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Lymphatic filariasis in 2016 in American Samoa: using non-spatial and three spatial analytical methods

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Outline

- Introduction
- Methods
- Findings and Discussion
- Conclusions

Background

- Lymphatic filariasis (LF): 120 million people infected in tropical and subtropical areas globally
- *Wuchereria bancrofti*, *Brugia malayi* and *B. timori*
- Damages lymphatic system
- Lymphoedema, elephantiasis and scrotal hydrocoele

Background: LF in American Samoa

- WHO- Global Programme to Eliminate Lymphatic Filariasis
- Pacific Programme to Eliminate LF (PacELF)-1999
- American Samoa: 7 MDA (2000-2006)
- Passed transmission assessment surveys (TAS)- 2011-2012 and 2015

Background: LF in American Samoa (cont.)

- Detected residual hotspots and ongoing transmission- 2010, 2014 and 2016
- In 2016- A Community-based cluster Survey' was conducted along with TAS Strengthening Survey
- Five different tests were used during this study- antigen (A), microfilaraemia (Mf), and antibodies (Ab [Wb123, Bm14, Bm33])

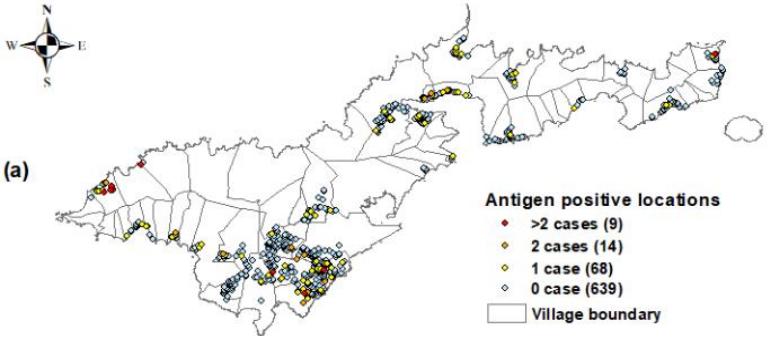
Aim

- To identify clustering and hotspots of LF Ag, microfilariae (Mf), and antibodies (Ab) using both non-spatial and spatial analytical methods, and compare the results between different methods.

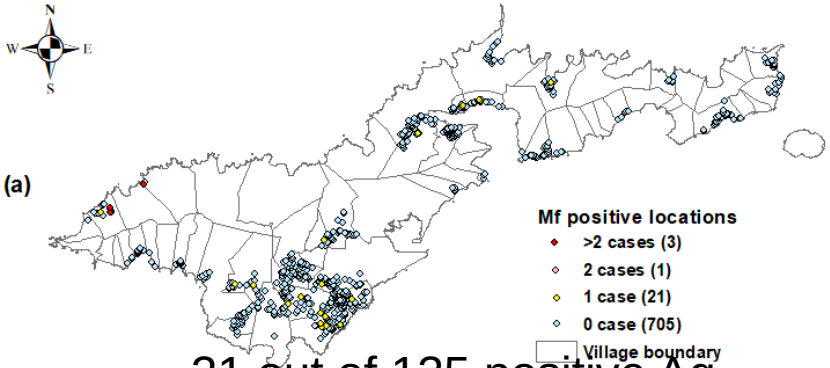
Methods

- Non-spatial: Intra-cluster correlation
- Spatial:
  - Global: Semivariograms
  - Local:
    - Clusters- SaTScan (Kulldorff's scan statistic)
    - Hotspots- Getis-Ord Gi* statistics

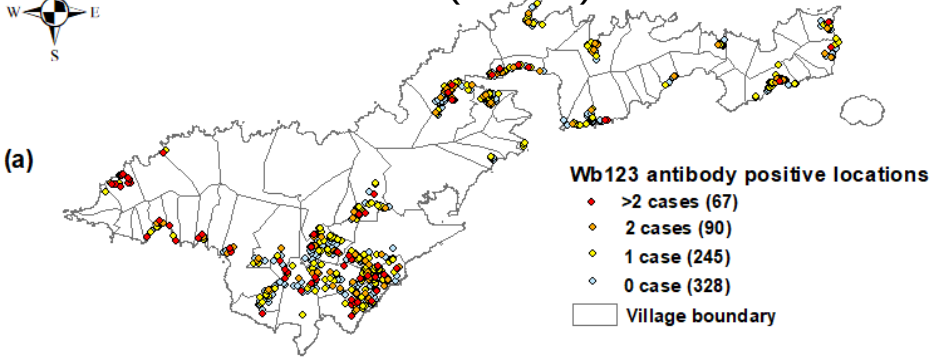
Findings and discussion: Descriptive



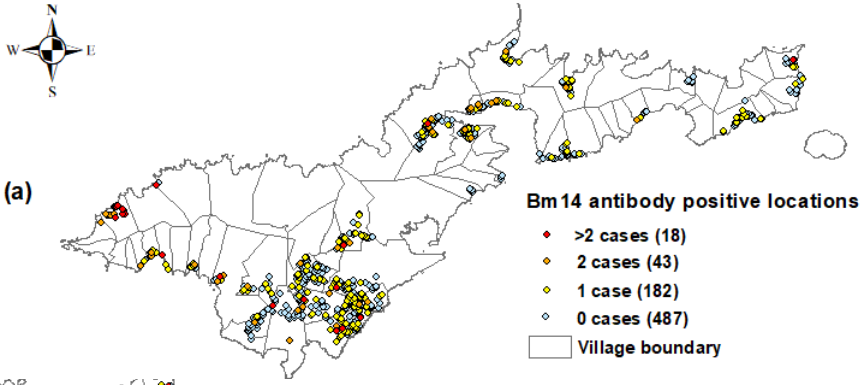
Prevalence- 5.1% (n=135)



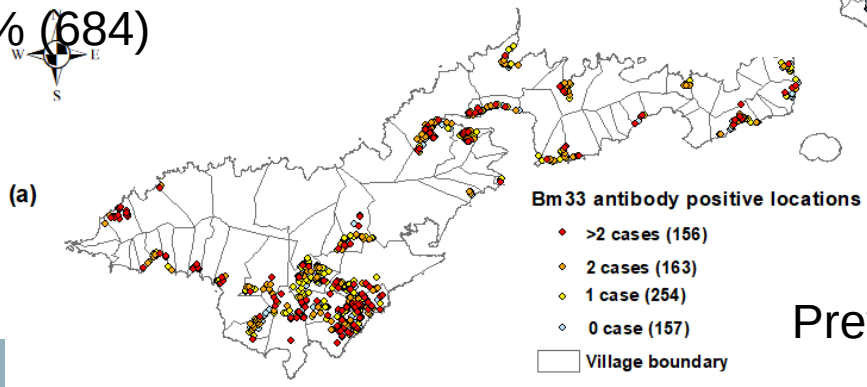
21 out of 135 positive Ag



Prevalence- 25.6% (684)



Prevalence- 13.1% (350)

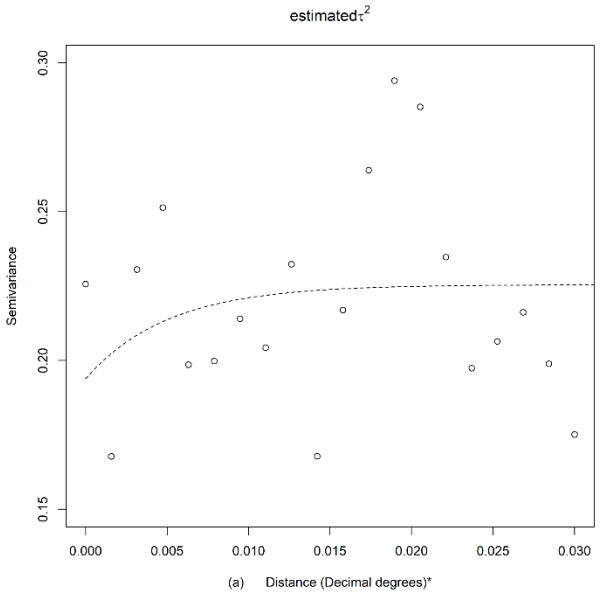


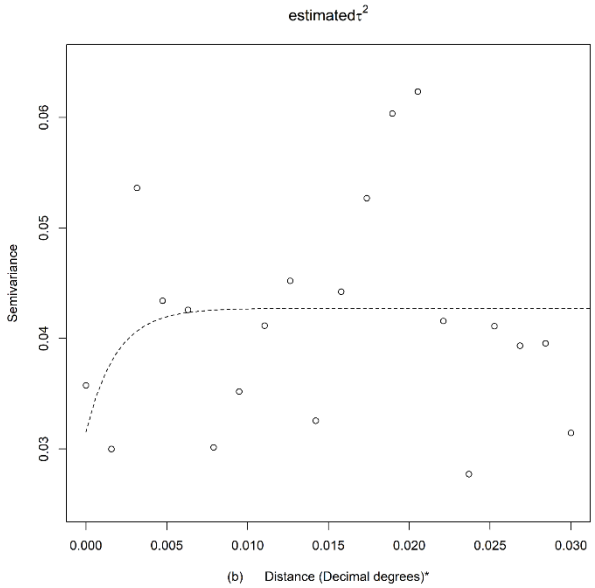
Prevalence- 45.9% (1,219)

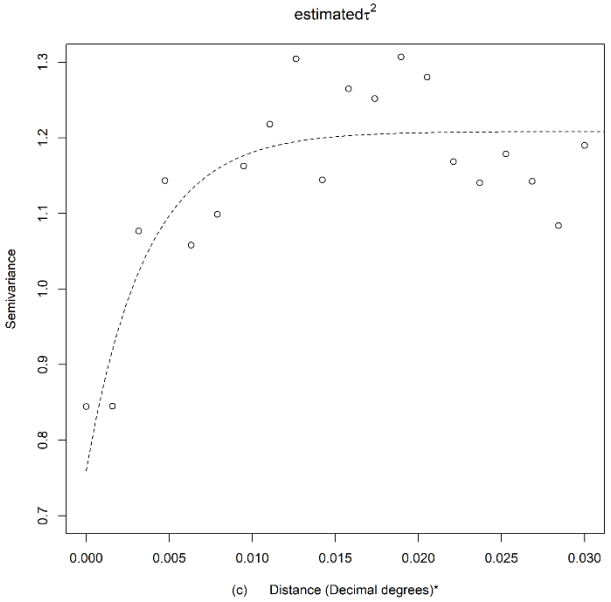
Intra-cluster correlation coefficients with 95% confidence interval

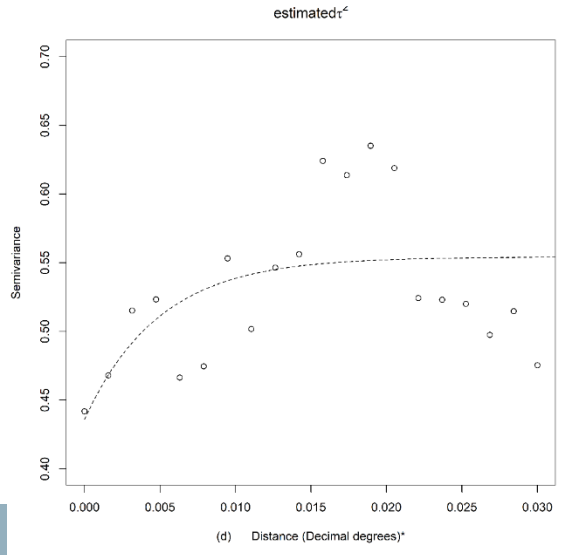
Tests	Household	Village
Antigen	**0.59 (0.45-0.71)**	**0.17 (0.08-0.33)**
Microfilaria	**0.69 (0.45-0.86)**	**0.30 (0.10-0.61)**
Wb123 Ab	0.27 (0.20-0.36)	0.11 (0.06-0.21)
Bm14 Ab	0.33 (0.23-0.44)	0.17 (0.09-0.29)
Bm33 Ab	0.20 (0.14-0.28)	0.10 (0.05-0.19)

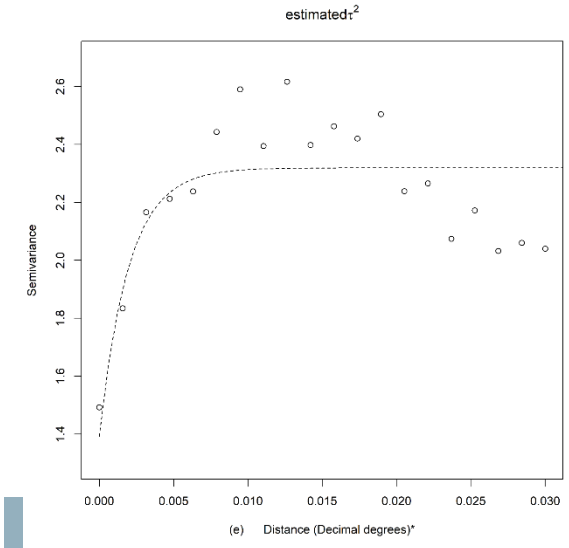
Semivariogram







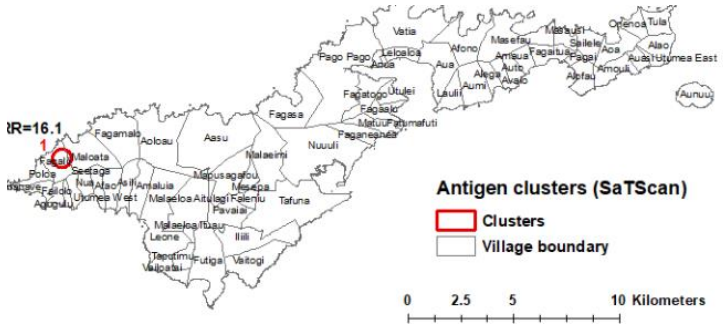


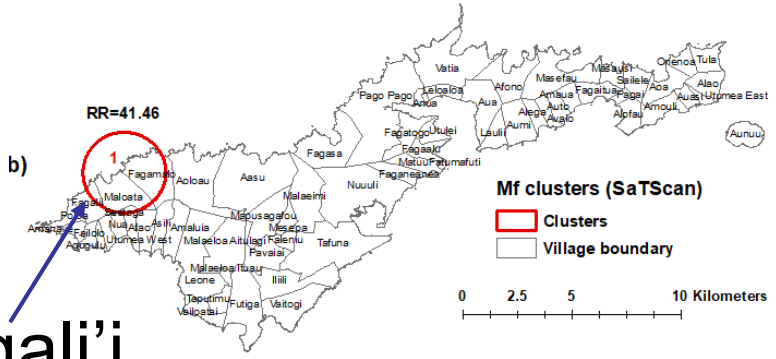


Parameters of spatial autocorrelation

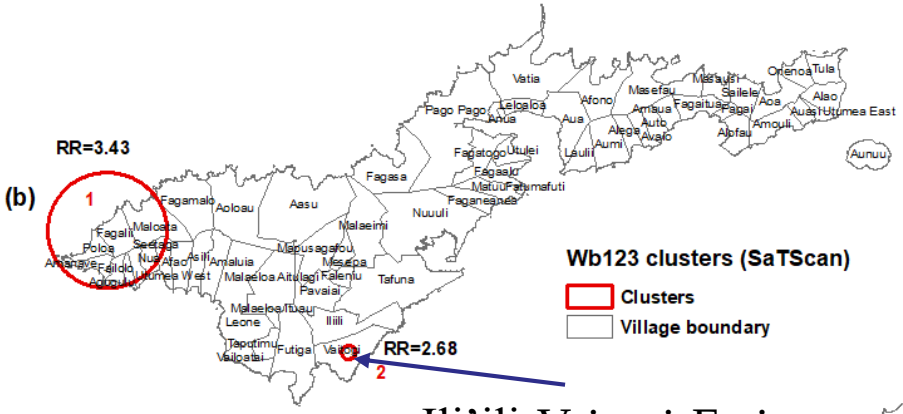
Spatial parameters	Ag	MF	Wb123 Ab	Bm14 Ab	Bm33 Ab
Partial sill	0.03	0.01	0.45	0.12	0.93
Range (degrees)*	0.0051	0.0019	0.0036	0.0049	0.0020
Range (meters)*	**562**	**207**	**397**	**548**	**220**
Nugget	0.19	0.03	0.76	0.44	1.39
Percentage of variance due to spatial dependence (%)	14	26	37	21	40

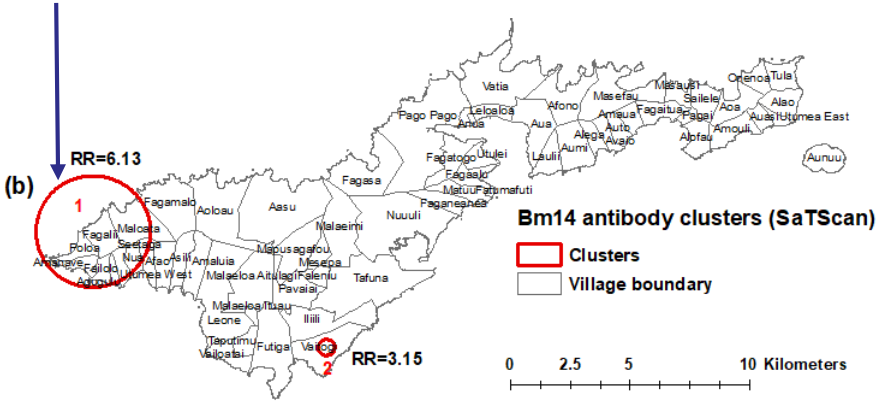
SaTScan: Cluster analysis



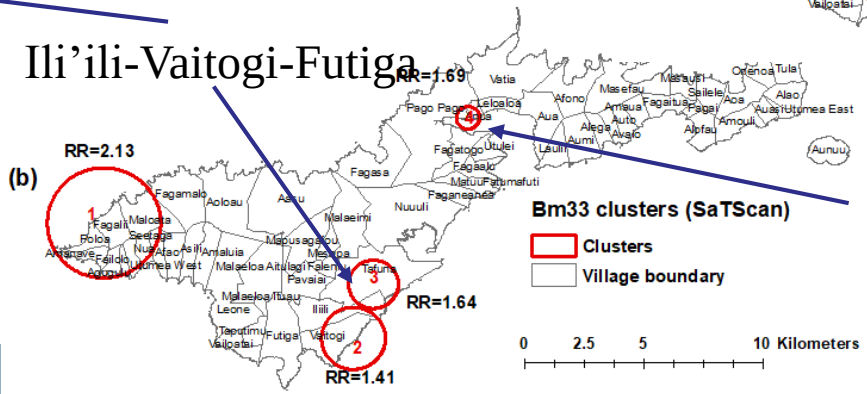


Fagali'i



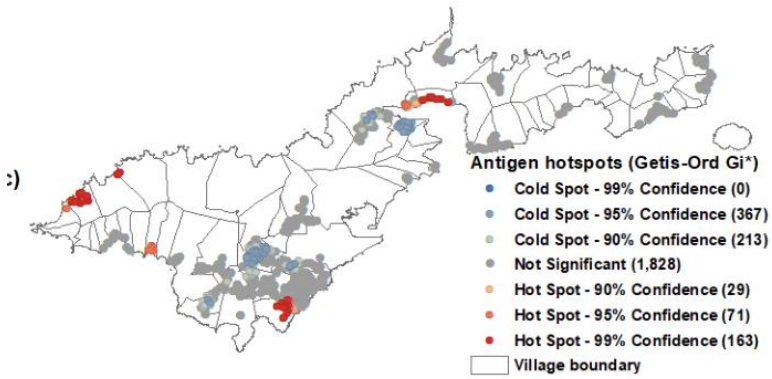


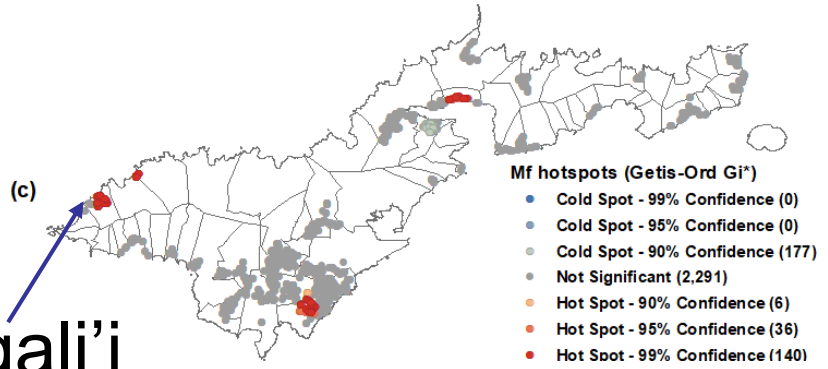
Ili'ili-Vaitogi-Futiga



Cluster 4 is a new area not previously known area

Hotspot analysis





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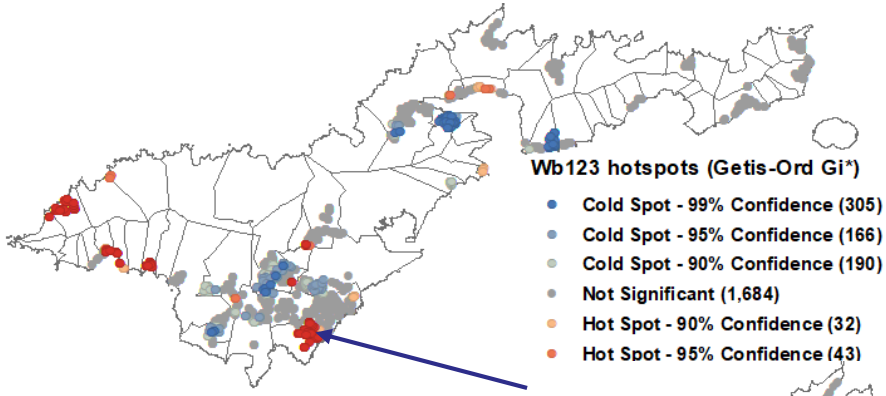

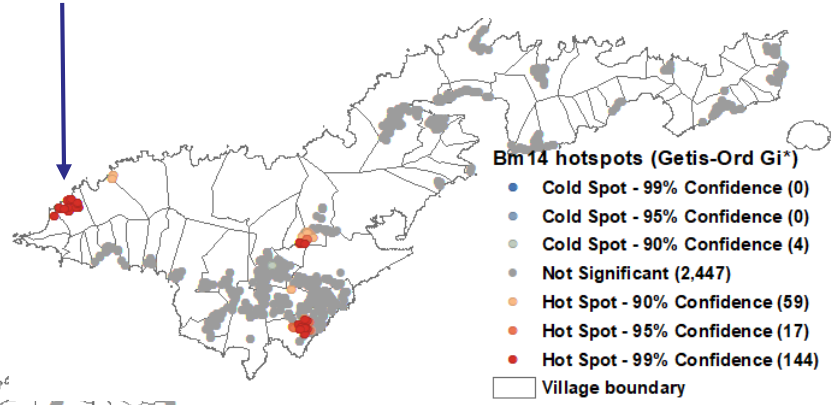

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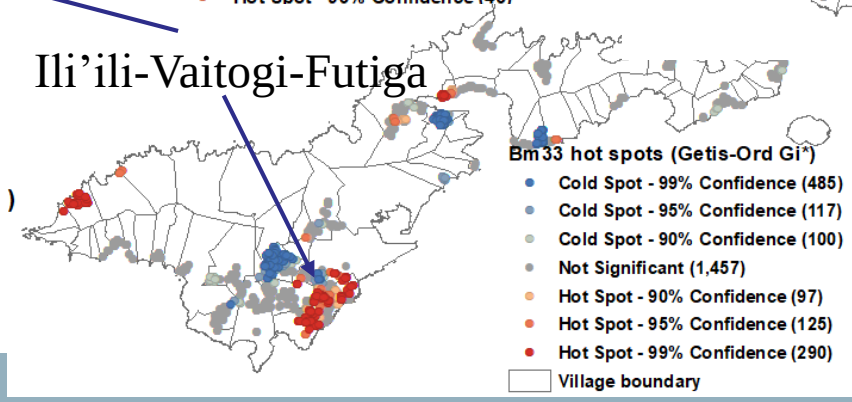
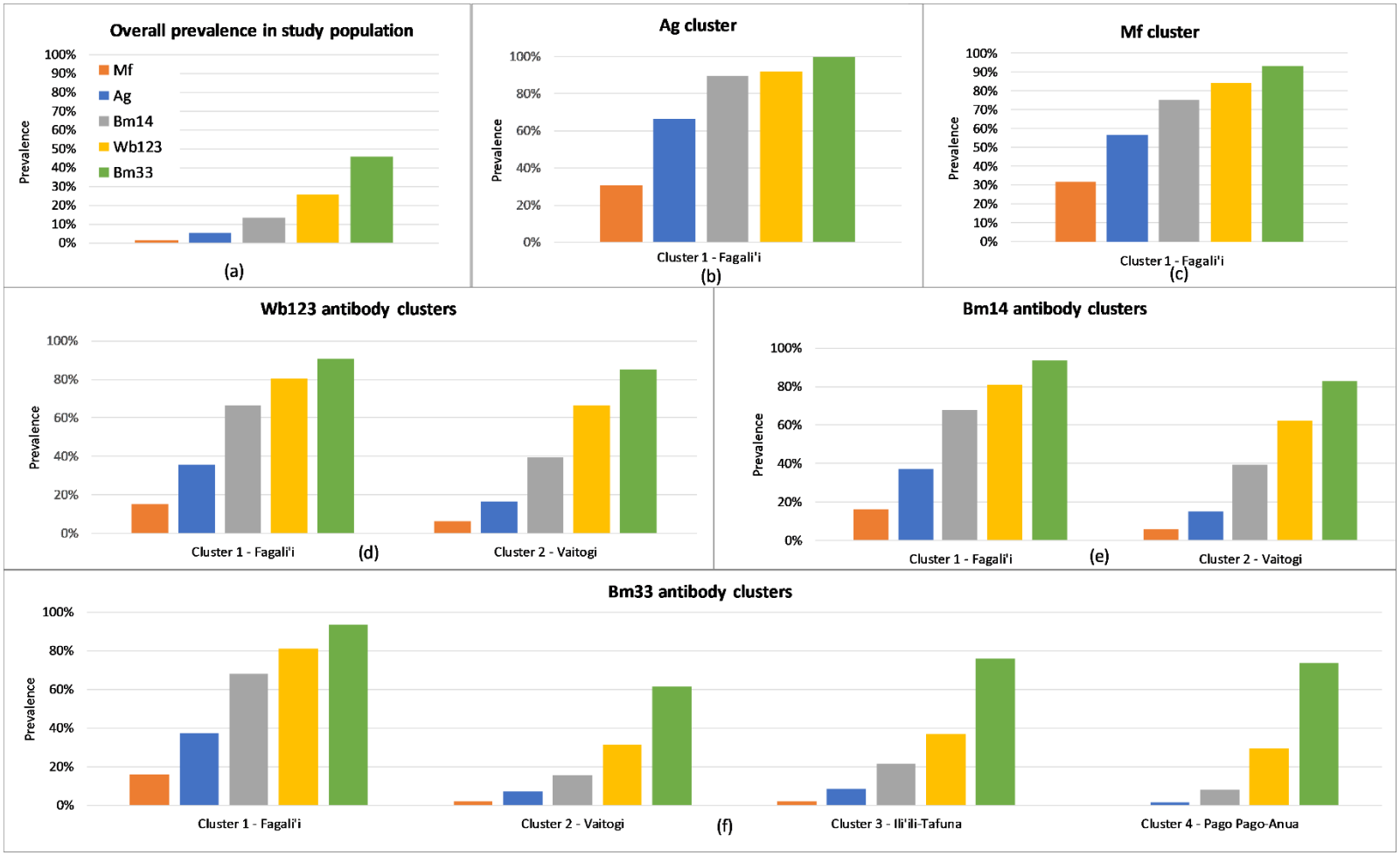


Prevalence of infection markers within SaTScan clusters



Conclusions

- Risk maps could be used by LF programmes for prioritising or intensifying LF elimination efforts in the high-risk areas:
  - Health promotion to maximise MDA coverage,
  - Vector control
  - Targeted testing and/or treating in communities and schools
  - Intensify surveillance.

Conclusions

- Kulldorff's scan statistics results
  - may be useful for providing signals of transmission
- Getis-Ord Gi* statistics appeared the most sensitive of the spatial methods explored in this study & yielded the most detailed output in terms of spatial resolution and risk stratification.

Conclusion

- The choice of methods will depend on the purpose of the analysis, and using a combination of methods (as we have done in this study) should also be considered
- Spatial heterogeneity were driven by: climatic and ecological factors, human behaviour, mosquito distribution and density, previous MDA coverage, or a combination of these factors

Conclusion

- Mf positivity represents active infection and infectiousness
- Ag positivity indicates the presence of adult worms and is a marker of active or recent infection
- Ab provide high probability evidence of current or past infection with LF

Thank you