Antibiogo

Smartphone based application to tackle antibiotic resistance in LMIC

Nada Malou, *Mai. Al Asmar, Rasheed. Fakhri, Nadia. Badaro, Rupa. Kanapathipilai, Philippe. Cavailler, Andrew. Lover, Shazeer. Majeed, Yvan. Caspard, Clara. Nordon*

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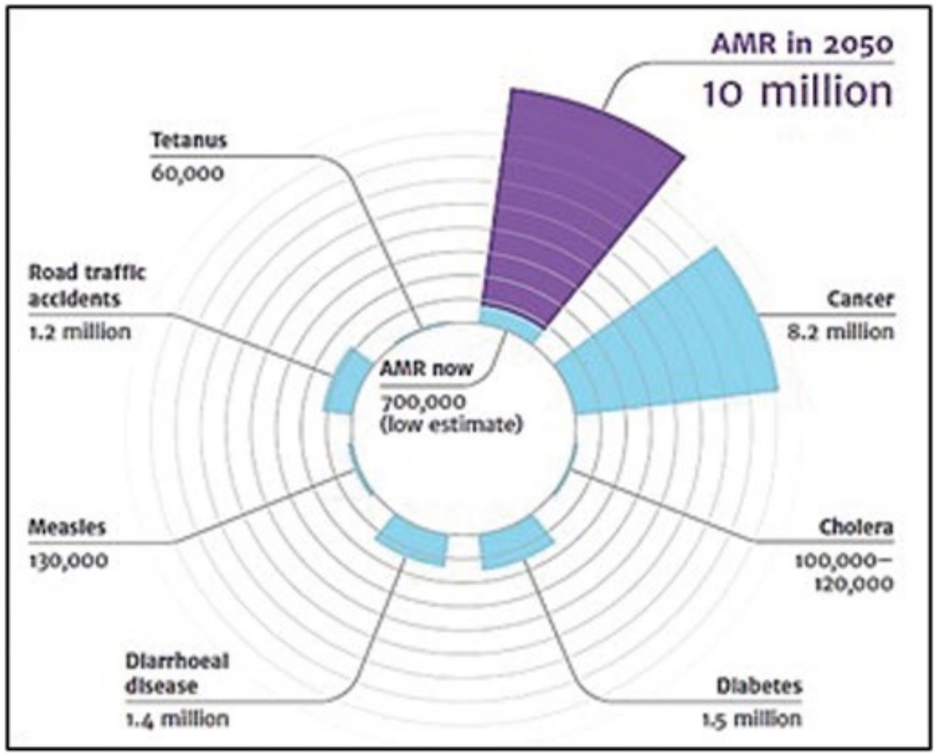
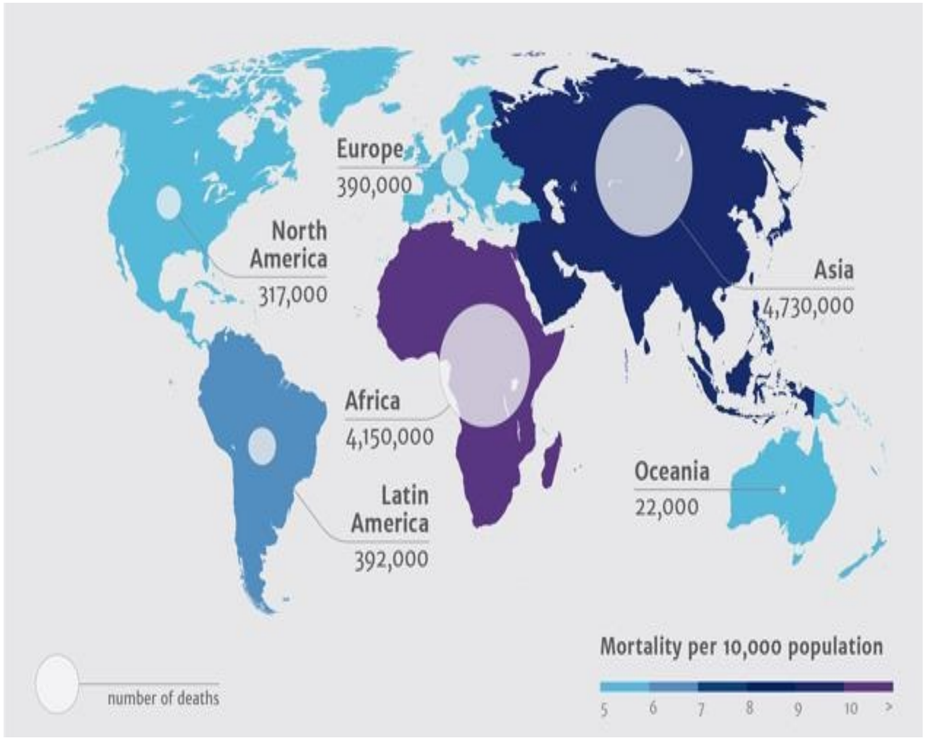
SCIENTIFIC DAYS

Antimicrobial Resistance



TACKLING DRUG-RESISTANT INFECTIONS GLOBALLY: FINAL REPORT AND RECOMMENDATIONS The Review on Antimicrobial Resistance. 2014



Sugden *et al.* 2016

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AMR in LMIC: the invisible threat

- The 2014 Antimicrobial Resistance Global Report on Surveillance: the largest gaps in the obtained surveillance data were seen in Africa, the Middle East : (52%) of the countries of the Region returned surveillance data (**the lowest participation rate)**

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WHO GLASS report. 2014

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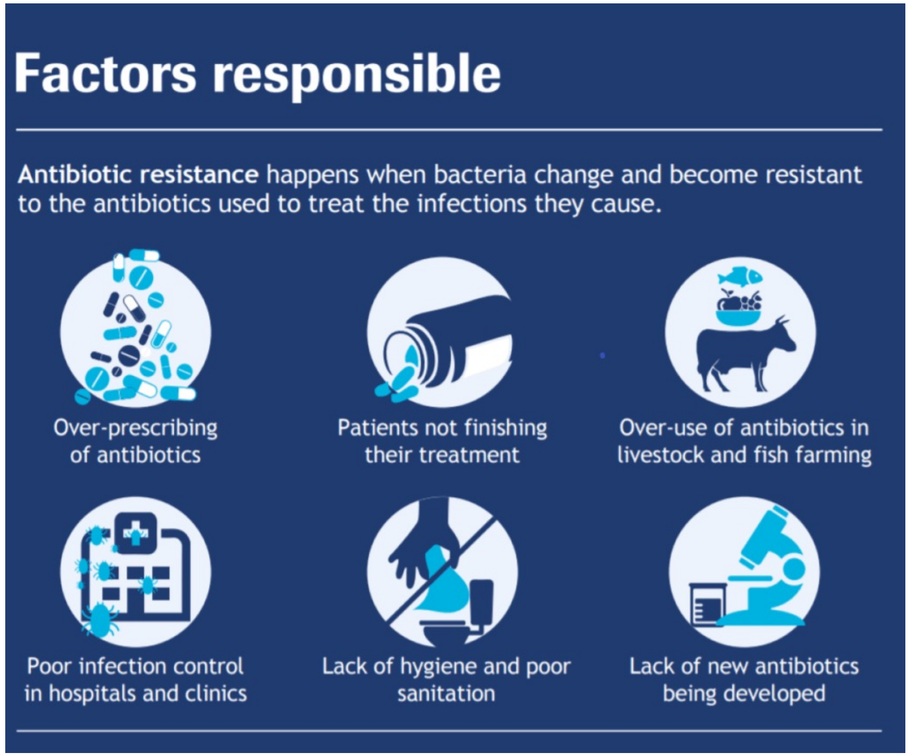
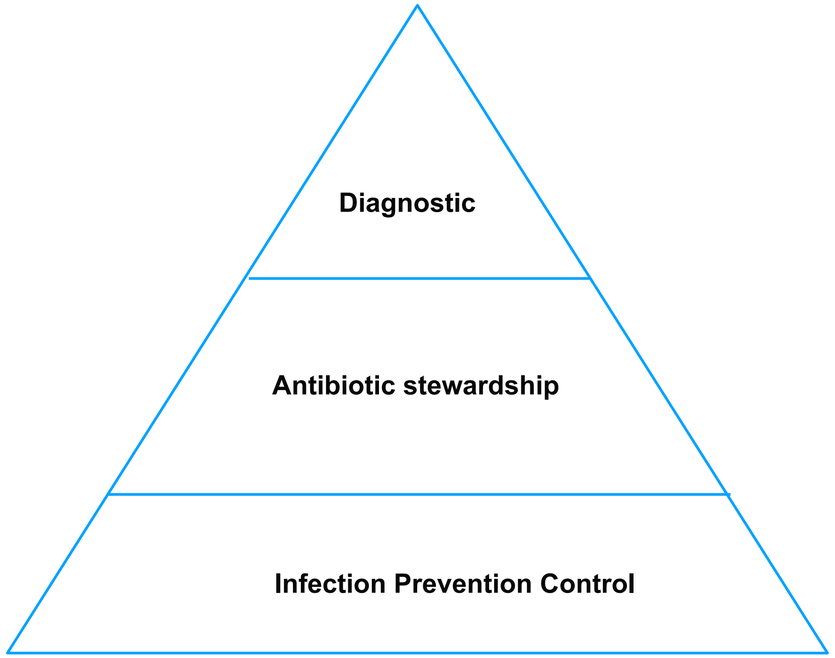
Multidisciplinary drivers: Multidisciplinary solutions



World Health Organisation Infographic (World Antibiotic Awareness Week 2017)



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Barriers for access to Bacteriology laboratories

- Infrastructure requirements
- Supplies of reagents and consumables: cost, adaptability to local constraints
- Human Resources: Clinical microbiologist

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MSF (France) strategy and experience in implementing bacteriology laboratories

Full MSF labs

- Koutiala (Mali)
- Amman(Jordan)
- Aden (Yemen)
- Bangui (CAR)
- Liberia (Monrovia)

Support (local labs)

- Baghdad (Iraq)
- Gaza (Palestine)
- Zahle (Lebanon)
- Sanaa (Yemen)

External labs

- Port au Prince (Haiti)
- Niger (Epicentre)

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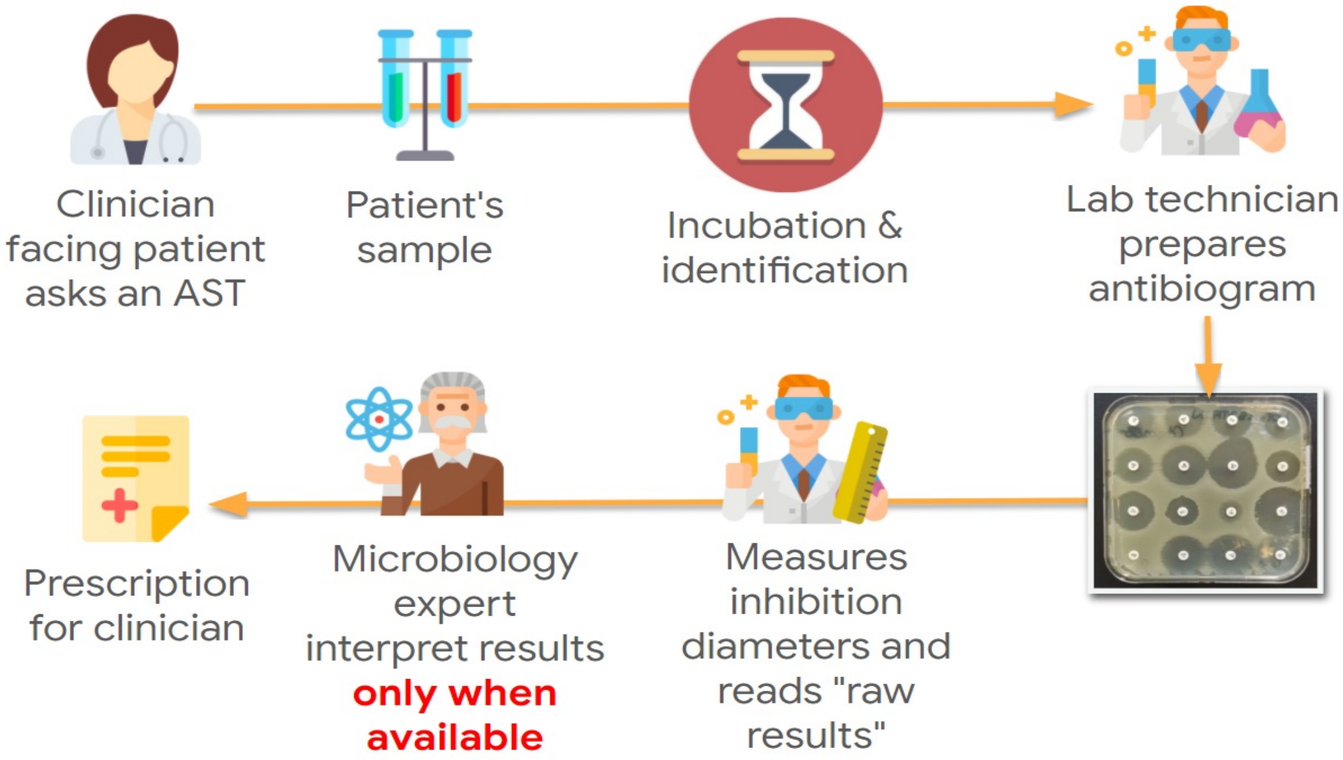
How to diagnose a bacterial infection?



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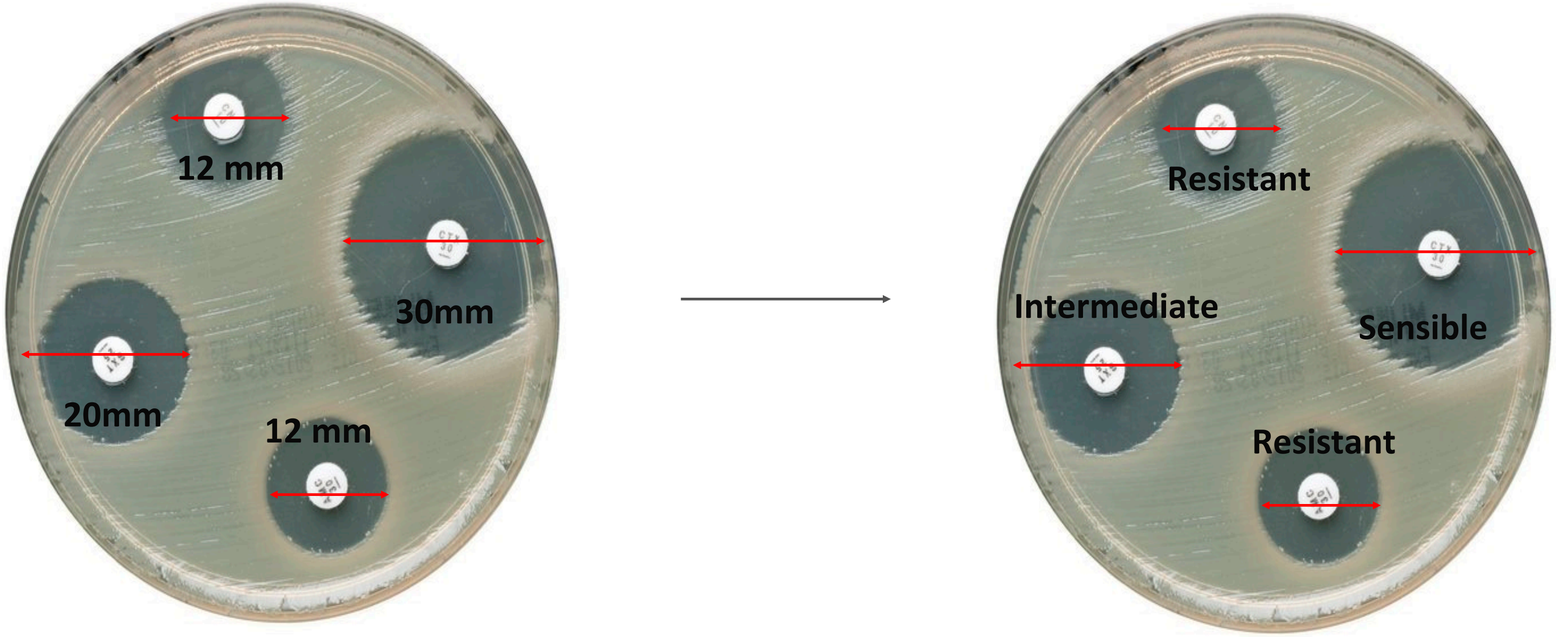
AST: Antimicrobial Suceptibility Testing

1. Measurement of Inhibition zone



Breakpoint provided by **EUCAST**: European Committee on Antimicrobial Susceptibility Testing

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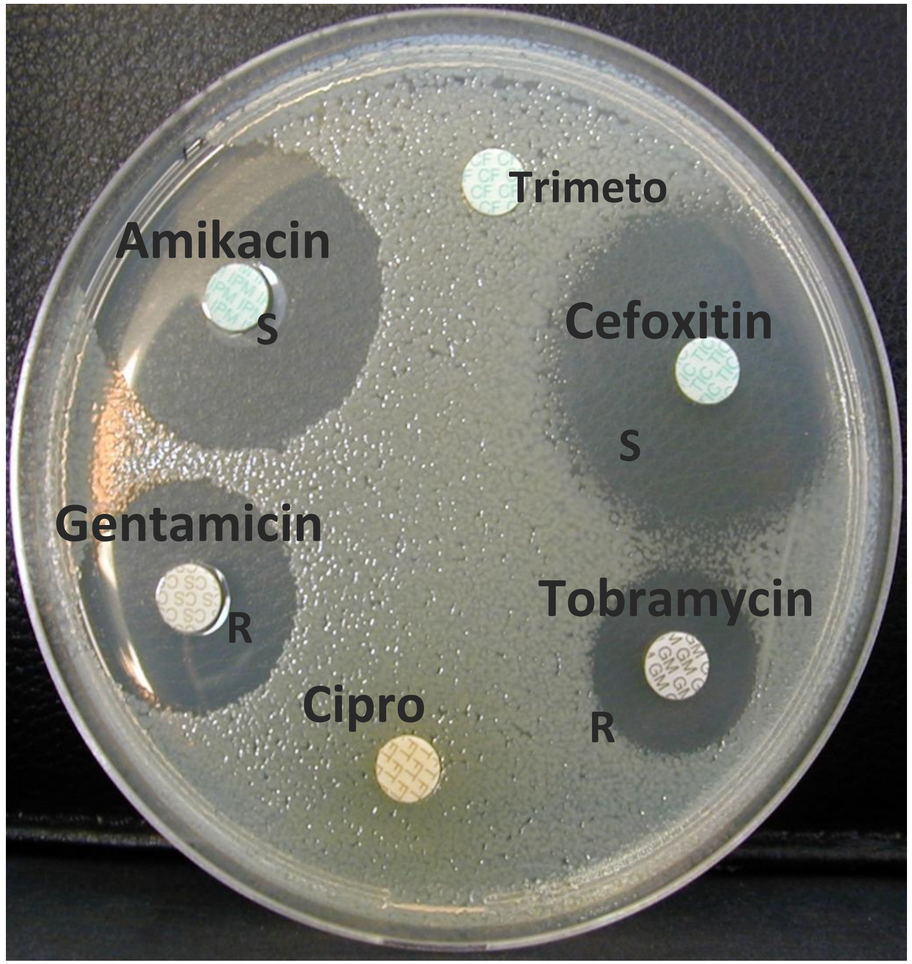
AST: Antimicrobial Suceptibility Testing
2. Interpretative reading



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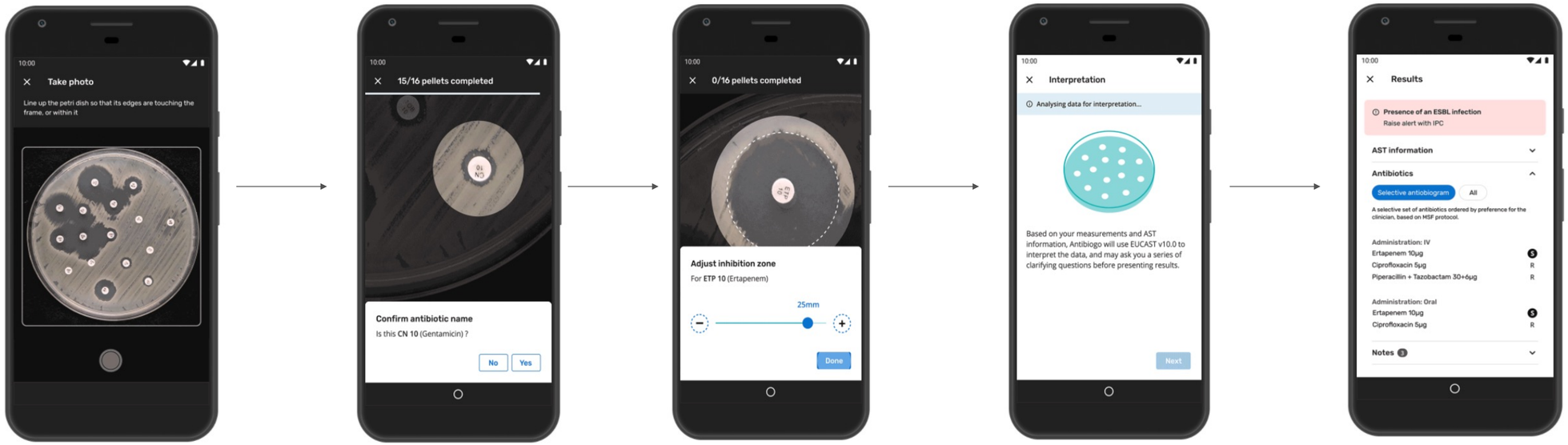
Antibiogo: smartphone-based app, open access, free and offline



Taking picture

Semi automatic detection of antibiotic discs and measurement of inhibition zone

Expert System Interpretation+ identification of resistance mechanism

Full results and selective reporting

Image processing

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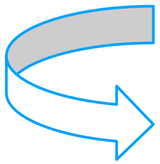
Evaluation of Antibiogo performances

Image processing:

8 pathogenic bacteria

RSP Amman

Automatic measurement (Initial+adjusted) Antibiogo

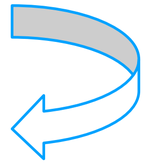


Manual measurement performed by 8 laboratory technicians

Expert System:

71 Bacteria from Clinical samples isolated from bones and tissues of patients with suspicion of osteomyelitis in RSP (Amman)

Antibiogo interpretation



External microbiologist interpretation

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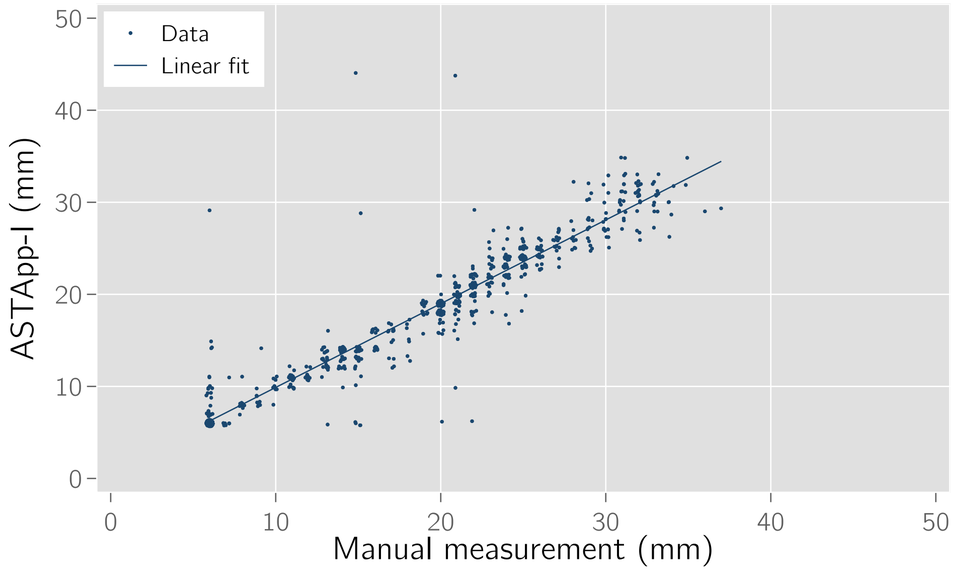
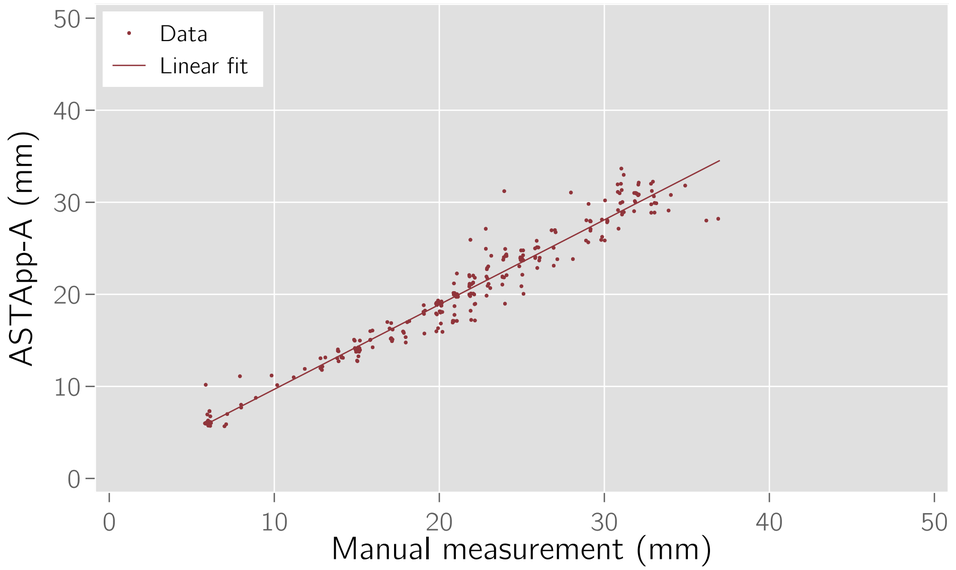
Image processing evaluation: Manual (Gold standard)VS Antibiogo



Note: Comparison of values from each individual observer
Concordance = 0.95 (95% CI: 0.94 to 0.96). (Jittered for clarity).



Note: Comparison of values from each individual observer
Concordance = 0.96 (95% CI: 0.95 to 0.97). (Jittered for clarity).

- For each technician, measurements obtained from both Antibiogo modes are highly concordant with manual measurements.

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Expert System evaluation. Antibiogo VS Microbiologist

A total of 1,073 antibiotic-pathogen pairs were assessed by both ES and an expert microbiologist

		Microbiologist			Total
Expert System		I	R	S	Total
	I	10	**1**	**1**	12
	R	**4**	500	**11**	515
	S	**10**	**18**	518	546
Total		24	519	530	1073

	Very major error	Major error	Minor error
Total	R (Glod standard) --- S (ES)	S(Gold standard)---R (ES)	I (Gold standard)—RS (ES)
N=45	**18**	**11**	**16**

- 95.8% concordance (95% CI: 94.6 – 97.0).
- Identification of main resistance mechanism: 90.6% concordance (95% CI: 87.9 – 93.3)
- A total of **45 combination** showed discordant readings

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Challenges for the development of Antibiogo

- Translation of a medical/technical need into a technological solution
- Identification of partners for development
- Data protection: AST pictures, samples ID
- Keeping the user in the loop: NO black box
- Medical device: First time for MSF

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Challenges for implementation of Antibiogo

- Different regulation from a country to another
- Acceptability /(Digital literacy)
- Certification process: which update will require a new clinical evaluation for CE IVD
- Identification of Partners for Hand over

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Antibiogo: Next steps

- Second and third reading for discordant results
- Evaluation of clinical performances in 2 other sites: Koutiala (Mali), Dakar (Senegal)
- Finalization of CE IVD
- KAP survey
- Mapping of local regulation for deployment

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Acknowledgments

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- *Philippe. Cavailler*
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- *Clara. Nordon*

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