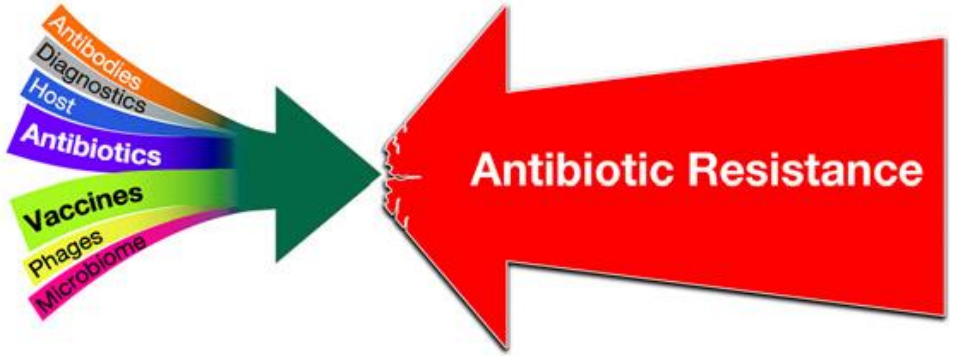
- Potential application for healthcare associated infections in HIC and LMIC



BARNARDS=Burden of Antibiotic Resistance in Neonates from Developing Countries

SUMMARY

- Innovations in vaccine technologies have great potential to improve healthcare and impact AMR
    - Direct effects: reduction in resistant pathogens
    - Indirect effects: reduction in antibiotic consumption (both viral and bacterial vaccines)
- Vaccines form a central part of BMGF strategy to address AMR
- Lessons from vaccine development in COVID-19 pandemic:
    - De-risking of novel platforms (mRNA)
    - Reveal potential for compressed timelines and inclusion of priority populations



Source: Baker, et al. Proc Natl Acad Sci, 2019

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