

Bayesian Spatial Modelling of Early Childhood Development in Australian Regions

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Research

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Abstract

Background

Children's early development plays a vital role for maintaining healthy lives and influences future outcomes. It is also heavily affected by community factors which vary geographically. Direct methods do not provide a comprehensive picture of this variation, especially for areas with sparse populations and low data coverage. In the context of Australia, the Australian Early Development Census (AEDC) provides a measure of early child development upon school entry. There are two primary aims of this study: (i) provide improved prevalence estimates of children who are considered as developmentally vulnerable in regions across Australia; (ii) ascertain how social-economic disadvantage partly explains the spatial variation.

Methods

The study included 308,953 children involved in the AEDC 2018 where 21.7% of them were considered to be developmentally vulnerable in at least one domain. We used Bayesian spatial hierarchical models with the Socio-economic Indexes for Areas (SEIFA) as a covariate for to provide improved prevalence estimates of all 335 SA3 regions in Australia.

Results

Our results reveal that there is an important geographical dimension to developmental vulnerability in Australia. In addition, there are significant improvements in estimation of the prevalence of developmental vulnerability through incorporating the socio-economic disadvantage in an area. These improvements persist in all five domains – the largest improvements occurred in the Language and Cognitive Skills domain,

Conclusion

There are a number of sparsely populated areas where direct estimation leads to unreliable estimates of the relatively small prevalence of child vulnerability. Bayesian spatial modelling can account for the spatial patterns in childhood vulnerability while including the impact of socio-economic disadvantage on geographic variation. Further investigation, using a broader range of covariates, could shed more light on explaining this spatial variation.

Full Text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed. However, the manuscript can be downloaded and accessed as a PDF.

Supplementary Figure Legends

Additional file 1: Map of the difference in CV in *Social Competence* domain

File format: .png

The filling colour reflect the distribution the difference between the percentage coefficient of variation (CV) of the model-based approach compared with direct estimation of the prevalence of vulnerability in the *Social Competence* Domain.

Additional file 2: Map of the difference in CV in *Emotional Maturity* domain

File format: .png

The filling colour reflect the distribution the difference between the percentage coefficient of variation (CV) of the model-based approach compared with direct estimation of the prevalence of vulnerability in the *Emotional Maturity* Domain.

Additional file 3: Map of the difference in CV in *Communication Skills* domain

File format: .png

The filling colour reflect the distribution the difference between the percentage coefficient of variation (CV) of the model-based approach compared with direct estimation of the prevalence of vulnerability in the *Communication Skills* Domain.

Additional file 4: Map of the ratio of the relative bias in *Social Competence* domain

File format: .png

The filling colours reflect the distribution of the ratio of the percentage relative bias (RB) of the model-based approach compared with direct estimation of the prevalence of vulnerability in the *Social Competence* Domain.

Additional file 5: Map of the ratio of the relative bias in *Emotional Maturity* domain

File format: .png

The filling colours reflect the distribution of the ratio of the percentage relative bias (RB) of the model-based approach compared with direct estimation of the prevalence of vulnerability in the *Emotional Maturity* Domain.

Additional file 6: Map of the ratio of the relative bias in *Communication Skills* domain

File format: .png

The filling colours reflect the distribution of the ratio of the percentage relative bias (RB) of the model-based approach compared with direct estimation of the prevalence of vulnerability in the *Communication*

Figures

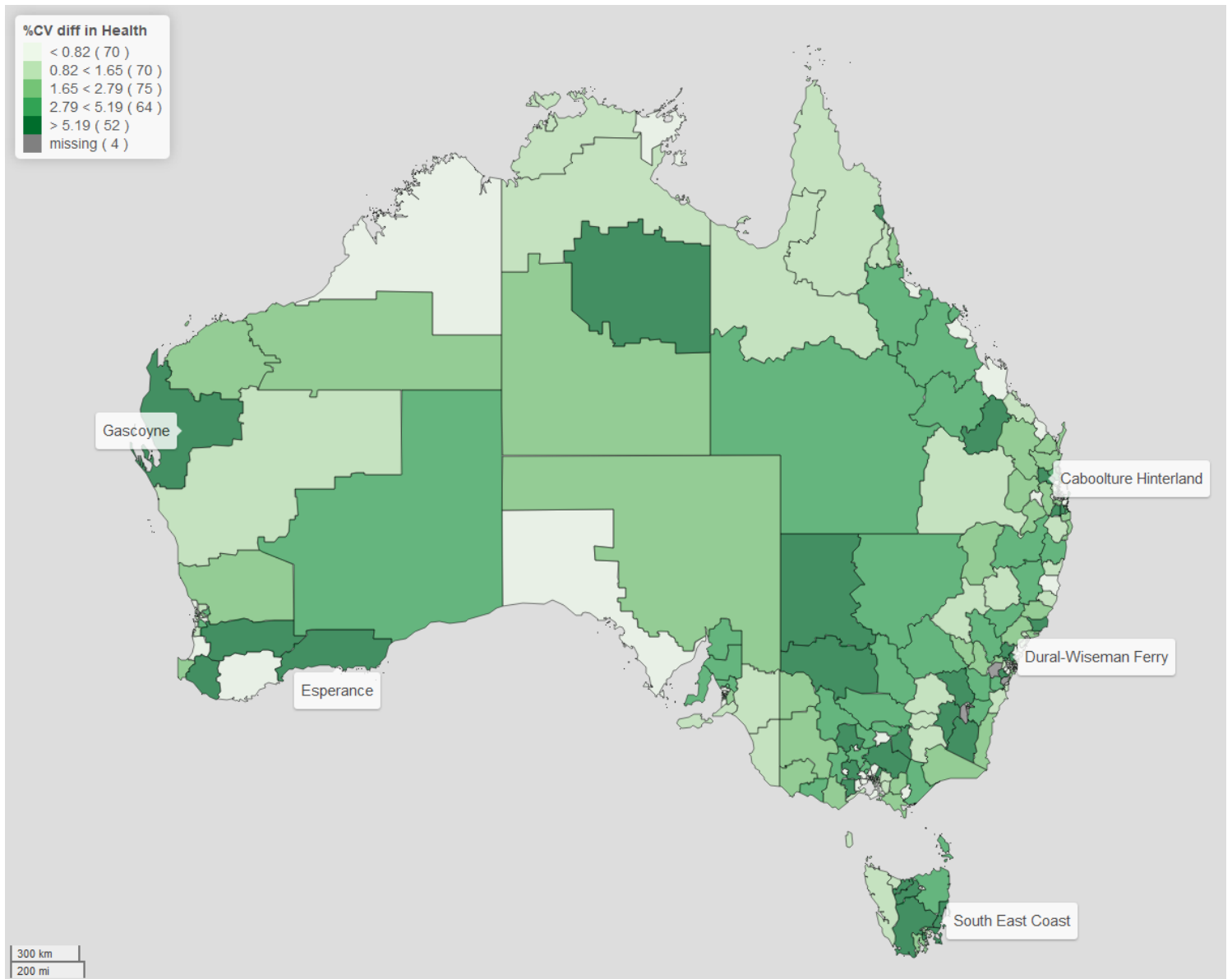


Figure 1

Map of the difference in CV in Physical Health and Wellbeing domain. The filling colour reflect the distribution the difference between the percentage coefficient of variation (CV) of the model-based approach compared with direct estimation of the prevalence of vulnerability in the Physical Health and Wellbeing Domain.

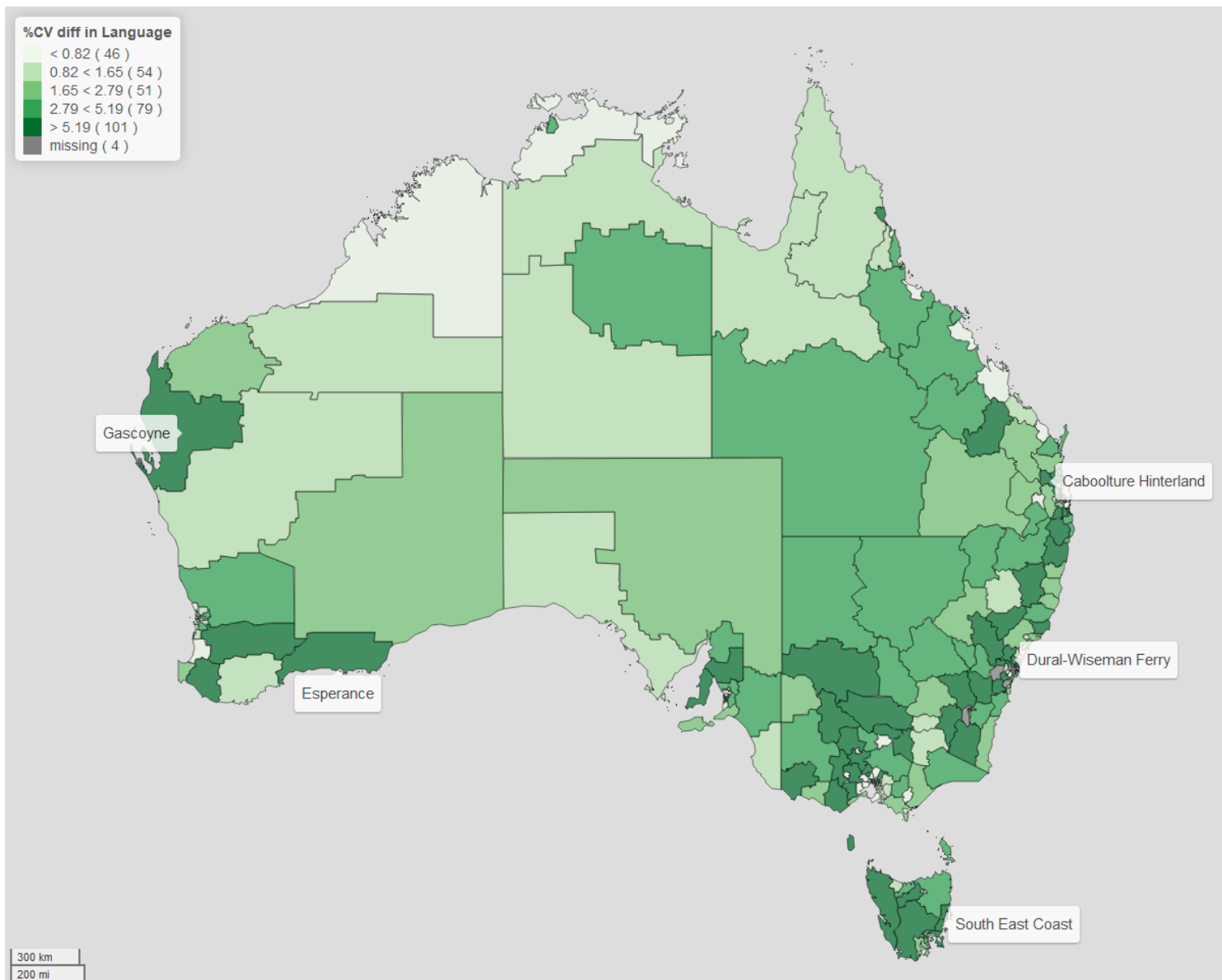


Figure 2

Map of the difference in CV in Language and Cognitive Skills domain. The filling colours reflect the distribution of the difference between the percentage coefficient of variation (CV) of the model-based approach compared with direct estimation of the prevalence of vulnerability in the Language and Cognitive Skills Domain.

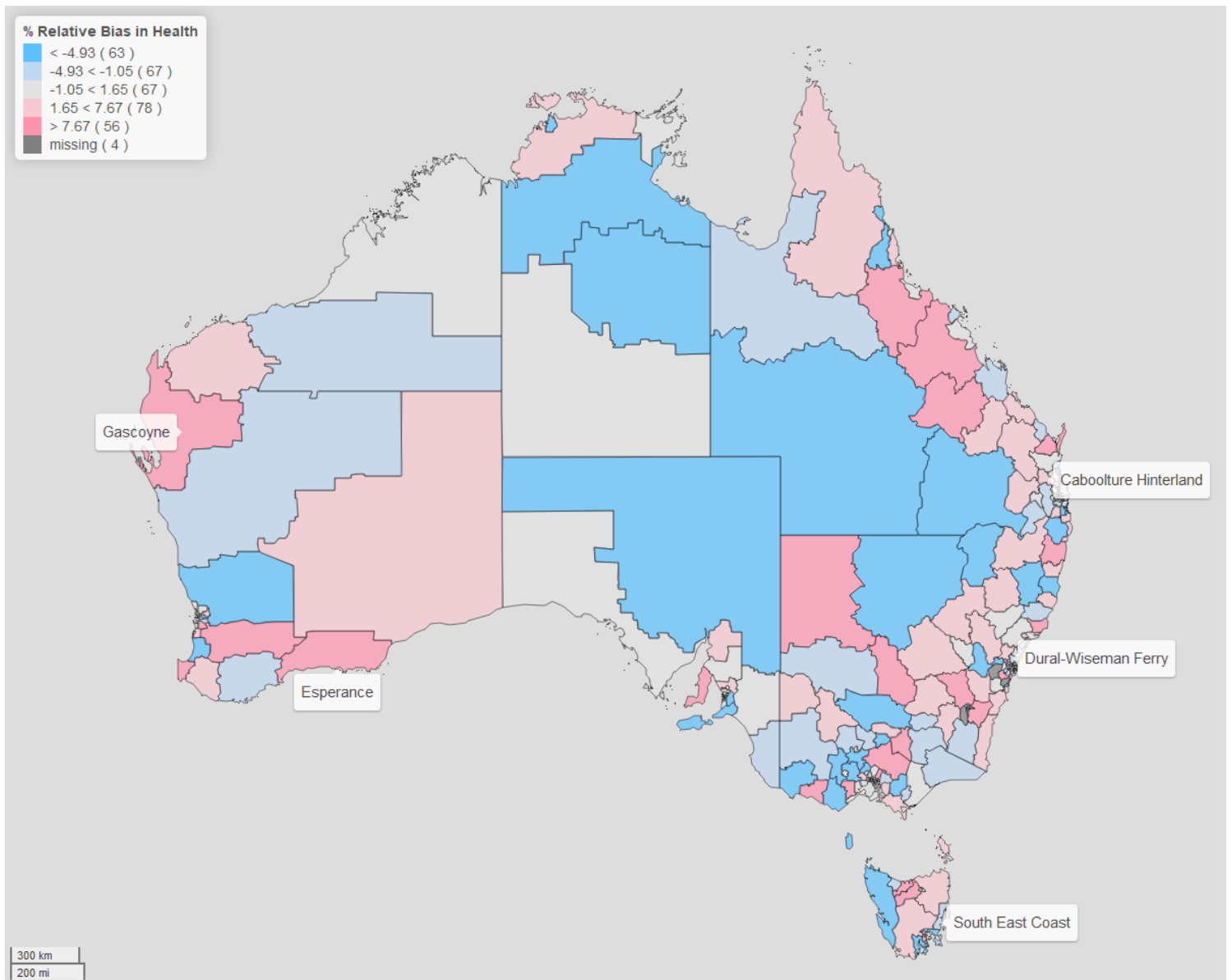


Figure 3

Map of the ratio of the relative bias in Physical Health and Wellbeing domain. The filling colours reflect the distribution of the ratio of the percentage relative bias (RB) of the model-based approach compared with direct estimation of the prevalence of vulnerability in the Physical Health and Wellbeing Domain.

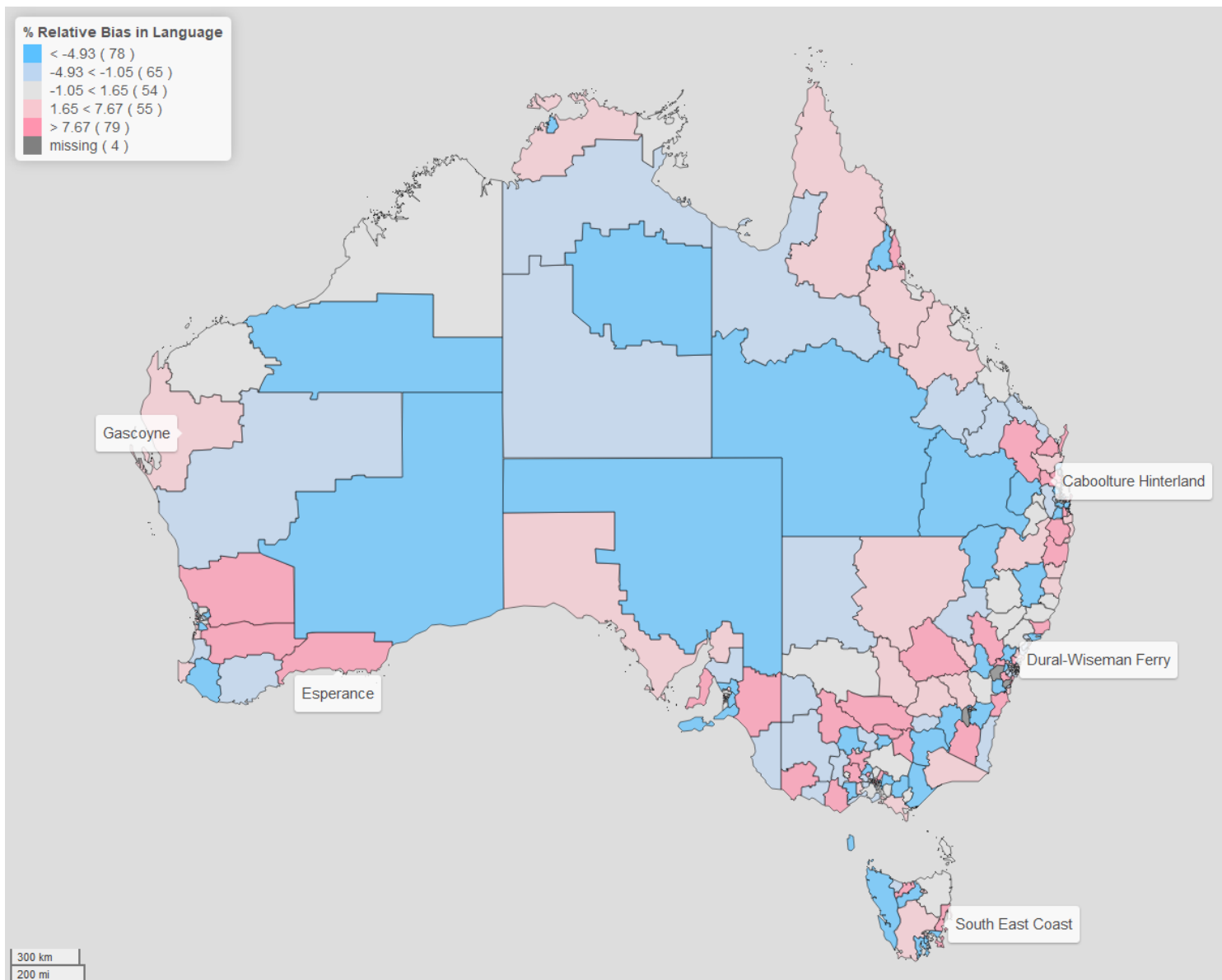


Figure 4

Map of the ratio of the relative bias in Language and Cognitive Skills domain. The filling colours reflect the distribution of the ratio of the percentage relative bias (RB) of the model-based approach compared with direct estimation of the prevalence of vulnerability in the Language and Cognitive Skills Domain.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Additionalfile6.png](#)
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