A Bayesian sensitivity and specificity estimation of the participatory disease surveillance program for highly pathogenic avian influenza in Egypt

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Africa EcoHealth conference

Côte d'Ivoire

01 – 05 October 2013

Africa 2013

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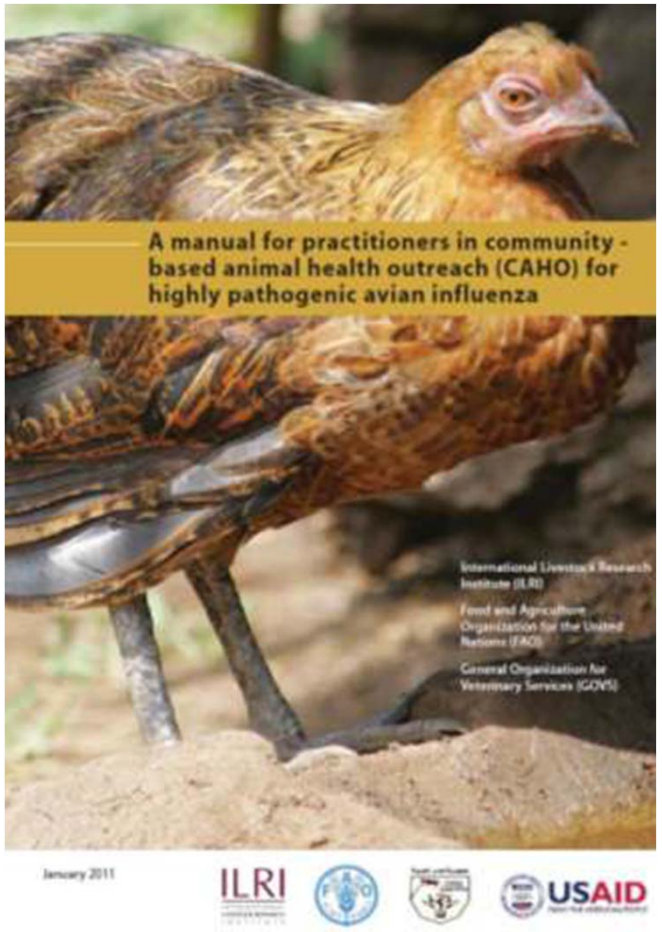
Background:

- In 2008, a PDS program was introduced after a large HPAI epidemic outbreak in Egypt
- Collaborative project between: MALR, FAO and ILRI
- Community based animal health outreach (CAHO) program
- **AIM:** improvement of HPAI surveillance and control, through the use of PE
- CAHO program cover 53 districts (30% of Egypt districts) in 15 governorates



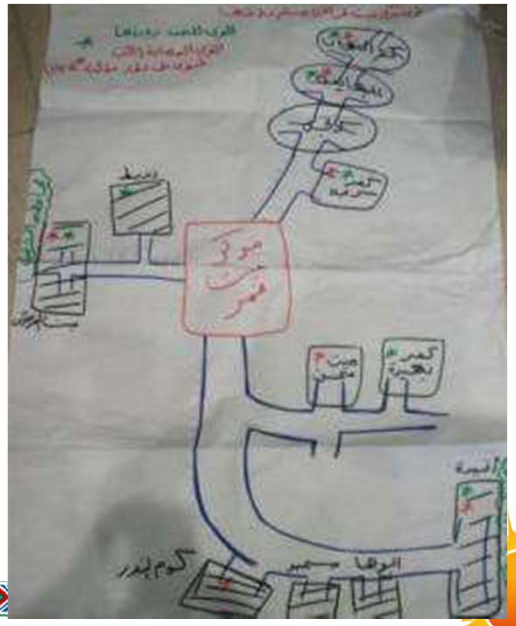
Research objective:

- No scientifically-sound assessment of CAHO diagnostic capabilities has been conducted

- **“Evaluate the performance of the CAHO program, estimating its ability to detect HPAI outbreaks at village level, based on the agreement between CAHO officers and laboratory test results”**

Material and Methods:
Data collection

- Data collected from March to June 2012
- Villages visit were purposive
- Key contacts > community meeting > suspected household inspection
- CAHO practitioners clinically inspected all birds species present at household level
- If household was assessed as
  - Infected: swab samples from all sick birds
  - Non-infected: swab samples from chicken only (random)
- Swab samples were PCR tested (H5, H7, H9)
- If a household was assessed as infected, the village was also regarded as positive



Material and Methods:
Statistical Analysis I

- Village level sensitivity & specificity (Vse & Vsp) were estimated by comparison of CAHO and PCR results
- However, Vse and Vsp are herd level test performance parameters
- Thus CAHO and PCR results can not be directly compared, assuming PCR as gold standard test
- A Bayesian latent class model (2T-2P), assuming no gold standard test, was used to obtain Vse and Vsp

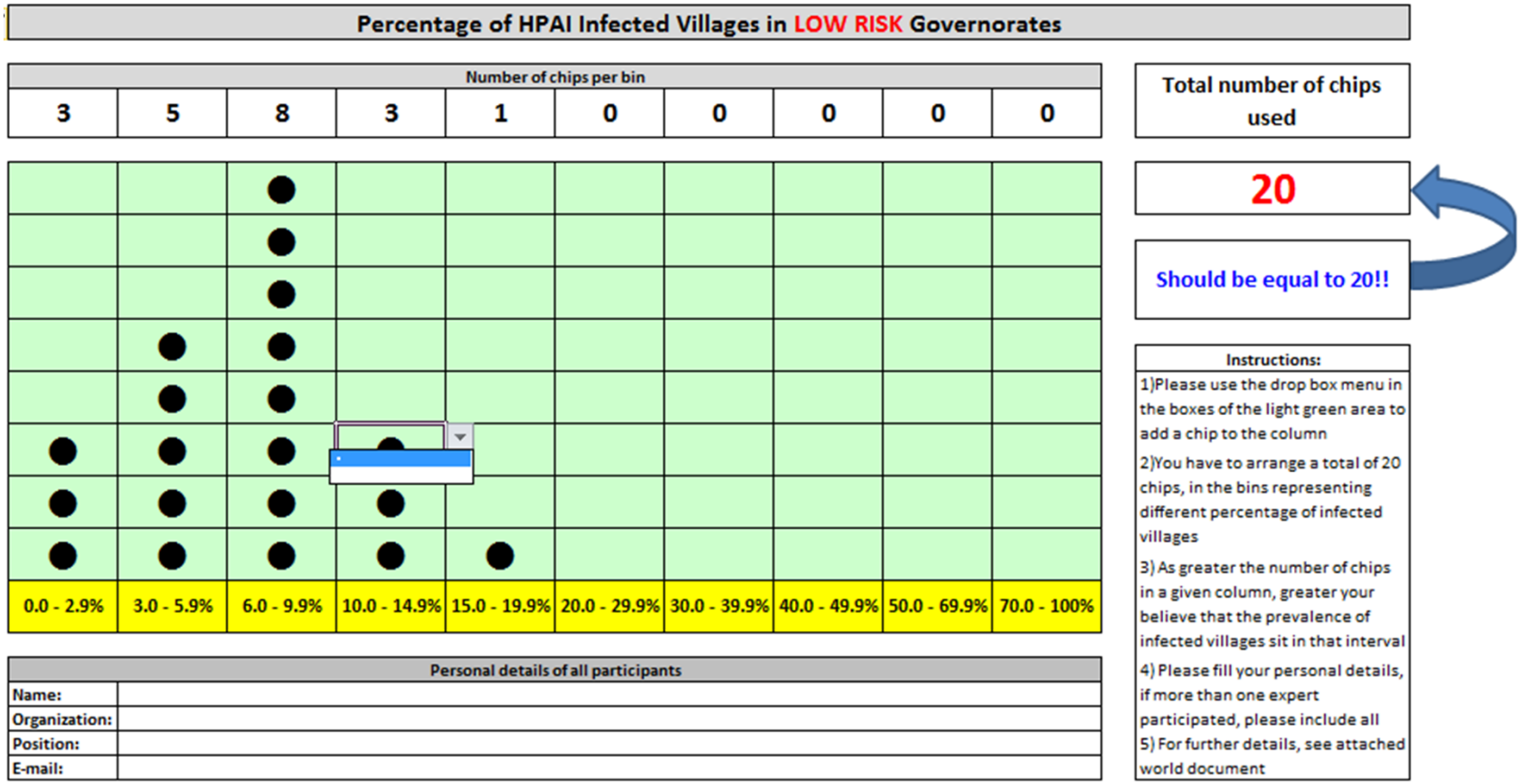
Material and Methods:
Statistical Analysis II

- Bayesian inference: **Prior + Data => Posterior**
- Prior distributions were elicited using a panel of experts when:
  - Parameters were not available from literature, or
  - They could not be estimated using standard models
- Three CAHO Vse and Vsp scenarios were assessed:
- The effect of CAHO diagnostic certainty was also considered

Material and Methods:

Prior elicitation (expert panel): Trial roulette method:

- To obtain PRIOR distributions for the V Pr



Percentage of HPAI Infected Villages in LOW RISK Governorates

Number of chips per bin									
3	5	8	3	1	0	0	0	0	0
0.0 - 2.9%	3.0 - 5.9%	6.0 - 9.9%	10.0 - 14.9%	15.0 - 19.9%	20.0 - 29.9%	30.0 - 39.9%	40.0 - 49.9%	50.0 - 69.9%	70.0 - 100%

Personal details of all participants	
Name:	
Organization:	
Position:	
E-mail:	

Total number of chips used
20
Should be equal to 20!!

Instructions:

1)Please use the drop box menu in the boxes of the light green area to add a chip to the column

2)You have to arrange a total of 20 chips, in the bins representing different percentage of infected villages

3) As greater the number of chips in a given column, greater your believe that the prevalence of infected villages sit in that interval

4) Please fill your personal details, if more than one expert participated, please include all

5) For further details, see attached world document

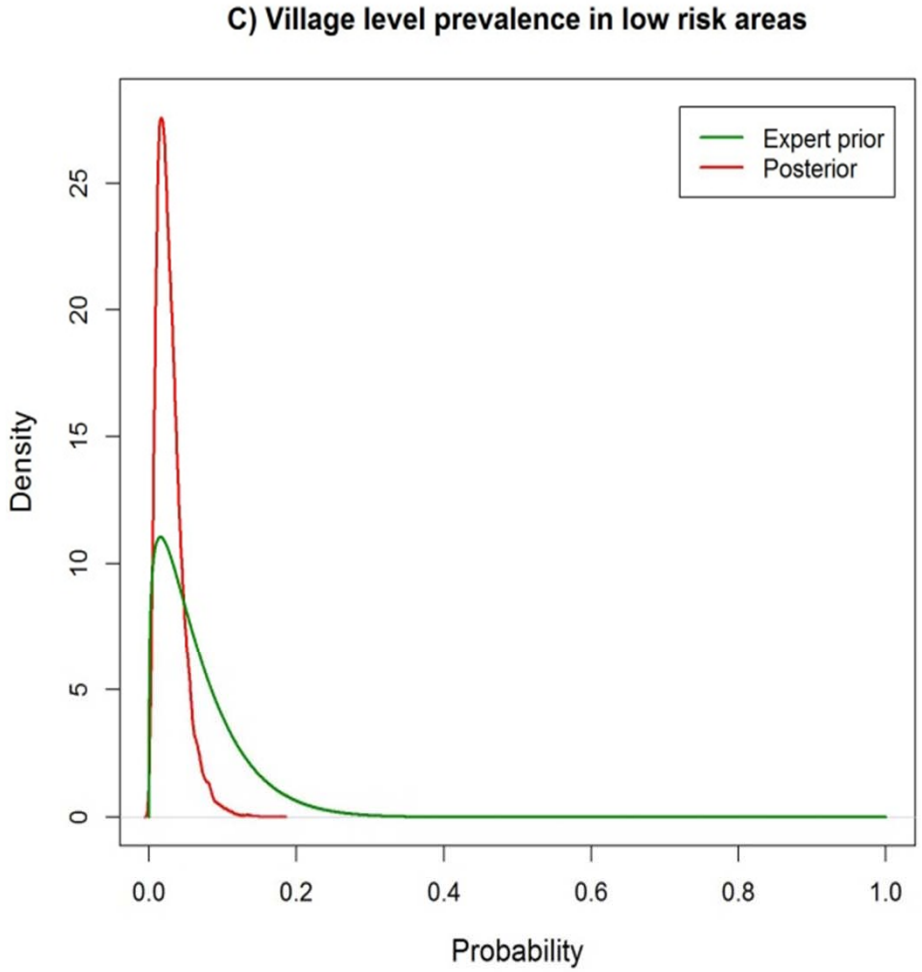
Results:

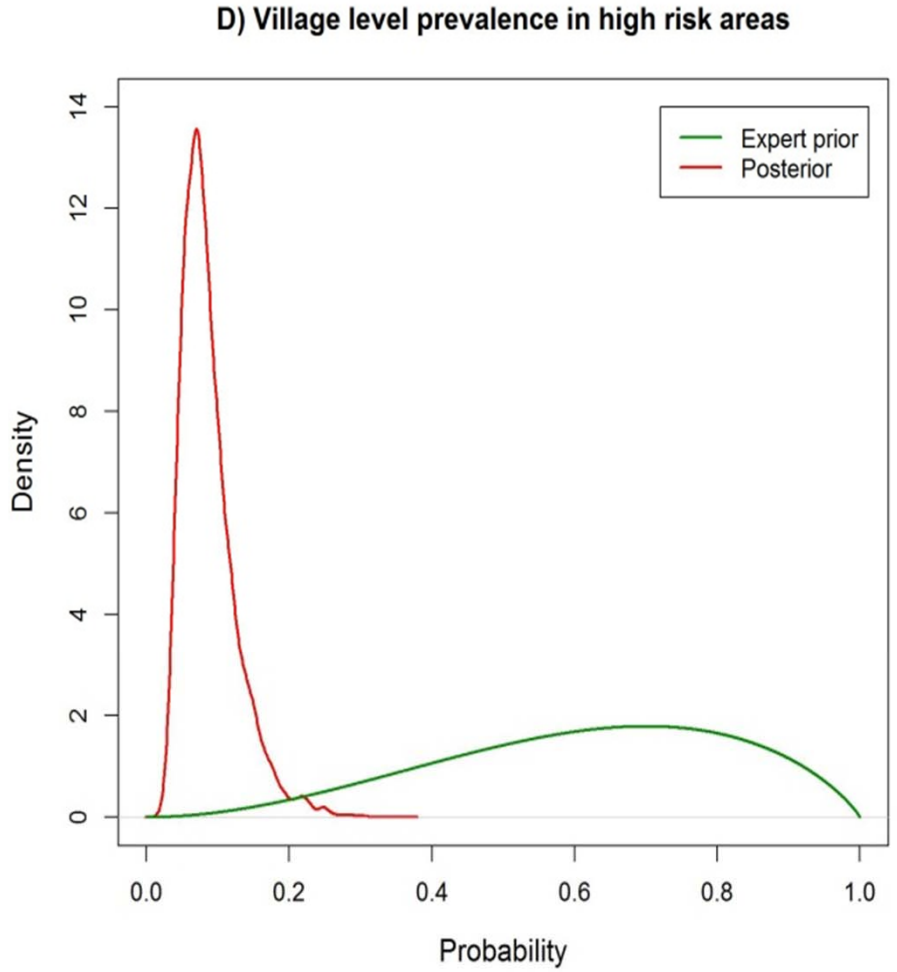
Data collection and test results

	Households	Villages	Birds	CAHO suspected villages	PCR positive villages
Low risk areas	290	245	1,143	91	4
High risk areas	626	472	2,315	144	14
Total	916	717	3,458	235	18

Results:

Village level prevalence (two populations)



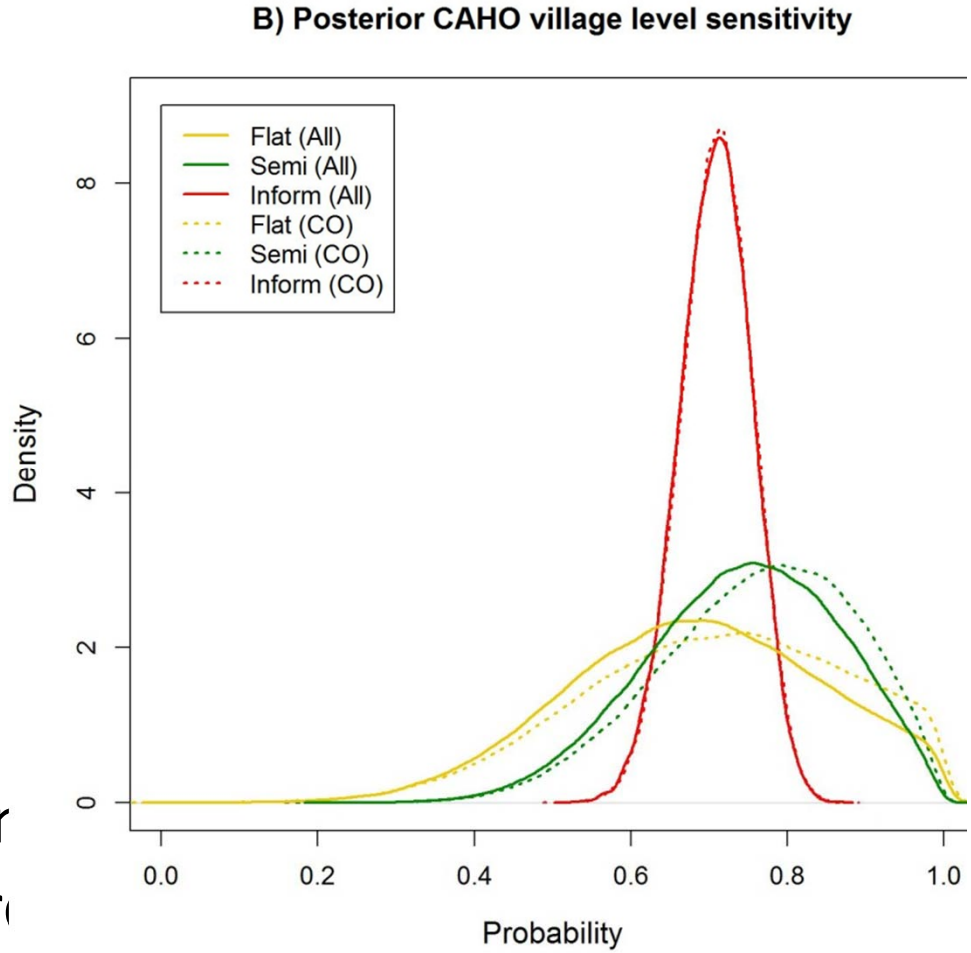


Results:

Vse: Prob. of classify a village (+) when is truly (+)

CAHO Vse:

- Non-informative (yellow)
  - 68.3% (36.1 – 96.7%)
- Semi-informative (green)
  - 74.7% (49.0 – 95.3%)
- Informative (red)
  - 70.9% (61.4 – 79.3%)
- **Dashed lines:** no significant difference when only certair CAHO results were consider

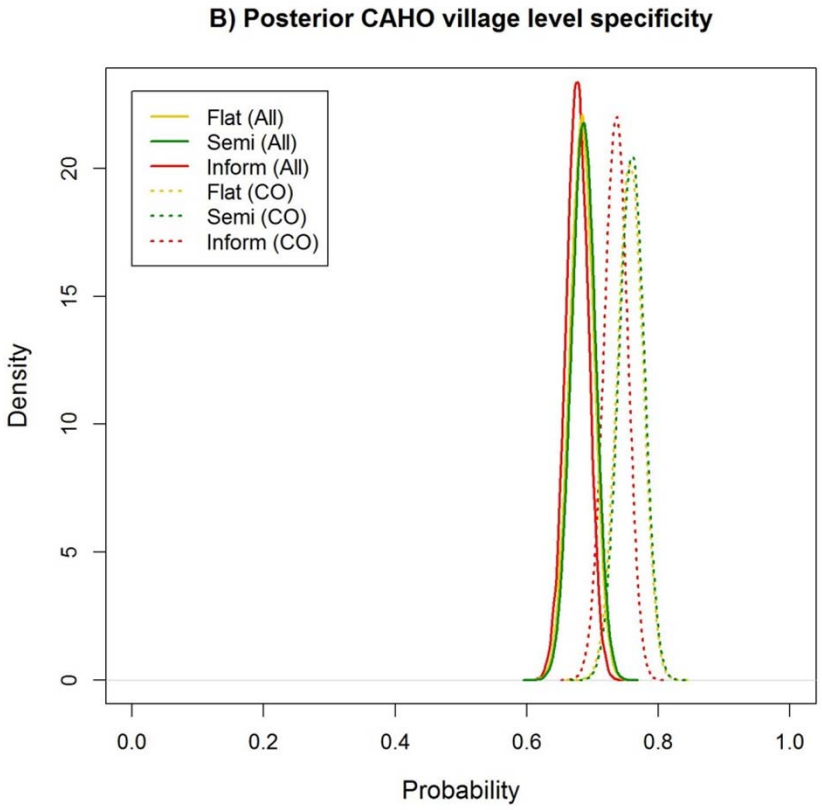


Results:

Vsp: Prob. of classify a village (-) when is truly (-)

CAHO Vsp:

- Non-informative (yellow)
  - 68.4% (64.8 – 71.9%)
- Semi-informative (green)
  - 68.6% (65.0 – 72.1%)
- Informative (red)
  - 67.7% (64.2 – 70.9%)
- **Dashed lines:** When uncertain CAHO results were excluded an increase of Vsp was observed



Discussion

- An important disagreement was observed between CAHO and PCR results
- Vse is influenced by the prior distribution, thus more data is required to accurate estimate it
    - Best guess (under available data): ~71%
- Vsp is insensitive to the prior distributions, thus confidently its value is around **68%**
- Considering practitioners diagnostic certainty only increases Vsp

Discussion

- The low Vse could be explained by the low prevalence observed in the field
  - A rise of Vse performance could be expected during epidemic periods

- The low Vsp could be explained by other diseases causing similar signs
  - Need for a rapid field level test for differential diag.

Conclusion

- Scientific assessment of CAHO program
- A moderate CAHO ability to diagnosis HPAI correctly
- The program could be more useful during **epidemic periods** rather than for endemic surveillance
- Need to increase ability for differential diagnosis

Image:
FAO

Acknowledgements

A special thanks to:

- Dr. Emad Saleh
- Dr. Magda Atef, and
- Dr. Rasha El Shabacy

Member of the expert panel for their valuable contribution

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