



# Bayesian Hierarchical Model for Measuring Clinical Outcomes in Smallholder Farm Systems, South Africa

Nokuthula Dlamini<sup>1</sup>, Selukwe Mafuta<sup>2</sup>, Kgoloko Molebogo<sup>1,3</sup>, Sifiso Mkhwanazi<sup>4,5</sup>

<sup>1</sup> Durban University of Technology (DUT)

<sup>2</sup> Department of Crop Sciences, University of Pretoria

<sup>3</sup> African Institute for Mathematical Sciences (AIMS) South Africa

<sup>4</sup> Department of Agricultural Economics, African Institute for Mathematical Sciences (AIMS) South Africa

<sup>5</sup> Department of Soil Science, Durban University of Technology (DUT)

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**Correspondence:** [ndlamini@hotmail.com](mailto:ndlamini@hotmail.com)

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## Author notes

*Nokuthula Dlamini is affiliated with Durban University of Technology (DUT) and focuses on Agriculture research in Africa.*

*Selukwe Mafuta is affiliated with Department of Crop Sciences, University of Pretoria and focuses on Agriculture research in Africa.*

*Kgoloko Molebogo is affiliated with Durban University of Technology (DUT) and focuses on Agriculture research in Africa.*

*Sifiso Mkhwanazi is affiliated with Department of Agricultural Economics, African Institute for Mathematical Sciences (AIMS) South Africa and focuses on Agriculture research in Africa.*

## Abstract

Clinical outcomes in smallholder farm systems have been studied extensively, but methods for longitudinal analysis are often underutilized. A longitudinal study employing a Bayesian hierarchical model was conducted on smallholder farm systems in South Africa. The model accounts for spatial, temporal, and individual variability within the data. The analysis revealed significant variation in clinical outcomes across different farms over two years, with a notable increase in disease prevalence among poultry from 20% to 45%. The Bayesian hierarchical model provided robust insights into the dynamics of smallholder farm health and identified key areas for intervention. Policy makers should consider targeting interventions where clinical outcomes are most critical, based on our findings. The empirical specification follows  $Y = \beta_{0+\beta}^{-1} p X + \text{varepsilon}$ , and inference is reported with uncertainty-aware statistical criteria.

**Keywords:** *African agriculture, smallholder farms, longitudinal analysis, Bayesian statistics, hierarchical modelling, econometrics, randomized trials*

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