Abstract

Despite progress, neonatal mortality remains high in Kenya at 21 deaths per 1000 live births (KDHS 2022), hampering progress towards SDG targets. Robust evidence on determinants is needed to guide investments for accelerated mortality reduction. County disparities exist but calculating and mapping the standardized neonatal mortality can inform localized interventions. The objective of this study was to identify key determinants of neonatal mortality in Kenya, develop a predictive model, and map neonatal mortality by counties using KDHS data.

Data on neonatal mortality and potential determinants was analysed for 19,530 live-born infants using the 2022 Kenya Demographic and Health Survey (KDHS) Kid's Recode dataset. There were 437 neonatal deaths recorded. Probit regression modelling was applied to estimate the impact of factors on the likelihood of neonatal death. Marginal effects were calculated to ascertain the relative importance of determinants. Machine learning methods including fitting a probit model were developed to predict neonatal mortality risk based on the determinants. Spatial mapping on neonatal mortality per county was carried out and standardised neonatal mortality was used to interpret the ratio of neonatal mortality per county spatial techniques were applied to generate high-resolution maps of neonatal mortality across Kenya counties. Python version 3.12.0 was used for analysis.

Key factors significantly associated with neonatal mortality were ANC, Birth weight, pregnancy duration, birth interval, birth type, education level, and place of residence. From the Standardized mortality ratio (SMR) map, we found that Mombasa, Busia, Lamu, Baringo, Garissa, Homabay, and Wajir had the highest SMR whereas Meru, Tharaka Nithi, and Marsabit counties had the lowest SMR. In addition, counties that were neighbouring each other displayed relatively close

standard mortality ratios.

ANC, Birth weight, pregnancy duration, birth interval, birth type, education level, and place of residence are critical determinants of neonatal mortality. Improving female education, enhancing nutrition and maternal health to reduce low birth weight, and mothers taking up more than three ANC visits should be prioritized to accelerate mortality decline. The spatial mapping provides novel insights into geographic inequalities in neonatal mortality risk across Kenya. Spatial mapping and predictive modelling of the 2022 KDHS provide updated evidence on neonatal mortality distribution and determinants in Kenya. Results will allow tracking of progress and data-driven decision-making to accelerate reductions in newborn mortality in line with Kenya's development goals. Advanced analytics maximise insights from detailed survey data now available.

One of the key recommendations from this study is to Compare the performance of different machine learning algorithms like random forest, neural networks, and gradient boosting.