

AMR surveillance using threshold surveys

Experiences from the OASIS project

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AMR Surveillance using Innovative Sampling

A JPIAMR project aiming to develop an antimicrobial resistance (AMR) surveillance strategy in a One Health context, which is applicable in high-, middle-, and low-income countries.

OASIS moves from conventionally estimating AMR prevalence to classifying populations/settings as having a “high” or “low” AMR prevalence, by applying a Lot Quality Assurance Sampling approach.



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FONDATION MERIEUX
France.



UNIVERSITY OF LOME
Togo.



NAZI BONI
UNIVERSITY
Burkina Faso.

Rationale OASIS project

- Conventional AMR surveillance
 - Predominantly laboratory-based
 - Known to be biased for community setting
 - Lack of detailed clinical data
- Growing interest population-based surveillance

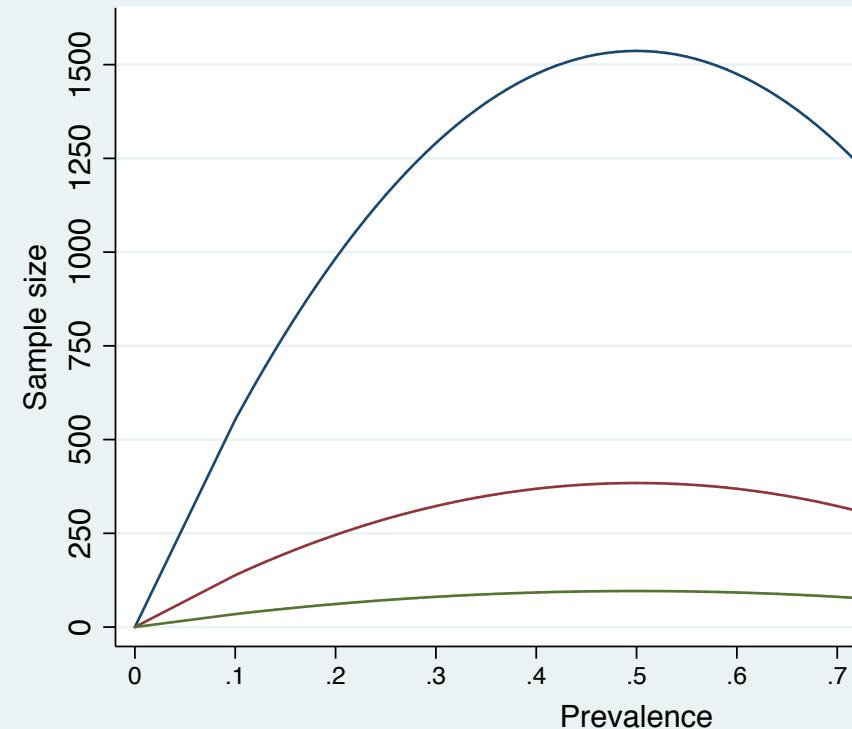
Population-based surveillance



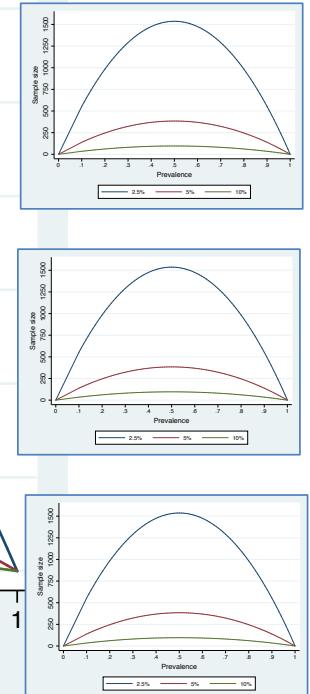
Rob Curren on Unsplash



Thor Alvis on Unsplash



— 2.5% — 5% — 10%



Threshold surveys

- Based on classification, not estimation
- Change of research question

Is the AMR prevalence above or below x %?

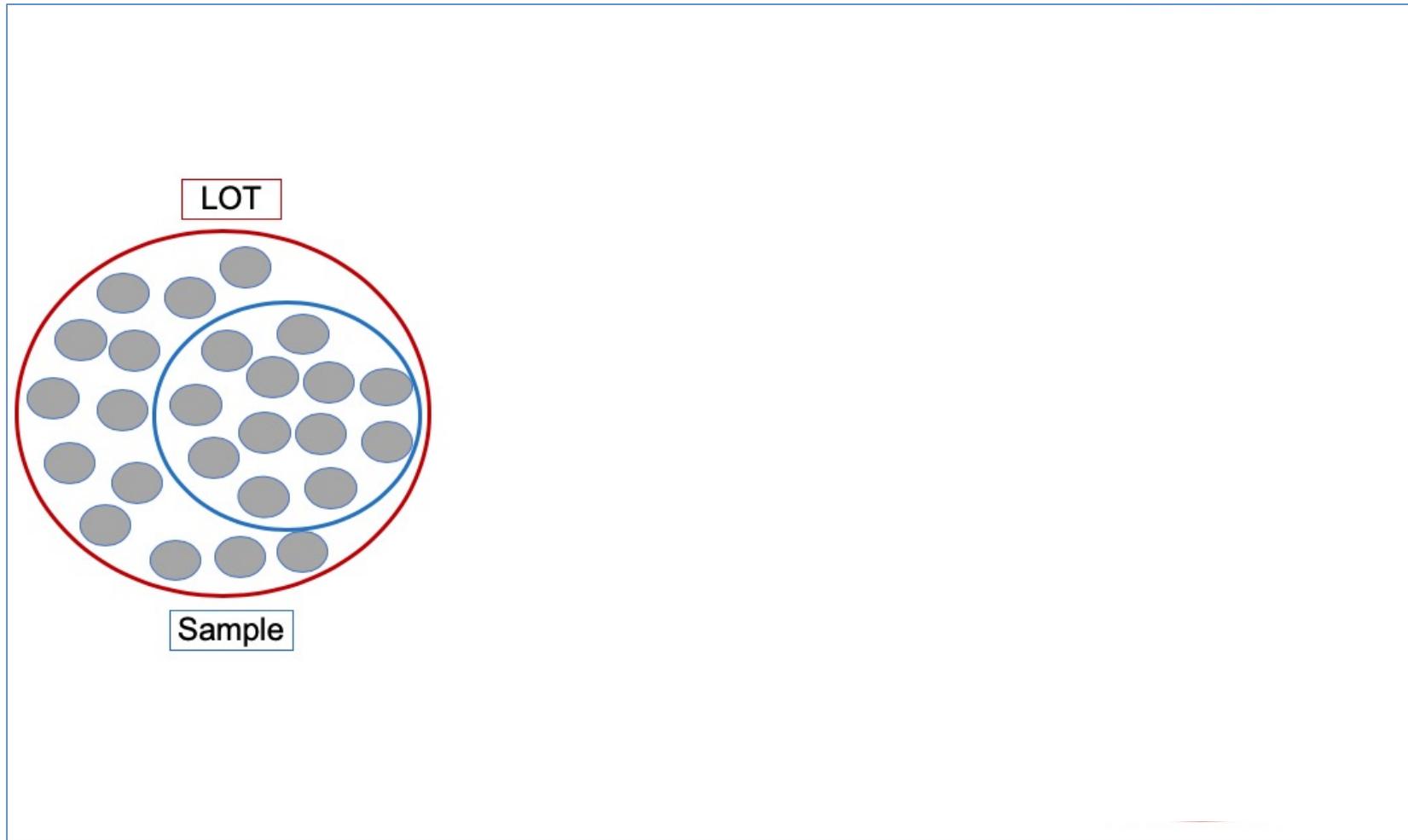
instead of

What is the prevalence of AMR in this population?

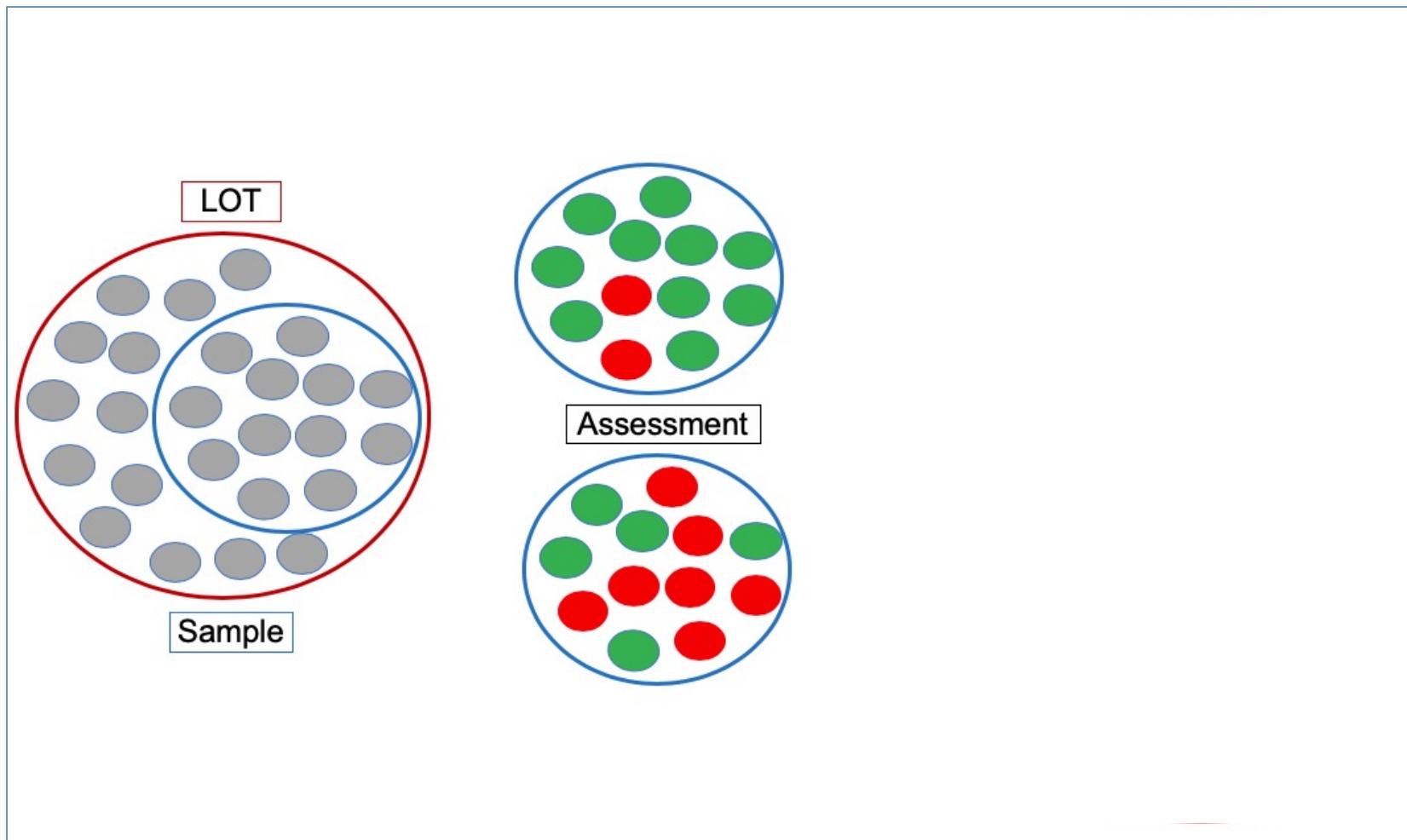
- Addresses sample size issues
 - Feasible to have parallel surveys

LOT QUALITY ASSURANCE SAMPLING (LQAS)

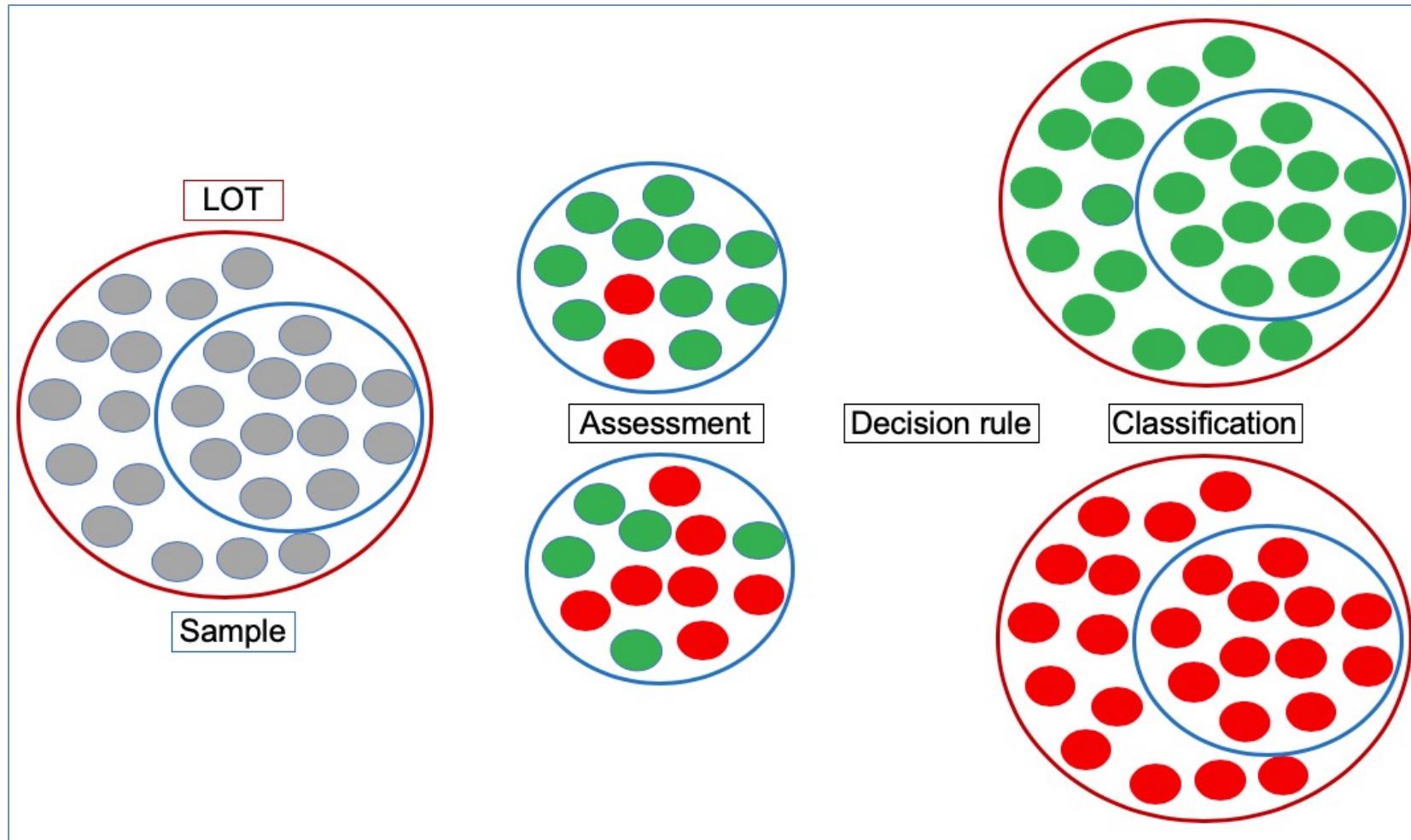
Lot Quality Assurance Sampling (LQAS)



Lot Quality Assurance Sampling (LQAS)



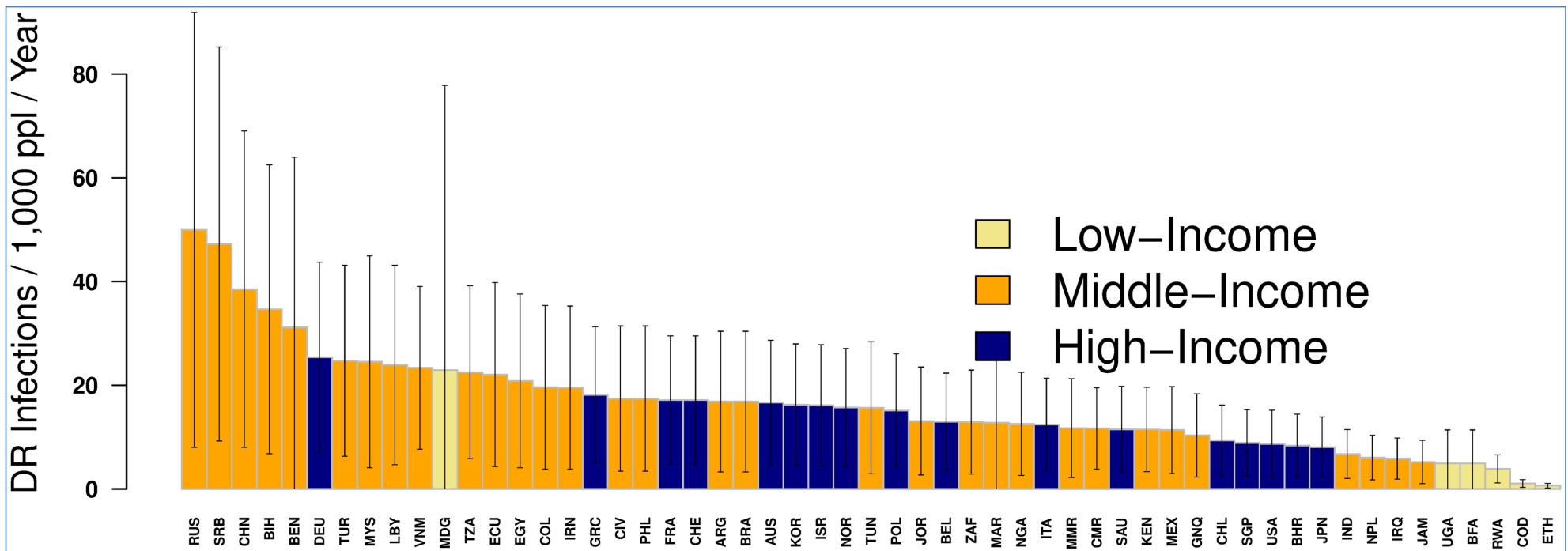
Lot Quality Assurance Sampling (LQAS)



Component LQAS

- Upper and lower threshold of outcome (AMR)
 - Above which threshold is action needed
 - Below which threshold is misclassification not minimized
- Misclassification
 - true “low” prevalence classified as “high” and *vice versa*

Misclassification versus precision



LQAS sample sizes

Misclassification	High to Low 5% Low to High 10%	
LQAS definition	Sample size	Decision rule
1 – 5	153	4
2 – 10	76	4
3 – 15	50	4
5 – 20	44	5
13 – 30	49	10
20 – 40	45	13
30 – 50	53	21

OASIS project



- Veterinary domain
 - Validation LQAS methodology
 - Test characteristics
 - Regional variation
- Human domain
 - LQAS-based AMR survey
 - Informing empirical treatment

Veterinary domain

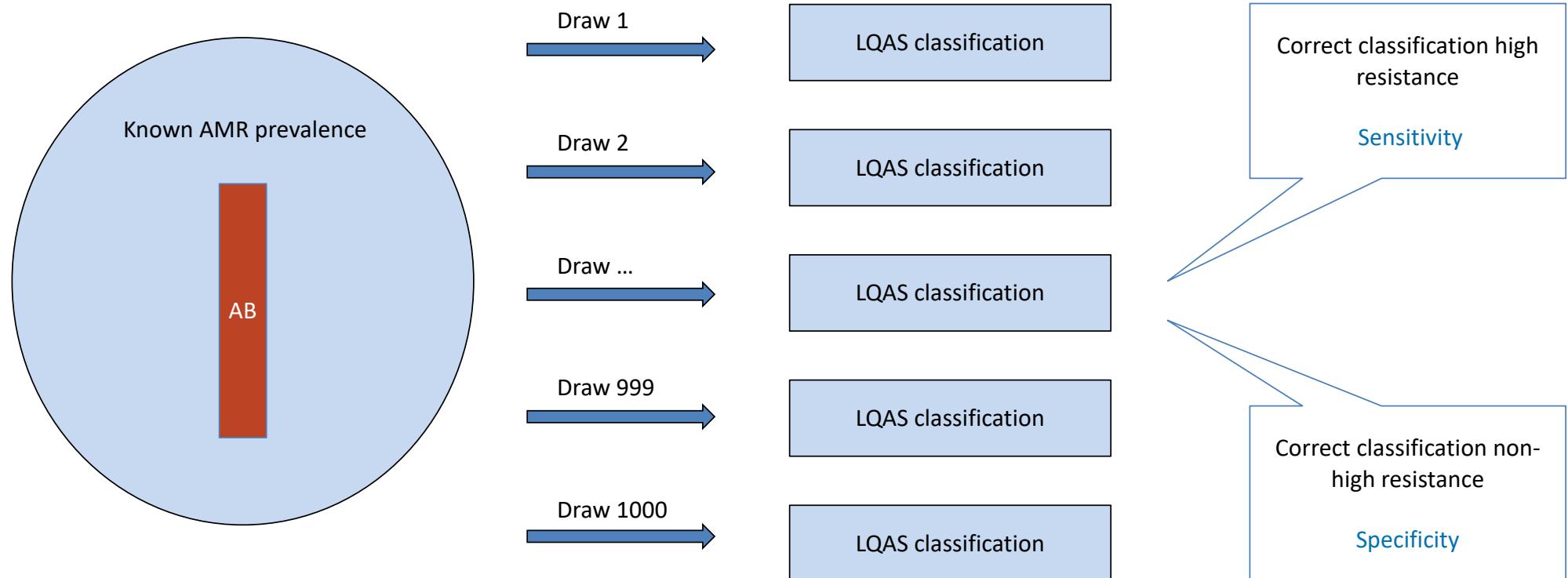
- Routine salmonella surveillance broiler chicken
- Survey pigs at single slaughterhouse
- In both
 - sample collection through boot swaps
 - *E. coli* isolates
 - Routine AST methods

Human domain

- Outpatient departments primary care
 - Togo and Burkina Faso
 - symptoms suspected UTI
 - consecutive enrolment
- Urine culture and AST
 - When urine dipstick positive

VALIDATION LQAS METHODOLOGY IN OASIS

LQAS classifications from repeated draws

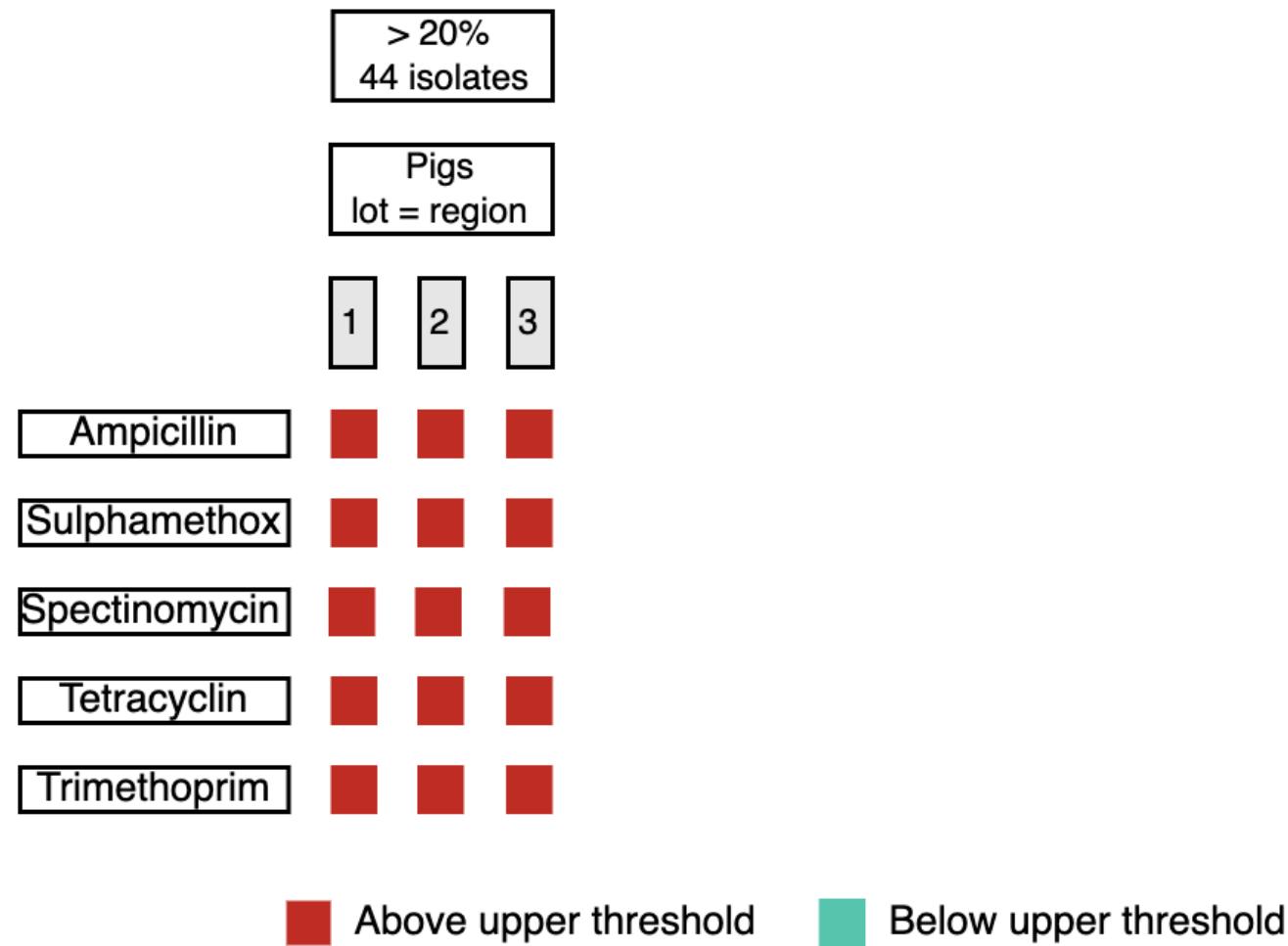


Test characteristics (calculated in data for pigs)

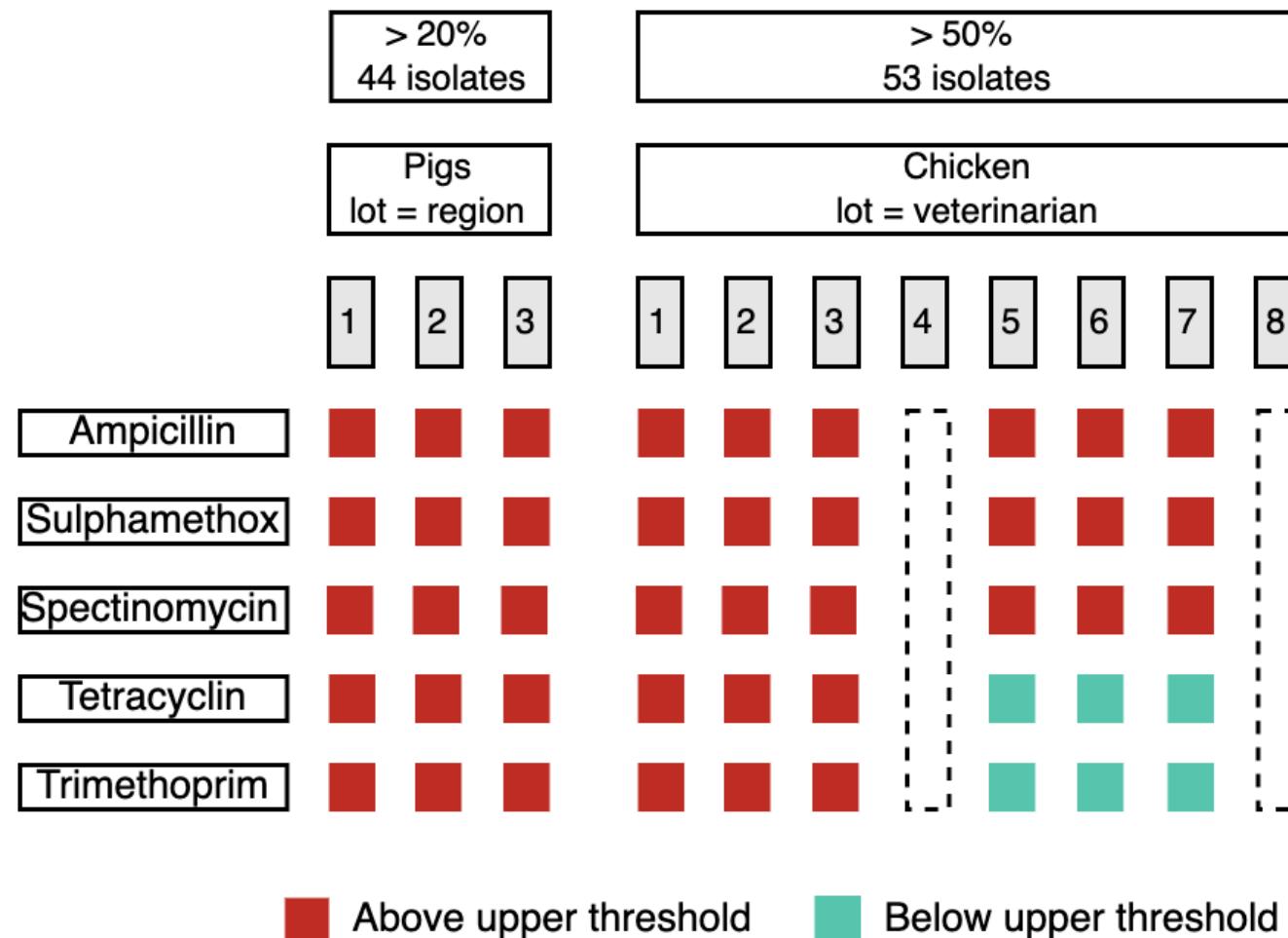
Definition	Sensitivity	95% CI	Specificity	
1 – 5	100	87.9 - 100	74.4	56.0 – 86.9
2 – 10	96.4	85.9 – 99.2	92.5	80.6 – 97.4
3 – 15	99.9	91.5 - 100	94.1	82.7 – 98.2
5 – 20	99.6	90.9 - 100	91.7	79.5 – 96.9
10 – 25	99.4	90.5 - 100	88.6	75.6 – 95.1
15 – 30	99.9	91.4 – 99.8	79.1	64.6 – 88.7
20 – 40	99.7	88.7 – 99.8	83.3	69.3 – 91.6
30 – 50	99.7	n/a	94.9	83.7 – 98.5

USE OF LQAS-BASED SURVEILLANCE

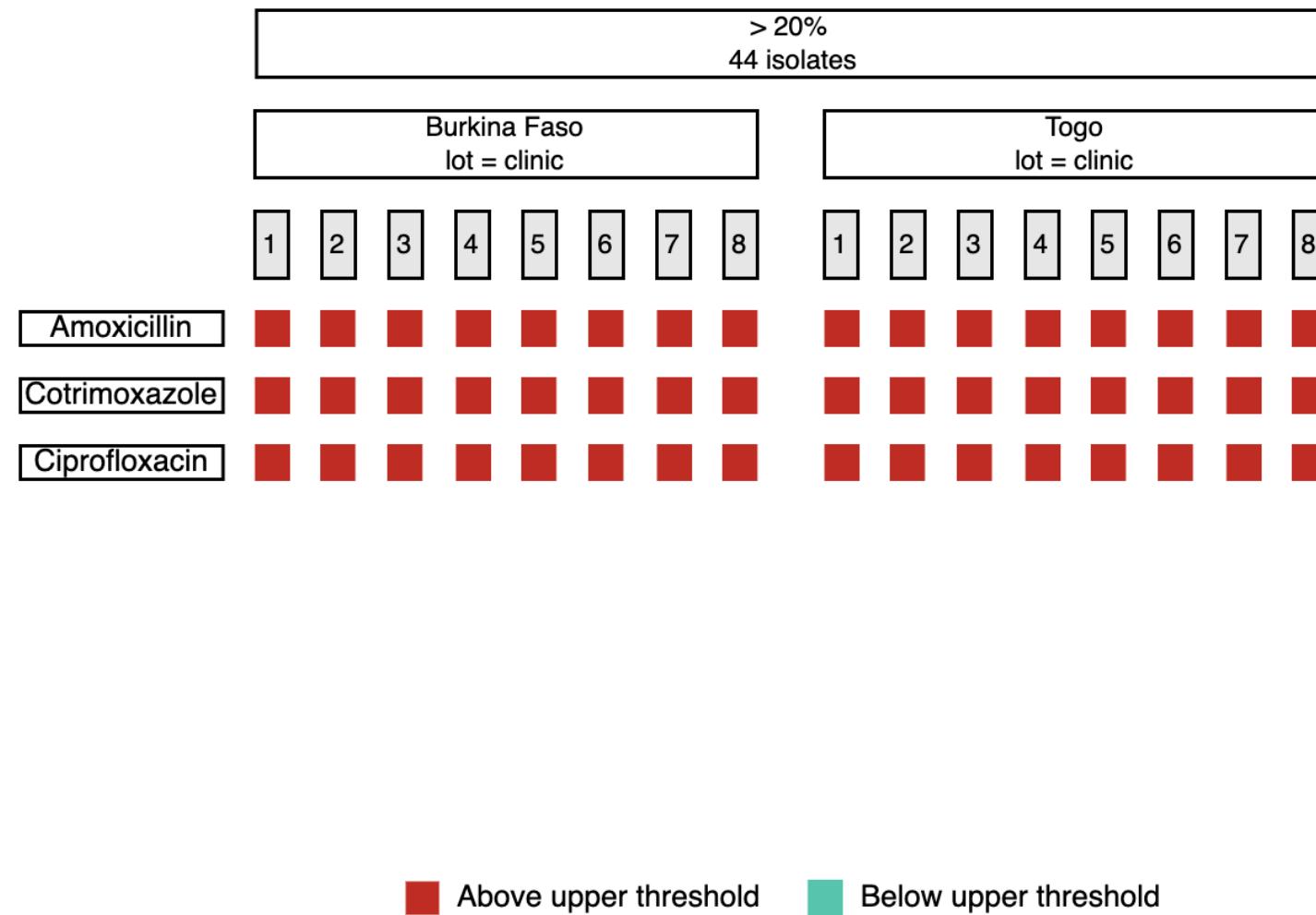
LQAS: veterinary, local variation



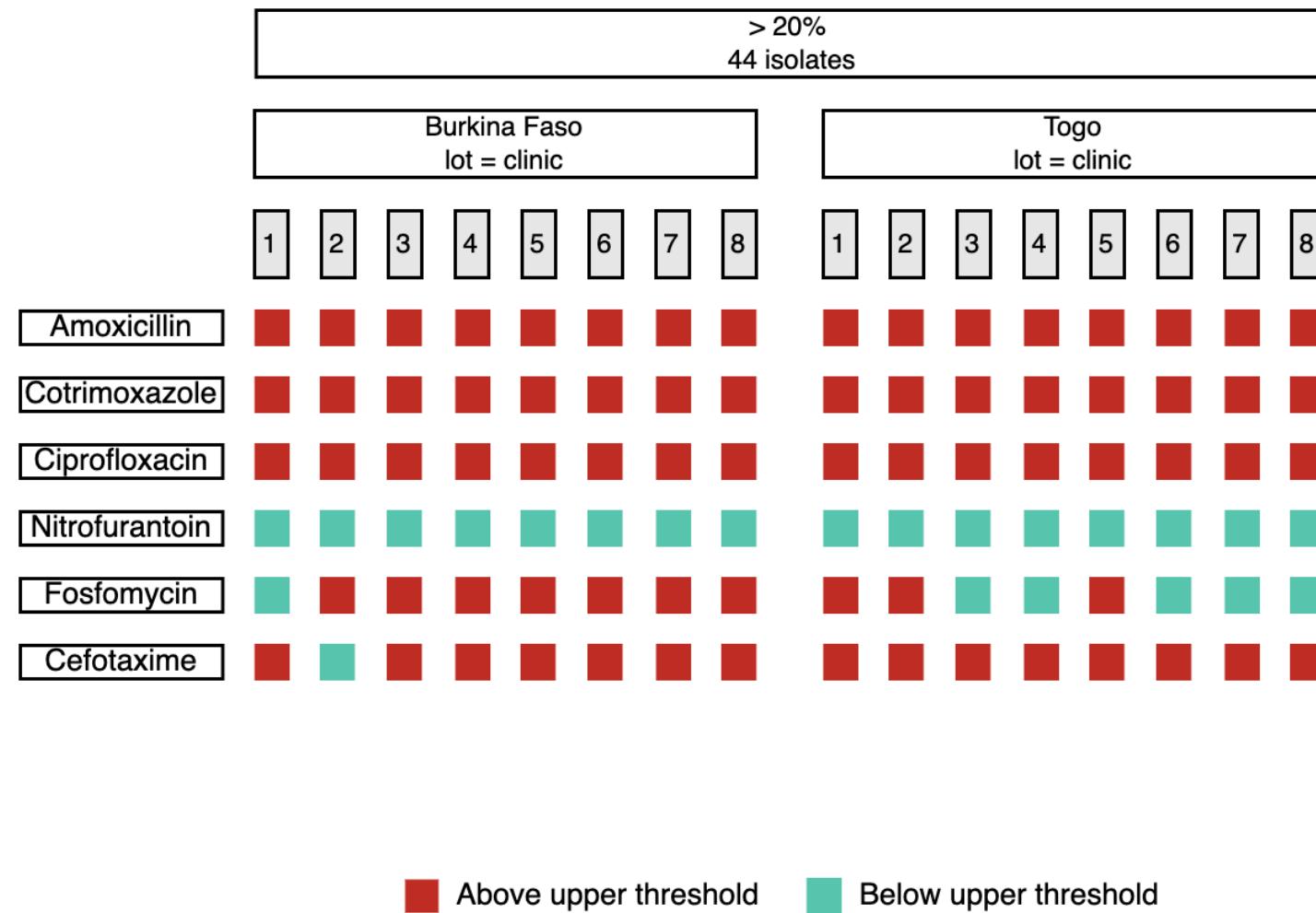
LQAS: veterinary, local variation



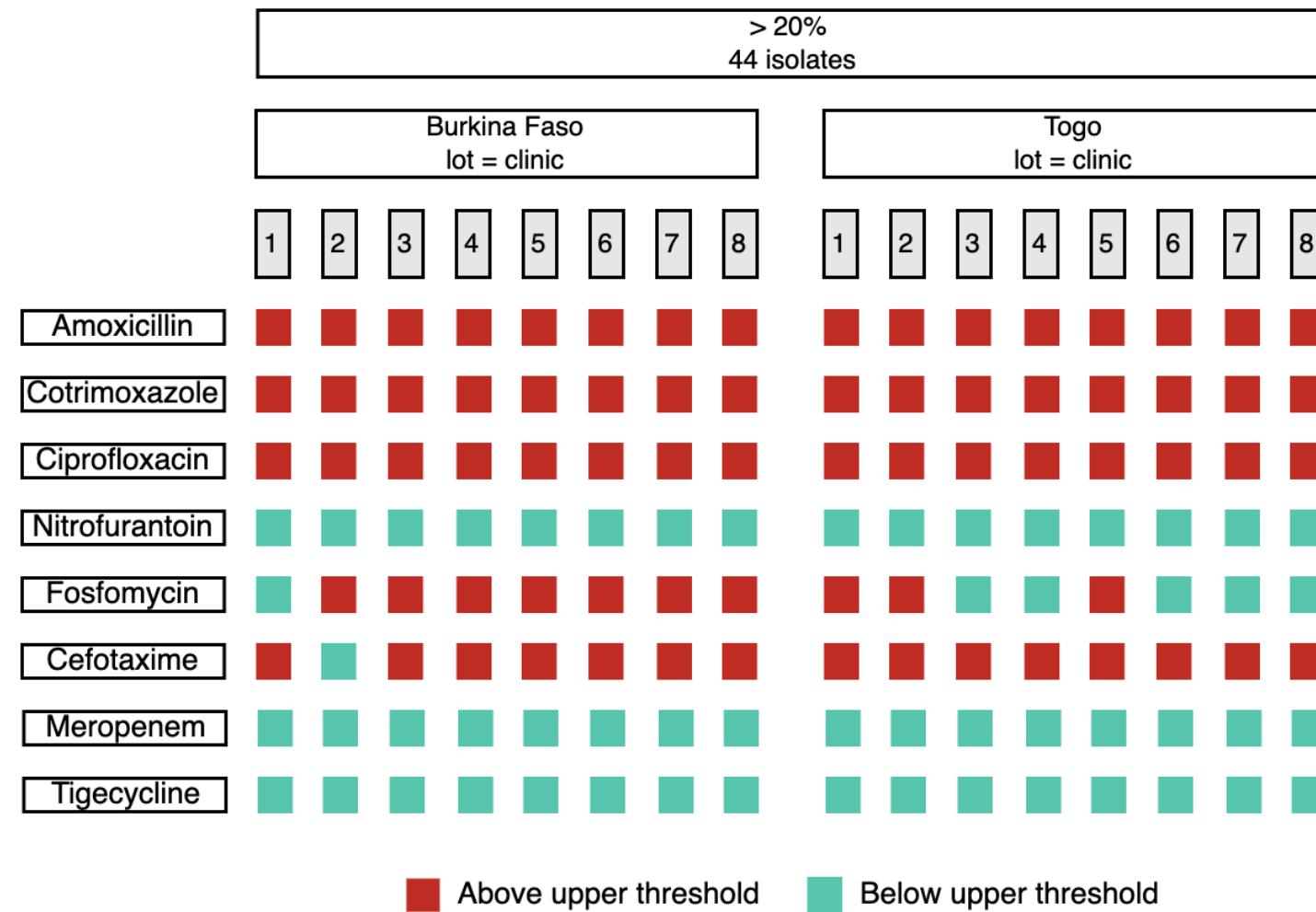
LQAS: human, informing empirical treatment



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LQAS: human, informing empirical treatment



LQAS for objectives AMR surveillance

- Guiding empirical antibiotic treatment based on AMR prevalence
 - Flagging areas high AMR prevalence by excellent sensitivity of method
- Assessing local variations in AMR prevalence
 - Small sample sizes enable parallel surveys in local areas
- Assessing changes AMR prevalence
 - Repeat surveys
- Assessing impact on interventions
 - Before – After surveys

No role LQAS in early warning (very low prevalence)

- Requires large sample size
 - Takes away advantage of method
- Poor test characteristics
 - Reducing allowable misclassification not possible
- Instead: design proper sentinel surveillance

CONCLUSION AND ACKNOWLEDGEMENT

Conclusion

- LQAS excellent approach to flag settings with high AMR prevalence
 - High sensitivity
- Suitable for most surveillance objectives
 - Not as an early warning approach
- Facilitates move from laboratory- to population-based surveillance
- Critical design decisions needed for proper interpretation
 - Action needed when exceeding upper threshold
 - Careful threshold setting to manage misclassification

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 **jpiamr**

