



# **Curbing Antimicrobial Resistance Menace in Africa through AMR Diagnostic Standardization and other Innovative Solutions**

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by

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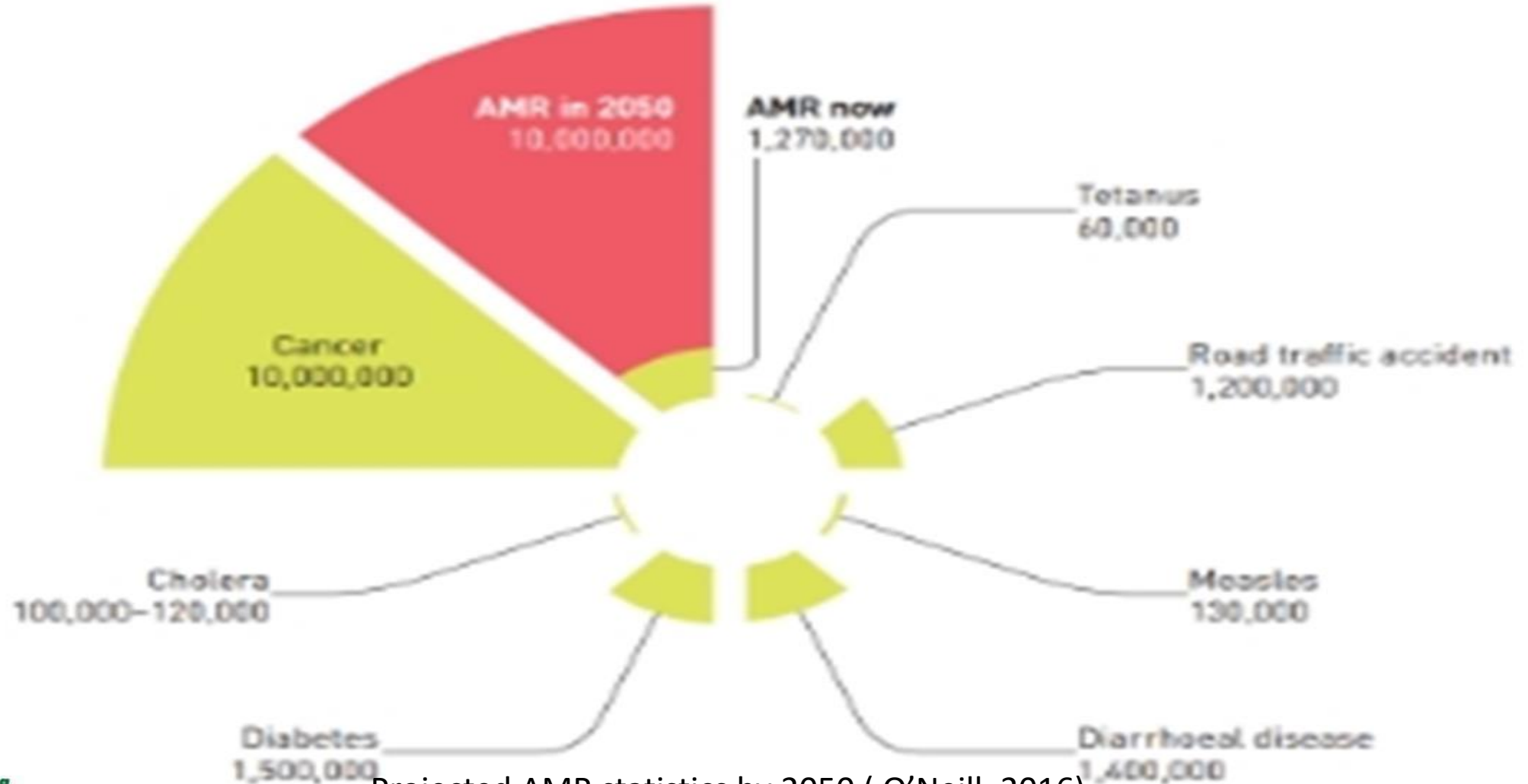
# Introduction

- The issues of antimicrobial resistance (AMR) is a significant global health threat due to the evolving resistance of microorganisms such as bacteria, viruses, fungi, and parasites to antimicrobial drugs.
- Every year, hundreds of thousands of deaths and large financial losses are attributed to AMR, a challenge that requires immediate action (Tadesse et al. 2017).
- Africa reportedly has the highest burden of AMR.
- AMR is one of the top global public health and development threats.
- It is estimated that bacterial AMR was directly responsible for 1.27 million global deaths in 2019 and contributed to 4.95 million deaths.
- In Nigeria in 2019, there were 263,400 deaths associated with AMR.



- Lesotho, and Eritrea had the highest mortality rates, with more than 200 deaths per 100,000 population.
- The deadliest infections associated with AMR are lower respiratory and thorax infections, with a total of 521,000 deaths (77%). 119,000 deaths (18%) were attributable to AMR.
- Four major pathogens—*Streptococcus pneumoniae*, *Klebsiella pneumoniae*, *Escherichia coli*, and *Staphylococcus aureus*—were responsible for over 100,000 deaths each.
- The WHO African region had the highest burden of AMR mortality, which is partly due to the region's high burden of infection-related mortality.
- AMR is widely considered to be a serious threat to human health. In 2016, the *Review on Antimicrobial Resistance* published a study reporting that 10 million deaths could occur annually from AMR by 2050 (Murray et al., 2016<sup>4</sup>).

- In 2022, the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) published the results of their global burden of AMR study, which found that nearly 5 million deaths had occurred in 2019 where a resistant bacterial infection was present (WHO, 2023).





# Current statistics of AMR in Africa

**DRI scores derived from 12 of the 14 African countries show that AMR is indeed a significant hazard. All countries assessed scored at least twice the benchmark of 25%. Their scores include:**

BURKINA FASO	KENYA	TANZANIA
<b>64.0%</b>	<b>56.20%</b>	<b>56.10%</b>
CAMEROON	MALAWI	UGANDA
<b>68.60%</b>	<b>74.10%</b>	<b>69.0%</b>
ESWATINI	NIGERIA	ZAMBIA
<b>64.80%</b>	<b>65.90%</b>	<b>60.80%</b>
GABON	SENEGAL	ZIMBABWE
<b>65.20%</b>	<b>79.80%</b>	<b>66.60%</b>



*An infographic from the Mapping Antimicrobial Resistance and Antimicrobial Use Partnership (MAAP) project, showing Drug Resistant Index (DRI) scores in 12 countries in Africa.*

This research aim to discuss infection prevention and control standards to effectively mitigate the impact of prevalent pathogen-drug combinations through diagnostic standardization and other innovative solutions.



# Key Question and Issues to be Addressed

- ✓ What are the factors causing high rates of Antibiotic Resistance in Sub-Saharan Africa
  - i. weak diagnostic capabilities.
  - ii. Inconsistent implementation of regulations.
  - iii. dispensing antibiotics without prescriptions.
  - iv. Limited access to healthcare (Bernabé et al., 2017)
- ✓ What are the current method for curbing AMR
  - i. Avoid antibiotics overuse and misuse
  - ii. Use diagnostic tests to guide treatment decisions.
  - iii. Surveillance
- ✓ Innovative Solutions





# Diagnostic Standardization

- ❑ Any approach to combat antimicrobial resistance (AMR) must include diagnostic tests as a key component (Kaprou *et al.*, 2021)
- ❑ Availability of rapid, reliable, and indeed affordable antimicrobial susceptibility testing methods and technologies is needed to curb AMR in Africa.
- ❑ Standardization is necessary to ensure different laboratories give the same result on the same sample no matter the technology used.
- ❑ This is to maintain accuracy, precision and other performance parameters of diagnostic tests.
- ❑ Data from various places may be compared more successfully with standardized processes, enabling improved resistance pattern monitoring.



# Innovative Solutions to Addressing AMR in Africa

- ❑ Strengthening Antimicrobial Stewardship Programs
- ❑ Enhancing Infection Prevention and Control (IPC) Measures
- ❑ Implementing Robust Surveillance Systems
- ❑ Investing in Novel Therapies and Vaccines
- ❑ Public Awareness Campaigns
- ❑ Leveraging Digital Health Solutions



# Role of AI and machine learning in AMR Diagnostics

- ❑ Automation of laboratory procedures by AI-powered devices can help reduce human error in diagnosis.
- ❑ Machine Learning (ML) methods have been developed to analyze bacterial genomes .
- ❑ The implementation of Machine Learning (ML) methods in bacterial susceptibility profiling like in Flow-cytometry Antimicrobial Susceptibility Testing (FAST) method and Infrared Spectrometry reduces testing time.
- ❑ Use of AI and ML can be enhanced for analyzing genomic data.
- ❑ The analysis of genomic data to find genetic markers linked to resistance can be enhanced using AI and ML.



# Role of AI and machine learning in AMR Diagnostics (Contd.)

- ❑ ML-driven predictive models of antimicrobial resistance can bridge the gap between specimen collection and the results of molecular and genotypic analysis, enabling timely empirical antibiotic decisions.
- ❑ Large data sets can be analyzed by AI and ML systems to find patterns and trends in AMR.



# Collaboration with International Organizations

- ❑ *As the world confronts the escalating threat of antimicrobial resistance, there is need for global collaboration, targeted interventions, and sustained investments.*
- ❑ Measures in current use are basically to improve awareness, obtain data through surveillance, reduce the infections incidence, optimize antimicrobial use, and sustain investments to develop diagnostics methods, vaccines and new drugs.
- ❑ There is need for coordinated action across diverse sectors and disciplines, with a broad range of stakeholders.
- ❑ Implementing and sustaining different National Action Plan on AMR will require multisectoral collaboration.
- ❑ Development partners, multilateral agencies, NGOs and other civil society partners are key support for these initiatives.



# Conclusion

- ❑ The implications of this study extend beyond immediate health concerns.
- ❑ The results emphasize the need for renewed investments in vaccine development and distribution to prevent infections, particularly against the four primary pathogens.
- ❑ Ultimately, the study highlights the importance of improving access to primary health care and effective antibiotics, particularly in vulnerable populations.
- ❑ Furthermore, the study sheds light on surveillance challenges, particularly in low-resource settings where limited laboratory infrastructure poses obstacles to accurate estimates. Recognizing data gaps, the report advocates for strengthened laboratory capacity and improved data collection efforts to refine future assessments of AMR.





# Conclusion (Contd.)

- ❑ Laboratories should adopt standard techniques for diagnostics in order to guarantee reliable data across national borders.
- ❑ Utilizing AI and additional resources is necessary to forecast resistance and better tackle problems.
- ❑ Veterinarians, clinicians, governments agencies, all have Individual roles to play.



# Selected References

- ❑ Bernabé, K. J., Langendorf, D., Ford, N., Rona, J. B., & Murphy, R. A. (2017). Anti-microbial resistance in West Africa: a systematic review and meta-analysis. *International journal of antimicrobial agent*, 50 (5), 629-639.
- ❑ World Health Organization, 2023. WHO Report.
- ❑ Tadesse, B. T., Ashley, E. A., Ongarello, S., Havumaki, J., Wijegoonewardena, M., Gonzalez, I. J., & Dittrich, S. (2017). Antimicrobial resistance in Africa: A systematic review. *BMC infectious diseases*, 17,1-17.
- ❑ Tomczyk, S., Taylor, A., Brown, A., De krake, M. E., El-Saed, A., Alshamrani, M., And WHO AMR Surveillance and Quality Assessment Collaborating Centers Network. (2021). Impact of the COVID-19 pandemic on the surveillance, prevention and control of antimicrobial resistance: a global survey. *Journal of Antimicrobial Chemotherapy*, 76(11), 3045-3058.



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