



Bayesian Hierarchical Model for Measuring Reliability in South African Municipal Water Systems

Nkosikhunyane Mpho Mashungwana¹, Makhathini Nhlanhla Gama², Kgalema Mogga Khumalo¹,
Sipho Thembinkosi Nkabinde^{3,4}

¹ Wits Business School

² North-West University

³ South African Institute for Medical Research (SAIMR)

⁴ Department of Interdisciplinary Studies, University of Zululand

Published: 12 February 2009 | **Received:** 08 October 2008 | **Accepted:** 18 January 2009

Correspondence: nmashungwana@yahoo.com

DOI: [10.5281/zenodo.18890651](https://doi.org/10.5281/zenodo.18890651)

Author notes

Nkosikhunyane Mpho Mashungwana is affiliated with Wits Business School and focuses on Environmental Science research in Africa.

Makhathini Nhlanhla Gama is affiliated with North-West University and focuses on Environmental Science research in Africa.

Kgalema Mogga Khumalo is affiliated with Wits Business School and focuses on Environmental Science research in Africa.

Sipho Thembinkosi Nkabinde is affiliated with South African Institute for Medical Research (SAIMR) and focuses on Environmental Science research in Africa.

Abstract

South African municipal water systems are critical for public health but often suffer from reliability issues due to aging infrastructure and inadequate maintenance. A Bayesian hierarchical model will be employed to estimate the reliability of municipal water systems. This model accounts for variations between municipalities by incorporating random effects into the model structure, allowing for more accurate predictions and inference. The analysis reveals a significant proportion (35%) of water supply interruptions in rural areas, highlighting the need for targeted interventions to improve system reliability. This study provides robust estimates of municipal water system reliability using Bayesian hierarchical modelling, which can inform policy decisions aimed at improving service delivery and public health outcomes. Policymakers should prioritise investments in maintenance and upgrading of infrastructure in areas with higher interruptions to enhance the overall reliability of South African municipal water systems. The empirical specification follows $Y = \beta_{0+\beta}^{-1} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Geographic, Hierarchical, Bayesian, Modelling, Reliability, Infrastructure, Maintenance*

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

✉ **REQUEST FULL PAPER**

Email: info@parj.africa

Request your copy of the full paper today!

SUBMIT YOUR RESEARCH

Are you a researcher in Africa? We welcome your submissions!

Join our community of African scholars and share your groundbreaking work.

Submit at: app.parj.africa



Scan to visit app.parj.africa

Open Access Scholarship from PARJ

Empowering African Research | Advancing Global Knowledge